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(Also referred to as FORM PTO-1465)

REQUEST FOR *EX PARTE* REEXAMINATION TRANSMITTAL FORM

Address to:
Mail Stop *Ex Parte* Reexam
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Attorney Docket No.: COM908

Date: October 4, 2023

1. ■ This is a request for *ex parte* reexamination pursuant to 37 CFR 1.510 of patent number 10,868,908 issued _____. The request is made by:
   ☐ patent owner. ■ third party requester.

2. ■ The name and address of the person requesting reexamination is:
   Unified Patents, LLC
   4445 Willard Ave., Suite 600
   Chevy Chase, MD 20815

3. Requester ☐ asserts small entity status (37 CFR 1.27) or ☐ certifies micro entity status (37 CFR 1.29). Only a patent owner requester can certify micro entity status. Form PTO/SB/15A or B must be attached to certify micro entity status.

4. This request is accompanied by payment of the reexamination fee as set forth in:
   ■ 37 CFR 1.20(c)(2); **or**
   ☐ 37 CFR 1.20(c)(1). **In checking this box for payment of the fee set forth in 37 CFR 1.20(c)(1), requester asserts that this request has forty (40) or fewer pages and complies with all other requirements of 37 CFR 1.20(c)(1).**

   Payment of the reexamination fee is made by the method set forth below.
   a. ☐ A check in the amount of $_____ is enclosed to cover the reexamination fee;
   b. ☐ The Director is hereby authorized to charge the reexamination fee to Deposit Account No. _____;
   c. ☐ Payment by credit card. Form PTO-2038 is attached; **or**
   d. ■ Payment made via EFS-Web.

   ■ In addition, the Director is hereby authorized to charge any fee deficiencies to Deposit Account No. 50-6990.

5. ■ Any refund should be made by ☐ check or ■ credit to Deposit Account No. 50-6990. 37 CFR 1.26(c). If payment is made by credit card, refund must be to credit card account.

6. ■ A copy of the patent to be reexamined having a double column format on one side of a separate paper is enclosed. 37 CFR 1.510(b)(4).

7. ☐ CD-ROM or CD-R in duplicate, Computer Program (Appendix) or large table
   ☐ Landscape Table on CD

This collection of information is required by 37 CFR 1.510. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) a request for reexamination. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 18 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Mail Stop *Ex Parte* Reexam, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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8. ☐ Nucleotide and/or Amino Acid Sequence Submission
If applicable, items a. – c. are required.
   a. ☐ Computer Readable Form (CRF)
   b. Specification Sequence Listing on:
      i. ☐ CD-ROM (2 copies) or CD-R (2 copies) **or**
      ii. ☐ paper
   c. ☐ Statements verifying identity of above copies.

9. ■ A copy of any disclaimer, certificate of correction or reexamination certificate issued in the patent is included.

10. ■ Reexamination of claim(s) 1-3, 5, 6, 13-15 is requested.

11. ■ A copy of every patent or printed publication relied upon is submitted herewith including a listing thereof on Form PTO/SB/08, PTO-1449, or equivalent.

12. ☐ An English language translation of all necessary and pertinent non-English language patents and/or printed publications is attached.

13. ■ The attached detailed request includes at least the following items:
   a. A statement identifying each substantial new question of patentability based on prior patents and printed publications. 37 CFR 1.510(b)(1).
   b. An identification of every claim for which reexamination is requested, and a detailed explanation of the pertinency and manner of applying the cited art to every claim for which reexamination is requested. 37 CFR1.510(b)(2).

14. ☐ A proposed amendment is included (only where the patent owner is the requester). 37 CFR 1.510(e).

15. ■ It is certified that the statutory estoppel provisions of 35 U.S.C. 315(e)(1) or 35 U.S.C. 325(e)(1) do not prohibit requester from filing this *ex parte* reexamination request. 37 CFR 1.510(b)(6).

16. Service
   a. ■ It is certified that a copy of this request (if filed by other than the patent owner) has been served in its entirety on the patent owner as provided in 37 CFR 1.33(c).

      The name and address of the party served are:

      Harold McGurk

      The Law Office of Clay McGurk, P.O. Box 1488

      Orange, CA 92856

      Date of Service: October 4, 2023

   OR

   b. ☐ A duplicate copy is enclosed since service on patent owner was not possible. An explanation of the efforts made to serve patent owner **is attached**. See MPEP 2220.

17. Correspondence Address: Direct all communication about the reexamination to:

☒ The address associated with Customer Number: 165774

OR

☐ Firm or Individual Name _____
(at the address identified below)

Address

Unified Patents, LLC, 4445 Willard Avenue, Suite 600

City	State	Zip
Chevy Chase	MD	20815

Country

USA

Telephone	Email
559-214-3388	michelle@unifiedpatents.com

18. ☒ The patent is currently the subject of the following concurrent proceeding(s):

a. ☐ Copending reissue Application No. _____

b. ☐ Copending reexamination Control No. _____

c. ☐ Copending Interference No. _____

d. ☒ Copending litigation styled:

Competitive Access Systems, Inc. v. Oracle Corp., 1:23-cv-00286 (W.D. Tex.)

WARNING : Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

/Michelle Aspen/	October 4, 2023
Authorized Signature	Date
Michelle Aspen	75,665
Typed/Printed Name	Registration No.

☐ For Patent Owner Requester ☒ For Third Party Requester

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent of Eric M. Delangis	§	REQUEST FOR *EX PARTE*
	§	REEXAMINATION
U.S. Patent 10,868,908	§	
	§	Attorney Docket No.: COM908
Filed: May 23, 2016	§	
	§	Customer No.: 165774
Issued: December 15, 2020	§	
	§	Real Party in Interest:
Title: DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS	§	Unified Patents, LLC
	§	
	§	

REQUEST FOR *EX PARTE* REEXAMINATION OF U.S. PATENT 10,868,908

Mail Stop "*Ex Parte* Reexam"
Attn: Central Reexamination Unit
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

Pursuant to the provisions of 35 U.S.C. §§ 301-307, Unified Patents, LLC ("Requester") hereby requests an *ex parte* reexamination of claims 1–3, 5, 6, and 13–15 (the "Challenged Claims") of U.S. Patent 10,868,908 ("the '908 Patent," EX1001), which issued on December 15, 2020 to Eric M. Delangis, resulting from U.S. Application 15/161,787 filed on May 23, 2016. The '908 Patent claims priority through a series of continuation applications to U.S. Application 10/686,375, now U.S. Patent 7,606,156, but Unified disputes that the priority claim is proper for the previous application's failure to provide adequate written description support for the Challenged Claims. The '908 Patent is assigned to Competitive Access Systems, Inc. ("CAS"), recorded in the U.S. Patent and Trademark Office ("USPTO") at reel/frame 056236/0492.

Requester submits that this Request presents prior art references and analyses that are non-cumulative of the prior art that was before the Examiner during the original prosecution of the '908 Patent and that claims 1–3, 5, 6, and 13–15 of the '908 Patent are unpatentable over these references. Requester therefore requests that an order for reexamination and an Office Action rejecting claims 1–3, 5, 6, and 13–15 be issued.

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Ex Parte Patent Reexamination Filing Requirements

Pursuant to 37 C.F.R. § 1.510(b)(1), statements pointing out at least one substantial new question of patentability based on material, non-cumulative reference patents and printed publications for the Challenged Claims of the '908 Patent are provided in Section I of this Request.

Pursuant to 37 C.F.R. § 1.510(b)(2), reexamination of the Challenged Claims of the '908 Patent is requested, and a detailed explanation of the pertinence and manner of applying the cited references to the Challenged Claims is provided in Section II of this Request.

Pursuant to 37 C.F.R. § 1.510(b)(3), copies of every patent or printed publication relied upon or referred to in the statement pointing out each substantial new question of patentability or in the detailed explanation of the pertinence and manner of applying the cited references are provided as Exhibits 1001-1018 of this Request.

Pursuant to 37 C.F.R. §1.510(b)(4), a copy of the '908 Patent is provided as Exhibit 1001 of this Request, along with a copy of any disclaimer, certificate of correction, and reexamination certificate issued corresponding to the patent.

Pursuant to 37 C.F.R. § 1.510(b)(5), the attached Certificate of Service indicates that a copy of this Request, in its entirety, has been served on Patent Owner at the following address of record for Patent Owner, in accordance with 37 C.F.R. § 1.33(c):

64828 - Harold McGurk
The Law Office of Clay McGurk
P.O. BOX 1488
Orange, CA 92856
UNITED STATES

Also submitted herewith is the fee set forth in 37 C.F.R. § 1.20(c)(2).

Pursuant to 37 C.F.R. § 1.510(b)(6), Requester hereby certifies that the statutory estoppel provisions of 35 U.S.C. § 315(e)(1) and 35 U.S.C. § 325(e)(1) do not prohibit Requester from filing this *ex parte* patent reexamination request.

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APPENDIX OF EXHIBITS

Exhibit	Description
1001	U.S. Patent 10,868,908 (the "'908 Patent")
1002	File History for U.S. Patent 10,868,908
1003	Declaration of James Geier ("Geier")
1004	U.S. Patent 6,160,808 to Maurya ("Maurya")
1005	International Publication WO 97/22212 to Low *et al.* ("Low")
1006	U.S. Patent 5,809,070 to Krishnan *et al.* ("Krishnan")
1007	U.S. Patent 7,606,156 to Delangis ("Delangis-156")
1008	File History for U.S. Application 13/531,294
1009	U.S. Patent 8,861,349 ("'349 Patent")
1010	Neil Briscoe, *Understanding the OSI 7-Layer Model*, PC Network Advisor Issue 120, pp. 13-14 (Jul. 2000) ("Briscoe")
1011	John Day and Hubert Zimmerman, *The OSI Reference Model*, Proc. of the IEEE 71(12), 1334-1340 (Dec. 1983) ("Day")
1012	W. Simpson, *The Point-to-Point Protocol*, Network Working Group, RFC 1661 (Jul. 1994), available at https://www.rfc-editor.org/rfc/rfc1661 ("Simpson")
1013	U.S. Patent 6,112,245 to Araujo *et al.* ("Araujo")
1014	U.S. Patent 5,774,660 to Brendel *et al.* ("Brendel")
1015	K. Sklower, et al., *The PPP Multilink Protocol (MP)*, Network Working Group, RFC 1990 (Aug. 1996), available at https://www.rfc-editor.org/rfc/rfc1990.html ("Sklower")
1016	U.S. Patent 7,315,900 to Ofelt *et al.* ("Ofelt")
1017	Mel Beckman, *Integrated Services Digital Network Tutorial*, ARC Electronics (1995), available at https://arcelect.com/isdn.htm ("Beckman")
1018	Lillian Goleniewski, Excerpt of *Telecommunications Essentials: The Complete Global Source for Communications Fundamentals, Data Networking and the Internet, and Next-Generation Networks*, Telecommunications Technology Fundamentals, Addison Wesley (Dec. 28, 2001), available at https://www.informit.com/ articles/article.aspx?p=24687 ("Goleniewski")

I. U.S. PATENT 10,868,908

A. Summary of the '908 Patent

The '908 Patent relates to a Residential Communications Gateway ("RCG").[1] The RCG is a stand-alone modem-like device that "combines the capabilities of IP routers, Class 5[2] circuit switches and wireless LANs" that is capable of providing additional services over a Plain Old Telephone Service (POTS) line. *'908 Patent* (EX1001), 2:36-40.[3] The "primary function of the RCG is to provide a platform for Competitive Local Exchange Companies (CLECs) to compete with the Local Exchange Companies (LECs)." *Id.*, 1:21-24. Specifically, the RCG provides "new calling features and services over the existing POTS line" that are not offered by the LECs, without requiring new infrastructure (such as cable or DSL). *Id.*, 1:40-2:6.

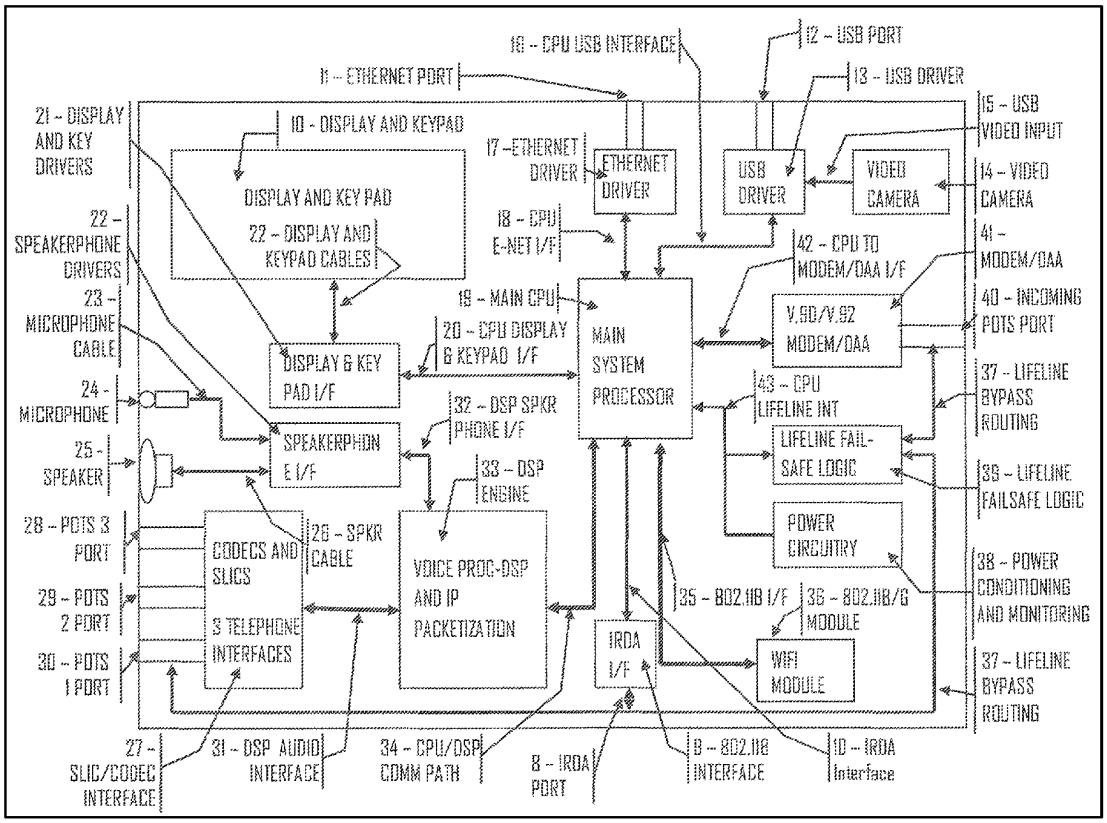
In its "most basic usage," the allegedly novel RCG is plugged into a POTS line and includes three line-output jacks to provide additional telephone lines into the household or office. *Id.*, 2:54-60; *see also* 2:48-53. Additional interfaces, such as a Universal Serial Bus (USB), Ethernet port, and 802.11b/g interface, are included for computer connectivity if data communications are desired. *Id.*, 2:60-3:1.

Figure 1 illustrates a preferred embodiment of the RCG, while Figure 4 shows a top view of the RCG:

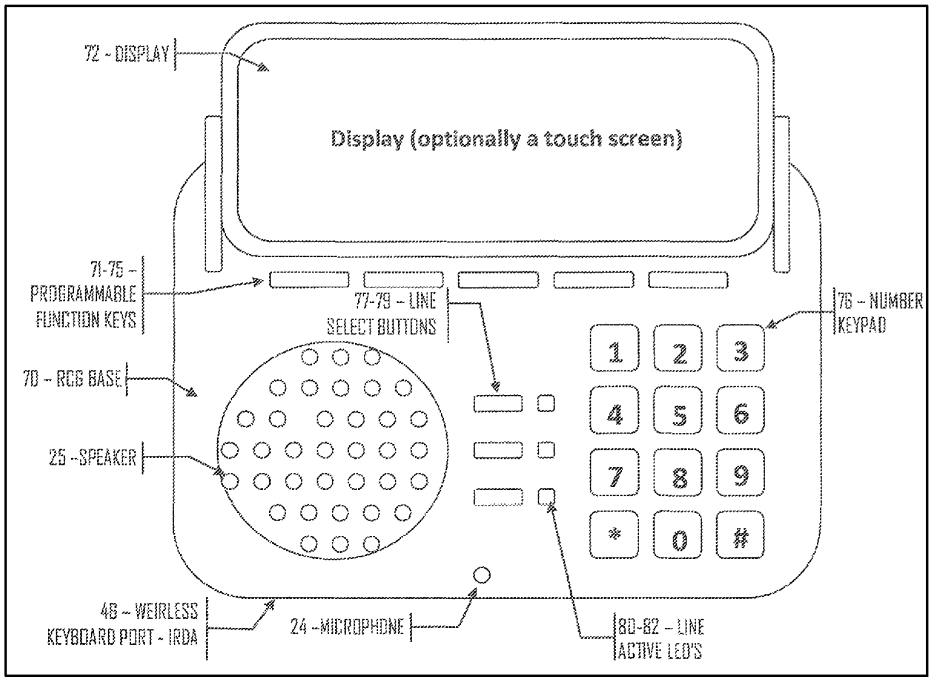
[1] The term "RCG" is not defined in the '908 Patent. It was defined in parent patent abstracts, but the abstract changed in the '908 Patent. *See*, *e.g.*, EX1007 (57).

[2] "Class 5" refers to a local exchange switch in, for example, an office building. *Geier* (EX1003), ¶ 33 (citing EX1018).

[3] "POTS" is also not defined in the '908 Patent.

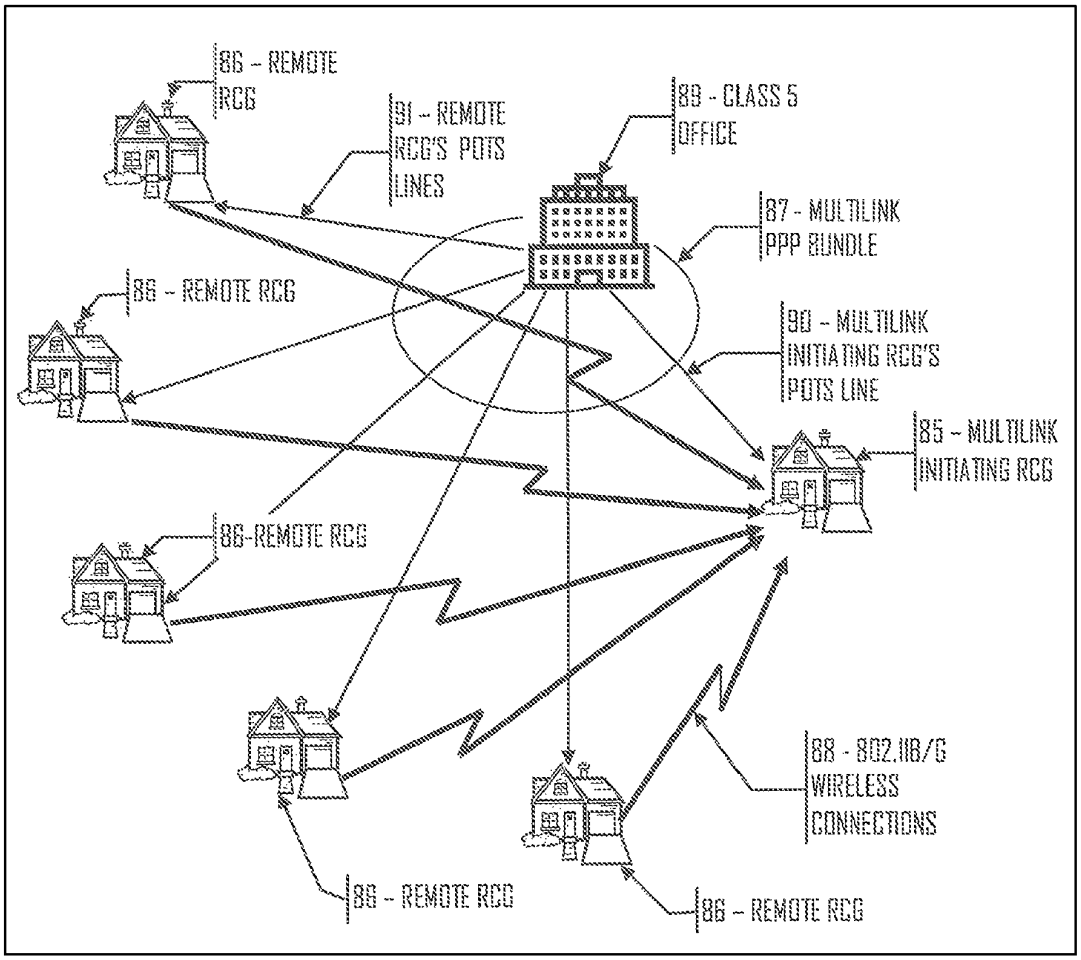


Id., Fig. 1.



Id., Fig. 4.

In one embodiment, the RCG may communicate using the multilink point-to-point protocol, configured "per RFC 1990." *Id.*, 11:25-28. The link is established by negotiating parameters with a "remote computer i.e. internet URL" (not shown) "via Link Control Protocol (LCP) session management." *Id.*, 12:2-9; *see also* Fig. 7. During setup, the RCG receives a "multilink PPP session ID, or 'magic number'" to identify the session and add or remove links from the bundle. *Id.*, 12:9-14. The RCG selects remote RCGs for transferring data based on a desired transfer bandwidth and the available bandwidth of other RCGs. *Id.*, 9:22-51. Each RCG represents a logical "link" in the initiating RCG's multilink PPP bundle. *Id.*, 12:57-60. The initiating RCG sends each remote RCG an initialization packet containing the session ID and the URL of the destination. *Id.*, 12:51-57. The remote RCGs send a multilink packet "to the destination URL" with the session ID and a request to be added to the bundle. *Id.*, 12:60-63.



Id., Fig. 7. Then, "the destination URL [not pictured] accepts the request of each of the remote RCGs" and sends data to each RCG. *Id.*, 12:63-66. The remote RCGs relay the data to the initiating

RCG, which is responsible for reassembly. *Id.*, 12:66-13:7. Challenged independent claims 1 and 13 are directed to multilink communications.

B. Prosecution History

The prosecution of the '908 Patent was characterized not only by repeated wholesale amendments the scope of the claims, but also by repeated efforts to change the nature of the technology claimed. This strategic gear-shifting forced the examiner to find not only additional prior art with every amendment, but to familiarize themselves with new technologies and their nuances in order to understand the scope of the claims and the prior art, making prosecution needlessly complicated.

The original claims, reciting a "network edge device" for participating in "multipath" connections with a "data-requesting device," (*File History* (EX1002), 46), were rejected as obvious. *Id.*, 56–58.[4]

The next round of claims referred to a multipath connection including two network edge devices. *Id.*, 69. These were rejected as obvious. *Id.*, 83–85. The applicant made minor amendments and responded that the prior art did not disclose a "multipath connection" (*id.*, 93–98), but the examiner disagreed. *Id.*, 104.

The applicant next claimed a device for receiving data from a server over two communication interfaces and a processor aggregating the data received over the two interfaces. *Id.*, 126. The examiner issued a restriction requirement and withdrew the aggregating-data claim set. *Id.*, 139–141.

The applicant then amended the claims to match the claims that were not deemed withdrawn and added 13 new claims. *Id.*, 145–146. But the applicant still included two different claim sets—claims for routing data, and claims for to "joining" or "assembling" data. *Id.*, 176–185. The examiner rejected the claims as not conforming to the written description requirement and as obvious. *Id.*, 197–206.

The applicant then cancelled claims 1–40 and proposed two new claim sets. The first set was directed to a client device including two or more network interfaces and a processor that (1)

[4] Despite the applicant's citation to the Figure 7 embodiment as supporting the multipath claim language, multipath, which was originally claimed, and multilink, which was finally claimed, are different concepts.

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transmitted messages including an identifier unique to a multilink session and information identifying one of the network interfaces for receiving data from both of the network interfaces and (2) received data through "any combination" of the two or more network interfaces. *Id.*, 243–244, 246–249. The second set was directed to a method for allocating bandwidth on a network including multiple remote gateways supporting a multilink connection. *Id.*, 250. The applicant identified the embodiments described in Figures 6–8 as providing written description support. *Id.*, 251. A restriction requirement was made, and the chosen claims, related to multilink communications, were rejected for lacking adequate written description support and as anticipated and/or obvious. *Id.*, 305–316.

The applicant amended some claims to recite that the message included a multilink request and a destination URL in a first message from a first network interface and a multilink session identification and destination URL in a second message from a second network interface in the client claims. *Id.*, 335. The amendments also added that the first and second network interfaces had different or separate data transfer rates and that the communication would provide "an increased data transfer rate" for the device receiving data. *Id.*, 335–337.

For these multilink claims, the applicant cited written description support in the embodiment of Figure 7 and argued that it was "inherent in a 'multilink PPP connection'" that an initiating RCG "receives data over multiple links ... thereby fulfilling one of the main purposes of the invention which is to increase data transfer rate for a particular device." *Id.*, 343–44. Thus, the applicant acknowledged that multilink communications were already known to increase data transfer rates. *Id.*, 343–44.

The examiner allowed claims reciting the multilink session identification but rejected the argument that the prior art did not teach an increased data transfer rate. *Id.*, 350–351. The applicant amended the remaining claims to recite a multilink session identification, arguing that the prior art's disclosure of a "multi-path identifier" was not the same. *Id.*, 373–74.

The remaining claims were allowed without a statement of a reasons for allowance. *Id.*, 380. However, given the context of the applicant's amendments and examiner's rejections, **it appears the claims were allowed based on the content of messages, namely the inclusion of a multilink session identification**.

C. Priority

The '908 patent was filed on September 15, 2016. The '908 Patent purports to claim

priority through a series of continuations to a provisional application filed on October 2, 2002.

The '908 Patent is not entitled to the priority date of applications filed before October 11, 2014, when U.S. Patent 9,350,649 was filed, as the claims of the '908 Patent lack adequate written description support from earlier applications. *See* Section IV.C.1, *infra*. Grounds 1 and 2 render the Challenged Claims obvious regardless of whether CAS can show priority to previous applications.

D. Level of Ordinary Skill in the Art

Requester assumes that a POSA would be a person having, at least by October 15, 2002: (1) at least an undergraduate degree in electrical engineering or closely related field, or similar advanced pose-graduate education in this area; and (2) 2 or more years of experience with communications systems, with more experience substituting for less education and vice versa. *Geier* (EX1003), ¶¶ 30–32. If a later priority date is applied, a POSA would have at least possessed as much knowledge and skill after 2002. *Id.*, ¶ 30.

E. Claim Construction

Because the '908 Patent expires October 14, 2023, Requester proposes the below constructions based on the standards applied by Article III courts. *See* MPEP § 2258(G) (citing *Ex parte Papst-Motoren*, 1 USPQ2d 1655 (Bd. Pat. App. & Inter. 1986)); *see also Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005) (*en banc*).

1. the first message includes a multilink request a destination URL; the second message includes a multilink session identification the destination URL (Claim 1)

Claim 1 includes two limitations with missing conjunctions. Requester is unaware of an attempt by CAS to correct this error.

Requester has assumed that the missing conjunction is "and," like similar limitations of claim 13. *Zoho Corp. v. RFID Tech. Innovations, LLC*, IPR2021-00448, Paper 4, 9–10 (PTAB Jul. 23, 2021) (DI, accepting Requester's construction that a claim was meant to include the phrase "object and"). However, claim 1 would be obvious under either possible missing conjunction: *or* and *and*.[5]

[5] Even if claim 1 is indefinite, it is both appropriate and possible to evaluate obviousness. *Intel Corp. v. Qualcomm Inc.*, 21 F.4th 801, 813-14 (Fed. Cir. 2021).

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II. SUBSTANTIAL NEW QUESTIONS OF PATENTABILITY

A. Grounds for Reexamination

Claims 1–3, 5–6, and 13–15 of the '908 Patent are invalid as obvious in light of the following grounds:

Ground	Claims	Challenge
1	1, 2, 5, 6	Obviousness over Maurya[6] and Low[7]
2	1, 2, 5, 6, 13–15	Obviousness over Maurya, Krishnan,[8] and Low
3	1, 2, 5, 6	Obviousness over Maurya, Low, and Delangis-156[9]
4	1–3, 5–6, 13–15	Obviousness over Maurya, Krishnan, Low, and Delangis-156

The grounds below are also supported by the Declaration of James Geier, (EX1003),[10] who provides a background of the technology at issue in this matter, namely, point-to-point protocols and its variant, the multilink point-to-point protocol.

B. Maurya in View of Low Present Substantial New Questions of Patentability

1. Overview of Maurya

Maurya (EX1004) was filed on December 18, 1997 and issued on December 12, 2000. Maurya is prior art under post-AIA 35 USC § 102(a)(1)-(2) or pre-AIA 35 U.S.C. §§ 102(a), (b), and (e).

Maurya relates to communications techniques using the multilink point-to-point protocol ("ML-PPP"), also known as the multilink protocol ("MP"), in which packets of a common frame may be transmitted across and received from more than one link in a multi-link bundle. *Maurya* (EX1004), Abstract; *see also Geier* (EX1003), ¶ 36. Maurya provides an overview of the point-to-point protocol and one mechanism of implementation referred to as multilink. *Maurya* (EX1004),

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[6] U.S. Patent 6,160,808, EX1004.

[7] International Publication WO 97/22212, EX1005.

[8] U.S. Patent 5,809,070, EX1006.

[9] U.S. Patent 7,606,156, EX1007.

[10] Exhibit 1003 is similar to the version submitted in IPR2023-00584 by Unified Patents. Specifically, the only changes relate to cross-referencing this Request, and it has been reviewed and executed by Mr. Geier. No substantive changes have been made. MPEP 2214.

3:1-7. Maurya discloses applying the multilink protocol to systems in which a given endpoint, such as a client device, is associated with multiple outgoing links:

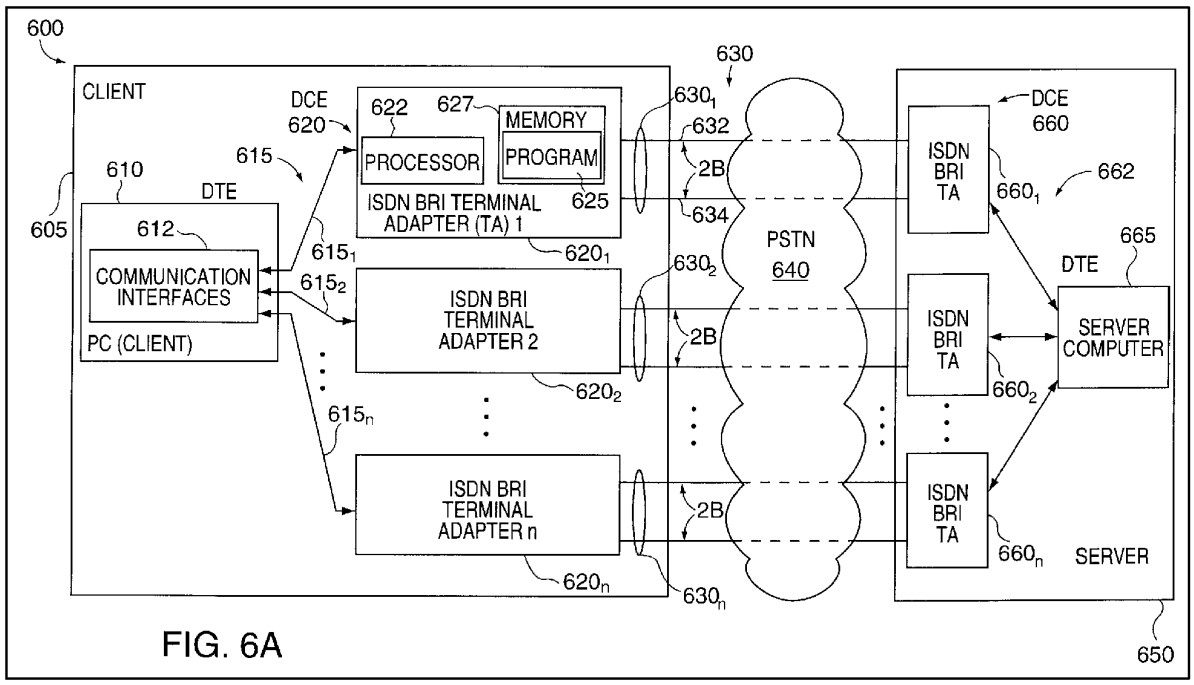


FIG. 6A

Id., Fig. 6; *see also* Abstract, 1:10-17.

Maurya uses certain terminology to refer to the various systems and components in a ML-PPP system. *Geier* (EX1003), ¶¶ 63–64. For example, a **peer** refers to a device that is (or seeks to be) part of the collection of devices exchanging data, including the client, server, and networking devices seeking to exchange data using the benefits of the multilink protocol. *Id.*, 5:29-37; *see also* 3:1-14. As examples, "peers" would have included terminal adapters, routers, or modems. *Geier* (EX1003), ¶ 64. A **link** refers to a physical layer, such as a communications channel, over which data is carried from a device. *Maurya* (EX1004), 1:10-14; *see also Geier* (EX1003), ¶ 64. A **bundle** refers to a collection of links conveying the data-carrying packets; for example, a computer and its terminal adapters. *Maurya* (EX1004), 3:1-9. By using the multilink protocol, the entire collection of links forms a single **pipe**, which logically behaves as one channel between the client and server. *Id.*, 3:6-14.

Maurya is analogous art to the '908 Patent. *Geier* (EX1003), ¶ 73. It is within the field of endeavor of the '908 Patent, as it relates to techniques of communicating large amounts of between different devices, including in the context of the multi-link point-to-point protocol. *Maurya* (EX1004), 1:10-17. Additionally, it is reasonably pertinent to at least one problem concerning the

inventors of the '908 Patent, namely, to provide higher level network services to more consumers, such as residential consumers, without severe infrastructure costs. *'908 Patent* (EX1001), 1:64-2:6; *see also Maurya* (EX1004), 4:52-55.

2. Overview of Low

Low (EX1005) was filed on December 11, 1996, designating the US, and published on June 19, 1997; thus, Low is prior art under post-AIA 35 USC § 102(a)(1) or pre-AIA 35 USC § 102(a), (b), and (e).

Low relates to providing resources supporting call-setup in a telephone system using servers connected to a computer network logically distinct from the telephone system infrastructure. *Low* (EX1005), Abstract. A given resource is locatable using a uniform resource identifier (URI) associated with a particular telephone number. *Id.* Low explains that it is a "cornerstone" of the World Wide Web to address information using a URI, generally either by a uniform resource locator (URL) or a uniform resource name (URN) that can be resolved into a URL. *Id.*, 12:1-4.

Low is analogous art to the '908 Patent. *Geier* (EX1003), ¶ 86. Low is within the field of endeavor of the '908 Patent because it relates to methods of accessing resources through a switched telecommunications system, including using the point-to-point protocol to allow users to communicate with an internet service provider (ISP) via a public telephone system. *Low* (EX1005), 1:7-9; *see also* 11:21-26, 46:23-27. Low is also reasonably pertinent to one problem concerning the inventors of the '908 Patent, such as the ability to provide users with communication and data services not provided by local exchange companies. *'908 Patent* (EX1001), 1:67-2:6. For example, Low discloses that its invention provides enhanced services to a user through different types of communications systems to provide a more "synergistic relationship" between the world of telephone networks and internet-based information services. *Low* (EX1005), 2:1-16.

3. The combination of Maurya and Low present an SNQ

The combination of Maurya and Low present a substantial new question of patentability as to claims 1, 2, 5, 6, and 13–15 of the '908 Patent. As shown in the detailed mapping in Section IV below, the combination of Maurya and Low teach each limitation of these claims, including the concept of a ***multilink session identification***. Additionally, the references themselves are new:

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neither Maurya nor Low were considered during prosecution of the '908 Patent.[11] Finally, as discussed in the detailed mapping in Section IV below, a POSA would have been motivated to combine, and would have had a reasonable expectation of success in combing, the teachings of Maurya and Low together. Therefore, a reasonable examiner would have considered the combined teachings of these references important in determining whether claims 1, 2, 5, 6, and 13–15 would have been unpatentable as obvious, particularly in view of the general knowledge of a skilled artisan.

C. Maurya in View of Krishnan and Low Presents a Substantial New Question of Patentability

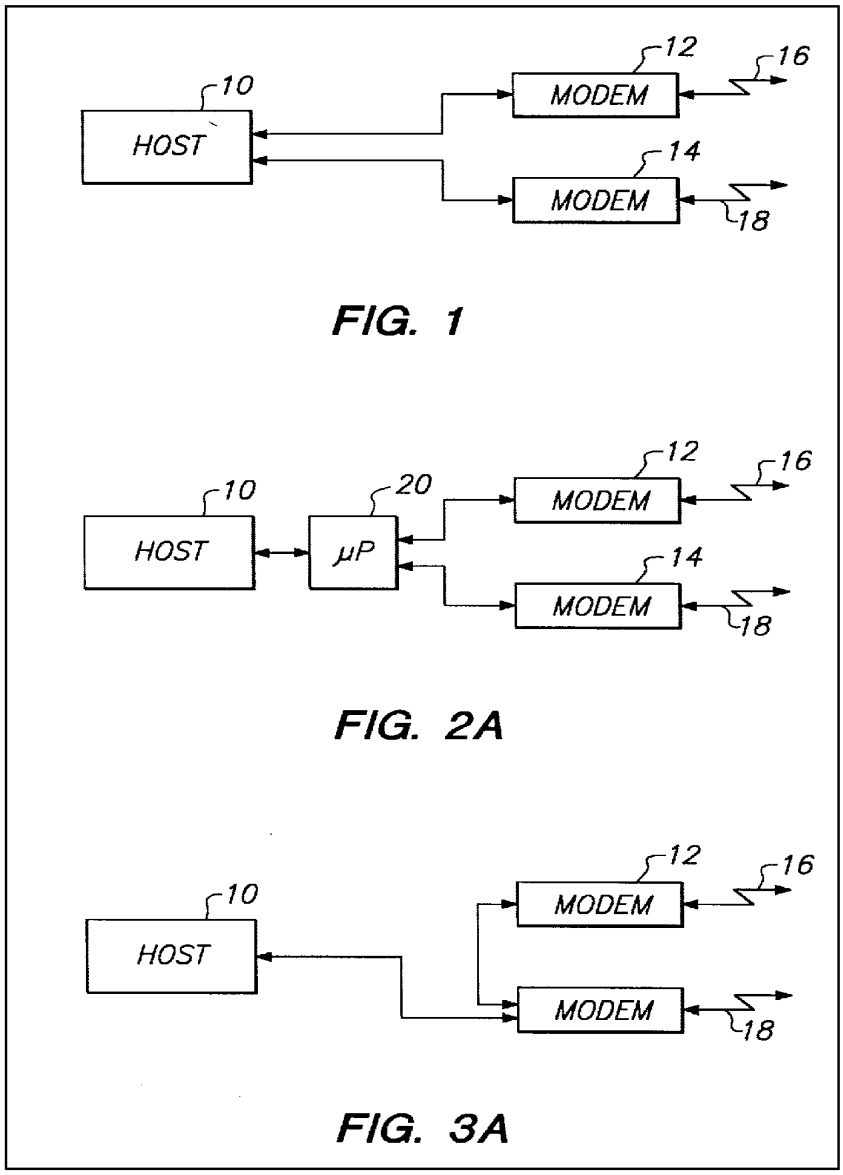
1. Overview of Krishnan

Krishnan (EX1006) was filed on August 9, 1996 and issued on September 15, 1998; thus, if the '908 Patent fails to properly claim priority to its parent applications, Krishnan is prior art under post-AIA 35 USC § 102(a)(1)-(2). Additionally, Krishnan is prior art under pre-AIA 35 U.S.C. §§ 102(a), (b), and (e).

Krishnan relates to methods for providing high-speed inter-computer data transmissions using multiple low-speed links. *Krishnan* (EX1006), Abstract. Krishnan accomplishes this using link control software to send data over multiple readily available modems:

[11] As discussed in Section IV, although these references were presented in an IPR, that proceeding was procedurally terminated by a joint motion to terminate prior to institution without any substantive or final rulings by the PTAB. *See Unified Patents, LLC v. Competitive Access Systems, Inc.,* IPR2023-00584, Paper 11 (PTAB, Oct. 2, 2023) ("[W]e we determine that it is appropriate to dismiss the Petition and terminate the proceeding as to both Requester and Patent Owner without rendering either a decision to institute or a final written decision."). Thus, the PTAB did not consider the SNQ presented herein.

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Id., Figs. 1, 2A, and 3A; *see also*; 1:25-32; 1:42-47 (modems are combined or bonded to create a high-speed data link using two low-speed links); 3:53-65 (in certain embodiments, host may or may not "see" modems as multiple logical connections). The host computer is programmed with multilink point-to-point protocol software (referred to as "MLPPP" in Krishnan), allowing transmitting and receiving sites to achieve higher bandwidth by splitting a high speed data stream onto multiple low-speed data streams. *Id.*, 2:33-41; *see also*, e.g., claims 1, 10.

Krishan is analogous art to the '908 Patent. *Geier* (EX1003), ¶ 93. Krishnan is within the field of endeavor of the '908 Patent, as it relates to techniques of communicating large amounts of

data between different devices, including in the context of the ML-PPP. *Krishnan* (EX1006), 2:22-41. Additionally, it is reasonably pertinent to at least one problem concerning the inventors of the '908 Patent, as it discloses providing enhanced services using existing public-telephone network connections. *Id.*, 1:36-50; *see also '908 Patent* (EX1001), 2:45-60 (device connected to primary plain-old-telephone-service line).

2. The combination of Maurya, Krishnan, and Low present an SNQ

The combination of Maurya, Krishnan, and Low present a substantial new question of patentability as to claims 1, 2, 5, 6, and 13–15 of the '908 Patent. As shown in the detailed mapping in Section IV below, the combination of Maurya and Low teach each limitation of these claims, including the concept of a ***multilink session identification***. Additionally, the references themselves are new:[12] neither Maurya, Krishnan, nor Low were considered during prosecution of the '908 Patent. Finally, as discussed in the detailed mapping in Section IV below, a POSA would have been motivated to combine, and would have had a reasonable expectation of success in combing, the teachings of Maurya, Krishnan and Low together. Therefore, a reasonable examiner would have considered the combined teachings of these references important in determining whether claims 1, 2, 5, 6, and 13–15 would have been unpatentable as obvious, particularly in view of the general knowledge of a skilled artisan.

D. Maurya in View of Krishnan, Low, and Delangis-156 Presents a Substantial New Question of Patentability

1. The '908 Patent lacks priority to Delangis-156

Under 35 U.S.C. § 120, to claim the benefit of the filing date of an earlier application, a patent must have, *inter alia* a claim must be disclosed in the "manner provided by section 112(a)," including written description support. To show written description support to an earlier application, one must show that the "disclosure of the application relied upon reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date" sought. *Ariad Pharm., Inc. v. Eli Lilly and Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010).

The burden is on the patent owner to show a challenged patent's claims are entitled to an earlier effective priority date than a patent's filing date. *See Dynamic Drinkware LLC v. National Graphics, Inc.*, 800 F.3d 1375, 1378, 1379 (Fed. Cir. 2015) (quoting *Tech. Licensing Corp. v.*

[12] *See supra*, n. 10.

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Videotek, Inc., 545 F.3d 1316, 1326–27 (Fed. Cir. 2008)) (to claim priority to an earlier application, patent owner must "'show not only the existence of the earlier application, but why the written description in the earlier application supports the claim.'").

Here, the claims of the '908 Patent lacks support under 35 U.S.C. § 112 ¶ 1 at least to U.S. Application 13/531,294 (the '294 Application, EX1008), which issued as U.S. Patent 8,861,349 (the '349 Patent, EX1009), and earlier applications, in at least three respects.

First, the '294 Application fails to disclose the claimed *first message* sent by a device in independent claims 1 and 13:

> *[1.3.1] transmit a first message through the first network interface to the server, wherein* ***the first message includes*** *a multilink request [and]* ***a destination URL***
>
> *[13.2.1] transmit a first message through the network interface to a second device, wherein* ***the first message includes*** *a multilink request* ***and a destination URL***

The specification of the '349 Patent does not disclose these limitations, nor do the original claims of the '294 Application. EX1008, 35–36. While the '349 Patent discloses that the RCG "that decides to initiate a multilink PPP session with a remote computer i.e. internet URL, requests a multilink PPP session with that URL resource via Link Control Protocol (LCP) session management," it does not indicate what is included in a message. *'349 Patent* (EX1009), 11:47-55. Specifically, the '349 Patent does not disclose a message to a server that includes both a multilink request and a "destination URL."

With respect to the Figure 7 embodiment describing the multilink request, "URL" is not used to refer to a uniform resource locator; rather, "computer" and "URL" are repeatedly used interchangeably. Therefore, where the specification describes that a device communicates a request "with that URL resource," the patent is not describing that an initial LCP request *includes* a destination URL in a request message, but that the message is with the destination *computer*. *Id.*, 11:48-53; *see also* 12:59-66 (describing that when a remote RCG drops below a threshold bandwidth that it will "notify the **remote computer (URL)** to be removed from the multilink bundle ..."); 12:36-42 (describing the "destination URL" as accepting requests to be added to a session).

Even if inclusion of a destination URL in a multilink request message was known or common, such would not save the '908 Patent's priority claims because entitlement to a filing date "extends only to that which is disclosed," **not** what would be obvious over what is disclosed.

Lockwood v. American Airlines, Inc., 107 F.3d 1565, 1571–72 (Fed. Cir. 1997). Including a destination URL in a multilink request may have been obvious, but it was not an inherent feature of LCP packets, as there were other known ways to reach a destination URL, such as through a uniform resource name that could be resolved into a URL. *Geier* (EX1003), ¶¶ 51–52.

Here, the '349 Patent simply refers to configuring multilink bundles "per RFC 1990," which does not discuss the use of destination URLs in multilink requests. *'349 Patent* (EX1009), 11:2-5; *see also Geier* (EX1003), ¶ 36 (citing EX1015); *see also* EX1015, generally (never disclosing including a URL as a necessary feature of setting up a data link layer). Therefore, the '908 Patent fails to disclose a ***first message include[ing]*** *a multilink request [and]* ***a destination URL***, as claimed in claims 1 and 13.

Second, the specification fails to provide adequate written description support for the following limitation of independent claim 1 of the '908 Patent:

> [1.3.2] **a client device ... comprising ... at least one processor configured to** ... **transmit a second message** through the second network interface **to the server**, wherein the second message includes a multilink session identification [sic] the destination URL

While the '349 Patent discloses a that the client sends second message that includes a session ID and identifying a destination URL, this second message is sent to an intermediate client device, *not* the server, as required by claim 1.

Indeed, nowhere does the specification disclose that the initiating RCG transmits this second message even indirectly to the server through the second client device. Rather, the other RCGs receive service requests from the initiating RCG (*'349 Patent* (EX1009), 11:65-12:5, 12:28-33). Then, these other RCGs separately transmit their own packets "to the destination URL with the multilink PPP session ID and a request to be added to that multilink PPP bundle." *Id.*, 12:36-39. There is no indication that the service requests are copied or forwarded by the intermediate RCGs or that the initiating RCG itself sends a second message to the server. Thus, because the specification never discloses that a first client device sends a second message including a multilink session identification and destination URL to the server, limitation 1.3.2 lacks written description support in the '294 Application.

Third, and finally, although "claims may be no broader than the supporting disclosure," the claims of the '908 Patent generally go to scope much broader than the '294 Application's

"stand-alone, external modem like" RCG connected to the POTS. *'349 Patent* (EX1009), 2:29-31; *see also* 2:36-40, 2:45-47 (explaining that the RCG is plugged into a POTS line from a local exchange company, or LEC); 3:16-26 (RCG meant to enhance the "existing telephone line," by "installing the low cost RCG device in the home telephone wiring"); 4:32-36. This is unchanged in the Figure 7 embodiment. *Id.*, Fig. 7 (RCG device still connected to class 5 office over POTS); *see also* 11:1-5. While the specification generically indicates that "any wireless interface scheme" may be used to configure multilink communications, it suggests that the RCG device may not simply be *any* standalone wireless device—the POTS interface is still necessary to transfer data. *Id.*, 11:58-60; *see also* 12:3-7 (remote RCGs selected based on available POTS bandwidth for carrying data). Despite this, the claims purport to cover cellular and Bluetooth devices and interfaces for performing multilink bundling (*see, e.g.*, claims 5, 7, 15). There is no indication in the specification that the inventor had possession over such a broad genus. *Lockwood v*, 107 F.3d at 1572 (a disclosure of a home television set connected to a central computer with a video disk player did not support claims reciting "an individual terminal containing a video disk player."). Therefore, the broad claims of the '908 Patent lack adequate written description in the '294 Application.

Indeed, the changes to the titles and abstracts over time in this family demonstrate a strategic attempt by the patent owner to broaden its claims of ML-PPP technology beyong what was originally conceived. The title of the '908 Patent was changed from "Residential communications gateway (RCG) for broadband communications over a plurality of standard POTS lines, with dynamic allocation of said bandwidth, that requires no additional equipment or modifications to the associated class 5 offices or the PSTN at large" in Delangis-156 (EX1007, (12)) to "Devices and methods for multipath communications." EX1001 (12). Further, despite being part of a series of continuations, the Abstract of the '908 Patent is unrecognizable from those of parent applications, dropping the phrase "residential communications gateway" in favor of "network-edge router," such as "a cellular device or tower." *Compare* EX1007 (57) and EX1009 (57); *with* EX1001, (57). None of these concepts are disclosed by the '349 Patent.

Thus, the earliest possible priority date for the '908 Patent is October 11, 2014, and previous applications may be used as prior art. *See Hollmer v. Harari*, 681 F.3d 1351, 1355 (Fed. Cir. 2012). Delangis-156, which was filed on October 14, 2003, published as U.S. Application 2005/0078690 on April 14, 2005, and issued on October 20, 2009, is prior art at least under pre-

AIA 35 USC §§ 102(a) and (e) and post-AIA 102(a)(1).

2. Mauryra in view of Krishnan, Low, and Delangis-156 presents an SNQ

The combination of Maurya, Krishnan, Low, and Delangis-156 present a substantial new question of patentability as to claims 1, 2, 5, 6, and 13–15 of the '908 Patent. As shown in the detailed mapping in Section IV below, the combination of these references teaches each limitation of these claims, including the concept of a ***multilink session identification***. Additionally, the combination of themselves are new[13]: neither Maurya, Krishnan, nor Low were considered during prosecution of the '908 Patent, and Delangis-156 is presented in a new light, as it was never considered prior art during prosecution of the '908 Patent.

Additionally, the examiner's previous consideration of whether the '908 Patent had written description support to itself does not change that there is an SNQ here for two reasons. First, in the context of prosecution, the burden is on an *examiner* to show that an application lacks written description support. However, in the context of claiming priority to an earlier application to show that it is not prior art, the *applicant* bears the burden of showing adequate written description support to each and every limitation of every claim. This burden shifting framework alone creates a new question of patentability, and Patent Owner cannot meet its burden for the reasons provided above. Second, the rationales presented in the preceding section are new, and the key nuances presented above appear never to have been considered by the previous examiner, who only generally considered the patentee's disclosure of multilink communications.

Finally, as discussed in the detailed mapping in Section IV below, a POSA would have been motivated to combine, and would have had a reasonable expectation of success in combing, the teachings of Maurya, Krishnan, Low, and Delangis-156 together. Therefore, a reasonable examiner would have considered the combined teachings of these references important in determining whether claims 1–3, 5, 6, and 13–15 would have been unpatentable as obvious, particularly in view of the general knowledge of a skilled artisan.

[13] *See supra,* n. 10.

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III. DETAILED APPLICATION OF THE PRIOR ART TO EVERY CLAIM FOR WHICH REEXAMINATION IS REQUESTED

A. Ground 1: Claims 1, 2, 5, 6, and 13–15 Are Obvious Over Maurya and Low

1. Claim 1

[1P]. A client device for multilink data packet communication with a server, the client device comprising:

Preambles are "'generally not limiting,'" and it should not be considered so here. *Symantec Corp. v. Computer Assoc. Intern.*, 522 F.3d 1279 (Fed. Cir. 2008) (quoting *Catalina Mktg. Int'l, Inc. v. Coolsavings.com, Inc.*, 289 F.3d 801, 808 (Fed. Cir. 2002)). The body of claim 1 provides a structurally complete invention, while the preamble simply provides the context of a client-server architecture. *Id.*, 522 F.3d at 1289. Assuming *arguendo* that it is limiting, the preamble is taught by, or at least obvious over, Maurya.

Maurya discloses *a client device for multi-link data packet communications with a server* (e.g., a client 605, including a PC 610 executing a client application, in communication with a server 650 using multi-link point-to-point (PPP) protocols). *Maurya* (EX1004), Abstract ("A communications technique which permits **incoming multi-link point-to-point (PPP) packets of a common PPP frame to be simultaneously transmitted** across more than one outgoing link").[14] Specifically, a client is in communication with a serve via multiple basic rate interfaces ("BRI") implementing the multilink protocol:

[14] Unless otherwise indicated, **bold** emphases in quotations have been added, and *italics* denote claim language.

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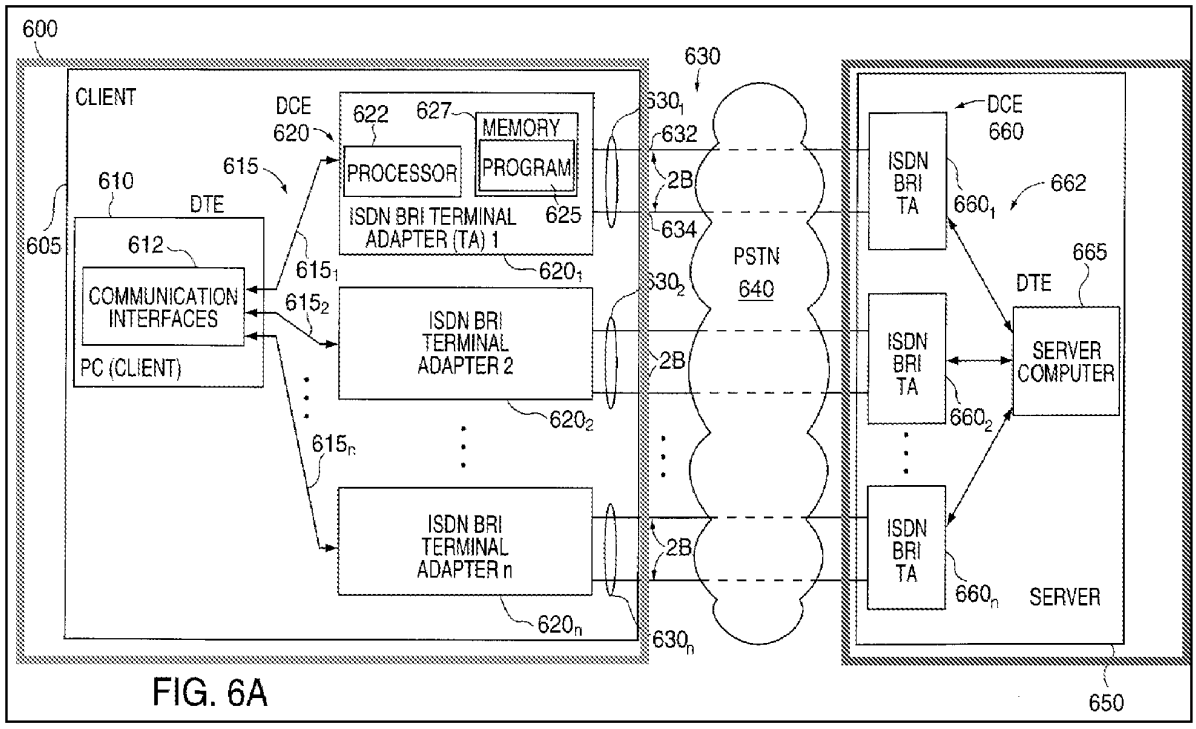


FIG. 6A

Id., Fig. 6A (annotated with a box on the left identifying client 605 and another box on the right identifying server 650); *see also* 11:40-45 ("**Client 605** is formed of client PC 610 . . . connected, through internal communication interfaces 612, typically separate serial ports (not specifically identified), and via corresponding links 615, to multiple identical ISDN BRI terminal adapters 620 as DCE (data circuit terminating equipment)"); 11:45-49 ("[L]inks 615 ... connect separate terminal adapters ... to separate corresponding serial ports provided by communication interfaces 612").

[1.1]. a first network interface having a first data transfer rate associated with a first path from the server to the first network interface of the client device;

Maurya teaches, or at least renders obvious, this limitation. Specifically, Maurya discloses a client having *a first network interface* (e.g., a **communication interface** corresponding to link 615_1, which is connected to a terminal adapter 620_1) *with a first path from the server to the first network interface of the client device* (e.g., channel 630_1).

The '908 Patent uses the word *interface* (I/F) broadly, referring to each of the link between a main processor and the network device, such as a WiFi module or ethernet driver (*see* Fig. 1, annotated), ports, or to the network devices themselves:

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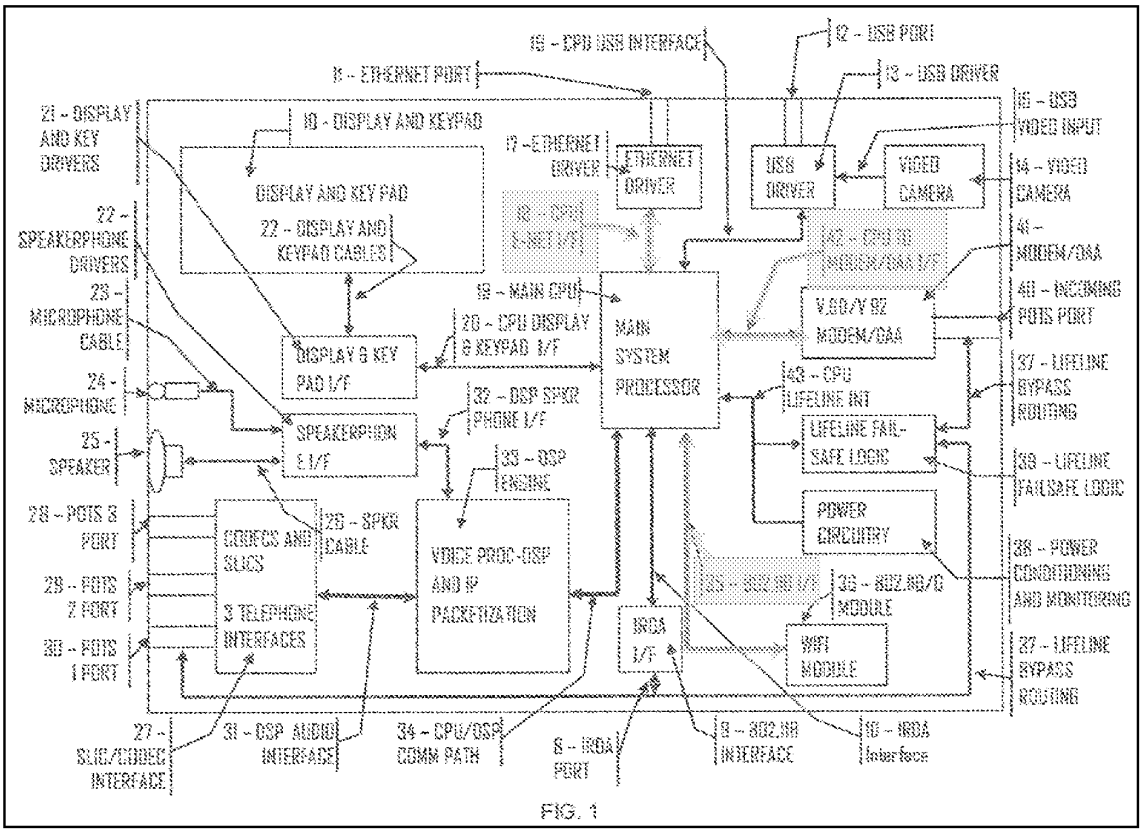


FIG. 1

'908 Patent (EX1001), Fig. 1 (annotated to shade I/Fs 18, 35, and 42 and their respective connections with main processor); uses I/F to refer to the link between a main processor and drivers/modules); 2:61-65 (referring to ethernet, USB, or firewire ports as "interfaces for computer connectivity"); 3:65-3:10 (the CPU includes ports, modems/DAA for routing data and an 802.11b/g modules); *see also*, Fig. 6.

Similarly, Maurya discloses that a given client is "interconnected to the server" through multiple ISDN basic rate interfaces (or "BRI"). *Maurya* (EX1004), 11:34-39. The client computer includes internal **communication interfaces 612**, which are connected via corresponding **links 615_n** to multiple ISDN terminal **adapters 620_n**. *Id.*, 11:40-49. These terminal adapters each have a data transfer rate *associated with* corresponding links 630_n to the server (each a *first path from the server to the first network interface of the client device*):

> **Client 605 is formed of client PC 610**, as DTE (data terminating equipment), connected, through **internal communication interfaces 612, typically separate serial ports (not specifically identified), and via corresponding links 615, to multiple identical ISDN BRI terminal adapters 620** as DCE (data circuit

terminating equipment). In that regard, links 615, which comprise links 615_1 , 615_2 , ... , 615_n connect separate terminal adapters 620_1 , 620_2 , ... , 620_n, respectively, to separate corresponding serial ports provided by communication interfaces 612. . . . **All these terminal adapters are collectively connected to one end of ISDN BRI lines 630, with each terminal adapter 620_1, 620_2, ... , 620_n, being individually connected to a pair of lines for two ISDN B channels, specifically lines 630_1 (having a separate pair of links 632 and 634 for pair of B channels), 630_2, ... , 630_n, respectively**.

Id., 11:40-67 (each ISDN BRI connection also entails a separate ISDN data ("D") channel connection).

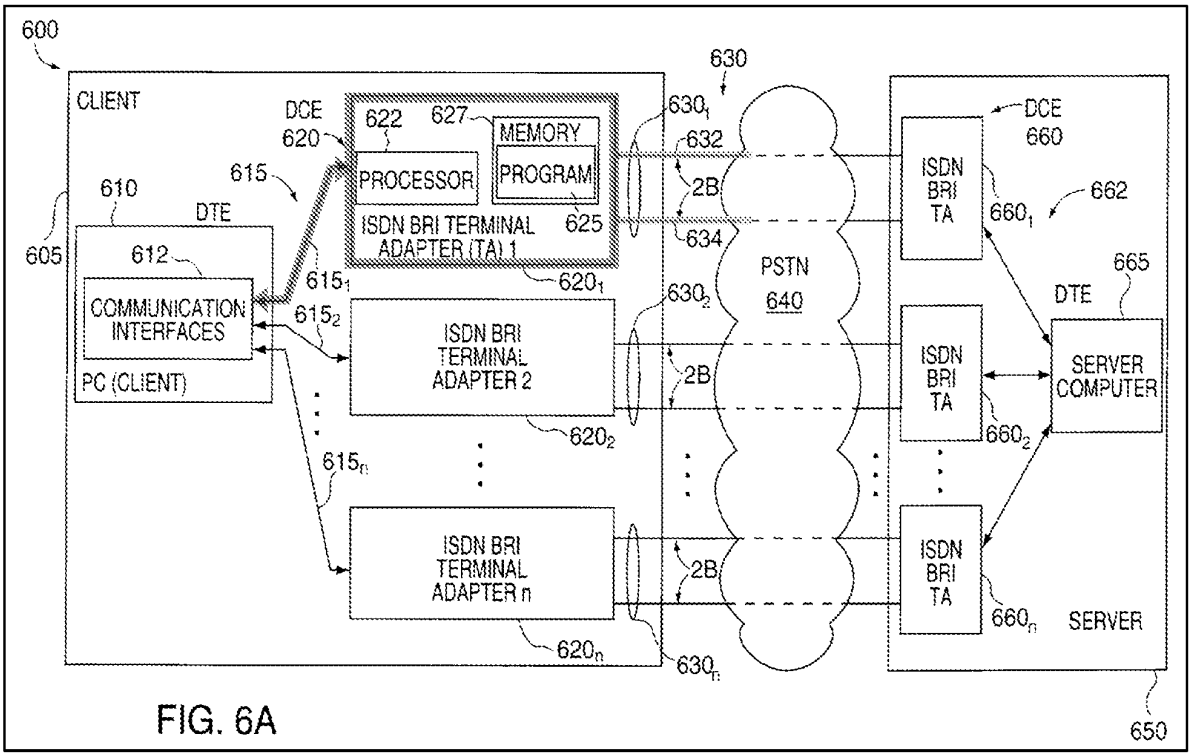


FIG. 6A

Id., Fig. 6A (annotated with a box around DCE adapter 620, shading of its first link 615, and shading of first path links 630). The communication interfaces are "typically . . . separate serial ports" and "not specifically identified." *Id.*, 11:42-43. These *network interfaces* correspond to first link 615_1, with adapter 620_1 and they have a data transfer rate associated with links 630_1, corresponding to the *first path* from the server to first network interface of the client device.

Each of Maurya's network interfaces has a *data transfer rate associated with* their

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respective *paths* 630 to the server. *Id.* 17:36-38 (discussing the "data transmission rate, such as two **B-channels** in an ISDN line"); *see also* Fig. 6A (labeling channels 630_1 . . . 630_n as 2B channels); 11:40-67. Additionally, Maurya recognizes that the different devices communicating along a path may, but need not, have the same data transmission rate. *Id.*, 17:36-57 (describing packet encapsulation when the same data transmission rate cannot be guaranteed across different links).

[1.2] a second network interface having a second data transfer rate associated with a second path from the server to the second network interface of the client device; and

Maurya teaches, or at least renders obvious, this limitation. Specifically, Maurya discloses a client 605 having *a second network interface* (e.g., a **communication interface** corresponding to link 615_2 to a terminal adapter 620_2) having a *second data transfer rate associated with a second path from the server to the first network interface of the client device* (e.g., link 630_2 to terminal adapter 660_2 of server 650):

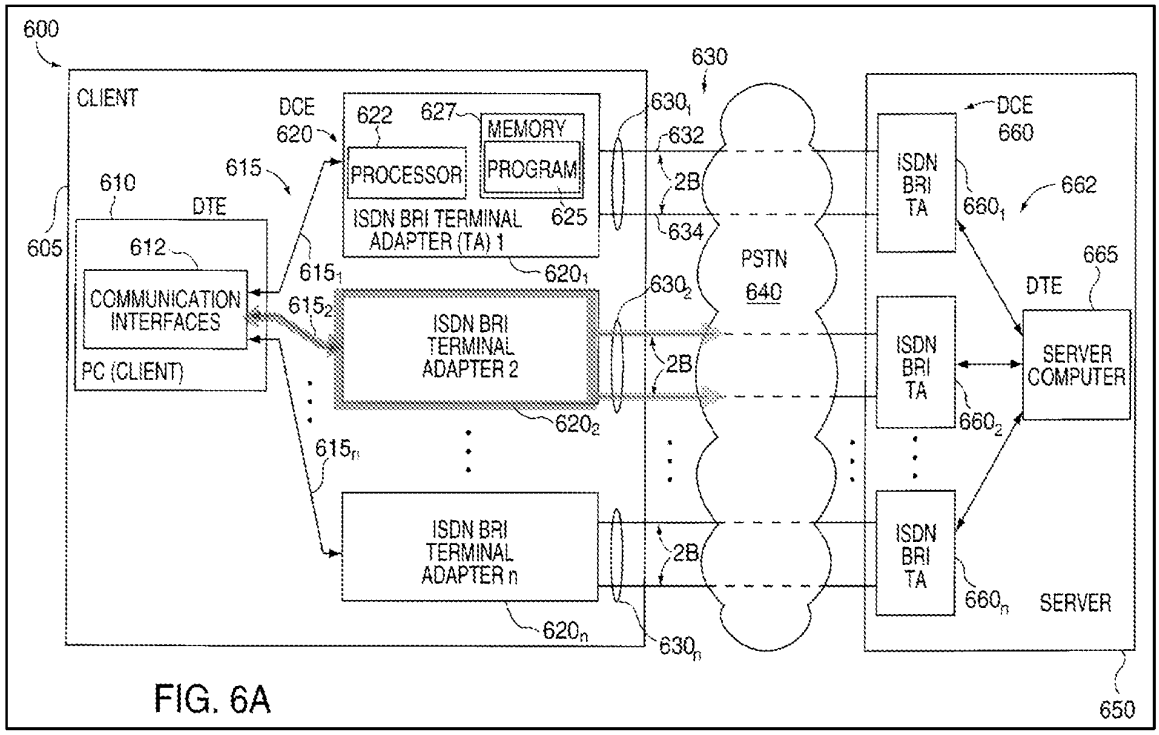


FIG. 6A

Maurya (EX1004), Fig. 6A (annotated with a box around second network interface 620, shading of its link 615 to terminal adapter 620, and shading of second path link 630); *see also* 11:40-67, 17:36-57.

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[1.3]. at least one processor configured to:

Maurya teaches, or at least renders obvious, this limitation. **Client PC 610** is a computer, which were known to function using a processor, such as a central processing unit. *Geier* (EX1003), ¶ 72. Maurya also discloses that a client device may be the "multi-link PPP originator" that employs a "**client application executing at a PC**" to assign itself a unique endpoint discriminator value and "inform[] all its immediate PPP peers, such as neighboring terminal adapters" of this value using a particular kind of LCP packet. *Maurya* (EX1004), 13:61-14:5; *see also* 5:29-37, 14:22-39. Thus, a POSA would have recognized based on Maurya's disclosure that the client PC 610 executes a client application during the course of configuring a link, that Maurya's client PC would have typically, if not inherently, included a processor to send out the LCP messages required for client 605 to interface with server 650. *Geier* (EX1003), ¶ 72 (citing e.g., *Maurya*, 14:22-27).

[1.3.1]. transmit a first message through the first network interface to the server, wherein the first message includes a multilink request [sic] a destination URL;

This limitation is obvious over the combination of Maurya and Low. Maurya discloses that links are configured using link control protocol ("LCP") packets under the point-to-point protocol. To set up a link for the multilink protocol, a client sends an LCP configuration request packet that includes a "Type" field, which is used to indicate a multilink configuration (i.e., *a multilink request*). Combined with Low, the packet would include a *destination URL* to reach the appropriate destination at the server, as Low teaches.

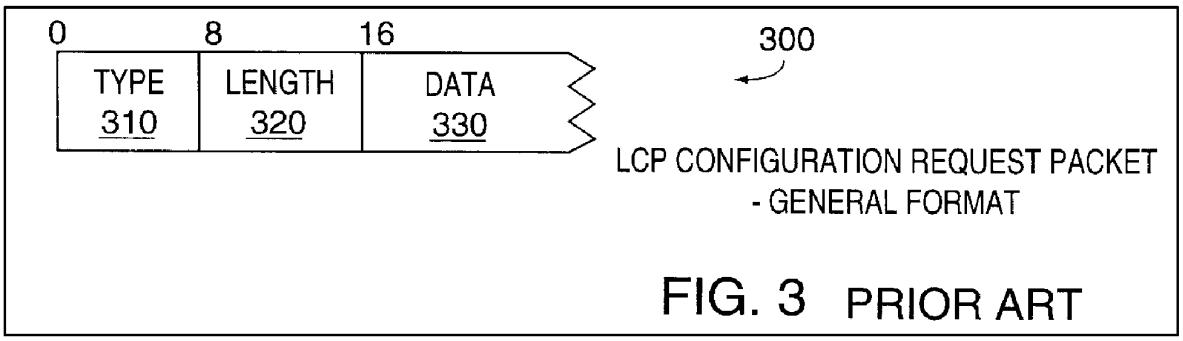
Maurya discloses that in the conventional PPP context, each peer, which includes each network device of the client, would transmit an LCP "**Configure Request**" to configure a link, establish a connection, add and remove connections, and test the link:

> Initially, as shown, a link is in Dead state 110, during which the PPP protocol is inactive. . . . **[A] link control protocol (LCP), which as part of the PPP protocol, exercises responsibility for establishing and configuring the link**, remains in an initial or starting state. Once the physical layer has appropriately signaled that the link is ready, then the link transitions, as symbolized by UP line 115, to Establish state 120.

Maurya (EX1004), 7:22-37; *see also* 1:52-55 ("Before any data is transmitted over a PPP link, **each PPP peer connected to one end of the link will send LCP configuration packets to the**

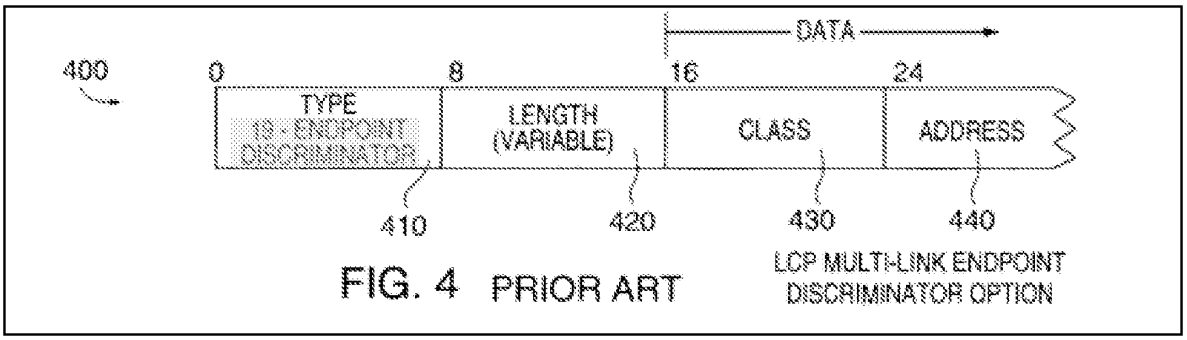
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other end to establish and test the link; thus, ensuring the link is fully operational."); *see also Geier* (EX1003), ¶¶ 49, 55 (citing EX1012-1013, noting other LCP packets). Figure 3 illustrates a general format for an LCP configuration request packet for initializing a link:



Maurya (EX1004), Fig. 3.

The "**Type**" field is how the peers signal that the link is to be configured according to the multi-link protocol (i.e., *as a multilink request*). *Id.*, 8:60-9:9 (type codes 17, 18 and 19 "designate a multi-link MRRU (Multi-link Maximum Receive Reconstructed unit) request, a multi-link Short Sequence Number header request and a 'multi-link endpoint discriminator' option, respectively"). Maurya teaches using type field is 19, signaling a particular kind of ***multilink*** configuration request, the endpoint discriminator option:



See id., 9:35-38, Fig. 4 (annotated to shade the multilink configuration request); *see also* 9:14-21.

A POSA would have recognized from Maurya's disclosure that messages to the server would include information for addressing a server resource, such as the *destination URL* taught by Low. *Geier* (EX1003), ¶¶ 87–88. Maurya describes accessing HTML links to visit websites via a web browser (*Maurya* (EX1004), 1:65-2:25), but because its invention relates to specific fields of LCP configuration packets, it does not go into detail regarding other information that would be included in the message. *Geier* (EX1003), ¶¶ 87–88; *see also* ¶¶ 40–48 (citing EX1010–1011,

describing how the packaging of data is modeled in a communications system, with a data-link layer operating after the application, transport, and network layers from the perspective of a sender). Such other information would include information for identifying the server resource. *Id.*, ¶ 88; *see also* ¶¶ 48, 50–52 (citing EX1010 and EX1013–1015, explaining how LCP packets operate at the data link layer and would include information compiled by "upper" layers of communication, such as the network/transport and application layers). Low explains that resources available over the world wide web were accessible via uniform resource locators, or *URL*s:

> **A cornerstone of the WWW is its ability to address particular information resources by means of an [*sic*] Uniform Resource Identifier (URI) that will generally be either a Uniform Resource Locator (URL)** that identifies a resource by location, or a Uniform Resource Name (URN) that can be resolved into an URL.

Low (EX1005), 12:1-4; *see also* 18:6-7 ("where URIs are referred to in [Low's disclosure] these URIs are URLs and/or URNs."). Low discloses that request to a server would typically include a resource URI, such as a URL:

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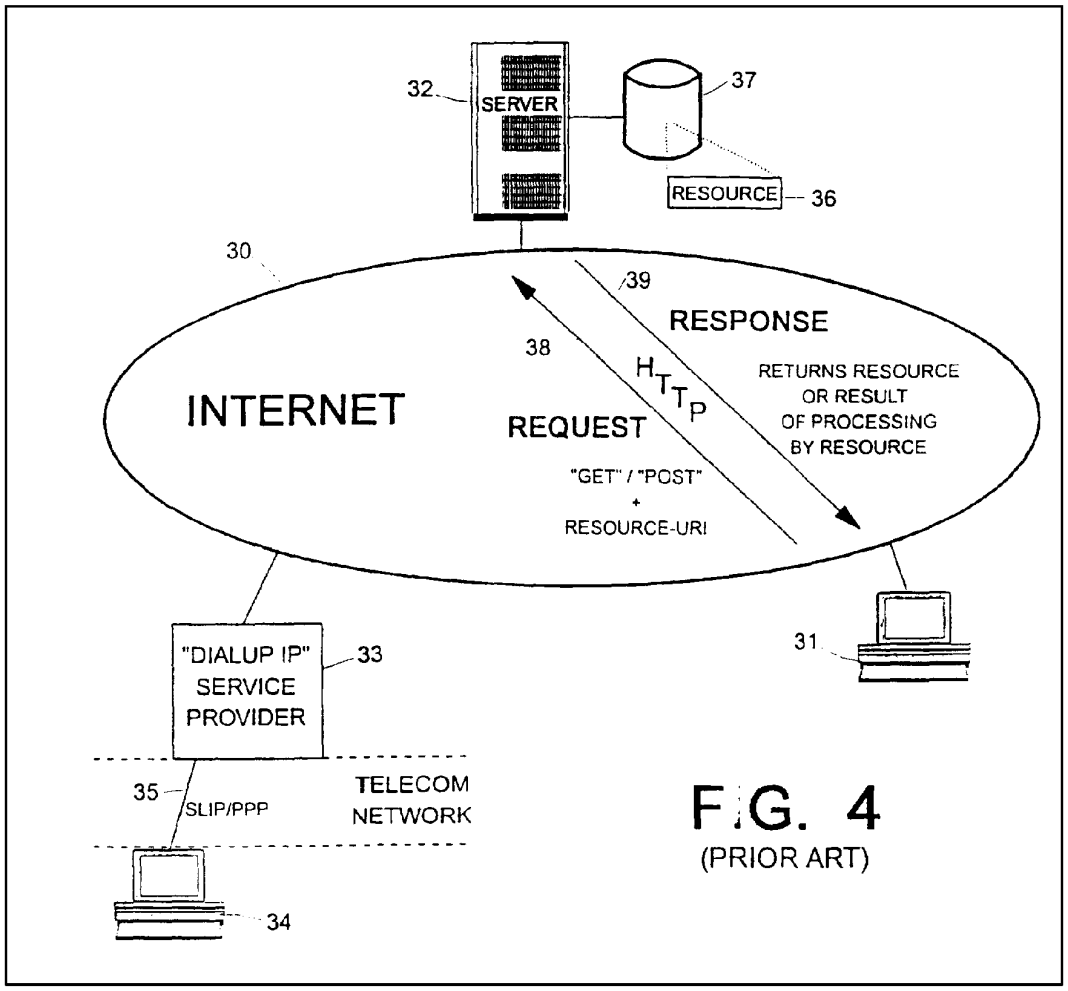


FIG. 4
(PRIOR ART)

Id., Fig. 4; *see also* Fig. 8, 23:17-21 (resource code for requesting a service resource includes a URI identifier and a relative resource identifier).

A POSA would have been motivated to incorporate Low's teachings regarding communications between a client and a web server because such would have been a matter of combining prior art elements (e.g., the contents of packets, as disclosed by Maurya and Low) according to known methods (e.g., using the known multilink protocol) to yield predictable results. *Geier* (EX1003), ¶ 87. Namely, as a POSA would have known, LCP packets operate at the data link layer, and the data link layer encapsulates information identified by higher communication layers, such as a destination URL requested by a client executing a web browser application. *Id.*, ¶¶ 51–52; *see also* ¶ 42 (in telecommunications, the data link layer provides the functional and procedural means for data transfer). Low simply provides additional context that Maurya lacks regarding what happens when a user clicks on a link on a web browser. *Id.*, ¶ 88.

For example, Maurya describes in its background how users click "on a hypertext link or otherwise selects a web page" to access HTML resources at "a remote web server "through an Internet connection," (*Maurya* (EX1004), 2:9-15), but because its invention is directed to specific fields of the LCP configuration packet, it does not go into detail regarding other information that may be included in the overall message, such as information for identifying the server resource. *Geier* (EX1003), ¶ 88. Low provides these implementation details for a resource on a web server. *Low* (EX1005), 13:24-25 (generally describing accessing HTML resources over a web browser). Namely, Low identifies two ways to identify a unique resource: by including a URL or by a uniform resource name (URN) that can be resolved into a URL. *Low* (EX1005), 12:1-4; 18:6-7; *see also Geier* (EX1003), ¶ 88. Thus, a POSA would have been motivated to incorporate Low's teachings regarding using a *destination URL* in messages sent from the client 605 to the server 650 when configuring a link in Maurya's system. *Geier* (EX1003), ¶ 88.

Further, a POSA would have had a reasonable expectation of success in making the combination because the prior art describes similar data link protocols for accessing web server resources, and the combination therefore merely involves at most minor modifications in software using known communication techniques. *Geier* (EX1003), ¶ 89. Low confirms that the use of URLs was known for user terminals and internet service providers employing the point-to-point protocol (PPP) to communicate packets. *Low* (EX1005), 11:21-30 (serial line interface protocol and point-to-point protocol "allow Internet packets to traverse ordinary telephone lines"); *see also* 46:23-27; 18:6-7, Fig. 6. Low also contemplates its own system using the PPP over multiple channels, including using ISDN lines. *Id.* 42:7-12 (noting that the use of ISDN lines, used in Maurya's preferred embodiments, would allow the use of PPP over multiple channels, thus not tying up an ordinary telephone line). As a POSA would have known, and as Maurya confirms, ML-PPP was simply a particular mechanism, or application, of PPP. *Maurya* (EX1004), 3:1-8; *see also Geier* (EX1003), ¶ 89.

[1.3.2] transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification [sic] the destination URL; and

This limitation is obvious over the combination of Maurya and Low. Specifically, Maurya that the client PC requires **each peer** to send the client's unique endpoint discriminator, or endpoint identifier (i.e., *multilink session identification*) when initiating a link. *Maurya* (EX1004), 9:14-34 (describing the multi-link endpoint discriminator option LCP Configuration Request packet); 1:52-

55 (each PPP peer sends LCP packets to the other end of the link to ensure it is fully operational). Thus, an application executing at the client PC 610 requires terminal adapter 620_2 to send a *second message* to the server including *a multilink session identification*. As combined with Low, this second message would also include a *destination URL*.

As discussed regarding limitation 1.3.1, an endpoint discriminator option allows different peers, such as the terminal adapters, to join a link by specifying an endpoint discriminator of an endpoint system:

> [A]n LCP Configure Request packet 35 specifies a multi-link endpoint discriminator option whenever the type field of the LCP Configure Request packet is set to value nineteen, as is field 410. **Identification of the endpoint system (commonly referred to as either an "endpoint discriminator" or "endpoint identifier") is accomplished through class field 430 and address field 440, which collectively contain data carried by this packet**.

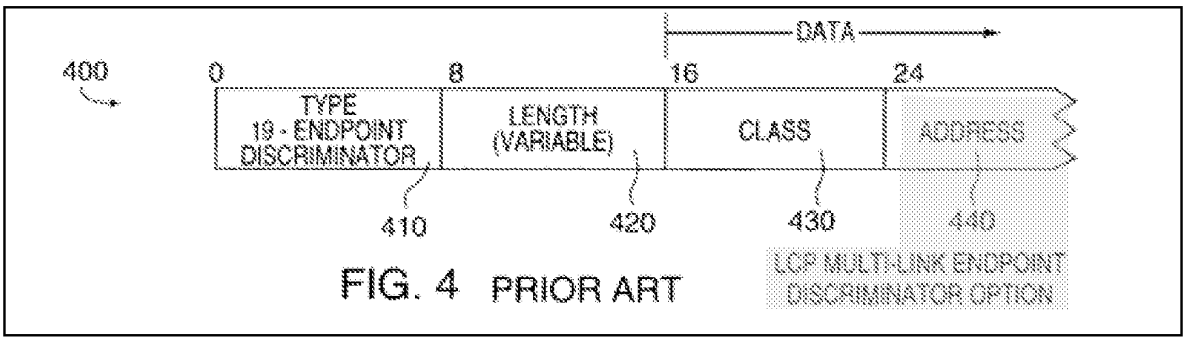


FIG. 4 PRIOR ART

Maurya (EX1004), 9:35-42, Fig. 4 (annotated to shade field 440, the "Address" LCP Multi-link Endpoint Discriminator Option); 1:52-55 ("Before any data is transmitted over a PPP link, **each PPP peer connected to one end of the link will send LCP configuration packets to the other end to establish and test the link**."). Endpoint discriminators were used to determine if a link is part of an existing bundle of links connecting these peers or if a new bundle should be established. *Id.*, 9:25-31; *see also* 10:22-29.

Maurya discloses that a unique endpoint discriminator may be assigned to all peers. Maurya explains that one drawback to conventional PPP systems is that multiple outgoing links connected to the same endpoint system, such as a client, still may have different endpoint discriminators; this results in the endpoint system at the opposite end of the pipe, such as a server, as viewing each network device as separate instead of as part of a common bundle of links

terminating at one system, resulting in packets not being properly reassembled at the client PC. *Id.*, 13:23-46.

Maurya purports to solve this problem by creating a "multi-multi" link protocol in which a client directs each peer at the end of one pipe to "share a common endpoint discriminator value." *Id.*, 13:54-60. This is performed during LCP negotiations by having "a multilink PPP originator, such as . . . a client application executing at a PC, assign[] itself a unique endpoint discriminator value and inform[] all its immediate PPP peers" of this value using an LCP Endpoint Discriminator packet containing this value." Each peer assumes this unique value as its own endpoint discriminator value and passes it through LCP packets down the pipe, fanning out until "all the links in this pipe will be viewed, by the multi-link protocol, as part of a common bundle." *Id.*, 14:5-21; *see also* 5:8-20, 5:29-55 (similar).

For example, a client PC 610 assigns itself a unique endpoint discriminator, which it supplies to each of the terminal adapters 620 to set as their own endpoint discriminator. *Id.*, 14:22-29; *see also* 14:35-37. When each of these terminal adapters of client 605 configure the link with each of the corresponding the adapters 660 at the server end of the pipe, they will provide this common endpoint discriminator via the LCP Configuration Request packet. *Id.*, 14:35-43; *see also* Fig. 6B. Then, "by virtue of the common endpoint discriminator associated [*sic*] the application executing at client PC 10," the server will see all of the peers as part of a common bundle for packets generated by and destined to client 605. *Id.*, 14:50-60.

A POSA would have recognized that Maurya's endpoint discriminator, also called an endpoint identifier (*id.*, 9:39-40, 10:22-25, 13:19-21), is a *multilink session identification* because it identifies the session using LCP configuration packets, which were used to add and remove devices from a link. *Geier* (EX1003), ¶¶ 74–75. Indeed, one example of multilink session identification in the '908 Patent is a "magic number." *'908 Patent* (EX1001), 12:9-14. It was well known that "magic number" was a class, or form, of endpoint discriminators, indicated using the number 4 in class field 430 of the endpoint discriminator packet of Figure 4. *Maurya* (EX1004), 9:42-44; *see also Geier* (EX1003), ¶ 76; *see also* ¶¶ 57–58 (citing RFC 1990, EX1015).[15]

[15] Maurya states that its system functions "equally well" with any class of endpoint discriminator. *Maurya* (EX1004), 9:49-55. Thus, to the extent CAS argues that *multilink session identification* is

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Finally, for the reasons discussed regarding limitation 1.3.1, *supra*, a POSA would have been motivated to, and would have had a reasonable expectation of success in modifying Maurya in light of Low's disclosure to include a *destination URL* with LCP packets transferred from the client to the server. *Maurya* (EX1004), 1:65-2:25; *see also Low* (EX1005), 12:1-4; *Geier* (EX1003), ¶¶ 87–89.

[1.3.3] receive data packets from the server through the first and second network interfaces of the client device during the multilink session

Maurya teaches or at least renders obvious this limitation. Maurya confirms that the purpose of the multi-link communications are to allow data transmissions between client 605 and server 650:

> **[S]erver computer 665** . . . will then, through conventional multi-link protocol processing correctly view links 630 as a common bundle, i.e., a pipe, **for packets generated by and destined to this application** and handle packets appearing thereon as multi-link PPP packets.

Maurya (EX1004), 14:50-57; *see also* 8:56-10:5.

> [A] transmitting side device which transmits (e.g., **any of devices 620 or 660**) an incoming packet . . . can alternate these packets between each of its physical links. . . . **A receiving side device merely passes the multi-link packets it receives to its associated [data terminal equipment] in increasing order of the sequence numbers** of the packets its received, while ignoring beginning and ending flags in the multi-link header . . .

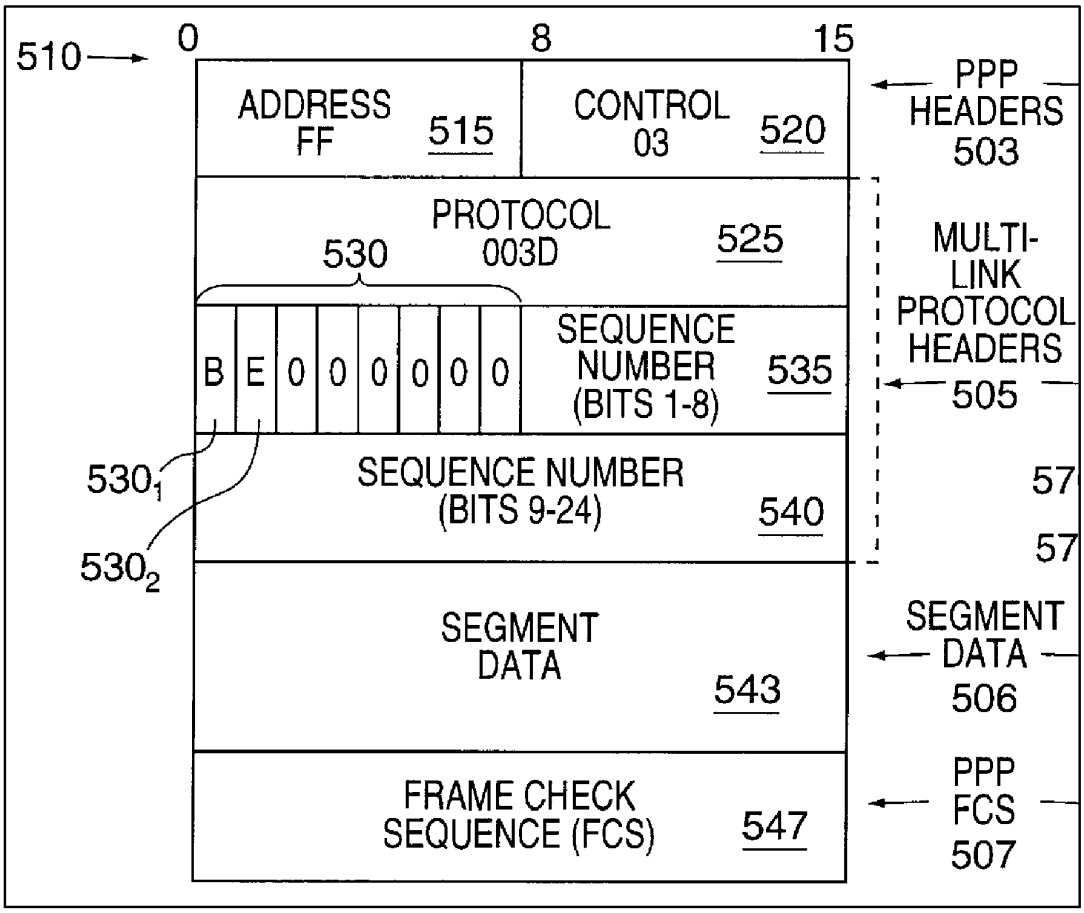
Id. 14:17-15:11 (describing the reception of packets at the client from the server via the terminal adapters 620), Fig. 8 (step 820).

Large transmissions are split into "segments" or "fragments" and sent over multiple network interfaces (i.e., *first and second network interfaces*) to "provide enhanced channel bandwidth." *Id.*, 6:66-7:6. Payload data is encapsulated as segments in a given PPP packet. *Id.*, 9:56-10:5. The segment data is included in every PPP packet as **field 543** for long-sequence format

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limited to magic numbers, such would still be obvious over Maurya in view of the knowledge of a POSA. *Geier* (EX1003), ¶ 76.

packets, and it includes the "actual segment data . . . carried by this multi-link PPP packet." *Id.*, 10:58-59; *see also* 11:13-18 (segment data field is identical for short-sequence format). Figure 5 illustrates payload-carrying packets:



Id., Fig. 5. In all of Maurya's embodiments, packets have "the general format" of Figure 5, but if packets are to be further split at a receiving site, then the devices situated at the level of the split further encapsulate the incoming packets as segment data and adds a sequence number for a particular "frame segment." *Id.* 15:11-25, Fig. 6C.

[1.3.4] wherein the first data transfer rate and the second data transfer rate provide an increased data transfer rate of the first path and the second path from the server to the client device.

Limitation 1.3.4 is a statement of general purpose of the data transfer rates recited in limitations 1.1 and 1.2, and, therefore, should not be given patentable weight; regardless, it is taught by, or at least obvious over, Maurya.

A clause that "merely states the result of the limitations" already in the claim "adds nothing

to the patentability or substance of the claim." *Texas Instruments Inc. v. U.S. Int'l Trade Comm'n*, 988 F.2d 1165, 1172 (Fed. Cir. 1993). While result limitations that recite "specific requirements" may be material to patentability, clauses reciting a "general purpose or aspirational result" are not. *See Allergan Sales, LLC v. Sandoz, Inc.*, 935 F.3d 1370, 1379 (Fed. Cir. 2019) (Prost, C.J., concurring); *accord L'Oréal USA, Inc. v. Olaplex, Inc.*, 844 Fed.App'x 308, 324 (Fed. Cir. 2021) (finding claims requiring decreases in hair breakage limiting because they recited specific percent amounts). Here, the limitation recites a "intended result of a process step previously recited," namely, a non-specific *increased data transfer rate* and thus lacks patentable weight. *Minton v. Nat'l Ass'n of Securities Dealers, Inc.*, 336 F.3d 1373, 1381 (Fed. Cir. 2003) (declining to give "traded efficiently" patentable weight).

Regardless, this limitation is at least obvious over Maurya. Maurya explains that the "multi-link protocol . . . can assign additional bandwidth, on demand, (so-called 'BonDing') in those situations where **two PPP peers can be connected through multiple physical links in a common bundle**." *Maurya* (EX1004), 3:1-9. By treating multiple physical links as one logical channel, called a pipe, the multilink operation "**dynamically provide[s] sufficient transmission bandwidth for the underlying communication** that is then to be carried by the channel." *Id.* 3:6-14. This provides "**increases in transmission bandwidth** to a network user." *Id.*, 2:66-3:1; *see also Geier* (EX1003), ¶¶ 77, 80 (increase in transmission bandwidth permits increased transfer rates).

Further, providing an increased data transfer rate by splitting the data over multiple lower-rate paths was the benefit of using the ML-PPP. *Geier* (EX1003), ¶ 53. The applicant even suggested during prosecution that the use of multiple links to fulfill an increased data transfer rate for a device was inherent in a multilink PPP connection. EX1002, 343. Thus, a POSA would appreciate that by employing multilink communications using multiple links, Maurya's systems provides for an increased bandwidth.

2. Claim 2

2. The client device of claim 1, wherein the at least one processor further is configured to transmit the first message and the second message to at least one server, wherein the at least one server is a device providing the data packets, or a device that manages the client device and another device that is providing data to the client device.

Claim 2 depends from claim 1, which is obvious over Maurya in view of Low. Maurya

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teaches, or at least renders obvious, the additional limitation of claim 2. As an initial matter, limitations 1.3.1 and 1.3.2 already require a processor configured to transmit the first and second messages to a server, so this aspect of claim 2 is rendered obvious by Maurya and Low for the reasons discussed in Sec. IV.A.3.

Claim 2 recites that the server may be *a device providing the data packets* ***or*** a *device that manages the client device and another device providing data to the client devic*e. As discussed regarding limitation 1.3.3, Maurya discloses that the client receives data packets from the server; thus, the server is a device *providing the data packets*. *Maurya* (EX1004), 14:50-57; *see also* 2:19-25, 8:56-10:5, 14:17-15:11, Fig. 8.

Thus, claim 2 is obvious over the combination of Maurya and Low.

3. Claim 5

5. The client device of claim 1, wherein each of the first network interface and the second network interface is one or more of cellular interface, Wi-Fi interface, a wireless interface, a cable interface, a wired interface, an Ethernet interface, a Bluetooth interface, a near-field communication interface, and an optical interface.

Claim 5 depends from claim 1, which is obvious over Maurya in view of Low. The added limitation of claim 5 is at least obvious over Maurya.

Claim 5 requires that the first network and second network interfaces are "one or more" of, *inter alia*, a wireless interface and a wired interface, along with other examples. Maurya's system uses ISDN terminal adapters connected to the client PC's communication interfaces 612 via links 615, which Maurya also refers to as "leads," indicating a wired connection. *Maurya* (EX1004), 11:12-16. Additionally, ISDN devices ultimately utilized a *wired* network system that allowed communications over a telephone network. *Geier* (EX1003), ¶¶ 81–82 (citing EX1017).

Notably, by including both *wireless* and *wired* interfaces, claim 5 encompasses the entire universe configuring a network interface to communicate; therefore, it is obvious for the same reasons discussed regarding claim 1. *Geier* (EX1003), ¶ 81.

Thus, claim 5 is obvious over the combination of Maurya and Low.

4. Claim 6

6. The client device of claim 1, wherein the processor is configured to reorder the one or more data packets that are received over the at least two or more network interfaces of the client device during the multilink session.

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Claim 6 depends from claim 1, which is obvious over Maurya in view of Low. The added limitation of claim 6 is taught, or at least rendered obvious, by Maurya. Specifically, Maurya discloses that a network interface employing the multi-link protocol would reorder packets based on the incremented portion of the sequence number. *Maurya* (EX1004), 10:54-58 ("The multi-link protocol increments the sequence number by one . . . such that these packets can be properly reordered upon reception to reconstitute a correct PPP frame."); *see also* 4:7-12; 14:61-15:11, 17:9-17 (describing ordering in embodiments using multi-multilink).

Thus, claim 6 is obvious over the combination of Maurya and Low.

B. Ground 2: Claims 1, 2, 5, 6, and 13–15 Are Obvious Over Maurya in View of Krishnan and Low

1. Claim 1

[1P]. A client device for multilink data packet communication with a server, the client device comprising:

As discussed in Sec. IV.A.3, Maurya discloses a *client device* (client 605) *for multilink packet communication with a server* (server 650) using multiple ISDN adapters.

Regarding the limitations that follow, Maurya is still cited for its disclosure related to a client device communicating over multiple links with a server via specific multilink configuration packets. Combined with Krishnan, Maurya's client device would communicate using interfaces with multiple modems at an endpoint client. *Geier* (EX1003), ¶ 97. Like Maurya, Krishnan discloses communication systems and methods for multilink packet communication. *Krishnan* (EX1006), 2:31-36 ("Host computer 10 is also programmed with link control software implementing a multi-link data communication protocol such as the Multi Link Point-to-Point Protocol"); *see also* 4:5-5:6 (claim 1, reciting communications between host and a remote computer). Krishnan discloses that a transmitting device "split[s] a single high speed data stream into multiple parallel data streams" that can be recovered at the receiving site as a high-speed data stream. *Id.*, 2:23-40.

A POSA would have recognized that Krishnan's disclosure related to computer 10 were applicable to a client device, like Maurya's client 605. *Geier* (EX1003), ¶¶ 94–96. Computer 10 is "an IBM compatible PC or other personal computer," and because the receiving site itself "receives and demultiplexes the multiple low speed data stream to recover the original high speed data stream," it must be able to employ the multilink protocol. *Krishnan* (EX1006), 1:36–42; *see also*

Geier (EX1003), ¶ 96 (both ends of a pipe must employ the multilink protocol; otherwise configuration requests would not be acknowledged). Further, computer 10 is a server is just one embodiment (EX1006, 3:6-10), and as Maurya shows, in ML-PPP communications, both clients and servers were capable of employing multiple links. *Geier* (EX1003), ¶ 96; *see also Maurya* (EX1004), Fig. 6A (client includes multiple communication interfaces and links); Abstract, 6:66-7:6.

Thus, a POSA would have appreciated from Krishnan's disclosure that the arrangement for computer 10 illustrated in Figures 1–3 are applicable to Maurya's client 605. *Geier* (EX1003), ¶ 96. For the purposes of the mapping to the body of claim 1 below, Requester has annotated the figures with the understanding that the basic configuration of the host and remote computers are the same in the proposed combination, employing Maurya's teachings of using multiple outgoing links at a client-side device in view of Krishnan's teachings using modems.

Krishnan discloses multiple embodiments of achieving multi-link communications to and from a device, such as (1) a computer connected having multiple interfaces to allow it to communicate over different modems (Fig. 1); and (2) a computer having a single interface to connect it to a communications controller connected to multiple modems (Figs. 2A, 2B); and (3) a computer having a single interface connecting it to a modem that is daisy chained to other modems (Figs. 3A, 3B). *Id.*, Figs. 1, 2A, and 3A; *see also* 3:20-23 (describing communication controller 20); 3:66-4:3 (describing multilink modem 34).[16] For the mapping of claim 1, Requester refers to Krishnan's Figure 1 embodiment:

[16] Figure 3A is missing reference number 34. EX1006, 3:66-4:6, Fig. 3B.

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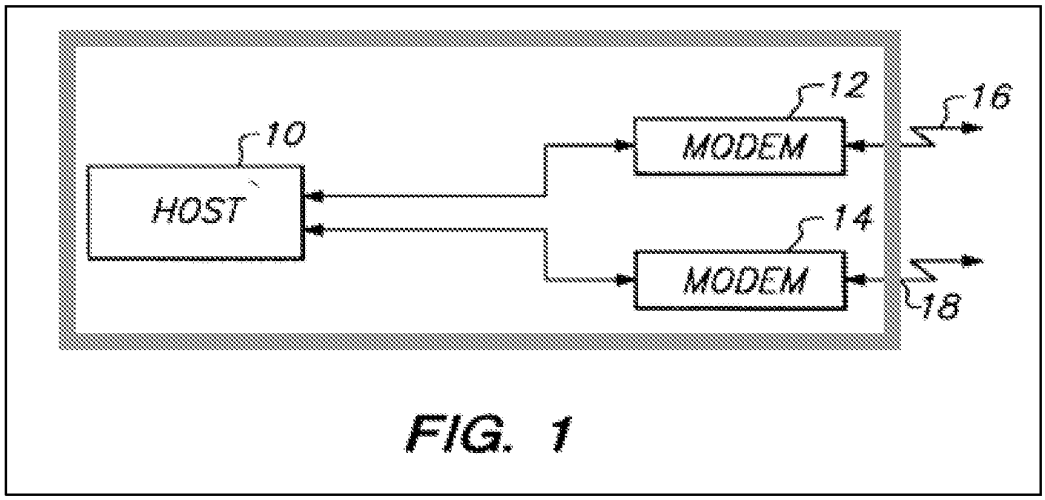


FIG. 1

Krishnan (EX1006), Fig. 1 (annotated with a box around host computer 10 connected to multiple modems 12 and 14).

A POSA would have been motivated to implement Maurya's client using multiple modems as opposed to ISDN adapters for three reasons. First, Krishnan provides express motivation to combine, explaining that modems were cheaper and more widely available than ISDN connections. *Id.*, 1:25-33; *see also Geier* (EX1003), ¶ 98.

Second, a POSA would have recognized that using Krishnan's modems would have been a simple matter of applying a known technique (the use of multiple network devices, such as modems) to a known device (an ML-PPP client device) ready for improvement to yield predictable results. *Geier* (EX1003), ¶ 99. Indeed, although Maurya suggests that conventional modems did not themselves possess multiple incoming and outgoing links (*Maurya* (EX1004), 4:33-41), Krishnan, which was published after Maurya was filed, addressed this by arranging the modems in a setup similar to Maurya's ISDN adapters—by linking and managing multiple modems at a computer programmed with link control software. *Geier* (EX1003), ¶ 99; *see also Krishnan* (EX1006), 2:31-41; 3:59-65.

Finally, the proposed combination would have at most amounted to a simple substitution of one known element (Krishnan's modems) for another (Maurya's ISDN adapters) to obtain predictable results: the communication of multilink packets to and from a server over the PTSN using alternative networking devices. *Geier* (EX1003), ¶ 100.

Further, a POSA would have had a reasonable expectation of success in making the modification because both Krishnan and Maurya are similar systems that use the ML-PPP and

have similar goals (transmitting and receiving large amounts of data). *Id.*, ¶ 101. Both Maurya and Krishnan connect these network devices to single system including a personal computer that is programmed to execute the multilink protocol. *Maurya* (EX1004), 3:46-53, 7:6-13, 13:61-14:5; *see also Krishnan* (EX1006), 1:40-42, 2:24-36. Maurya simply discloses techniques for clients to communicate using multiple ISDN adapters via the ML-PPP, while Krishnan teaches using multiple modems. *Geier* (EX1003), ¶ 101; *Maurya* (EX1004), Abstract; *Krishnan* (EX1004), Abstract.

[1.1]. a first network interface having a first data transfer rate associated with a first path from the server to the first network interface of the client device;

This limitation is obvious over Maurya in combination with Krishnan. Both Maurya and Krishan teach *a first network interface having a first data transfer rate associated with a first path* between two devices, such as a *server to first network interface of* a client. In Maurya, the client device links to ISDN terminal adapters to communicate with the server (*see* Sec. IV.A.3), while in Krishnan, conventional modems are used. Combined, Maurya and Krishnan teach a *client device* (e.g., a client 605) using the ML-PPP and *having a first network interface* (e.g., a network interface with a modem) *having a first data transfer rate associated with a first path from the server to the second network interface* (e.g., path 16) of the client device. For the same reasons discussed regarding the preamble, a POSA would have been motivated to combine, and would have had a reasonable expectation of success in combining, Maurya and Krishnan to achieve client-server communications using a client device with two modems associated with the same or different rates across separate paths using the ML-PPP. *Geier* (EX1003), ¶¶ 97–101.

Krishnan teaches a device comprising *a first network interface* (e.g., a network port linked to modem 12) has a first data transfer rate (e.g., 28.8 kbps), *associated with a first path from the server to the first network interface of the client device* (e.g., path 16):

> **Modems 12** and 14 are coupled to separate data ports of host computer 10 and **to separate telephone lines 16** and 18. Although only two modems are shown, additional modems may be used, as long as **each one is coupled to a separate data port of host computer 10**.

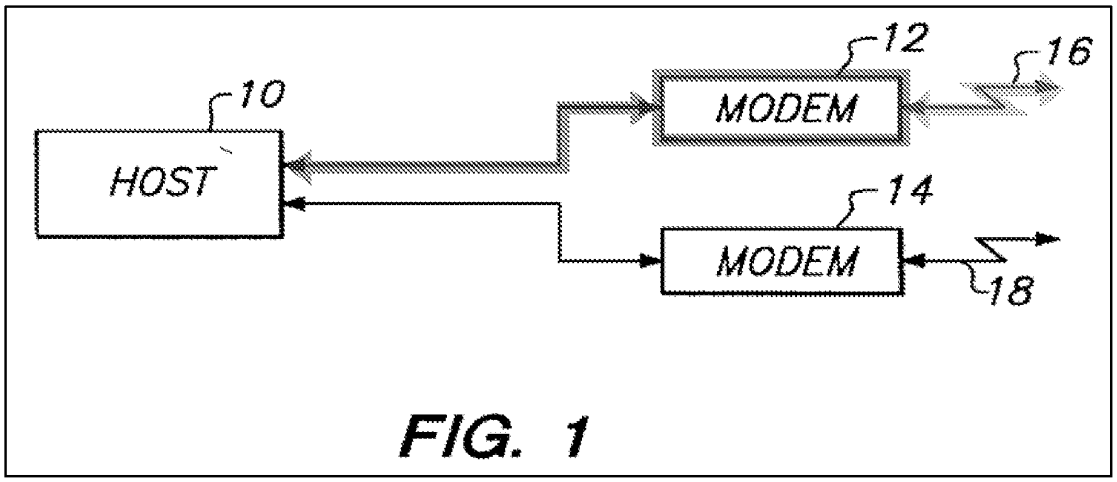
Krishnan (EX1004), 2:22-29; *see also* 3:14-29 (describing embodiment of Figure 2, where a communication controller, "which may be a stand-alone unit or an 'add-in' card within host computer 10," includes "**low-speed ports 30** and 32 **for connecting to multiple modems**"

executes link control software).

Krishnan also discloses that the first network interface has a first data transfer rate associated with path 16:

> [I]f the **data transmission rates across PSTN links 16 and 18** are unequal, the link control software may transmit data proportional to the data rate of modems 12 and 14. Thus, if **modem 12 transmits at 28.8 kbps** and modem 14 transmits at only 14.4 kbps, link control the [*sic*] software may transmit twice as much data via modem 12 as via modem 14.

Id., 2:66-3:5; *see also* 4:50-5:6 (claim 1, reciting "first modem circuitry coupled to the processor and to a first communication link, **the first communication link capable of transmitting data at a maximum rate of N bits/second**").



Id., Fig. 1 (annotated to show the first network interface between the host 10 and the modem 12 and the first path 16 to the server from the modem); *see also* Figs. 2A, 2B (alternative embodiment where a communication controller is used to enable multiple network interfaces with a host).[17] While Krishnan discloses different transfer rates in one embodiment, it also teaches the use of the same transfer rates. *See, e.g.*, *id.*, claim 9

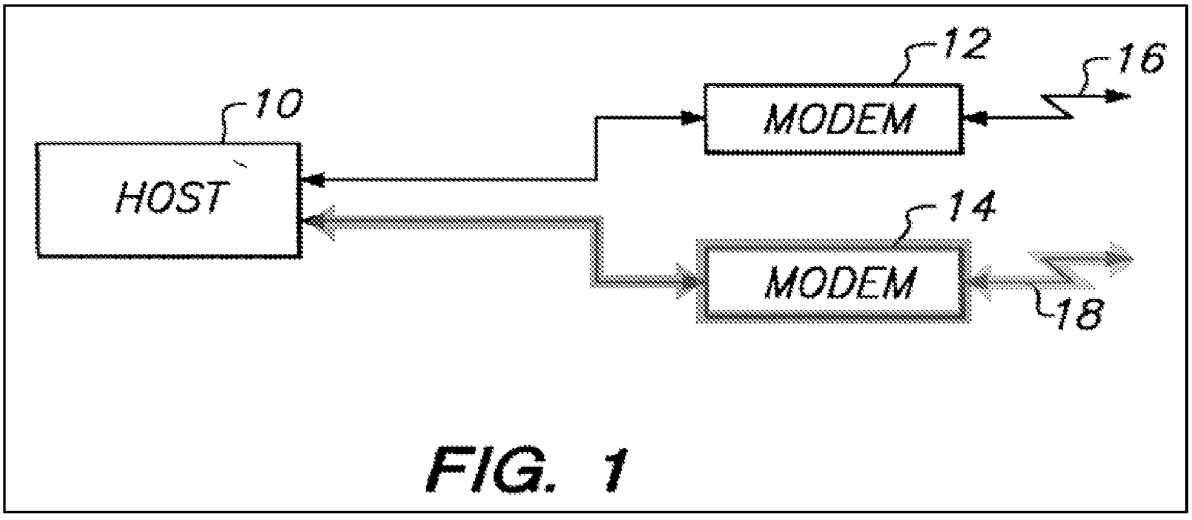
[17] As discussed regarding the preamble, while computer 10 acts as a server in some embodiments, a POSA would have recognized that the structure was also applicable to a personal client computer based on Krishnan's disclosure.

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[1.2] a second network interface having a second data transfer rate associated with a second path from the server to the second network interface of the client device; and

This limitation is obvious over Maurya in combination with Krishnan. Both Maurya and Krishan teach *a second network interface having a first data transfer rate associated with a second path* between two devices, such as a *server to second network interface of* a client. In Maurya, the client 605 comprises ISDN terminal adapters to communicate with the server (*see* Sec. IV.A.3), while Krishnan uses modems. Combined, Maurya and Krishnan teach a *client device* (e.g., a client 605) using the ML-PPP and *having a second network interface* (e.g., a network interface with a modem) *having a second data transfer rate associated with a second path from the server to the second network interface* (e.g., path 18) of the client device. For the same reasons discussed regarding the preamble and limitation 1.1, a POSA would have been motivated to combine, and would have had a reasonable expectation of success in combining, Maurya and Krishnan to achieve client-server communications using a client device with two modems associated with the same or different rates across separate paths using the ML-PPP. *Geier* (EX1003), ¶¶ 97–101.

Krishnan discloses a computer having *a second network interface* (network port linked to modem 14) *that has a second data transfer rate* (e.g., 14.4 kbps), *associated with a second path from the server to the first network interface of the client device* (e.g., bidirectional path 18, between a host computer and remote computer):



Krishnan (EX1006), Fig. 1 (annotated to show the second network interface connecting host 10 with modem 14 and second path 18 between host computer 10 and a remote computer); *see also* 2:63-3:5 (describing the different transfer rates across paths 16 and 18); *see also* 4:50-5:6 (claim

1, reciting "**second modem circuitry second modem circuitry coupled to the processor and to a second communication link**, the second communication link capable of transmitting data **at a maximum rate of M bits/second**"); *see also* Figs. 2A, 2B (alternative embodiment using communication controller 22).[18] While Krishnan discloses different transfer rates in one embodiment, it also teaches the use of the same transfer rates. *See, e.g.*, *id.*, claim 9.

[1.3]. at least one processor configured to:

This limitation is obvious over the combination of Maurya and Krishnan. As discussed, Maurya teaches or at least renders obvious this limitation. Sec. IV.A.3 (1.3).

Krishnan likewise discloses *at least one processor* that may be incorporated into or connected with a client device. In Krishnan's Figure 1 embodiment, it is a processor on the computer that executes link control software. *See Krishnan* (EX1006), 3:19-22; *see also* 2:31-36 ("**Host computer 10 is also programmed with link control software** implementing a multi-link data communication protocol . . .").[19] In discussing the Figure 2 embodiment, Krishnan confirms that it is a "host processor" that executes the link control software described with respect to Figure 1:

> Communication controller 20, which may be a stand-alone unit, or an "add-in" card within host computer 10, **executes link control software similar to the software executed on host processor 10 of FIG. 1.** The controller off-loads link control processing from the host thereby reducing the processing load on the **processor of host computer 10**.

Id., 3:14-25; *see also* 3:29-34 ("**Processor 22** may be any sufficiently powerful general purpose processor," or a "digital signal processor"); claims 1, 5–6 (processor may be on host computer or separate from host computer); 1:51-63.

Further, it would have been obvious to implement the client computer taught by Maurya to

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[18] As discussed, while computer 10 acts as a server in some embodiments, a POSA would have recognized from Krishnan's disclosure that its operation was also applicable to a personal client computer.

[19] As discussed regarding the preamble, the remote computer receiving data would also be set up with this arrangement to reconstruct the high-speed data stream.

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employ a processor and associated software allowing ML-PPP transmissions over separate modems, as taught by Krishnan. A POSA would have been motivated to modify Maurya's system and would have had a reasonable expectation of success in doing so for the same reasons discussed regarding the preamble and limitation 1.1. As further motivation, a POSA would have recognized that configuring a central client-based *processor* to perform the functions related to controlling the ML-PPP communication links would have been a simple matter of combining prior art elements (Krishnan's modem-based architecture and Maurya's teachings related to PPP communications) according to known methods (ML-PPP communications) to yield predictable results (the communication of data using the multilink protocol). *Geier* (EX1003), ¶ 99.

[1.3.1]. transmit a first message through the first network interface to the server, wherein the first message includes a multilink request [sic] a destination URL;

This limitation is obvious over the combination of Maurya, Krishnan, and Low. As discussed in Sec IV.A.3, the combination of Maurya and Low discloses transmitting a *message first message through* a *first network interface to the server, wherein the first message includes a multilink request [sic] a destination URL*. Combined with Krishnan, the network interfaces would connect to readily available modems to achieve multiple links at a device executing the multilink protocol.

As discussed regarding Ground 1, Maurya discloses that links would be configured using LCP configuration packets, including a first configuration request indicating a multilink configuration in a type field (i.e., *a multilink request*) sent over a first terminal adapter of client 605 to a corresponding terminal adapter of server 650. Sec. IV.A.3 (1.3.1). In light of the combination of Maurya and Low, a POSA would have been motivated to include, and would have reasonably expected success in including, a *destination URL* in messages between a client PC and a server resource in order to reach the appropriate destination. *Id.* For the reasons discussed regarding the preamble and limitation 1.1, a POSA would have been motivated to, and would have reasonably expected success in, implementing Maurya's *first network interface* using a first data port to a first modem 12, as taught by Krishnan.

[1.3.2] transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification [sic] the destination URL; and

This limitation is obvious over the combination of Maurya, Krishnan, and Low. As

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discussed regarding Ground 1, Maurya discloses that links would be configured using LCP configuration packets, including a second request specifying a unique endpoint discriminator (i.e., *multilink session identification*) sent from a second terminal adapter at client 605 to a corresponding adapter at server 650. Sec. IV.A.3 (1.3.2). In light of the combination of Maurya and Low, a POSA would have been motivated to include, and would have reasonably expected success in including, a *destination URL* in configuration messages between a client PC and a server. *Id.*

For the reasons discussed regarding the preamble and limitation 1.2, a POSA would have been motivated to, and would have reasonably expected success in, implementing Maurya's *second network interface* using a second data port to a second modem 14, as taught by Krishnan.

[1.3.3] receive data packets from the server through the first and second network interfaces of the client device during the multilink session

As discussed in Ground 1, Maurya teaches, or at least renders obvious, this limitation. *See* Sec. IV.A.3 (1.3.3), *see also, e.g.*, *Maurya* (EX1004), 14:50-57; Fig. 5 (example packet fragment), Fig. 6B (multi-multilink packet).

The combination with Krishnan would not change Maurya's disclosure regarding the transmission and reception of packets. Krishnan similarly discloses that packets are split by a transmitting site and that a receiving site receives and demultiplexes multiple low-speed data streams to recover a high-speed data stream. *Krishnan* (EX1006); Abstract, 2:36-41 (a transmitting site splits data over multiple low-speed data streams to allow a "receiver" to recover a high-speed data stream); *see also* Figs. 1, 2A, 3A. As discussed regarding a preamble, a POSA would have recognized that the architecture illustrated in Figure 1, which includes bi-directional arrows, would apply to a receiving client device. *Geier* (EX1003), ¶¶ 94-96.

For the same reasons discussed regarding the preamble and limitations 1.1 and 1.2, a POSA would have been motivated to implement, and would have had a reasonable expectation of success in implementing, Maurya's teachings using Krishnan's modem-based architecture.

[1.3.4] wherein the first data transfer rate and the second data transfer rate provide an increased data transfer rate of the first path and the second path from the server to the client device.

As discussed, limitation 1.3.4 is a statement of general purpose of the data transfer rates recited in limitations 1.1 and 1.2, and, therefore, should not be given patentable weight (*see* Sec. IV.A.3).

Regardless, this limitation is obvious over the combination of Maurya and Krishnan. As discussed above, providing an increased data transfer rate by splitting the data over multiple lower-rate paths was a benefit of using the ML-PPP, which Maurya confirms. *See* Sec. IV.A.3.

This would continue to be the case even implementing Maurya's ML-PPP techniques using Krishnan's modems, as Krishnan confirms that by using multiple modems and the ML-PPP, its system would "combine" the connections to "create a high speed data link" by splitting a high-speed data stream among multiple lower speed parallel data streams, each transmitted via a low speed modem and PSTN connection. *Krishnan* (EX1006), 1:36-50; *see also* Abstract, 2:36-41 (similar); claim 11 (a processor transmits data at a data rate of "**N+M**" by transmitting data over multiple modems); *Geier* (EX1003), ¶ 101.

Thus, this limitation is obvious over Maurya in view of Krishnan.

2. Claim 13

Claim 13 is like claim 1, but recites a device comprise a network interface that transmits messages to second and third devices, not necessarily a server. Claim 13 is obvious over the combination of Maurya, Krishnan, and Low.

[13P]. A first device comprising:

As with claim 1, the body of claim 13 is structurally complete; therefore, the preamble is non-limiting. Sec. IV.A.3 (1P). Even if the preamble is limiting, Maurya discloses, or at least renders obvious, a *first device*, such as personal computer 610 (i.e., *a first device*). *Id.*; *Maurya* (EX1004), 3:46-53, 7:6-13.

[13.1] a network interface; and

This limitation is obvious over Maurya in view of Krishnan. As discussed regarding claim 1, Maurya combined with Krishnan teaches a computer having at least one *network interface*, such as multiple ports to separate modems (Figure 1 embodiment) one port to a communications controller connected to multiple modems (Figure 2 embodiment) or a port to a multilink modem daisy chained to other modems (Figure 3 embodiment). *See* Sec. IV.B.2. (1P, 1.1, 1.2).

[13.2] at least one processor configured to:

This limitation is obvious over Maurya in view of Krishnan. As discussed regarding limitation 1.3, Maurya combined with Krishnan teaches that the computer includes a processor configured to handle sending and receiving information via the multilink protocol over multiple

modems. *See* Sec. IV.B.2 (1.3).

[13.2.1] transmit a first message through the network interface to a second device, wherein the first message includes a multilink request and a destination URL, the network interface to the second device having a data transfer rate associated therewith:

[13.2.2] transmit a second message through the network interface to a third device, wherein the second message includes a multilink session identification that is unique to the multilink session and the destination URL, the network interface to the third device having a data transfer rate associated therewith; and:

Limitations 13.2.1 and 13.2.2 require the transmission of similar messages from the first device (computer 610) to the second and third devices as the first and second messages recited in limitations 1.3.1 and 1.3.2. To the extent the first device may be associated with multiple network interfaces to the second and third device, these limitations are almost identical to the corresponding limitations of limitations 1.3.1 and 1.3.2, and are obvious over the combination of Maurya, Krishnan, and Low for the same reasons discussed above. *See* Sec. IV.B.2. Specifically, the PC 610 is the first device, while modems 12 and 14 are the second and third devices (or modems 34 and 12, respectively, for the third embodiment of Krishnan). Requester addresses potential differences below.

Maurya describes the endpoint discriminator as a *unique* value assigned by the client or server in establishing the link (i.e., *multilink session identification* ***that is unique to the multilink session***):

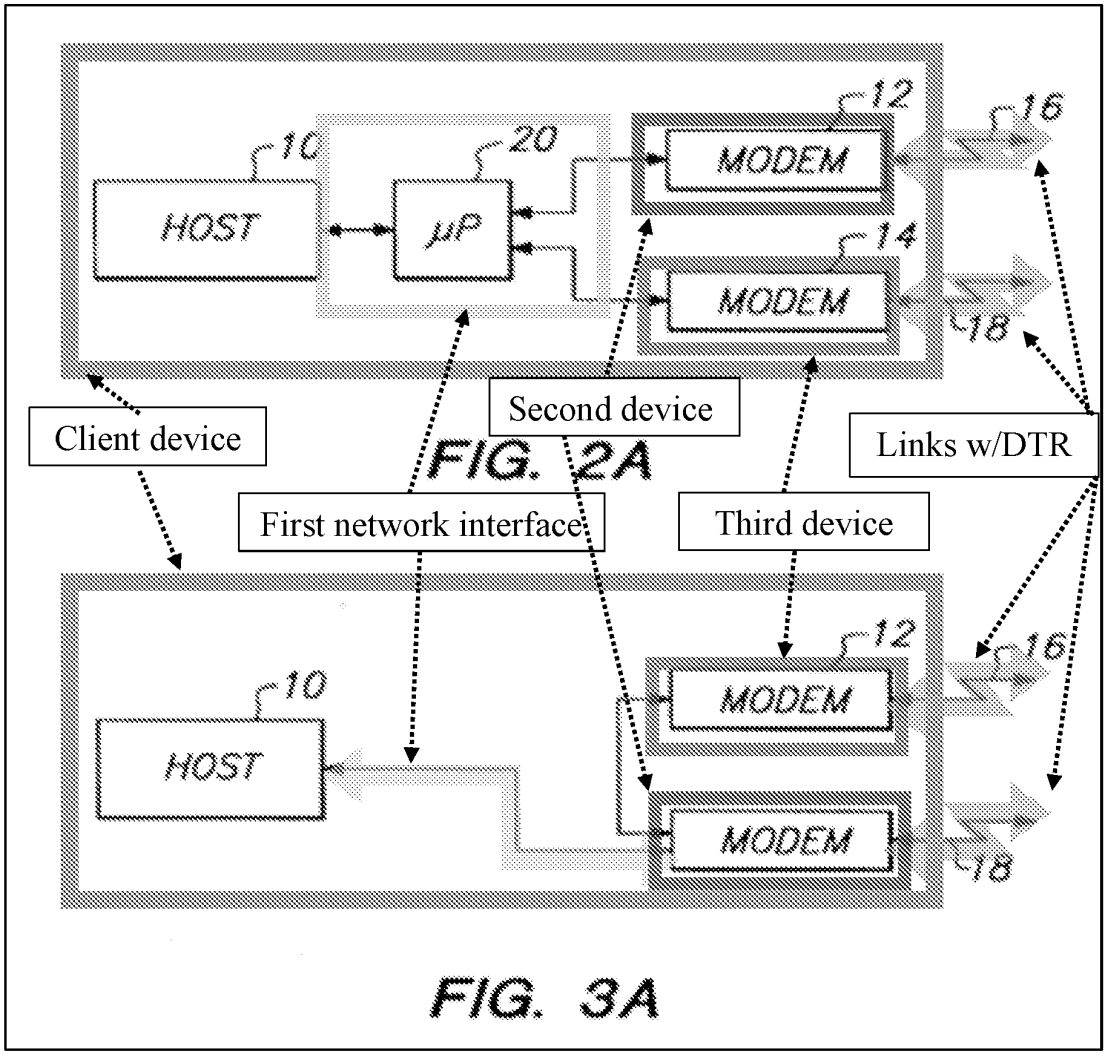
> During LCP negotiations, a multi-link PPP originator assigns itself a **unique endpoint discriminator value** and informs all its immediate PPP peers by sending the latter, via a first bundle of outgoing links, an LCP Endpoint Discriminator packet containing this value. Each of these immediate PPP peers assumes, as its endpoint discriminator, the value that has been provided to it . . .

Maurya (EX1004), Abstract; *see also* 5:29-42, 13:23-27, 13:61-14:5.[20]

[20] This would have been true even if a magic number was required by the claim, as magic numbers were used until a link was closed typically had a high probability of being unique. *Geier* (EX1003), ¶ 58.

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To the extent these limitations requires that a **single** network interface to both the second and third devices, such is obvious over Maurya in view of the second or third embodiments of Krishnan, where a computer includes a single network interface connected to second and third devices via a controller (the Figure 2 embodiments of Krishnan) or a multilink modem able to connect with other modems in a daisy-chain fashion (the Figure 3 embodiments of Krishnan):



Krishnan (EX1006), Fig. 2A, Fig. 3A (annotated); *see also* 3:14-52 (describing the Figure 2 embodiment, including how the link control software works and how the controller is connected to the host); 3:66-4:17 (describing the Figure 3 embodiment using downstream modems to offload

delivery of data); *Geier* (EX1003), ¶¶ 103–104.[21]

Combined with these alternative embodiments, Maurya's client computer would still send the first and second LCP messages discussed regarding limitations 1.3.1 and 1.3.2 to each of the modems, either directly or indirectly, so that they would assume the same unique endpoint discriminator value of the PC client 610 before configuring the link with the server. *Geier* (EX1003), ¶ 103; *see also* Sec. IV.A.3 For example, even though there is one physical connection in these embodiments, the host computer may have device driver software to "see" each modem and manage them through multiple logical connections to the controller/multilink modem. *Krishnan* (EX1006), 3:56-65 (Figure 2).

For the same reasons discussed regarding claim 1, a POSA would have been motivated to combine, and would have had a reasonable expectation of success in combing, Krishnan's teachings regarding the use of modems to communicate data in Maurya's system and would have had a reasonable expectation of success in doing so. Sec. IV.B.2. The Figure 2 and 3 embodiments are alternative examples of arranging Krishnan's system. *Krishnan* (EX1006), 2:8-16. A POSA would have recognized the same motivations and expectations of success in combining Maurya's teachings regarding a client device using the ML-PPP with multiple outgoing links with Krishnan's alternative arrangements as with the Figure 1 embodiment, as Maurya's teachings relate to managing an endpoint with multiple outgoing links, and Krishnan simply discloses alternative ways of arranging those links. *Geier* (EX1003), ¶ 105.

[13.2.3] receive the different data packets through the at least one network interface from the second device and from the third device during the multilink session [22]

As discussed regarding limitation 1.3.3 of claim 1, the combination of Maurya and Krishnan discloses *receiving the different data packets* through at least one interface from the second device (e.g., modem 12) and third device (modem 14). Sec. IV.B.2. However, to the extent

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[21] Claim 13 does not limit the first device to a client computer; it may even be a server. *See* claim 15. Regardless, as discussed regarding the preamble of claim 1, although Krishnan describes host computer sending data to a remote computer, the configuration applies to a receiving client. *See* Sec. IV.B.2.

[22] This is the first time *different data packets* is mentioned in claim 13. Requester assumes that the word "the" should have been omitted.

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this limitation requires a single network interface between the first device and the second and third devices, such is obvious over Maurya in view of Krishnan's Figure 2 or Figure 3 embodiments. As discussed regarding limitations 1.3.3 and 13.2.2, the computer 10 sends and receives data over the multiple modems through one network interface, such as a port to a controller (Figure 2) or specially-programmed multilink modem (Figure 3).

[13.2.4]. wherein the data transfer rate associated with the network interface to the second device and the network interface to the third device provide an increased data transfer rate for the first device.[23]

As a preliminary matter, this wherein clause states an intended purpose or result and, therefore, lacks patentable weight. *See* Sec. IV.A.3 (1.3.4).

Although the claim does not indicate what the "increased data rate for the first device" is to be compared against, given the context referring to multilink communications earlier in the claim and the intrinsic record, Requester assumes this refers to the combined bandwidth provided by using the second and third devices to receive data. *'908 Patent* (EX1001), 11:50-53; *see also* 12:31-44. As discussed regarding limitation 1.3.4, providing an increased data rate was a well-known feature of multilink communications, and it is taught by the combination of Maurya and Krishnan. Sec. IV.A.3, IV.B.2 (1.3.4).

3. Claims 2, 5, and 6

Each of claims 2, 5, and 6 depend from claim 1, which is obvious over the combination of Maurya, Krishnan, and Low. These claims are also obvious over the combination of Maurya, Krishnan, and Low.

Maurya discloses the additional limitation of claim 2. Specifically, combined with Krishnan, data packets would still be provided to Maurya's client 605 by a server, such as server 650, just through modems. Sec. IV.A.4.

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[23] Earlier limitations referred to ***a*** *network interface* (13.1) and transmitting messages *through* ***the*** *network interface* to the second (13.2.1) and third (13.2.2) devices, but limitation 1.2.3 referred to the "at least one" network interface, and this limitation implies different network interfaces to the second and third devices. Requester has shown how the combination of Maurya with different architectures disclosed by Krishnan render the claim obvious whether one or two network interfaces are required. *Intel Corp.*, 21 F.4th at 813-14.

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Regarding claim 5, the combination of Maurya and Krishnan still uses a *wired* network interface, as a wired interface, such as RS-232, couples the modems to ports of the host computer (EX1006, 1:39-42), and paths 16 and 18 go to PTSN telephone lines (EX1006, 2:25-27). *Geier* (EX1003), ¶ 102.

Finally, regarding claim 6, Maurya discloses that original data packets are re-ordered according to sequence numbers of fragments, and this would not change in the combination. Sec. IV.A.6. Indeed, Krishnan notes that in its own, a high-speed data stream may be received "nearly" in sequence, and some processing is necessary to reassemble the original data stream. *Krishnan* (EX1006), 2:63-66.

4. Claim 14

14. The first device of claim 13, wherein the first device and the second device are separate devices or separate parts of the same device.

As discussed, claim 13 is obvious over the combination of Maurya, Krishnan, and Low or Maurya, Krishnan, and Low. As discussed regarding limitation 13.2, the combination of Maurya and Krishnan teach the additional limitation of claim 14. The client computer 610 (the *first device*) is a separate device from each of the modems, including modem 12/34 (the *second device*). Alternatively, these devices are separate parts of the same overall client system 605. *See* Sec. IV.B.3 (13.2.1).

5. Claim 15

15. The first device of claim 13, wherein the first device is one of a cell phone, a tablet, a switch, a server, a network device, a router, a computer, a Wi-Fi device, a Wi-Max device, a mobile communication device, a wireless communications device, a near-field communications device, and a Bluetooth device.

As discussed, claim 13 is obvious over the combination of Maurya, Krishnan, and Low. Claim 15 adds that the first device may be a computer, which Maurya discloses. Sec. IV.B.3 (13P). Thus, claim 15 is obvious over the combination of Maurya, Krishnan, and Low.

C. Grounds 3 and 4: Claims 1–3, 5, and 6 Are Obvious Over Maurya in View of Low and Delangis-156; Claims 1–3, 5, 6, and 13–15 Are Obvious Over Maurya in View of Krishnan, Low, and Delangis-156.

1. Claims 1, 13

As discussed in Grounds 1 and 2, claim 1 is obvious over the combination of Maurya and

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Low, and claims 1 and 13 are obvious over the combination of Maurya, Krishnan, and Low. For example, to the extent the endpoint discriminator as described by Maurya is determined not to be a *multilink session identification*, as in limitations 1.3.2 and 13.2.2 such is obvious over the combination of the prior art cited in Grounds 1 and 2 in further view of Delangis-156, which describes the use of a multilink session identification, such as a magic number, in multilink initialization packets. *Delangis-156* (EX1007), 12:52-58.

A POSA would have been motivated to combine Maurya's teachings regarding an endpoint discriminator option with using a magic number (i.e., a multilink session identification), as taught by Delangis-156. *Geier* (EX1003), ¶ 108. Such a combination would have amounted to at most a simple substitution of one known element (an endpoint discriminator for a client device) for another (a magic number unique to a multilink session) to obtain predictable results, namely, the same result accomplished by Maurya in unifying a set of fragments coming from different outgoing links. *Id.*

Further, a POSA would have had a reasonable expectation of success in making the combination, as magic numbers were already a known class of endpoint discriminator options, and Maurya itself indicates that its system would function "equally well" with any class of endpoint discriminator address. *Maurya* (EX1004), 9:50-55; *Geier* (EX1003), ¶ 110. Thus, the combination would have involved at most minor modifications in software and yielded predictable results consistent with Maurya's disclosure. *Geier* (EX1003), ¶ 110.

2. Claim 3

3. The client device of claim 1, wherein a server provides the multilink session identification that is unique to the multilink session.

Claim 3 depends from claim 1, which is obvious over the combination of Maurya, Krishnan, Low, and Delangis-156. The additional limitation of claim 3 is obvious over the combination of Maurya in view of Delangis-156. While Maurya suggests that a server may provide its endpoint discriminator to be used, it does not disclose that this information is assigned *by the server* in a session set up by a client device for receiving packets from the server. Such would have been obvious in further view of Delangis-156, which describes a multilink session ID as a "magic number" that is assigned by the server. EX1007, 12:11-16.

A POSA would have been motivated to employ some form of identification provided by Maurya's *server* because such would have been the combination of prior art elements (the different

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types of identifying information) according to known methods (known LCP configuration techniques) to yield predictable results. *Geier* (EX1003), ¶ 109. Indeed, it was well known that additional identifying information may appended to a PPP packet to identify a particular link or bundle. *Geier* (EX1003), ¶ 59. And in its inventive embodiment, Maurya suggests that a server may be an originator for multilink communications for assigning the endpoint discriminator value to all of its immediate PPP peers. *See, e.g.*, *Maurya* (EX1004); 13:61-14:5; *see also* 16:25-30, Fig. 7 (step 730) (disclosing steps when a server is the originator). Additionally, such would have been obvious to try, as only a finite number of devices along a given pipe would supply the identification information for a given session, and one of the ends of the link, which would have been involved in negotiating the configuration options for the link, would be a common-sense choice of these finite options. *Geier* (EX1003), ¶ 109. Finally, a POSA would have had a reasonable expectation of success in making the combination, as such would have been a simple matter of making minor modifications in software and yielding predictable results related to execution of the endpoint discriminator option in Maurya's system.

3. Claims 2, 5–6, 14–15

As discussed in Sections IV.A and IV.B, the additional limitations of dependent claims 2, 6, and 15 are taught by, or obvious over, Maurya, and the additional limitations of claims 5 and 14 are taught by, or obvious over Maurya (Ground 1) and Maurya in combination with Krishnan (Ground 2). Therefore, claims 2, 5, and 6 are obvious over the combination of Maurya, Low, and Delangis-156, and claims 2, 5, 6, 14, and 15 are obvious over the combination of Maurya, Krishnan, Low, and Delangis-156.

D. Secondary Considerations

This Request demonstrates that the Challenged Claims of the '908 Patent are unpatentable as obvious in view of the prior art references. The Applicant did not identify any evidence of secondary considerations during prosecution. Further, the clear teachings in the prior art cannot be overcome by any supposed "secondary considerations." Ex. 1006, ¶47; *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 36 (1966).

IV. DISCRETIONARY DENIAL IS NOT WARRANTED

There is no reason to deny reexamination based on any discretionary factor. As explained in greater detail above, the combination of prior art references cited herein was not before the Examiner during prosecution of the '908 patent. While the Requester previously filed an IPR with

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a similar ground as the one presented in this Request, that proceeding was procedurally terminated by a joint motion to terminate prior to institution without any substantive or final rulings by the PTAB. *See Unified Patents, LLC v. Competitive Access Systems, Inc.,* IPR2023-00584, Paper 11 (PTAB, Oct. 2, 2023) ("[W]e determine that it is appropriate to dismiss the Petition and terminate the proceeding as to both Requester and Patent Owner without rendering either a decision to institute or a final written decision."). And while Patent Owner filed a preliminary response, it also did not seek discretionary denial. Further, the '908 patent is not currently being challenged in any other post-grant proceeding. Accordingly, the same or substantially the same arguments have not been previously presented to the Office for final review, nor have they been subject to any written or final decisions. *See* 35 U.S.C. § 325(d).

V. DISCLOSURE OF CONCURRENT LITIGATION, REEXAMINATION, AND RELATED PROCEEDINGS

Based on information available to Requester, the '908 Patent is the subject of one (1) current and one (1) *inter partes* review terminated pre-institution, as listed below. Requester is unaware of any prior reexaminations or other post-grant proceedings in which the '908 Patent is or has been involved.

- *Competitive Access Systems, Inc. v. Oracle Corp. et al.*, 1:23-cv-00286 (W.D. Tex.)[24];
- *Unified Patents, LLC v. Competitive Access Systems, Inc.*, IPR2023-00584 (PTAB) (terminated on October 2, 2023).

VI. CONCLUSION

For the foregoing reasons, Requester respectfully requests *ex parte* reexamination of Claims 1–3, 5, 6, and 13–15 of U.S. Patent No. 10,868,908. The Commissioner is hereby authorized to charge Deposit Account 50-6990 under Docket No. COM908 the *Ex Parte* Reexamination fee of $12,600 under 37 C.F.R. § 1.20(c)(1). Requester believes no other fee is due with this submission, however the Commissioner is hereby authorized to charge any fee deficiency or credit any over-payment to Deposit Account 50-6990.

Please direct all correspondence in this matter to the undersigned.

---

[24] This case was originally filed in the Eastern District of Texas on July 27, 2022 and transferred to the Western District earlier this year. *Competitive Access Systems, Inc. v. Oracle Corp. et al.*, 2:22-cv-00287, Doc. 50 (W.D. Tex. Mar. 16, 2023)

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Respectfully,

Dated: October 4, 2023

By: */Michelle Aspen/*

Michelle Aspen, Reg. No. 75,665
Jessica L.A. Marks, Reg. No. 67,451

4445 Willard Avenue, Suite 600
Chevy Chase, MD 20815
michelle@unifiedpatents.com
T: 559-214-3388
jessica@unifiedpatents.com
T: 202.847.5260

Counsel for Requester
Unified Patents, LLC

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of Delangis	§	REQUEST FOR *Ex Parte* REEXAMINATION
U.S. Patent No.: 10,868,908	§	
	§	Attorney Docket No.: COM908
Issue Date: December 15, 2020	§	
	§	Customer No.: 165774
Filing Date: May 23, 2016	§	
	§	
Title: DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS	§	Real Party in Interest: Unified Patents, LLC

REQUESTER'S POWER OF ATTORNEY
PURSUANT TO 37 C.F.R. 1.510(f)

Pursuant to 37 C.F.R. 1.510(f) Requester, **Unified Patents, LLC**, hereby appoints the Practitioner(s) association with **Customer Number 165774**, as its attorney(s) to prosecute and transact all business in the United States Patent and Trademark Office in connection with the above-identified request for *Ex Parte* Reexamination. Please recognize the correspondence address (including any electronic mail address) associated with **Customer Number 165774** for the above-identified *Ex Parte* Reexamination proceeding number to be the address associated with the appointed counsel(s).

The undersigned is authorized to sign this Power of Attorney on behalf of the Requester.

Executed on 10/4/2023.

Unified Patents, LLC

By: Jonathan Stroud

Printed Name: Jonathan Stroud

Title: General Counsel

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PTO/SB/08a (07-09)
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Substitute for form 1449/PTO				***Complete if Known***	
				Application Number	In Ex Parte Reexamination of U.S. Patent 10,868,908
INFORMATION DISCLOSURE STATEMENT *(Use as many sheets as necessary)*				Filing Date	Herewith
				First Named Inventor	Delangis
				Art Unit	TBD
				Examiner Name	TBD
Sheet	1	of	2	Attorney Docket Number	COM908

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.1	Document Number Number-Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	EX1004	6,160,808	12-12-2000	Maurya	
	EX1006	5,809,070	09-15-2008	Krishnan *et al.*	
	EX1007	7,606,156	10-20-2009	Delangis	
	EX1009	8,861,349	10-14-2014	Delangis	
	EX1013	6,112,245	08-29-2000	Araujo *et al.*	
	EX1014	5,774,660	06-30-1998	Brendel *et al.*	
	EX1016	7,315,900	01-01-2008	Ofelt *et al.*	

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Examiner Initials*	Cite No.1	Foreign Patent Document Country Code3 –Number 4 –Kind Code5 (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T6
	EX1005	WO 97/22212	06-19-1997	Low *et al.*		

Continued on next page

PTO/SB/08a (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO				***Complete if Known***	
				Application Number	In Ex Parte Reexamination of U.S. Patent 10,868,908
INFORMATION DISCLOSURE STATEMENT *(Use as many sheets as necessary)*				Filing Date	Herewith
				First Named Inventor	Delangis
				Art Unit	TBD
				Examiner Name	TBD
Sheet	2	of	2	Attorney Docket Number	COM908

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1003	Declaration of JAMES GEIER (Oct. 4, 2023)	
	1010	BRISCOE, *Understanding the OSI 7-Layer Model*, PC Network Advisor Issue 120, pp. 13-14 (Jul. 2000)	
	1011	DAY and ZIMMERMAN, *The OSI Reference Model*, Proc. of the IEEE 71(12), 1334-1340 (Dec. 1983)	
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	1018	GOLENIEWSKI, *Source for Communications Fundamentals, Data Networking and the Internet, and Next-Generation Networks*, Telecommunications Technology Fundamentals, Addison Wesley (Dec. 28, 2001), available at https://www.informit.com/ articles/article.aspx?p=24687	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.
This collection of information is required by 37 CFR 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.** *If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.*

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EXHIBIT 1001

U.S. Patent 10,868,908 ("'908 Patent)

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US010868908B2

(12) **United States Patent**
Delangis

(10) **Patent No.: US 10,868,908 B2**
(45) **Date of Patent: Dec. 15, 2020**

(54) **DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS**

(71) Applicant: **Eric M. Delangis**, Huntsville, AL (US)

(72) Inventor: **Eric M. Delangis**, Huntsville, AL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/161,787**

(22) Filed: **May 23, 2016**

(65) **Prior Publication Data**

US 2016/0269547 A1 Sep. 15, 2016

Related U.S. Application Data

(63) Continuation of application No. 14/512,414, filed on Oct. 11, 2014, now Pat. No. 9,350,649, which is a (Continued)

(51) **Int. Cl.**

H04M 3/00	(2006.01)
H04L 12/707	(2013.01)
H04L 12/54	(2013.01)
H04W 40/02	(2009.01)
H04L 12/911	(2013.01)
H04W 88/16	(2009.01)
H04L 12/741	(2013.01)
H04L 29/12	(2006.01)
H04L 29/06	(2006.01)
H04M 1/60	(2006.01)

(Continued)

(52) **U.S. Cl.**

CPC ***H04M 3/007*** (2013.01); ***H04L 12/5692*** (2013.01); ***H04L 45/24*** (2013.01); ***H04L 45/54*** (2013.01); ***H04L 47/821*** (2013.01); ***H04L 61/2015*** (2013.01); ***H04L 69/168*** (2013.01); ***H04M 1/6033*** (2013.01); ***H04W 88/16*** (2013.01); *H04M 2203/052* (2013.01); *H04M 2203/60* (2013.01); *H04M 2250/06* (2013.01); *H04W 8/26* (2013.01); *H04W 28/06* (2013.01); *H04W 40/02* (2013.01); *H04W 72/04* (2013.01); *H04W 80/00* (2013.01); *H04W 84/12* (2013.01); *H04W 84/18* (2013.01); *Y02D 30/70* (2020.08)

(58) **Field of Classification Search**

None

See application file for complete search history.

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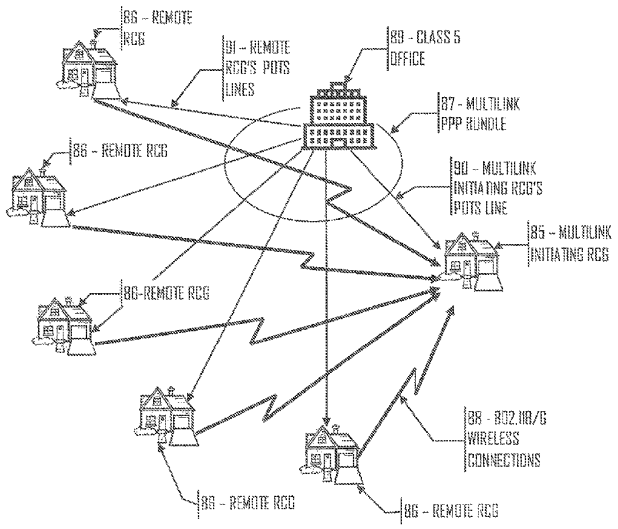
Primary Examiner — Hong S Cho

(74) *Attorney, Agent, or Firm* — Clay McGurk; The Law Office of Clay McGurk

(57) **ABSTRACT**

The broadband network-edge router is a broadband communications device that receives broadband packetized data and then wirelessly communicates to and from a router located in a typical residence or small business or other device. The broadband network-edge router can be for example, a Wi-Fi device or a cellular device or tower, and routes data to the data-requesting devices during multipath or multilink connections.

17 Claims, 9 Drawing Sheets



Related U.S. Application Data

continuation of application No. 13/531,294, filed on Jun. 22, 2012, now Pat. No. 8,861,349, which is a continuation of application No. 12/581,852, filed on Oct. 19, 2009, now Pat. No. 8,228,801, which is a continuation of application No. 10/686,375, filed on Oct. 14, 2003, now Pat. No. 7,606,156.

(60) Provisional application No. 60/418,521, filed on Oct. 15, 2002.

(51) **Int. Cl.**

H04W 8/26	(2009.01)
H04W 28/06	(2009.01)
H04W 72/04	(2009.01)
H04W 80/00	(2009.01)
H04W 84/12	(2009.01)
H04W 84/18	(2009.01)

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* cited by examiner

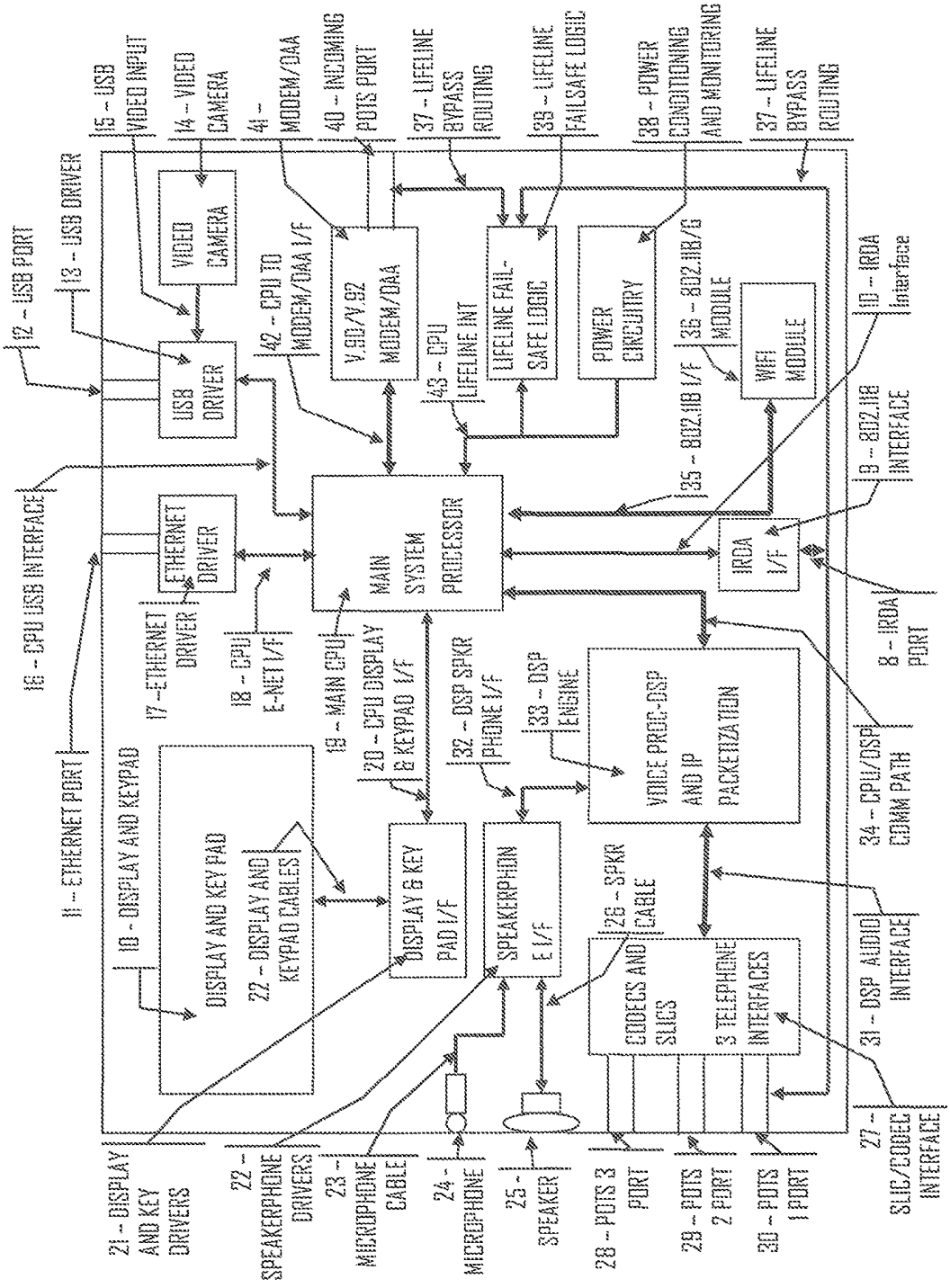


FIG. 1

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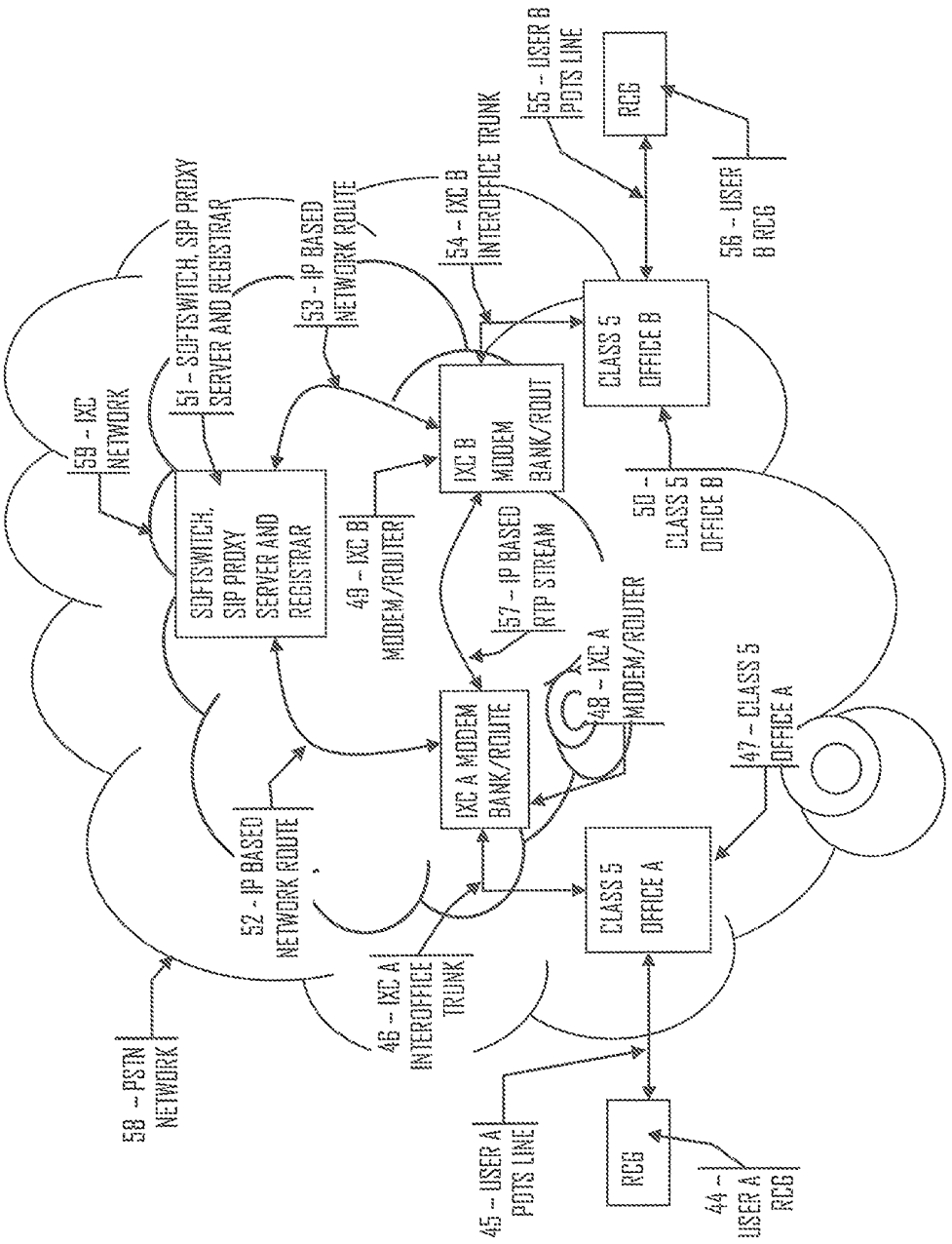


FIG. 2

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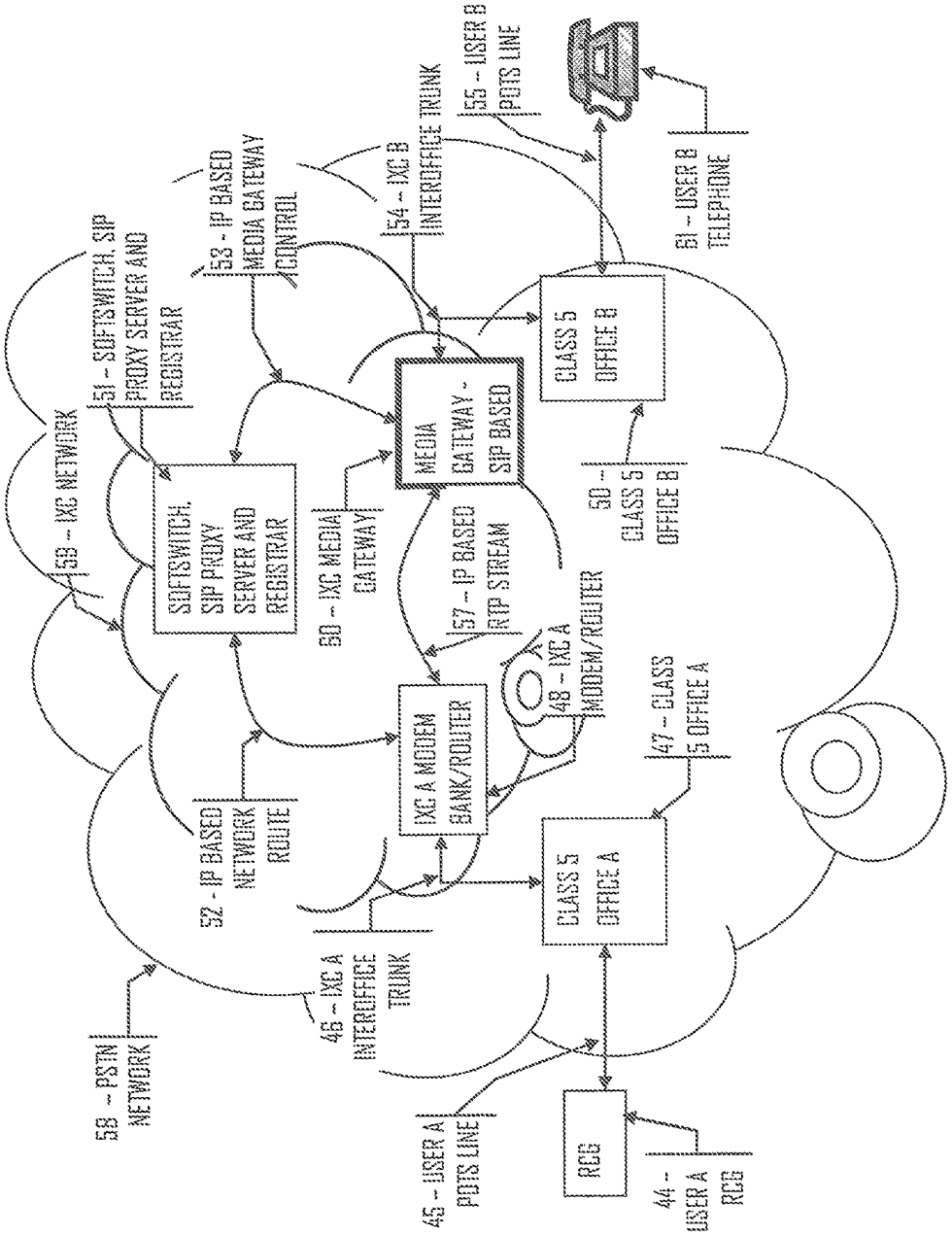


FIG. 3

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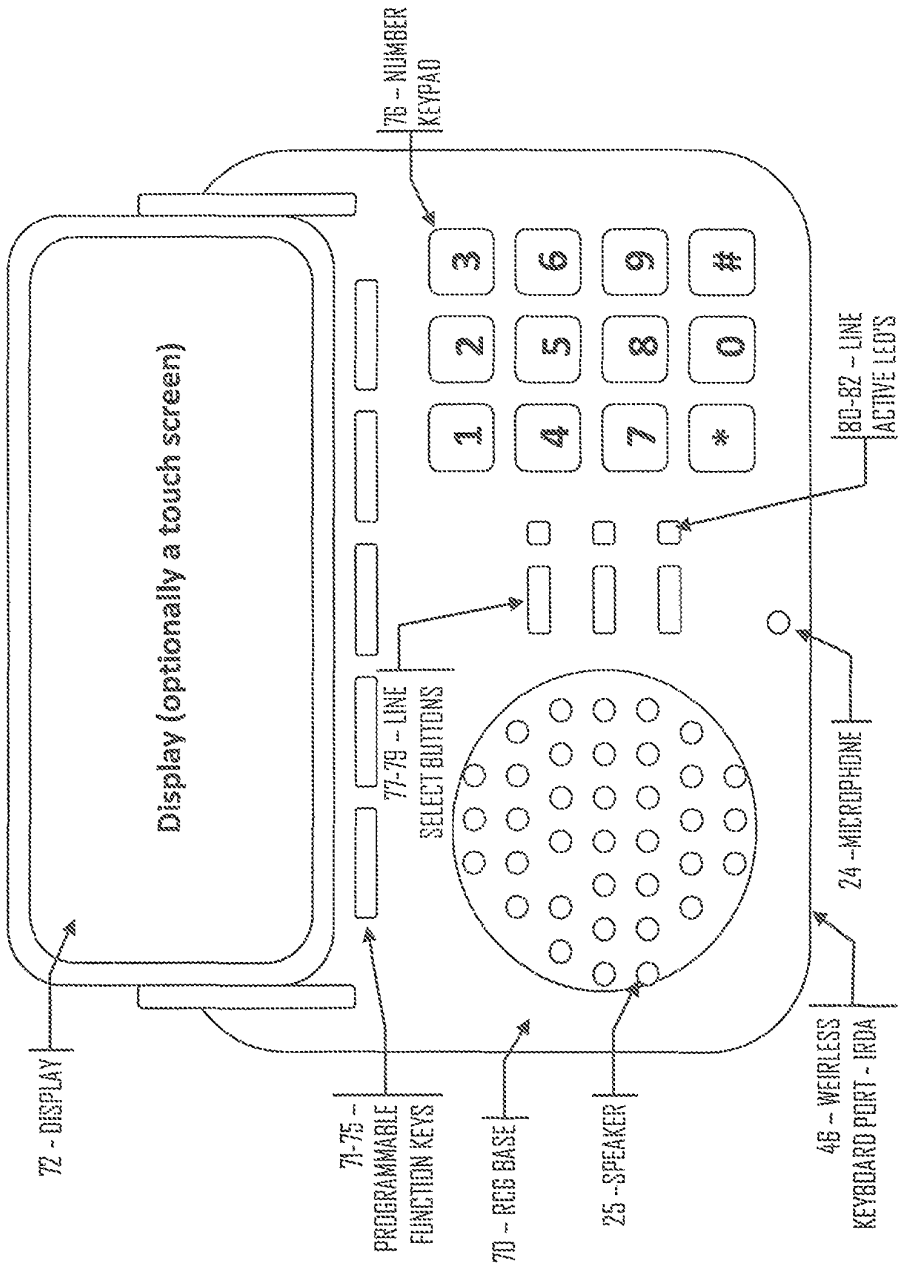

76 – NUMBER KEYPAD
Display (optionally a touch screen)
1
2
3
4
5
6
7
8
9
*
0
#
80-82 – LINE ACTIVE LED'S
77-79 – LINE SELECT BUTTONS
72 - DISPLAY
71-75 – PROGRAMMABLE FUNCTION KEYS
70 – BASE
25 – SPEAKER
46 – WEIRLESS KEYBOARD PORT - IRDA
24 – MICROPHONE

FIG. 4

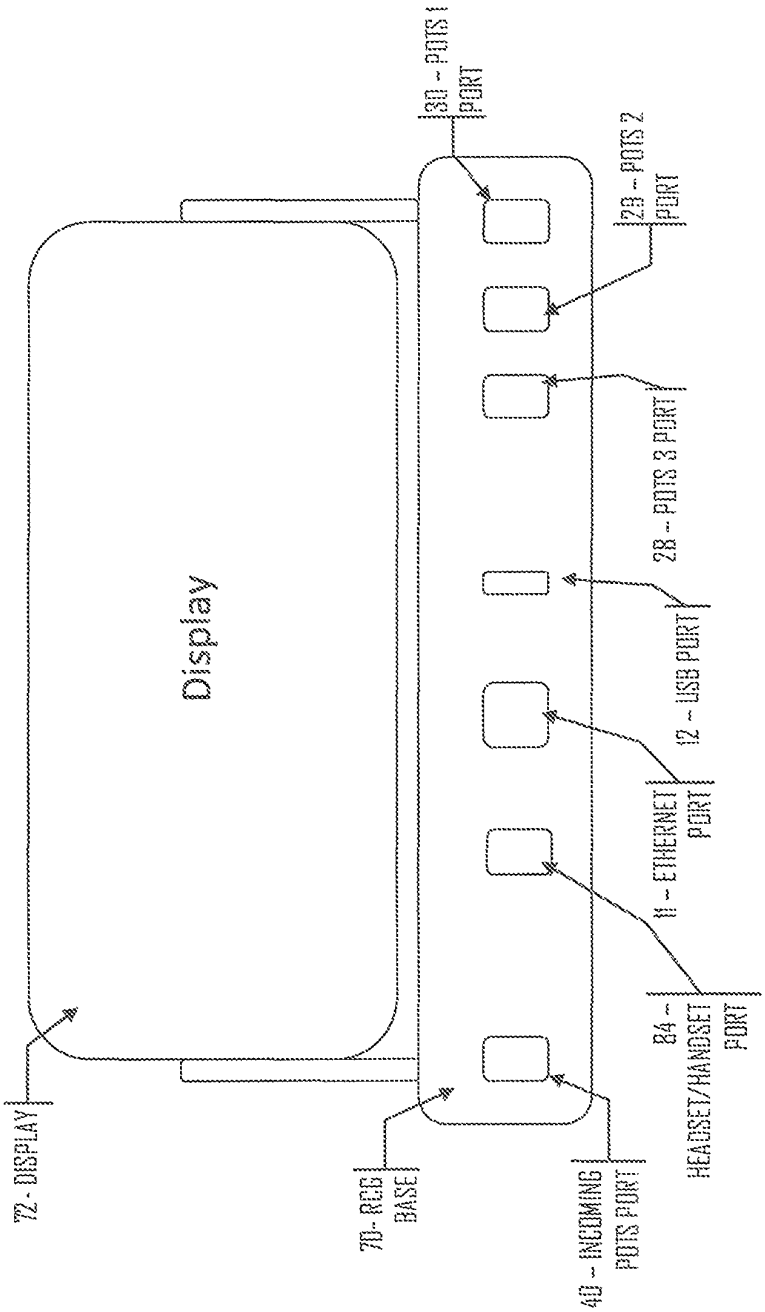

Display
72 - DISPLAY
70 - REG BASE
40 - INCOMING POTS PORT
84 - HEADSET/HANDSET PORT
11 - ETHERNET PORT
12 - USB PORT
28 - POTS 3 PORT
28 - POTS 2 PORT
80 - POTS 1 PORT

FIG. 5

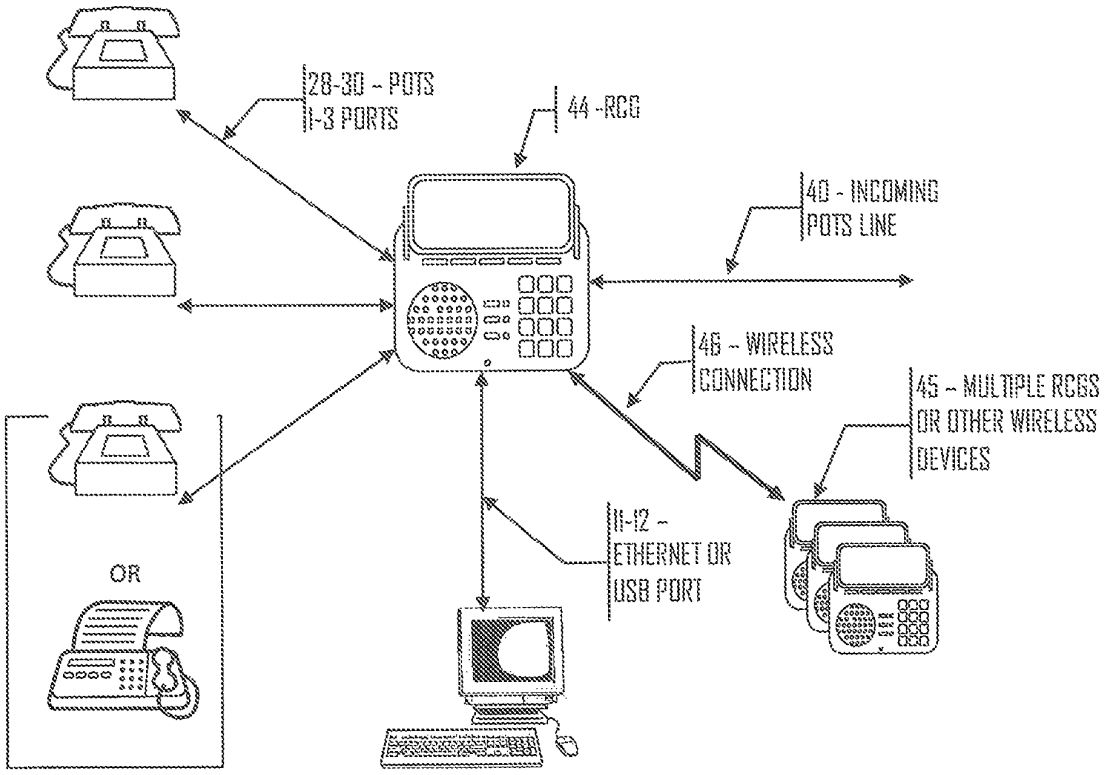

28-30 ~ POTS
1-3 PORTS
44 -RCG
40 - INCOMING
POTS LINE
46 ~ WIRELESS
CONNECTION
45 ~ MULTIPLE RCGS
OR OTHER WIRELESS
DEVICES
11-12 ~
ETHERNET OR
USB PORT
OR

FIG. 6

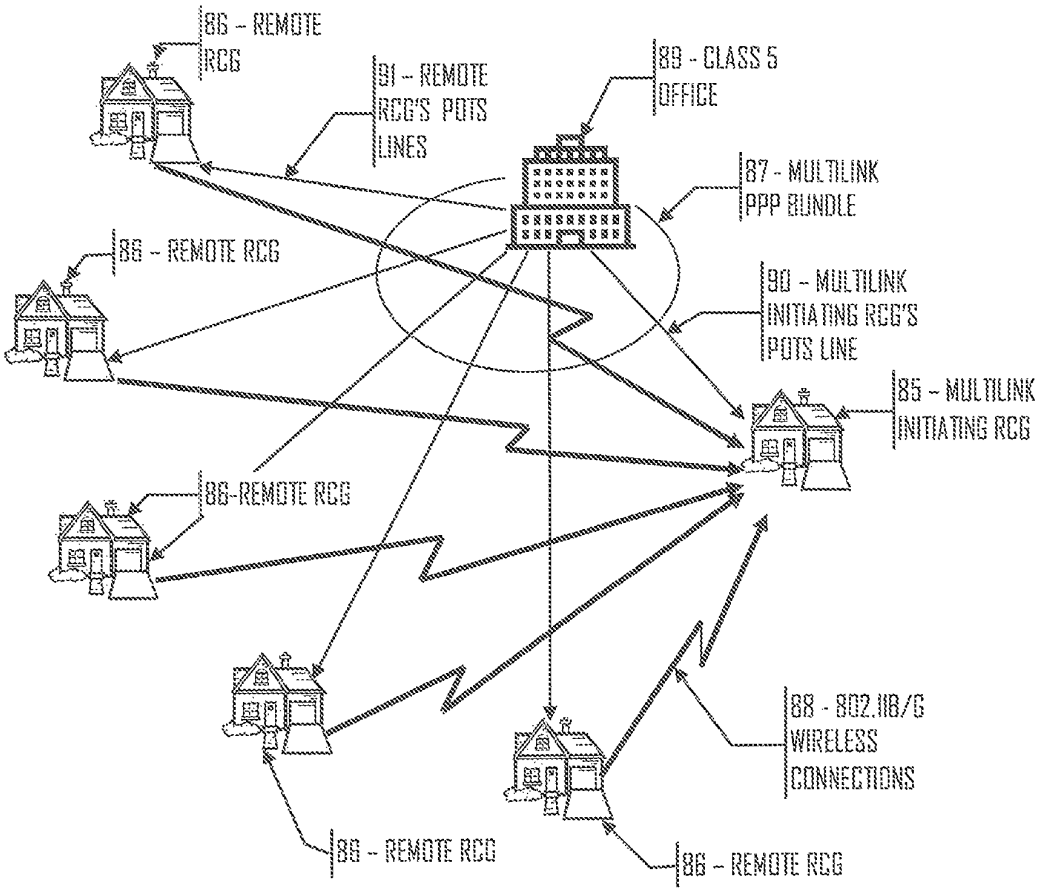

86 – REMOTE RCG
91 – REMOTE RCG'S POTS LINES
89 - CLASS 5 OFFICE
87 - MULTILINK PPP BUNDLE
86 – REMOTE RCG
90 – MULTILINK INITIATING RCG'S POTS LINE
85 – MULTILINK INITIATING RCG
86-REMOTE RCG
88 - 802.11B/G WIRELESS CONNECTIONS
86 – REMOTE RCG
86 – REMOTE RCG

FIG. 7

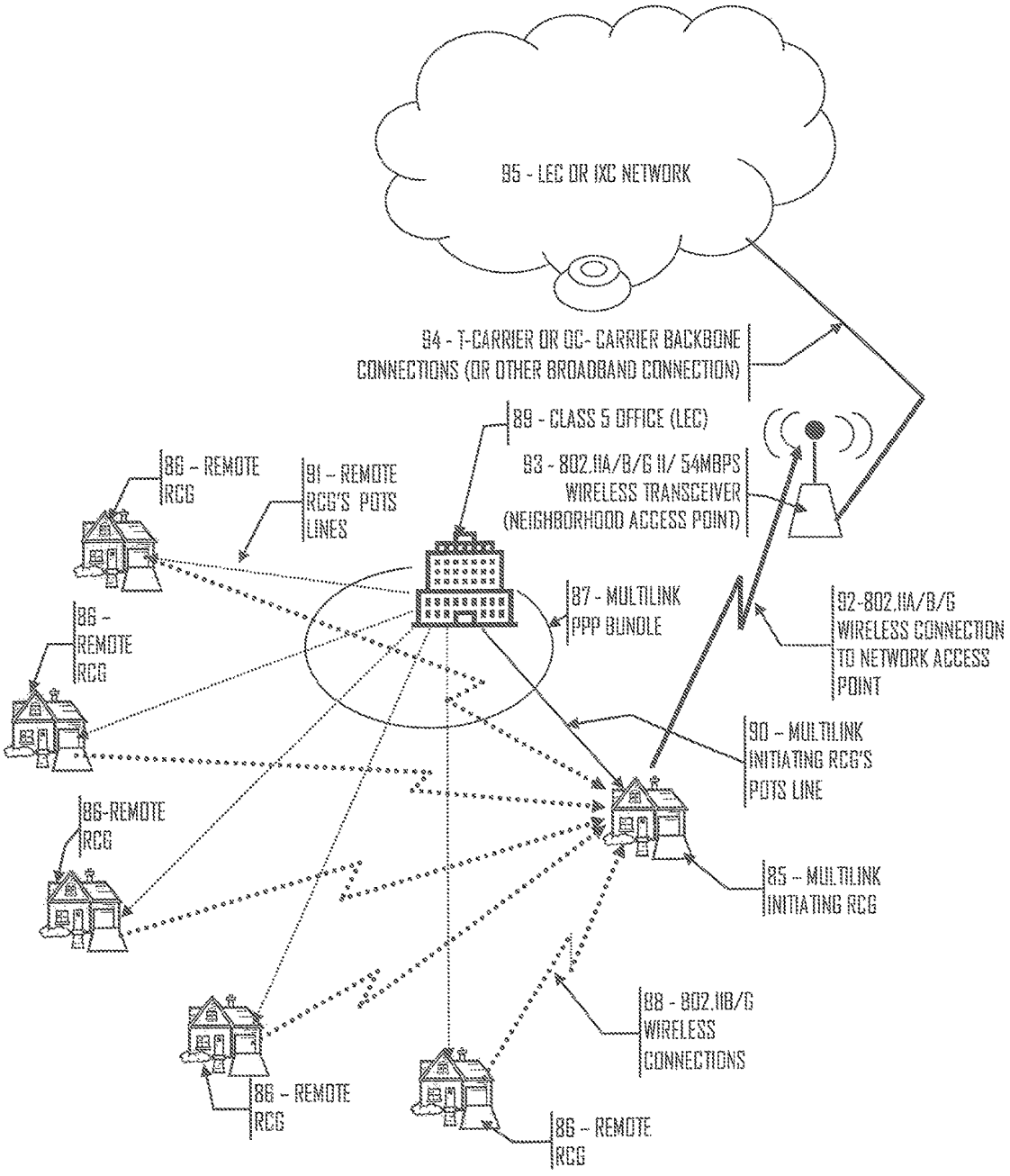

95 - LEC OR IXC NETWORK
94 - T-CARRIER OR OC- CARRIER BACKBONE CONNECTIONS (OR OTHER BROADBAND CONNECTION)
89 - CLASS 5 OFFICE (LEC)
93 - 802.11A/B/G II/ 54MBPS WIRELESS TRANSCEIVER (NEIGHBORHOOD ACCESS POINT)
86 – REMOTE RCG
91 – REMOTE RCG'S POTS LINES
87 - MULTILINK PPP BUNDLE
92-802.11A/B/G WIRELESS CONNECTION TO NETWORK ACCESS POINT
86 – REMOTE RCG
90 – MULTILINK INITIATING RCG'S POTS LINE
86-REMOTE RCG
85 – MULTILINK INITIATING RCG
88 - 802.11B/G WIRELESS CONNECTIONS
86 – REMOTE RCG
86 – REMOTE RCG

FIG. 8

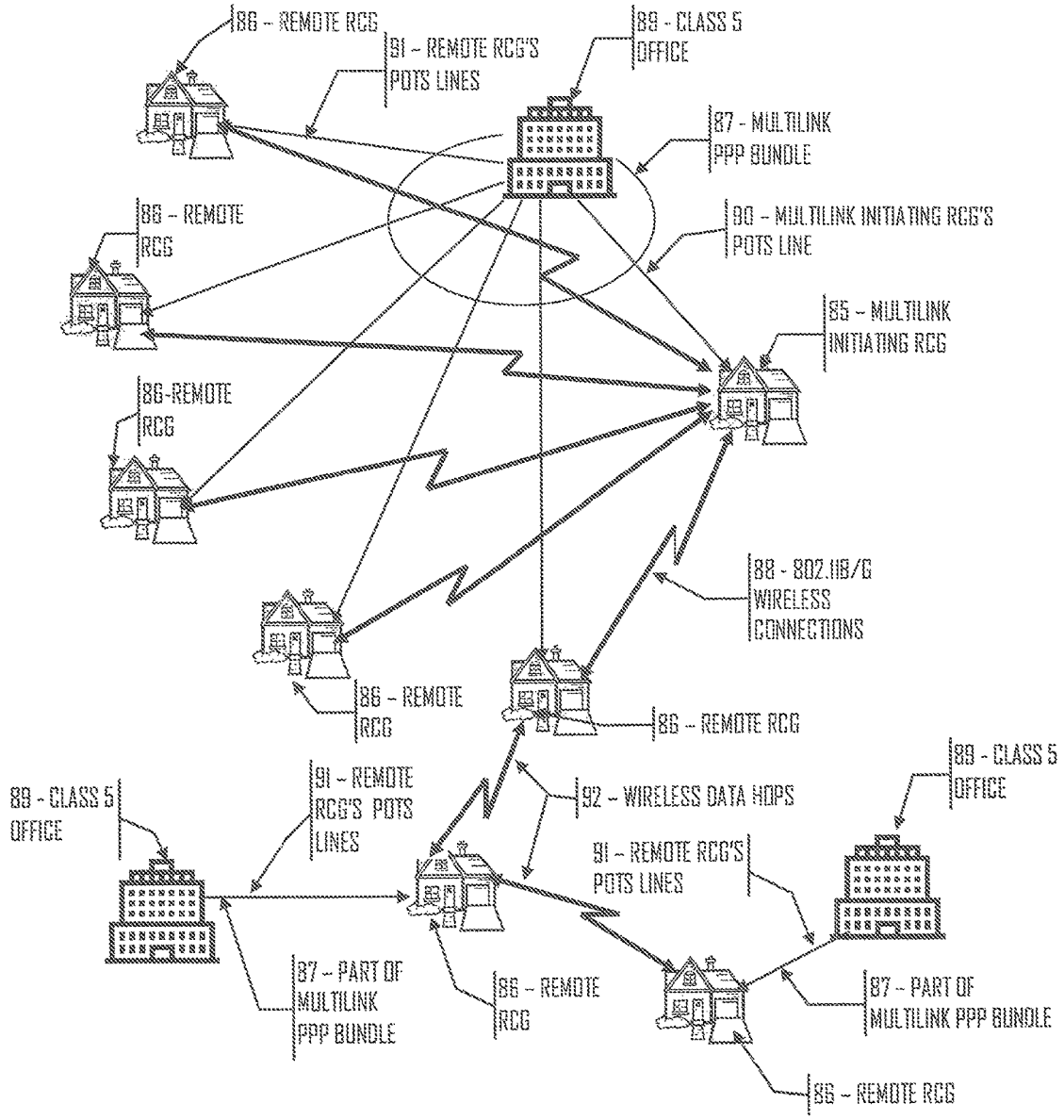

86 – REMOTE RCG
91 – REMOTE RCG'S POTS LINES
89 - CLASS 5 OFFICE
87 - MULTILINK PPP BUNDLE
86 – REMOTE RCG
90 – MULTILINK INITIATING RCG'S POTS LINE
85 – MULTILINK INITIATING RCG
86-REMOTE RCG
88 - 802.11B/G WIRELESS CONNECTIONS
86 – REMOTE RCG
86 – REMOTE RCG
89 - CLASS 5 OFFICE
91 – REMOTE RCG'S POTS LINES
92 – WIRELESS DATA HOPS
89 - CLASS 5 OFFICE
91 – REMOTE RCG'S POTS LINES
87 – PART OF MULTILINK PPP BUNDLE
86 – REMOTE RCG
87 – PART OF MULTILINK PPP BUNDLE
86 – REMOTE RCG

FIG. 9

DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS

RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 14/512,414 filed Oct. 11, 2014, now patented as U.S. Pat. 9,350,649, which is a continuation of U.S. patent application Ser. No. 13/531,294 filed Jun. 12, 2012, now patented as U.S. Pat. No. 8,861,349, which is a continuation of U.S. patent application Ser. No. 12/581,852 filed Oct. 19, 2009, now patented as U.S. Pat. No. 8,228,801, which is a continuation of U.S. patent application Ser. No. 10/686,375 filed Oct. 14, 2003, now patented as U.S. Pat. No. 7,606,156, which claims priority to U.S. Provisional Application Ser. No. 60/418,521, filed Oct. 15, 2002, all of which are incorporated by reference herein.

BACKGROUND OF INVENTION

The primary function of the RCG is to provide a platform for Competitive Local Exchange Companies (CLECs) to compete with the Local Exchange Companies (LECs) for residential voice and data services. The LECs have a strangle hold on the "last mile" of copper over which almost all residential customers receive their communications services. Today, most CLECs resell the existing services that are offered by the LECs. CLECs make their money by purchasing these services from the LECs at a discount and marking them up to the customer. Since these services are regulated and controlled by the Public Utilities Commission (PUC) the pricing for these services to the CLECs is set. The monthly CLEC discount is approximately $5 to $6 per line per month for basic rate services. This means, in practicality, that a CLEC can only charge an additional $5 or $6 to the residential customer for basic rate services otherwise they would be more expensive than the LEC, and no one would buy the services from them; telephone customers would simply stay with the LEC.

To be competitive then, CLECs try to sell additional services such as call waiting, caller ID, etc. where they have as much as a 50% margin. Some CLECs also bundle long distance services with their packages as additional incentive to get residential customers to buy local telephone service from them. Since long distance fees are as low as pennies per minute to the customer, there is little profit in long distance for the CLECs. As it is, the pricing structure is such that the LECs will stay in control of the residential market, and the CLECs are nothing more than a marketing arm of the LEC. This structure also keeps the CLECs at an equal competitive advantage, or disadvantage, with respect to each other. The only thing that one CLEC could do to gain more customers is to be a better marketer. Since the CLECs are unable to discount their services because their margins are too slim as it is, the net effect is that the consumer looses by not really getting competition in the residential markets, and prices are kept artificially high.

For the CLECs to be truly competitive in the local telecommunications markets, they must be able to do more than simply resell the LECs services. CLECs must be able to offer many more features or services than those that the LEC provides, and they must be able to do this at a lower cost, in order to attract new customers.

So, what new services can the CLECs offer? As things stand today there are none, with the exception of DSL or Cable services which require tremendous infrastructure costs on behalf of the CLEC. However, by deploying an RCG in a residence, CLECs can offer advanced new calling features and services over the existing POTS line. Their costs for the POTS line from the LEC remains the same, but they can now charge for high bandwidth data services as well as additional calling and messaging features that the LECs cannot offer. This is their competitive advantage.

Competition:

Many companies are currently trying to provide VoIP services to residential customers over high-speed or broadband backbones such as DSL and cable modems, over Internet connections via a computer. The high-speed services require expensive infrastructure enhancements to the local telephone companies' facilities and cable plants, as well as expensive modems at the customer's end. These services are also difficult to deploy and too complicated for the average user. Internet based VoIP services suffer from Internet delays caused by a lack of true Quality of Service (QOS) capabilities across the Internet. Existing VoIP services also require access to a computer and a technical knowledge to be able to make it work. Because of these problems, VoIP services are primarily targeted at the corporate market place where private IP networks that can carry VoIP services with a true guaranteed QOS exist, or can be controlled.

The only available alternatives for the residential user for high speed services are DSL and cable modems. DSL and Cable based communications reach only a small segment of the population, and growth has failed to live up to initial expectations. The recent collapse of the internet boom has led to the failure of many DSL service providers and has effectively eliminated DSL as a potential service for most POTS users for the immediate future.

SUMMARY OF THE INVENTION

The RCG combines the capabilities and features of IP routers, Class 5 circuit switches and wireless LANs in a small stand-alone external modem like device. Additional capabilities for a hands-free speakerphone device with a large touch display are also detailed. The RCG can employ a large display with sufficient resolution to provide a functional user interface to access all of the advanced features offered by the RCG, but also to be able to provide video telephone services.

The device is placed in a residence and connected to the primary POTS line coming from the LEC. Up to three standard telephones or FAX machines (or any combination) are typically connected into the RCG. It also has a Universal Serial Bus (USB) and/or a 10-100 Ethernet interface for connection to a computer or a Local Area Network (LAN). In addition, it has an 802.11b/g wireless interface for wireless home networking as well as broadband-to-the-home services.

The system is installed in a customer's home by simply plugging it into the existing incoming telephone line that provides POTS services from the LEC. One or more standard telephones are then plugged into its three line-output jacks. This is the simplest and most basic usage. In this implementation, the user only is interested in gaining additional telephone lines into the household. No computer connection is required in order to use the system. However, if data communications are desired, then there are three additional interfaces for computer connectivity. Typically either an Ethernet port, USB port or firewire (IEEE 1394) port is used to connect to a PC or LAN. The 802.11b/g interface is for wireless communications between the RCG and PCs, other RCGs as well as any other types of compat-

ible wireless devices. A version of the RCG includes a speakerphone and video camera to provided for video telephone services.

Services provided by the RCG:

The following discussion refers to FIG. **1**. The RCG has a main system processor that is responsible for all house keeping and traffic routing tasks. The Main CPU **19** routes data to and from the Ethernet Port **11**, USB Port **12**, Modem/DAA **41**, DSP Engine **33**, 802.11b/g Module **36** and the Display and Keypad **10**.

The RCG provides a total telecommunications communications services package for residential and small business customers. With the RCG, a CLEC can offer its customers dialtone for up to three separate telephone numbers per residence (the limit of three telephone numbers is an arbitrary number based upon typical residential usage and is not a limit imposed by the system), all local and long distance services, 24/7 always-on Internet access, a host of custom messaging and calling features, as well as Broadband access and lifeline service. All of these services can be offered over a customer's existing POTS line, and it doesn't require any network infrastructure build out like DSL and Cable services. Because there is no expensive network equipment required, it can be readily deployed throughout the country to expand the CLECs customer base quickly.

The RCG is designed to enhance, not replace, the existing telephone line, enabling it to provide new combined packetized voice and data services. Meanwhile, all existing telecommunications infrastructure and equipment will continue to work seamlessly with the RCG. Aside from simply installing the low cost RCG device in the home telephone wiring, no other equipment needs to be purchased by either the home owner or telephone companies. This eliminates the tremendously expensive infrastructure costs for communications companies that are trying to provide voice services using DSL or cable modems.

The RCG VIP Home Gateway Features:

Up to three telephone lines i.e. numbers, over a single POTS line and/or wireless connection.

Ethernet, USB and IEEE 1394 computer interfaces.

Full G1, G2 and G3 FAX support.

Full support for all CLASS services.

Broadband networking for home computers and appliances as well as wide area networking using a combination of a plurality POTS lines connected to a plurality of RCGs and/or a direct wireless connection to a wireless access point. (These interfaces allow smart devices to communicate to other devices within the home, or over the Internet through the RCG.)

Automated, remote upgradability and configuration. (Requires the customer to do nothing.)

Transparent user operation. (User doesn't have to know that any new technology is being employed)

100% compatible with existing public telephone system.

Video Telephone capabilities.

No local or long distance usage charges.

No Internet access fees.

Lower monthly communication costs.

Multiple telephone calls at the same time.

Voice messaging, follow me features, call forwarding, automatic call back, conferencing, custom call routing. Home networking capabilities, all CLASS calling features, high speed broadband networking, continuous 24/7 internet access. and many others.

All of these features are available even while connected to the Internet.

Very low cost of entry into the market, especially as compared to broadband alternatives.

New calling features that are not currently available to home users.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows the RCG functional block diagram with the preferred embodiment of an 802.11 wireless connection.

FIG. **2** shows the network topology for native RCG to RCG communications.

FIG. **3** shows the network topology for an RCG to PSTN call.

FIG. **4** shows the RCG top view with associated functions.

FIG. **5** shows the RCG rear view and associated connections.

FIG. **6** shows a typical application with peripheral equipment connections.

FIG. **7** shows an ad-hoc wireless LAN configuration with ppp multilink data distribution and wireless connectivity.

FIG. **8** shows an ad-hoc wireless LAN configuration with ppp multilink data distribution and wireless connectivity with connection to a broadband neighborhood access point (Wi-Fi hot spot).

FIG. **9** shows an ad-hoc wireless LAN configuration with ppp multilink data distribution and wireless connectivity with wireless data hopping with POTS connections through numerous different Class 5 offices.

DETAILED DESCRIPTION OF THE INVENTION

The preferred embodiment is detailed herein using the ubiquitous 802.11 wireless protocol. It is by no means insinuated that this is the only wireless scheme that can be used by this device; rather, it is intended that any wireless transmission scheme can be used for wireless communications between this device and other wireless devices as various applications may dictate.

System Initialization

Refer to FIGS. **1**, **2** and **3** for the following discussion. When the RCG is first plugged into an AC power outlet the Main CPU **19**, performs a Power-on Self Test (POST) routine. Once the POST completes and the RCG is connected to an active POTS line, connected to the LEC, by means of the Incoming POTS Port **40**, the RCG automatically initiates a modem connection via the Modem/DAA **41**, to a registration service via a toll free 800 telephone number. The registration service connects directly to the service provider's sales or customer service offices via a VoIP connection. An operator or an automated service answers the call and sets up a new account for the customer. Once the account is set up, the service provider's network automatically sends control information to the device to store the required routing and feature/service information in its non-volatile memory of its Main CPU **19**. As part of this information, a local dialup telephone number is sent to the device that it will use for local network access in the same fashion as a standard ISP connection is made from a home computer. The URL of the Softswitch/SIP Proxy Server and Registrar **51** that will be controlling this particular device is also stored at this time. During the service activation and configuration process, the customer service operator can send test requests to the device, as well as call into it on another telephone number (assuming an additional telephone number is part of the users class of service) or the

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speakerphone to verify that it is configured and working properly. The final step of the configuration and initialization process is to register the device with the appropriate Softswitch/SIP Proxy Server and Registrar **51** so that the Softswitch/SIP Proxy Server and Registrar **51** knows that it is the controlling SIP Proxy for this RCG. Also configured at this time is the username/password verification server (this is a standard network device and is not shown) that is used to allow the RCG's modem to make a connection onto the service provider's network. Once the RCG configuration is completed, it disconnects the call by hanging up the Modem/DAA **41**, then dials the new local network access number that had been sent during the configuration process and establishes a constant local network connection. This connection is maintained continuously on a 24/7 basis, and is immediately reestablished whenever it drops. Should the RCG become unable to reestablish this connection after several tries, it will switch over to failsafe mode and inform the user via the Display and Keypad **10**. The RCG will try to reestablish the connection every few minutes until it finally succeeds.

By default, the first telephone port, POTS **1** Port **30**, is assigned as the termination port for the existing POTS service that is connected to Incoming POTS Port **40**. This is the existing telephone service that the user already has as his primary telephone service from his LEC. POTS **1** Port **30**, typically has connected to it a standard telephone set that does not require any power (other than that derived over the POTS interface) to operate properly. POTS **1** Port **30** is the Lifeline telephone port for the user. In the case that all power is lost to the RCG, POTS **1** Port **30** will fail to a direct connection to the Incoming POTS Port **40** telephone line that comes into the RCG from the LEC to provide uninterrupted telephone services to the user. In this state, however, none of the enhanced VoIP services of the RCG are available to the user since the user simply has a stand POTS telephone service to the LEC.

Two additional and unique telephone numbers can be assigned to the other two telephone ports, POTS **2** Port **29** and POTS **3** Port **28**, by the service provider at any time. These numbers are drawn from a pool of available telephone numbers assigned to the service provider. POTS **2** Port **29** and POTS **3** Port **28** must to have standard telephone numbers assigned to them so that the PSTN is able to route calls from its network to these ports. For calls originating from IP based telephones, these numbers are not necessarily needed since POTS **1** Port **30**, POTS **2** Port **29** and POTS **3** Port **28** are uniquely identifiable to IP networks via their IP addresses assigned through the Dynamic Host Configuration Protocol (DHCP) at the time that the RCG establishes a connection to the service provider's network. Since POTS **2** Port **29** and POTS **3** Port **28** must have a telephone number assigned to them, it is a matter of convenience to use the assigned telephone numbers as part of their SIP address for IP routing of their data. In this way, all three user POTS ports, POTS **1** Port **30**, POTS **2** Port **29** and POTS **3** Port **28** are all addressed the same manor.

At this point, the user is able to take advantage of all of the RCG's features that have been activated according to his service agreement. The user can at any time connect additional telephones, a computer or a computer network to the RCG. The user will only be able to use those telephone ports (POTS **1** Port **30**, POTS **2** Port **29** or POTS **3** Port **28**) that have been activated, and assigned unique telephone numbers by the service provider. Any type of standard telephone can be connected to the three POTS ports, POTS **1** Port **30**, POTS **2** Port **29** and POTS **3** Port **28**. In the event that a cordless telephone or a telephone that derives its power from an AC outlet is connected to POTS **1** Port **30**, the lifeline functionality of this port will be ineffective since the telephone itself will not operate once power is lost.

The speaker phone feature of the RCG, comprised of Speakerphone Drivers **22**, Microphone **24**, Speaker **25** and DSP Engine **33**, can be used on any of the activated telephone numbers and is by default enabled to operate on POTS **1** Port **30**. Once either of the other two telephone ports, POTS **2** Port **29** or POTS **3** Port **28**, is activated, the speakerphone function is activated for those lines as well. To use the speakerphone for any assigned telephone number, the user simply presses either the Line Select Button **79-81** for Line **1**, Line**2** or Line **3** on the face of the RCG, and the speakerphone function is activated on that line. This is convenient for answering any call directly at the RCG. The RCG may or may not have a number keypad for originating calls. This feature may be added or removed based upon the target market price points.

The determination as to which Inter Exchange Carrier (IXC) the RCG will route its data through is determined by any of a number of criteria including, but not limited to, whether the RCG is a private labeled product, or which carrier has the lowest cost routing, or if a specific carrier is specified by the customer, or and number of other considerations. The RCG can be programmed to change its routing path to any IXC at any time by the service provider. Complicated routing algorithms can be programmed into the RCG to control which IXC it will use at any time.

Failsafe Mode

During any time that the RCG is in failsafe mode i.e. Lifeline failsafe logic **39** is activated, the RCG will only be able to receive or initiate telephone calls via the telephone connected to its primary telephone port, POTS **1** Port **30** or through its speakerphone feature. In this condition, all activated telephone numbers are ported via the PSTN to the primary (first) telephone number for delivery to the user's telephone that is connected to POTS **1** Port **30**. While in failsafe mode, the modem is not activated, and the RCG appears to the local Class 5 office as a standard telephone, and the PSTN will route all incoming calls to the RCG as it normally would to any standard telephone.

Call Flow **1**:

Dialed call origination from a telephone connected to an RCG POTS port and terminating at another user's RCG POTS port:

When a user picks up a telephone connected to any of the three POTS ports, POTS **1** Port **30**, POTS **2** Port **29** and POTS **3** Port **28**, an off hook condition is detected by the SLIC/CODEC Interface **27** that is connected to the DSP Engine **33** by way of the DSP Audio Interface **31**. The DSP Engine **33** responds by sending digitally generated dialtone to the appropriate POTS interface over the DSP Audio Interface **31**. (Note: all BORSCHT telephony functions are performed by the DSP Engine **33** and the SLIC/CODEC Interface **27**.) Upon hearing the dialtone, the user enters the desired telephone number on his telephone keypad. The Dual Tone Multi-Frequency (DTMF) digits that the user dials are decoded within the DSP Engine **33**. The dialed digits are transferred to the Main CPU **19** via the CPU/DSP Communications Path **34**. The Main CPU **19** polls the DSP Engine **33** approximately every two milliseconds looking for data. The Main CPU **19** polling rate varies according to the process that is being performed. The CPU/DSP Communications path **34** also can generate an interrupt to force data transfer between it and the Main CPU **19**.

The Main CPU **19** generates a SIP Invite IP packet using the dialed digits as the called destination address and the URL of its local controlling SIP Proxy Server which was programmed into the RCG during the configuration process. The Main CPU **19** passes this SIP packet off to the Modem/DAA **41** for transmission over the network. The RCG Modem/DAA **41** is connected to and communicating with a modem in a modem bank located in the Inter Exchange Carrier's (IXCs) facility. This facility may actually be located in the LEC's physical plant or it may be physically located at another location.

Referring to FIG. **2**, User A RCG **44** is connected via its modem to the LEC's local Class 5 Office A **47**. In this example, the service provider's connections to the IXC A Modem Bank & Router **48** are through IXC A Inter-Office Trunks **46**. The service provider may or may not be the IXC. If the service provider does not have its own network, then it will purchase capacity from an IXC and route its traffic to that IXC's facilities. The SIP Invite IP Packet that is sent from User A RCG **44** transits the LEC's Class 5 Office A **47** facilities and is routed to the IXC A Modem Bank/Router **48** via the IXC A Inter-Office Trunks **46**. It is the job of the router to take the IP packet and route it on to its intended destination, in this case the appropriate SIP proxy server **51**. The router uses the URL for the Softswitch/SIP Proxy Server and Registrar **51** contained in the SIP Invite to know where to route the packet. (Note: The Softswitch, SIP Proxy Server and Registrar are logical devices that may reside in a single computer system, or may be implemented as completely separate devices. In this example, the Softswitch, SIP Proxy Server and Registrar are all shown as a single physical device running these three separate processes.) The IXC A Modem Bank/Router **48** sends the SIP Invite IP packet on to Softswitch/SIP Proxy Server and Registrar **51** via an IP based network route **52**.

The SIP Proxy Server process running on Softswitch/SIP Proxy Server and Registrar **51** performs a look up to determine the termination destination for the call using the dialed digits passed along in the SIP Invite IP packet. In this example, the terminating device for User B RCG **56** is via IXC B's Modem Bank/Router **49** then through Class 5 Office B **50** and over User B POTS line **55** and finally to User B RCG **56**. Not covered in detail here is the SIP message handling since it is completely covered in IETF RFC2543. This example shows that both the originating and terminating ends of this call are controlled by the same Softswitch/SIP Proxy Server and Registrar **51** device. Where the originating and terminating ends of a call are controlled by different Softswitch/SIP Proxy Server and Registrar devices, an additional level of SIP messaging is used between the two SIP Proxy Server processes of each of the Softswitch/SIP Proxy Server and Registrar devices to locate and control the terminating location of the call. Again, that information is covered in IETF RFC2543 and is repeated here.

After the call routing is setup using SIP, and User B answers the call, the Softswitch/SIP Proxy Server and Registrar **51** device sends IP address of the originating User A RCG **44** to the User B RCG **56** and the IP address of User B RCG **56** to User A RCG **44**. Once both RCG's have the other's IP address, they then communicate directly to each other using Real Time Protocol (RTP), and the Softswitch/SIP Proxy Server and Registrar **51** device is no longer part of the connection. This direct communication is shown as IP based RTP Stream **57** between IXC A Modem Bank/Router **48** and IXC B Modem Bank/Router **49**.

On the receiving end of the call, referring back to FIG. **2**, User B RCG **56** receives the SIP Invite data stream through its Modem/DAA **41** and passes it on to the Main CPU **19**. The Main CPU **19** reassembles the SIP IP packet and interrogates the header information to determine which POTS port, POTS **1** Port **30**, POTS **2** Port **29** and POTS **3** Port **28** the call is destined for based upon the dialed number contained in the SIP Invite message. The Main CPU **19** commands the DSP Engine **33** to control the SLIC/CODEC Interface **27** to apply ringing voltage to the selected POTS port to ring the phone. A corresponding SIP **180** (ringing) message is sent back to User A RCG **44** in the reverse direction. When the phone attached to the selected POTS port is answered, the off hook condition detected by the SLIC/CODEC Interface **27** is sent through the DSP Engine **33** to the Main CPU **19** that sends the SIP **200** OK message back to User A RCG **44** to let the RCG know that the call was answered by User B RCG **56** and to turn off the audible ringing tone for User B. Once the call is established, User A RCG **44** sends and ACK F12 SIP message to User B RCG **56** indicating that User A RCG **44** understands that the call setup has been completed.

The two RCGs now exchange SIP messages that include the type of voice encoding that will be used such as G.729, G.723.1, G.711 etc to configure their RTP streams so that they can reliably transfer the user information between them. At this point the call (voice data) is sent between both RCGs and a normal telephone conversation takes place between the user A and user B.

Call teardown is accomplished by either user hanging up their telephone. The RCG of the terminating end (the end that hangs up the phone first) detects the on-hook condition and sends a SIP Bye message to the other end. The other end upon receiving the SIP Bye message responds with an OK **200** SIP message and disables the appropriate POTS port that the user was using.

The Speakerphone interface can be used for either end of a telephone conversation in exactly the same way as described above except that the corresponding POTS port that the call was intended for is disabled if the call is answered via the speakerphone.

Call Flow **2**:

Calls between an RCG device and a PSTN telephone:

Refer to FIG. **3** for the following discussion.

In the previous call example, the PSTN network had nothing to do since the call was over a previously established modem connection between two RCGs. In the cases where a call originates or terminates to a standard telephone serviced by a Class 5 office, the process is a bit more complicated.

When a call originates from a user via an RCG, such as User A RCG **44**, the call handling practices are exactly the same up to the point that the SIP Proxy Server process in the Softswitch, SIP Proxy Server and Registrar **51** performs a lookup to determine how to route the call. In this case, the SIP Proxy Server process determines that the call terminates at a standard PSTN telephone attached to the Class 5 Office B **50**. Since the call originates as a native VoIP service, it must be converted to a standard switched circuit based service to be able to be delivered to User B's telephone **61**. The conversion is performed by the IXC's Media Gateway **60** device. In this example, the SIP Proxy Server process routes the call via the IXC's Media Gateway **60** device instead of through the IXC B Modem Bank/Router **49** as before. The SIP Proxy Server process sends a SIP Invite to the IXC's Media Gateway **60** device, as well as other control information, to direct the Media Gateway **60** device to

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terminate the call and to apply the appropriate voice compression algorithm to the media stream to convert it between switched circuit PCM format and the selected VoIP protocol. At the same time, the Softswitch process of the Softswitch, SIP Proxy Server and Registrar **51** device sends commands to the Media Gateway **60** device to cause it to route the call's PCM data to a specific channel on the IXC B Interoffice Trunk **54**. The Softswitch process then generates an SS7 ISUP message that is sent over the PSTN SS7 signaling network to the Class 5 Office B informing it of the incoming call and on which circuit the call has been placed. It is up to the PSTN at this point to ring the User B telephone **61** and process the call between the IXC's Media Gateway and the User B Telephone **61**. The Softswitch process handles the signaling conversion between the PSTN's SS7 network and the IXC's SIP messaging, as well as any other proprietary signaling schemes utilized by the IXC to control its network. The standard SS7 call control messages, such as ringing, busy, ring back etc., all have a comparable SIP call flow control messages. The Softswitch simply maps the SS7 messages into SIP messages and visa-versa while routing the messages to the appropriate network equipment.

As in the case of a call between two RCGs, the RTP media stream (the actual call data) is routed directly be the IXC A Modem Bank/Router **48** and the IXC's Media Gateway **60** via an IP based RTP Stream **57**.

Again, call teardown is accomplished by either user hanging up their telephone. Depending which end hangs up the phone first, the associated network will generate the appropriate messages which will eventually make it back to the Softswitch process. The Softswitch process will relay the appropriate call control messages between the PSTN and the IXC's SIP based control system.

A telephone call originating from a PSTN telephone is configured and setup in the same fashion as the above description except that the originating messaging begins within the PSTN network instead of the IXC's network.

Personal Computer Based Communications:

Where the RCG is connected to a Personal Computer (PC) through either its USB Port **11** or Ethernet Port **12**, the RCG operates exactly as a cable or DSL type modem device. The RCG is simply a pass through for the computer's data. The RCG receives the IP packets (of whatever type) from the computer and sends the information unchanged to the Modem/DAA **41** interface for transmission over the Internet. Received information from the Internet is processed in the reverse way.

Dynamic Bandwidth Allocation:

When a modem connection is established between the RCG and the "Network", the total available bandwidth of this connection is used in a shared/prioritized fashion. Voice services (calls) take precedence over data services. Therefore, when no calls are in progress all of the available bandwidth is used by data type services such as surfing the Internet or uploading/downloading files. However, when a call is to be passed through the RCG, the required bandwidth for the call is deallocated from the data services and prioritized for the telephone call. This necessary because the Quality Of Service (QOS) is important for effective communications over electronic networks. Since the voice data is carried over a "data centric" network topology (an IP based network), call quality can suffer greatly. Every effort must be taken to eliminate or reduce the packet delay through every network element to be able to provide the best call quality. For data applications such as surfing the Internet or downloading files packet delay is acceptable and expected, and it does not affect the "quality" of the data.

Since all voice and data is transmitted as packets, there are no "time slots" or other type of "channelization" associated with the transmission of this data over either the POTS line or the wireless interface. Channelization of the voice data does occur within the SLIC/Codec Interface—**27** but is converted into IP packets by the DSP engine—**33** and is handled as packets from that point on.

Regardless of whether the call is originating or terminating at the RCG, the bandwidth allocation process is the same. When the SIP call setup messages are processed, the type of voice compression that will be used is defined. The RCG Main CPU **19** handles the IP packet flow between the DSP Engine **33**, USB Port **12**, Ethernet Port **11**, 802.11b/g Module **36** and the Modem/DAA **41** devices giving priority to the voice packets to and from the DSP Engine **33** and the Modem/DAA **41** interfaces. Voice compression algorithms create IP packets at a specified number of packets per second. These packets are handled by a timed process in the RCG. This process is started during call setup so that the packets are handled at the correct rate based upon the compression algorithm's packet generation rate. There is no priority assigned between the voice packets of each of the three different POTS Ports **28-30**. When more than one voice call is in progress, they are handled in a round robin fashion based upon the packet rate for the compression algorithm used. If, for example, two calls are using a compression scheme that generates packets every 2 milliseconds, and the third generates packets every 4 milliseconds, then the calls utilizing the faster packet rate will be polled at twice the rate as the call using a slower packet rate but they are not given priority "over" the other call. Only when there are no voice packets ready for transmission to the Modem/DAA **41**, i.e. during the approximately 2 to 4 millisecond packetization period between packets, will any pending data packets received from the USB Port **12**, Ethernet Port **11** or the 802.11b/g Module **36** be sent to the Modem/DAA **41** for transmission over the network.

Thus, the POTS bandwidth is allocated on a per packet basis, not on a "time slot" or "channelization" or even a "frequency" basis as it the case with T-Carrier, DSL or channelized DSL systems. The same is true for the wireless interface, whether it is carrying pure data or voice.

Security is currently a big concern in today's networks, and especially with wireless 802.11 transmissions. For this reason, the RCG defaults to route voice data over the users POTS connection via Incoming POTS Port **40**. As security concerns regarding wireless communications transmissions are addressed and alleviated, voice call data can, and will, be routed over the wireless interface via the 802.11 b/g Module **36**.

FAX Transmission:

Group I, **2** and **3** fax transmission is completely supported by the RCG. Fax transmission has the same priority as other voice communications. That is to say that FAX transmission is treated the same as a voice call and takes precedence over native IP data traffic.

Broadband Over POTS:

One of the primary functions of the RCG is to be able to transfer large files such as video files over the POTS lines to a residence. The ability to do this is limited by the maximum of 56 Kbps due to the design of the digital Class 5 office linecards and network transmission schemes based upon T carriers. Typical Class 5 linecard design samples the POTS lines at a rate of 8,000 samples per second. Typically, each sample is digitized into 12 to 16 bits by a codec device. The digitized sample is then companded to an 8 bit sample (1 byte) which makes up the PCM data stream that is trans-

ferred over the PSTN. Therefore, each POTS line is sampled at an effective rate of 64 Kbps. Since legacy T1 transmission equipment uses robbed-bit signaling, the maximum guaranteed transmission rate for the PSTN as a whole is 56 Kbps. Because of this limitation, standard POTS lines can only guarantee a maximum of 56 Kbps transfer rate under the best conditions. DSL equipment gets around this problem by installing DSL Access Multiplexing (DSLAM) equipment at the Class 5 office end of the POTS line. By routing around the linecard, as well as routing the data directly over the Internet or other private IP based networks, and therefore the 64 Kbps sampling rate, DSL is not bandwidth limited like PSTN traffic is. DSL, however, suffers from the very high costs associated with the purchase, installation, maintenance, floor lease costs, etc. DSL also suffers from very high deployment costs resulting from the labor intensive process to turn up each line. Each DSL "POTS" line must be inspected, conditioned and all load coils removed.

The RCG gets around the 56 Kbps POTS limitation as well as the DSL problems by using the standard POTS lines as they are, and not requiring any additional equipment to be installed at the Class 5 end of the POTS line. This technique simplifies deployment and drastically cuts costs.

Multilink PPP Connections:

Referring to FIG. **7**, the RCG implements broadband over POTS by employing an 802.11 b/g wireless interface to configure a multilink PPP bundle—**87** (per RFC 1990) comprised of the POTS lines connected to up to 32 RCGs. The limitation of 32 RCGs in a multilink PPP bundle is an arbitrary number and can be scaled up or down as required to support changes in network equipment capabilities. An 802.11b/g interface—**87** is shown as the preferred embodiment, since its 11/54 Mbps interface is considered sufficient bandwidth at this time also, its transmission distances are sufficient for implementation of this device, as opposed to other shorter ranged wireless transmission schemes. However as time goes on, some other wireless interface may be more desirable. There is nothing special or specific to the 802.11 wireless interface that makes it particularly suited to this application. Any wireless interface scheme can be used to implement this device.

The 802.11b/g interface—**88** on an individual RCG is also used to provide a peer-to-peer wireless home networking environment to other 802.11 compatible wireless component within the residence (such as a hand-held computer device) while acting as an always on dialup Internet gateway over the POTS line—**40** for the other wireless devices. An RCG that is transferring a very large file can request the services of 31 (in this embodiment) other RCGs to assist in the file transfer using their respective POTS lines. A single RCG can therefore gain the combined bandwidth of up to 32 POTS lines transferring data at as much as 56 Kbps each to transfer information. This is roughly equivalent to a transfer rate of 1.79 Mpbs in the inbound direction (towards the RCG) and approximately 1.075 Mbps in the outbound direction (towards the PSTN).

The multilink PPP connection—**87** is initiated by an RCG when it determines that the file (or streaming service) that it is to download (receive) is of sufficient size or requires a minimum amount of bandwidth to justify the use of a multilink PPP connection. This determination can be made on many different criteria such as the file size, type of data being transmitted, the type of compression if any, a Quality-of-Service requirement or any other pertinent information. (Since a certain amount of overhead is required to set up a Multilink PPP connection, it doesn't make sense to use it for small or low data rate transfers.)

Multilink PPP Bandwidth Allocation and Initialization:

Referring to FIG. **7**, an RCG—**85** that decides to initiate a multilink PPP session with a remote computer i.e. internet URL, requests a multilink PPP session with that URL resource via Link Control Protocol (LCP) session management. The initiating RCG—**85** and the remote server computer (not shown) will negotiate the pertinent multilink parameters such as compression, packet size, sync/async, link quality monitoring, bit stuffing etc. As part of a successful multilink PPP session setup, the initiating RCG—**85** receives a multilink PPP session ID, or "magic number", which is used to identify this particular multilink PPP session and is also used for adding or removing links from the multilink bundle—**87** . Once the multilink bundle is setup, the initiating RCG—**85** begins data transfer across its POTS interface—**90** with the far end computer system. The initiating RCG—**85** then looks up the addresses of up to 31 (in this embodiment) other RCGs in its router tables to use for the multilink PPP transfer. (If a Neighborhood Access Point is available the RCG could request service through it instead of setting up a Multilink PPP connection—see FIG. **8**.) The initiating RCG—**85** determines the number of remote RCGs—**86** that it wants to use to get the desired bandwidth for the transfer and sends multilink PPP service requests via the 802.11 b/g wireless connections—**88** to the selected remote RCGs—**86**. The selected remote RCGs—**86** respond back to the initiating RCG with either an acceptance or denial of multilink PPP service request. This decision is made based upon the remote RCG's currently available POTS bandwidth and the current local demands for that bandwidth. The remote RCG—**86** makes a decision to participate in a multilink PPP service for an initiating RCG if its POTS line—**91** has a current average bandwidth utilization of less than some arbitrary limit such as 8 Kbps to 16 Kbps. This 8 Kbps to 16 Kbps bandwidth utilization represents about two concurrent voice conversations using standard voice compression techniques, or some small amount of data transmission occurring on the remote RCG's POTS interface—**91** or a combination thereof. Assuming that the remote RCG—**86** has a modem connection speed somewhere between 33 Kbps to 56 Kbps, this would leave approximately 17 Kbps to 40 Kbps of POTS bandwidth that the remote RCG—**86** could offer to the initiating RCG—**85** for use in its multilink PPP bundle—**87**. Of course, if there is no activity on the remote RCG—**86** POTS line, then the entire bandwidth will be used for the multilink transfer. If the remote RCG—**86** accepts the multilink PPP service request from the initiating RCG—**85** it also sends its currently available bandwidth on its POTS line—**91** that the initiating RCG—**85** will have available to it for the multilink PPP transfers. The initiating RCG then selects which of the responding remote RCGs—**86** it will use for the multilink PPP bundle—**87** and sends them a multilink initialization packet containing the URL of the destination as well as the multilink PPP session ID (magic number) and any other pertinent information required for the remote RCG to join in the existing multilink PPP bundle—**87**. Each remote RCG POTS interface—**91** participating in a multilink PPP bundle, represents a logical "link" in the initiating RCG's multilink PPP bundle—**87**. The remote RCGs—**86** then send a multilink PPP packet (over their respective POTS lines—**91**) to the destination URL with the multilink PPP session ID and request to be added to that multilink PPP bundle—**87**. The destination URL accepts the request of each of the remote RCGs—**86** and begins sending data packets to each over their respective POTS lines—**91**. When the remote RCGs—**86** receive data packets sent over their respective POTS

lines—**91**, that are destined for the multilink PPP bundle—**87**, they simply relay the data packets over their 802.11b/g interface—**88** to the initiating RCG—**85**. It is the responsibility of the initiating RCG—**85** to perform all housekeeping tasks associated with the multilink transfer such as detection of lost packets and data packet reassembly, if those functions are required. Typically, lost packet detection and retransmission and reassembly are performed at higher OSI layers by the requesting software such as a browser. The remote RCGs—**86** are simply data transport nodes and do not perform any data processing on data received over a multilink PPP bundle destined for another RCG.

The initiating RCG—**85** of the multilink PPP bundle—**87** continually monitors the bandwidth of each remote RCG's—**86** multilink link which together comprise its multilink bundle—**87**. When the available bandwidth for the multilink PPP link of an individual remote RCG—**86** falls below an arbitrary minimum set by the initiating RCG—**85**, the initiating RCG—**85** instructs the offending remote RCG, via its 802.11b/g wireless interface—**88**, to remove itself from the multilink bundle. The remote RCG—**86** will then notify the remote computer (URL) to be removed as a link in the current multilink bundle on which it is participating. Alternatively, a remote RCG—**86** can inform the initiating RCG—**85** of local demands on its POTS bandwidth, and request that the initiating RCG—**85** remove it (the remote RCG—**86**) from the participation in the initiating RCG's multilink bundle—**87**. The remote RCG—**86** will not unilaterally remove itself from participation in a multilink bundle without prior notification to the Initiating RCG—**85**. The remote RCG—**86** must get authorization from the initiating RCG—**85** to remove itself from the bundle, since the initiating RCG—**85** will have no way of knowing if the loss of data from that remote RCG is due to some sort of failure or from the remote RCG simply removing itself from participation in the multilink bundle—**87**. Also, for services that require a minimum Quality of Service (QOS) such as streaming video, the initiating RCG—**85** needs to control the multilink bundle—**87** bandwidth, and it can not do that if remote RCGs—**86** drop out of the multilink bundle—**87** at will. When a remote RCG—**86** requests to be removed from participation in a multilink bundle—**87**, the initiating RCG—**85** must immediately grant the request. If the initiating RCG—**85** were to not grant the request, then the remote RCG—**86** could, in worst case, delay or drop incoming multilink packets destined for the initiating RCG—**85**. If this were to happen, the initiating RCG—**85** will have missing packets and could over run its reassembly buffer (if reassembly is being performed by the RCG) causing catastrophic data loss and potentially have to restart the entire transmission. In the least case, the initiating RCG—**85** would have to initiate retransmission of potentially many packets which it assumes to be lost, but may simply be delayed by the remote RCG—**86**. Once a remote RCG—**86** has been removed from participating in a multilink bundle—**87**, the initiating RCG—**85** will then look up another remote RCG in its router tables that can be used to participate in the multilink PPP bundle—**87**, and request that the new remote RCG—**86** to join the existing multilink bundle—**87**. This is necessary to maintain a minimum Quality of Service. Since RCGs prioritize their bandwidth requirements based upon their own "local" service requirements, their participation in any multilink PPP service is available only to bandwidth that is not required for its own current local demands. Therefore, a remote RCG's—**86** bandwidth that is available for multilink services can change at any time. The dynamic reassignment of remote RCGs that participate in a multilink bundle is also required to prevent a remote RCG—**86** from receiving packets so slowly that the originating RCG—**85** interprets this delay as lost packets. When the initiating RCG—**85** determines that a packet has been lost, and it is performing packet reassembly, it will, itself, request that the remote computer retransmit the lost packet. The initiating RCG will not ask any remote RCG—**86** to perform retransmissions or any other kind of data computations or manipulations.

Refer to FIG. **8** for the following discussion. In areas where there are existing 802.11 network equipment such as Neighborhood Access Point—**93**, or where there is sufficient bandwidth requirements from an installed base of RCGs to warrant the deployment of a Neighborhood Access Point—**93**, the RCGs will automatically detect the presence of the compatible neighborhood access points and register with that equipment for transport services. In this case, an RCG has an alternative broadband service route in addition to the multilink option. An RCG can communicate directly with a local 802.11 Network Access Point—**93** that is connected to the PSTN or another carrier's network via some sort of high bandwidth backbone such as a T-Carrier or optical carrier connection (T1, T3, OC3, OC12 etc.). The RCGs can communicate directly with neighborhood access points at their full 11/54 Mbps data rates to provide up to that full bandwidth to the user. This functionality is, of course, subject to the Network Access Point—**93** allowing access to its resources to the RCG according to the 802.11 wireless protocol.

This architecture is important since it provides an avenue to relieve the local class 5 offices of congestion that can be caused by a wide spread deployment of RCGs within the class 5 service area. Since each RCG requires a constant 24/7 modem connection, this ties up the class 5 switch in a fashion that it was not designed for. This could lead to wholesale class 5 office expansions which would be extremely expensive, and potentially prohibitive for the Local Exchange Carriers (LECs). By deploying neighborhood access points that operate at 54 Mbps (802.11a/g), in areas where the RCG concentration starts placing too high of a demand on the local class 5 office, the bandwidth from the RCGs can be aggregated by the neighborhood access points into large capacity backbones to relieve the switch congestion. In this case, the RCG POTS interface—**40** can be used solely as a lifeline connection, or when the 802.11 wireless LAN in which the RCG resides is congested. With this implementation, voice calls will be carried over the wireless interface as opposed to the POTS interface on which they would normally be carried. Also, the RCG modem—**41** connected to the POTS interface—**40** would not need to maintain a constant always on connection, it could be a dialed on demand connection and thereby relieving the local class 5 office switch.

Bouncing or Hopping Traffic:

Refer to FIG. **9**. In areas where the density of RCGs is less than the arbitrary number of 32 RCGs within its transmission radius for multilink connections, the RCGs can bounce, or relay, the data traffic between each other to reach other RCGs located farther than the RCGs wireless transmission area. Since the POTS data rate of 56 Kbps is miniscule as compared to the 11/54 Mbps 802.11b/g transfer rate, the overhead associated with bouncing data traffic is not a concern. This will allow for the fastest possible data transfer across POTS lines for every RCG user.

RCGs can also communicate directly with an 802.11a Neighborhood Access Point—**93** device (such as that used in WI-FI networks) that is connected to a data network con-

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nection such as a DS3 or OC3 service via a Metro Access Point. Where an RCG has access to a broadband device such as an 802.11a type device, either directly or via a bounced signal across several RCGs, a direct high speed data connection can be used to transfer large files. When an RCG is communicating directly with an 802.11a device, data transfer speeds up to the full 11/54 Mbps can be achieved to speed video transfers for such applications as video on demand.

RCG Router Tables:

The RCG continually monitors its 802.11b/g wireless interface for transmissions from other RCGs or 802.11a Access Points as well as other 802.11b/g wireless devices within the residence. The RCG provides a means to identify and store the addresses of other RCGs and Neighborhood Access Points within its local area. The RCG creates routing tables, much like an IP router device, so that it knows which RCGs are local to itself, and how many hops will be needed to reach the maximum of 32 POTS lines or a Neighborhood Access Point. The RCG can then determine how to route its data transfers to gain the most efficient routing and network efficiencies.

The router tables in each RCG are continually updated by monitoring the 802.11 frames received from other RCGs or Network Access Points. The number of entries in the router tables can be limited to an arbitrary number of other RCGs but contains room for at least 32 entries. For each RCG listed in the router tables, certain information is kept such as signal strength, if the other device is another RCG or some other 802.11 compatible device, if the other RCG is reachable directly, or if it is accessed via another RCGs by hopping. In the case there RCG hopping is used, the address of each RCG that is hopped is stored in the routing table. When an RCG is first powered up, it monitors its 802.11 interface for a period of time to identify other RCGs or Neighborhood Access Point devices, or other Wi-Fi devices within its transmission area. When first deployed, the RCG will not have any entries in its routing tables. This condition can persist for some time, until another RCG or other 802.11 device is deployed within the former RCGs transmission range. In this state, the RCG can be used for wireless networking within the residence, connecting the local computer to the RCGs always on Internet connection as well as to other wireless devices within the home. When an 802.11 frame is received by an RCG that contains the address of an RCG whose address does not exist in the receiving RCG's router table (as is the case when a new RCG is first installed), the receiving RCG polls the transmitting RCG for its router table information. The received router information is reviewed for other RCG's or other 802.11 compatible devices that are not listed in its own router tables. A decision is made to use some, all, or none of the new route information in its router tables. There is no real limitation on the number of RCGs that can be "hopped" in order to build a complete router table or to reach many more RCGs, Neighborhood Access Points or Metro Access Points.

Equipment and Services Priorities:

Just as voice has priority over data transfers within a single RCG, local RCG traffic (both voice and data) has priority over remote transfer requests by other RCGs. If an RCG is currently using all of its available POTS bandwidth for its own purposes, it will deny any remote RCG's request for access to its POTS line. Only when there is available POTS bandwidth available will an RCG allow other RCGs access to its POTS line. It will, however, bounce the traffic to other RCGs within its transmission area if requested by the originating RCG. In this case, available wireless bandwidth of any RCG (that amount of the 11/54 Mbps not currently used for its own traffic) can be used to relay traffic between other RCGs that do have available POTS bandwidth. In the same fashion, excess wireless bandwidth of any RCG can be by other RCGs to access high speed backbones via Neighborhood or Metro Access Points.

RCGs can also access other 802.11 wireless networks (Wi-Fi for example) that happen to be deployed within their service areas. In this case, access agreements between the RCG service provider and the wireless network operator must be put into place. By remaining compatible with the 802.11 standards, the RCGs capabilities will benefit by the growing WI-FI network infrastructure, an the WI-FI network will benefit by the RCG network.

Voice Over POTS and Data Over Wireless:

Normally, all communications from an RCG will be transmitted over the local POTS line, or a multilink bundle made up of many remote RCG POTS lines. By default, all voice calls will be carried over the "local" POTS line—**40** to alleviate security/privacy concerns and only "data" will be transmitted via multilink bundles. Generally, since voice "data" is compressed locally by the RCG, the required bandwidth for a voice call is so small that it does not make for a good choice to route it over a multilink connection. However, it is possible to route voice calls entirely over another RCGs POTS line. It is also possible for an RCG to transmit voice data over POTS lines connected to other RCGs via multilink bundles or directly over its 802.11 wireless interface, and since the 802.11 specification does support the Wired Equivalent Privacy (WEP) specification, a secured connection can be made in this fashion.

Remote Upgradability

The RCG is designed with the capability for unassisted remote upgradability. The remote upgradability feature is not the same as the storing of operational parameters during the configuration process. This feature allows the system operator to add new features as they are developed, or to correct bugs remotely and without the users knowledge or involvement. This feature can also be used to install a complete new operating system (OS).

Key to the successful implementation of the Remote upgradability feature is that a completely fail-safe routine be implemented that can recover from any failure during the upgrade process and to re-initiate and monitor the upgrade process until it has successfully completed. This process is carried out by loading a boot loader program that is stored in non-volatile memory. The boot loader program provides the minimum capabilities to start up the RCG and connect into the system operator's diagnostics network to download fixes or a new OS. The boot loader program is technically part of the OS, but it cannot be over written by any upgrade process. It is responsible for detecting failure of the RCG and initiating a connection to the diagnostics network. Once connected with the diagnostics network, the boot loader will provide diagnostics support to help correct the RCG's operation and reconfigure the OS.

What is claimed is:

1. A client device for multilink data packet communication with a server, the client device comprising:

a first network interface having a first data transfer rate associated with a first path from the server to the first network interface of the client device;

a second network interface having a second data transfer rate associated with a second path from the server to the second network interface of the client device; and

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at least one processor configured to:

transmit a first message through the first network interface to the server, wherein the first message includes a multilink request a destination URL;

transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification the destination URL; and

receive data packets from the server through the first and second network interfaces of the client device during the multilink session wherein the first data transfer rate and the second data transfer rate provide an increased data transfer rate of the first path and the second path from the server to the client device.

2. The client device of claim **1**, wherein the at least one processor further is configured to transmit the first message and the second message to at least one server, wherein the at least one server is a device providing the data packets, or a device that manages the client device and another device that is providing data to the client device.

3. The client device of claim **1**, wherein a server provides the multilink session identification that is unique to the multilink session.

4. The client device of claim **1**, wherein the first information is comprised of at least one of an Internet address associated with the first network interface, and the second information is comprised of at least one of an Internet address associated with the second network interface.

5. The client device of claim **1**, wherein each of the first network interface and the second network interface is one or more of cellular interface, Wi-Fi interface, a wireless interface, a cable interface, a wired interface, an Ethernet interface, a Bluetooth interface, a near-field communication interface, and an optical interface.

6. The client device of claim **1**, wherein the processor is configured to reorder the one or more data packets that are received over the at least two or more network interfaces of the client device during the multilink session.

7. The client device of claim **1**, wherein the client device is one of a cell phone, a tablet, a switch, a server, a network device, a router, a computer, a Wi-Fi device, a Wi-Max device, a wireless device, a mobile communication device, a near-field communications device, and a Bluetooth device.

8. A server for multilink communication with a device, the server comprising:

at least one server network interface; and

one or more processors coupled to the at least one server network interface and configured to:

receive a first multilink packet over the at least one server network interface, the first multilink packet comprised of a request for a multilink communication and first information associated with first network communication interface of the device that is capable of being used by the device to receive data packets;

sending a data packet including the multilink session identification to the first network communication interface of the device;

receive a second multilink packet over the at least one server network interface, the second multilink packet comprised of the multilink session identification and second information associated with a second network communication interface of the device that is capable of being used by the device to receive data packets; and

send different groups of data packets over the at least one server network interface to the first network communication interface of the device and to the second network communication interface of the device, wherein each of the different groups of data packets includes the multilink session identification.

9. The server of claim **8**, wherein the one or more processors is further configured to send the multilink session identification that is unique to the data packets being sent to the first network communication interface and the second network communication interface.

10. The server of claim **8**, wherein the one or more processors is further configured to:

receive a third multilink packet, the third multilink packet is comprised of multilink information associated with a third network communication interface of the device that is capable of being used by the device to receive data packets; and

send different groups of data packets to the first network communication interface of the device, the second network communication interface of the device and the third network communication interface of the device.

11. The server of claim **8**, wherein the one or more processors is further configured to receive a multilink packets comprised of multilink information associated with which one of the first network communication interface of the device, the second network communication interface of the device and the third network communication interface of the device is to be removed from the multilink session.

12. The server of claim **8**, wherein the one or more processors is further configured to receive different multilink packets over the at least one server network interface at different periods of time.

13. A first device comprising:

a network interface; and

at least one processor configured to:

transmit a first message through the network interface to a second device, wherein the first message includes a multilink request and a destination URL, the network interface to the second device having a data transfer rate associated therewith;

transmit a second message through the network interface to a third device, wherein the second message includes a multilink session identification that is unique to the multilink session and the destination URL, the network interface to the third device having a data transfer rate associated therewith; and

receive the different data packets through the at least one network interface from the second device and from the third device during the multilink session, wherein the data transfer rate associated with the network interface to the second device and the network interface to the third device provide an increased data transfer rate for the first device.

14. The first device of claim **13**, wherein the first device and the second device are separate devices or separate parts of the same device.

15. The first device of claim **13**, wherein the first device is one of a cell phone, a tablet, a switch, a server, a network device, a router, a computer, a Wi-Fi device, a Wi-Max device, a mobile communication device, a wireless communications device, a near-field communications device, and a Bluetooth device.

16. A first device for multilink communication, comprising:

at least one network interface; and

one or more processors coupled to the at least one network interface and configured to:

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receiving one or more multilink packets where each multilink packet comprises information associated with one or more of a plurality of network communication interfaces of a second device that are capable of being used to receive data packets;

during a multilink session

splitting up data from a data source into different groups of data packets; and

controlling a data server where the data server sends the different groups of data packets from the data server to different network communication interfaces of the second device, wherein each of the different groups of data packets includes the multilink session identification.

17. A client device for multilink communication, the client device comprising:

a first network interface having a first data transfer rate associated therewith;

a second network interface having a second data transfer rate associated therewith; and

at least one processor and configured to:

transmit a first message through the first network interface to at least one server, wherein the first message includes a multilink request and a destination URL;

transmit a second message through the second network interface to the at least one server, wherein the second message includes a multilink session identification that is unique to the multilink session and the destination URL; and

receive concurrently the different data packets from the server through the first network interface and the second network interface of the client device during the multilink session, wherein the first data transfer rate and the second data transfer rate provide an increase in the data transfer rate of the client device.

* * * * *

EXHIBIT 1003

Declaration of James Geier ("Geier")

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of Delangis	§	
	§	
U.S. Patent No.: 10,868,908	§	
	§	Attorney Docket No.: COM908
Issue Date: December 15, 2020	§	
	§	Customer No.: 165774
Filing Date: May 23, 2016	§	
	§	
Title: DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS	§	Real Party in Interest: Unified Patents, LLC

DECLARATION OF JAMES GEIER

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I. BACKGROUND AND QUALIFICATIONS

1. My name is James Geier, and I am over 21 years and otherwise competent to make this Declaration. I make this Declaration based on facts and matters within my own knowledge and on information provided to me by others, and, if called as a witness, I could and would competently testify to the matters set forth herein.

2. I have been retained as a technical expert witness in this matter by Counsel for the Requester, Unified Patents, LLC ("Requester") to provide my independent opinions on certain issues requested by Counsel for Requester relating to the accompanying reexamination request of U.S. Patent No. 10,868,908 ("the '908 Patent"), challenging Claims 1–3, 5, 6, and 13–15 (the "Challenged Claims"). My compensation in this matter is not based on the substance of my opinions or on the outcome of this matter. I have been informed that Competitive Access Systems, Inc. ("Patent Owner") is the purported owner of the '908 Patent. I note that I have no financial interest in Requester or Patent Owner, and I have no other interest in the outcome of this matter.

3. I have over 30 years of industry experience, including a substantial portion of which was spent working with communications systems, including systems involving wireless and multipath communications. I have summarized in this section my educational background, career history, and other qualifications

relevant to this matter. I have also included a current version of my curriculum vitae as Appendix A to this declaration.

4. I received a B.S. degree in Electrical Engineering from California State University in 1985. In 1990, I received an M.S. degree in Electrical Engineering from the Air Force Institute of Technology.

5. In my commercial experience, I have designed and implemented various network systems, including an enterprise-wide Ethernet/IEEE 802.3 network to support client-server systems and middleware software for improving the performance between mobile wireless devices and application servers. integrating new ports into conventional devices, such as integrating ethernet, Wi-Fi, Bluetooth, cellular, and USB transceivers into mobile devices such as phones, monitors, cable T.V. boxes, bar code scanners, and wireless printers. I have also designed large-scale wireless networks for municipalities, hospitals, airports, and manufacturing facilities for supporting voice, video, and data applications.

6. I have also authored over a dozen books on mobile and wireless topics, including Designing and Deploying 802.11 Wireless Networks (Cisco Press), Implementing 802.1X Security Solutions (Wiley), Wireless Networking Handbook (New Riders) and Network Re-engineering (McGraw-Hill). I have been an active participant within standards organizations, such as the IEEE 802.11 Working Group and the Wi-Fi Alliance. I have served as Chairman of the IEEE Computer Society,

Dayton Section, and various conferences.

7. As part of my work in forming my opinions in connection with this proceeding, I have reviewed the following materials, which I believe those in the field would reasonably rely upon in forming opinions regarding the subject matter of this proceeding:

Exhibit[1]	Description
1001	U.S. Patent 10,868,908 (the "'908 Patent")
1002	File History for U.S. Patent 10,868,908
1004	U.S. Patent 6,160,808 to Maurya ("Maurya")
1005	International Publication WO 97/22212 to Low *et al.* ("Low")
1006	U.S. Patent 5,809,070 to Krishnan *et al.* ("Krishnan")
1007	U.S. Patent 7,606,156 to DeLangis ("DeLangis-156")
1008	File History for U.S. Application 13/531,294
1009	U.S. Patent 8,861,349 to DeLangis
1010	Neil Briscoe, *Understanding the OSI 7-Layer Model*, PC Network Advisor, Issue 120, pp. 13-14 (Jul. 2000) ("Briscoe")
1011	John D. Day and Hubert Zimmerman, *The OSI Reference Model*, Proc. of the IEEE 71(12), 1334-1340 (Dec. 1983) ("Day")
1012	W. Simpson, *The Point-to-Point Protocol*, Network Working Group, RFC 1661 (Jul. 1994), available at https://www.rfc-editor.org/rfc/rfc1661 ("Simpson")
1013	U.S. Patent 6,112,245 to Araujo *et al.* ("Araujo")
1014	U.S. Patent 5,774,660 to Brendel *et al.* ("Brendel")

[1] For ease of reference, I cite to the exhibit page number provided at the bottom right of each exhibit that is not a patent or patent publication. This number corresponds to the PDF page number.

1015	K. Sklower, et al., *The PPP Multilink Protocol (MP)*, Network Working Group, RFC 1990 (Aug. 1996), available at https://www.rfc-editor.org/rfc/rfc1990.html ("Sklower")
1016	U.S. Patent 7,315,900 to Ofelt *et al*. ("Ofelt")
1017	Mel Beckman, *Integrated Services Digital Network Tutorial*, ARC Electronics (1995), available at https://arcelect.com/isdn.htm ("Beckman")
1018	Lillian Goleniewski, Excerpt of *Telecommunications Essentials: The Complete Global Source for Communications Fundamentals, Data Networking and the Internet, and Next-Generation Networks*, Telecommunications Technology Fundamentals, Addison Wesley (Dec. 28, 2001), available at https://www.informit.com/articles/article.aspx?p=24687 ("Goleniewski")

II. LEGAL FRAMEWORK

A. Obviousness

8. I am a technical expert and do not offer any legal opinions. However, I have been informed about certain legal principles regarding patentability and related matters under United States patent law, which I have applied in performing my analysis and arriving at my technical opinions in this matter.

i. General Framework

9. I am informed that a person cannot obtain a patent on an invention if the differences between the invention and the prior art are such that the subject matter as a whole would have been obvious to a person having ordinary skill in the art obvious at the time of the invention. I am informed that a conclusion of obviousness may be founded upon more than a single item of prior art. I am also informed that obviousness is determined by evaluating the following factors: (1) the scope and content of the prior art, (2) the differences between the prior art and the claim at issue, (3) the level of ordinary skill in the pertinent art, and (4) secondary considerations of non-obviousness. In addition, the obviousness inquiry should not be done in hindsight. Instead, the obviousness inquiry should be done through the eyes of a person having ordinary skill in the art at the time of the alleged invention.

10. In considering whether certain prior art renders a particular patent claim obvious, I am informed that one must consider the scope and content of the prior art,

examples of which include disclosures in patents, trade publications, journal articles, conference papers, industry standards, product literature and documentation, texts describing competitive technologies, requests for comment published by standard setting organizations, and materials from industry conferences.

11. I am informed that for a patent claim to be found obvious, the proper perspective to consider is that of a person having ordinary skill in the art (often referred to as a "PHOSITA," "POSITA," or "POSA") at the time of the alleged invention. I am informed that the factors to consider in determining the level of ordinary skill in the art include (1) the educational level and experience of people working in the field at the time the invention was made, (2) the types of problems faced in the art and the solutions found to those problems, and (3) the sophistication of the technology in the field.

ii. Analogous Art

12. I am informed that for a prior art reference to be proper for use in an obviousness analysis, the reference must be "analogous art" to the claimed invention. I am informed that a reference is analogous art to the claimed invention if: (1) the reference is from the same field of endeavor as the claimed invention (even if it addresses a different problem); or (2) the reference is reasonably pertinent to one or more problems faced by the inventor (even if it is not in the same field of endeavor as the claimed invention). In order for a reference to be "reasonably

pertinent" to a problem, it must logically have commended itself to an inventor's attention in considering the problem. In determining whether a reference is reasonably pertinent, one should consider problems faced by the inventor, as reflected either explicitly or implicitly, in the specification. I believe that all of the references I considered in forming my opinions in this IPR are well within the range of references a person having ordinary skill in the art would have consulted by the time of the invention to address the type of problems described in the Challenged Claims.

iii. Combining Known Elements in the Art, Common Sense

13. I am informed that, in order to establish that a claimed invention was obvious based on a combination of prior art elements, a clear articulation of the reason(s) why a claimed invention would have been obvious must be provided. Specifically, I am informed that, under the U.S. Supreme Court's KSR decision, a combination of multiple items of prior art renders a patent claim obvious when there was an apparent reason for a person having ordinary skill at the time of the invention to combine or modify the prior art. I am informed that such reason may include, but is not limited to, one or more of the following rationales: (A) combining prior art methods according to known methods to yield predictable results; (B) substituting one known element for another to obtain predictable results; (C) using a known technique to improve a similar device in the same way; (D) applying a known

technique to a known device ready for improvement to yield predictable results; (E) trying a finite number of identified, predictable potential solutions, with a reasonable expectation of success; (F) identifying that known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art; or (G) identifying an explicit teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine the prior art references to arrive at the claimed invention.

14. I am informed that the test for obviousness is *not* whether the features of a secondary reference may be *bodily incorporated* into the structure of the primary reference, but rather whether one of skill would have been motivated to combine the teachings of the prior art references to achieve the claimed invention. Nevertheless, I am informed that an invention that is a combination of prior art must do more than yield predictable results to be non-obvious and that, even where one or more motivations to combine exist, claims are not necessarily obvious unless a person having ordinary skill in the art would have had a reasonable expectation of success in implementing or applying the proposed combination at the time of the invention.

15. I also am informed that in conducting an obviousness analysis, a precise teaching directed to the specific subject matter of the challenged claim need not be

sought out because it is appropriate to take account of the inferences and creative steps that a person having ordinary skill in the art at the time of the invention would employ. In other words, the prior art need not be directed towards solving the same specific problem as the problem addressed by the patent. Further, the individual prior art references themselves need not all be directed towards solving the same problem. The prior art considered can be directed to any need or problem known in the field of endeavor at the time of invention and can provide a reason for combining the elements of the prior art in the manner claimed. Common sense teaches that familiar items may have obvious uses beyond their primary purposes, and a person having ordinary skill in the art will often have been able to fit the teachings of multiple prior art references like pieces of a puzzle. I am informed that, under the *KSR* standard, common sense is important and should be considered in assessing obviousness.

16. I also am informed that the fact that a particular combination of prior art elements was "obvious to try" may indicate that the combination was obvious even if no one attempted the combination. If the combination was obvious to try (regardless of whether it was actually tried) or leads to anticipated success, then it is likely the result of ordinary skill and common sense rather than innovation. I am further informed that in many fields it may be that there is little discussion of obvious techniques or combinations, and it often may be the case that market demand, rather than scientific literature or knowledge, will drive the design of an innovation. When

there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person having ordinary skill in the art has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation, but of ordinary skill and common sense.

iv. Teaching Away

17. I am informed that it is improper to combine references where the references teach away from their combination. I am informed that a reference may be said to teach away when a person of skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the patent applicant. In general, a reference will teach away if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the patentee. I am informed that a reference teaches away, for example, if (1) the combination would produce a seemingly inoperative device, or (2) the references leave the impression that the product would not have the property sought by the patentee. However, I am informed that a reference does not teach away if it merely expresses a general preference for an alternative invention but does not criticize, discredit, or otherwise discourage investigation into the invention claimed. Further, a person of skill will often appreciate that different courses of action often have

simultaneous advantages and disadvantages, and I am informed the existence of such does not necessarily obviate a motivation to combine.

v. Secondary Considerations

18. I am informed that even if a *prima facie* case of obviousness is established, the final determination of obviousness must also consider "secondary considerations" if presented. I am informed that in most instances, the patentee raises these secondary considerations of non-obviousness. In that context, the patentee argues an invention would not have been obvious in view of these considerations, which include: (a) commercial success of a product due to the merits of the claimed invention; (b) a long-felt, but unsatisfied need for the invention; (c) failure of others to find the solution provided by the claimed invention; (d) deliberate copying of the invention by others; (e) unexpected results achieved by the invention; (f) praise of the invention by others skilled in the art; (g) lack of independent simultaneous invention within a comparatively short space of time; (h) teaching away from the invention in the prior art.

19. I am further informed that secondary-considerations evidence is only relevant if the offering party establishes a connection, or nexus, between the evidence and the claimed invention. The nexus cannot be based on prior art features. For example, if commercial success of products allegedly embodying the claims is presented as a secondary indicium of non-obviousness, the patent owner must show

that such success is due to features of the claimed invention, and not features unrelated to the claimed invention or that already existed in the prior art. The establishment of a nexus is a question of fact. While I understand that the Patent Owner here has not offered any secondary considerations at this time, I will supplement my opinions in the event that Patent Owner raises secondary considerations during the course of this proceeding.

B. Claim Construction

20. I am informed that in performing an obviousness analysis, it is necessary to understand the scope of the claims. I am also informed the first step in an unpatentability analysis, therefore, involves construing the claims. Second, the construed claim language is then compared to the disclosures of the prior art. I am informed that claim terms need only be construed to the extent necessary to resolve the ultimate question of obviousness.

21. I am informed that claims are generally given their ordinary and custom meaning as understood by one of ordinary skill in the art at the time of the invention, in light of the patent specification. I am informed that, for the purposes of claim construction, while expert testimony may be helpful to provide background on the technology at issue, to explain how an invention works, to ensure an understanding of the technical aspects of the patent is consistent with that of a person having ordinary skill in the art, or to establish that a particular term in the patent had a

particular meaning in the pertinent field at the time of the invention. However, I am also informed testimony from a technical expert is generally less reliable than the patent itself and its prosecution history in determining the meaning of claim terms, and it is not the role of technical experts to supplant courts and PTAB judges in applying principles of claim interpretation. However, the "Background of the Technology" that I provide in Section III.C of my opinion sheds light on background on the technology at issue in this proceeding and, hopefully, provides the adjudicators with an understanding of certain pertinent technical aspects that a person having ordinary skill in the art would have appreciated by the time of the '908 Patent.

22. For this proceeding, I have applied the claim construction set forth in Section I.E of the reexamination request that this declaration accompanies when analyzing the prior art and the claims. First, I have been instructed to assume that the word "and" is missing from following limitations of Claim 1 of the '908 Patent: *the first message includes a multilink request* ***[and]*** *a destination URL*; *the second message includes a multilink session identification* ***[and]*** *the destination URL*. However, I note that my opinions regarding the ultimate issue of patentability remain the same even if the word "or" was meant to be used in Claim 1.

23. I have also been instructed on certain elements of claim 13, discussed at Section III.B.3 of the Request. First, I have been instructed that in limitation

13.2.3, which recites *receive the different data packets through the at least one network interface from the second device and from the third device during the multilink session, wherein the data transfer rate associated with the network interface to the second device and the network interface to the third device provide an increased data transfer rate for the first device* refers to "the different data packets" for the first time. I am informed that patent claim terms following words such as "the" and "said" generally should have antecedent basis earlier in a claim. Thus, I have been instructed to assume that this word "the" should have been omitted, as indicated in Section III.B.3 of the Request (limitation 13.2.3 analysis).

24. Claim 13 uses different articles to refer to a network interface to the second and third devices, making it is unclear as to whether whether the same network interface must be used to connect a first device to second and third devices or if two different network interfaces may be used. Request, Section III.B.3 (limitation 13.2.1 and 13.2.2 analysis). Some limitations refer to ***a*** *network interface* (13.1), and then transmitting a first message *through* ***the*** *network interface* to the second device (13.2.1) and a second message *through* ***the*** *network interface* to a third device (13.2.2). These limitations also each refer to *the network interface to the [second/third] device having a data transfer rate associated therewith*. And other limitations refers to ***the at least one network interface*** (13.2.3) and ***the*** *data transfer rate associated with* ***the network interface to the second device and network***

interface to the third device (13.2.4). Therefore, I discuss alternative embodiments of Krishnan supporting the combination of Maurya, Krishnan, and Low that would satisfy either possibility of one or two network interfaces being required by claim 13 and motivations to combine for each.

25. Finally, regarding the final limitation of claim 13 (limitation 13.2.4), although it does not indicate what the "increased data rate for the first device" is to be compared against, given the context referring to multilink communications earlier in the claim, I have been instructed to assume that the *increased data rate* refers to the combined bandwidth provided by using the second and third devices to transmit different segments of a transfer of information, such as a file, which appears consistent with the specification. *'908 Patent* (EX1001), 11:50-53.

26. For those terms not expressly construed, counsel has not instructed me to apply a construction of the claims notwithstanding their ordinary meaning. Therefore, I have applied the meaning of the claim terms of the Challenged Claims that is generally consistent with the terms' ordinary and customary meaning, as a person having ordinary skill in the art would have understood them in the context of the '908 Patent at the time of the alleged invention.

III. OPINION

A. Summary of My Opinions

27. In forming my opinions below, I have reviewed the '908 Patent, the file history of the '908 Patent, the scope of the prior art discussed herein and in the Request, and I have considered the knowledge and skill a person of ordinary skill in the art would have had by the time of the priority date of the '908 Patent. If Patent Owner submits additional evidence pertaining to the patentability of the '908 Patent, I intend to review such materials and update my analysis and conclusions as appropriate and as permitted under the rules of this proceeding.

28. I have also relied on my education, experience, and knowledge in the relevant field of art in forming my opinions expressed below. The "Background of Technology" that I provide in Section III.C sheds light on the background of the technology at issue in this proceeding and, hopefully, will provide the adjudicators with an understanding of certain technical aspects that are pertinent to this proceeding. In my opinion, the cited contents accurately reflect the general knowledge that a POSA would have had by October 15, 2002, and certainly later if a different priority date is assigned to the '908 Patent. I note that this background is not exhaustive—a POSA would have been familiar with many of the facets of multilink communication systems that are not described, but I have endeavored to touch on concepts relevant to the technology claimed.

29. I've also reviewed the Request's explanation as to why the Challenged Claims are unpatentable, including based on the technical background I provide here, and contributed to the arguments presented in the Request. I agree with the Request's explanation as to how the prior art teaches the limitations of the challenged claims.

B. Level of Skill of a Person Having Ordinary Skill in the Art

30. I was asked to provide my opinion as to the level of skill of a person having ordinary skill in the field of the '908 Patent at the time of the claimed invention (referred to herein as a "POSA"). I have been instructed to assume is that the time of the claimed invention of the '908 Patent is October 15, 2002; however, I note that if a later priority date is applied to the Challenged Claims, this person would still have all of the skill and knowledge described in my background below. In determining the characteristics of a POSA, I was told to consider several factors, including the type of problems encountered in the art, the solutions to those problems, the rapidity with which innovations are made in the field, the sophistication of the technology, and the education level of active workers in the field. I also placed myself back in the time frame of the claimed invention and considered the colleagues with whom I had worked at that time.

31. In my opinion, a POSA would have been a person having, as of the priority date of the '908 Patent (1) at least an undergraduate degree in electrical

engineering or closely related field, or similar advanced pose-graduate education in this area; and (2) 2 or more years of experience with communications systems, with more experience substituting for less education and vice versa, with more experience substituting for less education and vice versa. Such a person of ordinary skill in the art would have been capable of understanding the '908 Patent and the prior art references discussed herein.

32. Based on my education, training, and professional experience in the field of the claimed invention, I am familiar with the level and abilities of a POSA. Additionally, I met at least these minimum qualifications at least as of October 15, 2002. Further, although my qualifications may exceed those of the hypothetical person defined above, my analysis and opinions regarding the '908 Patent have been rendered from the perspective of a POSA during the relevant time frame. Again, I note that if a later priority date were applied to the claims, the POSA would have at least possessed the knowledge and skill presented below, and likely more as technology and resources became more widely available.

C. Background of the Technology

33. The '908 Patent relates to a communications gateway, or RCG, for use in, for example, a home or small office, that "combines the capabilities of IP routers,

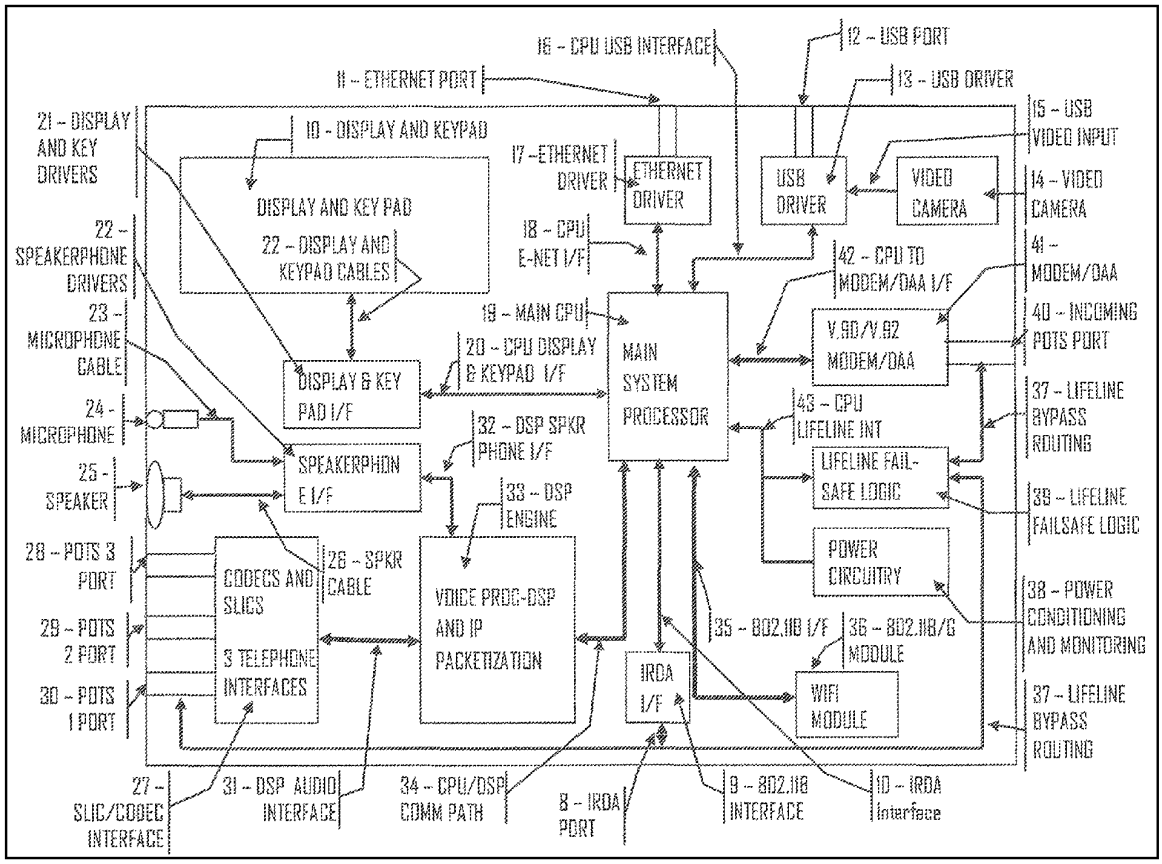
Class 5[2] circuit switches and wireless LANs" that is capable of providing additional services over a Plain Old Telephone Service (POTS) line. *'908 Patent* (EX1001), 2:36-40. The RCG purports to provide "new calling features and services over the existing POTS line" not offered by existing local exchange companies without requiring new infrastructure (such as cable or DSL). *Id.*, 1:40-2:6.[3]

34. The RCG is plugged into POTS line and includes three line-output jacks to provide additional telephone lines into the household or office. *Id.*, 2:54-60; *see also* 2:48-53. Additional interfaces, such as a Universal Serial Bus (USB) or Ethernet port and 802.11b/g interface, are included for computer connectivity if data communications are desired. *Id.*, 2:60-3:1. For example, Figure 1 shows the internal interfaces that could be provided in the RCG:

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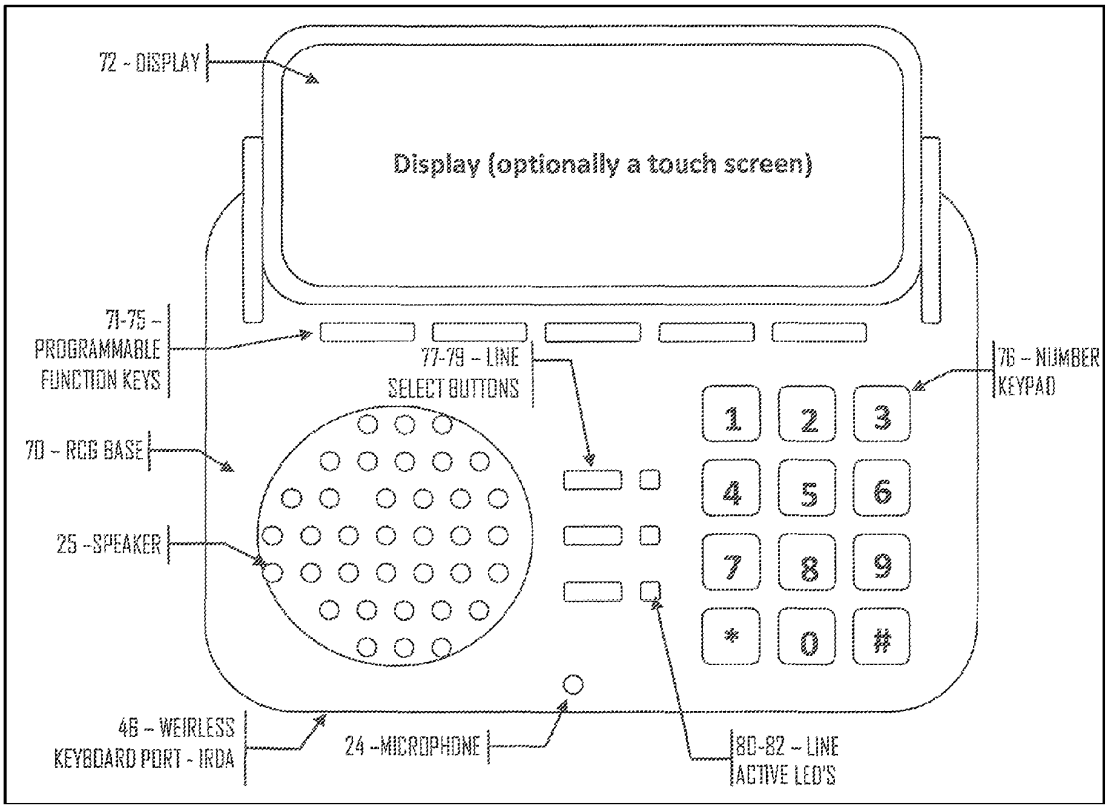
[2] A "class 5" telephone switch refers to an exchange in the public switched telephone network that directly provides services to subscribers, and it was also known as the "local exchange" or the "central office." *See Goleniewski* (EX1018), 3.

[3] While the Abstract of the '908 Patent identifies a general "network-edge router," such as "cellular device or tower," the specification never otherwise uses these terms, nor does the specification of, for example, DeLangis-156 or another parent patent, U.S. Patent 8,861,349.



Id., Fig. 1.

35. The RCG is a "small stand-alone external modem like device." *Id.*, 2:36-38. It is plugged into the POTS to provide additional phone lines in its "simplest and most basic usage," but it may also be connected to a computer for data communications, such as through an Ethernet or USB port. *Id.*, 2:56-65. An 802.11b/g interface may the RCG to communicate wirelessly with other computers. Figure 4 illustrates an example embodiment of an RCG that includes a speakerphone and display:



Id., Fig. 4.

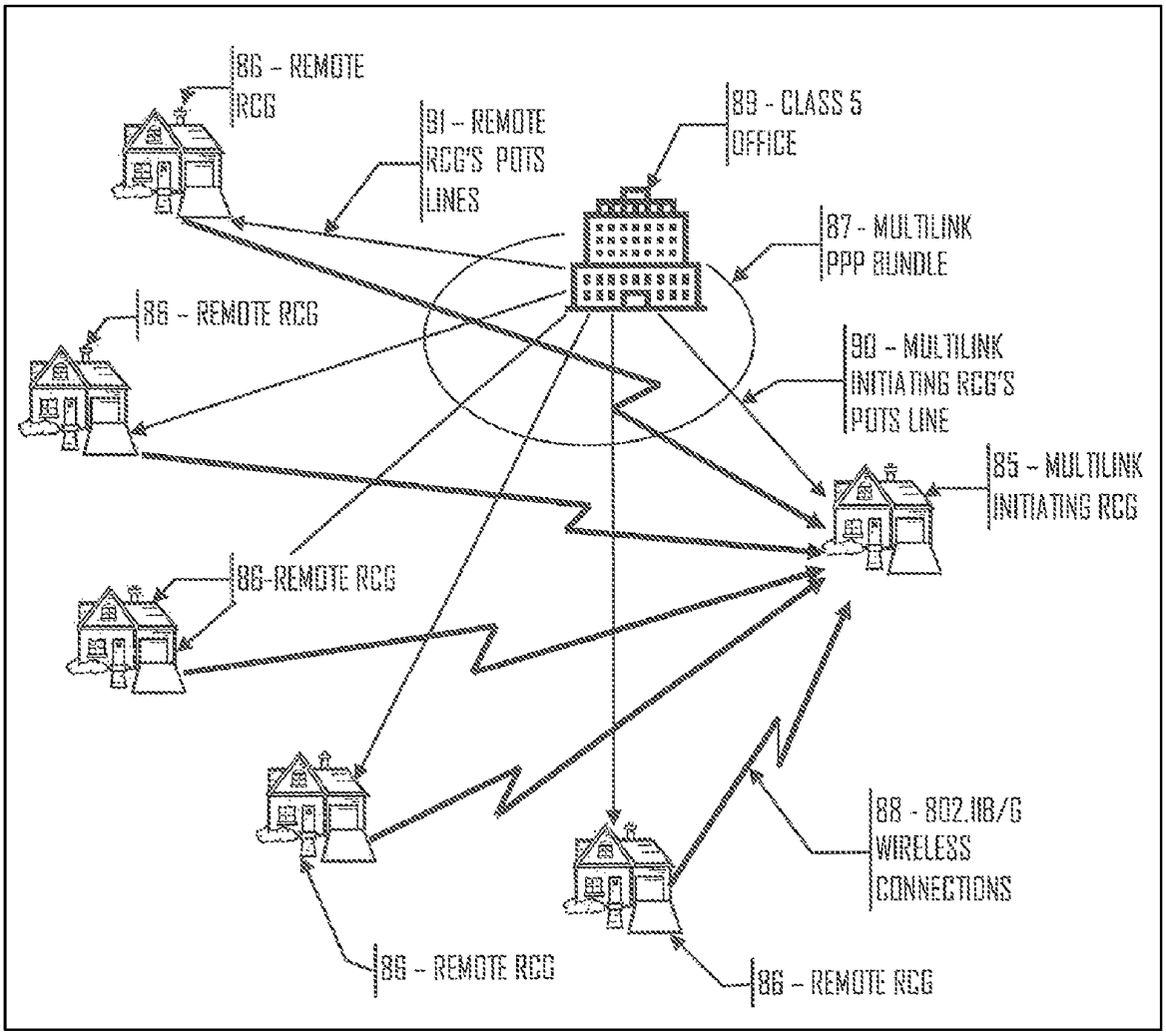
36. In one embodiment, the '908 Patent describes that the RCG "implements broadband over POTS by employing an 802.11 b/g to configure a multilink PPP bundle—87 (per RFC 1990) comprised of the POTS lines" of other RCGs. *Id.*, 11:25-28. The point-to-point protocol ("MLPPP"), also known as the multilink protocol ("MP") was a well-known implementation of the point-to-point protocol. By RFC 1990, I presume the applicant was referring to Sklower (Exhibit 1015), which a POSA certainly would have been familiar with when dealing with multilink communications by 2002. Additionally, a POSA would have been familiar with the broader point-to-point protocol, such as described in RFC 1661. I discuss

the multilink protocol in more detail in Section III.C.iii below.

37. In the multilink embodiment, the link is established by negotiating parameters with a "remote computer i.e. internet URL" through Link Control Protocol (LCP) session management. *Id.*, 12:2-9; *see also* Fig. 7. As part of a successful setup, the RCG receives a "multilink PPP session ID, or 'magic number'" to identify the session and add or remove links from the multilink bundle. *Id.*, 12:9-14.

38. The RCG then selects remote RCGs for transferring data to the requesting device based on a desired transfer bandwidth and the available bandwidth of the remote RCGs. *Id.*, 9:22-51. The initiating RCG sends the remote RCG an initialization packet containing the session ID and the destination URL for the transfer. *Id.*, 12:51-57. After receiving the initialization packet from the originating RCG, the remote RCGs send their own multilink packet to the destination URL with the session ID and a request to be added to the bundle. *Id.*, 12:60-63. Then, "the destination URL accepts the request of each of the remote RCGs" and begins sending data packets to each RCG. *Id.*, 12:63-66. The remote RCGs relay the data to the initiating RCG, which will be responsible for reassembling packets. *Id.*, 12:66-13:7.

39. Figure 7 purports to illustrate the multilink communication arrangement.



Id., Fig. 7. Each RCG represents a logical link in the in the initiating RCG's multilink PPP bundle. *Id.*, 12:57-60. The destination URL/remote server computer is not shown. *Id.*, 12:6-8.

i. Background of Communication Layers

40. For two devices to communicate, the data must be sent and packaged in a particular way—devices communicating directly with one another must agree on the protocols being used, and if those devices are not compatible, specialized

programming or devices must be used to make the communications compatible. Most (if not all) networked communications rely on what are referred to as "layers" of the communication system to work properly. The industry standard model for communications layers is the Open System Interconnection, or "OSI" reference model. *See Briscoe* (EX1010), 1. The OSI model has seven layers. Other common systems, such as TCP/IP, may refers to fewer layers, but understanding the seven layers of the OSI model is still a helpful teaching tool to understand these other systems. *Id.*

41. Layer 1 is the "Physical Layer." *Id.* When communicating using computers on the OSI model, the devices are passing strings of data using electrical, optical, magnetic, electromagnetic, or some other type of signal. *Id.*, 1. The smallest unit of these strings of data is a bit, which can have one or two states, 0 or 1. *Id.* represented by voltage, current, or wave. *Id.* The physical layer refers to the devices and interfaces that pass and store data, such as network interface controllers (NIC), wires, router interfaces, and flip flops in memory devices. All network devices physically communicate through a physical layer.

42. Layer 2 is the "Data Link Layer." *Id.* The data link layer defines the access strategy for sharing the media stored on the physical medium. *Id.* The point-to-point protocol, including the MLPPP, operates at the data link layer. *Id.* The data link layer provides the functional and procedural means for data transfer itself

between network elements. *See, e.g.*, *Day* (EX1011), 6. In other words, the data link layer provides functions such as network device addressing, data synchronization and error control.

43. Layer 3 is the "Network Layer." *Briscoe* (EX1010), 1. The network layer provides a means for communicating open systems to establish, maintain, and terminate network connections. This is the layer at which the IP protocol is used. *Id.*, 1. The network layer handles the relaying and routing of data through one or more networks, and all routers operate at the network layer. *Id.*; *see also Day* (EX1011), 6.

44. Layer 4 is the "Transport Layer." *Briscoe* (EX1010), 1–2. This layer ensures data reliability and integrity and may be implemented as software or specialized switching technology. *Id.*, 1–2. This is where the transmission control protocol, or TCP, operates. *Id.*, 1.

45. Layer 5 is the "Session Layer," and it is this layer that prevents interference with communication between two devices by organizing and structuring the interactions between different application processes. *Id.*, 2; *see also Day* (EX1011), 5.

46. Layer 6 is the "Presentation Layer." *Briscoe* (EX1010), 2. The presentation layer is where application data is packed or unpacked for use by a running application, and it includes steps like protocol conversions,

encryption/decryption, data compression/expansion. *Id.*

47. The final layer, layer 7, is the "Application Layer." *Id.* This is where one would find the end-user and end-application protocols. *Id.*

48. When a packet of data is sent from one device to another, it "descends" the different layers, starting at a client application (for example) at layer 7, being wrapped in different headers and trailers, perhaps encrypted and compressed, as it goes through the different layers until, having reached the physical layer, it is sent across some medium to the destination device and "ascends" the layers, stripping unnecessary information and decrypting and expanding the original application data for the server application to process. *Id.*

ii. The Point-to-Point Protocol

49. The point-to-point protocol operates at the data link layer and the network layer. *See Simpson* (EX1012), 1. It includes a link control protocol ("**LCP**") for establishing, configuring, and testing the data-link connection. *Id.* It also comprises a family of "network control protocols" ("**NCP**s") for establishing and configuring different network-layer protocols, primarily to minimize issues in interacting with other network protocols. *Id.*, 3–4; *see also Araujo* (EX1013), 1:33-43.

50. A Uniform Resource Locator, or URL, identifies a domain, a host within that domain, and sometimes a resource or file within a directory structure on

the host computer (e.g., an html resource). *Brendel* (EX1014), 1:37-39. For example, the domain "ibm.com" identifies a domain for the company IBM, which may include "thousands" of individual server computers. *Id.*, 1:39-43. When a user clicks on or types in a URL into a browser, the host name (e.g., "www.ibm.com") will be extracted from the URL and sent to a domain-name-system (DNS) server, which looks up (or requests another DNS server to look up) the physical IP address for the web-server host in the domain. *Id.*, 2:18-35. The client browser can then use this IP address to initiate a communication session with the remote computer that physically has the needed resource. *Id.*, 2:36-43. Once the session is initiated, the client sends the URL to the server. *Id.*, 2:44-47.

51. Because the LCP packets in the point-to-point protocol operate at the data link layer, whether a "destination URL" is included in a packet depends on what information is compiled by the upper layers of the communication model or protocol suite and the information requested by the transmitting device. For example, when a person types a URL into their browser (or clicks on a link), the web browser will create a request and tells the lower-layer stacks (such as the network and transport layers) to send the request to, for example, "google.com," and the data-link layer will wrap these "datagrams" according to the protocol(s) being used and send it over the physical link to the intended recipient. *See, e.g.*, *Araujo* (EX1013), 1:32-61; *see also Sklower* (EX1015), 7 (in the multilink protocol, network protocol packets are

encapsulated according to point-to-point procedures in the multilink protocol).

52. As discussed in more detail below regarding Low, a URL was a common, but not the only way to reach a server or identify a URL resource; for example, a uniform resource name (URN) that can be resolved into a URL may be used. *Low* (EX1005), 18:6-7. Therefore, while a POSA would appreciate that a destination URL may commonly have been included in the overall message to the recipient (such as a URL requested by a client executing a web browser application), it would not be the subject of the LCP configuration fields discussed in, for example, Maurya, and it would not inherently be included in an LCP configuration request to any server.

iii. The Multilink Protocol

53. The point-to-point multilink protocol, often referred to using the abbreviations MP, MLPPP, or ML-PPP, is a method of splitting, recombining, and sequencing datagrams across multiple logical data links. *Sklower* (EX1015), 1. First proposed in 1994 (RFC 1717), the multilink protocol had the advantage of providing users with greater additional "bandwidth on demand." *Id.*, 2. Because of this greater bandwidth, and as the '908 Patent itself recognizes, one feature a user would expect from employing devices capable of using multiple simultaneous channels and the multilink protocol is greater transmission rates. *See, e.g., '908 Patent* (EX1001), 11:50-56.

54. The '908 Patent refers to the term "magic number" as a "session" identification. *'908 Patent* (EX1001), 12:9-14. Magic numbers were known to be used both as an error checking tool to prevent loopedback communications and as a type of endpoint identifier to add links to a multilink bundle as part of specific LCP configuration requests. *See generally Simpson* (EX1012) (RFC related to PPP); *Sklower* (EX1015) (RFC related to the multilink point-to-point protocol, describing the use of a magic number as an endpoint discriminator, or identifier); *see also '908 Patent* (EX1001), 12:11-14, 12:51-57 (multilink session identifier used for adding and removing devices from the multilink bundle).

55. For the multilink protocol, no magic number is negotiated as a default, and a zero is inserted where the magic number might have been in certain requests. *Simpson* (EX1012), 47; *see also Sklower* (EX1015), 5 (magic number not used for error checking as a default in the multilink protocol). However, if one is desired, an implementer first negotiates a magic number with its peer by sending a request with its own magic number; if it receives an identical magic number back from its peer, such indicates that the link is looped back, and a new one should be sent in a new Configure Request. *Simpson* (EX1012), 47–48. Otherwise, certain requests, such as Echo-Request, Echo-Reply, and Discard-Request packets, should always include the peer's Magic-Number field set to the negotiated Magic-Number. When peers negotiate a magic number, the Magic-Number of zero must always be responded to

with a negative acknowledgment ("nak'd") or rejected outright. *Id.*, 48.

56. A magic number was generally known as an error-checking tool used to detect looped-back links. *Simpson* (EX1012), 47–48; *see also Sklower* (EX1015), 19. Reception of a magic number other than the negotiated number may also indicate a link that had been misconfigured for communications with a different peer, and this could be fixed by transmitting echo-request packets until an appropriate echo-reply is received. *Simpson* (EX1012), 47–48.

57. Magic numbers had other purposes as well. For example, if endpoint discriminators, also known as endpoint identifiers, were desired, this would be indicated by the number 19 in the "Type" field of a configuration request packet. *Sklower* (EX1015), 17. There were commonly five classes of addresses (other than the null class) for use as an endpoint discriminator, each with predictable advantages and disadvantages:

1 — Locally Assigned Address

2 — Internet Protocol (IP) Address

3 — IEEE 802.1 Globally Assigned MAC Address

4 — PPP Magic–Number Block

5 — Public Switched Network Directory Number

Sklower (EX1015), 17–18.

58. Thus, in the context of multilink point-to-point communications, the

use of magic numbers as an endpoint identifier address class was one of a few options, and although it was not necessarily preferred, it was permissible and well-known. *Sklower* (EX1015), 17, 19. The same magic number would be continuously used by the endpoint until the link was closed. *Id.*, 19. Magic numbers were preferably random numbers with a high probability of being a unique, such as by using a unique seed like a serial number or other hardware address along with some timing of an event, such as the timing of the arrival of a packet or a server response time. *Simpson* (EX1012), 47.

59. The use of additional identifiers for a multilink packet, such as through the use of an additional header or data to be included in the segment field, was well known prior to 2002, including in the context of point-to-point communications and multilink point-to-point communications. *See e.g.*, *Araujo* (EX1013), 2:37-42 (disclosing a technique of using a session identifier in place of the high-level data link control address in establishing a point-to-point session); *see also Ofelt* (EX1016), 9:3-11, Fig. 8B (describing appending an additional multilink header that includes a bit field identifying a bundle associated with a data block to communications from a router).

60. For a split, or fragmented, data-carrying packet, certain header information would be used to so that the packet could be compiled properly at the receiving site. Specifically, each fragment would be assigned a sequence number

split into two fields. Using Maurya's long-sequence format as an example, the sequence number is a 24-bit value spread over two fields, with Field 535 including the first eight "significant bits" while Field 540 including the remaining sixteen bits. *Maurya* (EX1004), 10:48-51. The sequence number is incremented by one for each successive packet in the multi-link protocol so that the entire packet can be reordered upon reception. *Id.*, 10:54-58. Each sequence number would fall somewhere within the beginning sequence number and end sequence number (indicated by a different field in the header), so a receiver would be able to identify what the packet belonged to and where the packet fell.

D. The Combination of Maurya and Low

i. Overview of Maurya

61. Maurya relates to communications techniques using the multi-link protocol in systems where two endpoints, such as a client device and server, are associated with multiple incoming/outgoing links, such as Integrated Services Digital Network ("ISDN") basic rate interface ("BRI") terminals:

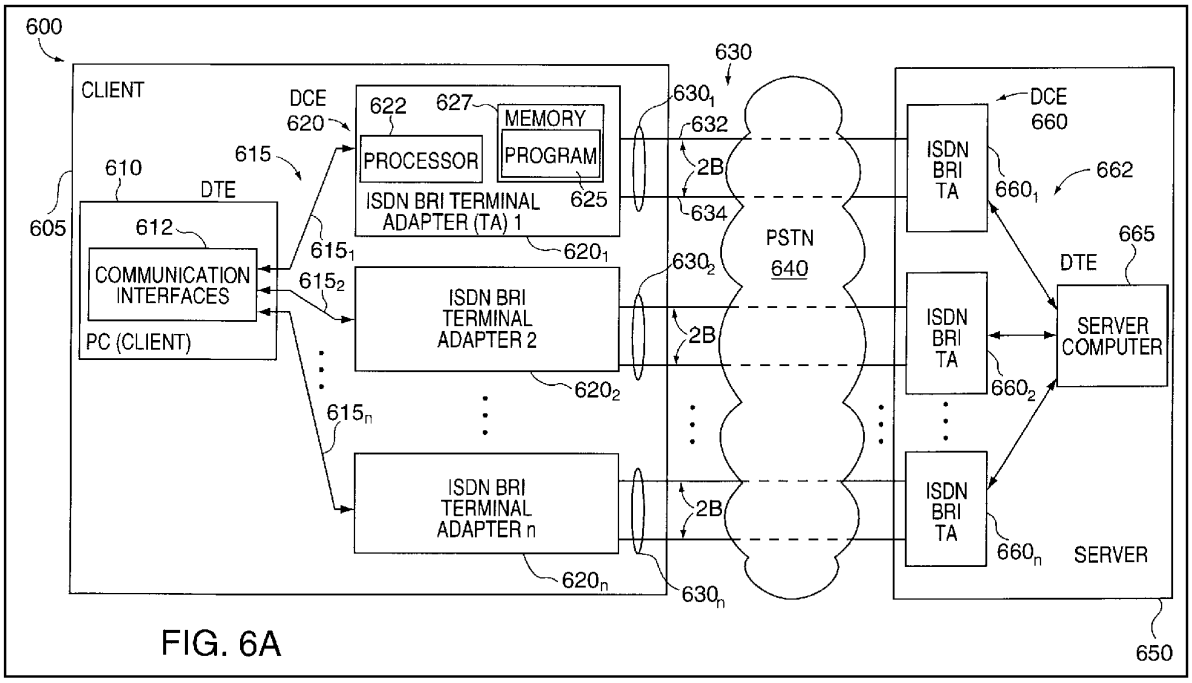


FIG. 6A

Maurya (EX1004), Fig. 6; *see also* Abstract ("A communications technique which permits incoming multi-link point-to-point (PPP) packets of a common PPP frame to be simultaneously transmitted across more than one outgoing link in a multi-link bundle."); 1:10-17.

62. In Maurya's system, a client is interconnected to the server through communication interfaces 612 connected via links $615_1 \ldots 615_n$ to terminal adapters $620_1 \ldots 620_n$, each associated with corresponding links to a server $630_1 \ldots 630_n$, which has corresponding terminal adapters $660_1 \ldots 660_n$. *Id.*, 11:40-67. The communication interfaces 612, which are not specifically identified in the figure would typically be separate serial ports connected to the ISDN adapters through links 615. *Id.*, 11:40-49. Thus, like the '908 Patent, Maurya discloses first and second

network interfaces (as in claim 1) each associated with a path to the server. *'908 Patent* (EX1001), Fig. 1 (using I/F to refer to the link between a main processor and drivers/modules); 2:61-65 (referring to ethernet, USB, or firewire ports as "interfaces for computer connectivity"); 3:65-3:10 (the CPU includes ports, modems/DAA for routing data and an 802.11b/g modules).

63. Maurya also provides a detailed background of the point-to-point protocol, including the multilink protocol (which Maurya accurately describes as a mechanism of the point-to-point protocol) through the use of link control protocol ("LCP") packets. *Maurya* (EX1004), 3:1-8. To understand Maurya's disclosure, it is helpful to understand the terms it uses to describe different systems and components; while Maurya's use of these terms is consistent with how a POSA would have understood them, a layperson might be confused by some overlapping concepts. For example, in the above figure, "client" is used both to describe personal computer 610 and the overall client system 600 from which a request originates. *Id.*, Fig. 6. Therefore, I will discuss some of these terms.

64. First, in Maurya, a **peer** refers to a device that is (or seeks to be) part of the collection of devices exchanging data, including the client, server, and networking devices seeking to exchange data using the benefits of the multilink protocol. *Maurya* (EX1004), 5:29-37; *see also* 3:1-14. As examples, "peers" included terminal adapters, routers, or modems, that is, things that may be viewed

as data terminating equipment from the perspective of another endpoint. *Id.*, 7:6-13. A **link** refers to a physical layer, such as a communications channel, over which data is carried from a device. *Id.*, 1:10-14. A **bundle** refers to a collection of links conveying the data-carrying packets for a given session; for example, a client computer and its terminal adapters, and it is helpful to think of a bundle as something that appears as a set of links that should be treated as one for the purposes of splitting and reordering packets. *Id.*, 3:1-9; *see also Ofelt* (EX1016), 5:20-29. By using the multilink protocol, the entire collection of links forms a single **pipe**, which logically behaves as one channel between the client and server. *Maurya* (EX1004), 3:6-14.

65. Maurya describes that the Maurya discloses that in the conventional PPP context, each peer, which includes a client, server, and each network device, would transmit an LCP "**Configure Request**" to configure a link to establish an initial connection add and remove connections, and test the link:

> Initially, as shown, a link is in Dead state 110, during which the PPP protocol is inactive. . . . **[A] link control protocol (LCP), which as part of the PPP protocol, exercises responsibility for establishing and configuring the link**, remains in an initial or starting state. Once the physical layer has appropriately signaled that the link is ready, then the link transitions, as symbolized by UP line 115, to Establish state 120.

Id., 7:22-37; *see also* 1:52-55 ("Before any data is transmitted over a PPP link, each PPP peer connected to one end of the link will send LCP configuration packets to

the other end to establish and test the link; thus, ensuring the link is fully operational."). As discussed above, LCP packets operated on the "data link layer" of communication systems, and they would be used to establish, test, and close a link, as well as set parameters for how data would be packaged and unpackaged. *See* ¶¶ 42, 49, *infra*; *see also Simpson* (EX1012), 1; 21–23 (describing different actions used to test the link).

66. Figure 2 of Maurya depicts a generalized LCP packet. *Maurya* (EX1004) Fig. 2; 6:23-25. Figure 3 shows one example of a type of configuration request, which is used to configure a link and negotiate parameters associated with a new or current link. *Id.*, Fig. 3; 6:26-28; 8:54-59. Included in this packet is an eight-bit type field that can be used to designate a multilink configuration using the values 17, 18, or 19. *Id.*, 8:60-65 (describing the type field); 9:1-9 (describing the three multilink type fields).

67. When the option 19 is used in the Type field, the basic LCP packet follows the format of Figure 4, which is the Multi-link Endpoint Discriminator Option packet:

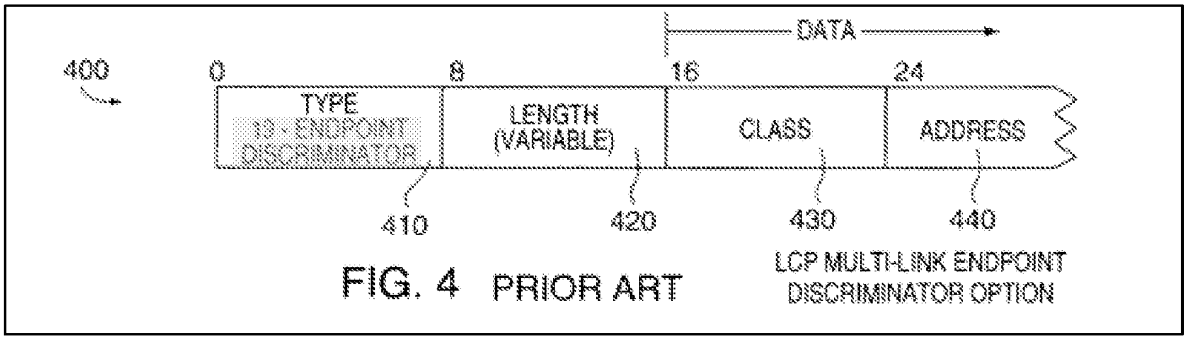


FIG. 4 PRIOR ART

Id., Fig. 4 (annotated); *see also* 9:14-18; 9:1-9. Thus, when a configuration request has "19" in the Type field, a message including this packet would be understood by the recipient as including *multilink reque*st, as recited in Claim 1.

68. As mentioned above, an endpoint discriminator, which was also known as an endpoint *identifier* (*Maurya*, 9:38-41, 10:22-26, 13:19-21) may be used to identify a link, but as Maurya teaches, it can be used for even more than that. Maurya discloses embodiments in which a unique endpoint discriminator may be assigned to all peers so that multiple outgoing links may be located at a given endpoint system, an idea that Maurya calls the "multi-multi" link protocol. *Id.*, 13:54-60.

69. This assignment of a unique endpoint discriminator to all peers is performed during LCP negotiations by having "a multilink PPP originator, such as . . . a client application executing at a PC, assign[] itself a unique endpoint discriminator value and inform[] all its immediate PPP peers" of this value using an LCP Endpoint Discriminator packet containing this value." Each peer assumes this unique value as its own endpoint discriminator value and passes on LCP packets down the pipe, fanning out until "all the links in this pipe will be viewed, by the multi-link protocol, as part of a common bundle." *Id.*, 14:5-21; *see also* 5:8-20, 5:29-55 (similar).

70. For example, if a client wishes to send a request to a server, it will assign itself an endpoint discriminator and, using the LCP endpoint discriminator

option packet, require each of the terminal adapters 620 to set this value as their own endpoint discriminator for communications to and from the server. *Id.*, 14:22-29; *see also* 14:35-37. When each of these terminal adapters of client 605 configure the link with each of the corresponding the adapters 660 at the server end of the pipe, they will provide this common endpoint discriminator via the LCP Configuration Request packet illustrated at Figure 4. *Id.*, 14:35-43; *see also* Fig. 6B. Then, "by virtue of the common endpoint discriminator associated [*sic*] the application executing at client PC 10," the server will see all of the peers as part of a common bundle for packets generated by and destined to client 605. *Id.*, 14:50-60.

71. Upon setting up the link, the client may receive data from the server via the terminal adapters. *Id.*, 14:50-57; *see also* 8:56-10:5; 14:17-15:11 (describing the reception of packets at the client from the server), Fig. 8 (step 820). I discuss the segmenting/fragmenting of large data packets in more detail below. *See* ¶¶ 77–79, *infra*.

72. I note that the client comprises a client PC, i.e., a **p**ersonal **c**omputer, 610, also referred to as "data terminating equipment (DTE)" for executing an application to configure a link. *Maurya* (EX1004), 7:6-13; *see also* 13:61-14:5; 5:29-37, 14:22-39; 14:50-52. The client PC executes application software to implement the multilink protocol techniques described by Maurya, such as "during the course of configuring links 615." *Id.*, 14:22-29. Personal computers typically, if not

inherently, included processors, such as central processing units (CPUs), to execute application software; thus, a POSA would have recognized from Maurya's disclosure, Maurya's client PC would have included a processor to carry out the specialized multilink protocol implemented by client 605 to interface with server 650.

73. In my opinion, a POSA would have considered Maurya to be analogous art to the '908 Patent because it is both within the field of endeavor and reasonably pertinent to at least one problem concerning the named inventors of the '908 Patent. Maurya is within the field of endeavor of the '908 Patent, as it relates to techniques of communicating large amounts of between different devices, including in the context of the multi-link point-to-point protocol. *Id.*, 1:10-17. Additionally, it is reasonably pertinent to at least one problem concerning the inventors of the '908 Patent, namely, to provide higher level network services to more consumers, such as residential consumers, without severe infrastructure costs. *'908 Patent* (EX1001), 1:64-2:6; *see also Maurya* (EX1004), 4:52-55.

ii. Maurya's Endpoint Discriminator/Identifier as a Multilink Session Identification

74. In my opinion, a POSA would have appreciated that Maurya's endpoint discriminator is a *multilink session identification*, as in claims 1 and 13 of the '908 Patent, because it identifies the session using LCP configuration packets, which were used to configure and add and remove devices from a link. Indeed, one

example of multilink session identification described in the '908 Patent is the "magic number." *'908 Patent* (EX1001), 12:9-14. As mentioned in Paragraphs 54 and 57–59 above, it was well known that "magic number" was class of endpoint discriminators, specifically Class 4. *Maurya* (EX1004) 9:42-44 (describing the role of a class field in an endpoint discriminator option packet).

75. Maurya discloses using the endpoint discriminator option to allow different peers, such as the client PC and, through it, the terminal adapters 620, to join a link:

> [A]n LCP Configure Request packet 35 specifies a multi-link endpoint discriminator option whenever the type field of the LCP Configure Request packet is set to value nineteen, as is field 410. Identification of the endpoint system (commonly referred to as either an "endpoint discriminator" or "endpoint identifier") is accomplished through class field 430 and address field 440, which collectively contain data carried by this packet.

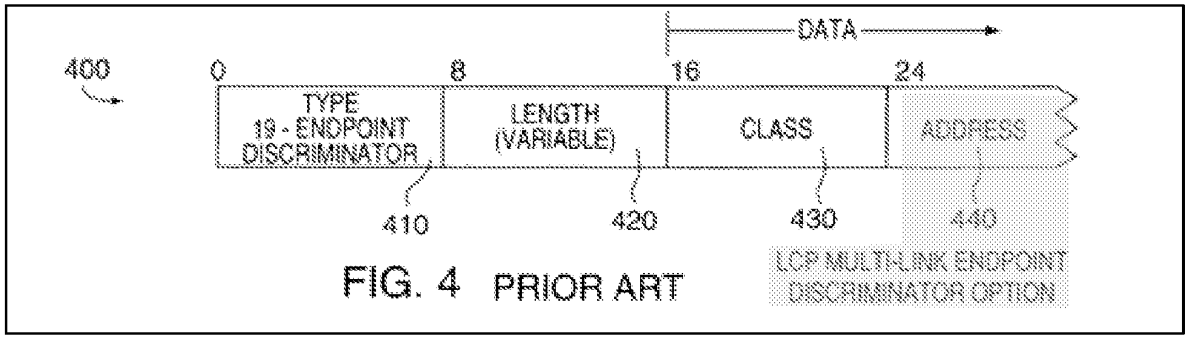


FIG. 4 PRIOR ART

Id., 9:35-42, Fig. 4 (annotated); 1:52-55 ("Before any data is transmitted over a PPP link, each PPP peer connected to one end of the link will send LCP configuration

packets to the other end to establish and test the link."). Endpoint discriminators were used to determine if a link is part of an existing bundle of links connecting these peers or if a new bundle should be established. *Id.*, 9:25-31; *see also* 10:22-29.

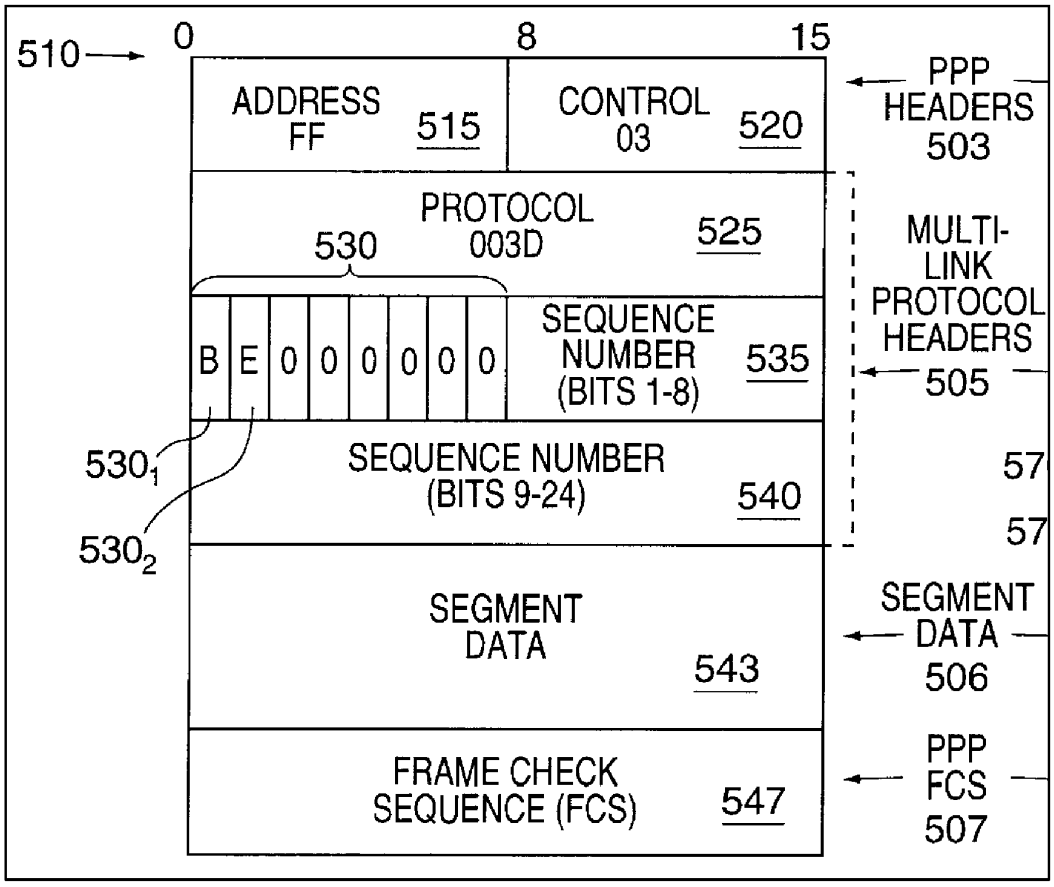
76. As Maurya explains, its system would function "equally well" with any endpoint discriminator address class. *Id.*, 9:49-55. Thus, in my opinion, and to the extent Patent Owner argues that a multilink session identification is limited to magic numbers, such would have at most been an obvious variation of Maurya's teachings in view of the knowledge and ordinary skill of a POSA, as there were only a finite number of class options for the endpoint discriminator packet, and a POSA would have recognized predictable advantages and disadvantages with each type of class.

iii. Providing an Increased Data Rate through Multilink Communications

77. Multilink communications provide "enhanced channel bandwidth" bandwidth by splitting large data packets into smaller packets called segments or fragments. *Maurya* (EX1004), 6:66-7:6; *see also* 12:16-21, 12:32-42 (explaining that a client may segment packets to send across a link to a server). Maurya also explains that the "multi-link protocol . . . can assign additional bandwidth, on demand, (so-called "BonDing") in those situations where two PPP peers can be connected through multiple physical links in a common bundle." *Maurya* (EX1004), 3:1-9. By treating multiple physical links as one logical channel, called a pipe, the multilink operation "dynamically provide[s] sufficient transmission bandwidth for

the underlying communication that is then to be carried by the channel." *Id.* 3:6-14; *see also* 2:66-3:1 (explaining that Maurya's system provides "increases in transmission bandwidth to a network user.").

78. Payload data is encapsulated as segments in a given PPP packet, illustrated by Maurya's Figure 5:



Id., 9:56-10:5; Fig. 5. The PPP headers 503 include a set address field, "FF," and control field having a set value of "03(hex)." *Id.*, 10:34-37. multilink header includes protocol field 525, where the value 003D "identifies the multilink protocol" to indicate how the packet is to be processed. *Id.*, 10:39-42. The sequence number fields

include a sequence number that is used to properly reorder packets as flag fields that indicate whether the packet is a beginning segment, ending segment, or neither/a middle segment. *Id.*, 10:42-58.

79. Segment data is included in every PPP packet as **field 543** for long-sequence format packets, and it includes the "actual segment data . . . carried by this multi-link PPP packet." *Id.*, 10:58-59; *see also* 11:13-18 (segment data field is identical for short-sequence format). In Maurya's inventive embodiments, the packet "has the general format" of Figure 5, but if packets are to be further split at a receiving side, then each multi-link PPP device situated at the level of the split further encapsulates the incoming packets as segment data and adds a sequence number representative of the particular "frame segment" that was split. *Id.* 15:11-25; *see also* Fig. 6C.

80. As a POSA would have recognized, by virtue of providing increased bandwidths, Maurya's ML-PPP system using multiple outgoing links at a client device provides increased transfer rates between two communicating devices. Indeed, as I mentioned in Paragraph 53 above, this benefit was a known feature of using the multilink protocol, as the '908 Patent itself acknowledges.

iv. Claim 5 of the '908 Patent

81. Claim 5 of the '908 Patent depends from claim 1 (which I understand to mean that it incorporates all of the limitations of claim 1) and adds that "*each of*

the first network interface and the second network interface is one or more of cellular interface, Wi-Fi interface, a wireless interface, a cable interface, a wired interface, an Ethernet interface, a Bluetooth interface, a near-field communication interface, and an optical interface." As an initial matter, by including both *wireless* and *wired* interfaces, claim 5 encompasses the entire universe configuring a network interface to communicate.

82. Maurya's system uses ISDN terminal adapters connected to the client PC's communication interfaces 612 via links 615, which Maurya also refers to as "leads." This would indicate a wired connection to a POSA. Additionally, the ISDN was a wired network system that allowed digital communications over the existing telephone network. *See, e.g.*, *Beckman* (EX1017), 11.

v. Overview of Low

83. Low relates to providing resources supporting call-setup in a telephone system using servers connected to a computer network logically distinct from the telephone system infrastructure. *Low* (EX1005), Abstract. A resource is locatable using a uniform resource identifier (URI) associated with a particular telephone number. *Id.* Examples of service resource items include telephone numbers, service logic, downloadable service data, or downloadable service logic. *Id.*, 17:28-18:4. A server holding a service resource item may be a typical HTTP server. *Id.*, 18:6-7.

84. Low explains that it is a cornerstone of the World Wide Web to address

information using a URI, generally either by a uniform resource locator (URL) or a uniform resource name (URN) that can be resolved into a URL:

> **A cornerstone of the WWW is its ability to address particular information resources by means of an [*sic*] Uniform Resource Identifier (URI) that will generally be either a Uniform Resource Locator (URL)** that identifies a resource by location, or a Uniform Resource Name (URN) that can be resolved into an URL.

Id., 12:1-4; *see also* 18:6-7 (as used in Low's disclosure, URIs are URLs and/or URNs). A request for something at a server would typically include a resource URL, such as a URL:

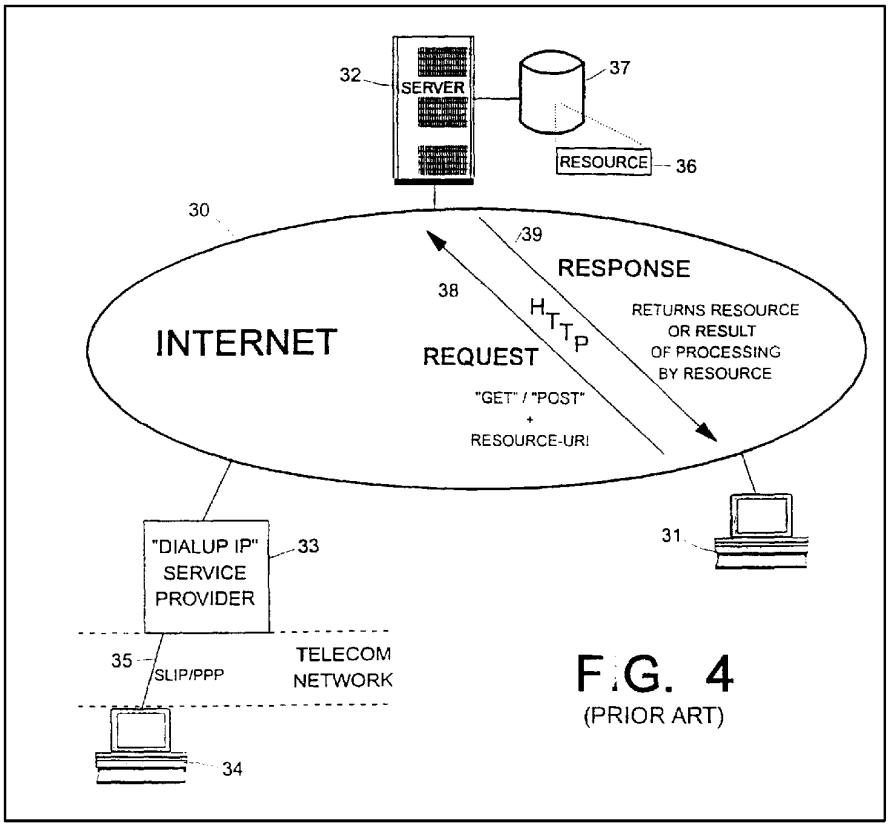


FIG. 4
(PRIOR ART)

Id., Fig. 4; *see also* Fig. 8.

85. As Low indicates, and as was known, the use of URLs was known for user terminals and internet service providers employing the point-to-point protocol (PPP) to communicate packets. *Id.*, 11:21-30; *see also* 46:23-27.

86. In my opinion, a POSA would have considered Low to be analogous art to the '908 Patent because it is both within the field of endeavor of the '908 Patent and reasonably pertinent to at least one problem concerning the inventors of the '908 Patent. Low is within the field of endeavor of the '908 Patent because it relates to methods of accessing resources through a switched telecommunications system, including using the point-to-point protocol to allow users to communicate with an internet service provider (ISP) via a public telephone system. *Id.*, 1:7-9; *see also* 11:21-26, 46:23-27. Low is also reasonably pertinent to one problem concerning the inventors of the '908 Patent, such as the ability to provide users with communication and data services not provided by local exchange companies. *'908 Patent* (EX1001), 1:67-2:6. For example, Low discloses that its invention provides enhanced services to a user through different types of communications systems to provide a more "synergistic relationship" between the world of telephone networks and internet-based information services. *Low* (EX1005), 2:1-16.

vi. Motivations to Combine Maurya and Low

87. Combined with Low, Maurya's client 605 would direct communications to a server 650 using uniform resource locators, *destination URLs*,

as recited in the first- and second- message limitations of each of claims 1 and 13. A POSA would have been motivated to incorporate the more specific teachings of Low regarding communications between a client and a server because such would have been a matter of combining prior art elements (e.g., the contents of packets, as disclosed by Maurya and Low) according to known methods (e.g., using the known ML-PPP) to yield predictable results. Maurya itself describes its disclosure in the context of accessing HTML links via a web browser to visit websites over the "world wide web." *Maurya* (EX1004), 1:65-2:25. For example, Maurya describes in its background how users click "on a hypertext link or otherwise selects a web page" to access HTML resources at "a remote web server "through an Internet connection." *Id.*, 2:9-15.

88. However, because Maurya's invention is specific to operations of the *data link layer* (i.e., specific fields of a particular kind of LCP packet) it does not go into detail regarding other information that may be included in the message, such as information for identifying the server resource. Low simply provides additional context that Maurya lacks regarding what happens when a user clicks on a link on a web browser, providing implementation details regarding accessing a resource via a web browser. *Low* (EX1004), 13:24-14:5. Namely, Low describes two ways to identify a unique resource: by a URL or by a uniform resource name (URN) that can be resolved into a URL. *Id.*, 12:1-4; *see also* 18:6-7 ("Preferably, where URIs are

referred to in the foregoing, these URIs are URLs and/or URNs. Furthermore, the servers referred to are preferably HTTP servers."). Thus, a POSA would have been motivated to incorporate Low's teachings to include a destination URL in messages sent from the client 605 to the server 650 when configuring a link, such as in a field identifying a desired resource or an address field generated by the appropriate network communications layer, which comes "before" the data link layer from the perspective of a sender, as I discussed above in Paragraphs 40-48.

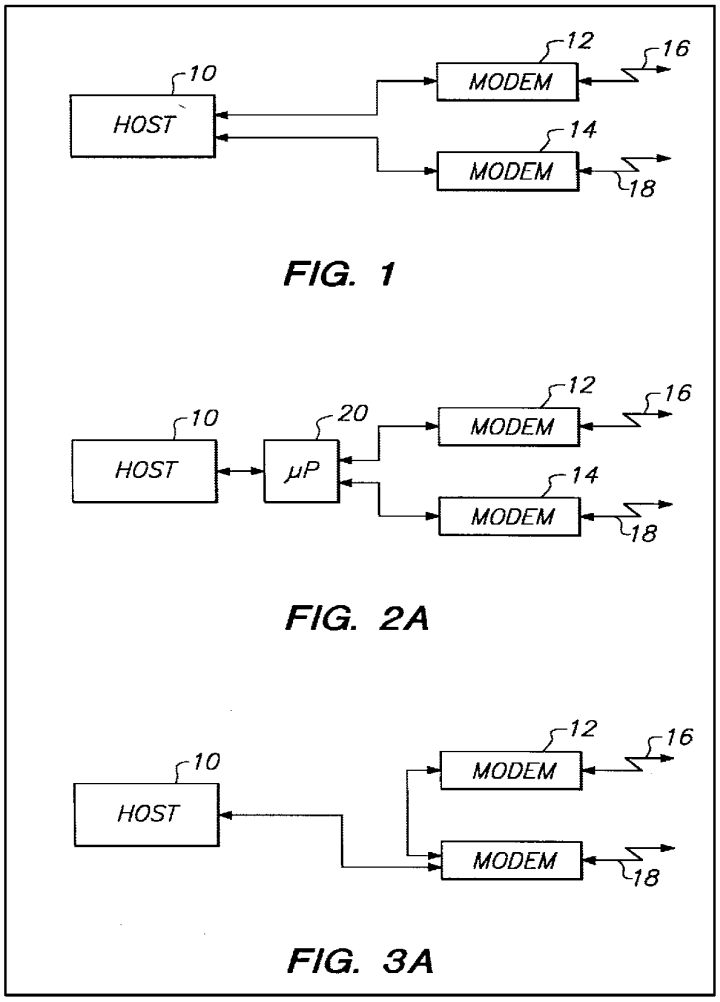
89. In my opinion, POSA would have had a reasonable expectation of success in making the combination because the prior art describes similar data-link protocols for accessing resources on the web, and the combination therefore merely involves at most minor modifications in software using known communication techniques. Low confirms that the use of URLs was known for user terminals and internet service providers employing the point-to-point protocol (PPP) to communicate packets. *Low* (EX1004), 11:21-30 (serial line interface protocol and point-to-point protocol "allow Internet packets to traverse ordinary telephone lines"); *see also* 46:23-27; 18:6-7, Fig. 6. Low also contemplates its own system using the PPP over multiple channels, such as through the use of ISDN lines. *Id.* 42:7-12 (noting that the use of ISDN lines, used in the preferred embodiments of Maurya, would allow use of PPP over multiple channels, thus not tying up an ordinary telephone line). A POSA would have known (and Maurya confirms) that

the multi-link protocol was simply a particular mechanism, or application, of the point-to-point protocol. *Maurya* (EX1005), 3:1-8.

E. The Combination of Maurya, Krishnan, and Low

i. Overview of Krishnan

90. Krishnan relates to methods for providing high-speed inter-computer data transmissions using multiple low-speed links. *Krishnan* (EX1006), Abstract. Krishnan accomplishes this using link control software to send data over multiple modems, 12 and 14, with various possible arrangements, such as by using separate data ports to connect modems 12 and 14 directly to the host (Figure 1), using an additional controller 20, which can be a stand-alone unit or add-in card within the host (Figures 2A–2B) or a specially programmed multi-linked modem 34 that can daisy-chained with other modems (Figures 3A–3B):



Id., Figs. 1, 2A, and 3A;[4] *see also*; 1:25-32; 1:42-47 (modems are combined or bonded to create a high-speed data link using two low-speed links).

91. Krishnan discloses communication systems and methods between a two

[4] It appears that Figure 3A is missing a reference number for the first modem, multilink modem 34, which is shown on Figure 3B and described in the specification. *Krishnan* (EX1006), 3:66-4:6

computers using the multilink protocol. *Id.*, Abstract; *see also* 2:31-36 ("Host computer 10 is also programmed with link control software implementing a multi-link data communication protocol such as the Multi Link Point-to-Point Protocol"); *see also* 4:505:6 (claim 1, reciting communications between host and a remote computer), *see also* claims 3, 10, 16. The modems may communicate using different transfer rates (*id.*, 3:2-5) or equal transfer rates (*id.*, claim 9).

92. Computer 10 includes software, or is connected to a controller that executes software, that uses the modems to carry out multilink point-to-point protocol software, which provides the transmitting and receiving sites to achieve higher bandwidth by "split[ting] a single high speed data stream into multiple parallel data streams" that can be recovered at the receiving site as a high-speed data stream. *Id.*, 2:33-41; *see also,* 3:53-65 (in certain embodiments, host may or may not "see" modems as multiple logical connections); claims 1, 10. Computer 10 may be "an IBM compatible PC or other personal computer." *Id.*, 1:36–42.

93. In my opinion, a POSA would have considered Krishnan to be analogous art to the '908 Patent because it is both within the field of endeavor of the '908 Patent and reasonably pertinent to problems concerning the inventors of the '908 Patent. Krishnan is within the field of endeavor of the '908 Patent, as it relates to techniques of communicating large amounts of data between different devices, including in the context of the ML-PPP. *Id.*, 2:22-41. Additionally, Krishnan is

reasonably pertinent to at least one problem concerning the inventors of the '908 Patent, such as providing enhanced services using existing public-telephone network connections. *Id.*, 1:36-50; *see also '908 Patent* (EX1001), 2:45-60 (device connected to primary plain-old-telephone-service line).

ii. Krishnan's Architecture Applies to Client Devices

94. While Krishnan does not illustrate the setup of the remote computer, a POSA would have recognized, or at least found obvious, that Krishnan's disclosure also applies to a receiving site, such as a Maurya's client 605, so that both communicating devices may take advantage of the multilink protocol. Krishnan confirms that the arrangements described were applicable to commercially available client personal computers, such as "an IBM compatible PC or other personal computer." *Id.*, 1:36–42; *see also* 2:24-26. And although Krishnan describes the host as a server in one embodiment (EX1006, 3:8-14), the configuration applies to a client, as computers typically would be able to both send and receive data.

95. Further, based on Krishnan's disclosure that the "receiving site receives and demultiplexes the multiple low speed data stream to recover the original high speed data stream" a POSA would have recognized that the receiving site requires separate interfaces to receive data over multiple links (as indicated by the bidirectional paths illustrated in the figures). *Id.*, 2:39-41; *see also* claims 3, 10, 16 (remote computer receives data over multiple links).

96. To use the multilink protocol, both ends of a pipe must be able to and agree to employ it; otherwise, the requisite acknowledgments would never be received for configuration requests establishing the link. Further, as Maurya confirms, ML-PPP clients and servers were capable of employing multiple links. *See, e.g.*, *Maurya* (EX1004), Fig. 6A (client includes multiple communication interfaces and links); *see also* Abstract, 6:66-7:6. Thus, in my opinion, a POSA would have appreciated from Krishnan's disclosure that the arrangement for computer 10 illustrated in Figures 1–3 was applicable to a receiving client or a transmitting server. For the purposes of understanding the combination of Maurya with Krishnan, discussed in Section E.iii below, I refer to the architecture of Krishnan's computer 10 with the understanding that, in the combination with Maurya's teachings regarding the multilink protocol using multiple links at one client, the modems are client-side network devices.

iii. Motivations to Combine Maurya, Low, and Krishnan – Use of Modems as Multiple Outgoing Links

97. Combined with Krishnan, Maurya's client 605 would communicate with a server using multiple modems. Indeed, Krishnan's system is similar to Maurya's in that a personal computer is associated with multiple links for handling multilink communications. For example, as relevant to claim 1, *Maurya* discloses *a first network interface* (the interface to ISDN adapter 620_1, purple) *having a first data transfer rate associated with a first path* (630_1, orange) *from the server to . . .*

the client device (green) and *a second network interface* (the interface to ISDN adapter 620_2, blue) *having a second data transfer rate associated with a second path* (630_2, pink):

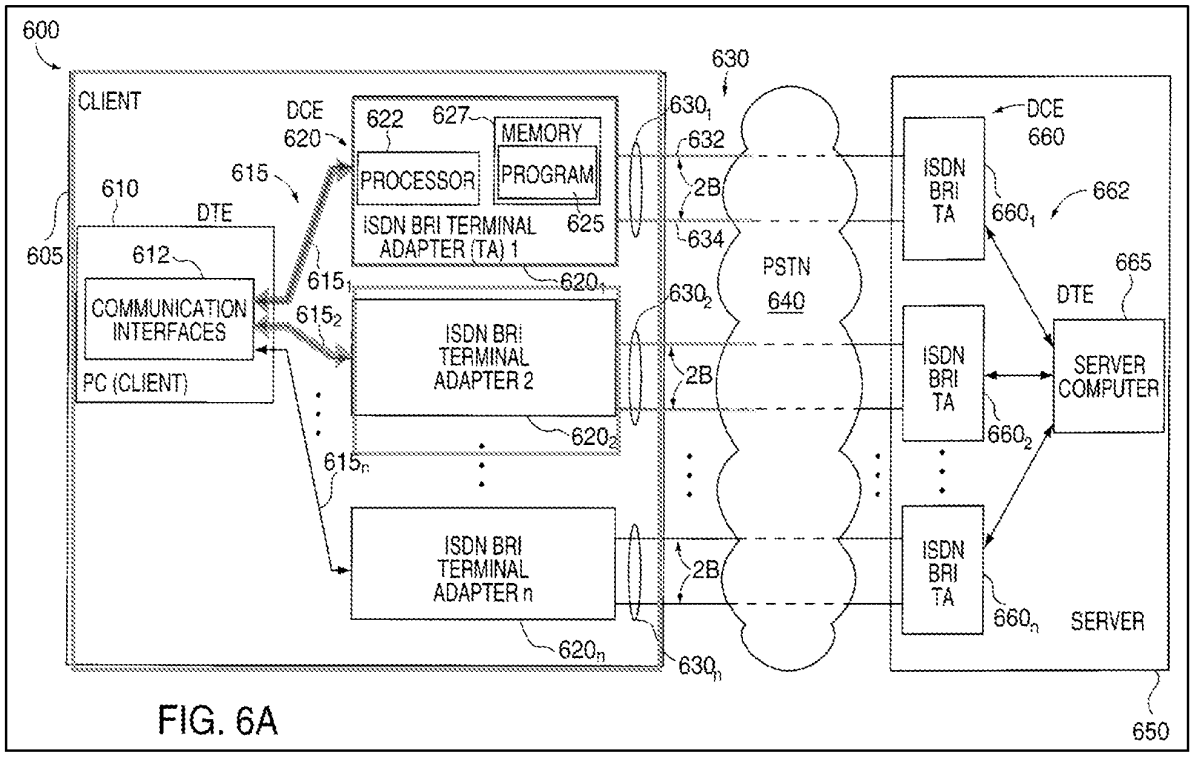


FIG. 6A

Similarly, Krishnan discloses a computer 10 that includes a first *network interface* (the interface with modem 12, purple) *having a first data transfer rate associated with a first path* (path 16, orange) from the server to the client (green) and *a second network interface* (the interface with modem 14, blue) *having a second data transfer rate associated with a second path* (path 18, pink):

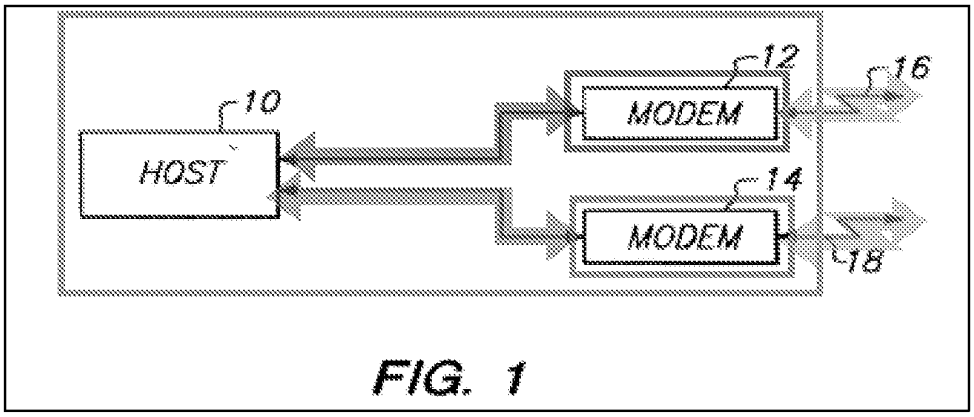


FIG. 1

98. In my opinion, a POSA would have been motivated to combine Maurya's ML-PPP systems with Krishnan's regarding the use of modems to achieve multilink communications for three reasons. First, Krishnan provides express motivation to combine, explaining that modems were cheaper and more widely available than ISDN connections. *Krishnan* (EX1006), 1:25-33. The cost-effectiveness of a network system is always one consideration of implementors.

99. Second, a POSA would have recognized that using Krishnan's modems would have been a simple matter of applying a known technique (the use of multiple network devices, such as modems) to a known device (an ML-PPP client device) ready for improvement to yield predictable results. Although Maurya suggests that conventional modems did not themselves possess multiple incoming and outgoing links (*Maurya* (EX1004), 4:33-41), Krishnan, which was published after Maurya was filed, addressed this by arranging the modems in a setup similar to Maurya's ISDN adapters—by linking multiple modems to a computer programmed with link control software to manage the modems as different links. *Krishnan* (EX1006), 2:31-

41; 3:59-65. Additionally, the concept of configuring a central client based processor to perform functions like managing the modems and controlling the ML-PPP communication links, such as at personal computer 605, would have been a simple matter combining prior art elements (Krishnan's modem-based architecture and Maurya's teachings related to PPP communications) according to known methods (ML-PPP communications) to yield predictable results (the communication of data using the multilink protocol).

100. Finally, the proposed combination would have at most amounted to a simple substitution of one known element (Krishnan's modems) for another (Maurya's ISDN adapters) to obtain predictable results, namely, the communication of multilink packets to and from a server over the PTSN using alternative networking devices.

101. Further, in my opinion, a POSA would have had a reasonable expectation of success in making the modification because both Krishnan and Maurya are similar systems that use the multilink protocol and have similar goals (transmitting and receiving large amounts of data), and Maurya confirms that it was possible for clients to communicate using multiple devices via the ML-PPP. For example, both Maurya and Krishnan show these multiple network devices at a single system including a personal computer that is programmed with software to execute the multilink protocol. *Maurya* (EX1004), 3:46-53, 7:6-13, 13:61-14:5; *see also*

Krishnan (EX1006), 1:40-42, 2:24-26, 2:33-36. Maurya discloses techniques for clients to communicate using multiple ISDN adapters via the ML-PPP; Krishnan teaches using multiple modems. And, like Maurya, Krishnan discloses that its application of the multilink protocol using multiple modems provided for higher transfer rates. *Krishnan* (EX1006), 1:36-50; *see also* Abstract, 2:36-41 (similar); claim 11 (a processor transmits data at a data rate of N+M by transmitting data over multiple modems).

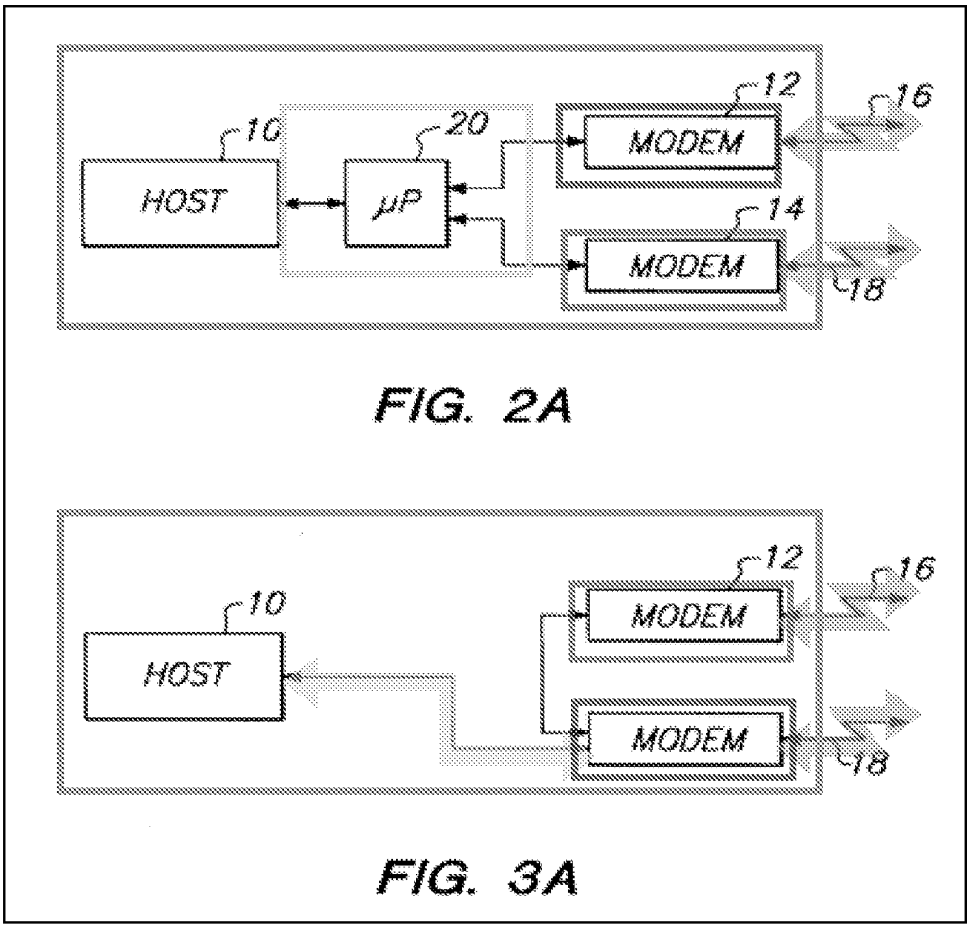
102. Regarding claim 5 of the '908 Patent, I note that this arrangement would still provide a *wired* interface based on Krishnan's disclosure. For example, an RS-232 interface may couple the modems to ports of the host computer (EX1006, 1:39-42), and paths 16 and 18 go to PTSN telephone lines (EX1006, 2:25-27).

iv. Motivations to Combine – Krishnan's Alternative Embodiments

103. In my opinion, the above motivations to combine would apply to all three of the alternative arrangements described by Krishnan, as Maurya's client PC 610 would send the relevant first and second LCP messages to each of the modems, either directly or indirectly, so that they would assume the same unique endpoint discriminator value of the PC client 610 before configuring the link with the server. For example, Krishnan mentions that the host computer may have device driver software to "see" each modem and manage them through multiple logical connections, despite only one physical connection to the controller/multilink

modem. *Krishnan* (EX1006), 3:56-65.

104. In these embodiments, there may therefore be one physical network interface (yellow) at the client device (computer 10 in Krishnan, personal computer 610 in Maurya), but the computer would still send LCP configuration packets to first (purple) and second (blue) modems, where each modem would be associated with its own transfer rate (e.g., represented by paths 16 and 18) to another device, such as a server or peer.



Id., Figs. 2A, 3A (annotated); *see also* 3:20-23 (describing communication controller

20); 3:66-4:3 (describing multilink modem 34).

105. Thus, A POSA would have recognized the same motivations and expectations of success in combining Maurya's teachings regarding a client device using the ML-PPP with multiple outgoing links with Krishnan's alternative arrangements as with the Figure 1 embodiment, as Maurya's teachings relate to managing an endpoint with multiple outgoing links, and Krishnan simply discloses alternative ways of arranging those links.

F. The Combination of Maurya, Low, and DeLangis-156 and Maurya, Krishnan, Low, and DeLangis-156

i. Overview of DeLangis-156

106. I understand that DeLangis-156 is in the same family as, and precedes, the '908 Patent. There specifications of the patents are similar, although there appear to be some differences, such as in the title, abstract, and minor changes to the figures, such as the exclusion of a description under the figures of the '908 Patent. I understand DeLangis-156 is available as prior art to the '908 Patent if the chain of the '908 Patent failed to properly claim priority to DeLangis-156, such as by claiming concepts unsupported by the written description of DeLangis-156 or an intervening patent application. While I have offered testimony that may be relevant to this inquiry, I am informed that the proponent of a priority claim bears the burden of showing that certain statutory requirements have been met, and I reserve the right to review and respond to technical assertions made by Patent Owner relevant to its

priority claim.

107. Regarding Figure 7, which discusses the use of the multilink protocol, DeLangis-156 describes the use of a "magic number" as a multilink session identification, recited in the second-message limitations of claims 1 and 13 of the '908 Patent. *DeLangis-156* (EX1007), 12:52-58.

ii. Motivations to Combine Maurya, Krishnan, Low, and DeLangis-156

108. In my opinion, a POSA would have been motivated to implement Maurya's teachings regarding an endpoint discriminator option packet using a magic number (i.e., a multilink session identification), as taught by DeLangis-156. For example, such a combination would have amounted to at most a simple substitution of one known element (an endpoint discriminator for a client device) for another (a magic number unique to a multilink session) to obtain predictable results, namely, the same result accomplished by Maurya in unifying a set of fragments coming from different outgoing links.

109. Further, while Maurya suggests that a server may provide its endpoint discriminator to be used (*see, e.g.*, EX1004, 13:61-65), it does not disclose that this identifier is assigned by the server in a session set up by a client device for receiving packets from the server, as recited in Claim 3 of the '908 Patent. However, a POSA would have been motivated to employ the server's endpoint discriminator as part of the LCP negotiation process in light of the teachings of DeLangis-156, which

describes that the "magic number" is assigned by the server. *DeLangis-156* (EX1007), 12:11-16. A POSA would also have been motivated to employ a magic number assigned by the server, as recited in claim 3 of the '908 Patent and taught by DeLangis-156, as such would have been the combination of prior art elements (the different types of identifying information) according to known methods (known LCP configuration techniques) to yield predictable results. Further, using the server to assign a magic number would have at least been obvious to try, as only a finite number of devices along a given pipe would supply the identification information for a given session, and one of the ends of the link, which would have been involved in negotiating the configuration options for the link, would be a common-sense choice of these finite options.

110. Further, and consistent with my opinion in Paragraph 76 above, a POSA would have had a reasonable expectation of success in making the combination, as magic numbers were already a known class of endpoint discriminator options, and Maurya states that its system would function "equally well" with any class of endpoint discriminator address. *Maurya* (EX1004), 9:50-55. Thus, the combinations proposed above would have involved at most minor modifications in software and yielded predictable results.

IV. CONCLUSION

111. I declare that all statements made herein of my knowledge are true, and that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Date: October 4, 2023

By: James T. Geier

James Geier

APPENDIX A

James T. Geier

CONTACT INFORMATION

Name: James T. Geier
Title: Principal Consultant
Company: Wireless-Nets, Ltd.
Address: 2468 Locust Hill Blvd., Beavercreek, Ohio 45431 U.S.A.
Email: jimgeier@wireless-nets.com
Cell Phone: +1 937-829-0008
Website: www.wireless-nets.com

PROFILE

James Geier has 40 years of experience in the communications industry designing, analyzing, and implementing communications systems, wireless networks, and mobile wireless devices. He has authored over a dozen books on mobile and wireless topics, including Designing and Deploying 802.11 Wireless Networks (Cisco Press), Implementing 802.1X Security Solutions (Wiley), Wireless Networking Handbook (New Riders) and Network Re-engineering (McGraw-Hill). He had been an active participant within standards organizations, such as the IEEE 802.11 Working Group and the Wi-Fi Alliance. He has served as Chairman of the IEEE Computer Society, Dayton Section, and various conferences dealing with wireless networking.

PROFESSIONAL EXPERIENCE

Principal Consultant and Founder – *Wireless-Nets, Ltd. (Apr 2000 - present)*

- Designs mobile devices and implements corresponding software / firmware.
- Designs and integrates Wi-Fi, Bluetooth, cellular, Ethernet and USB transceivers into mobile devices, such as smart phones, hospital patient monitors, cable T.V. boxes, and bar code scanners.
- Designs large-scale wireless networks for municipalities, hospitals, airports, and manufacturing facilities for supporting voice, video and data applications.

President, CEO, and Cofounder – *Health Grade Networks LLC. (Aug 2014 – Dec 2015)*

- Provided strategic direction and management of the company for implementing wireless network solutions.

Product Engineer / Manager - *Monarch Marking Systems (Aug 1996 – Mar 2000)*

- Designed and implemented RF radios for Monarch's bar code scanners and printers.
- Integrated Ethernet and USB transceivers into tabletop printers.
- Designed and implemented wireless middleware software for improving performance between mobile wireless devices and application servers.
- Designed and implemented wireless network infrastructures for wireless bar code scanners and portable printers used in retail and manufacturing applications.

Senior Systems Engineer - *TASC, Inc. (Mar 1994 to Jul 1996)*

- Designed and implemented an enterprise-wide Ethernet / IEEE 802.3 and wireless network for Dayton Power and Light to support the migration from mainframe to client/server systems.
- Designed an information system architecture that supports internal and external communications for the U.S. Navy's NSSN attack submarine.
- Analyzed requirements for hardware, software, and support of the Joint Logistics Systems Center (JLSC) Materiel Management Standard System (MMSS) for the combined U.S. militaries.

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Senior Systems Engineer - *Adroit Systems, Inc. (Aug 1992 to Feb 1994)*

- Researched and analyzed emerging wireless network technologies as part of the Department of Defense Airborne Reconnaissance Data Link Architecture (ARDA) study, supporting communications for airborne systems.
- Designed a software tool that aids network engineers in planning, upgrading and maintaining shipboard computer networks - based on a Small Business Innovative Research (SBIR) government grant obtained from the U.S. Navy.

Systems Design Engineer - *Information Systems Center, Captain U.S. Air Force (Sep 1990 – Jun 1992)*

- Evaluated the effectiveness of wireless LAN technology for use in mobile and portable military environments.
- Represented the Air Force as part of the IEEE 802.11 Wireless LAN standards development.
- Designed and implemented large-scale Ethernet / IEEE 802.3 LANs and WANs for various government organizations.

Communications Test Engineer - *AFCC Operational Test and Evaluation Center, Lieutenant U.S. Air Force (Sep 1986 - May 1989)*

- Performed analog, digital, and protocol tests on various government wireless computer networks and long-haul communications systems.
- Developed approaches and methods for testing computer networks.

Radar Technician - *75th TCF, U.S. Air Force (Dec 1977 - Jun 1983)*

- Performed acceptance testing of newly designed radar systems.
- Maintained automatic tracking radar systems in support of tactical Air Force operations worldwide.

EDUCATION

M.S., Electrical Engineering, *Air Force Institute of Technology (1990)* – thesis involved designing and implementing a wireless mesh network for the U.S. Department of Defense.

B.S., Electrical Engineering, *California State University (1985)*.

MILITARY EXPERIENCE

U.S. Air Force, Dec 1977 – Jun 1992 (Commissioned Officer Mar 1986 – Jun 1992).

BOOK PUBLICATIONS

- *Designing and Deploying 802.11 Wireless LANs (2nd Edition)*, Cisco Press, 2015.
- *Designing and Deploying 802.11n Wireless LANs*, Cisco Press, 2010.
- *Implementing 802.1x Security Solutions*, Wiley, 2008.
- *Deploying Voice over Wireless LANs*, Cisco Press, 2007.
- *Computer Security*, Wiley, 2007.
- *Computer Transfer and Backup*, Wiley, 2007.
- *CCIE Routing and Switching* – Official Exam Cortication Guide, 2nd Edition, Cisco Press, 2006.
- *Wireless Networks – 5-minute Fixes*, Wiley, 2006.
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- *Wireless Networks – First Step, Cisco Press*, 2005 (translated to Chinese, French, Hungarian, Italian, Korean, Polish, Portuguese, and Romanian).
- *Certified Wireless Analysis Professional - Official Study Guide*, McGraw-Hill, 2004.

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- *Wireless LANs, 2nd Edition*, SAMs, 2001.
- *Wireless LANs*, Macmillan Technical Publishing, 1999.
- *Wireless Networking Handbook*, Macmillan (New Riders) Publishing, 1996.
- *Network Re-Engineering*, McGraw-Hill, 1996.

INDUSTRY AFFILIATIONS

Chairman, IEEE Computer Society - Dayton Section:
- Managed the 900-member organization and established a continuing education program.

Chairman, IEEE International Conference on Wireless LAN Implementation:
- Managed all aspects of the conference from 5/91 to 12/92.

Member, Wi-Fi Alliance
- Voting member of the Wireless ISP for Roaming (WISPr) committee.

IEEE 802.11 Wireless LAN Working Group
- Represented interests of the Department of Defense for dealing with applications and frequency allocations.

TEACHING EXPERIENCE

U.S. Naval Post Graduate School
- Developed and regularly instructed a course on wireless network design and security to students and faculty.

Wright State University
- Periodically instructed graduate courses on computer communications.

USAF Test and Evaluation School
- Developed and instructed a 240 hour training course on wireless system test and evaluation.

Conferences
- Regularly gives presentations at international conferences, including Supercomm (Asia), Scantech (Germany), and IBC (England).

Infocomm Solutions
- Developed and instructed workshops in India, Singapore and Malaysia on wireless network implementation.

Technology Training Corporation (TTC)
- Developed and instructed international training courses in Mexico and South America on wireless networking and network re-engineering.

Educational Services Institute
- Developed and instructed courses on software project management, software testing, system integration and network re-engineering as part of the Project Management Institute (PMI) Project Management Professional (PMP) certification program.

Onsite Training
- Regularly instructs workshops on wireless network design and deployment for product developers, system integrators, hospitals, and enterprises worldwide.

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TESTIFYING EXPERIENCE

Cases where James Geier has testified at depositions and trials:

Ericsson v. Apple

Law firm: Fish & Richardson

Expert on behalf of the defendant (Apple) during 2022 regarding patent litigation within the International Trade Commission. Analyzed patents, products, prior art and other case documents associated with wireless roaming algorithms; analyzed product firmware; wrote expert reports regarding patent invalidity and non-infringement; testified at deposition; testified at the International Trade Commission in 2022 (Judge Elliot).

IOENGINE v. Ingenico, Inc.

Law firm: Sunstein Kann Murphy & Timbers

Expert on behalf of Ingenico during 2021-2022 regarding patent litigation within the U.S. District Court – Delaware. Analyzed patents, products, prior art and other case documents associated with wireless credit card processing systems; analyzed product firmware; wrote expert reports regarding patent non-infringement and invalidity; testified at deposition; testified at a jury trial within the District Court of Delaware in 2022 (Judge Bryson).

AIG Specialty Insurance Company v. Pegatron Corporation

Law Firm: Gordon Rees

Expert on behalf of the plaintiff (AIG Specialty Insurance Company) during 2020-2021 regarding Wi-Fi / cellular interference issues within the Northern District of Georgia. Analyzed test reports and case documents; wrote a declaration; testified at deposition.

NTT Corporation, et al. v. MediaTek, Acer, and Texas Instruments

Law Firm: Dickinson Wright

Expert on behalf of the plaintiff (NTT Corporation) during 2020-2021 regarding claim construction within district court of the Western District of Texas. Analyzed patents and case documents related to wireless communications; wrote a declaration regarding claim construction; testified at deposition.

Bertram Communications, LLC v. Simon Westlake, et al.

Law Firm: Kilpatrick Townsend

Expert on behalf of the plaintiff (Bertram Communications) during 2019-2020 regarding trade secret litigation within the State of Wisconsin, Circuit Court, Sheboygan County. Analyzed wireless designs and other case documents associated with wireless ISP systems in relation to trade secret analysis; wrote expert reports regarding associated analysis; testified at deposition.

Ingenico, Inc.

Law firm: Sunstein Kann Murphy & Timbers

Expert on behalf of Ingenico regarding an Inter Partes Review (IPR) with the USPTO Patent Trial and Appeal Board during 2018-2020. Analyzed patents, prior art and other case documents associated with wireless credit card processing systems; wrote declarations regarding patent invalidity; testified at depositions.

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Next Caller, Inc.

Law firm: McDermott Will & Emery

Expert on behalf of Next Caller regarding an Inter Partes Review (IPR) with the USPTO Patent Trial and Appeal Board during 2018-2019. Analyzed patents, prior art and other case documents associated with caller profile systems; wrote a declaration regarding patent validity; testified at deposition.

Samsung, Inc.

Law firm: Kirkland & Ellis

Expert on behalf of Samsung regarding an Inter Partes Review (IPR) with the USPTO Patent Trial and Appeal Board during 2018-2019. Analyzed patents, prior art and other case documents associated with battery charging systems for mobile devices; wrote declarations regarding patent invalidity; testified at deposition.

Foxconn Technology Group

Law firm: McDermott Will & Emery

Expert on behalf of Foxconn regarding an Inter Partes Review (IPR) within the USPTO Patent Trial and Appeal Board during 2018. Analyzed patents, prior art and other case documents associated with short circuit protection for reversible connectors; wrote a declaration regarding patent invalidity; testified at deposition.

ZTE, Inc.

Law firm: McDermott Will & Emery

Expert on behalf of ZTE, Inc. regarding an Inter Partes Review (IPR) within the USPTO Patent Trial and Appeal Board during 2018. Analyzed patents, prior art and other case documents associated with supplying a power source to mobile devices over standardized ports; wrote a declaration regarding patent invalidity; testified at deposition.

Certain Wireless Headsets

Law firm: Haynes Boone

Expert on behalf of defendants (BlueAnt, Creative, GN Netcom, Jawbone and Sony) during 2015-2018 regarding patent litigation within the International Trade Commission (ITC). Analyzed patents and other case documents associated with wireless audio headsets; wrote expert reports regarding patent written description and inception date; testified at deposition.

Camsoft Data Systems, Inc. v. Southern Electronics Supply and Active Solutions, LLC

Law firm: Melancon & Rimes

Expert on behalf of the plaintiff (Camsoft Data Systems) during 2014-2018 regarding trade secret litigation within the 19th Judicial District Court – State of Louisiana. Analyzed wireless designs and other case documents associated with wireless video surveillance systems in relation to trade secret analysis; wrote expert reports regarding associated analysis; testified at deposition.

United States of America v. IBM Corporation

Law firm: Jones Day

Expert on behalf of the defendant (IBM Corporation) during 2017 regarding litigation within the U.S. District Court, Northern District of Illinois - Eastern Division. Analyzed designs, contracts, and other case documents associated with wireless networks and integration methods; wrote an expert report regarding associated analysis; testified at deposition.

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Emerson Electric Co.

Law firm: Ropes & Gray

Expert on behalf of Emerson Electric Co. regarding an Inter Partes Reviews (IPRs) within the USPTO Patent Trial and Appeal Board during 2016-2017. Analyzed patents, prior art and other case documents associated with optimum route determination over computer networks; wrote declarations regarding patent invalidity; testified at multiple depositions.

Emerson Electric Co.

Law firm: Ropes & Gray

Expert on behalf of Emerson Electric Co. regarding a Covered Business Method Patent Review (CBMPR) within the USPTO Patent Trial and Appeal Board during 2016-2017. Analyzed patents, prior art and other case documents associated with systems for communicating information; wrote declarations regarding patent invalidity; testified at multiple depositions.

Chrimar v. Aerohive

Law firm: Wilson, Sonsini, Goodrich & Rosati

Expert on behalf of the defendant (Aerohive) during 2016-2017 regarding patent litigation within the U.S. District Court – Eastern Division of Texas (Judge Gilstrap). Analyzed patents, products, and other case documents associated with power-over-Ethernet technologies; performed testing of power-over-Ethernet products; wrote an expert report regarding patent non-infringement; testified at deposition; testified at a jury trial within the District Court of Eastern Texas in 2017 (Judge Gilstrap).

Intellectual Ventures v. AT&T

Law firm: Dechert

Expert on behalf of the plaintiff (Intellectual Ventures) during 2014-2017 regarding patent litigation within the U.S. District Court - Delaware. Analyzed patents, prior art and other case documents associated with IEEE 802.11 encryption and quality of service (QoS) technologies; performed testing and protocol analysis of Wi-Fi products; wrote expert reports regarding patent infringement and validity; testified at deposition.

Chrimar v. AMX

Law firm: McDermott, Will & Emery

Expert on behalf of the defendant (AMX) during 2016 regarding patent litigation within the U.S. District Court – Eastern Division of Texas. Analyzed patents, products, prior art and other case documents associated with power-over-Ethernet technologies; performed testing of power-over-Ethernet products; wrote expert reports regarding patent non-infringement and invalidity; testified at deposition.

Universal Remote

Law firm: Ostrolenk Faber

Expert on behalf of Universal Remote regarding an Inter Partes Review (IPR) within the USPTO Patent Trial and Appeal Board filed during 2015. Analyzed patents, prior art and other case documents associated with TV remote control technologies; wrote a declaration regarding patent invalidity; testified at deposition.

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Skyhook v. Google

Law firm: Tensegrity

Expert on behalf of the plaintiff (Skyhook) during 2012-2015 regarding patent litigation within the U.S. District Court - Boston. Analyzed patents, software, and other case documents associated with Wi-Fi-based location systems; performed in-depth review and analysis of associated software; wrote an expert report regarding patent infringement; testified at deposition.

MTEL v. UPS

Law firm: Reed & Scardino

Expert on behalf of the plaintiff (MTEL) during 2014 regarding patent litigation within the U.S. District Court – Atlanta. Analyzed patents, prior art and other case documents associated with mail delivery notifications; wrote an expert report regarding patent validity; testified at deposition.

Motorola v. Microsoft

Law firm: Sidley Austin

Expert on behalf of the defendant (Microsoft) during 2012 regarding patent litigation within the International Trade Commission. Analyzed patents, products, prior art and other case documents associated with data addressing and data update mechanisms; wrote expert reports on patent invalidity and indirect non-infringement; testified at deposition; testified at the International Trade Commission in 2012 (Judge Shaw).

Motorola v. Microsoft

Law firm: Sidley Austin

Expert on behalf of the defendant (Microsoft) during 2011 regarding patent litigation within the International Trade Commission. Analyzed patents, products, prior art and other case documents associated with security and encryption protocols; analyzed product firmware; wrote expert reports regarding patent invalidity and non-infringement; testified at deposition; testified at the International Trade Commission in 2011 (Judge Shaw).

Motorola v. Microsoft

Law firm: Sidley Austin

Expert on behalf of the defendant (Microsoft) during 2011 regarding patent litigation within the U.S. District Court – Southern Florida. Analyzed patents, products, prior art and other case documents associated with application registry and data update technologies; wrote expert reports regarding patent invalidity and non-infringement; testified at deposition.

Autocell v. Cisco Systems

Law Firm: Hanify & King

Expert on behalf of the plaintiff (Autocell) during 2009-2011 regarding patent litigation within the U.S. District Court - Delaware. Analyzed patents, products, prior art and other case documents associated with transmit power control of 802.11 radios and access points; performed laboratory and field testing of associated products; analyzed product firmware; wrote expert reports regarding patent infringement and validity; testified at deposition.

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Truckstop.Net v. Sprint Communications

Law Firm: Holland & Hart

Expert on behalf of the plaintiff (Truckstop.Net) during 2004-2010 regarding contract litigation within the U.S. District Court - Idaho. Analyzed case documents including wireless network designs and contracts associated with wireless networks installed at truck stops; performed in-depth field testing and analysis of wireless signal coverage and performance at truck stops located throughout the U.S.; wrote expert reports regarding test results and review of case documents; testified at deposition.

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EXHIBIT 1004

U.S. Patent 6,160,808 to Maurya ("Maurya")

US006160808A

United States Patent [19]

Maurya

[11] Patent Number: 6,160,808

[45] Date of Patent: Dec. 12, 2000

[54] **TECHNIQUE FOR TRANSMITTING INCOMING MULTI-LINK POINT-TO-POINT (PPP) PACKET TRAFFIC OVER MULTIPLE OUTGOING LINKS IN A MULTI-LINK BUNDLE**

[75] Inventor: **Sanjiv Kumar Maurya**, Chicago, Ill.

[73] Assignee: **3Com Corporation**, Santa Clara, Calif.

[21] Appl. No.: **08/993,541**

[22] Filed: **Dec. 18, 1997**

[51] **Int. Cl.**[7] **H04L 12/28**

[52] **U.S. Cl.** **370/389**; 370/392; 370/395

[58] **Field of Search** 370/392, 395, 370/389, 352, 420, 421, 474, 470, 522, 524; 709/217, 218, 230

[56] **References Cited**

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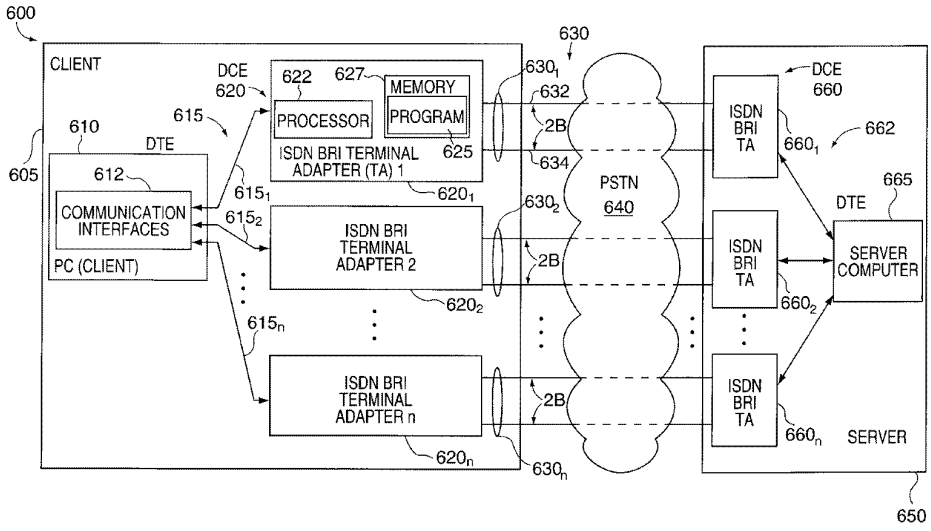
P. Miller, TCP/IP Explained, Digital Press (©1997, Butterworth–Heinemann), pp. 402–434.

Primary Examiner—Chi H. Pham
Assistant Examiner—Brenda H. Pham
Attorney, Agent, or Firm—Michaelson & Wallace; Peter L. Michaelson

[57] **ABSTRACT**

A communications technique which permits incoming multi-link point-to-point (PPP) packets of a common PPP frame to be simultaneously transmitted across more than one outgoing link in a multi-link bundle. Specifically, during LCP negotiations, a multi-link PPP originator assigns itself a unique endpoint discriminator value and informs all its immediate PPP peers by sending the latter, via a first bundle of outgoing links, an LCP Endpoint Discriminator packet containing this value. Each of these immediate PPP peers assumes, as its endpoint discriminator, the value that has been provided to it in the LCP Endpoint Discriminator packet it receives from the originator and then sends an LCP Endpoint Discriminator packet containing this same endpoint discriminator value, via a second bundle of outgoing links, to all of its immediate PPP peers. This is recursively repeated until all hierarchically inter-connected multi-link PPP devices at one end of a pipe, which fan-out from the originator, have set their endpoint discriminators to the same value. Consequently, all the links in the pipe will be viewed, by the multi-link protocol, as part of a common bundle.

44 Claims, 6 Drawing Sheets



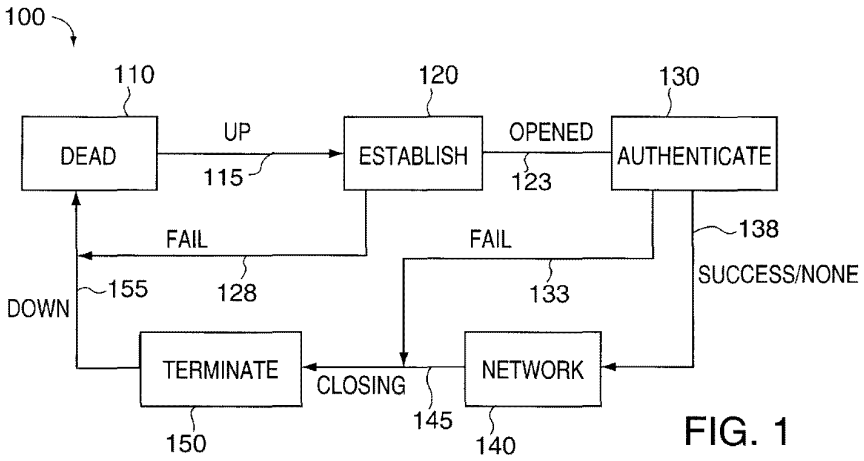


FIG. 1
PRIOR ART

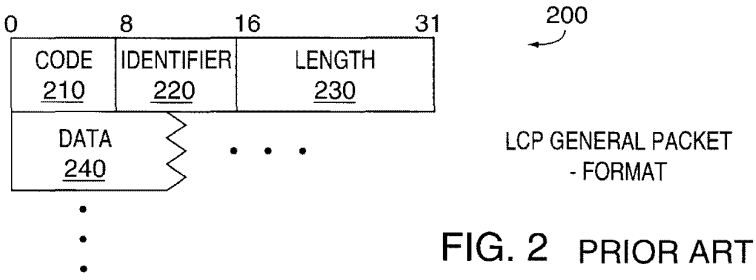


FIG. 2 PRIOR ART

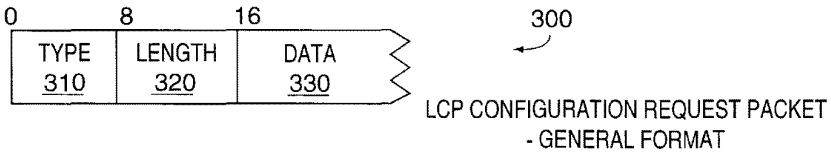


FIG. 3 PRIOR ART

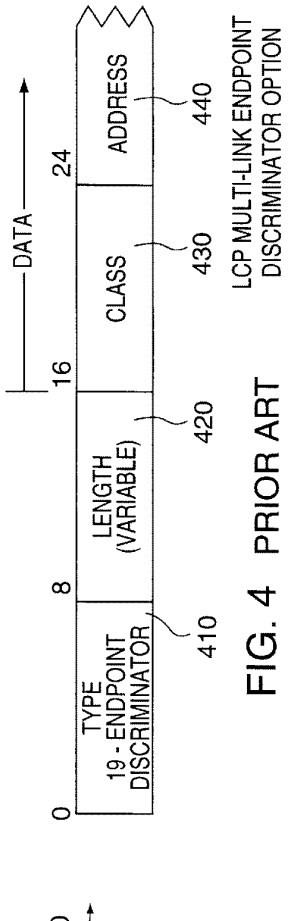


FIG. 4 PRIOR ART

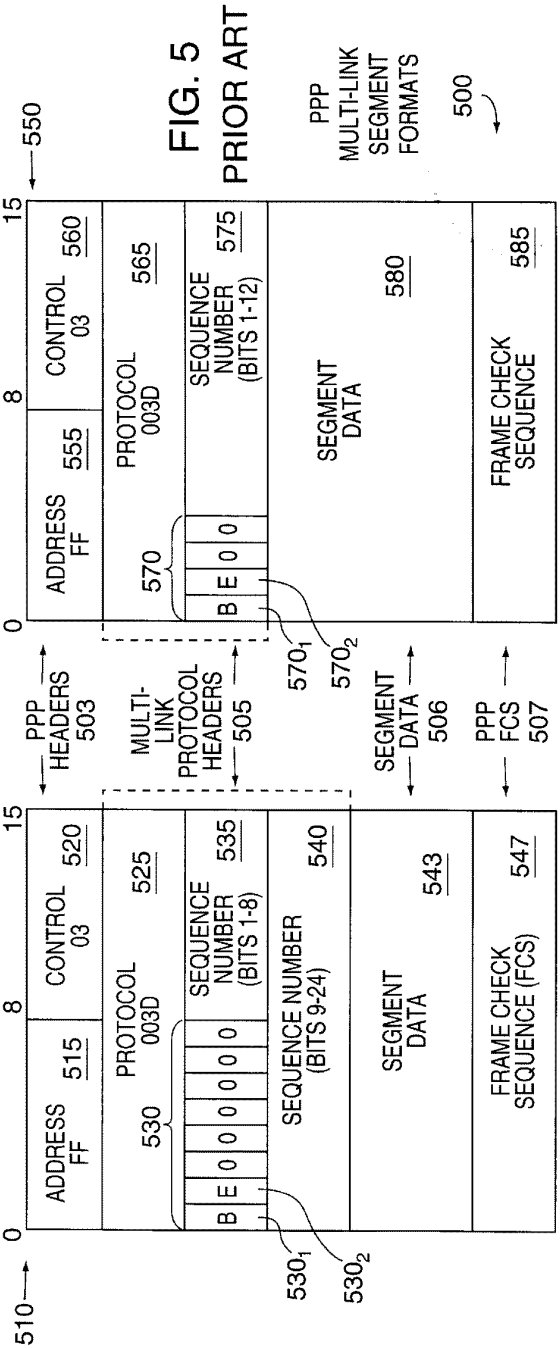


FIG. 5 PRIOR ART

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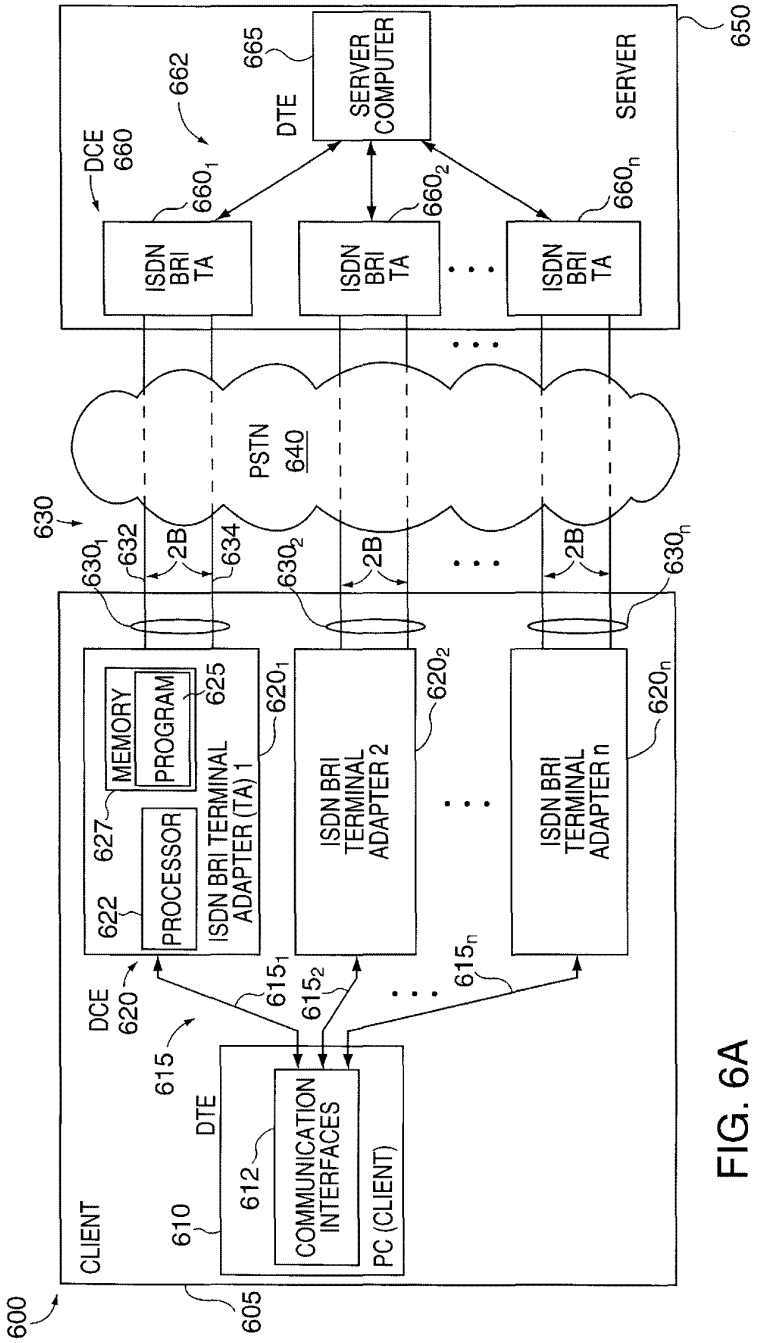


FIG. 6A

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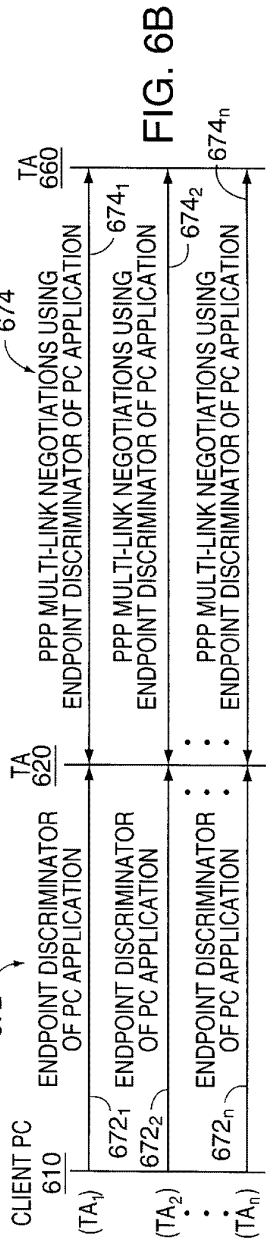


FIG. 6B

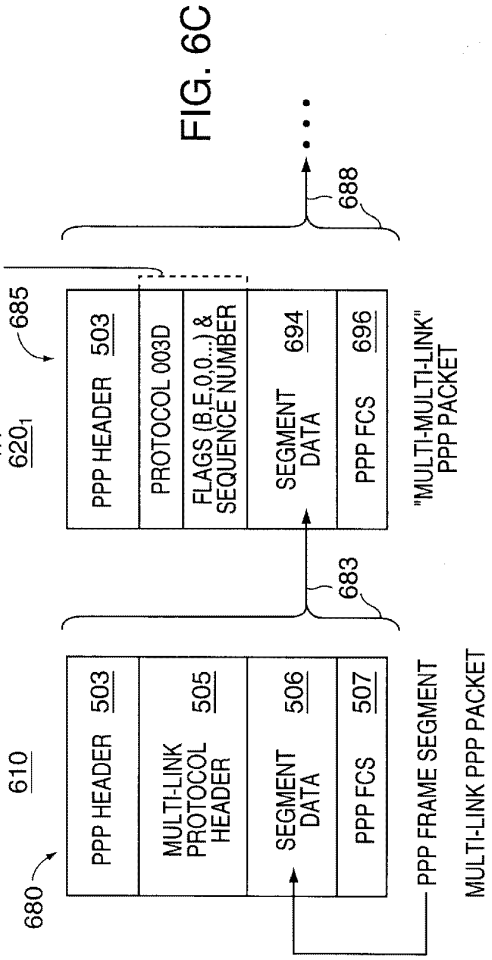


FIG. 6C

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FIG. 7

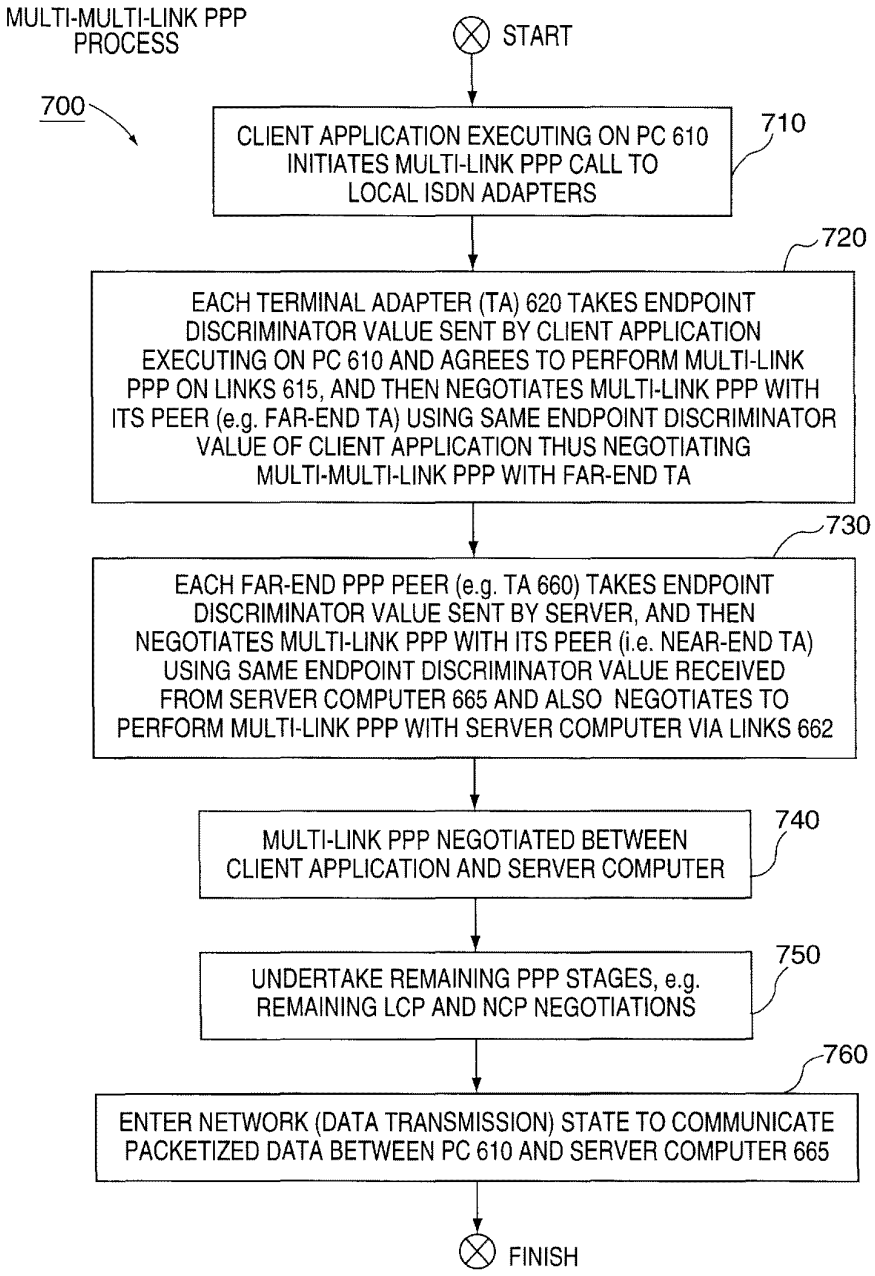
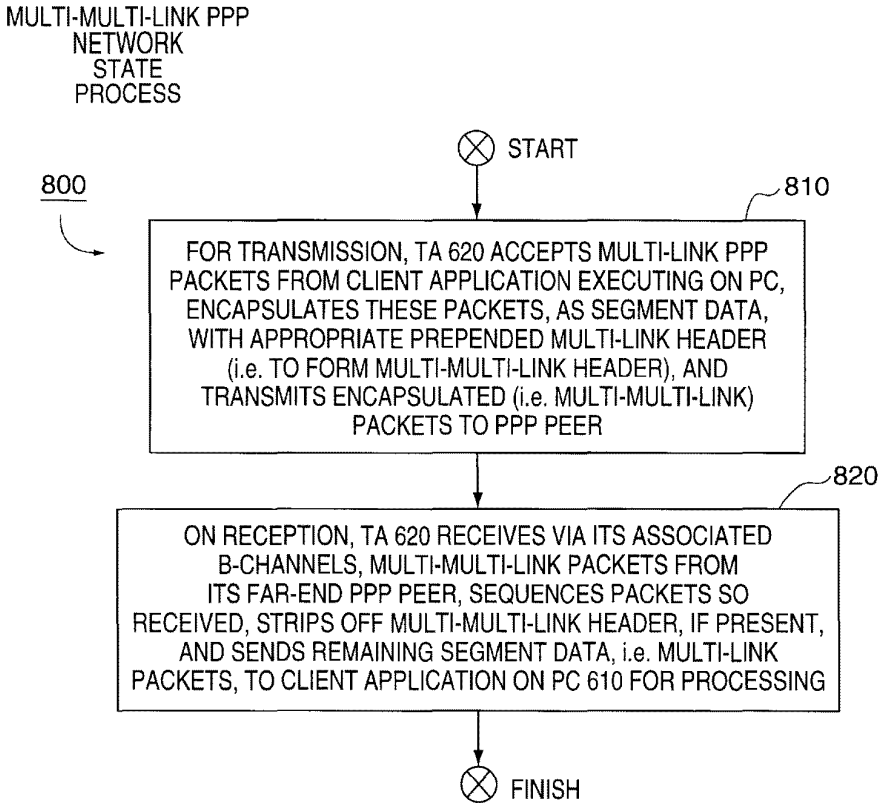

MULTI-MULTI-LINK PPP PROCESS
START
700
CLIENT APPLICATION EXECUTING ON PC 610 INITIATES MULTI-LINK PPP CALL TO LOCAL ISDN ADAPTERS
710
720
EACH TERMINAL ADAPTER (TA) 620 TAKES ENDPOINT DISCRIMINATOR VALUE SENT BY CLIENT APPLICATION EXECUTING ON PC 610 AND AGREES TO PERFORM MULTI-LINK PPP ON LINKS 615, AND THEN NEGOTIATES MULTI-LINK PPP WITH ITS PEER (e.g. FAR-END TA) USING SAME ENDPOINT DISCRIMINATOR VALUE OF CLIENT APPLICATION THUS NEGOTIATING MULTI-MULTI-LINK PPP WITH FAR-END TA
730
EACH FAR-END PPP PEER (e.g. TA 660) TAKES ENDPOINT DISCRIMINATOR VALUE SENT BY SERVER, AND THEN NEGOTIATES MULTI-LINK PPP WITH ITS PEER (i.e. NEAR-END TA) USING SAME ENDPOINT DISCRIMINATOR VALUE RECEIVED FROM SERVER COMPUTER 665 AND ALSO NEGOTIATES TO PERFORM MULTI-LINK PPP WITH SERVER COMPUTER VIA LINKS 662
740
MULTI-LINK PPP NEGOTIATED BETWEEN CLIENT APPLICATION AND SERVER COMPUTER
750
UNDERTAKE REMAINING PPP STAGES, e.g. REMAINING LCP AND NCP NEGOTIATIONS
760
ENTER NETWORK (DATA TRANSMISSION) STATE TO COMMUNICATE PACKETIZED DATA BETWEEN PC 610 AND SERVER COMPUTER 665
FINISH

FIG. 8


MULTI-MULTI-LINK PPP NETWORK STATE PROCESS
START
800
810
FOR TRANSMISSION, TA 620 ACCEPTS MULTI-LINK PPP PACKETS FROM CLIENT APPLICATION EXECUTING ON PC, ENCAPSULATES THESE PACKETS, AS SEGMENT DATA, WITH APPROPRIATE PREPENDED MULTI-LINK HEADER (i.e. TO FORM MULTI-MULTI-LINK HEADER), AND TRANSMITS ENCAPSULATED (i.e. MULTI-MULTI-LINK) PACKETS TO PPP PEER
820
ON RECEPTION, TA 620 RECEIVES VIA ITS ASSOCIATED B-CHANNELS, MULTI-MULTI-LINK PACKETS FROM ITS FAR-END PPP PEER, SEQUENCES PACKETS SO RECEIVED, STRIPS OFF MULTI-MULTI-LINK HEADER, IF PRESENT, AND SENDS REMAINING SEGMENT DATA, i.e. MULTI-LINK PACKETS, TO CLIENT APPLICATION ON PC 610 FOR PROCESSING
FINISH

TECHNIQUE FOR TRANSMITTING INCOMING MULTI-LINK POINT-TO-POINT (PPP) PACKET TRAFFIC OVER MULTIPLE OUTGOING LINKS IN A MULTI-LINK BUNDLE

BACKGROUND OF THE DISCLOSURE

1. Field of the Invention

The invention relates to a communications technique which permits incoming multi-link point-to-point (PPP) packets of a common PPP frame to be simultaneously transmitted across more than one outgoing link, e.g., a physical channel, in a multi-link bundle. This technique is particularly, though not exclusively, suited for supporting transmission of such incoming packets over several outgoing B-channels across multiple ISDN connections.

2. Description of the Prior Art

To facilitate carriage of datagrams of different network layer protocols, such as IP (Internet Protocol), IPX, DECnet, AppleTalk and others, over a single point-to-point link, a protocol, collectively referred to as the "PPP" protocol, has recently been developed. The PPP protocol has self-contained mechanisms for specifying a specific network layer protocol to be carried in a PPP packet, testing the link itself and negotiating a variety of options for facilitating efficient communication over that link.

In particular, the PPP protocol is itself formed of three basic constituents: (a) a method of encapsulating multi-protocol datagrams—though any one packet is limited to containing a datagram that uses just one network layer protocol; (b) a link control protocol (LCP) that is capable of establishing, configuring and testing a link which is to carry PPP packet traffic between two PPP peers; and (c) a family of network control protocols (NCPs) which collectively configure the link for the various network layer protocols (such as IP, IPX and others) to be used with datagrams to be carried over that link.

In operation, the LCP, executing at two PPP peers, each on an opposite side of the link, automatically negotiates and agrees on various operational characteristics to maximize the efficiency of the ensuing communication. These characteristics include, e.g., PPP encapsulation format, size of the packets to be used, detection of looped-back links, authentication and others. To accommodate datagrams with differing network layer protocols, each datagram is encapsulated, as payload information, in a corresponding PPP packet (as a PPP "frame") and is preceded, within that PPP packet, by a protocol field that specifies the particular network layer protocol associated with that particular datagram.

Before any data is transmitted over a PPP link, each PPP peer connected to one end of the link will send LCP configuration packets to the other end to establish and test the link; thus, ensuring the link is fully operational. Once the LCP protocol has successfully completed its negotiations, the PPP peers then negotiate the necessary NCPs to properly configure the link for the different network layer protocols that are to be used; with a different NCP being negotiated for each different network layer protocol. Once the NCP(s), for the various network layer protocols, have been successfully negotiated and configured at both PPP peers, then PPP packet traffic containing encapsulated data, using the network layer protocols, can commence over that link.

During the past five years, Internet usage, particularly that of the world wide web, has exploded and continues to do so. Substantial increases still occur, on a monthly basis, not only

in the size of the user community but also in the number of operational web sites. Moreover, as potential and existing site proprietors realize the potential of the Internet to very inexpensively reach an ever-increasing and diverse pool of widely dispersed potential users, these proprietors continue to post vastly increasing amounts of data, specifically, e.g., files for increasingly sophisticated web pages that include both textual and graphical information, to their web sites for user selection and downloading. Each time a user stationed at, e.g., a personal computer (PC) and using a web browser, "clicks" on a hypertext link or otherwise selects a web page, a file containing, e.g., HTML (hypertext mark-up language) source code for that page is transmitted by a remote web server through an Internet connection to the personal computer for rendering thereat. In addition, the Internet is also increasingly being used as a cost-effective method to deliver software to end users; an item of software being transmitted, again as a file(s), though oftentimes in compressed form, from a remote "ftp" (file transfer protocol) server to a personal computer then being operated by that user. Moreover, currently, the Internet also sees exploding use for disseminating files containing information in other electronic forms, such as digitized full motion video, digitized still pictures, digitized audio files and others—again selectable and accessible for downloading by a user through, e.g. associated web pages.

While the growth in available information accessible over the Internet provides an ever-increasing user community with an overwhelmingly rich information source, and one that continues to expand at a staggering rate, this growth has engendered various problems which have adversely affected the user community.

First, not only are the downloadable files, whether containing source code for web pages, software or other information, increasing in astonishing numbers but these files are also becoming much larger in size. Compressed software files on the order of tens of megabytes are becoming rather common. Inasmuch as most users connect to the Internet through dial-up telephone connections which have a rather limited bandwidth, a significant amount of time ("download" time or latency) may be required for a user to completely download a file of interest, particularly if that file is rather large, such as on the order of several megabytes or more. Second, as more users simultaneously contend for available network bandwidth at particular times, such as when the network experiences its peak daily loading, the network becomes increasingly congested. Hence, at these times, network traffic tends to slow which also tends to lengthen download time, thereby frustrating the users particularly those seeking relatively large files.

A basic approach to remedying these problems lies in cost-effectively increasing the transmission bandwidth available to a user such that a file will require much less time to download, thereby easing user frustration particularly during periods of peak network congestion.

This approach is traditionally effectuated through providing a user with the ability to cost-effectively utilize a faster transmission channel, such as, e.g., an JSDN (Integrated Services Digital Network) line, than a conventional dial-up "plain old telephone service" (POTS) analog line or an increasingly faster modem for use with a POTs line. While both of these solutions have certainly alleviated the problem, as it presently exists, to a significant extent; the problem will undoubtedly return as file sizes continue to increase, and the user community and web sites both continue to explosively expand.

Another approach is often employed, in conjunction with using high speed transmission channels, to provide further

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increases in transmission bandwidth to a network user. In particular, the PPP protocol, through its LCP, fortunately provides a mechanism through a so-called "multi-link protocol" (frequently referred to as simply multi-link PPP), that can assign additional bandwidth, on demand, (so-called "BonDing") in those situations where two PPP peers can be connected through multiple physical links in a common bundle (the entire multi-linked connection is commonly referred to as a "pipe"). In essence, multi-link operation involves real-time allocation (and deallocation) of any number of these links in the bundle to a common communication channel, i.e., the pipe, in order to dynamically provide sufficient transmission bandwidth for the underlying communication that is then to be carried by the channel.

For example, consider multi-link PPP being used over a basic rate interface (BRI) ISDN connection. Once successfully negotiated between two PPP peers, then, at a transmitting peer, multi-link PPP segments a packetized data stream (i.e., a PPP frame) into segments (or fragments), forms a stream of multi-link PPP packets each containing one such a segment, and then assigns these multi-link PPP packets on an approximately equal basis, where practical, between two B channels in the BRI connection for transmission to a receiving PPP peer; here the two B channels form a pipe. Small packets may not be segmented and to accommodate links of different speeds (which is not the case with two ISDN B channels), the segments need not be of the same size nor do the same number of segments need to be transmitted over each link. In any event, each such multi-link PPP packet contains a sequence number—which increases by one with each successive packet, inserted by the multi-link protocol. At the receiving peer, the multi-link protocol extracts the segments from the received packets carried by the pipe, and re-assembles these segments into proper order based on their corresponding sequence numbers so as to properly and fully reconstruct the PPP frame.

One can readily appreciate that, by simultaneously utilizing available transmission bandwidth provided by multiple links to carry packet traffic that forms a PPP frame for a given user, multi-link PPP can significantly increase overall transmission bandwidth for that user.

However, the multi-link protocol, as it presently exists, suffers from a drawback that effectively prevents this protocol from providing even further increases in transmission bandwidth, particularly where, e.g., ISDN lines are used to carry packet traffic between two PPP peers.

In particular, to exploit the increased bandwidth available from simultaneous use of multiple links, a number of currently available and forthcoming client personal computer (PC) operating systems can segment a single PPP frame into multi-link PPP packets, i.e., for subsequent carriage across a pipe formed of separate corresponding physical links.

In this regard, multi-link PPP packets can be transported over, e.g., a pipe formed of a plurality of POTs lines, each with a separate modem and a corresponding serial communication port on a client PC. This approach operates quite well with communication devices, such as modems, that have one incoming data path and one outgoing data path and do not implement the PPP protocol. However, this approach does not function, owing to, what the art believes, is a limitation inherent in multi-link PPP frame re-assembly, with communication devices, such as ISDN terminal adapters, that possess one incoming data path and several outgoing data paths and implement the multi-link protocol.

To appreciate this limitation, consider a situation where a client PC were to generate multi-link PPP packets for a common PPP frame and distribute these packets among two or more separate links with a separate ISDN terminal adapter connected to each link. As noted above, each multi-link PPP packet would contain a sequence number, in this case assigned by the PC and which increments by one from each multi-link PPP packet for a common PPP frame to the next. To ensure proper ordering, each terminal adapter, were it to use the multi-link protocol, would buffer each incoming multi-link PPP packet it receives and then reorder its received packets based on their sequence numbers, and then transmit only properly reordered packets amongst its two ISDN B channels. If incoming multi-link PPP packets were received, but with gaps in their sequence numbers, a conventional terminal adapter, then executing the multi-link protocol, would simply buffer these incoming packets pending receipt of those packets containing the missing sequence numbers. However, these "missing" packets would never arrive at that particular terminal adapter. Specifically, since the client PC is intentionally distributing packets, generally on a round-robin basis, among several links to the terminal adapters, then each terminal adapter would not receive a stream of incoming multi-link PPP packets with sequence numbers that would consecutively increase by one, but rather would increase by the number of links across which the personal computer is distributing the multi-link PPP packets. The existence of incoming multi-link PPP packets, at each terminal adapter, with gaps in their sequence numbers would totally frustrate transmission of these packets through the terminal adapters and preclude their downstream communication to a PPP peer. Thus, the incoming PPP frame applied across all the terminal adapters would never "get through" the adapters.

As such, multi-link PPP packets can only be handled by communication devices that have one incoming data link and one outgoing data link. Such a device, typified by a conventional analog modem, simply transmits incoming data appearing on its incoming data link onto its outgoing data link once a communication path is established therebetween. These devices simply do not utilize the multi-link protocol and, as such, ignore the multi-link segmented nature of the incoming data. However, conventional high-speed communication devices, such as ISDN terminal adapters, that process a stream of incoming packetized data, such as through segmentation and sequencing, to utilize multiple outgoing data links can not function with, as discussed above, incoming multi-link PPP packets. Consequently, though a client PC can generate multi-link PPP packets, high speed communication devices that execute the multi-link protocol can not handle these packets as input; thus relegating a user to much slower speed communication devices, such as analog modems, that can.

Thus, in practice, the promise of providing significantly higher user transmission bandwidth, through use of client PC software that executes the multi-link protocol, has yet to be fully satisfied.

Therefore, a need exists in the art for a technique, specifically apparatus and accompanying methods, for use in a communication device with one incoming physical link and multiple outgoing physical links for properly handling incoming multi-link PPP packets. Such a technique would permit incoming multi-link PPP packets, appearing on any one of several incoming physical links, to themselves be transmitted over a pipe formed of several outgoing physical links, thereby providing significantly increased transmission bandwidth to a user. Advantageously, this technique would find particular, though not exclusive, application in, e.g., an ISDN terminal adapter which were to receive multi-link PPP

packets from a client PC, thus allowing that client to simultaneously utilize more than one ISDN terminal adapter, and correspondingly more than 2 B channels on a pipe, to attain such increased bandwidth.

SUMMARY OF THE INVENTION

The present invention overcomes the deficiencies in the art and satisfies these needs by setting, in direct contravention to conventional multi-link protocol processing, an endpoint discriminator of each multi-link PPP device, connected to one end of a pipe to be formed of several physical outgoing links, to the same value as that of a neighboring PPP device that generates incoming multi-link PPP packets to the former device for transport over the outgoing links. This use of neighboring endpoint discriminator values is recursively employed at each end of the pipe to encompass all hierarchically connected multi-link PPP devices thereat, including a multi-link PPP originator thereat. As a result, all the multi-link PPP devices at one end of the pipe share a common endpoint discriminator value. Consequently, a BRI ISDN terminal adapter like device that utilizes my invention can accept and negotiate the multi-link protocol on its data terminal equipment (DTE) side where, conventionally, such a device has only one link and will accept an endpoint discriminator provided from its DTE side and use this discriminator to negotiate the multi-link protocol on multiple outgoing links connected to the device, e.g., on its public switched telephone network (PSTN) side.

In accordance with my specific inventive teachings, setting identical endpoint discriminators is readily accomplished during LCP negotiations wherein a multi-link PPP originator, such as, e.g., a server or a client application executing at a PC, assigns itself a unique endpoint discriminator value and informs all its immediate PPP peers, such as neighboring terminal adapters, by sending the latter, via a first bundle of outgoing links, an LCP Endpoint Discriminator packet containing this value. Each of these immediate PPP peers, rather than assigning itself a unique endpoint discriminator value, assumes the value that has been provided to it in the LCP Endpoint Discriminator packet it receives from the originating device, as its own endpoint discriminator. Each of these peers then, in turn, sends an LCP Endpoint Discriminator packet containing its endpoint discriminator value (i.e., that of the originating multi-link PPP system), via a second bundle of outgoing links, to its immediate PPP peers, and so forth until all hierarchically inter-connected multi-link PPP peers at one end of the pipe and which fan-out from the originator have set their endpoint discriminator to a single common value, i.e., the endpoint discriminator of the multi-link PPP originator. Each multi-link PPP device situated in a final, e.g. m^{th}, level of hierarchically organized multi-link PPP peers supplies the common endpoint discriminator value, through an associated LCP Endpoint Discriminator packet and via a separate physical link in the pipe, to its remote multi-link PPP peer at the other end of the pipe. Consequently, all the links in this pipe will be viewed, by the multi-link protocol, as part of a common bundle.

Furthermore, through use of the present invention, advantageously no changes need to be made to the contents of any multi-link PPP packet to transmit that packet through any one or more levels, in a hierarchy of multi-link PPP devices, with incoming multi-link being applied by any such device in, e.g., a round-robin (or other predefined) fashion among its outgoing links. Alternatively, each multi-link PPP device situated at a given level in the hierarchy can encapsulate its incoming multi-link PPP packets as segment data into new outgoing multi-link PPP packets, i.e., "multi-multi-link" PPP packets, along with a multi-link protocol header, including a sequence number appropriate to the multi-link PPP packets generated at that level, i.e., a "multi-multi-link" header.

Advantageously, through use of my invention, an incoming PPP frame formed of multi-link PPP packets can be simultaneously transmitted through several high speed communication devices—whether hierarchically organized or not, each having one incoming link and several outgoing links, thus providing significantly higher transmission bandwidths than heretofore possible with such packets.

BRIEF DESCRIPTION OF THE DRAWINGS

The teachings of the present invention can be readily understood by considering the following detailed description in conjunction with the accompanying drawings, in which:

FIG. **1** diagrammatically depicts conventional states of a link that carries PPP traffic and associated state transitions therefor;

FIG. **2** depicts a format of a conventional generalized link control protocol (LCP) packet that is used during an LCP portion of the PPP protocol;

FIG. **3** depicts a format of a conventional generalized LCP Configuration Request packet which is used in configuring a link during the LCP portion of the PPP protocol;

FIG. **4** depicts a format of a conventional LCP Multi-link Endpoint Discriminator Option packet which is a particular type of an LCP Configuration Request packet shown in FIG. **3**;

FIG. **5** depicts two conventional formats for multi-link PPP packets;

FIG. **6**A depicts a high level block diagram of illustrative multi-link client-server communication apparatus **600** that simultaneously utilizes multiple links to carry inventive multi-multi-link PPP packets;

FIG. **6**B depicts use, in accordance with the present invention, of an endpoint discriminator for client PC **610**, shown in FIG. **6**A;

FIG. **6**C depicts multi-link PPP and inventive multi-multi-link PPP packets generated by client PC **610** and terminal adapters **620**, respectively, shown in FIG. **6**A;

FIG. **7** depicts a high-level flowchart of my inventive Multi-multi-link PPP process **700** that is performed by apparatus **600** shown in FIG. **6**A; and

FIG. **8** depicts a high-level flowchart of my inventive Multi-multi-link Network State process **800** that is performed by each terminal adapter, illustratively each of adapters **620**, shown in FIG. **6**, to handle transmission and reception of multi-multi-link PPP packets, during network state **140**, as shown in FIG. **1**, of the PPP protocol.

To facilitate understanding, identical reference numerals have been used, where possible, to designate identical elements that are common to various figures.

DETAILED DESCRIPTION

After considering the following description, those skilled in the art will clearly realize that the teachings of the present invention can be readily utilized in conjunction with any equipment, such as illustratively a computer or terminal adapter, that can generate multi-link point-to-point (PPP) packets. Through use of the present invention, the multi-link PPP packets appearing on any one of a number of incoming

links can themselves be transmitted across a pipe formed of several outgoing communication links in a bundle, wherein the packets are distributed across the outgoing links in order to simultaneously utilize the transmission bandwidth available on all these outgoing links, thereby providing enhanced channel bandwidth. To simplify the ensuing description, I will discuss my invention in the illustrative context of use within ISDN (Integrated Services Digital Network) terminal adapters, as DCE (data circuit terminating equipment) that collectively connect, e.g., a personal computer (PC) as DTE (data terminal equipment) to a pipe formed of several outgoing ISDN lines, where each line has two bearer (B) channels.

However, before discussing the invention itself, I will quickly elucidate various salient aspects of the conventional PPP protocol, as it is currently used, such that subsequently the reader can fully understand my inventive modifications to this protocol.

FIG. **1** diagrammatically depicts conventional states of a link that carries PPP traffic and associated state transitions therefor.

Initially, as shown, a link is in Dead state **110**, during which the PPP protocol is inactive. During this state, the protocol is waiting for a physical layer (not specifically shown but well known) to signal that the link is ready. This signal may arise from an external event or activation of a data carrier detect signal in the case of a serial linkage being initiated over that link. At this point with no activity on the link, a link control protocol (LCP), which as part of the PPP protocol, exercises responsibility for establishing and configuring the link, remains in an initial or starting state. Once the physical layer has appropriately signaled that the link is ready, then the link transitions, as symbolized by UP line **115**, to Establish state **120**. In this state, the LCP, executing on each end of the link and through exchanging and acknowledging LCP Configure packets through the link, forms a PPP connection through the link. Should this configuration process fail, then the link transitions, via FAIL line **128**, back to Dead state **110**.

As part of configuring the link, if a PPP peer at either end of the link requests the use of authentication and authentication is enabled at the PPP peers at both ends of the link, then, once the link has been established by the LCP, LCP will undertake to conventionally authenticate both PPP peers. In this case, the state of the link transitions, as symbolized by OPENED line **123**, to Authenticate state **130**. PPP supports two standard authentication protocols: password authentication protocol (PAP) and challenge handshake authentication protocol (CHAP). Inasmuch as the authentication protocols are irrelevant to the present invention, I will omit any further details thereof. If either no authentication was requested or authentication was successful, then the link transitions, via Success/None line **138**, to Network state **140**. In this state, a different Network Control Protocol (NCP) for each of the desired network layer protocols, e.g. IP (Internet Protocol), IPX, DECnet, AppleTalk and others, that are to be used to carry packet traffic over that link, will then be sequentially negotiated by the PPP peers on both sides of the link, so as to properly configure the link for this traffic. Once the necessary network layer protocols have been successfully negotiated, packet traffic can then commence over the link. NCPs can be negotiated any time the link is open in order to the accommodate another network layer protocol for use over the link or to drop a network layer protocol that is no longer needed. If a particular NCP fails or an associated network layer protocol was not negotiated at all, then any packets using that protocol that are received, via the link, by either of the PPP peers will be returned to its sender using a PPP Reject packet.

If PPP traffic has concluded and either PPP peer desires to terminate the link, then the link transitions, as symbolized by CLOSING line **145**, to Terminate state **150**. In this state, both PPP peers exchange appropriate PPP terminate packets and, where possible, acknowledgements thereof. Link termination can occur at any time through, e.g., a failure in the link, or some other event, such as, as symbolized by FAIL line **133**, an authentication failure. In the event of a link failure, no termination acknowledgements will occur; the link will simply be terminated after a predefined timeout interval occurs. However, in a non-failure condition, the PPP protocol utilizes such acknowledgements to assure a graceful link termination. Once the link has been completely terminated, the link transitions, as symbolized by DOWN line **155**, back to Dead state **110**, to be re-initiated at some future time and so forth.

Since my invention modifies conventional multi-link LCP packet messaging, during link configuration for multi-link operation, I will now discuss the salient, though conventional, LCP messages.

FIG. **2** depicts a format of conventional generalized LCP packet **200**. As shown, packet **200** is formed of eight-bit code field **210**, eight-bit identifier field **220**, sixteen-bit length field **230** and finally variable-length data field **240**. This packet can be any one of several types, with the value of the code field, having values typically ranging from one to thirteen, specifying the type of any such packet. Of note, a value of one indicates that the packet is an LCP Configure Request packet. Such a request packet is sent by a PPP peer whenever that peer desires to change a configuration parameter, such as from a default value, associated with the link. A code field having a value of two or three specifies the packet as an LCP Configure Positive Acknowledgement (ACK) or LCP Configure Negative Acknowledgement (NACK) which, when issued, by a receiving PPP peer, respectively specifies that options (the salient option being discussed below) in the Configuration Request were either all accepted, i.e., now being acknowledged, or one or more of these options rejected, i.e., now being negatively acknowledged, by that peer. Inasmuch as none of the other code fields is relevant to an understanding of the present invention, I will omit any further discussion of them. Identifier field **220** contains a number which is used by the protocol to match requests with their corresponding responses. The length field specifies, the overall length in octets, of the LCP packet. Data field **240** contains data carried by the LCP packet, with the actual data depending on the type of LCP packet and therefore the value of the code specified therein.

With the above in mind, FIG. **3** depicts a format of conventional generalized LCP Configuration Request packet **300**. As stated above, an LCP Configuration Request packet is sent by a PPP peer whenever that peer desires to change any default parameter associated with the link or a parameter which the link is currently using.

Packet **300** contains eight-bit type field **310**, eight-bit length field **320** and variable-length data field **330**. Type field contains any one of a number of predefined values, typically ranging from zero to nineteen, with the particular value specifying a particular configuration option, i.e., parameter, that is then to be set or changed. Each specific option has to be separately negotiated between the PPP peers and appropriately acknowledged prior to its use. Inasmuch

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as the only values for this type field, i.e., the only configuration options, that are relevant to understanding the invention are **17**, **18** and **19**, which designate a multi-link MRRU (Multi-link Maximum Receive Reconstructed unit) request, a multi-link Short Sequence Number header request and a "multi-link endpoint discriminator" option, respectively (which will all be discussed in detail below in conjunction with FIG. **5**), I will dispense with describing any other LCP configuration options. Length field **320** specifies a length, in octets, of packet **300**, including the contents of its type, length and data fields. For any particular packet **300**, data field **330** contains data specific to a corresponding configuration option associated with that particular packet.

Having described and shown a generalized LCP Configure Request packet, FIG. **4** depicts a format of conventional LCP Multi-link Endpoint Discriminator Option packet **400**—which, as noted above, forms one type of the LCP Configure Request packet. The endpoint discriminator packet identifies, by specifying an address, of an end system (an "endpoint"), then situated on an end of a link, that is transmitting this particular packet. This peer can be an existing system, i.e., one whose address has already been specified through prior LCP negotiations to its communicating peer, though using another, i.e., existing, link to that peer, or a different system altogether. If the data contained in this packet identifies the end system as an existing system (i.e., previously so identified), then, through the PPP protocol, the link will be joined to an existing bundle of links, so as to form a "pipe" among which multi-link PPP packets will be distributed for transport between the end system peer and its peer. Alternatively, if the data contained in packet **400** differs from that of any existing system, then the PPP protocol assumes a new bundle of links exists and assigns the link to this new bundle.

As depicted in FIG. **4**, an LCP Configure Request packet specifies a multi-link endpoint discriminator option whenever the type field of the LCP Configure Request packet is set to value nineteen, as is field **410**. Identification of the endpoint system (commonly referred to as either an "endpoint discriminator" or "endpoint identifier") is accomplished through class field **430** and address field **440**, which collectively contain data carried by this packet. The class field defines the type of address then specified within the address field and its length. For example, a class field having a value of illustratively zero, one or two specifies that the following address is a null class (i.e., the address is zero octets long), a locally assigned address, such as a serial number (having a length up to twenty octets), or an Internet Protocol (IP) address (having a length of four octets). Other classes of addresses exist. Inasmuch as the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention, I will omit any further details of the latter two aspects. Length field **420** specifies overall length in octets, of LCP packet **400**.

Once the multi-link protocol has been successfully negotiated by the LCP between two PPP peers for use with a pipe, then, at a transmitting peer, the multi-link protocol segments a packetized PPP data stream (referred to as a PPP frame) into segments (also called fragments), forms a stream of multi-link PPP packets each containing one such a segment, and then assigns these multi-link PPP packets on an approximately equal basis, generally speaking and where practical, between all the links in the pipe. Each such multi-link PPP packet contains a sequence number—which increases by one with each successive packet, inserted by the multi-link protocol. At the receiving peer, the multi-link protocol extracts the segments from the received packets carried by the pipe, and re-assembles the payload data contained in these segments into proper order based on their corresponding sequence numbers to properly reconstruct the PPP frame.

FIG. **5** depicts two alternate and conventional formats **500** of multi-link PPP packets, with a difference therebetween being a length of the sequence number. These formats are depicted as long and short sequence number formats **510** and **550** having 24- and 12-bit sequence numbers, respectively. The specific format of the multi-link PPP packet to use in any situation can be specified by a PPP sender by transmitting an LCP Configuration Request message for a Multi-link Maximum Receive Reconstructed Unit (MRRU) format, i.e., designating long sequence number format **510**, or a Multi-link Short Sequence Number Header format, i.e., designating short sequence number format **550**, coupled with successful negotiations with its PPP peer therefor. Use of format **510** or **550** is requested by a type field having a value of 17 or 18, respectively, in an LCP Configure Request message, as noted above, transmitted by the PPP sender to its PPP peer. The format of the multi-link PPP packet is negotiated before an LCP Configure Request packet is transmitted by the PPP sender on a given link to specify its endpoint discriminator (endpoint identifier) to its PPP peer on that link. As discussed above, the discriminator determines whether that link should join an existing bundle of links connecting these PPP peers or whether a new bundle should be established for that link.

Focusing on long sequence number format **510** for the moment, this format contains PPP link layer frame header **503**, encapsulated multi-link protocol header **505**, encapsulated segment data **506** and PPP frame check sequence (FCS) field **507**. The PPP link layer frame header itself contains address field **515**, specifically having a predefined value of "FF", and control field **520** having a predefined value of "03(hex)". Following PPP link layer frame header **503**, format **510** contains, in seriatim, protocol field **525**, flag field **530** and sequence number fields **535** and **540**. The protocol field has a value of "003D" which identifies the multi-link protocol; hence specifying that the entire packet is to be processed through the multi-link protocol. Flag field **530** contains 8-bits, the first two of which, i.e., bits $\mathbf{530}_1$ and $\mathbf{530}_2$ in bit positions **1** and **2**, indicate, by a high setting, whether the segment data contained in this packet is a beginning (B) or ending (E) segment in a packetized data stream, or neither. The values of the remaining six bits in flag field **530** are all set to zero. Field **535** contains the most significant eight bits of the sequence number assigned to this multi-link PPP packet by the multi-link protocol; with the remaining sixteen bits being provided in field **540**. Fields **525**, **530**, **535** and **540** collectively form multi-link protocol header **505**.

The multi-link protocol increments the sequence number by one for each successive multi-link PPP packet in a multi-link transmission, such that these packets can be properly reordered upon reception to reconstitute a correct PPP frame. Segment data **506** contains the actual segment data in field **543** carried by this multi-link PPP packet. PPP FCS field **507** follows the segment data. The FCS field, being either 16-bits (LCP default value, as shown) or alternatively 32-bits in length (if specifically negotiated through a corresponding LCP Configuration Request option), contains FCS field **547**. Field **547** contains a value, generated through a conventional cyclic redundancy check, which is used to ensure integrity of the packet when received. In essence, a sending system which transmits a multi-link PPP

packet calculates an FCS value, based on the PPP link layer header, protocol, sequence number fields and the segment data and then inserts a resulting FCS value into field **547**. Upon receiving the packet, a receiving PPP peer recalculates the FCS value based on the same components of the multi-link PPP packet, compares the recalculated value to the FCS value specified in field **547** of the received packet and, if the two values match, accepts the multi-link PPP packet as being "good" hence warranting further processing, or, if not, rejects and discards the packet and supplies an appropriate reject message to the sending system.

Short sequence number format **550** is highly similar to format **510**. Apart from the multi-link protocol header contained in this packet, the remaining fields of this packet; namely PPP header **503**, here containing fields **555** and **560**, segment data **506**, containing segment data field **580**, and FCS field **507** containing FCS field **585**, are identical to fields **515**, **520**, **543** and **547**, respectively, in format **510**. Protocol field **565** is identical to protocol field **525**. Rather than containing an eight-bit flag field followed by a 24-bit sequence number field, format **550** contains four-bit flag field **570** (only having two rather than six lower-order zero-valued bits) followed by 12-bit sequence number field **575**. In an identical fashion to flag field **530** in format **510**, the first two bits of flag field **570**, i.e., bits 570_1 and 570_2, contain values for the beginning and ending flags (B and E), respectively, associated with the segment data in field **580** carried by the multi-link PPP packet.

For further information on the PPP protocol, the reader is referred to Section 22.3, "The Point-to-Point Protocol" on pages 402–434 of P. Miller, *TCP/IP Explained*, Digital Press (© 1997, Butterworth-Heinemann), which is incorporated by reference herein.

With the above discussion of conventional multi-link PPP in mind , consider FIG. **6A** which depicts a high level block diagram of illustrative multi-link client-server apparatus **600**, which incorporates the teachings of the present invention. Here, client **605** is inter-connected to server **650** through multiple ISDN BRI (basic rate interface) lines **630**.

Client **605** is formed of client PC **610**, as DTE (data terminating equipment), connected, through internal communication interfaces **612**, typically separate serial ports (not specifically identified), and via corresponding links **615**, to multiple identical ISDN BRI terminal adapters **620** as DCE (data circuit terminating equipment). In that regard, links **615**, which comprise links 615_1, 615_2, . . . , 615_n, connect separate terminal adapters 620_1, 620_2, . . . , 620_n, respectively, to separate corresponding serial ports provided by communication interfaces **612**. Terminal adapter 620_1 contains, to the extent relevant, processor **622**, typically a conventional microprocessor, and memory **627**, the latter having program store **625** which stores computer executable instructions (along with accompanying data values) that, when executed by the processor, control the operation of the terminal adapter and specifically, among other functions, implement my inventive technique. Each of the other terminal adapters is identical to adapter 620_1. All these terminal adapters are collectively connected to one end of ISDN BRI lines **630**, with each terminal adapter 620_1, 620_2, . . . , 620_n, being individually connected to a pair of lines for two ISDN B channels, specifically lines 630_1 (having a separate pair of links **632** and **634** for pair of B channels), 630_2, . . . , 630_n, respectively. Though each ISDN BRI connection also entails a separate ISDN data ("D") channel connection, for simplicity, all such D-channel connections, which are readily apparent to those skilled in the art, are omitted from the figure and will not be discussed further. ISDN connections are extended from terminal adapters **620**, through public switched telephone network (PSTN) **640**, to server **650** having corresponding identical terminal adapters **660**, as DCE, and server computer **665**, as DTE. Each one of terminal adapters **620** is connected through a separate pair of ISDN B-channels and the PSTN, to a separate corresponding one of terminal adapters **660**, the latter terminal adapters collectively connected, via links **662**, to server computer **665**. Each of adapters **660** is illustratively identical to each of adapters **620**.

To make maximum use of available bandwidth on two B-channels, each of terminal adapters **620** would execute the multi-link protocol in an attempt to segment a PPP frame appearing on its input lead, e.g., lead 615_1 for terminal adapter 620_1, into multi-link PPP packets for carriage over its corresponding pair of B-channels, e.g., lines 630_1.

Currently, client PC **610** can utilize any one of various existing operating systems that, if appropriately configured, is able to segment a PPP frame into multi-link PPP packets and distribute those packets among multiple links in a bundle (i.e., a pipe). Inasmuch as presently available ISDN terminal adapters have only one physical link on their DTE side, such as link 615_1 if terminal adapter 620_1 were to be conventional, these adapters unfortunately do not attempt to accept multi-link PPP packets and send those packets over both of their BRI links, e.g., links 630_1, towards a PSTN, here PSTN **640**. If multi-link PPP packets were to be applied over links **615**—in an effort to utilize bandwidth provided across multiple ISDN BRI lines **630**, then the multi-link PPP packets would not pass through ISDN terminal adapters **660** (adapters **620** for packets flowing in an opposite direction).

In particular, as discussed above and depicted in FIG. **5**, each multi-link PPP packet generated by client PC **610**, shown in FIG. **6A**, would contain a sequence number which increments by one from each multi-link PPP packet to the next in a common PPP frame. To ensure proper ordering, each of terminal adapters **660** would buffer each incoming multi-link PPP packet it receives, via links **630**, from its corresponding PPP peer in adapters **620**, and then reorder its received packets based on their sequence numbers, and then transmit only properly reordered packets to server computer **665**. Inasmuch as PC **610** is distributing the multi-link PPP packets, typically in sequential round-robin fashion, amongst terminal adapters **620**, each one of terminal adapters **660** would receive packets having sequence numbers that increment not by the value one but by the integer value n; hence, skipping intervening sequence numbers. Under conventional multi-link protocol processing, if incoming multi-link PPP packets were received by any given terminal adapter, such as in adapters **660**, but with gaps in their sequence numbers, then each of these terminal adapters would simply buffer these incoming packets pending receipt of those packets containing the missing (here skipped) sequence numbers. Since packets with "skipped" sequence numbers would have been intentionally sent by client PC **610**, via links **615**, to adapters, within adapters **620**, other than the peer to the given adapter, then the "missing" packets would simply never arrive at the given terminal adapter. As a result, the given adapter would continually buffer its incoming multi-link PPP packets pending the receipt of multi-link PPP packets that would never arrive. Hence, the buffered packets would not be forwarded by the terminal adapters to server computer **665**. Thus, the incoming PPP frame applied across all terminal adapters **620** would never "get through" all the adapters to the server computer.

Consequently, with conventional multi-link protocol processing, multi-link PPP packets can only be handled by

communication devices, such as, e.g., modems, that have one incoming data link and one outgoing data link, and not by higher-speed devices, such as ISDN terminal adapters that provide multiple outgoing links and execute the protocol. Unfortunately, the former devices generally provide significantly less transmission bandwidth that do the latter; thus, relegating client PC **610**, should it use multi-link PPP, to use of markedly slower transmission speeds.

As a result of the present invention, I have advantageously surmounted this limitation in the art.

In particular, I have discovered that this drawback arises, due to various reasons: (a) terminal adapters **620**, as conventionally constituted, do not accept multi-link PPP packets inasmuch as these adapters possess only one physical link to their DTE, here DTE **610**; (b) strict frame re-assembly mechanism used in the multi-link protocol which inhibits frames from reaching a destination server, e.g., here server computer **665**, from terminal adapters **660**, if conventionally constituted; and (c) the conventional manner through which the multi-link protocol, in a PPP system at one end of a link, utilizes the endpoint discriminator (endpoint identifier) provided by each multi-link PPP peer connected to an opposite end of that link. As generally discussed above, during LCP negotiations, a multi-link PPP system at the end of each link in a multi-link PPP bundle will supply its unique endpoint discriminator address to the PPP system situated at the other end of that link. As such, each ISDN terminal adapter, as a multi-link PPP system, will conventionally have a different endpoint discriminator associated with it. Consequently, the conventional multi-link protocol, executing at, e.g., client PC **610** or server computer **665**, will not treat all terminal adapters **620** or adapters **660**, respectively, as being linked to a common bundle (i.e., a single pipe formed of ISDN lines **630**) for purposes of carrying multi-link PPP packets. Specifically, under the conventional multi-link protocol, the client PC (and server computer **665**) will assume that the ISDN BRI line (pair of B channels) associated with each of terminal adapters **620** (and **660**, respectively) is associated with a different bundle. Hence, packets appearing across the separate pairs of B channels and generated by an application executing at the client PC would not be properly re-assembled at the opposite end of, what should constitute a pipe, by the server into a common PPP frame (and similarly with multi-link PPP packets for a common PPP frame that were expected to travel in a reverse direction from the server to the client application at the PC).

Therefore, in accordance with my invention, and directly contrary to conventional multi-link protocol processing, each multi-link PPP device connected to one end of a pipe to be formed of several physical outgoing links, such as JSDN lines, sets its endpoint discriminator value to the same value as that of a neighboring PPP device that generates incoming multi-link PPP packets to the former device for transport over the outgoing links. This use of neighboring endpoint discriminator values is recursively employed at each end of the pipe to encompass all hierarchically connected devices thereat, including a multi-link PPP originator, such as a client or server computer, thereat. As a result, all the multi-link PPP devices at one end of the pipe share a common endpoint discriminator value.

This is readily accomplished during LCP negotiations wherein a multi-link PPP originator, such as, e.g., a server or a client application executing at a PC, assigns itself a unique endpoint discriminator value and informs all its immediate PPP peers, such as neighboring terminal adapters, by sending the latter, via a bundle of outgoing links, an LCP Endpoint Discriminator packet containing this value. In accordance with my invention, each of these immediate PPP peers, rather than assigning itself a unique endpoint discriminator value, assumes the value that has been provided to it in the LCP Endpoint Discriminator packet it receives from the originator, as its own endpoint discriminator. Each of these peers then, in turn, sends an LCP Endpoint Discriminator packet containing its endpoint discriminator value (i.e., that of the multi-link PPP originator), via a second bundle of outgoing links, to its immediate PPP peers, and so forth until all the hierarchically inter-connected multi-link PPP peers at one end of the pipe and which fan-out from the originator have set their endpoint discriminator to a single common value, i.e., the endpoint discriminator of the originator. Each multi-link PPP device situated in a final, e.g., m^{th}, level of hierarchically organized multi-link PPP peers supplies the common endpoint discriminator value, through an associated LCP Endpoint Discriminator packet and via a separate physical link in the pipe, to its remote multi-link PPP peer at the other end of the pipe. Consequently, all the links in this pipe will be viewed, by the multi-link protocol, as part of a common bundle.

Hence, for client-server apparatus **600** shown in FIG. **6**A and through the teachings of my invention, a client application executing at client PC **610**, during the course of configuring links **615** connecting the PC with terminal adapters **620**, will establish its own endpoint discriminator value which, in turn, it will supply, via LCP Endpoint Discriminator packets during LCP negotiations, to each of terminal adapters **620**. This is symbolized by lines **672** shown in FIG. **6**B wherein client PC **610** sends its endpoint discriminator value to each of terminal adapters $\mathbf{620}_1$, $\mathbf{620}_2$, . . . , $\mathbf{620}_n$ as specifically symbolized by lines $\mathbf{672}_1$, $\mathbf{672}_2$, . . . , $\mathbf{672}_n$, respectively. Only one hierarchical level of multi-link PPP devices, here terminal adapters **620**, exists within client **605**. Each of these terminal adapters will then set the value of its own endpoint discriminator to match that of the application at the client PC. Thereafter, while each of terminal adapters **620** negotiates with a corresponding one of far-end terminal adapters **660** during the LCP phase of PPP negotiations to configure links **630**, each of terminal adapters **620** will transmit an outgoing LCP Endpoint Discriminator packet to its multi-link peer within terminal adapters **660**. This is symbolized by lines **674** shown in FIG. **6**B wherein each of terminal adapters **620**, specifically terminal adapters $\mathbf{620}_1$, $\mathbf{620}_2$, . . . , $\mathbf{620}_n$ (also denoted as TA_1, TA_2, . . . , TA_n, respectively), sends the same endpoint discriminator value to its corresponding peer in terminal adapters **660**, specifically $\mathbf{660}_1$, $\mathbf{660}_2$, . . . , $\mathbf{660}_n$ as specifically symbolized by respective lines $\mathbf{674}_1$, $\mathbf{674}_2$, . . . , $\mathbf{674}_n$. As a result, server computer **665**, by virtue of the common endpoint discriminator associated the application executing at client PC **610** and with every ISDN BRI (B channel pair) emanating from client **605**, will then, through conventional multi-link protocol processing correctly view links **630** as a common bundle, i.e., a pipe, for packets generated by and destined to this application and handle packets appearing thereon as multi-link PPP packets. Additionally, both peer terminal adapters will realize that they will be performing multi-multi-link PPP by mutual agreement; the agreement resulting from appropriate LCP negotiations.

To ensure proper re-ordering, upon ultimate reception at a far-end location, of multi-link PPP packets that are to be transmitted at each level, either of two approaches can be used inasmuch as both peer devices (in, e.g., adapters **620** and **660**) realize that they are performing multi-multi-link PPP. First, a transmitting side device which transmits (e.g., any of devices **620** or **660**) an incoming packet need not split

any of these incoming packets but can alternate these packets between each of its physical links, i.e., applies these packets in a round-robin (or other predefined) fashion among its outgoing links. In this scenario, no changes need to be made to the contents of each of these incoming packets to transmit that packet through one or more levels in a hierarchy of multi-link PPP devices. A receiving side device merely passes the multi-link packets it receives to its associated DTE in increasing order of the sequence numbers of the packets its received, while ignoring beginning and ending flags in the multi-link header of each such packet. Second, if either side at any level in the hierarchy desires to split its incoming multi-link packets, then each multi-link PPP device situated at that level encapsulates its incoming multi-link PPP packets as segment data into new outgoing multi-link PPP packets, which I refer to as "multi-multi-link" PPP packets. Each multi-multi-link PPP packet produced at that level has a separate predefined PPP header, a multi-link protocol header appropriate to that level (forming what I refer to as a "multi-multi-link" header), an incoming multi-link packet as segment data, and a corresponding frame check sequence field.

In particular, as shown in FIG. **6**C, for apparatus **600**, each multi-link PPP packet produced by an application executing at client PC is depicted as packet **680**, and has the general format discussed above in conjunction with FIG. **5**. In that regard, a PPP frame produced by the client application executing at client PC **610** is segmented and sequenced by the multi-link protocol executing within the PC with a particular frame segment, here segment **506**, being encapsulated with PPP header **503**, multi-link protocol header **505** and frame check sequence (FCS) **507** to form packet **680**. Within packet **680**, the multi-link protocol header contains an assigned sequence number for the encapsulated frame segment. Each such multi-link packet **680** incident upon a given terminal adapter, e.g. adapter 620_1, is itself then encapsulated, as symbolized by brace and arrow **683**, as segment data **694**, and sequenced by that terminal adapter into an outgoing multi-link packet, i.e., "multi-multi-link" packet **685**. The latter packet also contains PPP header **503**, which is the same for both multi-link and multi-multi-link PPP packets; multi-multi-link header **692**, and PPP FCS field **696**. Multi-multi-link header **692**, has an identical format as that of header **505**, but contains beginning and ending (B and E) flags and a sequence number pertinent to the segment data contained within packet **685**. FCS field **696** serves the same function and is identical in format to FCS field **507** but has a value associated with the contents of: PPP link layer header **503**, protocol and sequence number fields in header **692** and segment data **694**. Should terminal adapters **620** feed another level of multi-link PPP devices (which is not the case in FIG. **6**A), then each multi-multi-link packet **685** incoming to any terminal adapter at this level would itself be encapsulated in its entirety, as symbolized by brace and arrow **688**, by that particular terminal adapter into an outgoing multi-multi-link packet, and so on for each additional level of hierarchically related multi-link PPP devices. Furthermore, since some of the fields and their values in each outgoing multi-multi-link packet generated by a terminal adapter will be common to the corresponding fields and their values, respectively, in the incoming multi-link PPP packets applied thereto, such as, e.g., PPP header **503** and protocol field **525**, these fields can simply be reused and not duplicated in the multi-multi-link PPP packets, thereby reducing packet size and conserving transmission bandwidth.

Advantageously, through use of my invention, an incoming PPP frame formed of multi-link PPP packets can be simultaneously transmitted through several high speed communication devices—whether hierarchically organized or not, each having one incoming link and several outgoing links, thereby providing significantly higher transmission bandwidths than heretofore possible with such packets.

FIG. **7** depicts a high-level flowchart of my inventive Multi-multi-link PPP process **700** that is performed by apparatus **600** shown in FIG. **6**.

As shown, process **700** begins with step **710** wherein, e.g., a client application executing at PC **610** initiates a multi-link PPP ISDN call through these adapters to a remote site. Once this occurs, step **720** occurs through which each of near-end terminal adapters **620** takes the endpoint discriminator value (the contents of both class field **430** and address field **440** shown in FIG. **4**) sent by the client PC as part of an LCP Multi-link Endpoint Discriminator Option packet as its own endpoint discriminator and agrees to perform multi-link PPP via links **615**. Thereafter, this particular terminal adapter then negotiates with its far-end PPP peer, i.e., one of far-end terminal adapters **660** to perform multi-multi-link PPP therewith. During the course of LCP negotiations therewith, the near-end terminal adapter sends its peer far-end adapter an LCP Multi-link Endpoint Discriminator Option packet containing the endpoint discriminator value of the former adapter, i.e., that associated with the client application. Once this occurs, then process **700** progresses to step **730**. At this step, each of far-end terminal adapters **660** takes the endpoint discriminator value (the contents of both class field **430** and address field **440** shown in FIG. **4**) sent by server computer **665** as part of an LCP Multi-link Endpoint Discriminator Option packet as its own endpoint discriminator. Thereafter, this particular terminal adapter then negotiates with its near-end PPP peer, i.e., one of terminal adapters **620**, and also negotiates to perform multi-link PPP with server computer **665**, via links **662**. During the course of LCP negotiations, the far-end terminal adapter sends its peer near-end adapter an LCP Multi-link Endpoint Discriminator Option packet containing the endpoint discriminator value of the former adapter, i.e., that associated with the server computer. After this occurs, step **740** occurs during which multi-link PPP operation is negotiated between the client application, executing on the PC, and the server computer. When these negotiations successfully complete, step **750** is performed to complete PPP negotiations by negotiating any remaining LCP configuration requests and appropriate network control protocols (NCPs) pertinent to the specific network layer protocols to be used between the client application and the server computer. Once these negotiations are successfully concluded, then process **700** progresses to step **760** at which the links between the near and far-end terminal adapters all enter network (data transmission) state **140** (see FIG. **1**) during which communicate packetized data can be transported between the client PC and the server computer. When all such communication subsequently terminates, either intentionally or through a fault condition (such as through, e.g., a link failure), process **700** ends.

FIG. **8** depicts a high-level flowchart of my inventive Multi-multi-link Network State process **800** that is performed by each terminal adapter, such as illustratively each of adapters **620**, shown in FIG. **6**, to handle transmission and reception of multi-multi-link PPP packets, during the network state.

As shown, process **800** contains two steps **810** and **820**, to accommodate transmission and reception of multi-multi-link PPP packets. Though these steps are shown with transmission occurring first, this is merely for purposes of illustration; either step can occur first and, as often occurs, execution can repeatedly alternate between these steps.

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During step **810**, to transmit outgoing packets, the terminal adapter accepts incoming multi-link PPP packets generated by the client application executing on the PC. The terminal adapter then encapsulates these packets, as segment data and as shown in FIG. **6**C, with, inter alia, appropriate prepended multi-link headers **692** (see FIG. **6**C) (to form multi-multi-link headers) and transmits the resulting multi-multi-link PPP packets to its far-end PPP peer.

Step **820** occurs for packet reception. During this step, the terminal adapter receives, via one of its associated B-channels, incoming multi-multi-link PPP packets. Thereafter, these incoming packets are properly buffered and ordered based on the sequence numbers contained in their multi-multi-link headers. Once this occurs, the multi-multi-link header is then stripped off each such buffered packet, with the multi-link PPP packets contained in the segment data being sent to the client application executing at PC **610**. When packet transmission concludes, i.e., the network stage terminates, process **800** ends.

Though the inventive apparatus has been shown and described in detail with only one hierarchical level of multi-link PPP communication devices, each with one incoming link and several outgoing links, at both the client and server sites, those skilled in the art can readily expand this apparatus to accommodate substantially any number and hierarchical organization of levels of multi-link PPP communication devices in order to demultiplex multi-link PPP packets across an increased number of physical links in a pipe connecting two disparate locations. Hence, through the present invention, a link in an original multi-link bundle and carrying multi-link PPP packets can itself be effectively divided (demultiplexed) into substantially any number of different paths with these paths being remotely and correctly recombined (multiplexed) so as to appear to be a link of the original multi-link bundle.

Furthermore, if all multi-link PPP links in a bundle have same data transmission rate such as two B-channels in an ISDN line, then each terminal adapter can simply send its incoming multi-link PPP packets as outgoing multi-link PPP packets on alternating B-channels without the need to encapsulate these packets with multi-multi-link protocol headers. If more than two such links exist in a bundle, then such outgoing packets can be distributed through a predefined sequential ordering among these links with its peer terminal adapter ordering its incoming packets from those links on that same sequential basis. In this instance, both the near- and far-end terminal adapters would need to be synchronized, which could be accomplished during multi-link PPP negotiations, such that both adapters would start with the same link and progress through all the links connected thereto at the same rate and in the same order. However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used.

Although a single embodiment which incorporates the teachings of my present invention has been shown and described in detail herein, those skilled in the art can readily devise many other embodiments that still utilize these teachings.

I claim:

1. A method for use in communicating multi-link PPP packets from a multi-link originator through a plurality of communications devices onto multiple outgoing links, each of the devices having one incoming link and a plurality of the outgoing links, the incoming links for all of said devices defining a bundle of first links, wherein the originator is connected to each different one of the devices through a different corresponding link in said first links, with all of the outgoing links from all of the devices forming a bundle of second links, wherein the method comprises the steps of:

in the originator:

transmitting to each different one of the devices over a different corresponding one of the first links and during a configuration phase of a point-to-point (PPP) protocol for said corresponding one first link, a first packet containing an endpoint value which specifies an address that identifies the originator to said one device; and

in said each different one device:

receiving the first packet transmitted by the originator;

assigning the endpoint value in the first packet to be the endpoint value of said one device; and

transmitting, over a corresponding one of the second links, connected at one end thereof to said one device, to a PPP peer situated at an opposite end of said one of the second links, and during a configuration phase of a PPP protocol for said one of the second links, a second packet containing the endpoint value of said one device wherein said one of said second links connects said one device and said PPP peer, whereby the originator and all of the communication devices have a common endpoint value.

2. The method in claim **1** further comprising the steps of, in the different one device:

performing multi-link negotiations with the originator; and

sequencing outgoing multi-link packets for transport over the plurality of second links connected to the different one device.

3. The method in claim **2** wherein the sequencing step comprises the step of either:

applying individual ones of the incoming multi-link packets as outgoing multi-link packets, in a predefined fashion, to corresponding ones of the outgoing links connected to the different one device; or

forming and transmitting multi-multi-link packets comprising the steps of:

encapsulating each of the incoming multi-link packets with at least an associated sequence number to form a corresponding multi-multi-link packet; and

transmitting the corresponding multi-multi-link packet to the PPP peer over the bundle of the second links.

4. The method in claim **3** wherein the applying step comprises the step of applying each individual one of the incoming multi-link packets to successive ones of the outgoing links such that the incoming packets are distributed amongst the outgoing links, connected to the different one device, in a round-robin fashion.

5. The method in claim **3** wherein the second packet transmitting step comprises the step of sending the second packet over each of the second links connected to said one corresponding device.

6. The method in claim **5** wherein each of the communication devices is an integrated services digital network (ISDN) terminal adapter and each of the second links is an ISDN bearer (B) channel.

7. The method in claim **6** wherein the endpoint value is a link control protocol (LCP) endpoint discriminator value, the endpoint discriminator value having a unique address value assigned to the originator.

8. The method in claim 7 wherein the first packet and second packet transmitting steps both occur during an LCP phase of PPP protocol negotiations between the originator and said one of the devices, and between said one of the devices and the PPP peer, respectively.

9. The method in claim 8 wherein the communication devices are organized in a hierarchy having at least first and second levels of said devices, each of the levels having a plurality of different ones of the devices, and each of the devices in the first level is connected, via a corresponding plurality of third links and at a common end thereof, to each of a plurality of the devices in the second level, situated at a opposite end of the third links, wherein the method further comprises the steps of:

in each of the devices at the second level:

a) receiving a third packet, over a corresponding one of the third links, transmitted by one of the devices at the first level and containing the endpoint value of the originator;

b) assigning the endpoint value in the third packet to be the endpoint value of said each one device in the second level; and

c) transmitting, over a corresponding one of a plurality of outgoing links, connected at one end thereof to said each one device at the second level, and at an opposite end thereof to a corresponding peer in the devices situated at a next successive level of the hierarchy and during a configuration phase of the PPP protocol for said corresponding one of the outgoing links connecting said each one device at the second level at the communications device at the next successive level, a fourth packet containing the endpoint value of said each one device at the second level; and

d) repeating steps (a), (b) and (c) within each of the devices situated at each successive level in the hierarchy, such that the originator and all the devices in the hierarchy have a common endpoint value.

10. The method in claim 5 wherein the endpoint value is a link control protocol (LCP) endpoint discriminator value, the endpoint discriminator value having a unique address value assigned to the originator.

11. The method in claim 10 wherein the first packet and second packet transmitting steps both occur during an LCP phase of PPP protocol negotiations between the originator and said one of the devices, and between said one of the devices and the PPP peer, respectively.

12. The method in claim 11 wherein the communication devices are organized in a hierarchy having at least first and second levels of said devices, each of the levels having a plurality of different ones of the devices, and each of the devices in the first level is connected, via a corresponding plurality of third links and at a common end thereof, to each of a plurality of the devices in the second level, situated at a opposite end of the third links, wherein the method further comprises the steps of:

in each of the devices at the second level:

a) receiving a third packet, over a corresponding one of the third links, transmitted by one of the devices at the first level and containing the endpoint value of the originator;

b) assigning the endpoint value in the third packet to be the endpoint value of said each one device in the second level; and

c) transmitting, over a corresponding one of a plurality of outgoing links, connected at one end thereof to said each one device at the second level, and at an opposite end thereof to a corresponding peer in the devices situated at a next successive level of the hierarchy and during a configuration phase of the PPP protocol for said corresponding one of the outgoing links connecting said each one device at the second level at the communications device at the next successive level, a fourth packet containing the endpoint value of said each one device at the second level; and

d) repeating steps (a), (b) and (c) within each of the devices situated at each successive level in the hierarchy, such that the originator and all the devices in the hierarchy have a common endpoint value.

13. Apparatus having a plurality of communication devices for communicating multi-link PPP packets from a multi-link originator through the devices onto multiple outgoing links, each of the devices having one incoming link and a plurality of the outgoing links, the incoming links for all of said devices defining a bundle of first links, wherein the originator is connected to each different one of the devices through a different corresponding link in said first links, with all of the outgoing links from all of the devices forming a bundle of second links, wherein the apparatus comprises, in each of the devices:

a processor; and

a memory connected to the processor and having executable instructions stored therein; and

wherein the processor, in response to the stored instructions:

receives a first packet transmitted by the originator over a different corresponding one of the first links and during a configuration phase of a point-to-point (PPP) protocol for said corresponding one first link, the first packet containing an endpoint value which specifies an address that identifies the originator to said one device;

assigns the endpoint value in the first packet to be the endpoint value of said one device; and

transmits, over a corresponding one of the second links, connected at one end thereof to said one device, to a PPP peer situated at an opposite end of said one of the second links, and during a configuration phase of a PPP protocol for said one of the second links, a second packet containing the endpoint value of said one device wherein said one of said second links connects said one device and said PPP peer, whereby the originator and all of the communication devices have a common endpoint value.

14. The apparatus in claim 13 wherein the processor, in response to the stored instructions:

performs multi-link negotiations with the originator; and

sequences outgoing multi-link packets for transport over the plurality of second links connected to the different one device.

15. The apparatus in claim 14 wherein the processor, in response to the stored instructions either:

applies individual ones of the incoming multi-link packets as outgoing multi-link packets, in a predefined fashion, to corresponding ones of the outgoing links connected to the different one device; or

encapsulates each of the incoming multi-link packets with at least an associated sequence number to form a corresponding multi-multi-link packet; and

transmits the corresponding multi-multi-link packet to the PPP peer over the bundle of the second links.

16. The apparatus in claim 15 wherein the processor, in response to the stored instructions, applies each individual

one of the incoming multi-link packets to successive ones of the outgoing links such that the incoming packets are distributed amongst the outgoing links, connected to the different one device, in a round-robin fashion.

17. The apparatus in claim **15** wherein the processor, in response to the stored instructions, sends the second packet over each of the second links connected to said one corresponding device.

18. The apparatus in claim **17** wherein each of the communication devices is an integrated services digital network (ISDN) terminal adapter and each of the second links is an ISDN bearer (B) channel.

19. The apparatus in claim **18** wherein the endpoint value is a link control protocol (LCP) endpoint discriminator value, the endpoint discriminator value having a unique address value assigned to the originator.

20. The apparatus in claim **19** wherein the processor, in response to the stored instructions, receives the first packet and transmits the second packet during an LCP phase of PPP protocol negotiations between the originator and said one of the devices, and between said one of the devices and the PPP peer, respectively.

21. The apparatus in claim **20** wherein the communication devices are organized in a hierarchy having at least first and second levels of said devices, each of the levels having a plurality of different ones of the devices, and each of the devices in the first level is connected, via a corresponding plurality of third links and at a common end thereof, to each of a plurality of the devices in the second level, situated at a opposite end of the third links, wherein, in each of the devices in the second level, the processor situated therein, in response to the instructions stored in the memory therein:

receives a third packet, over a corresponding one of the third links, transmitted by one of the devices at the first level and containing the endpoint value of the originator;

assigns the endpoint value in the third packet to be the endpoint value of said each one device in the second level; and

transmits, over a corresponding one of a plurality of outgoing links, connected at one end thereof to said each one device at the second level, and at an opposite end thereof to a corresponding peer in the devices situated at a next successive level of the hierarchy and during a configuration phase of the PPP protocol for said corresponding one of the outgoing links connecting said each one device at the second level at the communications device at the next successive level, a fourth packet containing the endpoint value of said each one device at the second level.

22. The apparatus in claim **17** wherein the endpoint value is a link control protocol (LCP) endpoint discriminator value, the endpoint discriminator value having a unique address value assigned to the originator.

23. The apparatus in claim **22** wherein the processor, in response to the stored instructions, receives the first packet and transmits the second packet during an LCP phase of PPP protocol negotiations between the originator and said one of the devices, and between said one of the devices and the PPP peer, respectively.

24. The apparatus in claim **23** wherein the communication devices are organized in a hierarchy having at least first and second levels of said devices, each of the levels having a plurality of different ones of the devices, and each of the devices in the first level is connected, via a corresponding plurality of third links and at a common end thereof, to each of a plurality of the devices in the second level, situated at a opposite end of the third links, wherein, in each of the devices in the second level, the processor situated therein, in response to the instructions stored in the memory therein:

receives a third packet, over a corresponding one of the third links, transmitted by one of the devices at the first level and containing the endpoint value of the originator;

assigns the endpoint value in the third packet to be the endpoint value of said each one device in the second level; and

transmits, over a corresponding one of a plurality of outgoing links, connected at one end thereof to said each one device at the second level, and at an opposite end thereof to a corresponding peer in the devices situated at a next successive level of the hierarchy and during a configuration phase of the PPP protocol for said corresponding one of the outgoing links connecting said each one device at the second level at the communications device at the next successive level, a fourth packet containing the endpoint value of said each one device at the second level.

25. A method for use in a communications device having one incoming link and a plurality of outgoing links for communicating incoming multi-link PPP packets onto the outgoing links comprising the steps of:

receiving a first packet on the incoming link and during a configuration phase of a point-to-point (PPP) protocol for the incoming link, the first packet containing an endpoint value which specifies an address that identifies a multi-link originator to the device;

assigning the endpoint value in the first packet to be the endpoint value of the device; and

transmitting, over one of the outgoing links and during a configuration phase of a PPP protocol for said one outgoing link, a second packet containing the endpoint value of the device whereby the originator and the device have a common endpoint value.

26. The method in claim **25** further comprising the steps of:

performing multi-link negotiations with the originator; and

sequencing outgoing multi-link packets for transport over the plurality of second links connected to the different one device.

27. The method in claim **26** wherein the sequencing step comprises the step of either:

applying individual ones of the incoming multi-link packets as outgoing multi-link packets, in a predefined fashion, to corresponding ones of the outgoing links; or

forming and transmitting multi-multi-link packets comprising the steps of:

encapsulating each of the incoming multi-link packets with at least an associated sequence number to form a corresponding multi-multi-link packet; and

transmitting the corresponding multi-multi-link packet to the PPP peer over the outgoing links.

28. The method in claim **27** wherein the applying step comprises the step of applying each individual one of the incoming multi-link packets to successive ones of the outgoing links such that the incoming packets are distributed amongst the outgoing links in a round-robin fashion.

29. The method in claim **27** wherein the second packet transmitting step comprises the step of sending the second packet over each of the outgoing links.

30. The method in claim **29** wherein the device is an integrated services digital network (ISDN) terminal adapter and each of the outgoing links is an ISDN bearer (B) channel.

31. The method in claim 30 wherein the endpoint value is a link control protocol (LCP) endpoint discriminator value, the endpoint discriminator value having a unique address value assigned to the originator.

32. The method in claim 31 wherein the first packet and second packet transmitting steps both occur during an LCP phase of PPP protocol negotiations between the originator and the device, and between the device and a PPP peer connected thereto, respectively.

33. The method in claim 29 wherein the endpoint value is a link control protocol (LCP) endpoint discriminator value, the endpoint discriminator value having a unique address value assigned to the originator.

34. The method in claim 33 wherein the first packet and second packet transmitting steps both occur during an LCP phase of PPP protocol negotiations between the originator and the device, and between the device and a PPP peer connected thereto, respectively.

35. Apparatus for a communications device having one incoming link and a plurality of outgoing links for communicating incoming multi-link PPP packets onto the outgoing links comprising:

a processor; and

a memory connected to the processor and having executable instructions stored therein;

wherein the processor, in response to the stored instructions:

receives a first packet on the incoming link and during a configuration phase of a point-to-point (PPP) protocol for the incoming link, the first packet containing an endpoint value which specifies an address that identifies a multi-link originator to the device;

assigns the endpoint value in the first packet to be the endpoint value of the device; and

transmits, over one of the outgoing links and during a configuration phase of a PPP protocol for said one outgoing link, a second packet containing the endpoint value of the device whereby the originator and the device have a common endpoint value.

36. The apparatus in claim 35 wherein the processor, in response to the stored instructions:

performs multi-link negotiations with the originator; and

sequences outgoing multi-link packets for transport over the plurality of second links connected to the different one device.

37. The apparatus in claim 36 wherein the processor, in response to the stored instructions either:

applying individual ones of the incoming multi-link packets as outgoing multi-link packets, in a predefined fashion, to corresponding ones of the outgoing links; or

encapsulates each of the incoming multi-link packets with at least an associated sequence number to form a corresponding multi-multi-link packet; and

transmits the corresponding multi-multi-link packet to the PPP peer over the outgoing links.

38. The apparatus in claim 37 wherein the processor, in response to the stored instructions, applies each individual one of the incoming multi-link packets to successive ones of the outgoing links such that the incoming packets are distributed amongst the outgoing links in a round-robin fashion.

39. The apparatus in claim 37 wherein the processor, in response to the stored instructions, sends the second packet over each of the outgoing links.

40. The apparatus in claim 39 wherein the device is an integrated services digital network (ISDN) terminal adapter and each of the outgoing links is an ISDN bearer (B) channel.

41. The apparatus in claim 40 wherein the endpoint value is a link control protocol (LCP) endpoint discriminator value, the endpoint discriminator value having a unique address value assigned to the originator.

42. The apparatus in claim 41 wherein the processor, in response to the stored instructions, receives the first packet and transmits the second packet during an LCP phase of PPP protocol negotiations between the originator and the device, and between the device and a PPP peer connected thereto, respectively.

43. The apparatus in claim 39 wherein the endpoint value is a link control protocol (LCP) endpoint discriminator value, the endpoint discriminator value having a unique address value assigned to the originator.

44. The apparatus in claim 43 wherein the processor, in response to the stored instructions, receives the first packet and transmits the second packet during an LCP phase of PPP protocol negotiations between the originator and the device, and between the device and a PPP peer connected thereto, respectively.

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(71) **Applicant** *(for all designated States except US)*: HEWLETT-PACKARD COMPANY [US/US]; 3000 Hanover Street, Palo Alto, CA 94304 (US).

(72) **Inventors; and**
(75) **Inventors/Applicants** *(for US only)*: LOW, Colin [GB/GB]; 19 Parklands, Wootton-under-Edge, Gloucestershire GL12 7LT (GB). SEABORNE, Andrew, Franklin [GB/GB]; 1 Shipley Road, Bristol BS9 3HR (GB). BOUTHORS, Nicolas [GB/GB]; 16, le Roupoir, Les Bealires, F-38240 Meylan (FR).

(74) **Agent:** YENNADHIOU, Peter; Hewlett-Packard Limited, Intellectual Property Section, Building 2, Filton Road, Stoke Gifford, Bristol BS12 6QZ (GB).

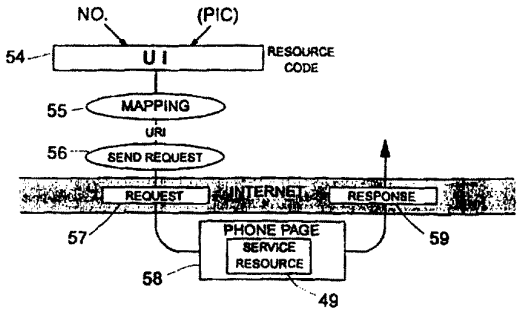
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(54) **Title:** METHOD OF ACCESSING SERVICE RESOURCE ITEMS THAT ARE FOR USE IN A TELECOMMUNICATIONS SYSTEM

(57) **Abstract**

Service resource items (49) for use in call setup in a telephone system are held on servers (58) that are connected to a computer network which is logically distinct from the telephone system infrastructure; this computer network may, for example, make use of the Internet. Each service resource item (49) is locatable on the network at a corresponding URI and is associated with a particular telephone number. A mapping is provided between telephone numbers and the URIs of associated service resource items. When it is desired to access a service resource item (49) associated with a particular telephone number, this mapping is used to retrieve the corresponding URI (step 55) which is then used to access the desired service resource item (56, 57, 59).



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METHOD OF ACCESSING SERVICE RESOURCE ITEMS THAT ARE FOR USE IN A TELECOMMUNICATIONS SYSTEM

Field of the Invention

The present invention relates to a method of accessing service resource items that are intended to be used in setting up bearer channels through a switched telecommunications system.

As used herein, the term "switched telecommunication system" means a system comprising a bearer network with switches for setting up a bearer channel through the network. The term "switched telecommunication system" is to be taken to include not only the existing public and private telephone systems (whether using analogue phones or ISDN-based), but also broadband (ATM) and other switch-based bearer networks that are currently being implemented or may emerge in the future. For convenience, the term "switched telecommunication system" is sometimes shortened herein to telecommunication system.

Reference to a "call" in the context of a switched telecommunication system is to be understood as meaning a communication through a bearer channel set up across the bearer network, whilst references to call setup, maintenance and takedown are to be taken to mean the processes of setting up, maintaining and taking down a bearer channel through the bearer network. Terms such as "call processing" and "call handling" are to be similarly interpreted.

The term "communication system" when used herein should be understood as having a broader meaning than switched telecommunication system, and is intended to include datagram-based communication systems where each data packet is independently routed through a bearer network without following a predetermined bearer channel.

Background of the Invention

Telecommunication companies running PSTNs (Public Switched Telephone Networks) and PLMNs (Public Land Mobile Networks) are in the business of providing communication services and in doing so are providing increasing built-in intelligence in the form of "IN services" such as 800 number services and call forwarding. In contrast, the World Wide Web (WWW), which has seen explosive growth in recent times, is an example of an Internet-based global network providing complex information services. These two worlds, that of the large communications utilities and that of the highly dynamic, pioneer-spirit WWW information culture, are uneasy companions and each plans to encroach on the domain previously occupied by the others; thus telephony services will be offered over the WWW and information services over the public communication infrastructure.

The present invention proposes technologies for a more synergetic relationship between these two worlds than is currently envisaged and in order to place the present invention in context, a review will first be given of each of these two worlds.

Telephone Networks with IN Services

The Basic PSTN. The basic service provided by a PSTN (Public Switched Telephone Network) is the interconnection of two telephones (that is, setting up a bearer channel between the telephones) according to a called-party telephone number input at the calling-party telephone. Figure 1 is a simplified representation of a PSTN providing such a service. In particular, customer premises equipment, CPE, 10 (such as standard analogue telephones, but also more recently ISDN terminals) are connected through an access network 11 to switching points, SPs 12. The SPs 12 form nodes in an int exchange network 13 made up of interconnecting trunks 14 and SPs that are controlled by control entities 15 in the SPs. The control effected by the control entities 15 is determined by signalling inputs received from the CPEs and other SPs, and involves call setup, maintenance and clearance to provide the desired bearer channel between calling CPE and called CPE. Conceptually, the PSTN may be thought of as a bearer

network and a control (signalling) network, the function of the latter being to effect call control through the bearer network, namely the control of setup, maintenance and take down of bearer channels through the bearer network; in practice, the bearer and signalling networks may use the same physical circuits and even the same logical channels.

Thus, where the CPE is a traditional dumb telephone, control signalling between the CPE and its local SP is in-band signalling, that is, the signalling is carried on the same channel as used for voice; this signalling is interpreted and converted at the SPs 12 into signalling between SPs that uses a dedicated common-channel signalling network 16 (implemented nowadays using the SS7 protocol suite). Where the CPE is an ISDN terminal, signalling is carried in a separate channel directly from the CPE on an end-to-end. Modern SPs use the ISUP (ISDN User Part) SS7 protocol for inter-exchange call control signalling whether the CPE is a standard telephone or an ISDN terminal.

Telephone Numbering Plans - As certain aspects of the present invention are influenced by the structuring of telephone numbers, a brief description will now be given of the structuring of such numbers. Telephone numbers form an international, hierarchical addressing scheme based on groups of decimal digits. The top level of the hierarchy is administered by the ITU-T, which has allocated single-digit numeric codes to the major geographic zones (for example "1" for North America, "2" for Africa, "3" for Europe, "4" for Europe, "5" for South America and Cuba, etc.). Within each zone countries are assigned 2 or 3 digit codes, so that within zone 3 France is "33", and within zone 4 the UK is "44". Administration of the numbering plan within a country is delegated to a national body, such as the Office of Telecommunications ("Oftel") in the UK. The following further description is based on the UK numbering plan, but the scheme described will be recognised as having widespread applicability.

In the UK all national numbers are prefixed by a code from 01 to 09 (the '0' prefix is dropped in international dialling). The currently assigned codes are "01" for Geographic Area Codes, "02" for Additional Geographic Area Codes, "04" for Mobile Services, "07" for Personal Numbers, and "08" for Special Service (freephone,

information). Normal wireline PSTN subscriber telephone numbers are allocated from the Geographic Area Code codes, and currently only codes prefixed by 01 are allocated. Geographic area codes are presently 3 or 4 digits (excluding the leading '0') and there are currently 638 geographic areas each with its own code. A full national UK dialled number takes two forms:

0	**171**	**634 8700**
	area code	local number (7 digit)
0	**1447**	**456 987**
	area code	local number (6 digit)

The first case has the '0' prefix, a 3 digit area code and a 7 digit local number, and the second case has the '0' prefix, a 4 digit area code, and a 6 digit local number. Further interpretation of the local number will take place within the area exchange, as even a 6 digit address space is too large for a single switch, and for a typical local area several switches may be needed to host the required number of subscriber lines. This interpretation is opaque and is a matter for the area service provider.

In the current PSTN the inherently hierarchical and geographic interpretation of telephone numbers is mirrored by the physical architecture of the network. A telephone number is structured in a way that makes it easy to route a call through the network. At each step, the prefix of the number provides information about the current routing step, and the suffix (perhaps opaquely) provides information about subsequent routing steps; as long as a switch knows how to parse a prefix and carry out a routing step, it does not need to understand the content of the suffix, which is left for subsequent routing steps. For this reason the international and national switching fabric is also organised hierarchically.

Intelligent Networks. Returning now to a consideration of the current telephone network infrastruture, in addition to basic call handling, an SP may also serve to provide what are called IN (Intelligent Network) services; in this case the SP is termed a service switching point, SSP. An SSP 25 is arranged to suspend call processing at defined points-in-call upon particular criteria being met, and to delegate the continuation of call processing to a service control subsystem providing a service

control function (SCF) either in the form of a service control point, SCP 17 (see Figure 2) or an Adjunct 18. The Adjunct 18 is directly associated with an SSP 25 whilst the SCP 17 and SSP 25 communicate with each other via an extended common channel signalling (CCS) network 16 that may include signal transfer points (STP) 19. The SCP 17 may be associated with more than one SSP 25. Both the SCP 17 and Adjunct 18 provide a service logic execution environment (SLEE) 20 in which instances of one or more service logic programs (SLP) 21 can execute. The SLEE 20 and SLP 21 together provide service control functionality for providing services to the SSP 25.

Service logic running in an SCP or Adjunct will generally make use of subscriber information stored in a service data function (SDF) 22 that may be integral with the SCP/Adjunct or partially or wholly separate therefrom. The service data function (SDF), like the service control function (SCF) forms part of the service control subsystem of the PSTN. It may be noted that some or all of the service control function may be built into the PSTN switches themselves.

In addition to the SCP 17 and Adjunct 18, the Figure 2 network includes an intelligent peripheral (IP) 23. The IP 23 provides resources to the SSP 25 such as voice announcements and DTMF digit collection capabilities. The network will also include an operation system (not shown) that has a general view of the network and its services and performs functions such as network monitoring and control.

In operation, when the SSP 25 receives a call, it examines internal trigger conditions and, possibly, user information (eg dialled digits) to ascertain if the call requires a service to be provided by the service control subsystem 17, 18; the checking of trigger conditions may be carried out at several different points in call processing. Where the SSP 25 determines that a service is required it messages the service control subsystem (either SCP 17 or Adjunct 18) requesting the desired service and sending it a logic representation of the call in terms of its connectivity and call processing status. The service control subsystem then provides the requested service and this may involve either a single interaction between the SSP and service control subsystem or a session of interactions. A typical service is call forwarding which is a called-party service

giving expression to an end-user requirement as simple as "if you call me on number X and it rings ten times, try calling number Y". In this case, it is the SSP local to the called end-user that triggers its associated SCP (or Adjunct) to provide this service; it will, of course, be appreciated that the SSP must be primed to know that the service is to be provided for a called number X.

The above-described model for the provision of IN services in a PSTN can also be mapped onto PLMNs (Public Land Mobile Networks) such as GSM and other mobile networks. Control signalling in the case of a mobile subscriber is more complex because in addition to all the usual signalling requirements, there is also a need to establish where a call to a mobile subscriber should be routed; however, this is not a very different problem from a number of called-party IN services in the PSTN. Thus in GSM, the service data function (SDF) is largely located in a system named a Home Location Register (HLR) and the service control function in a system named a Visitor Location Register (VLR) that is generally associated on a one-to-one basis with each SSP (which in GSM terminology is called a Mobile Switching Centre, MSC).

Because subscribers are mobile, the subscriber profile is transported from the HLR to whichever VLR happens to be functionally closest to be mobile subscriber, and from there the VLR operates the (fixed) service using the subscriber profile and interacts with the SSP. The HLR and VLR thus constitute a service control subsystem similar to an SCP or Adjunct with their associated databases.

It is, of course, also possible to provide IN services in private telephone systems and, in this case, the service control function and service data function are generally either integrated into a PABX (Private Automatic Branch Exchange) or provided by a local computer. The service control subsystem, whilst present, may thus not be a physically distinct from the PABX.

The above-described general architectural framework for providing IN services has both strengths and flaws. Its main strength is that it works and many services have been successfully deployed, such as 800 number services, credit card calling,

voicemail, and various call waiting and redirection services. However, despite years of standardisation, services are still implemented one-at-a-time on proprietary platforms and do not scale well. The approach has been based on large, fault-tolerant systems which provide services for hundreds of thousands or even millions of subscribers and take years to deploy. Furthermore, since the networks used to support these services also constitute the basic telephone infrastructure, anything attached to these networks must be rigorously vetted. Additionally, each country and operator tends to have local variations of the so-called standards making it difficult to supply standard products and thereby braking the dynamics of competition.

The World Wide Web

In contrast to the slow deliberate progress of the telephone infrastructure, the WWW has grown explosively from its inception in 1989 to become the primary electronic information distribution service in terms of spread, availability and richness of information content. Anyone can, for a modest outlay, become an information provider with a world-wide audience in a highly interconnected information architecture.

The WWW is a client-server application running over the Internet and using a client-server protocol which mandates only the simplest of exchanges between client and server. This protocol is HTTP (Hyper Text Transfer Protocol) which is optimised for use over TCP/IP networks such as the Internet; the HTTP protocol can, however, also be used over networks using different communication protocol stacks.

Since the availability of literature concerning the WWW has seen the same sort of growth as the WWW itself, a detailed description of the WWW, HTTP and the Internet will not be given herein. An outline description will, however, be given with attention being paid to certain features of relevance to the present invention.

The WWW uses the Internet for interconnectivity. Internet is a system that connects together networks on a worldwide basis. Internet is based on the TCP/IP protocol suite and provides connectivity to networks that also use TCP/IP. For an entity to have a presence on the Internet, it needs both access to a network connected to the Internet

and an IP address. IP addresses are hierarchically structured. Generally an entity will be identified at the user level by a name that can be resolved into the corresponding IP address by the Domain Name System (DNS) of the Internet. Because the DNS or adaptions of it are fundamental to at least certain embodiments of the invention described hereinafter, a description will next be given of the general form and operation of the DNS.

The Domain Name System - The DNS is a global, distributed, database, and without its performance, resilience and scalability much of the Internet would not exist in its current form. The DNS, in response to a client request, serves to associate an Internet host domain name with one or more Registration Records (RR) of differing types, the most common being an address (A) record (such as 15.144.8.69) and mail exchanger (MX) records (used to identify a domain host configured to accept electronic mail for a domain). The RRs are distributed across DNS name servers world-wide, these servers cooperating to provide the domain name translation service; no single DNS server contains more than a small part of the global database, but each server knows how to locate DNS servers which are "closer" to the data than it is. For present purposes, the main characteristics of the DNS of interest are:

-- The host name space is organised as a tree-structured hierarchy of nodes with each host having a corresponding leaf node; each node has a label (except the root node) and each label begins with an alphabetic character and is followed by a sequence of alphabetic characters or digits. The full, or "fully qualified" name of a host is the string of node labels, each separated by a ".", from the corresponding leaf node to the root node of the hierarchy, this latter being represented by a terminating "." in the name. Thus a host machine "fred" of Hewlett-Packard Laboratories in Bristol, England will have a fully qualified domain name of "fred.hpl.hp.com." (note that if a host name does not have a terminal "." it is interpreted relative to the current node of the naming hierarchy).

-- Each host has one or more associated Registration Records (RRs).

-- There are a plurality of DNS servers each with responsibility for a subtree of the name space. A DNS server will hold RRs for all or part of its subtree - in

the latter case it delegates responsibility for the remainder of the subtree to one or more further DNS servers. A DNS server knows the address of any server to which it has delegated responsibility and also the address of the server which has given it the responsibility for the subtree it manages. The DNS servers thus point to each other in a structuring reflecting that of the naming hierarchy.

-- An application wishing to make use of the DNS does so through an associated "resolver" that knows the address of at least one DNS server. When a DNS server is asked by this resolver for an RR of a specified host, it will return either the requested RR or the address of a DNS server closer to the server holding the RR in terms of traversal of the naming hierarchy. In effect, the hierarchy of the servers is ascended until a server is reached that also has responsibility for the domain name to be resolved; thereafter, the DNS server hierarchy is descended down to the server holding the RR for the domain name to be resolved.

-- The DNS uses a predetermined message format (in fact, it is the same for query and response) and uses the IP protocols.

These characteristics of the DNS may be considered as defining a "DNS-type" system always allowing for minor variations such as in label syntax, how the labels are combined (ordering, separators), the message format details, evolutions of the IP protocols etc.

Due to the hierarchical naming structure, it is possible to delegate responsibility for administering domains (subtrees) of the name space recursively. Thus, the top-level domains are administered by InterNic (these top-level domains include the familiar 'com', 'edu', 'org', 'int', 'net', 'mil' domains as well as top-level country domains specified by standard two-letter codes such as 'us', 'uk', 'fr' etc.). At the next level, by way of example Hewlett-Packard Company is responsible for all names ending in 'hp.com' and British Universities are collectively responsible for all names ending in 'ac.uk'. Descending further, and again by way of example, administration of the domain 'hpl.hp.com' is the responsibility of Hewlett-Packard Laboratories and administration of the subtree (domain) 'newcastle.ac.uk' is the responsibility of the University of Newcastle-upon-Tyne.

Figure 3 illustrates the progress of an example query made from within Hewlett-Packard Laboratories. The host domain name to be resolved is 'xy.newcastle.ac.uk', a hypothetical machine at the University of Newcastle, United Kingdom. The query is presented to the DNS server responsible for the "hpl.hp.com" subtree. This server does not hold the requested RR and so responds with the address of the "hp.com" DNS server; this server is then queried and responds with the address of the 'com' DNS server which in turn responds with the address of the '.' (root) DNS server. The query then proceeds iteratively down the 'uk' branch until the 'newcastle.ac.uk' server responds with the RR record for the name 'xy' in its subtree.

This looks extremely inefficient, but DNS servers are designed to build a dynamic cache, and are initialised with the addresses of several root servers, so in practice most of the iterative queries never take place. In this case the 'hpl.hp.com' DNS server will know the addresses of several root servers, and will likely have the addresses of 'uk' and 'ac.uk' servers in its cache. The first query to the 'hpl.hp.com' server will return the address of the 'ac.uk' server. The second query to the 'ac.uk' server will return the address of the 'newcastle.ac.uk' server, and the third query will return the RR in question. Any future queries with a 'newcastle.ac.uk' prefix will go direct to the newcastle DNS server as that address will be retained in the "hpl.hp.com" DNS server cache. In practice names within a local subtree are resolved in a single query, and names outside the local subtree are resolved in two or three queries.

Rather than a resolver being responsible for carrying out the series of query iterations required to resolve a domain name, the resolver may specify its first query to be recursive in which case the receiving DNS server is responsible for resolving the query (if it cannot directly return the requested RR, it will itself issue a recursive query to a 'closer' DNS server, and so on).

It should also be noted that in practice each DNS server will be replicated, that is, organised as a primary and one or more secondaries. A primary DNS nameserver initialises itself from a database maintained on a local file system, while a secondary initialises itself by transferring information from a primary. A subtree will normally

have one primary nameserver and anything up to ten secondaries - the limitation tends to be the time required by the secondaries to update their databases from the primary. The primary database is the master source of subtree information and is maintained by the domain DNS administrator. The secondaries are not simply standby secondaries but each actively participates in the DNS with dependent servers that point to it rather than to the corresponding primary.

DNS implementations, such as BIND, are widely available as a standard part of most UNIX systems, and can claim to be among the most robust and widely used distributed applications in existence.

Operation of the WWW Referring now to Figure 4 of the accompanying drawings, access to the Internet 30 may be by direct connection to a network that is itself directly or indirectly connected to the Internet; such an arrangement is represented by terminal 31 in Figure 4 (this terminal may, for example, be a Unix workstation or a PC). Having a connection to the Internet of this form is known as having 'network access'. Any entity that has network access to the Internet may act as a server on the Internet provided it has sufficient associated functionality; in Figure 4, entity 32 with file store 37 acts as a server.

Many users of the WWW do not have network access to the Internet but instead access the Internet via an Internet service provider, ISP, 33 that does have network access. In this case, the user terminal 34 will generally communicate with the ISP 33 over the public telephone system using a modem and employing either SLIP (Serial Line Interface Protocol) or PPP (Point-to-Point Protocol). These protocols allow Internet packets to traverse ordinary telephone lines. Access to the Internet of this form is known as "dialup IP" access. With this access method, the user terminal 34 is temporarily allocated an IP address during each user session; however, since this IP address may differ between sessions, it is not practical for the entity 34 to act as a server.

A cornerstone of the WWW is its ability to address particular information resources by means of an Uniform Resource Identifier (URI) that will generally be either a Uniform Resource Locator (URL) that identifies a resource by location, or a Uniform Resource Name (URN) that can be resolved into an URL. By way of example, a full or "absolute" URL will comprise the following elements:

scheme - this is the access scheme to be used to access the resource of interest;

host - the Internet host domain name or IP address;

port - the host port for the (TCP) connection;

abs-path - the absolute path of the resource on the host.

In fact, the 'port' may be omitted in which case port 80 is assumed.

Figure 5 of the accompanying drawings shows an example URL for the Hewlett-Packard products welcome page. In this case, the elements are:

scheme - http

host - www.hp.com

port - omitted (port 80 assumed)

abs-path - Products.html

The HTTP protocol is based on a request/response paradigm. Referring again to Figure 4 of the drawings, given a particular URI identifying a resource 30 to be accessed, a client establishes a connection with the server 31 corresponding to the "host" element of the URI and sends a request to the server. This request includes a request method, and the "Request-URI" (which is generally just the absolute path of the resource on the server as identified by the "abs-path" element of the URI); the request may include additional data elements. The server 31 then accesses the resource 36 (here held on storage 37) and responds and this response may include an entity of a type identified by a MIME (Multipurpose Internet Mail Extensions) type also included in the response.

The two main request methods are:

GET - This method results in the retrieval of whatever information (in the form of an entity) is identified by the Request-URI. It is important to

note that if the Request-URI refers to a data-producing process, it is the produced data which is returned as the entity in the response and not the source text of the process.

POST - This method is used to request that the destination server accept the entity enclosed in the request as a new subordinate of the resource identified by the Request-URI. The POST method can be used for annotation of existing resources, providing a message to a bulletin board, providing data to a data-handling process (for example, data produced as the result of submitting a form), and extending a database through an append operation.

In summary, the GET method can be used to directly retrieve data, or to trigger any process that will return an entity (which may either be data or a simply an indication of the result of running the process). The POST method is used for registering data and specifying this method is also effective to trigger a process in the server to handle the posted data appropriately.

The passing of information to a process triggered to run on a server using either the GET or POST method is currently done according to an interface called the Common Gateway Interface (CGI). The receiving process is often written in a scripting language though this is not essential. Typically, the triggered server script is used for interfacing to a database to service a query included in a GET request. Another use, already referred to, is to append data associated with a POST request to a database.

Other important factors in the success of the WWW is the use of the HyperText Markup Language (HTML) for representing the makeup of documents transferred over the WWW, and the availability of powerful graphical Web browsers, such as Netscape and Mosaic, for interpreting such documents in a client terminal to present them to a user. Basically, HTML is used to identify each part of a document, such as a title, or a graphic, and it is then up to the browser running in the client terminal to decide how to display each document part. However, HTML is more than this - it also enables a URI and a request method to be associated with any element of a document (such as a particular word or an image) so that when a user points to and clicks on that element,

the resource identified by the URI is accessed according to the scheme (protocol) and request method specified. This arrangement provides a hyperlink from one document to another. Using such hyperlinks, a user at a client terminal can skip effortlessly from one document downloaded from a server on one side of the world, to another document located on a server on the other side of the world. Since a document created by one author may include a hyperlink to a document created by another, an extremely powerful document cross-referring system results with no central bureaucratic control.

Hyperlinks are not the only intelligence that can be built into an HTML document. Another powerful feature is the ability to fill in a downloaded "Form" document on screen and then activate a 'commit' graphical button in order to have the entered information passed to a resource (such as a database) designed to collect such information. This is achieved by associating the POST request method with the 'commit' button together with the URI of the database resource; activating the 'commit' button results in the entered information being posted to the identified resource where it is appropriately handled.

Another powerful possibility is the association of program code (generally scripts to be interpreted) with particular documents elements, such as graphical buttons, this code being executed upon the button being activated. This opens up the possibility of users downloading program code from a resource and then running the code.

It will be appreciated by persons skilled in the art that HTML is only one of several currently available scripting languages delivering the functionality outlined above and it may be expected that any serious Web browser will have built-in support for multiple scripting languages. For example, Netscape 2.0 supports HTML 3.0, Java and LiveScript (the latter being Netscape proprietary scripting Language).

The importance of the role of the graphical Web browser itself should not be overlooked. As well as the ability to support multiple scripting languages, a Web browser should provide built-in support for standard media types, and the ability to

load and execute programs in the client, amongst other features. These browsers may be viewed as operating systems for WWW interaction.

WWW and the Telephone Network

It is possible to provide a telephony service over the Internet between connected terminals by digitising voice input and sending it over the Internet in discrete packets for reassembly at the receiving terminal. This is an example of a communication service on the Internet. Conversely, it is possible to point to a variety of information services provided over the telephone system, such as the Minitel system widely available in France. However, these encroachments into each anothers traditional territories pose no real threat to either the Internet or the public telephone system.

Of more interest are areas of cooperative use of the Internet and the telephone system. In fact, one such area has existed for some considerable time and has been outlined above with reference to Figure 4, namely the use of a modem link over the PSTN from a user computer 34 to an Internet service provider 33 in order to obtain dialup IP access to the Internet. This cooperative use is of a very simple nature, namely the setting up of a bearer channel over the PSTN for subsequently generated Internet traffic; there is no true interaction between the Internet and the PSTN.

Another known example of the cooperative use of the Internet and PSTN is a recently launched service by which an Internet user with a sound card in his/her terminal computer can make a voice call to a standard telephone anywhere in the world. This is achieved by transferring digitised voice over the Internet to a service provider near the destination telephone; this service provider then connects into the local PSTN to access the desired phone and transfers across into the local PSTN the voice traffic received over the Internet. Voice input from the called telephone is handled in the reverse manner. Key to this service is the ability to identify the service provider local (in telephony charging terms) to the destination phone. This arrangement, whilst offering the prospect of competition for the telecom operators for long distance calls, is again a simple chaining together of the Internet and PSTN. It may, however, be noted that in this case it is necessary to provide at least a minimum of feedback to the

Internet calling party on the progress of call set to the destination telephone over the PSTN local to that telephone; this feedback need only be in terms of whether or not the call has succeeded.

From the foregoing it can be seen that the current cooperative use of the Internet and telephone system is at a very simple level.

It is an object of the present invention to provide a method of accessing a service resource item over a communications network that facilitates the integration of the PSTN and the WWW.

Summary of the Invention

According to the present invention, there is provided a method of accessing service resource items for use in respect of setting up bearer channels through a switched telecommunications system, the method including the steps of:

(a) -- provisioning at least one server connected to a computer network with a plurality of service resource items that are thereafter locatable on said computer network by corresponding known URIs, said computer network being logically distinct from the telecommunications system, and said service resource items relating to setup control for bearer channels through said telecommunications system with each said service resource item being associated with a respective predetermined code, said predetermined codes being distinct from said URIs and identifying end-point entities for said bearer channels;

(b) -- providing a mapping between each said predetermined code and the said known URI of the service resource item associated with that predetermined code; and

(c) -- utilising a said predetermined code to access a corresponding said service resource item by using said mapping to determine the URI corresponding to that resource item and then using this URI to access the service resource item over said computer network.

In one embodiment, at least some of the URIs are derivable from their corresponding said predetermined codes by manipulation according to a function specified by said

mapping. In another embodiment, at least some of the URIs are derivable from their corresponding said predetermined codes by look up in an association table associating said predetermined codes and URIs according to said mapping. This association table can advantageously be held on at least one database server connected to the computer network, step (c) involving accessing the database server over the computer network to determine the URI corresponding to the said predetermined code. Preferably, the said at least one database server is provided by a DNS-type distributed database system in which the URIs are held in records associated with respective names, herein referred to as domain names, by which the records can be retrieved. In this case, step (c) involves translating said predetermined code into a corresponding domain name and using this domain name to retrieve the URI of the required service resource item from the DNS-type distributed database system.

More than one service resource item can be located at the same URI; in this case, the predetermined codes of these service resource items will include respective relative-resource-identifier values that can be used at the server holding the service resource items to identify the required resource item amongst the service resource items at the same URI.

The telecommunications system may be a telephone system with each said predetermined code being either the telephone number of the calling party or the telephone number of the called party (these numbers may either be the numbers of specific telephones, or personal numbers). In one preferred embodiment where at least some of said predetermined codes are called-party telephone numbers, the corresponding service resource items are the current telephone numbers of the called parties.

Generally as regards the nature of the service resources, these may be of the following type:

-- service logic intended to be executed by the corresponding server upon being accessed with the result of this execution being returned to the accessing entity;

-- downloadable service data which upon being accessed is intended to be downloaded to the accessing entity;

-- downloadable service logic which upon being accessed is intended to be downloaded to the accessing entity for execution thereby.

Preferably, where URIs are referred to in the foregoing, these URIs are URLs and/or URNs. Furthermore, the servers referred to are preferably HTTP servers.

It is to be understood that reference in the foregoing to the computer network being logically distinct from the telecommunications system is not to be taken to imply that there is physical separation of the two - indeed, there will frequently be joint use of the same physical infrastructure. Furthermore, not only may bearer channels set up in the telecommunications system share the same transmission medium as the computer network, but such a bearer channel may act as a pipe for traffic across the computer network. The intention of requiring the computer network to be logically distinct from the telecommunications system is to exclude computer networks that are dedicated to the management or monitoring of the bearer network and effectively form part of the telecommunications system itself.

Preferably, the computer network is generally accessible to users of the telecommunications system as this provides a number of benefits to users that will become apparent hereinafter. The phrase "generally accessible" should not be construed as meaning that all users of the telecommunications system have such access to the computer network or can get such access but, rather, it should be understood as meaning that a significant proportion of these users have or can obtain access to the computer network.

By way of example, in one preferred embodiment of the invention, the computer network generally accessible to users of the telecommunications system but logically distinct from it, is the Internet and the telecommunications system is a public telephone system. In another embodiment, the telecommunication system is a private system including a PABX, and the computer network is a LAN.

Brief Description of the Drawings

Embodiments of the present invention will now be described, by way of non-limiting example, with reference to the accompanying diagrammatic drawings, in which:

.**Figure 1** is a simplified diagram of a standard PSTN;

.**Figure 2** is a simplified diagram of a known PSTN with IN service capability;

.**Figure 3** is a diagram illustrating host domain name resolution by the DNS of the Internet;

.**Figure 4** is a diagram illustrating the functioning of the World Wide Web;

.**Figure 5** is a diagram illustrating the format of a standard URL;

.**Figure 6** is a diagram of a first arrangement in which service resource items are held on HTTP servers accessible both by the service control subsystem of a PSTN and by Web users;

.**Figure 7** is a diagram illustrating the processing of a service request by the SCP of Figure 6;

.**Figure 8** is a diagram illustrating the format of a resource code used by the Figure 6 SCP when accessing a service resource item;

.**Figure 9** is a diagram illustrating the process of accessing a service resource in the case where the service code does not include an RRI part;

.**Figure 10** is a diagram illustrating the process of accessing a service resource in the case where the service code includes an RRI part;

.**Figure 11** is a diagram illustrating the derivation of the URI of a service resource by parsing an input telephone number in accordance with the present invetion;

.**Figure 12A** is a diagram depicting a name space (the "telname space") constituted by the domain names derived by a parsing of a predetermined set of telephone numbers;

.**Figure 12B** is a diagram depicting the incorporation of the telname space without fragmentation into the DNS;

.**Figure 12C** is a diagram depicting the incorporation of the telname space in fragmented form into the DNS;

.**Figure 13** is a diagram illustrating the overall operation of the Figure 6 arrangement in providing a roaming number service in response to a telephone number being dialled at a standard phone;

.**Figure 14** is a diagram illustrating the overall operation of the Figure 6 arrangement when utilised by a Web user in setting up a call through a telephone interface integrated into the user's Web terminal;

.**Figure 15** is a diagram illustrating the overall operation of an arrangement in which an interface is provided between the PSTN and the Internet for telephone traffic;

.**Figure 16** is a diagram illustrating the overall operation of an arrangement in which a call setup gateway is provided between the Internet and the PSTN;

.**Figure 17** is a diagram illustrating the overall operation of an arrangement in which a freephone service is implemented for Web users; and

.**Figure 18** is a diagram similar to Figure 6 illustrating the provision of a distributed processing environment for interconnecting elements of the service control subsystem of the PSTN.

Best Mode of Carrying Out the Invention

Figure 6 illustrates an arrangement for the provision of services in a PSTN conventionally comprising an inter-exchange network 13 (including trunks and switches at least some of which are SSPs 41 with associated IPs), an access network 11 connecting customer permise equipment (here shown as telephones 40) to the network 13, and a service control subsystem 42 including at least one SCP for providing services to the SSPs 41 upon request. It will be appreciated that the Figure 6 representation of a PSTN is highly diagrammatic.

The SCP 43 may operate in a conventional manner responding to service requests from SSPs 41 to run specific service logic on particular data according to information contained in the service request, and to send back to the requesting SSP appropriate instructions for effecting call set up. A service request is generated by the SSP in

response to predetermined trigger conditions being met at a trigger check point, there being one or more such check points in the course of handling a call (it may be noted that where the trigger conditions have been downloaded to the SSP from the SCP then it could be said that the SSP is responding to an information request by the SCP when contacting the SCP upon the trigger conditions being met - however, in the present specification, this initial communication from the SSP to the SCP will be referred to as a "service request").

The SCP 43 is also provided with a network access interface 44 to the Internet 50 in order to make use of certain service resource items 49 (also referred to below simply as "service resources") during the course of processing at least certain service requests from the SSPs 41. These service resources 49 are held as WWW pages on HTTP servers 51 (more particularly, on service resource databases 52 of these servers 51). The WWW pages containing these service resources are referred to below as "phone" pages. The servers 51 are connected to the Internet and the phone pages are read accessible using respective URLs or URNs (for convenience, the more general term URI will be used hereinafter to mean the Internet-resolvable indicator of the location of a phone page).

The service resources may be service logic or service data and may be used by an otherwise standard service logic program running on the SCP, by accessing the phone page of the required resource using the appropriate URI. In certain cases, the service resources 49 may provide substantially all of the service control and data associated with a particular service. In this case, the service logic program running in the SCP 43 is of skeleton form, being instantiated on receipt of a service request and then serving to initiate service resources access and to return the results of this access to the entity that made the service request. In fact, according to this approach, the SCP could be implemented simply as a platform for fetching and executing phone-page service logic and would not need to have the complex provisioning and management systems for such logic as is required by standard SCP platforms; SCPs could then become more ubiquitous, possibly being associated with every SSP.

Figure 7 is a flow chart illustrating the progress of events in the case where the SCP 43 handles a service request by accessing a phone-page service resource. Upon receipt of a service request in an INAP message (step 100), SCP 43 decodes the TCAP/INAP message structure in standard manner (steps 101 and 102) well understood by persons skilled in the art. Next, SCP 43 instantiates a service logic program, SLP, to handle the request (step 103). This SLP is then responsible for looking up the URL of the required service resource as determined from information contained in the service request (steps 104, 105). For example, if the service request relates to a called-party service, then the required resource will be indicated by the dialled number and the latter will be used to derive the URL of the resource. Once the URL of the desired service resource has been ascertained, a resource request (for example, in the form of an HTTP request message) is sent over the Internet to the corresponding server holding the desired service resource (step 106); a correlation ID is also passed with the resource request to enable a response from the latter to be linked with the appropriate SLP instance. A timer is also started (step 107).

If a response is received from the accessed resource before the expiration of a time-out period (tested in step 108), then the response, which is usually in the form of a destination number, is supplied to the appropriate SLP as identified using the correlation ID passed with the response (step 109). An INAP/TCAP response message is then prepared and sent to the entity that made the original service request (steps 110 and 111) after which the SLP instance is terminated (113).

If in step 108, a time-out occurs before a response is received, then a default response value (generally a default destination number) may be looked up in the customer record and put in an INAP/TCAP message and sent back to the requesting entity (steps 114 to 116). The SLP instance is then terminated (113).

Locating & Accessing Service Resources

The functionality associated with accessing a phone-page resource is schematically represented in Figure 6 by resource access block 46. Block 46 includes URI determination block 47 for determining the URI of the phone page containing the

desired resource on the basis of parameters passed to block 46. Using the URI returned by block 47, the resource access block 46 then accesses the phone page of the required service resource 49 over the Internet through interface 44.

Resource Codes - It is possible that more than one service resource is associated with a particular telephone number; in this case the resource access block 46 will need to know additional information (such as current point-in-call, pic) to enable the appropriate service resource to be identified. If the service resources associated with a number are located on different phone pages, then the additional information is also passed to the URI determination block 47 to enable it to return the URI of the appropriate phone page. It is also possible for all the service resources associated with a number to be located on the same phone page. In this case, the resource access block 46 uses the additional information to pass a resource-identifying parameter with its access request to the phone page concerned; it is then up to the functionality associated with the phone page to access the correct service resource.

Thus, each service resource can be considered as being identified by a respective resource code 54 (see Figure 8) made up of a first part UI ("URI Identifier") used to identify the URI at which the resource is located on the Internet, and a second part RRI ("Relative Resource Identifier") used to identify the resource amongst plural resources at the same URI.

Resource Access - Where only one service resource 49 is located on a phone page 58 identified by a unique URI, then the resource code 54 simply comprises the UI, generally either a telephone number alone or a telephone number plus a pic parameter (see Figure 9). In this case, accessing a resource simply involves mapping the whole resource code 54 into the corresponding URI (process 55) and then sending a request 57 to the corresponding phone page 58, this latter itself constituting the desired service resource 49. The result of accessing resource 49 is then returned in response message 59.

In contrast, where multiple service resources 49 are located on the same phone page 58 (Figure 10), the resource code 54 comprises both a UI and RRI, the UI generally being a telephone number and the RRI a pic or other parameter for distinguishing between the co-located resources. In this case, accessing a resource involves mapping the UI part of the resource code 54 into the corresponding URI (process 55) and then sending a request 57 to the corresponding phone page (process 56), the request including the RRI of the resource code. The phone page 58 includes functionality 64 for accessing the required resource on the basis of the RRI in the request message. The result of accessing the required resource 49 is then returned in response message 59.

An alternative to the Figure 10 method of accessing a service resouce that is co-located with other resources on a phone page, would be to retrieve the whole page across the Internet simply using the URI derived from the UI part of the resource code, and then to extract the desired resource on the basis of the RRI.

URI Determination from Resource Code - The implementation of the URI determination block 47 that performs process 55 will next be considered. Block 47 may be implemented in a variety of ways, four of which are described below:

Direct Input

It would be possible, though not necessarily convenient, to arrange for the calling party to input directly the required URI. The calling party may thus input the host id component of the URI required (either in the form of a host domain name or host IP address) plus the path component of the URI. For example, in the case where the phone page of a called party is to be accessed, the calling party may input the URI of the called party and, indeed, this input may substitute for the normal input of a telephone number. A leading input string (for example "999") may be used to identify the input as an URI. As regards the input means, where a user only has a standard 12 key telephone, input of host domain names and other URI elements requiring alpha characters, will need to be done using one of the standard techniques for alpha input from a phonepad (such techniques are already used, for example, to enable a calling

party to "spell" out the name of the called party). It would also be possible to provide users with a full alphanumeric keypad to facilitate URI input.

Computation

Service resource access over the Internet could be restricted to a set of dialled numbers from which it was possible to compute a corresponding URI; in this case, this computation would be the responsibility of block 47.

Association Table Lookup

Probably the simplest implementation for the block 47 is as an association table (either in memory or held on database disc store 48) associating a URI with the UI part of each resource code. A potential problem with this approach is that a service resource may be required for a called party number on the other side of the world which implies a rigorous update regime between PSTN operators worldwide in order to keep the association table up-to-date. (Note that the same implication is not necessarily applicable in respect of marking the called-party number as one required to trigger a service request, since the number may be arranged to be one of a group of numbers all triggering an appropriate service request, in a manner similar to 800 numbers).

DNS-Type Lookup

An alternative lookup solution is to use a hierarchically-structured distributed database system, similar to (or even part of) the Domain Name System (DNS) of the Internet, in order to resolve the UI part of a resource code to a corresponding URI. This approach, which will be described in more detail below, would typically involve databases maintained by each PSTN operator for its numbers with which URIs are associated. These databases would be accessible by all PSTNs through a network such as the Internet with resolution requests being pointed to the appropriate database in a manner similar to the Domain Name System. In this case, the block 47 is constituted by an appropriate resolution program arranged to request UI resolution over the Internet through interface 44.

Before describing a DNS-type lookup implementation for the URI determination block 47, some further general comments are appropriate. Whatever method is used to determine the URI, certain simplifications are possible if limited constraints are placed on the URIs permitted. In particular, it is not necessary to determine all components of an URI in the following cases:

(i) A part of the URI path component can be made standard for all service resources, this standard part being simply added by the block 47 once the rest of the URI has been determined. For example, where a roaming number is to be looked up, it may by convention always be held in a file "roam" in a subdirectory "tel" of a subscriber's directory on a particular server. In this case the URI host component and the subscriber-unique part of the path component are first determined and then the remaining path part "/tel/roam" is added.

(ii) The URI path component can be arranged to be the same as a predetermined part of the resource code, the block 47 needing only to determine the host component and then add the path. For example, it may be agreed that the path must always end with the telephone number concerned, or sufficient of the terminating digits to have a high probability of uniqueness on the host machine. The path may also include standard components to be added by block 47.

(iii) Blocks of telephone numbers may have their corresponding service resources located on the same host server so that it is only necessary to use a part of the telephone number to determine the host component of the URI; in this case, the path component can conveniently include all or part of each telephone number. This situation implies a tight degree of control by the telephone operators and does not offer the telephone user the freedom to choose the host server on which user places their phone page.

Another general point worthy of note is that however the URI is determined, the host component of the URI may be provided either in the form of a host domain name or a host IP address. Where the host is identified by a domain name, then a further resolution of URI host name to IP address will subsequently be carried out in standard manner by interface 44 using the Domain Name System of the Internet. This further resolution can be avoided if the host identity is directly provided as an IP address.

Where a database lookup is used to provide the number to URI translation, this database may be independent of, or combined with, a customer database containing other customer-related information. Factors affecting this choice include, on the one hand, the possible desirability of having the number-to-URI translation information widely available, and on the other hand, the possible desirability of restricting access to other customer-related information.

DNS-Type URI Lookup

A DNS-type lookup implementation for the URI determination block 47 will now be described in some detail for the case where the UI part of the resource code is a telephone number and there are no constraints on the URI, thereby requiring both the full host and path components of the URI to be returned by the lookup. A key part of the overall process is the formation of the equivalent of a host domain name from the telephone number of interest; this domain-name equivalent is then resolved into a corresponding URI by a lookup mechanism which in the present example is identical to that employed by the DNS (indeed, the lookup mechanism may be incorporated into the DNS though it can also be independently implemented).

The nature of the DNS has already been described above with reference to Figure 3 when the term "DNS-type" system was also introduced. For convenience in the following a DNS-type system organised to provide a telephone number to URI translation facility will be referred to as a "Duris" system (standing for "DNS-type URI Server" system).

The basic principles surrounding operation of a Duris system are:

- every telephone number can be turned into a host domain name (the name space containing such host domain names for the telephone numbers of interest is referred to below as the "telname space"); and
- for every host domain name in the host domain space there is a Registration Record held by the Duris system containing the corresponding URI.

Thus, an input telephone number forming, in the present case, the UI part of a resource code 54 (see Figure 11), is first parsed to form a domain name (step 120) and

then passed to the Duris system (illustrated in Figure 11 as formed by the DNS itself) to retrieve the RR with the corresponding URI (step 121). Following on from the URI lookup, if the URI returned has its host component as a domain name, the DNS is next used to derive the host IP address (step 122); this step is, of course not needed if the host component is stored as an IP address in the RR. The URI is then used to make a resource request to the appropriate server, passing any RRI part of the resource code 54 (step 123).

There are a number of possibilities at the top level as to how a Duris system could be implemented:

(a) Independent of the DNS. In this option, the telname space constitutes the entire name space to be managed with the root of the telname space being the "." name space root (see Figure 12A where the telname space is shown hatched). In this case, the Duris system is independent of the DNS itself. The Duris system could, of course, use the same basic infrastructure as the DNS (that is, the Internet) or an entirely separate network. Where the telname space comprises all the domain names corresponding to all public telephone numbers worldwide, parsing a full international telephone number would give a fully qualified domain name. Of course, the telname space could be a much smaller set of names such as those derived from internal extension numbers within a company having worldwide operations.

(b) Unfragmented Telname Space within the DNS. In this option, the telname space is a domain of the DNS name space and the Duris system is provided by the DNS itself. Thus, where the telname space comprises all domain names derived from public telephone numbers worldwide, the telname space could be placed within the domain of the ITU, in a special subdomain "tel", the root of the telname space then being "tel.itu.int." (see Figure 12B where again, the hatched area represents the telname space). The responsability for administering the domain "tel.itu.int." would then lie with the ITU. With this latter example, to form a fully qualified domain name from an input telephone number, after the number has been parsed to form the part of the domain name corresponding to the structuring within the telname space, the tail "tel.itu.int." is added. The

fully qualified domain name is then applied to the DNS and the corresponding RR record, holding the required URI, is retrieved. As a further example, the telname space could be all name derived from internal extension numbers within Hewlett-Packard in which case the root of the telname space would be "tel.hp.com." and Hewlett-Packard would be entirely responsible for managing this domain.

(c) Fragmented Telname Space within the DNS. In this option, the telname space is split between multiple domains of the DNS name space and the Duris system is provided by the DNS itself. Thus where the telname space comprises all domain names derived from public telephone numbers worldwide, the telname space could be split between respective "tel" subdomains of each country domain; thus, as illustrated in Figure 12C, the part of the telname space corresponding to French telephone numbers would have a root of "tel.fr." and the part of the telname space corresponding to UK telephone numbers would have a root of "tel.uk.". The responsability for administering each "tel" subdomain would then lie with each country. With this latter example, to form a fully qualified domain name from an input telephone number, the part of the telephone number following the country code is parsed to form the part of the domain name within a country 'tel' subdomain and then a host domain name tail is added appropriate for the country concerned. Thus for a French telephone number, the "33" country code is stripped from the number prior to parsing and used to add a tail of "tel.fr.". The tail appropriate to each country can be stored in a local lookup table. As a further example, two commercial organisations (X company and Y company) with respective DNS domains of "xco.com." and "yco.com." may agree to operate a common Duris system with a telname space split between "tel.xco.com." and "tel.yco.com". In this case, any Y company telephone number input from X company will be parsed to a fully qualified domain name terminating "tel.yco.com." and vice versa.

Consideration will next be given to the parsing of a telephone number into a domain name - in other words, where to insert the "." characters into the number to provide the structuring of a domain name. Of course, as already explained, telephone numbers

are hierarchically structured according to each country's numbering plan. Thus one approach would be to follow this numbering plan structuring in dividing up a telephone number to form a domain name. By way of example, the telephone number "441447456987" which is a UK number (country code "44") with a four digit area code ("1447") and six digit local number ("456987") could be divided to form a domain name of 456987.1447.44 (note that the reversal of label order occassioned by the fact that the DNS labels are arranged least significant first). If the telname space is a subdomain of the DNS with a placement as illustrated in Figure 12B, the fully qualified domain name derived from the telephone number would be:

456987.1447.44.tel.itu.int.

There are however, difficulties inherent with trying to match the numbering plan hierarchy when parsing a telephone number into a host name. Firstly, in order to parse an international number correctly, it would be necessary for each entity tasked with this operation to know the structuring of each country's numbering plan and where, as in the UK, area codes may be of differing length the required knowledge may need to take the form of a lookup table. Whilst this is not a complicated computational task, it is a major administrative nuisance as it means that each country will need to inform all others about its numbering plan and any updates. The second problem is that a six or seven digit local number is a very large domain; it would be preferable to create subdomains for performance and scaling reasons but there is no obvious way of doing this.

These problems can be overcome by giving up the restriction that the parsing of telephone number into a domain name should match the structuring of national numbering plans. In fact, there is no strong reason to follow such a scheme as DNS servers know nothing about the meaning of the name space. It is therefore possible to parse telephone numbers using a deterministic algorithm taking, for example, 4 digits at a time to limit the size of each subdomain and making it possible to 'insert the dots' without knowing the numbering plan concerned. So long as the DNS domains and zones served by the DNS servers are created correctly it will all work.

For international numbers it would still seem appropriate to separate off the country codes and so a hybrid parsing scheme would be to parse the initial part of a dialled number according to known country codes and thereafter use a deterministic scheme (for example 3,7 or 4,6 or 3,3,4) to separate the digits. Of course, if a fragmented telname space is being used as illustrated in Figure UC then the country code is used to look up the host name tail and it is only the national part of the number which would be parsed.

Finally, as regards the details of how a DNS server can be set up to hold RR records with URIs, reference can be made, for example, to "DNS and BIND", Paul Albitz and Criket Liu, O'Reilly & Associates, 1992 which describes how to set up a DNS server using the Unix BIND implementation. The type of the RR records is, for example, text.

It should be noted that DNS labels should not in theory start with a digit. If this convention is retained, then it is of course a trivial exercise when parsing a telephone number to insert a standard character as the first character of each label. Thus, a 4 digit label of 2826 would become "t2826" where "t" is used as the standard starting character.

It will be appreciated that as with domain names, where an input telephone number is not the full number (for example, a local call does not require any international or area code prefix), it would be parsed into a domain name in the local domain.

The foregoing discussion of Duris system implementation, has been in terms of translating a telephone number into an URI where the telephone number forms the full UI of a resource code and the Duris system returns a full URI. It will be appreciated that the described Duris implementation can be readily adapted to accommodate the various modification discussed above regarding the form of the UI and what parts of the URI need to be looked up. For example, where there are a number of differents service resources associated with a subscriber each in its own file and the required source is identified by a pic part of the resource code, then the input telephone number

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will be used to look up, not the full URI, but the host component and that part of the path component up to the relevant subdirectory, the pic part of the UI then being appended to identify the required resource file.

For small local Duris implementations, it may be possible to have a single server; the implementation should still, however, be considered as of a DNS type provided the other relevant features are present.

Nature of Service Resources

Turning now to a consideration of the service resources 49, how these service resources can be provisioned onto the servers 51 will be described more fully below but, by way of present example, the service resource or resources associated with a particular PSTN user (individual or organisation, whether a calling or called party) can be placed on a server 51 over the Internet from a user terminal 53 in one or more WWW pages.

Consider the simple case where the service resource is a service data item such as a telephone number (for example, an alternative number to be tried if the user's telephone corresponding to the number dialled by a calling party is busy). This diversion number could be made the sole service resource of a phone page of the user. The phone page URI could be a URL with scheme set to HTTP in which case the GET method could be used to retrieve the diversion number. Such an arrangement is suitable if the phone page is only to be used for functional retrieval of the diversion number. However, if the diversion number is to be visually presented at a user terminal 53, then it may be desirable to accompany the number with explanatory material (this will often not be necessary as the diversion number can be arranged to be returned into an existing displayed page that already provides context information). However, where the phone page does include explanatory material as well as the diversion number, an entity only wishing to make functional use of the phone page, could be arranged to retrieve the phone page and then extract the diversion number (this would, of course,

require a standard way of identifying the information to be extracted from the phone page).

An alternative and preferred arrangement for providing for both viewing and functional access to a resource requiring explanatory material for viewing, is to use an object-oriented approach to resource design. In this case, the resource object would have two different access methods associated with it, one for purely functional use of the resource and the other enabling viewing of associated explanatory material. It would then be up to the accessing entity to access the resource object using the appropriate object method.

Yet another arrangement for providing for both viewing and functional use of the diversion number, would be to provide separate resources appropriately configured for each use, each resource having its own resource code (generally, both such resources would be placed on the same phone page and in this case the UI part of each resource code would be the same).

Retrieval of a phone page for use by a human user will generally not be as time critical as retrieval for operational use by a PSTN. Thus, while for human use the scheme specified in the URL of a service resource could be HTTP, it may be advantageous for operational use to define a special "phone" scheme (access protocol) which would result in the server 51 using an optimised access routine to access the required resource (diversion number, in the current example) and respond to the accessing entity in the minimum possible time.

Besides data items, other possible types of service resource include service logic for execution in place (at the server) with the result of this execution being returned to the entity accessing the resource; service logic downloadable from the server to the accessing entity for execution at that entity; and a logging resource for logging information passed to it by the accessing entity (or simply for logging the fact that is has been accessed). It will be appreciated that the logging resource is really just a particular case of service logic executable in place.

By way of example, a service resource constituted by execute-in-place service logic can be arranged to implement time-of-day routing, the result of executing the service logic being the telephone number to which a call should be routed taking account of the time of day at the called party's location. An example of a service resource constituted by downloadable service logic is service logic for controlling calling-party option interrogation using the facilities provided by an IP. As regards the logging resource, this can be used for recording the number of calls placed to a particular number.

Where each resource has its own phone page and the resource is present only in its unembellished functional form, then the HTTP scheme can be employed for access using the GET method for both the downloadable service logic and the execution-in-place service logic, and the POST method for the logging resource. If it is desired to provide an explanatory material with each service resource, then any of the solutions discussed above in relation to data items, can be used.

Where more than one service resource is to be associated with a number, then each such resource can be placed on a respective phone page with its own URI. However, the preferred approach is to place all such service resources on the same page and use the RRI part of the corresponding resource codes to enable access to the appropriate resource. The accessed resource is then treated according to its form (executed if execute-in-place service logic, returned if downloadable service data or logic).

Thus if both a diversion-number service-data resource and a time-of-day execution-in-place service-logic resource are placed on the same phone page, the diversion-number resource code might have an RRI of "1" whilst the time-of day resource code might have an RRI value of "2".

Where calling/called party options are to be included in a service resource for presentation to such party, then as already indicated, this can conveniently be done by constituting the service resource as downloadable service logic with the chosen option possibly initiating request for a follow-up service resource.

It will be appreciated that a service resource will often be of a complex type, combining service data and/or downloadable service logic and/or execute in place service logic. A particularly powerful combination is the combination of the two types of service logic where the downloadable service logic is designed to interact with execute-in-place service logic; using this arrangement, the user can be presented with complex client-server type applications.

Example Usage of Service Resource

Figure 13 illustrates the operation of a service making use of a resource on a server 51. This service is equivalent to a "personal number" service by which a user can be accessed through a single, unchanging number even when moving between telephones having different real numbers. To achieve this, the user requiring this service (user B in the current example) is allotted a unique personal number (here referred to as the "Webtel" number of B) from a set of numbers all of which have the same leading number string to enable an SSP to readily identify a dialled number as a Webtel number. User B has a service resource 49 on a dedicated phone page on HTTP server 51, this phone page being located at a URL here identified as "URL (B phone page)". B's phone page when accessed returns the current roaming number (" B-telNb") where B can be reached. In the simplest case, B's phone page is just a single number that can be modified by B (for example, from a terminal 53) as B moves to a different phone. More likely is that B's phone page is an execute-in-place service logic providing time of day routing.

In the present example, the association between B's Webtel number and the URL of B's phone page is stored in an association table accessible to SCP 43.

Upon a user A seeking to contact user B by dialling the Webtel number of B, the telephone 40 being used by A passes a call set up request to SSP 41 (note that in Figure 13 the bearer paths through the telephony network are shown by the thicker lines 60, the other heavy lines indicating signalling flows). SSP 41 detects the dialled number as a Webtel number and sends a service request to SCP 43 together with B's Webtel number. SCP 43 on receiving this service request initiates a service logic

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program for controlling translation of B's Webtel number into a current roaming number for B; in fact, in the present case, this program simply requests the resource access block 46 to access the service resource identified by B's Webtel number, (that is, B's phone page 49) and return the result of this access. To this end, block 46 first translates B's Webtel number into the URL of B's phone page and then uses this URL to access B's phone page over the Internet (for example, using the 'phone' scheme already referred to with a method corresponding to the HTTP GET method). This results in B's current roaming number B-telNb being passed back to block 46 and in due course this number is returned to the SSP 41 which then initiates completion of call set up to the telephone 40 corresponding to B-telNb.

The Figure 13 example related to a called-party service; it will, of course, be appreciated that the principle of accessing service resources over the Internet can be applied to all types of services, including both calling-party and called-party services and hybrids. Thus, standard 800 number services can be implemented with the dialled 800 number resulting in access to a phone page resource constituted by execute-in-place service logic that returns the most appropriate number for controlling onward call routing.

It will be appreciated that although in the Figure 13 example the service request from the SSP was triggered by a leading number string of a dialled number, a service request may be triggered by a variety of triggers including calling-party number, called-party number, or some other user input, such triggers being possibly qualified by call setup progress (for example, called-party number qualified by a busy status or by ringing for more than a certain time).

With respect to the logging service resource mentioned above, one possible application for such a resource is in telephone voting. In this case, dialling the voting number causes the SSP picking up the call to pass a service request to SCP 43 which then contacts the appropriate logging resource over the Internet to register a vote after which the call is terminated. To minimise bottlenecks, a logging resource could be provided at a different URL for each SCP, it being a simple matter to collect and collate voting

from all these logging resources over the Internet. If an SCP with Internet access is provided at every SSP, then the risk of congestion is greatly reduced.

As already noted, a user's phone page may hold multiple service resources in which case the access request from the accessing SCP needs to contain an appropriate RRI identifying the required resource.

In the event that an SCP is to provide both a traditional IN service to some users and an equivalent service using an Internet-accessed service resource to other users, then a lookup table may need to be provided in the SCP to ensure that a service request is appropriately handled; such a lookup table can conveniently be combined with the customer record database.

Once a user, such as user B, has set up one or more phone pages specifying his desired service resources (particularly service logic defining personalised services), it is clearly logical for user B to want any PSTN operator he cares to use, to access and utilise such service resources. This is possible if the Webtel-to-URI databases are available to all operators. Thus multiple operators could be set to access B's phone page or pages. If an operator declines to use B's phone pages, B can obviously chose not to use that operator (at least where that operator provides a long haul carrier service subject to user selection). The possibility therefore arises that service provision will cease to command a premium from operators, but that the provision of phone-page utilisation by an operator will become a necessary basic feature of PSTN operation.

Provisioning and Updating Service Resources

Consideration will next be given as to how the service resources 49 are provisioned to the servers 51 and subsequently updated.

So far as provisioning is concerned, two basic actions are required: firstly, the service resource must be placed on a server 51 and, secondly, the URI of the service resource must be notified to the PSTN operator along with the trigger conditions (number plus any other condition such as point in call) calling for access to the resource; if multiple

resources are provided at the same URI, then the RRI values needed to retrieve the appropriate resource for a particular trigger condition, must also be notified. This notification process will be referred to hereinafter as 'registering' the service resource with the PSTN operator; registration is, of course, necessary to enable the association tables used by SCP 43 to be set up and for trigger conditions to be set in SSPs 43. For certain services, such as that described above with reference to Figure 13, it is not the user that supplies the triggering number (the Webtel number in the Figure 13 example); instead, the PSTN operator allocates an appropriate number to the user as part of the registration process.

As to the process of placing a service resource on a server 51, how this is carried out will depend on the attitude of the PSTN operator to the possible effects of such service resources on operation of the PSTN. Where the service resource simply returns a data item to an accessing entity, then an operator may not be too concerned about possible errors (accidental or deliberate) in implementing the service resource. However, the operator will probably be much more concerned about the proper operation of any service logic that may be returned by a resource; indeed, an operator may not permit such a service resource.

Assuming for the moment that an operator has no concerns about the nature or implementation of service resources, then how a resource is placed on a server 51 will largely depend on the nature of the server concerned. For example, if a user has a computer with network access to the Internet and this computer is used as server 51, then the user can simply load a desired resource onto the server as a WWW phone page for external access. A similar situation arises if the server is an organisation server to which the server has access over an internal LAN. In both these latter cases, loading the resource as a WWW phone page does not itself require Internet access. However, if the server 51 is one run by an external Internet service provider, then a user can arrange to download the required service resource into the user's allocated Web site space on the server; this may or may not involve Internet access. One special case of this latter scenario is where the PSTN operator provides a special server for user phone pages containing service resources.

Except where a user's own computer acts as server 51, placing a service resource on a server will generally involve clearing one or more levels of password protection.

As regards the origin of the service resource loaded by a user onto server 51, this may be generated by the user or, particularly where the resource includes service logic, may be provided by a third party (including the PSTN operator).

If the PSTN operator wishes to have control over the service resources 49 to avoid any adverse effects on operation of the PSTN, two approaches are possible. Firstly, the operator could require that every resource (or, possibly, a particular subset) had to be subject to a verification process before use, appropriate measures then being taken to avoid subsequent alteration of the resource by the user (except, possibly, for particular data items); in this respect, the operator could require that the resource be placed on a server under the operator's control and to which the user had no write access (except possibly for altering particular data items, as indicated above). A second, more attractive, approach to minimising adverse effects by the service resources 49, is for the operator to provide standard service resources to which a user could add the user's own data (and possibly make limited functional selections in case where the resource included service logic); the customised resource would then be loaded onto a server 51 controlled by the operator. This process can be conveniently implemented for a particular resource using an HTML "form" which a user could download over the WWW from the operator-controlled server. After completing the form and activating a 'commit' graphical button of the form, the entered information would be 'posted' back to the server where the information would be used to produce a customised service resource thereafter placed on the server for access over the Internet. An advantage of this approach is that registration of the service resource with the operator is simultaneaously effected. (It may be noted that if registration needs to be done as a separate act from having a service resource loaded on a server, then using an HTML form is a very convenient way to implement the registration process).

From the foregoing it can be seen that whilst the provisioning process does not necessarily require information to be passed over the Internet, in many cases this will

be the best solution, particularly if an HTML form exchanged over the WWW can be used to produce a customised service resource. It should be noted that producing a customised service resource using an HTML form is not limited to cases where the PSTN operator controls the server.

As regards updating service resources, there is likely to be a need to update certain data items on a fairly frequent basis (for example, roaming number). Where the PSTN operator does not place any controls on the service resources 49, then update is a relatively simple matter, only requiring write access to the server concerned (as already indicated, this will generally involve one or more levels of password protection). However, where the PSTN operator exercises control over the service resources, for example by only permitting customisations of standard service resources, such customised resources being loaded on servers controlled by the operator), then write access to the service resource may be tightly controlled. Again, an HTML form may conveniently be used as the medium for modifying a data item in such cases; to the operator, this has the benefit of limiting the modifications possible whilst to the user, a form interface should provide a simple route to resource modification.

For more complex updates, it may be necessary to go through a process similar to that required for initial provisioning.

Particularly where the service resources are held on a server 51 controlled by the PSTN operator, resource update will generally involve communication over the Internet.

Web User Interaction

Consideration will next be given to other possible uses of the service resources held in phone pages on the servers 51. For example, if user B's phone page contains a diversion number, then provided this phone page is read-accessible over the Internet from user A's terminal 53, user A can use a graphical Web browser running on terminal 53 to view B's phone page and discover B's diversion number. As earlier discussed, the diversion number may be passed to user A for display in an existing

visual context giving meaning to the number, or may be passed to user A with accompanying explanatory text.

A more useful example is a current roaming number service for user B. Suppose B's phone page 49 on server 51 (see Figure 14) is operative when accessed to return a current roaming number where B can be reached. Further suppose that user B has a Web site with several Web pages written in HTML and each page contains a graphical 'phone' button which when activated uses the GET method to access B's phone page by its URL. Now if user A whilst browsing (arrow 66) B's Web site over the WWW from user A's terminal 53, decides that he would like to call user B to discuss some item of interest, user A simply activates the phone button 65 on the currently viewed page of B. This causes B's phone page to be accessed using the HTTP request "GET URL (B Phone Page)" - see arrow 67.

B's current number to be called is then determined and passed to user A's terminal 53 (see arrow 68) where it is displayed. An explanatory text concerning the number will generally also be displayed; for example the text "Please call me at the following number:" could be displayed, this text being provided either by the HTML script associated with the phone button, or from the phone page when returning the current number. In fact, it would probably be more helpful to provide user A, not only with the current number for reaching user B, but also with all numbers where B could be reached together with the times when B was most likely to be at each number. Since this extra information is likely to be subject to frequent change, the only sensible way to provide the information is from the phone page. Thus, B's phone page not only provides the current number for reaching B, but also a text that includes numbers and times subject to change; scripting B's phone page is, of course, done in a way that ensures that variable data need only be altered in one place.

In a further example, B's phone page might include downloadable service logic for execution at user A's terminal. This is useful where choices are to be presented to a user, each choice producing a follow-up action such as fetching a further phone page. For example, the first-accessed phone page may be a family phone page giving the

general telephone number for a family but also giving the user the possibility of selecting further phone information on each family member, such as a time-of-day dependent number; in this case, each family member has their own follow-up phone page.

In the above scenarios, user A has been presented with a number to call over the PSTN. User A can now pick up his standard telephone and dial the number given. In fact, a complication arises if A only has Internet access via a SLIP/PPP connection over an ordinary, non-ISDN, PSTN line since, in this case, A's telephone line is already tied up with making Internet access when gateway 90 seeks to set up a call to A's telephone; with an ISDN connection, as two channels are available, this problem does not arise. One way of overcoming this problem would be to have user A's terminal 53, after obtaining the number to call from B's phone page, automatically suspend its Internet session by storing any required state information (for example, current WWW URL being accessed) and then terminate its SLIP/PPP connection to thereby free up the telephone line. A can then telephone B. At the end of this call, A can resume the suspended Internet session, using the stored state information to return to the point where A left off to call B. An alternative approach is to operate a suitable multiplexing modulation scheme on the telephone line to A allowing voice and data to be simultaneously carried. A number of such schemes already exist. The PSTN would then need to separate the combined data and voice streams coming from A at some point and pass each to its appropriate destination (the Internet data being forwarded to the ISP providing the SLIP/PPP connection for user A and the voice stream being passed to B); of course, data and voice traffic in the reverse direction would also need combining at some point for sending over the last leg to A's terminal.

Rather than A manually dialling B using a standard telephone, another possibility is that user A's terminal is provided with functionality enabling A to make a call over the PSTN from his terminal; this functionality generally comprises a hardware interface 70 (Figure 14) to a telephone line and phone driver software 71 for driving the interface 70 in response to input from application software such as the Web browser 73. A could call up his phone software and enter the required number or, preferably,

A need only "select" on screen the number returned from B's phone page and then pass it into A's phone software. Indeed, provided user B knew the software interface to the software 71 providing dialling functionality on A's terminal, it would be possible for B's phone page to return to A's terminal program code for automatically dialling B's number upon A confirming that he wishes to proceed with call placement. As an alternative to placing a voice call, if A's terminal is equiped with a suitable modem and controlling software, A could, instead, elect to send a fax or data to B through the PSTN either to B's ordinary number or to one specified in B's phone page as the number to be used for such transmissions. Of course, placing a call from A's terminal over the PSTN may be subject to the problem already discussed of conflict for use of the telephone line where this is not an ISDN line and A gains Internet access via a SLIP/PPP connection.

However the call is placed, if B's telephone corresponding to the number tried by A is busy, a number of possibilities exist. Thus if B has a phone page that specifies a diversion number, and B has registered this service resource with the PSTN, then the diversion number should be automatically tried by the PSTN. However, if the diversion number resource has not been registered with the PSTN. a busy signal will returned to A. Where A has placed the call through a standard telephone, A must now decide how to proceed and A may elect either to give up or to refer again to B's phone page to look up the diversion number and redial using this number. If A placed the original call using his terminal 53 then the latter can be programmed to detect the return of a busy signal and then automatically look up B's diversion number and redial using this number. This functionality can be included in service logic downloaded from B's phone page and run on A's terminal.

If A had to terminate his Internet session in order to free up the telephone line for voice use, then referring back to B's phone page requires a new Internet session to be started (in fact, this inconvenience could be avoided if B's diversion number were passed to A's terminal at the time the original number to be dialled for B was supplied).

The service resource accessed on B's phone page upon B's telephone being busy may, of course, be more complex than just a diversion number. In particular, user A may be presented with a range of options including, for example, B's fax or voice mailbox number, the selection of an option potentially initiating the running of appropriate accessing software. Another possible option would be for A to leave B a call back message using a form downloaded from B's phone page upon this option being chosen; the completed form would be posted back to server 51 and logged for B to check in due course.

Of course, it may arise that user A wishes to access B's phone page to find out, for example, B's current roaming number, but user A does not know the URI of B's Web site and only has B's Webtel number. A could just call B through the PSTN in which case the translation of B's Webtel number to roaming number would be automatically effected (assuming B is still registered for this service); however, A may not wish to call B straight away, but just note his current roaming number. In order to solve A's problem, the Webtel-to-URI association tables previously described are preferably made accessible on the Internet at a known address (for example, at a known Web site). All that A need now do is to access this Web site passing B's Webtel number; B's phone page URI will then be returned to A who can then use it to access B's phone page. This process can, of course be made automatic from the point when A sends B's Webtel number to the association-table Web site.

Internet/PSTN Call Interface

In the Figure 14 scenario, A's access to the PSTN was through a standard telephone interface even though the actual form of A's telephone differed from standard by being integrated into A's computer terminal 53. Figure 15 illustrates a situation where A, after being supplied with B's current roaming number as in the Figure 14 case, calls B via a route that starts out over the Internet and then passes through a user network interface 80 into the PSTN. Interface 80 is arranged to convert between ISDN-type telephone signalling on the PSTN and corresponding signalling indications carried

across the Internet in IP packets; in addition, interface 80 transfers voice data from IP packets onto trunk 60 and vice versa.

Thus, upon A initiating a call to B, Internet phone software 81 in A's terminal sends call initiation signalling over the Internet to interface 80, the address of which is already known to A's terminal. At interface 80, the signalling is converted into ISDN-type signalling and passed to SSP 41. Call set up then proceeds in the normal way and return signalling is transferred back through interface 80, over the Internet, to the software 81 in A's terminal. This software passes call setup progress information to the WWW browser 73 for display to A. Upon the call becoming established, A can talk to B through his telephone and A's voice input is first digitised in phone hardware interface 83 and then inserted into IP packets by software 81 to traverse the Internet to interface 80 (see arrow 84); voice traffic from B follows the reverse path.

IN services can be provided to this call by SCP in response to a service request from an SSP 41. Thus, if B's phone is busy, and B is registered for call diversion, SCP 43 on receiving a service request will access B's appropriate phone page for call diversion and retrieve the diversion number. If SSP 41 is not set to initiate a service request on B's telephone being busy, the busy indication is returned to A's terminal where it can be handled in the manner already described with reference to Figure 14.

In fact, interface 80 can be provided with functionality similar to an SSP to set trigger conditions and generate a service request to SCP 43 on these conditions being satisfied.

Third-Party Call Setup Gateway

Figure 16 illustrates a further arrangement by which A can call B after receiving B's current roaming number. In this case, a third-party call set-up gateway 90 is provided that interfaces both with the Internet 50 and with an SSP 41. Conveniently, gateway 90 can be co-located with SCP 43 (though this is not essential). Gateway 90 has the capability of commanding SSP 41 to set up a call between specified telephones.

Thus, upon A wishing to call B, a third-party call setup request is sent from A's terminal over the Internet to the gateway 90 (see arrow 91). This setup request includes A's telephone number and B's current roaming number. Gateway 90 first attempts to setup the call to A's telephone (which should generally succeed) and thereafter to set up the call to B's identified telephone. Once the call is setup, A and B communicate in standard manner across the PSTN.

If B's phone had been busy, then any of the previously described scenarios may ensue.

Gateway 90 can also be arranged to make service requests to SCP 43 upon predetermined trigger conditions being satisfied. Thus, gateway 90 might be set to pick up the busy condition on B's telephone and initiate a service request to SCP 43 for a diversion number. However passing the busy indication back to A's terminal via gateway 90 is preferred because of the flexibility it gives A regarding further action.

As already generally discussed in relation to Figure 14, a complication arises if A only has Internet access via a SLIP/PPP connection over an ordinary, non-ISDN, PSTN line since, in this case, A's telephone line is already tied up with making Internet access when gateway 90 seeks to set up a call to A's telephone. The solutions discussed in respect of Figure 14 (termination of Internet session; multiplexing voice and Internet data on same telephone line) can also be used here. An alternative approach both for Figure 14 and for Figure 16 scenarios is possible if user A's terminal can handle a voice call as digitised voice passed over the Internet. In this case, the voice call can be placed through an interface 80 of the Figure 15 form, and the voice traffic and the Internet communication with the B's phone page and/or gateway 90 are both carried in Internet packets passed over the SLIP/PPP connection to/from A's terminal 53 but as logically distinct flows passed to separate applications running on terminal 53.

It may be noted that the third party call setup request made by A's terminal to gateway 90 could equally have been made by service logic held in B's phone page and executed by server 51 (such an arrangement would, of course, require A's telephone number to be passed to B's phone-page service logic and this could be arranged to occur either

automatically or through a form presented to user A at terminal A and then posted back to server 51).

It may also be noted that the interface 80 of Figure 15 and the gateway 90 of Figure 16 provide examples of service requests being passed to the service control subsystem by entities other than SSPs 41.

WWW-based "FreePhone" (800 number) Services

It is possible to implement a "FreePhone" or "800 number" type of service using a combination of the WWW and the PSTN. As will be seen from the following description of such a service with reference to Figure 17, a WWW/PSTN implementation does not necessarily rely either on transferring call charges from the calling to called party or on the use of a special "800" number, two characteristics of standard "Freephone" schemes. The WWW/PSTN implementations do, however, possess the more general characteristic of placing an enquiring party and the party to whom the enquiry is directed, in telephone contact at the expense of the latter party.

In the Figure 17 arrangement, a user D such as a large department store has a website on a server 51; for the sake of simplicity, it will be assumed that the server is under the control of user D who has direct computer access to the server over line 125. D's Website may, for example, contain many catalogue-like Web pages illustrating goods offered for sale by D. In addition, D has a freephone page 124 for handling enquiries placed on a freephone basis; the URL of this page is associated with a "freephone" graphical button 122 placed on each of the Website catalogue pages.

Suppose user A at terminal 53 is browsing D's Website, looking at the catalogue pages (arrow 121). If A sees an item of interest and wishes to make an enquiry to D about this item, then A can activate at terminal 53 the graphical freephone button 122 associated with the catalogue page concerned. This activation causes code embedded in the catalogue page currently loaded in A's terminal to prompt the user to enter their telephone number and, optionally, their name, after which an HTTP request is sent to D's freephone page using the POST method and enclosing the entered data (arrow

123). D's freephone page on receiving this request executes service logic to enter a new enquiry (including A's name and telephone number) in an enquiry queue 127 maintained in an enquiry control system 126. In the present example, the enquiry control system is connected to the server 51 via line 125, externally of the Internet; however, it would also be possible to have server 51 communicate with the enquiry control system through the Internet and, indeed, this may be the most practical arrangement where D's Website is on an ISP server rather than on a server controlled by D. In fact, the code run in A's terminal upon activation of the freephone graphical button 122 could be arranged to directly forward the enquiry request to the enquiry control system over the Internet rather than passing it back through the server 51.

The enquiry control system 126 manages enquiries passed to it to ensure that they are dealt with in an ordered manner. The system 126 on receiving a new enquiry preferably estimates approximately how long it will be before the enquiry is dealt with, this estimation being based on the number of currently queued enquiries and the average time taken to handle an enquiry. This estimation of waiting time is passed back via server 51 to user A in the response to the POST request message.

The enquiry control system 126 looks after the distribution of enquiries to a number of agents each of which is equipped with a telephone 40 and a display 129. A's enquiry will be dealt with as soon as it reaches the head of the queue 127 and there is an agent detected as available to handle the enquiry (thus, for example, the system may be arranged to detect when an agent's telephone goes on hook). When these conditions are met, a distribution and setup control unit 128 takes A's enquiry and displays A's name and telephone number on the display 129 of the available agent (for clarity, herein referenced as agent D'); if user D keeps a database on D's past customers or credit rating data, then unit 128 will also look for and display any such further information known about A. At the same time, unit 128 makes a third-party call setup request (arrow 130) over the Internet to gateway 90 asking for a call to be set up between the telephone of the available agent D' and the telephone of user A, both telephones being identified by their respective numbers. If both D' and A pick up the call, the enquiry then proceeds, the cost of the call being paid for by D as it is D that

originated the call over the PSTN. If, for whatever reason, the call remains incomplete (for example, unanswered by A) for a predetermined timeout period, then unit 128 can be arranged to automatically pass on to the next enquiry at the head of the queue 127.

It would, of course, be possible to dispense with having the unit 128 request call setup through gateway 90 and either have the agent D' dial A's number manually or have unit 126 initiate auto-dialling for D' telephone (agent D' having, for example, a computer-integrated telephone similar to that of A's in Figure 14). The advantageof these approaches is that the existing PSTN could be used without adaption and without any service installation, in implementing the WWW-based freephone service.

As discussed in relation to Figures 11 and 13, a complication arises in placing a call to A if A only has Internet access via a SLIP/PPP connection over an ordinary, non-ISDN, PSTN line since, in this case, A's telephone line is already tied up with making Internet access when user D tries to set up a call to A's telephone. The solutions discussed in respect of Figures 11 and 13 can also be used here (termination of Internet session; multiplexing voice and Internet data on same telephone line; and placing the call over the Internet to A's terminal). With respect to the solution based on termination of the Internet session, such termination could be delayed until A's enquiry was about to be dealt with; however, to do this, it would be necessary to provide feedback from the control system 126 over the Internet to A's terminal 53 and to associate this feedback with code for bringing about Internet-session termination. One way to achieve this would be to have the response message sent by server 51 in reply to the original POST request message from A, include a correlation code; any subsequent feedback from system 126 passed to A would also include this code (server A having also passed the code to control system 126) thereby allowing A's terminal to correctly identify this feedback. In fact, the same mechanism could be used to provide user A with updates on how much longer user A is likely to be waiting to be called back, this mechanism being usable independently of whether or not there was a conflict problem for use of A's telephone line.

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Where user A only has a telephone 40 and no terminal 53, it is still possible to utilise the basic structure of Figure 17 to provide a freephone service for user A without resorting to the complexity of call charge transfer. More particularly, A would dial a special number for user D's freephone service (typically an 800 number), and the SSP 41 would recognise this special number in standard manner and make a service request to SCP 43 including both this special number and A's number. SCP 43 would then ascertain D's freephone-page URL by doing a number-to-URL translation and access D's freephone page using a POST-method HTTP request similar to request 123. Once this request had been registered as an enquiry by D's freephone page 124, the lattter could send a response to SCP 43 asking it to play an announcement such as "Your freephone enquiry has been registered; please hang up and you will be contacted shortly". This announcement could be played to A by an IP in standard manner. A would then hang up and be ready to receive a call from D.

A significant advantage of the above freephone schemes using WWW, is that user D is not running up charges for use of the PSTN during periods when an enquiry is enqueued, waiting to be handled.

Variants

Many variants are, of course, possible to the above-described arrangements and a number of these variants are described below.

Distributed Processing Environment. As is illustrated in Figure 18, the SCP 43 may access the HTTP servers 51 through a distributed processing environment, DPE 98, at least logically separate from the Internet. Preferably in this case the servers 51 are controlled by PSTN operators and are thus restricted in number.

Service Resources on DNS-Type Servers. In the foregoing examples, the service resource items have been been placed on servers 51 connected to the Internet and a desired service resource has then been accessed over the Internet by the service control subsystem of the PSTN, and/or by Internet users, through the use of an URI derived from a resource code that identifies the the desired service resource item. In a

preferred arrangement for deriving the URI from a resource code in the form of a telephone number, all or part of the telephone number concerned was parsed into domain name form and then resolved into an URI using a DNS-type distributed database system that, indeed, could be integrated into the DNS itself (see Figures 11 and 12, and related description). In fact, it would be possible to place service resource items directly in Registration Records held by a DNS-type distributed database system so that instead of the parsed telephone number being resolved to an URI which is then used to access the required resource, the parsed telephone number is directly resolved to the required service resource item. The mechanism employed in this process is exactly as already described for resolving a parsed telephone number into an URI. The DNS-type distributed database system used for this would preferably be one accessible over the Internet or the DNS itself so as to provide access to the service resource items for Internet users as well as for the service control subsystem of the PSTN (in the same manner as described above with reference to Figure 18, the DNS-type servers holding the service resource items may be accessible to the service control subsystem by a network other than the Internet). Whilst the placing of service resource items in RRs held on DNS-type servers may not be suitable for all types of service resource items, it is suitable for items such as telephone numbers that do not change frequently. Thus, a suitable usage is to provide number portability; in this case, a dialled personal number triggers a lookup in the DNS-type system with all or part of the personal number being first parsed and then applied to the DNS type system to return a current number for call routing. All dialled numbers could be treated as personal numbers or simply a subset of such numbers, this subset comprising numbers that are readily identifiable as personal numbers by, for example, local lookup at an SSP or the presence of a predetermined leading digit string. The general concept of parsing a telephone number (or similar number) in whole or in part to form a domain name for resolution in a DNS-type distributed database system can be used for the retrieval of other items of information besides URIs and service resource items.

Feedback Mechanisms. In discussing the WWW-based freephone arrangement of Figure 17, it was mentioned that user A could be supplied with feedback on the likely length of waiting time before A would be called back. This is one example of using

the Internet to provide a feedback path for a potential or actual telephone user. Another example was provided in relation to Figure 16 where the progress of call setup was reported back by the call setup gateway to user A's terminal. In fact, generally where a user is known to be using a terminal actively on the Internet the opportunity arises to provide the user with feedback on the progress of call setup through the telephone system. In oreder to do this, it is of course necessary to ensure that the feedback can be passed to the appropriate application running on terminal A and this will generally require the application to have made appropriate linking information available. As well as call setup progress information, other information can also be fedback for example during a call holding period. Thus, for example, a special server can be provided on the Internet holding multimedia clips or even videos that could be output to user A during a call holding period.

In the described arrangments, the servers 51 have held service resource items concerned primarily with call setup control. It may be noted that in a somewhat different application, Internet servers could be arranged to hold data that could be accessed from the telephone system in response to a user-initiated telephone request and returned to that telephone user. Such a service would be provided, for example, in response to an SSP triggering a service request upon a particular telephone number being input, the service request prompting an SCP to cause an intelligent peripheral to access a particular Internet server (not necessarily an HTTP server) and retrieve the required data for return to the calling party. The intelligent peripheral may include a text-to-voice converter for replaying the data vocally to the user.

One further feedback process is also worthy of note, in this case in relation to service resource items themselves. By way of example, a telephone user G may subscribe to a service by which calls passed through to G's telephone are to be separated by a minimum of X minutes, X being user settable. To implement this service, G has a phone page on a server 51 that includes a "busy" status indication. Upon termination of a successful call to G, G's local SSP triggers the sending of a message by the associated SCP over the Internet to G's phone page. This message causes G's busy indication to be set to indicate that G is busy; the message also starts a timer which

times out after a period X and causes the busy status indication to be reset. A call attempt to G will either be rejected at G's SSP because G's line is genuinely busy or will trigger the SSP to enquire via the SCP whether G's phone-page busy status indication is set. If the busy status indication is set (which it will be during the period X following termination of a successful call) the call attempt is rejected whereas if the busy status indication is in its reset condition, the call attempt is allowed to proceed. By placing the busy status indication mechanism on G's phone page, it is possible to arrange for G to be able to easily change the value of X.

More General Variants. Whilst the service control subsystem of the PSTN has been embodied as an SCP in the foregoing examples, it will be appreciated that the functionality of the service control subsystem could be provided as part of an SSP or in an associated adjunct. Furthermore, the triggering of service requests can be effected by equipment other than SSPs, for example by intercept boxes inserted in the SS7 signalling links.

It will be appreciated that the term "Internet" is to be understood to include not only the current specification of the TCP/IP protocols used for the Internet and the current addressing scheme, but also evolutions of these features such as may be needed to deal with isochronous media. Furthermore, references to the WWW and the HTTP protocol should equally be understood to encompass their evolved descendants.

The present invention can also be applied to telephone systems other than just PSTNs, for example to PLMNs and other mobile networks, and to private systems using PABXs. In this latter case, a LAN or campus-wide computer network serving generally the same internal users as the PABX, will take the role of the Internet in the described embodiments.

Furthermore, the present invention has application where any switched telecommunication system (for example, a broadband ATM system) requires service control and a computer network can be used for the delivery of service resources to the service control subsystem of the telecommunication system.

CLAIMS

1. A method of accessing service resource items for use in respect of setting up bearer channels through a switched telecommunications system, said method including the steps of:

(a) -- provisioning at least one server connected to a computer network with a plurality of service resource items that are thereafter locatable on said computer network by corresponding known URIs, said computer network being logically distinct from the telecommunications system, and said service resource items relating to setup control for bearer channels through said telecommunications system with each said service resource item being associated with a respective predetermined code, said predetermined codes being distinct from said URIs and identifying end-point entities for said bearer channels;

(b) -- providing a mapping between each said predetermined code and the said known URI of the service resource item associated with that predetermined code; and

(c) -- utilising a said predetermined code to access a corresponding said service resource item by using said mapping to determine the URI corresponding to that resource item and then using this URI to access the service resource item over said computer network.

2. A method according to claim 1, wherein at least some of said URIs are derivable from their corresponding said predetermined codes by manipulation according to a function specified by said mapping.

3. A method according to claim 1, wherein at least some of said URIs are derivable from their corresponding said predetermined codes by look up in an association table associating said predetermined codes and URIs according to said mapping.

4. A method according to claim 3, wherein said association table is held on at least one database server connected to said computer network, step (c) involving accessing said database server over the computer network to determine the said URI corresponding to the said predetermined code.

5. A method according to claim 4, wherein said at least one database server is provided by a DNS-type distributed database system in which said URIs are held in records associated with respective names, herein referred to as domain names, by which the records can be retrieved, step (c) involving translating said predetermined code into a corresponding said domain name and using this domain name to retrieve the URI of the required service resource item from said DNS-type distributed database system.

6. A method according to claim 1, wherein at least two said service resource items are located at the same URI, the said predetermined codes of these service resource items including respective relative-resource-identifier values that are used at the server holding the service resource items to identify the required resource item amongst the service resource items at the same URI.

7. A method according to any one of the preceding claims, wherein said switched telecommunications system is a telephone system and said predetermined codes comprise numbers from at least one of the following categories:

-- the telephone number of the calling party;

-- the telephone number of the called party.

8. A method according to claim 1, wherein said switched telecommunication system is a telephone system, at least some of said predetermined codes being called-party telephone numbers and serving to retrive service resource items that are the current telephone numbers of the called parties.

9. A method according to any one of the preceding claims, wherein at least one said service resource items is service logic which is executed by the corresponding server upon being accessed with the result of this execution being returned to the accessing entity for use in bearer-channel setup control.

10. A method according to any one of the preceding claims, wherein at least one said service resource items is downloadable service data which upon being accessed is downloaded to the accessing entity for use thereby in bearer-channel setup control.

11. A method according to any one of the preceding claims, wherein at least one said service resource items is downloadable service logic which upon being accessed is downloaded to the accessing entity for execution in bearer-channel setup control.

12. A method according to claim 1, wherein said computer network is generally accessible to users of the telecommunications system.

13. A method according to any one of the preceding claims, wherein said computer network is the Internet.

14. A method according to any one of the preceding claims, wherein said switched telecommunication network is a PSTN.

15. A method according to any one of claims 1 to 13, wherein said telecommunication system is a private system including a PABX with which said service control system is associated, and wherein said computer network is a LAN.

16. A method according to any one of the preceding claims, wherein said URIs are URLs and/or URNs, and said server is an HTTP server.

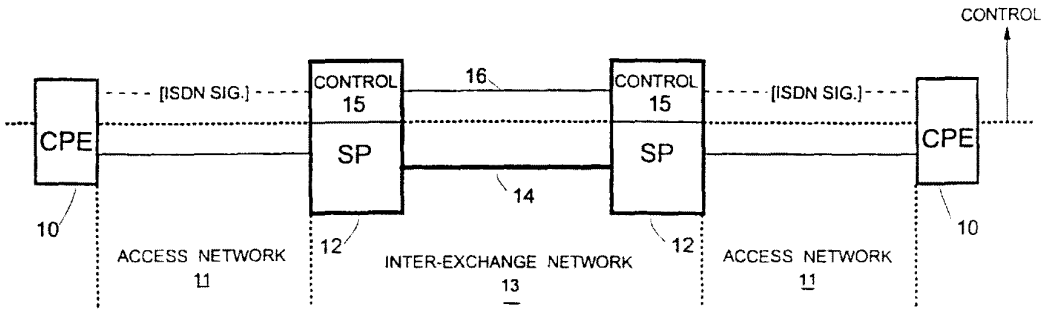


FIG. 1
(PRIOR ART)

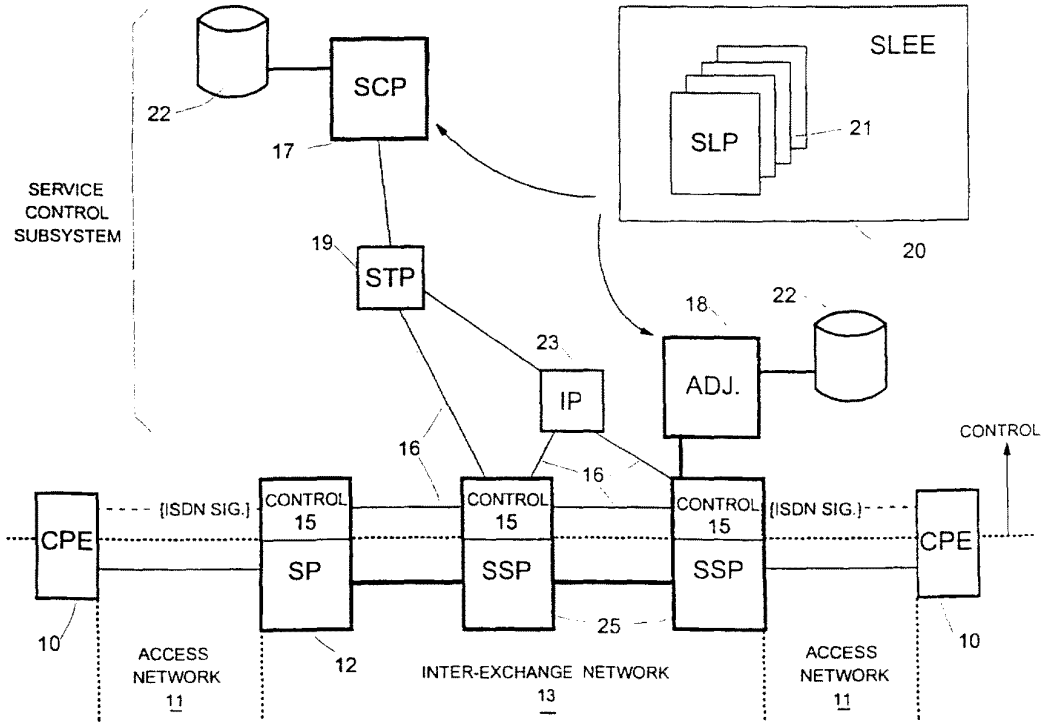


FIG. 2
(PRIOR ART)

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RED HAT V. CAS

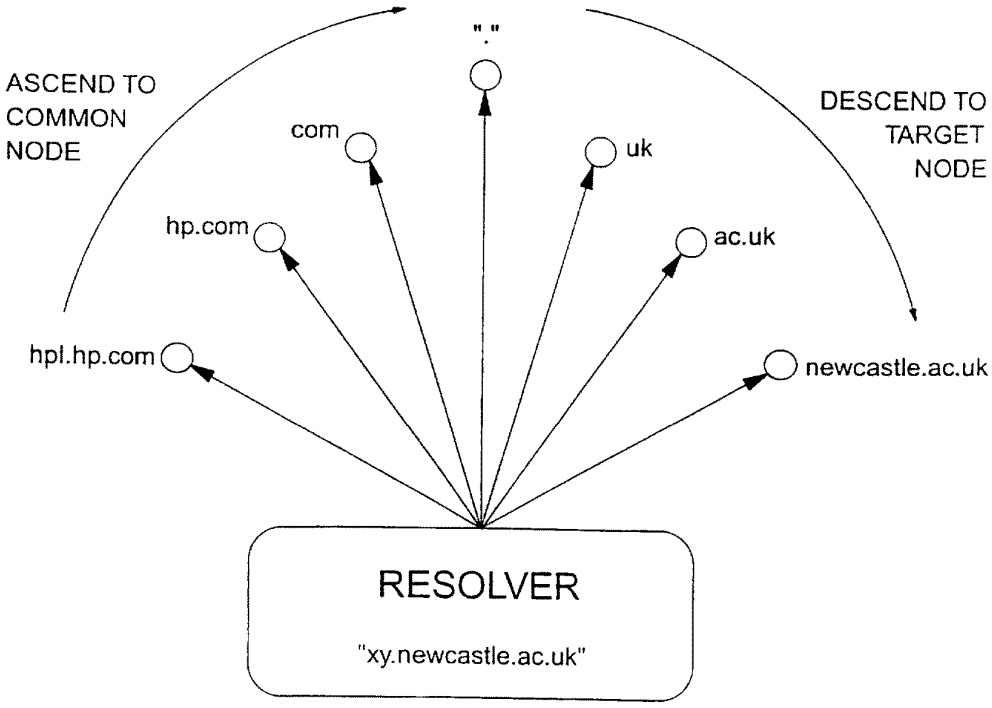


FIG. 3
(PRIOR ART)

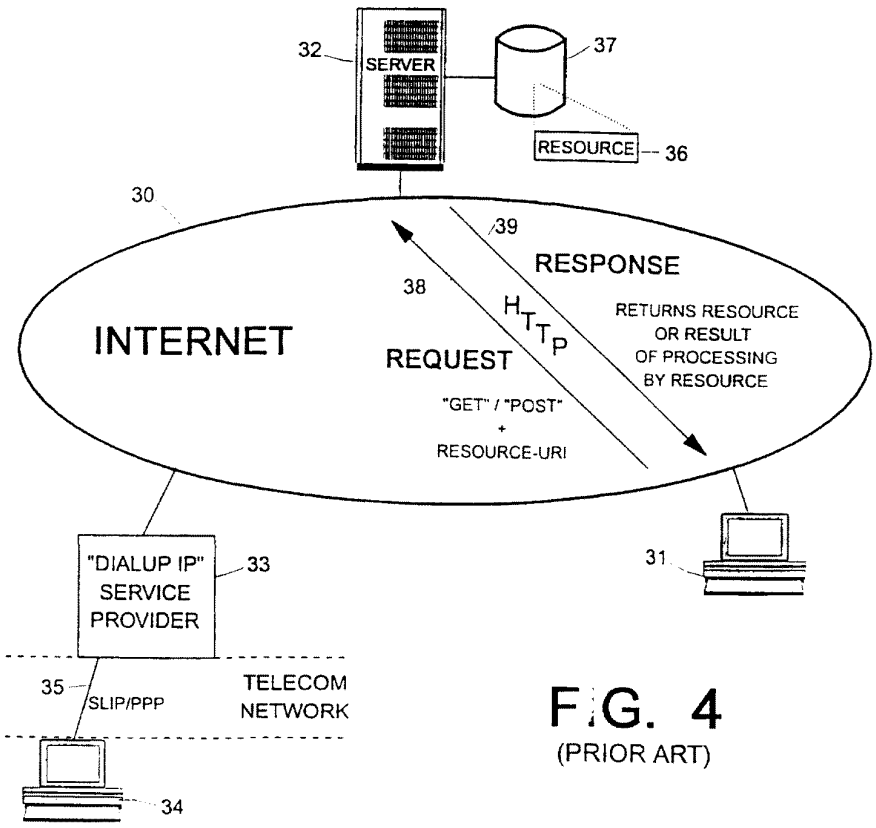


FIG. 4
(PRIOR ART)

http : //www.hp.com/Products.htlm

SCHEME HOST LOCATION ABSOLUTE PATH

FIG. 5
(PRIOR ART)

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RED HAT V. CAS

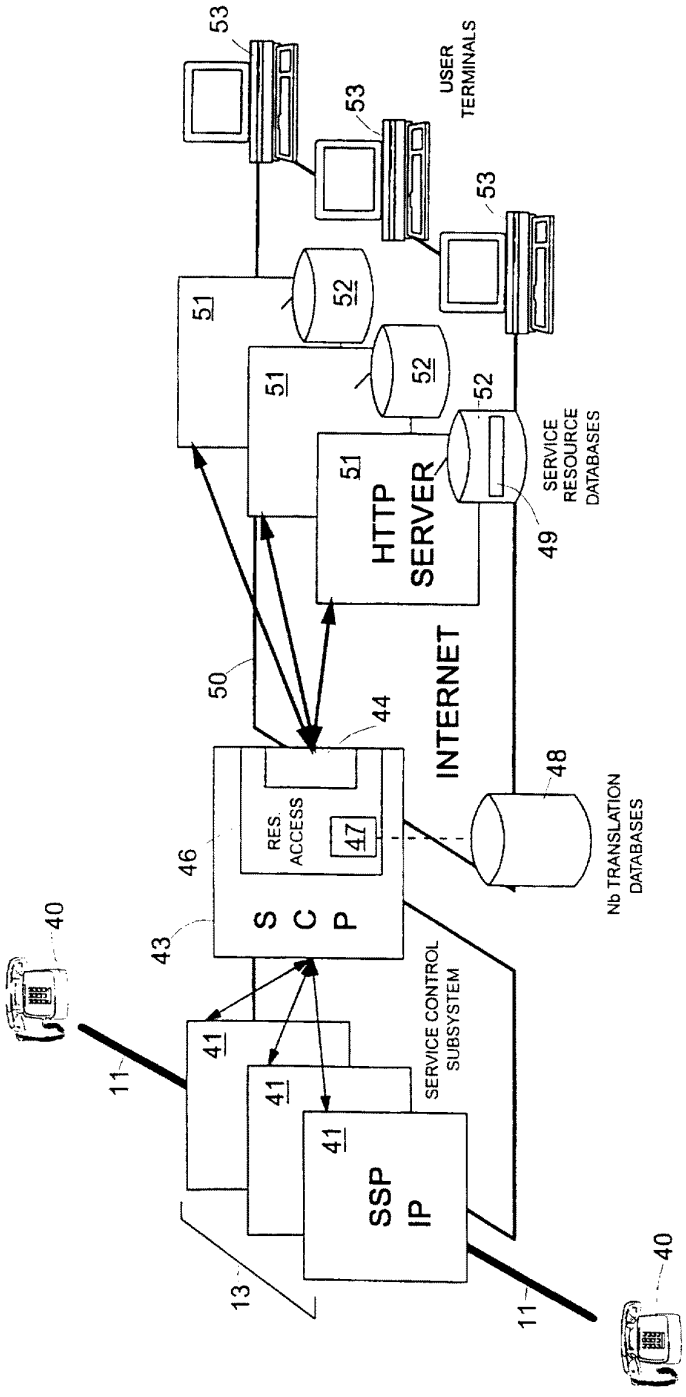

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USER TERMINALS
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52
SERVICE RESOURCE DATABASES
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HTTP SERVER
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50
INTERNET
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48
Nb TRANSLATION DATABASES
46
RES. ACCESS
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S C P
43
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41
SERVICE CONTROL SUBSYSTEM
41
SSP IP
13
11
40

FIG. 6

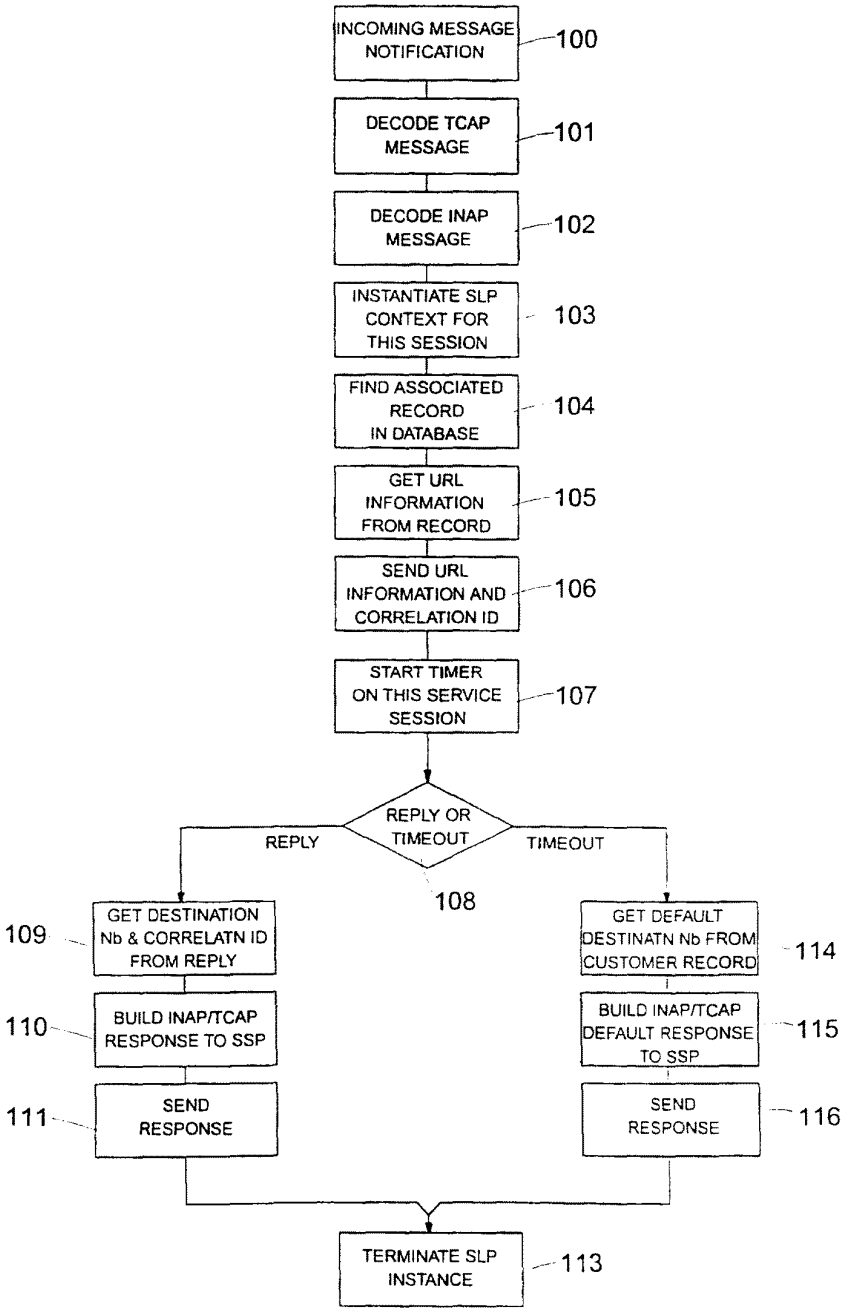


FIG. 7

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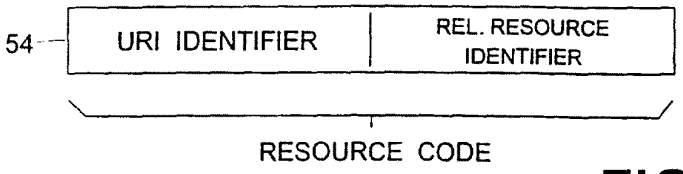


FIG. 8

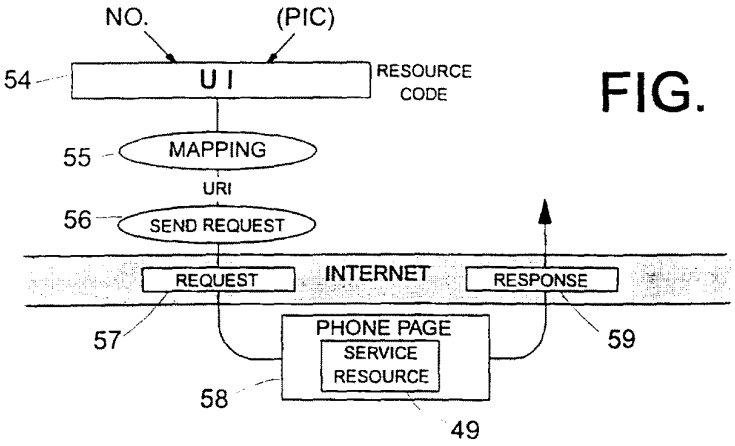


FIG. 9

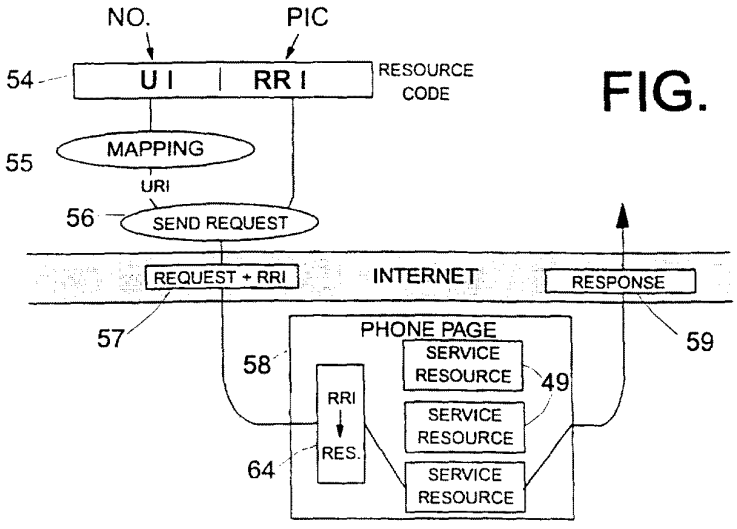


FIG. 10

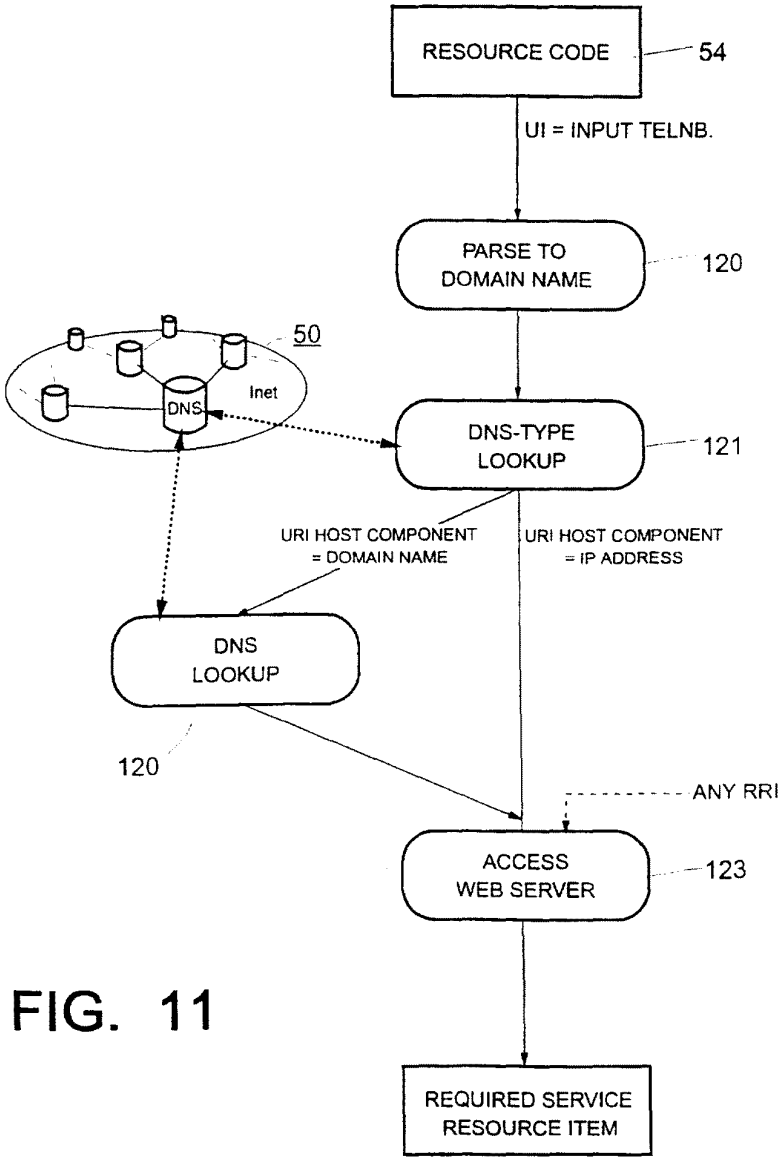


FIG. 11

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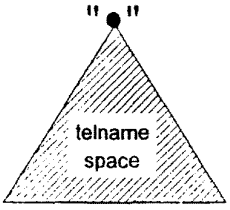


FIG. 12A

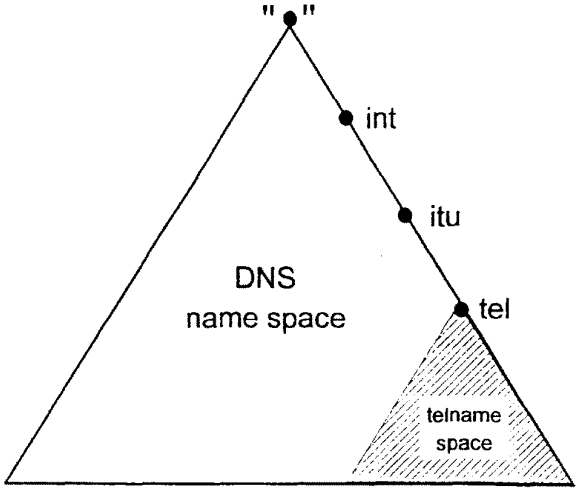


FIG. 12B

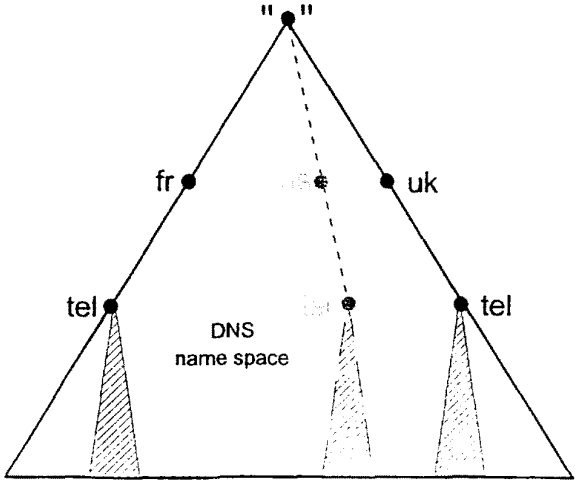


FIG. 12C

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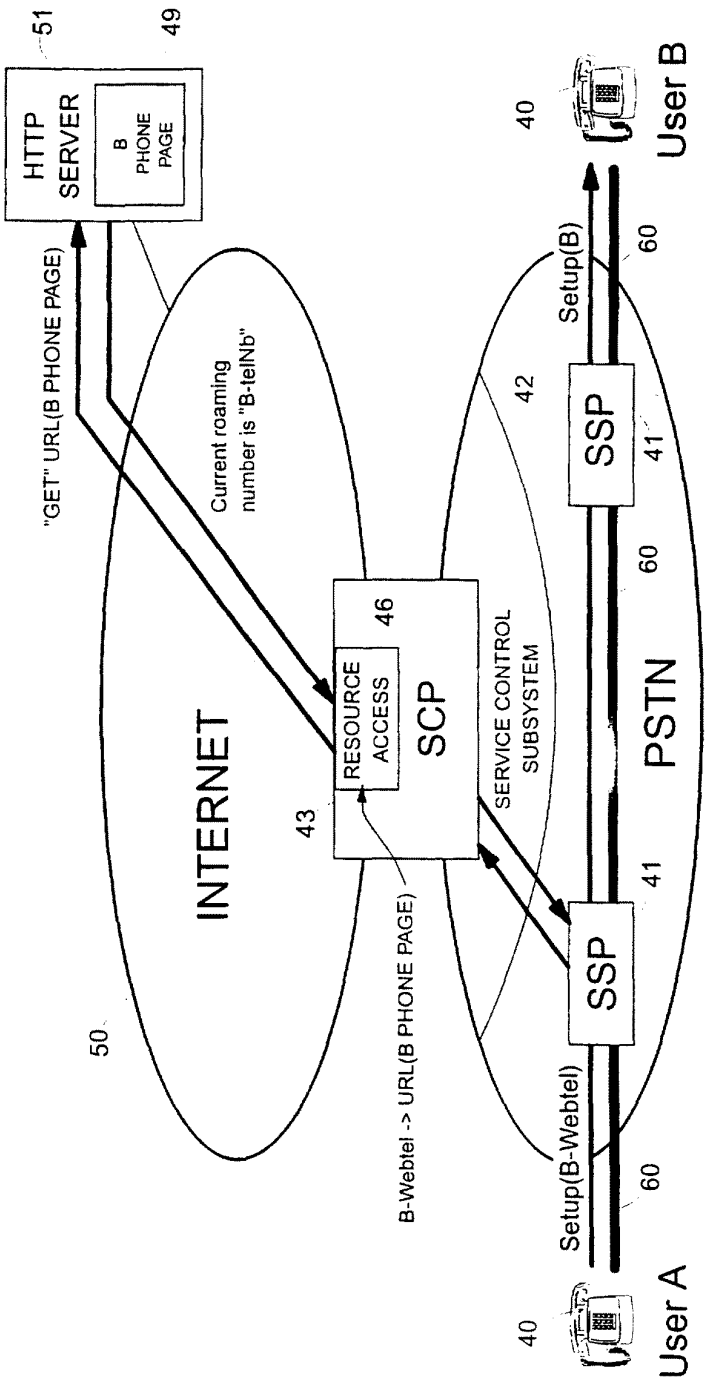


FIG. 13

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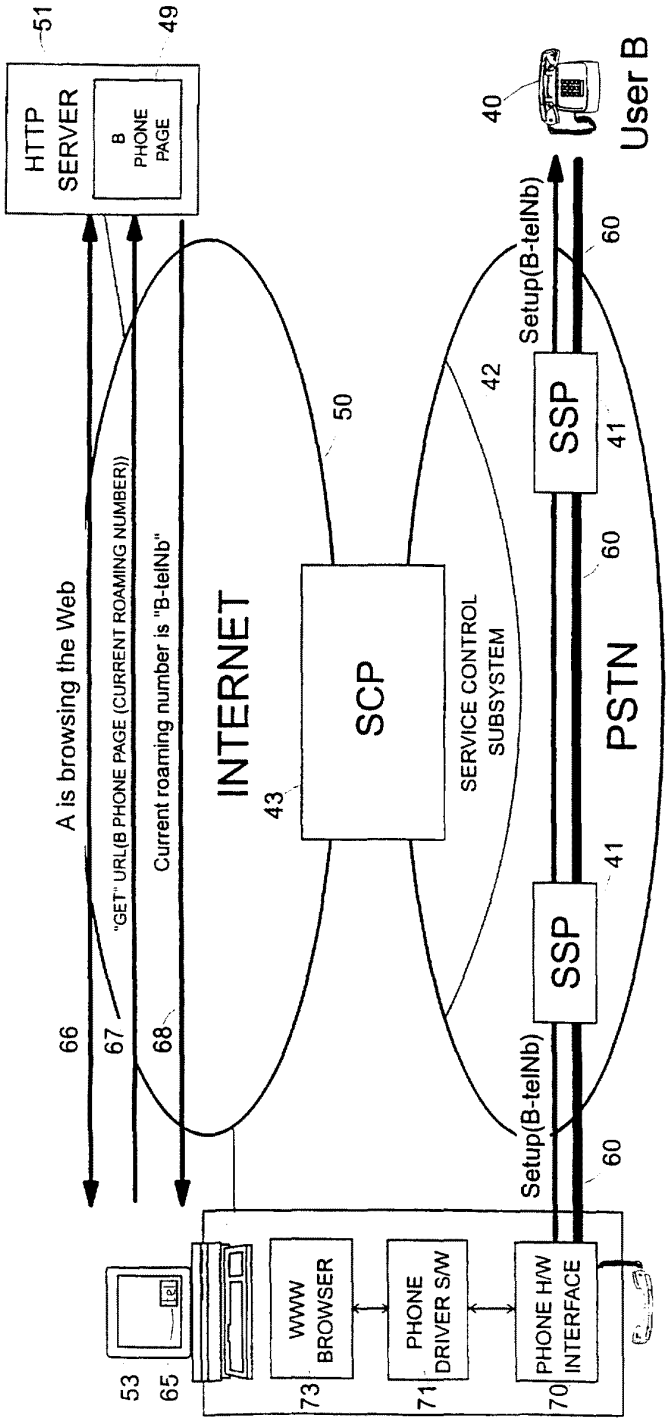


FIG. 14

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249

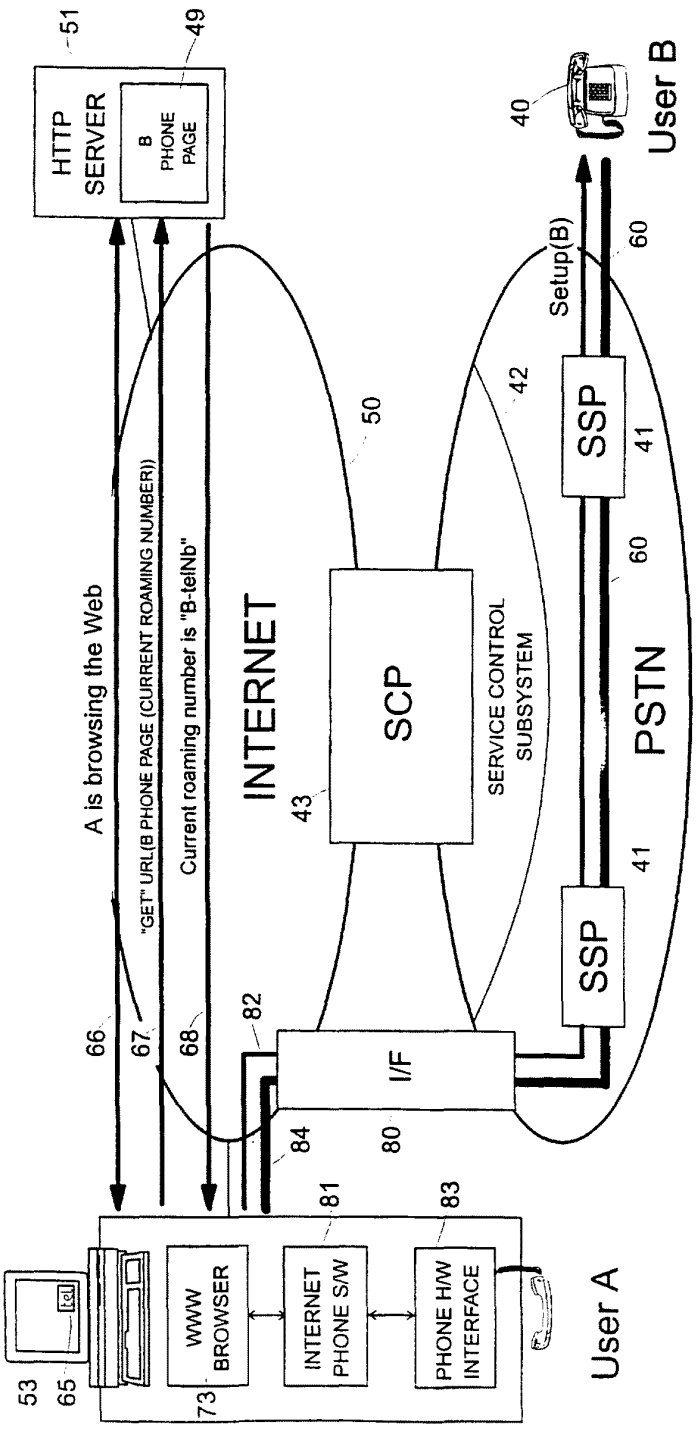


FIG. 15

250

RED HAT 1051
RED HAT V. CAS

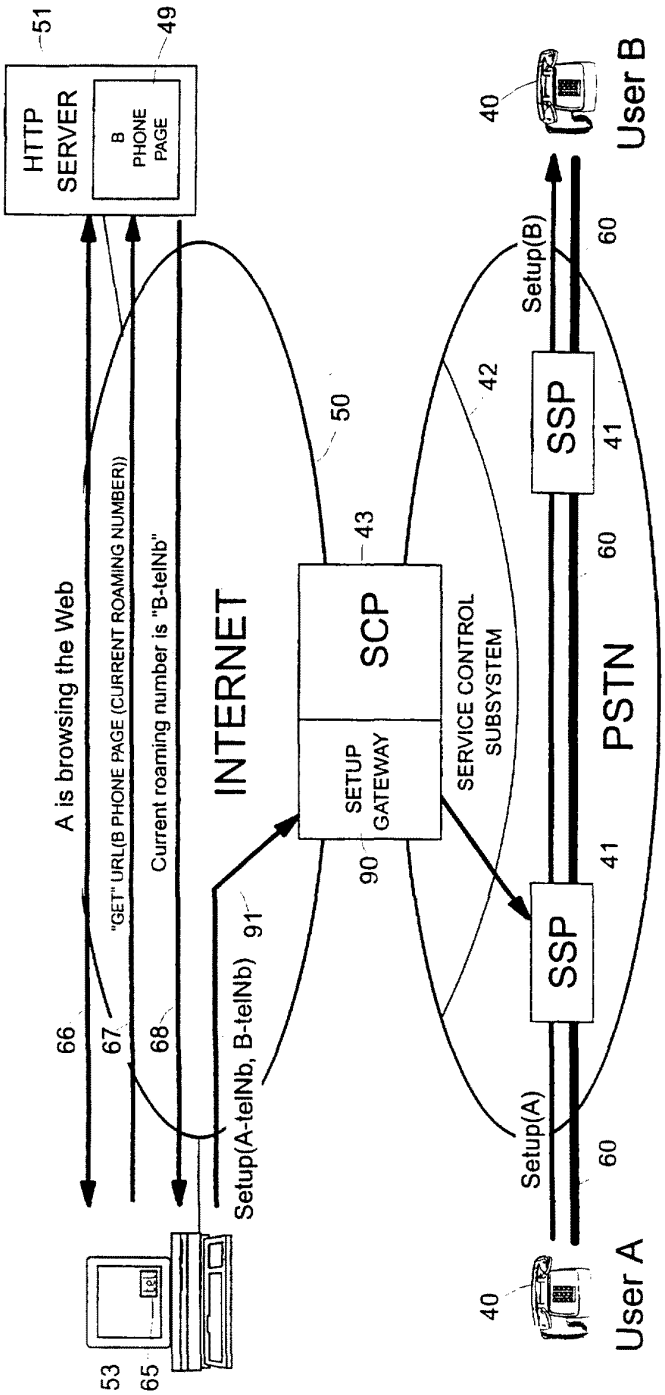


FIG. 16

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RED HAT V. CAS
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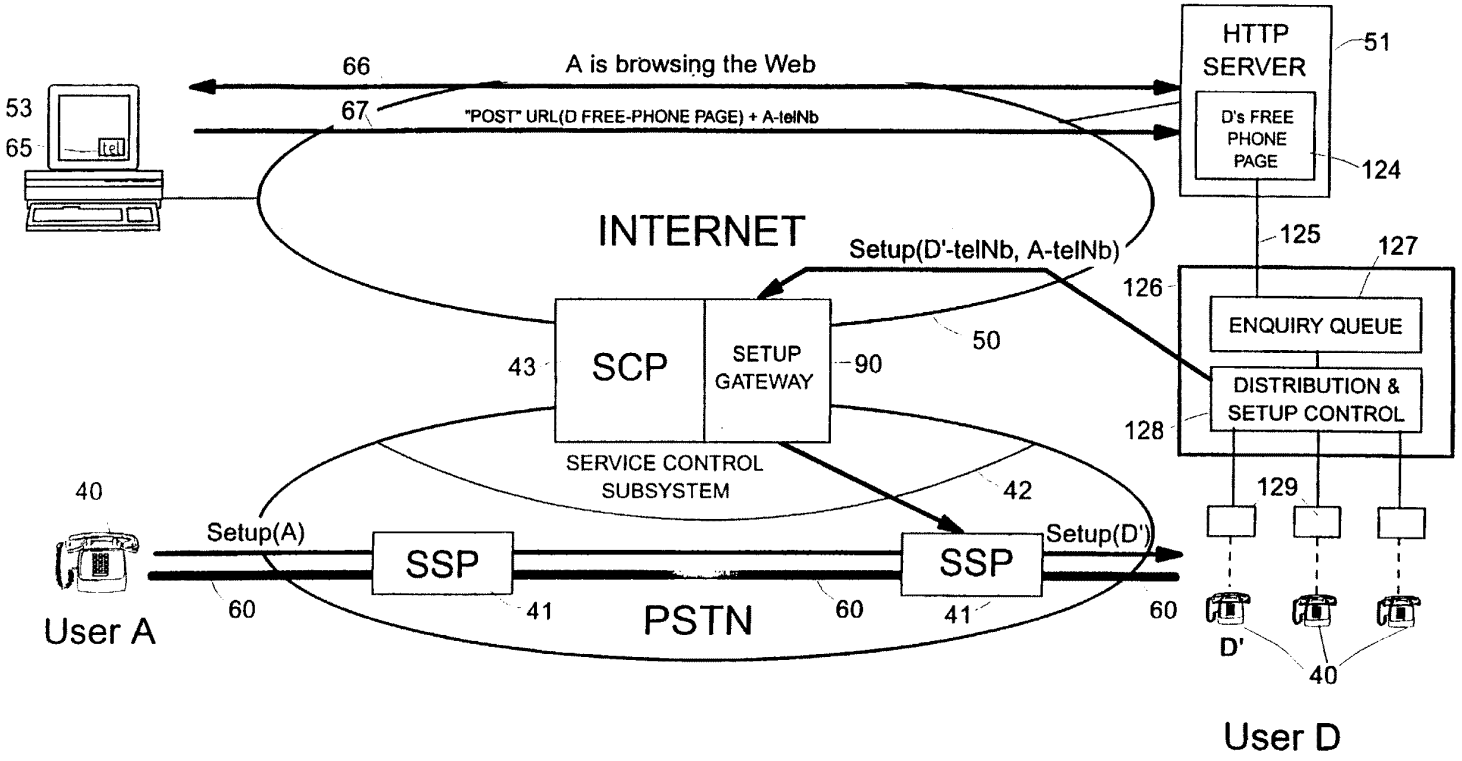


FIG. 17

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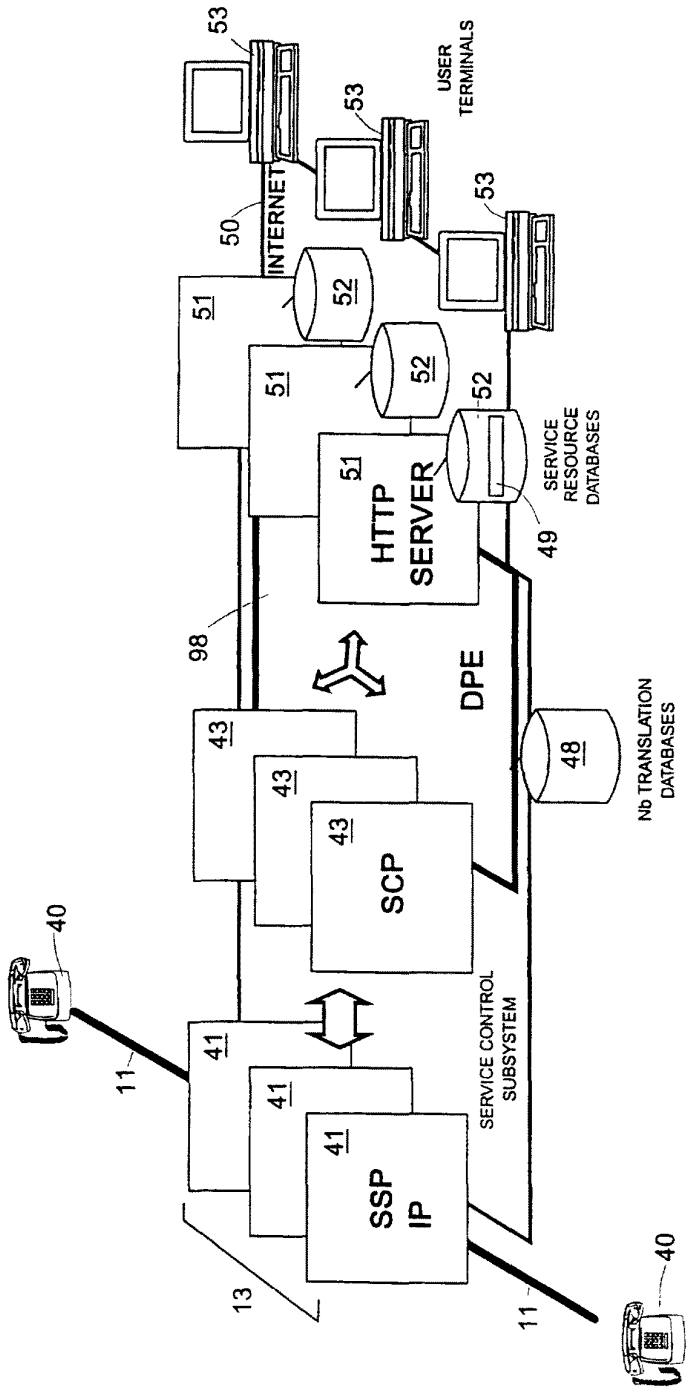

53
USER TERMINALS
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INTERNET
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SERVICE RESOURCE DATABASES
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HTTP SERVER
49
98
DPE
43
48
Nb TRANSLATION DATABASES
43
43
SCP
40
41
11
41
41
SSP IP
SERVICE CONTROL SUBSYSTEM
13
11
40

FIG. 18

INTERNATIONAL SEARCH REPORT

Inter onal Application No
PC1/GB 96/03055

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04Q3/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	ISS '95 WORLD TELECOMMUNICATIONS CONGRESS, vol. 2, 23 April 1995, BERLIN DE, pages 41-44, XP000495622 SEVCIK ET AL.: "Customers in driver's seat: Private Intelligent Network control point" see page 42, left-hand column, paragraph 5 - page 44, left-hand column, paragraph 2; figures 2,3 ---	1,7,10, 11,13-15
X	WO 94 23523 A (NOKIA TELECOMMUNICATIONS) 13 October 1994 see page 5, line 17 - page 6, line 23; figures 1,2 --- -/--	1,14

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

1

Date of the actual completion of the international search	Date of mailing of the international search report
10 March 1997	27.03.97

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Lambley, S

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INTERNATIONAL SEARCH REPORT

Inter nal Application No
PC1/GB 96/03055

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GLOBECOM '93, vol. 3, 29 November 1993, HOUSTON US, pages 1911-1917, XP000436141 YANG ET AL.: "The design and implementation of a Service Logic Execution Environment platform" see page 1914, left-hand column, line 3 - page 1915, left-hand column, line 9 ---	1,13-16
A	ELECTRONICS & COMMUNICATIONS IN JAPAN, PART I - COMMUNICATIONS, vol. 76, no. 1, January 1993, NEW YORK US, pages 34-44, XP000408623 ESAKI ET AL.: "Abstraction and control of transport network resources for Intelligent Networks" ---	
A	IEEE GLOBECOM, vol. 2, 28 November 1994 - 2 December 1994, SAN FRANCISCO US, pages 876-880, XP000488664 CHANG ET AL.: "Rapid deployment of CPE-based telecommunications services" -----	

1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

UNIFIED PATENTS EXHIBIT 1005
Page 74 of 75

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte' onal Application No
PC I/GB 96/03055

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9423523 A	13-10-94	FI 92895 B	30-09-94
		AU 675708 B	13-02-97
		AU 6430394 A	24-10-94
		CN 1120878 A	17-04-96
		EP 0694239 A	31-01-96
		JP 8508375 T	03-09-96

Form PCT/ISA/210 (patent family annex) (July 1992)

EXHIBIT 1006
U.S. Patent 5,809,070 to
Krishnan *et al.* ("Krishnan")

RED HAT 1051
RED HAT V. CAS

US005809070A

United States Patent [19]

Krishnan et al.

[11] Patent Number: 5,809,070

[45] Date of Patent: Sep. 15, 1998

[54] **HIGH SPEED DATA COMMUNICATIONS USING MULTIPLE LOW SPEED MODEMS**

[75] Inventors: **Kalyan Krishnan**, Fremont; **Leo Salinas**, Mountain View, both of Calif.

[73] Assignee: **Flat Connections, Inc.**, Fremont, Calif.

[21] Appl. No.: **695,054**

[22] Filed: **Aug. 9, 1996**

Related U.S. Application Data

[60] Provisional application No. 60/012,379, Feb. 27, 1996.

[51] **Int. Cl.**[6] **H04B 1/38**

[52] **U.S. Cl.** **375/222**; 375/260; 375/377; 370/465; 379/93.06; 379/93.07; 395/309

[58] **Field of Search** 375/220, 222, 375/260, 377, 370/431, 433, 465, 468; 379/93.01, 93.06, 93.07; 395/309

[56] **References Cited**

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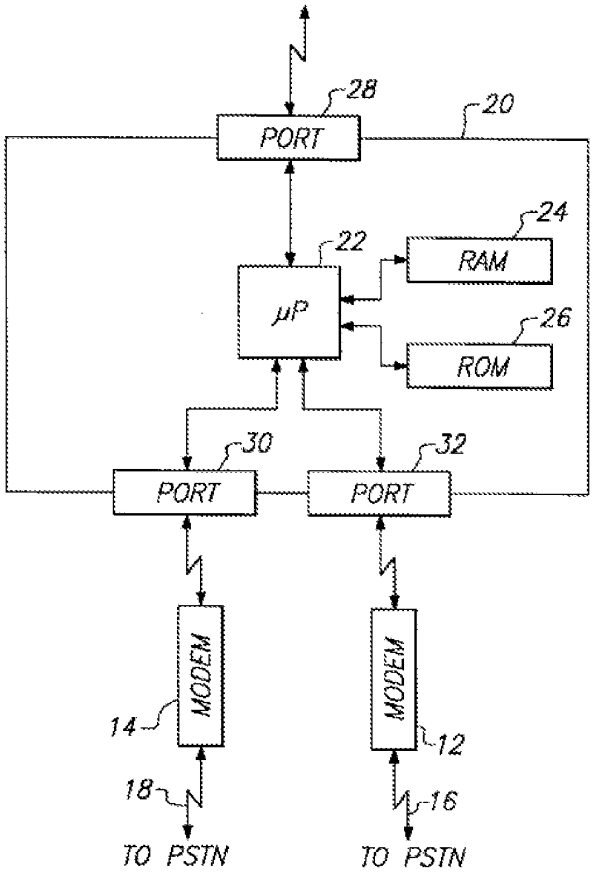
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5,317,415	5/1994	Kinami et al.	358/425
5,393,239	2/1995	Morris et al.	379/93.08

Primary Examiner—Don N. Vo
Assistant Examiner—Amanda T. Le
Attorney, Agent, or Firm—Fish & Neave; Nicola A. Pisano

[57] **ABSTRACT**

Methods and apparatus for providing high speed inter-computer data transmission using multiple low speed communication links. At the transmitting site, a high speed data stream is split into multiple low speed data stream and multiplexed onto to the low speed links. The receiver demultiplexes, buffers, and synchronizes the multiple low speed data streams to recreate the high speed data stream.

23 Claims, 3 Drawing Sheets



UNIFIED PATENTS EXHIBIT 1006
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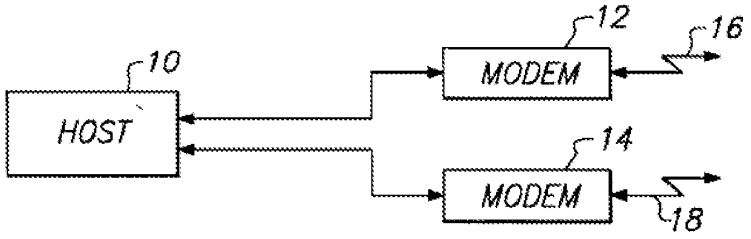


FIG. 1

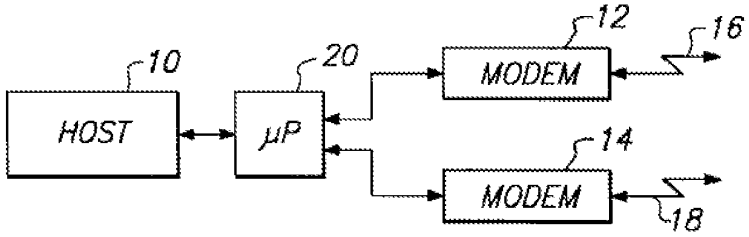


FIG. 2A

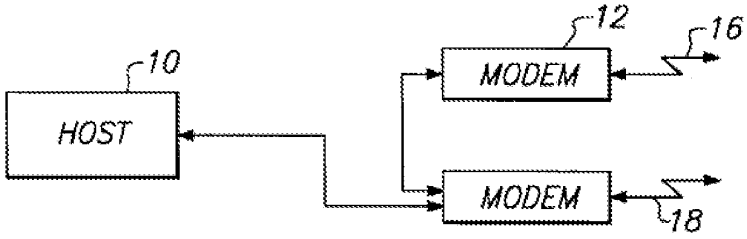


FIG. 3A

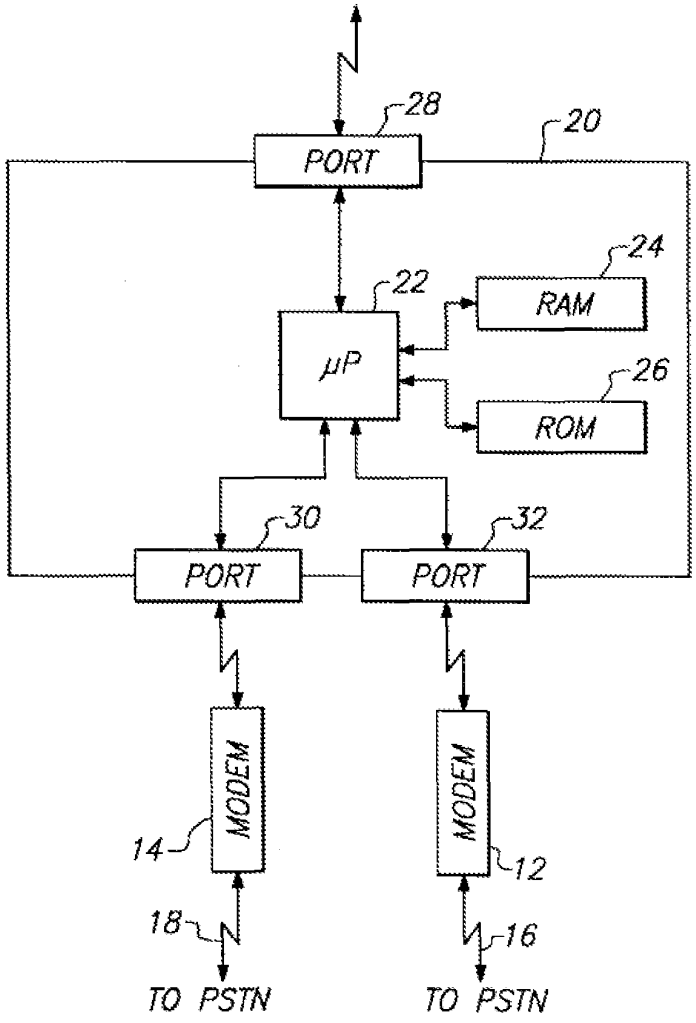

28
20
PORT
24
22
RAM
μP
26
ROM
30
32
PORT
PORT
MODEM
MODEM
14
12
18
16
TO PSTN
TO PSTN

FIG. 2B

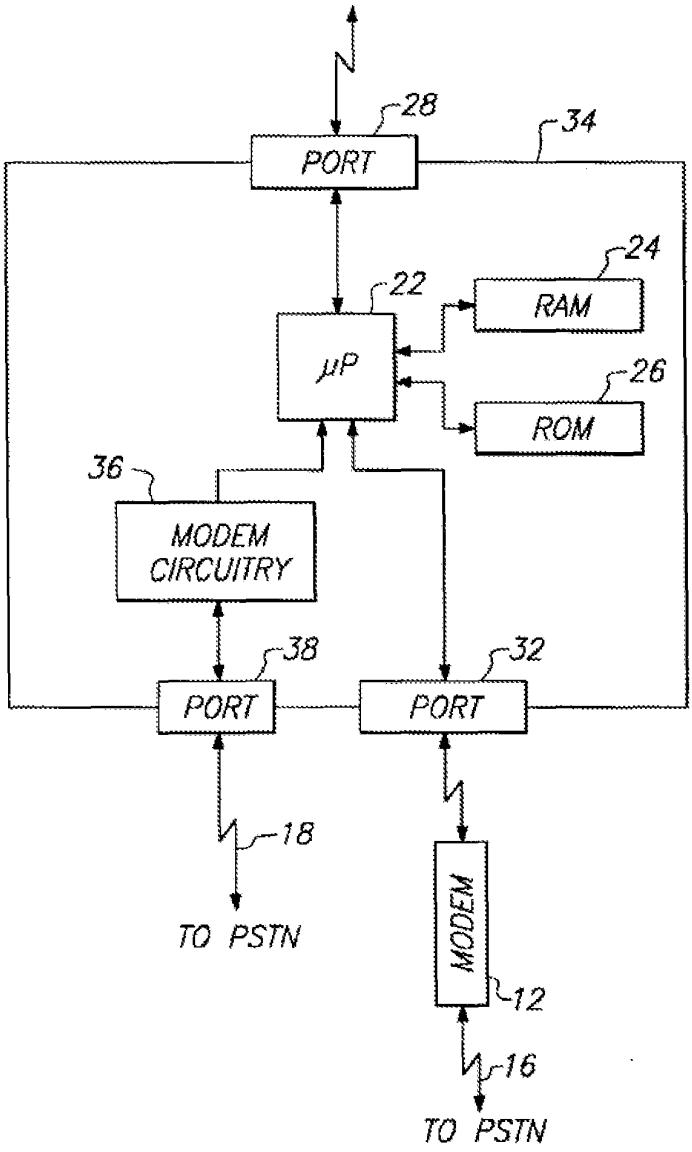

28
34
PORT
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22
RAM
μP
26
ROM
36
MODEM
CIRCUITRY
38
32
PORT
PORT
18
TO PSTN
MODEM
12
16
TO PSTN

FIG. 3B

HIGH SPEED DATA COMMUNICATIONS USING MULTIPLE LOW SPEED MODEMS

This application claims benefit of USC 119(e) of any U.S. Provisional Application No. 60/012,379, filed Feb. 27, 1996.

BACKGROUND OF THE INVENTION

Modems provide a means for remote computers to communicate over the Public Switched Telephone Network ("PSTN"), and have been in use for several decades. While data transmission rates using analog modems have risen considerably over the past decades, from 120 bits-per-second (bps) to 28,800 bps, it is unlikely that they will exceed 35,000 bps due to the available bandwidth of the PSTN.

There has been a rapid increase in the use of computer networks, such as the Internet, for publishing, sharing and accessing data on remote computers. The increasing amount of "multimedia content" present causes the data to be voluminous. Many users connect to these networks via "dial-up connections" using relatively low speed modems, resulting in lengthy data transfer (download) times. Thus, there is a need for high speed modem connections.

While new digital technologies, such as Integrated Subscriber Digital Network (ISDN), may bring very high speed data communications, they are relatively expensive and are not yet widely available. However, PSTN connections are inexpensive, widely available, and additional lines may be added at little or no cost. Thus it would be desirable to provide a method for communicating data at high rates using PSTN-type connections with readily available modems and computers.

SUMMARY OF THE INVENTION

The objects of the present invention are met by providing methods and apparatus for achieving high data transmission rates using multiple, simultaneous, parallel PSTN connections. In a first embodiment of the invention, two or more modems are coupled to a host computer. For example, two modems may be coupled to separate RS-232 ports of an IBM compatible PC or other personal computer. An operating system component controls the modems either as independent communications channels, or for high speed data transmissions, "combines," or "bonds" multiple PSTN-type connections together to create a high speed data link. This is accomplished by splitting a high speed data stream into multiple lower speed data streams and transmitting each lower speed data stream via a low speed modem and PSTN connection.

In an alternative embodiment of the present invention, a communication controller is coupled between the host computer and the modems. The controller off-loads execution of the multi-link protocol from the host processor. In this configuration a single local, high speed link connects the host computer to the communications controller and two or more links connect the communication controller to PSTN based links via modems.

A third embodiment of the present invention, is a multi-link modem, including a communication controller and standard modem circuitry. The modem has a high speed communications link between the communication processor and the host processor. The modem also has a second port for connecting to a second modem in a daisy chain fashion. Additional multilink modems may be daisy-chained to provide three, four, or more PSTN links, thereby increasing the maximum data rate.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects and advantages of the present invention will be apparent upon consideration of the following detailed description, taken in conjunction with the accompanying drawings, in which like reference characters refer to like parts throughout, and in which:

FIG. **1** is an illustrative block diagram of a first embodiment of an inter-computer communication system employing multiple communication links in accordance with the principles of the present invention;

FIGS. **2A** and **2B** are illustrative block diagrams of an alternative embodiment of the multiple link data communications system of the present invention, and

FIGS. **3A** and **3B** are illustrative block diagrams of another embodiment of a multiple link data communication system in accordance with the principles of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring first to FIG. **1**, a first embodiment of the present invention is described. Host computer **10** may be any general purpose computer such as an IBM AT-PC or Apple McIntosh type computer. Modems **12** and **14** are coupled to separate data ports of host computer **10** and to separate telephone lines **16** and **18**. Although only two modems are shown, additional modems may be used, as long as each one is coupled to a separate data port of host computer **10**.

Host computer **10** is preferably programmed with communication software so that it may transfer data to another computer via modem **12** or **14**. Host computer **10** is also programmed with link control software implementing a multi-link data communication protocol such as the Multi-Link Point-to-Point Protocol (MLPPP). MLPPP provides a method for a transmitting site to split a single high speed data stream into multiple parallel data streams which are multiplexed onto multiple low speed data links. A receiving site receives and demultiplexes the multiple low speed data streams to recover the original high speed data stream.

In a preferred embodiment the link control software dynamically adds and deletes low speed links as required to support the rate of data transmission. For example, as the data rate increases beyond the capacity of modem **12** and PSTN line **16**, a second PSTN connection may be established via modem **14** and PSTN line **18**. Subsequently, as the data rate decreases to a level within the capacity of a single modem, modem **14** may be disconnected. Preferably, the link control software includes a hysteresis characteristic in the code that deletes unneeded low speed links so that modem **14** is not disconnected prematurely due to a temporary reduction in the data transmission rate.

Various strategies may be employed by the link control software executing on host computer **10** to maximize data throughput. For example, the link control software may transmit as much data as possible via modem **12**, so that modem **12** is operating near its maximum possible data rate, and transmit any additional data via modem **14**. Alternatively, the link control software may distribute the data evenly between modems **12** and **14** thereby equalizing the load on each.

In addition, it may be desirable to transmit the data so that it is received nearly in sequence so as to minimize the amount of processing required to reassemble the high speed data stream. For example, if the data transmission rates across PSTN links **16** and **18** are unequal, the link control

software may transmit data proportional to the data rate of modems **12** and **14**. Thus, if modem **12** transmits at 28.8 kbps and modem **14** transmits at only 14.4 kbps, link control the software may transmit twice as much data via modem **12** as via modem **14**.

In a particularly preferable embodiment of the invention, the link control software is also capable of operating modems **12** and **14** as two distinct data links. For example, host computer **10** may be a modem server on a local area computer network. It may then be desirable to be able to transmit data to a first remote computer via modem **12** and transmit the same or different data to a second remote computer via modem **14**. Thus, maximum data communication flexibility is maintained.

Referring now to FIG. **2A**, an alternative embodiment of the present invention is described, in which host computer **10**, modems **12** and **14**, and PSTN lines **16** and **18** are as described above in connection with FIG. **1**. Interposed between host computer **10** and modems **12** and **14** is communication controller **20**. Communication controller **20**, which may be a stand-alone unit, or an "add-in" card within host computer **10**, executes link control software similar to the software executed on host processor **10** of FIG. **1**. The controller off-loads link control processing from the host thereby reducing the processing load on the processor of host computer **10**.

As shown in FIG. **2B**, communication controller **20** includes processor **22**, RAM **24**, ROM **26**, high speed data port **28**, and low speed ports **30** and **32** for connecting to multiple modems. Processor **22** may be any sufficiently powerful general purpose processor, such as a 80386 class processor manufactured by Intel, of Santa Clara, Calif. Alternatively, processor **22** may be a digital signal processor (DSP), such as the 56300 family of DSP's manufactured by Motorola, Inc. Schaumburg, Ill.

ROM **26** contains the link control software and may also contain various diagnostic and troubleshooting programs. RAM **24** provides buffering for incoming and outgoing data, as well as a scratchpad area for the link control software. In addition, RAM **24** may include a non-volatile portion for the storage of configuration and control parameters of the link control software.

Data port **28** may be a serial port compatible with the EIA-232 or Universal Serial Bus (USB) standards, or a parallel port compatible with the Enhanced Parallel Port standard. Alternatively, data port **28** may be a connection to a local area network such as an Ethernet or Token Ring network. To maintain compatibility with most current stand-alone modems, ports **30** and **32** are standard EIA-232 ports, although it is anticipated that parallel ports and high speed serial ports may become common modem interfaces in the future.

In one embodiment of the link controller of FIGS. **2A** and **2B**, the controller effectively hides multiple modems **12** and **14** from host computer **10** so that controller **20** appears to be a single high speed data modem connected to host **10** via a single physical port. In an alternative embodiment, a software program, typically referred to as a device driver, is installed in host computer **10**. The device driver creates multiple logical connections between host **10** and controller **20**, wherein each logical connection corresponds to a modem, such as modems **12** and **14**. Thus, even though there is only one physical connection between host **10** and controller **20**, application software running on host computer **10** "sees" multiple logical connections.

Referring now to FIG. **3**, another embodiment of the present invention is disclosed. In the embodiment of FIG. **3A**, modem **14** and communication controller **20** of FIG. **2A** are essentially combined into multilink modem **34**. Modem **12** is then "daisy-chained" off of multilink modem **34**.

As shown in FIG. **3B**, multilink modem **34** includes processor **22**, RAM **24**, ROM **26**, and data ports **28** and **32** as discussed in connection with FIGS. **2A** and **2B**. Multilink modem **34** also including modem circuitry **36** and telephone jack **38**. Modem circuitry **36** implements standard modem signaling conventions and may comprise an off-the-shelf modem chip set. Alternatively, modem circuitry **36** may comprise custom modem circuitry that is simplified to take advantage of the processing power of processor **22**. Telephone jack **38** is any suitable jack for providing a connection to the PSTN, and may for example be an RJ-45 type jack. Several multilink modems may be cascaded between host **10** and standard modem **12** to increase the maximum possible data throughput.

In the embodiment of FIG. **3**, the link control software running on processor **22** must know how many modems are "downstream." This information may be obtained from Hayes AT-style commands that are transmitted by host computer **10** during initialization of communications applications running on host **10**. Preferably, multilink modems **34** include software and protocols to automatically determine this information when initially powered-on or reset. For example, most modems provide a capability for a host to interrogate configuration information from the modem. Thus, each modem in the daisy chain could interrogate its downstream neighbor to determine the total number of downstream links, wherein each modem returns a count of 1 plus the count received from the downstream neighbor. As will of course be understood by one skilled in the art more elaborate protocols are possible.

By determining the number of downstream modems, each multilink modem in the daisy chain can determine how to partition outgoing data for transmission over the PSTN links. For example, if there are a total of three modems (two multilink and one standard), the multilink modem farthest upstream may transmit 40% of the data over its internal modem and pass the remaining 60% to the next multilink modem. This modem may in turn transmit half of the remaining 60% and send the remainder to the standard modem for transmission.

One skilled in the art will appreciate that the present invention may be practiced by other than the described embodiments, which are presented for purposes of illustration and not of limitation.

What is claimed is:

1. Apparatus for high data rate communications using multiple communication links to transmit data between a host computer and at least one remote computer, the apparatus comprising:

a processor; and

first modem circuitry coupled to the processor and to a first communication link, the first communication link capable of transmitting data at a maximum rate of N bits/second;

second modem circuitry coupled to the processor and to a second communication link, the second communication link capable of transmitting data at a maximum rate of M bits/second,

the processor programmed to determine a total rate of data transmission between the host computer and the remote computer, and to transmit the data via the first modem circuitry when the total rate of data transmission is less than a first threshold, the processor further programmed

to establish the second communication link responsive to the total rate of data transmission exceeding the first threshold, so that a first portion of the data is transmitted via the first modem circuitry, and a second portion of the data is transmitted via the second modem circuitry.

2. The apparatus of claim 1 wherein the processor determines the first and second portions of the data proportional to the maximum rates N and M of the first and second communication links, respectively.

3. The apparatus of claim 1 wherein the first and second communication links couple the first and second modem circuitries to a first remote computer.

4. The apparatus of claim 1 wherein the first communication link couples the first modem circuitry to a first remote computer and the second communication link couples the second modem circuitry to second remote computer.

5. The apparatus of claim 1 wherein the processor comprises a portion of the host computer.

6. The apparatus of claim 1 wherein the processor is coupled to the host computer.

7. The apparatus of claim 6 further comprising a housing for enclosing the processor, the housing including a first interface adapted to couple the processor to a host computer for communicating data therebetween, wherein the transmitted data are communicated between the processor and the host computer via the first interface.

8. The apparatus of claim 7 wherein the housing also encloses the first modem circuitry, the housing further including a second interface adapted to couple the processor to the second modem circuitry.

9. The apparatus of claim 1 wherein the rates N and M are equal.

10. A modem comprising:

a first port for receiving data from a host computer;

a second port for coupling the modem to a first remote computer via a first communication link, the first communication link having a maximum data rate of N;

a third port for coupling the modem to a second modem; and

a processor coupled to the first, second, and third ports, the processor programmed to coordinate data communications between the host computer, the first remote computer, and the second modem, to determine a first threshold rate, to determine a total rate of data transmission between the host computer and the first remote computer, and to establish a second communication link having a maximum data rate of M with the first remote computer via the third port and the second modem, responsive to the total rate of data transmission exceeding the first threshold rate.

11. The modem of claim 10 wherein the processor transmits data from the host computer to the first remote computer at a data rate of N+M by transmitting a first portion of the transmitted data via the second port and transmitting a second portion of the transmitted data via the third port and the second modem.

12. The modem of claim 11 wherein the processor selects the first and second portions of transmitted data proportional to the data rates of the first and second communication links, respectively.

13. The modem of claim 10 wherein the first threshold rate is based on the maximum data rate of the first modem over the first communications link.

14. The modem of claim 10 wherein the processor disestablishes the second communication link responsive to the rate of data communicated between the host computer and the first remote computer falling below a second threshold rate.

15. The modem of claim 10 wherein the processor establishes a second communication link with a second remote computer via the third port and the second modem responsive to the host computer requiring to communicate with the second remote computer.

16. A method of transmitting data from a host computer to a remote computer at a high data rate using multiple communication links comprising:

establishing a first communication link to a remote computer;

transmitting data to the remote computer over the first communication link;

determining the rate of data transmission between the host computer and the remote computer;

establishing a second communication link to the remote computer responsive to the rate of data transmission exceeding a first threshold rate; and

transmitting a first portion of the data to the remote computer over the first communication link and a second portion of the data to the remote computer over the second communication link.

17. The method of claim 16 wherein establishing a second communication link to the remote computer responsive to the rate of data transmission exceeding a first threshold rate further comprises:

determining a maximum data throughput of the first communication link; and

setting the first threshold to a predetermined percentage of the maximum data throughput.

18. The method of claim 16 further comprising:

determining a total rate of data transmission between the host computer and the remote computer over the first and second communication links;

disestablishing the first communication link responsive to the total data rate falling below a second threshold rate; and

transmitting the data to the remote computer over the second communication link.

19. The method of claim 16 further comprising:

determining a total rate of data transmission between the host computer and the remote computer over the first and second communication links;

disestablishing the second communication link responsive to the total data rate falling below a second threshold rate; and

transmitting the data to the remote computer over the first communication link.

20. The method of claim 16 further comprising:

determining a rate of data transmission between the host computer and the remote computer over the first communication link;

determining a rate of data transmission between the host computer and the remote computer over the second communication link;

disestablishing one of the first and second communication links responsive to the total data rate being within the capacity of the other of the first and second communication links; and

transmitting the data to the remote computer over a remaining one of the first and second communication links.

21. The method of claim 16 wherein transmitting the first and second portions of the data to the remote computer over the first and second communication links further comprises:

determining a maximum data rate of the first and second communication links; and

selecting the size of the first and second portions of the data based on the maximum data rate of the first and second communication links.

22. The method of claim **21** wherein selecting the size of the first and second portions of the data based on the maximum data rate of the first and second communication links further comprises:

selecting the first and second portions proportional to the maximum data rates of the first and second communication links, respectively.

23. The method of claim **21** wherein selecting the size of the first and second portions of the data based on the maximum data rate of the first and second communication links further comprises:

selecting the first and second portions of data to cause the data rate of one of the respective first and second communication links to be substantially at its maximum data rate.

* * * * *

EXHIBIT 1007

U.S. Patent 7,606,156 to DeLangis ("DeLangis-156")

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(12) **United States Patent**
DeLangis

(10) **Patent No.: US 7,606,156 B2**
(45) **Date of Patent: Oct. 20, 2009**

(54) **RESIDENTIAL COMMUNICATIONS GATEWAY (RCG) FOR BROADBAND COMMUNICATIONS OVER A PLURALITY OF STANDARD POTS LINES, WITH DYNAMIC ALLOCATION OF SAID BANDWIDTH, THAT REQUIRES NO ADDITIONAL EQUIPMENT OR MODIFICATIONS TO THE ASSOCIATED CLASS 5 OFFICES OR THE PSTN AT LARGE**

(76) Inventor: **Eric M DeLangis**, 4339 Golf Vista Dr., Loveland, CO (US) 80537

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1099 days.

(21) Appl. No.: **10/686,375**

(22) Filed: **Oct. 14, 2003**

(65) **Prior Publication Data**

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(51) **Int. Cl.**
H04L 12/26 (2006.01)
H04L 12/28 (2006.01)

(52) **U.S. Cl.** **370/235**; 370/401

(58) **Field of Classification Search** 370/401, 370/352, 235, 230, 233, 363, 371, 374, 381, 370/433, 465–468, 470–474, 483–486, 493–495, 370/395, 252

See application file for complete search history.

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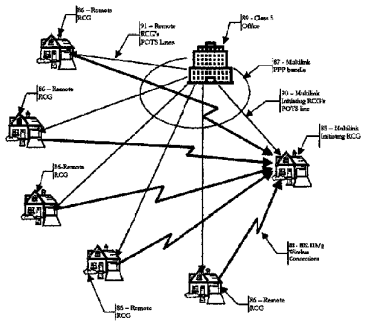
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Primary Examiner—Hong Cho
(74) *Attorney, Agent, or Firm*—Clay McGurk; The Law Office of Clay McGurk

(57) **ABSTRACT**

The Residential Communications Gateway (RCG) is a broadband communications device that combines all voice, data and video communications to and from a typical residence or small business for transmission over a single, or a plurality of Plain Old Telephone Service (POTS) lines separately or in conjunction with, a wireless broadband backbone. The RCG does this by employing packetized data with Voice over Internet Protocol (VoIP) technologies combined with RF communications technologies. A key consideration to the design of the RCG is that no additional or special transmission equipment must be installed at the Central Office or anywhere else in the network to enable new calling features provided by the RCG as is the case with DSL and Cable systems. By eliminating the requirement for costly infrastructure enhancements, ubiquitous high speed communications and services can be deployed to every POTS subscriber.

5 Claims, 9 Drawing Sheets



– Ad-hoc wireless LAN with broadband over POTS using 802.11b/g 11/54 Mbps wireless connections

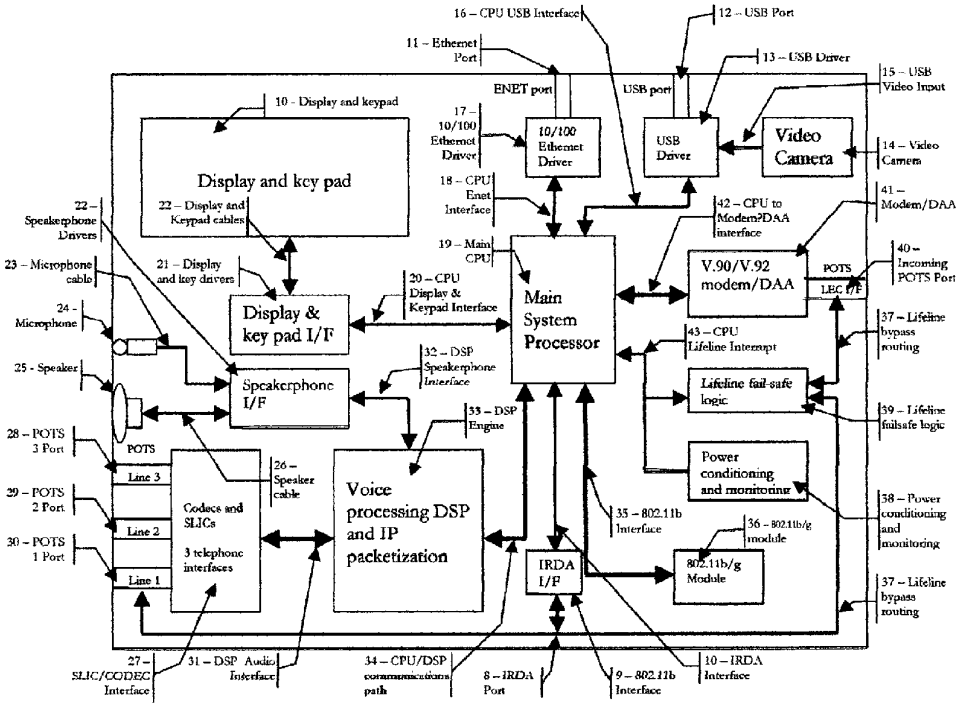


Figure 1 - Residential Communications Gateway (RCG) Block Diagram

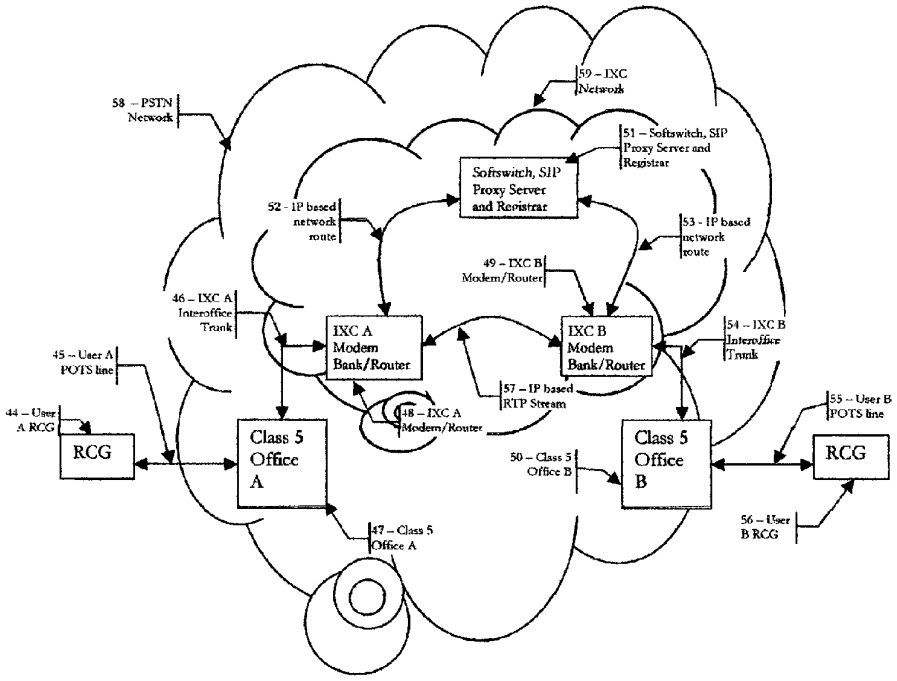


Figure 2 - Network Topology for RCG to RCG Communications

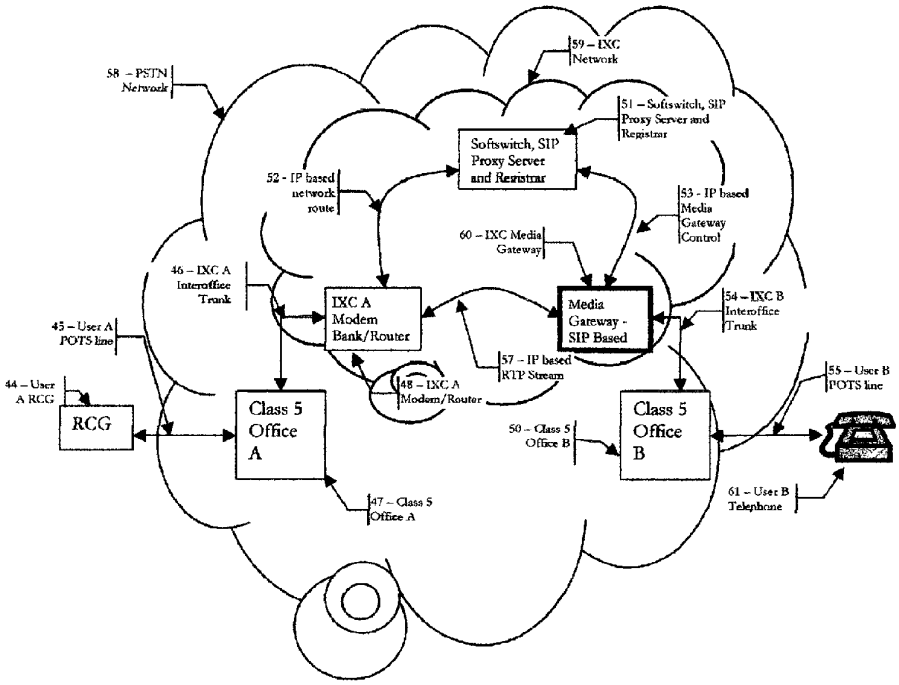


Figure 3 - Network Topology for RCG to PSTN call

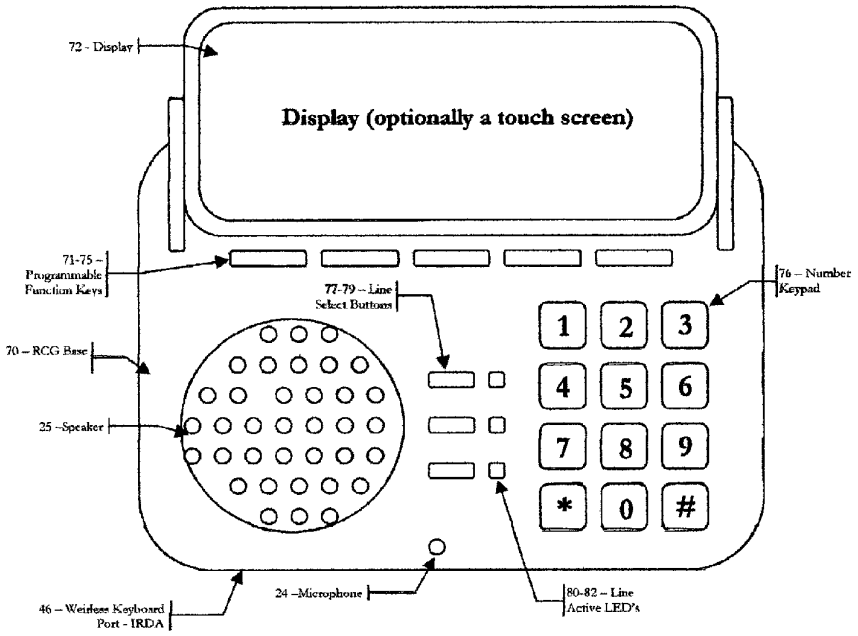


Figure 4 – RCG Top View

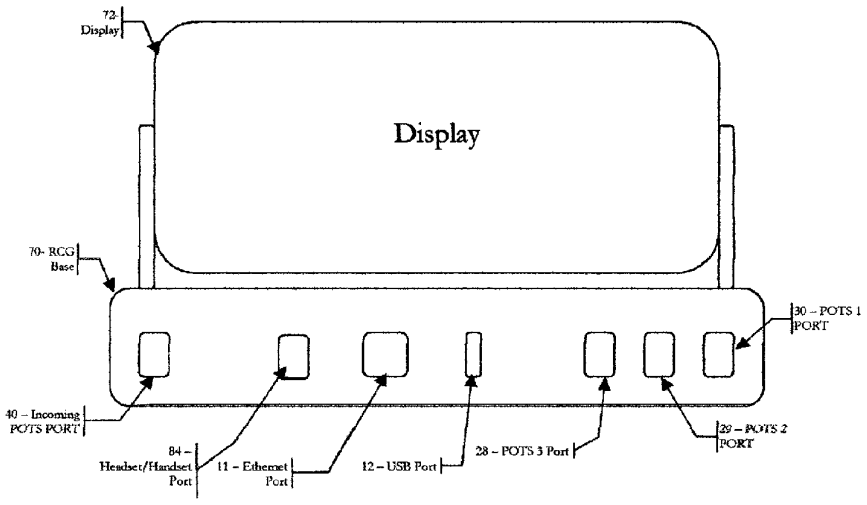


Figure 5 – RCG Rear View

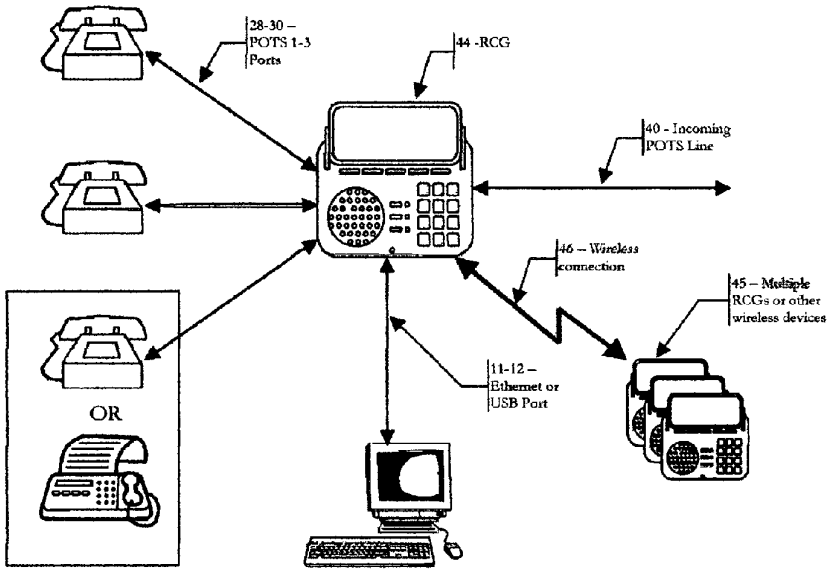


Figure 6 - Typical Application

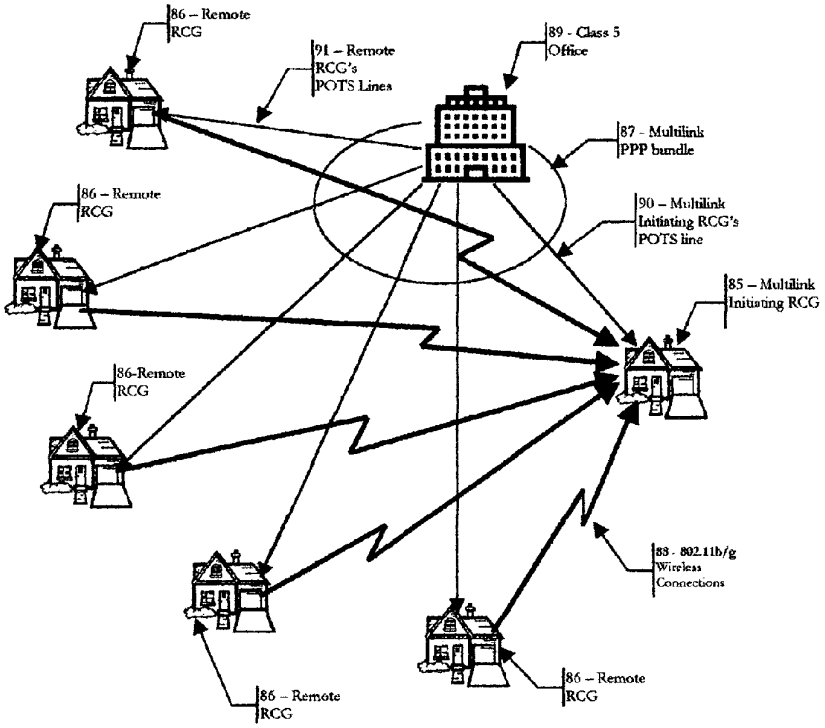


Figure 7 – Ad-hoc wireless LAN with broadband over POTS using 802.11b/g 11/54 *Mbps wireless connections*

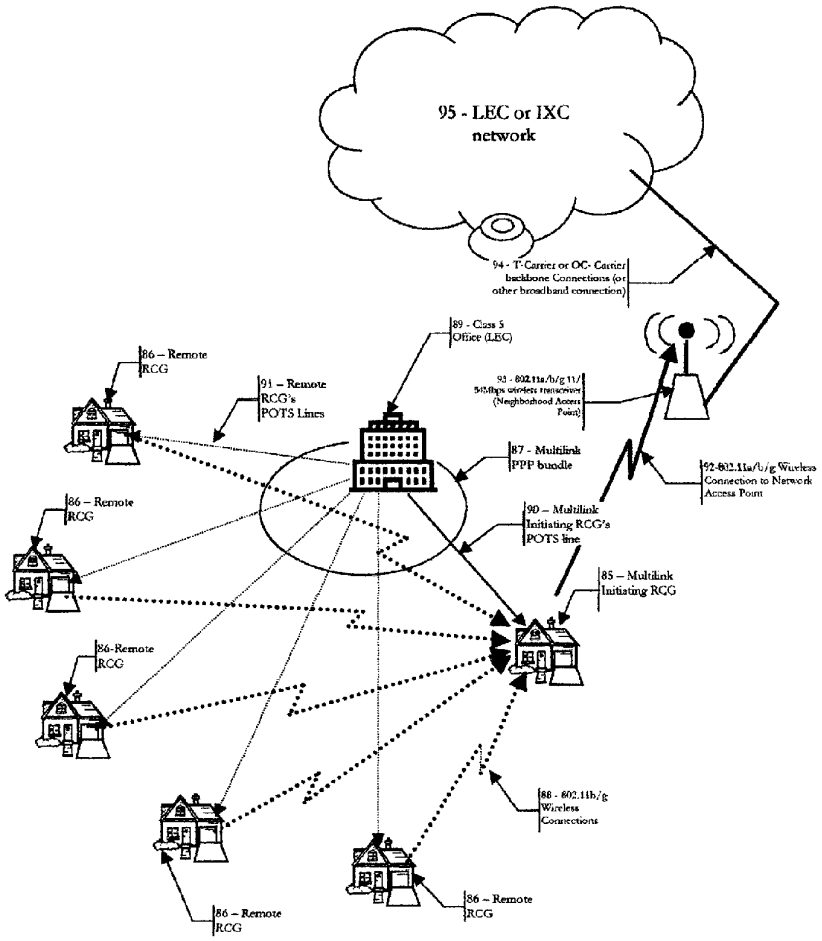


Figure 8 - Broadband over POTS w/ 802.11a/b/g 11/54Mbps wireless connections w/ broadband backbone connection to LEC or IXC

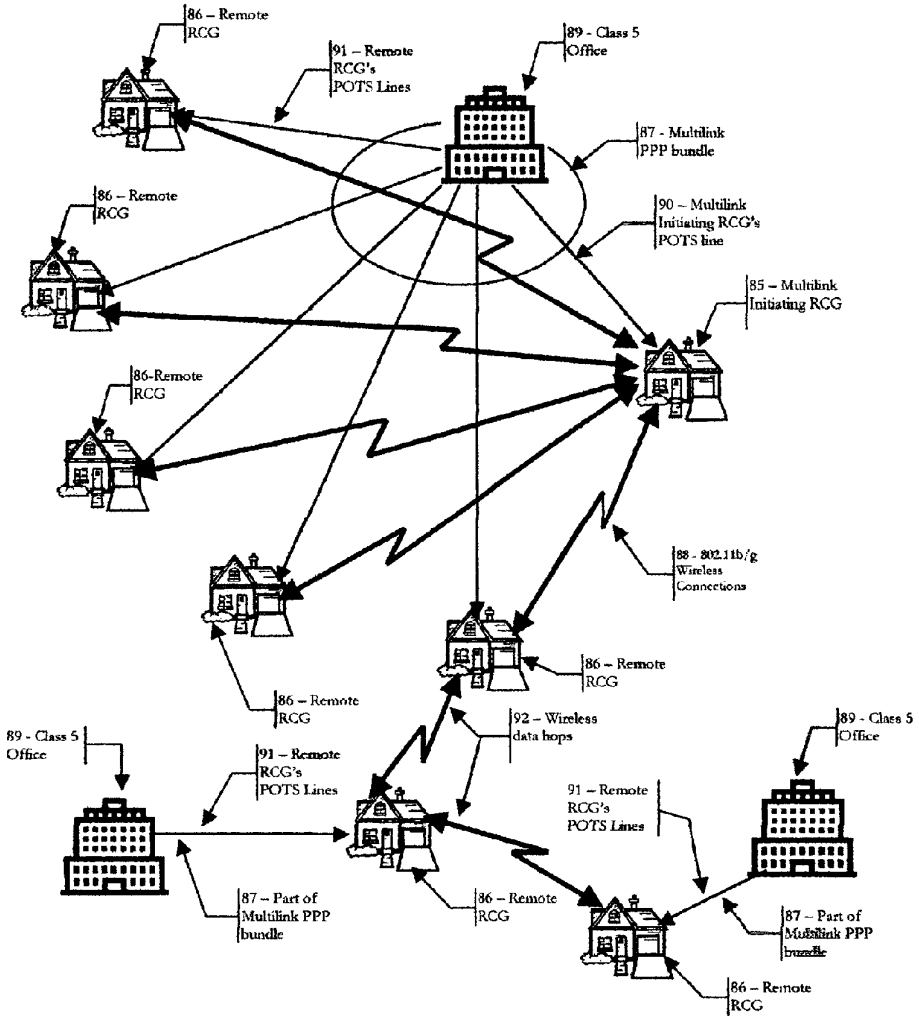


Figure 9 - Ad-hoc wireless LAN with data hopping

RESIDENTIAL COMMUNICATIONS GATEWAY (RCG) FOR BROADBAND COMMUNICATIONS OVER A PLURALITY OF STANDARD POTS LINES, WITII DYNAMIC ALLOCATION OF SAID BANDWIDTH, THAT REQUIRES NO ADDITIONAL EQUIPMENT OR MODIFICATIONS TO THE ASSOCIATED CLASS 5 OFFICES OR THE PSTN AT LARGE

RELATED U.S. APPLICATIONS

This first non-provisional patent applications makes claim to the Provisional Application for patent filed Oct. 15, 2002 and titled Residential Communications Gateway, of the same inventorship and with the express mail label no EF 100339383 US.

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FIELDS OF SEARCII

370/235, 230, 370/233, 363, 371, 374, 381, 433, 465-468, 470-474, 483-486, 493-495, 352, 395, 252, 379/399, 93.01, 375/222,

BACKGROUND OF INVENTION

The primary function of the RCG is to provide a platform for Competitive Local Exchange Companies (CLECs) to compete with the Local Exchange Companies (LECs) for residential voice and data services. The LECs have a strangle hold on the "past mile" of copper over which almost all residential customers receive their communications services. Today, most CLECs resell the existing services that are offered by the LECs. CLECs make their money by purchasing these services from the LECs at a discount and marking them up to the customer. Since these services are regulated and controlled by the Public Utilities Commission (PUC) the pricing for these services to the CLECs is set. The monthly CLEC discount is approximately $5 to $6 per line per month for basic rate services. This means, in practicality, that a CLEC can only charge an additional $5 or $6 to the residential customer for basic rate services otherwise they would be more expensive than the LEC, and no one would buy the services from them; telephone customers would simply stay with the LEC.

To be competitive then, CLECs try to sell additional services such as call waiting, caller ID, etc. where they have as much as a 50% margin. Some CLECs also bundle long distance services with their packages as additional incentive to get residential customers to buy local telephone service from them. Since long distance fees are as low as pennies per minute to the customer, there is little profit in long distance for the CLECs. As it is, the pricing structure is such that the LECs will stay in control of the residential market, and the CLECs are nothing more than a marketing arm of the LEC. This

structure also keeps the CLECs at an equal competitive advantage, or disadvantage, with respect to each other. The only thing that one CLEC could do to gain more customers is to be a better marketier. Since the CLECs are unable to discount their services because their margins are too slim as it is, the net effect is that the consumer looses by not really getting competition in the residential markets, and prices are kept artificially high.

For the CLECs to be truly competitive in the local telecommunications markets, they must be able to do more than simply resell the LECs services. CLECs must be able to offer many more features or services than those that the LEC provides, and they must be able to do this at a lower cost, in order to attract new customers.

So, what new services can the CLECs offer? As things stand today there are none, with the exception of DSL or Cable services which require tremendous infrastructure costs on behalf of the CLEC. However, by deploying an RCG in a residence, CLECs can offer advanced new calling features and services over the existing POTS line. Their costs for the POTS line from the LEC remains the same, but they can now charge for high bandwidth data services as well as additional calling and messaging features that the LECs cannot offer. This is their competitive advantage.

Competition:

Many companies are currently trying to provide VoIP services to residential customers over high-speed or broadband backbones such as DSL and cable modems, over Internet connections via a computer. The high-speed services require expensive infrastructure enhancements to the local telephone companies' facilities and cable plants, as well as expensive modems at the customer's end. These services are also difficult to deploy and too complicated for the average user. Internet based VoIP services suffer from Internet delays caused by a lack of true Quality of Service (QOS) capabilities across the Internet. Existing VoIP services also require access to a computer and a technical knowledge to be able to make it work. Because of these problems, VoIP services are primarily targeted at the corporate market place where private IP networks that can carry VoIP services with a true guaranteed QOS exist, or can be controlled.

The only available alternatives for the residential user for high speed services are DSL and cable modems. DSL and Cable based communications reach only a small segment of the population, and growth has failed to live up to initial expectations. The recent collapse of the internet boom has led to the failure of many DSL service providers and has effectively eliminated DSL as a potential service for most POTS users for the immediate future.

SUMMARY OF THE INVENTION

The RCG combines the capabilities and features of IP routers, Class 5 circuit switches and wireless LANs in a small stand-alone external modem like device. Additional capabilities for a hands-free speakerphone device with a large touch display are also detailed. The RCG can employ a large display with sufficient resolution to provide a functional user interface to access all of the advanced features offered by the RCG, but also to be able to provide video telephone services.

The device is placed in a residence and connected to the primary POTS line coming from the LEC. Up to three standard telephones or FAX machines (or any combination) are typically connected into the RCG. It also has a Universal Serial Bus (USB) and/or a 10-100 Ethernet interface for connection to a computer or a Local Area Network (LAN). In

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addition, it has an 802.11b/g wireless interface for wireless home networking as well as broadband-to-the-home services.

The system is installed in a customer's home by simply plugging it into the existing incoming telephone line that provides POTS services from the LEC. One or more standard telephones are then plugged into its three line-output jacks. This is the simplest and most basic usage. In this implementation, the user only is interested in gaining additional telephone lines into the household. No computer connection is required in order to use the system. However, if data communications are desired, then there are three additional interfaces for computer connectivity. Typically either an Ethernet port, USB port or firewire (IEEE 1394) port is used to connect to a PC or LAN. The 802.11b/g interface is for wireless communications between the RCG and PCs, other RCGs as well as any other types of compatible wireless devices. A version of the RCG includes a speakerphone and video camera to provided for video telephone services.

Services Provided by the RCG:

The following discussion refers to FIG. **1**. The RCG has a main system processor that is responsible for all house keeping and traffic routing tasks. The Main CPU **19** routes data to and from the Ethernet Port **11**, USB Port **12**, Modem/DAA **41**, DSP Engine **33**, 802.11b/g Module **36** and the Display and Keypad **10**.

The RCG provides a total telecommunications communications services package for residential and small business customers. With the RCG, a CLEC can offer its customers dialtone for up to three separate telephone numbers per residence (the limit of three telephone numbers is an arbitrary number based upon typical residential usage and is not a limit imposed by the system), all local and long distance services, 24/7 always-on Internet access, a host of custom messaging and calling features, as well as Broadband access and lifeline service. All of these services can be offered over a customer's existing POTS line, and it doesn't require any network infrastructure build out like DSL and Cable services. Because there is no expensive network equipment required, it can be readily deployed throughout the country to expand the CLECs customer base quickly.

The RCG is designed to enhance, not replace, the existing telephone line, enabling it to provide new combined packetized voice and data services. Meanwhile, all existing telecommunications infrastructure and equipment will continue to work seamlessly with the RCG. Aside from simply installing the low cost RCG device in the home telephone wiring, no other equipment needs to be purchased by either the home owner or telephone companies. This eliminates the tremendously expensive infrastructure costs for communications companies that are trying to provide voice services using DSL or cable modems.

The RCG VIP Home Gateway Features:

Up to three telephone lines i.e. numbers, over a single POTS line and/or wireless connection.

Ethernet, USB and IEEE 1394 computer interfaces.

Full G1, G2 and G3 FAX support.

Full support for all CLASS services.

Broadband networking for home computers and appliances as well as wide area networking using a combination of a plurality POTS lines connected to a plurality of RCGs and/or a direct wireless connection to a wireless access point (These interfaces allow smart devices to communicate to other devices within the home, or over the Internet through the RCG.)

Automated, remote upgradability and configuration. (Requires the customer to do nothing.)

Transparent user operation. (User doesn't have to know that any new technology is being employed).

100% compatible with existing public telephone system.

Video Telephone capabilities.

No local or long distance usage charges.

No Internet access fees.

Lower monthly communication costs.

Multiple telephone calls at the same time.

Voice messaging, follow me features, call forwarding, automatic call back, conferencing, custom call routing. Home networking capabilities, all CLASS calling features, high speed broadband networking, continuous 24/7 internet access and many others.

All of these features are available even while connected to the Internet.

Very low cost of entry into the market, especially as compared to broadband alternatives.

New calling features that are not currently available to home users.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows the RCG functional block diagram with the preferred embodiment of an 802.11 wireless connection.

FIG. **2** shows the network topology for native RCG to RCG communications.

FIG. **3** shows the network topology for an RCG to PSTN call.

FIG. **4** shows the RCG top view with associated functions.

FIG. **5** shows the RCG rear view and associated connections.

FIG. **6** shows a typical application with peripheral equipment connections.

FIG. **7** shows an ad-hoc wireless LAN configuration with ppp multilink data distribution and wireless connectivity.

FIG. **8** shows an ad-hoc wireless LAN configuration with ppp multilink data distribution and wireless connectivity with connection to a broadband neighborhood access point (Wi-Fi hot spot).

FIG. **9** shows an ad-hoc wireless LAN configuration with ppp multilink data distribution and wireless connectivity with wireless data hopping with POTS connections through numerous different Class 5 offices.

DETAILED DESCRIPTION AND PREFERRED EMBODIMENT

The preferred embodiment is detailed herein using the ubiquitous 802.11 wireless protocol. It is by no means insinuated that this is the only wireless scheme that can be used by this device; rather, it is intended that any wireless transmission scheme can be used for wireless communications between this device and other wireless devices as various applications may dictate.

System Initialization:

Refer to FIGS. **1**, **2** and **3** for the following discussion. When the RCG is first plugged into an AC power outlet the Main CPU **19**, performs a Power-on Self Test (POST) routine. Once the POST completes and the RCG is connected to an active POTS line, connected to the LEC, by means of the Incoming POTS Port **40**, the RCG automatically initiates a modem connection via the Modem/DAA **41**, to a registration service via a toll free 800 telephone number. The registration service connects directly to the service provider's sales or customer service offices via a VoIP connection. An operator or an automated service answers the call and sets up a new account for the customer. Once the account is set up, the

service providers network automatically sends control information to the device to store the required routing and feature/service information in its non-volatile memory of its Main CPU **19**. As part of this information, a local dialup telephone number is sent to the device that it will use for local network access in the same fashion as a standard ISP connection is made from a home computer. The URL of the Softswitch/SIP Proxy Server and Registrar **51** that will be controlling this particular device is also stored at this time. During the service activation and configuration process, the customer service operator can send test requests to the device, as well as call into it on another telephone number (assuming an additional telephone number is part of the users class of service) or the speakerphone to verify that it is configured and working properly. The final step of the configuration and initialization process is to register the device with the appropriate Softswitch/SIP Proxy Server and Registrar **51** so that the Softswitch/SIP Proxy Server and Registrar **51** knows that it is the controlling SIP Proxy for this RCG. Also configured at this time is the username/password verification server (this is a standard network device and is not shown) that is used to allow the RCG's modem to make a connection onto the service provider's network. Once the RCG configuration is completed, it disconnects the call by hanging up the Modem/DAA **41**, then dials the new local network access number that had been sent during the configuration process and establishes a constant local network connection. This connection is maintained continuously on a 24/7 basis, and is immediately reestablished whenever it drops. Should the RCG become unable to reestablish this connection after several tries, it will switch over to failsafe mode and inform the user via the Display and Keypad **10**. The RCG will try to reestablish the connection every few minutes until it finally succeeds.

By default, the first telephone port, POTS **1** Port **30**, is assigned as the termination port for the existing POTS service that is connected to Incoming POTS Port **40**. This is the existing telephone service that the user already has as his primary telephone service from his LEC. POTS **1** Port **30**, typically has connected to it a standard telephone set that does not require any power (other than that derived over the POTS interface) to operate properly. POTS **1** Port **30** is the Lifeline telephone port for the user. In the case that all power is lost to the RCG, POTS **1** Port **30** will fail to a direct connection to the Incoming POTS Port **40** telephone line that comes into the RCG from the LEC to provide uninterrupted telephone services to the user. In this state, however, none of the enhanced VoIP services of the RCG are available to the user since the user simply has a stand POTS telephone service to the LEC.

Two additional and unique telephone numbers can be assigned to the other two telephone ports, POTS **2** Port **29** and POTS **3** Port **28**, by the service provider at any time. These numbers are drawn from a pool of available telephone numbers assigned to the service provider. POTS **2** Port **29** and POTS **3** Port **28** must to have standard telephone numbers assigned to them so that the PSTN is able to route calls from its network to these ports. For calls originating from IP based telephones, these numbers are not necessarily needed since POTS **1** Port **30**, POTS **2** Port **29** and POTS **3** Port **28** are uniquely identifiable to IP networks via their IP addresses assigned through the Dynamic Host Configuration Protocol (DHCP) at the time that the RCG establishes a connection to the service provider's network. Since POTS **2** Port **29** and POTS **3** Port **28** must have a telephone number assigned to them, it is a matter of convenience to use the assigned telephone numbers as part of their SIP address for IP routing of their data In this way, all three user POTS ports, POTS **1** Port **30**, POTS **2** Port **29** and POTS **3** Port **28** are all addressed the same manor.

At this point, the user is able to take advantage of all of the RCG's features that have been activated according to his service agreement. The user can at any time connect additional telephones, a computer or a computer network to the RCG. The user will only be able to use those telephone ports (POTS **1** Port **30**, POTS **2** Port **29** or POTS **3** Port **28**) that have been activated, and assigned unique telephone numbers by the service provider. Any type of standard telephone can be connected to the three POTS ports, POTS **1** Port **30**, POTS **2** Port **29** and POTS **3** Port **28**. In the event that a cordless telephone or a telephone that derives its power from an AC outlet is connected to POTS **1** Port **30**, the lifeline functionality of this port will be ineffective since the telephone itself will not operate once power is lost.

The speaker phone feature of the RCG, comprised of Speakerphone Drivers **22**, Microphone **24**, Speaker **25** and DSP Engine **33**, can be used on any of the activated telephone numbers and is by default enabled to operate on POTS **1** Port **30**. Once either of the other two telephone ports, POTS **2** Port **29** or POTS **3** Port **28**, is activated, the speakerphone function is activated for those lines as well. To use the speakerphone for any assigned telephone number, the user simply presses either the line Select Button **79-81** for Line **1**, Line **2** or Line **3** on the face of the RCG, and the speakerphone function is activated on that line. This is convenient for answering any call directly at the RCG. The RCG may or may not have a number keypad for originating calls. This feature may be added or removed based upon the target market price points.

The determination as to which Inter Exchange Carrier (IXC) the RCG will route its data through is determined by any of a number of criteria including, but not limited to, whether the RCG is a private labeled product, or which carrier has the lowest cost routing, or if a specific carrier is specified by the customer, or and number of other considerations. The RCG can be programmed to change its routing path to any IXC at any time by the service provider. Complicated routing algorithms can be programmed into the RCG to control which IXC it will use at any time.

Failsafe Mode:

During any time that the RCG is in failsafe mode i.e. Lifeline failsafe logic **39** is activated, the RCG will only be able to receive or initiate telephone calls via the telephone connected to its primary telephone port, POTS **1** Port **30** or through its speakerphone feature. In this condition, all activated telephone numbers are ported via the PSTN to the primary (first) telephone number for delivery to the user's telephone that is connected to POTS **1** Port **30**. While in failsafe mode, the modem is not activated, and the RCG appears to the local Class 5 office as a standard telephone, and the PSTN will route all incoming calls to the RCG as it normally would to any standard telephone.

Call Flow **1**:

Dialed call origination from a telephone connected to an RCG POTS port and terminating at another user's RCG POTS port:

When a user picks up a telephone connected to any of the three POTS ports, POTS **1** Port **30**, POTS **2** Port **29** and POTS **3** Port **28**, an off hook condition is detected by the SLIC/CODEC Interface **27** that is connected to the DSP Engine **33** by way of the DSP Audio Interface **31**. The DSP Engine **33** responds by sending digitally generated dialtone to the appropriate POTS interface over the DSP Audio Interface **31**. (Note: all BORSCHT telephony functions are performed by the DSP Engine **33** and the SLIC/CODEC Interface **27**.)

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Upon hearing the dialtone, the user enters the desired telephone number on his telephone keypad. The Dual Tone Multi-Frequency (DTMF) digits that the user dials are decoded within the DSP Engine **33**. The dialed digits are transferred to the Main CPU **19** via the CPU/DSP Communications Path **34**. The Main CPU **19** polls the DSP Engine **33** approximately every two milliseconds looking for data The Main CPU **19** polling rate varies according to the process that is being performed. The CPU/DSP Communications path **34** also can generate an interrupt to force data transfer between it and the Main CPU **19**.

The Main CPU **19** generates a SIP Invite IP packet using the dialed digits as the called destination address and the URL of its local controlling SIP Proxy Server which was programmed into the RCG during the configuration process. The Main CPU **19** passes this SIP packet off to the Modem/DAA **41** for transmission over the network. The RCG Modem/DAA **41** is connected to and communicating with a modem in a modem bank located in the Inter Exchange Carrier's (IXCs) facility. This facility may actually be located in the LEC's physical plant or it may be physically located at another location.

Referring to FIG. **2**, User A RCG **44** is connected via its modem to the LEC's local Class 5 Office A **47**. In this example, the service provider's connections to the IXC A Modem Bank & Router **48** are through IXC A Inter-Office Trunks **46**. The service provider may or may not be the IXC. If the service provider does not have its own network, then it will purchase capacity from an IXC and route its traffic to that IXC's facilities. The SIP Invite IP Packet that is sent from User A RCG **44** transits the LEC's Class 5 Office A **47** facilities and is routed to the IXC A Modem Bank/Router **48** via the IXC A Inter-Office Trunks **46**. It is the job of the router to take the IP packet and route it on to its intended destination, in this case the appropriate SIP proxy server **51**. The router uses the URL for the Softswitch/SIP Proxy Server and Registrar **51** contained in the SIP Invite to know where to route the packet (Note: The Softswitch, SIP Proxy Server and Registrar are logical devices that may reside in a single computer system, or may be implemented as completely separate devices. In this example, the Softswitch, SIP Proxy Server and Registrar are all shown as a single physical device running these three separate processes.) The IXC A Modem Bank/Router **48** sends the SIP Invite IP packet on to Softswitch/SIP Proxy Server and Registrar **51** via an IP based network route **52**.

The SIP Proxy Server process running on Softswitch/SIP Proxy Server and Registrar **51** performs a look up to determine the termination destination for the call using the dialed digits passed along in the SIP Invite IP packet. In this example, the terminating device for User B RCG **56** is via IXC B's Modem Bank/Router **49** then through Class 5 Office B **50** and over User B POTS line **55** and finally to User B RCG **56**. Not covered in detail here is the SIP message handling since it is completely covered in IETF RFC2543. This example shows that both the originating and terminating ends of this call are controlled by the same Softswitch/SIP Proxy Server and Registrar **51** device. Where the originating and terminating ends of a call are controlled by different Softswitch/SIP Proxy Server and Registrar devices, an additional level of SIP messaging is used between the two SIP Proxy Server processes of each of the Softswitch/SIP Proxy Server and Registrar devices to locate and control the terminating location of the call. Again, that information is covered in IETF RFC2543 and is repeated here.

After the call routing is setup using SIP, and User B answers the call, the Softswitch/SIP Proxy Server and Registrar **51** device sends IP address of the originating User A RCG **44** to the User B RCG **56** and the IP address of User B RCG **56** to User A RCG **44**. Once both RCG's have the other's IP address, they then communicate directly to each other using Real Time Protocol (RTP), and the Softswitch/SIP Proxy Server and Registrar **51** device is no longer part of the connection. This direct communication is shown as IP based RTP Stream **57** between IXC A Modem Bank/Router **48** and IXC B Modem Bank/Router **49**.

On the receiving end of the call, referring back to FIG. **2**, User B RCG **56** receives the SIP Invite data stream through its Modem/DAA **41** and passes it on to the Main CPU **19**. The Main CPU **19** reassembles the SIP IP packet and interrogates the header information to determine which POTS port, POTS **1** Port **30**, POTS **2** Port **29** and POTS **3** Port **28** the call is destined for based upon the dialed number contained in the SIP Invite message. The Main CPU **19** commands the DSP Engine **33** to control the SLIC/CODEC Interface **27** to apply ringing voltage to the selected POTS port to ring the phone. A corresponding SIP **180** (ringing) message is sent back to User A RCG **44** in the reverse direction. When the phone attached to the selected POTS port is answered, the off hook condition detected by the SLIC/CODEC Interface **27** is sent through the DSP Engine **33** to the Main CPU **19** that sends the SIP **200** OK message back to User A RCG **44** to let the RCG know that the call was answered by User B RCG **56** and to turn off the audible ringing tone for User B. Once the call is established, User A RCG **44** sends and ACK F12 SIP message to User B RCG **56** indicating that User A RCG **44** understands that the call setup has been completed.

The two RCGs now exchange SIP messages that include the type of voice encoding that will be used such as G.729, G.723.1, G.711 etc to configure their RTP streams so that they can reliably transfer the user information between them. At this point the call (voice data) is sent between both RCGs and a normal telephone conversation takes place between the user A and user B.

Call teardown is accomplished by either user hanging up their telephone. The RCG of the terminating end (the end that hangs up the phone first) detects the on-hook condition and sends a SIP Bye message to the other end. The other end upon receiving the SIP Bye message responds with an OK **200** SIP message and disables the appropriate POTS port that the user was using.

The Speakerphone interface can be used for either end of a telephone conversation in exactly the same way as described above except that the corresponding POTS port that the call was intended for is disabled if the call is answered via the speakerphone.

Call Flow **2**:

Calls between an RCG device and a PSTN telephone:

Refer to FIG. **3** for the following discussion.

In the previous call example, the PSTN network had nothing to do since the call was over a previously established modem connection between two RCGs. In the cases where a call originates or terminates to a standard telephone serviced by a Class 5 office, the process is a bit more complicated.

When a call originates from a user via an RCG, such as User A RCG **44**, the call handling practices are exactly the same up to the point that the SIP Proxy Server process in the Softswitch, SIP Proxy Server and Registrar **51** performs a lookup to determine how to route the call. In this case, the SIP Proxy Server process determines that the cal terminates at a standard PSTN telephone attached to the Class 5 Office B **50**. Since the call originates as a native VoIP service, it must be converted to a standard switched circuit based service to be able to be delivered to User B's telephone **61**. The conversion is performed by the IXC's Media Gateway **60** device. In this

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ample, the SIP Proxy Server process routes the cal via the IXC's Media Gateway **60** device instead of through the IXC B Modem Bank/Router **49** as before. The SIP Proxy Server process sends a SIP Invite to the IXC's Media Gateway **60** device, as well as other control information, to direct the Media Gateway **60** device to terminate the call and to apply the appropriate voice compression algorithm to the media stream to convert it between switched circuit PCM format and the selected VoIP protocol. At the same time, the Softswitch process of the Softswitch, SIP Proxy Server and Registrar **51** device sends commands to the Media Gateway **60** device to cause it to route the call's PCM data to a specific channel on the IXC B Interoffice Trunk **54**. The Softswitch process then generates an SS7 ISUP message that is sent over the PSTN SS7 signaling network to the Class 5 Office B informing it of the incoming call and on which circuit the call has been placed. It is up to the PSTN at this point to ring the User B telephone **61** and process the call between the IXC's Media Gateway and the User B Telephone **61**. The Softswitch process handles the signaling conversion between the PSTNs SS7 network and the IXCs SIP messaging, as well as any other proprietary signaling schemes utilized by the IXC to control its network. The standard SS7 call control messages, such as ringing, busy, ring back etc., all have a comparable SIP call flow control messages. The Softswitch simply maps the SS7 messages into SIP messages and visa-versa while routing the messages to the appropriate network equipment.

As in the case of a call between two RCGs, the RTP media stream (the actual call data) is routed directly be the IXC A Modem Bank/Router **48** and the IXC's Media Gateway **60** via an IP based RTP Stream **57**.

Again, call teardown is accomplished by either user hanging up their telephone. Depending which end hangs up the phone first, the associated network will generate the appropriate messages which will eventually make it back to the Softswitch process. The Softswitch process will relay the appropriate call control messages between the PSTN and the IXC's SIP based control system.

A telephone call originating from a PSTN telephone is configured and setup in the same fashion as the above description except that the originating messaging begins within the PSTN network instead of the IXC's network.

Personal Computer Based Communications:

Where the RCG is connected to a Personal Computer (PC) through either its USB Port **11** or Ethernet Port **12**, the RCG operates exactly as a cable or DSL type modem device. The RCG is simply a pass through for the computer's data The RCG receives the IP packets (of whatever type) from the computer and sends the information unchanged to the Modem/DAA **41** interface for transmission over the Internet Received information from the Internet is processed in the reverse way.

Dynamic Bandwidth Allocation:

When a modem connection is established between the RCG and the "Network", the total available bandwidth of this connection is used in a shared/prioritized fashion. Voice services (calls) take precedence over data services. Therefore, when no calls are in progress all of the available bandwidth is used by data type services such as surfing the Internet of uploading/downloading files. However, when a call is to be passed through the RCG, the required bandwidth for the call is deallocated from the data services and prioritized for the telephone call. This necessary because the Quality Of Service (QOS) is important for effective communications over electronic networks. Since the voice data is carried over a "data centric" network topology (an IP based network), call quality can suffer greatly. Every effort must be taken to eliminate or reduce the packet delay through every network element to be able to provide the best call quality. For data applications such as surfing the Internet or downloading files packet delay is acceptable and expected, and it does not affect the "quality" of the data.

Since all voice and data is transmitted as packets, there are no "time slots" or other type of "channelization" associated with the transmission of this data over either the POTS line or the wireless interface. Channelization of the voice data does occur within the SLIC/Codec Interface—**27** but is converted into IP packets by the DSP engine—**33** and is handled as packets from that point on.

Regardless of whether the call is originating or terminating at the RCG, the bandwidth allocation process is the same. When the SIP call setup messages are processed, the type of voice compression that will be used is defined. The RCG Main CPU **19** handles the IP packet flow between the DSP Engine **33**, USB Port **12**, Ethernet Port **11**, 802.11b/g Module **36** and the Modem/DAA **41** devices giving priority to the voice packets to and from the DSP Engine **33** and the Modem/DAA **41** interfaces. Voice compression algorithms create IP packets at a specified number of packets per second. These packets are handled by a timed process in the RCG. This process is started during call setup so that the packets are handled at the correct rate based upon the compression algorithm's packet gene ration There is no priority assigned between the voice packets of each of the three different POTS Ports **28-30**. When more than one voice call is in progress, they are handled in a round robin fashion based upon the packet fate for the compression algorithm used. If, for example, two calls are using a compression scheme that generates packets every 2 milliseconds, and the third generates packets every 4 milliseconds, then the calls utilizing the faster packet rate will be polled at twice the rate as the call using a slower packet rate but they are not given priority "over" the other call. Only when there are no voice packets ready for transmission to the Modem/DAA **41**, i.e. during the approximately 2 to 4 millisecond packetization period between packets, will any pending data packets received from the USB Port **12**, Ethernet Port **11** or the 802.11b/g Module **36** be sent to the Modem/DAA **41** for transmission over the network.

Thus, the POTS bandwidth is allocated on a per packet basis, not on a "time slot" or "channelization" or even a "frequency" basis as it the case with T-Carrier, DSL or channelized DSL systems. The same is true for the wireless interface, whether it is carrying pure data or voice.

Security is currently a big concern in today's networks, and especially with wireless 802.11 transmissions. For this reason, the RCG defaults to route voice data over the users POTS connection via Incoming POTS Port **40**. As security concerns regarding wireless communications transmissions are addressed and alleviated, voice call data can, and will, be routed over the wireless interface via the 802.11b/g Module **36**.

FAX Transmission:

Group **1**, **2** and **3** fax transmission is completely supported by the RCG. Fax transmission has the same priority as other voice communications. That is to say that FAX transmission is treated the same as a voice call and takes precedence over native IP data traffic.

Broadband Over POTS:

One of the primary functions of the RCG is to be able to transfer large files such as video files over the POTS lines to a residence. The ability to do this is limited by the maximum of 56 Kbps due to the design of the digital Class 5 office linecards and network transmission schemes based upon T carriers. Typical Class 5 linecard design samples the POTS

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lines at a rate of 8,000 samples per second. Typically, each sample is digitized into 12 to 16 bits by a codec device. The digitized sample is then companded to an 8 bit sample (1 byte) which makes up the PCM data stream that is transferred over the PSTN. Therefore, each POTS line is sampled at an effective rate of 64 Kbps. Since legacy T1 transmission equipment uses robbed-bit signaling, the maximum guaranteed transmission rate for the PSTN as a whole is 56 Kbps. Because of this limitation, standard POTS lines can only guarantee a maximum of 56 Kbps transfer rate under the best conditions. DSL equipment gets around this problem by installing DSL Access Multiplexing (DSLAM) equipment at the Class 5 office end of the POTS line. By routing around the linecard, as well as routing the data directly over the Internet or other private IP based networks, and therefore the 64 Kbps sampling rate, DSL is not bandwidth limited like PSTN traffic is. DSL, however, suffers from the very high costs associated with the purchase, installation, maintenance, floor lease costs, etc. DSL also suffers from very high deployment costs resulting from the labor intensive process to turn up each line. Each DSL "POTS" line must be inspected, conditioned and all load coils removed.

The RCG gets around the 56 Kbps POTS limitation as well as the DSL problems by using the standard POTS lines as they are, and not requiring any additional equipment to be installed at the Class 5 end of the POTS line. This technique simplifies deployment and drastically cuts costs.

Multilink PPP Connections:

Referring to FIG. **7**, the RCG implements broadband over POTS by employing an 802.11b/g wireless interface to configure a multilink PPP bundle-**87** (per RFC 1990) comprised of the POTS lines connected to up to 32 RCGs. The limitation of 32 RCGs in a multilink PPP bundle is an arbitrary number and can be scaled up or down as required to support changes in network equipment capabilities. An 802.11b/g interface-**87** is shown as the preferred embodiment, since its 11/54 Mbps interface is considered sufficient bandwidth at this time also, its transmission distances are sufficient for implementation of this device, as opposed to other shorter ranged wireless transmission schemes. However as time goes on, some other wireless interface may be more desirable. There is nothing special or specific to the 802.11 wireless interface that makes it particularly suited to this application. Any wireless interface scheme can be used to implement this device.

The 802.11b/g interface-**88** on an individual RCG is also used to provide a peer-to-peer wireless home networking environment to other 802.11 compatible wireless component within the residence (such as a hand-held computer device) while acting as an always on dialup Internet gateway over the POTS line-**40** for the other wireless devices. An RCG that is transferring a very large file can request the services of **31** (in this embodiment) other RCGs to assist in the file transfer using their respective POTS lines. A single RCG can therefore gain the combined bandwidth of up to **32** POTS lines transferring data at as much as 56 Kbps each to transfer information. This is roughly equivalent to a transfer rate of 1.79 Mpbs in the inbound direction (towards the RCG) and approximately 1.075 Mbps in the outbound direction (towards the PSTN).

The multilink PPP connection-**87** is initiated by an RCG when it determines that the file (or streaming service) that it is to download (receive) is of sufficient size or requires a minimum amount of bandwidth to justify the use of a multilink PPP connection. This determination can be made on many different criteria such as the file size, type of data being transmitted, the type of compression if any, a Quality-of-Service requirement or any other pertinent information. (Since a certain amount of overhead is required to set up a Multilink PPP connection, it doesn't make sense to use it for small or low data rate transfers.)

Multilink PPP Bandwidth Allocation and Initialization:

Referring to FIG. **7**, an RCG-**85** that decides to initiate a multilink PPP session with a remote computer i.e. internet URL, requests a multilink PPP session with that URL resource via Link Control Protocol (LCP) session management The initiating RCG-**85** and the remote server computer (not shown) will negotiate the pertinent multilink parameters such as compression, packet size, sync/async, link quality monitoring, bit stuffing etc. As part of a successful multilink PPP session setup, the initiating RCG-**85** receives a multilink PPP session ID, or "magic number", which is used to identify this particular multilink PPP session and is also used for adding or removing links from the multilink bundle-**87**. Once the multilink bundle is setup, the initiating RCG-**85** begins data transfer across its POTS interface-**90** with the far end computer system. The initiating RCG-**85** then looks up the addresses of up to **31** (in this embodiment) other RCGs in its router tables to use for the multilink PPP transfer. (If a Neighborhood Access Point is available the RCG could request service through it instead of setting up a Multilink PPP connection—see FIG. **8**.) The initiating RCG-**85** determines the number of remote RCGs-**86** that it wants to use to get the desired bandwidth for the transfer and sends multilink PPP service requests via the 802.11b/g wireless connections-**88** to the selected remote RCGs-**86**. The selected remote RCGs-**86** respond back to the initiating RCG with either an acceptance or denial of multilink PPP service request. This decision is made based upon the remote RCG's currently available POTS bandwidth and the current local demands for that bandwidth. The remote RCG-**86** makes a decision to participate in a multilink PPP service for an initiating RCG if its POTS line-**91** has a current average bandwidth utilization of less than some arbitrary limit such as 8 Kbps to 16 Kbps. This 8 Kbps to 16 Kbps bandwidth utilization represents about two concurrent voice conversations using standard voice compression techniques, or some small amount of data transmission occurring on the remote RCG's POTS interface-**91** or a combination thereof. Assuming that the remote RCG-**86** has a modem connection speed somewhere between 33 Kbps to 56 Kbps, this would leave approximately 17 Kbps to 40 Kbps of POTS bandwidth that the remote RCG-**86** could offer to the initiating RCG-**85** for use in its multilink PPP bundle-**87**. Of course, if there is no activity on the remote RCG-**86** POTS line, then the entire bandwidth will be used for the multilink transfer. If the remote RCG-**86** accepts the multilink PPP service request from the initiating RCG-**85** it also sends its currently available bandwidth on its POTS line-**91** that the initiating RCG-**85** will have available to it for the multilink PPP transfers. The initiating RCG then selects which of the responding remote RCGs-**86** it will use for the multilink PPP bundle-**87** and sends them a multilink initialization packet containing the URL of the destination as well as the multilink PPP session ID (magic number) and any other pertinent information required for the remote RCG to join in the existing multilink PPP bundle-**87**. Each remote RCG POTS interface-**91** participating in a multilink PPP bundle, represents a logical "link" in the initiating RCG's multilink PPP bundle-**87**. The remote RCGs-**86** then send a multilink PPP packet (over their respective POTS lines-**91**) to the destination URL with the multilink PPP session ID and request to be added to that multilink PPP bundle-**87**. The destination URL accepts the request of each of the remote RCGs-**86** and begins sending data packets to each over their respective POTS lines-**91**. When the remote RCGs-**86** receive data packets sent over

their respective POTS lines-**91**, that are destined for the multilink PPP bundle-**87**, they simply relay the data packets over their 802.11b/g interface-**88** to the initiating RCG-**85**. It is the responsibility of the initiating RCG-**85** to perform all housekeeping tasks associated with the multilink transfer such as detection of lost packets and data packet reassembly, if those functions are required. Typically, lost packet detection and retransmission and reassembly are performed at higher OSI layers by the requesting software such as a browser. The remote RCGs-**86** are simply data transport nodes and do not perform any data processing on data received over a multilink PPP bundle destined for another RCG.

The initiating RCG-**85** of the multilink PPP bundle-**87** continually monitors the bandwidth of each remote RCG's-**86** multilink link which together comprise its multilink bundle-**87**. When the available bandwidth for the multilink PPP link of an individual remote RCG-**86** falls below an arbitrary minimum set by the initiating RCG-**85**, the initiating RCG-**85** instructs the offending remote RCG, via its 802.11b/g wireless interface-**88**, to remove itself from the multilink bundle. The remote RCG-**86** will then notify the remote computer (URL) to be removed as a link in the current multilink bundle on which it is participating Alternatively, a remote RCG-**86** can inform the initiating RCG-**85** of local demands on its POTS bandwidth, and request that the initiating RCG-**85** remove it (the remote RCG-**86**) from the participation in the initiating RCG's multilink bundle-**87**. The remote RCG-**86** will not unilaterally remove itself from participation in a multilink bundle without prior notification to the Initiating RCG-**85**. The remote RCG-**86** must get authorization from the initiating RCG-**85** to remove itself from the bundle, since the initiating RCG-**85** will have no way of knowing if the loss of data from that remote RCG is due to some sort of failure or from the remote RCG simply removing itself from participation in the multilink bundle-**87**. Also, for services that require a minimum Quality of Service (QOS) such as streaming video, the initiating RCG-**85** needs to control the multilink bundle-**87** bandwidth, and it can not do that if remote RCGs-**86** drop out of the multilink bundle-**87** at will. When a remote RCG-**86** requests to be removed from participation in a multilink bundle-**87**, the initiating RCG-**85** must immediately grant the request. If the initiating RCG-**85** were to not grant the request, then the remote RCG-**86** could, in worst case, delay or drop incoming multilink packets destined for the initiating RCG-**85**. If this were to happen, the initiating RCG-**85** will have missing packets and could over run its reassembly buffer (if reassembly is being performed by the RCG) causing catastrophic data loss and potentially have to restart the entire transmission. In the least case, the initiating RCG-**85** would have to initiate retransmission of potentially many packets which it assumes to be lost, but may simply be delayed by the remote RCG-**86**. Once a remote RCG-**86** has been removed from participating in a multilink bundle-**87**, the initiating RCG-**85** will then look up another remote RCG in its router tables that can be used to participate in the multilink PPP bundle-**87**, and request that the new remote RCG-**86** to join the existing multilink bundle-**87**. This is necessary to maintain a minimum Quality of Service. Since RCGs prioritize their bandwidth requirements based upon their own "local" service requirements, their participation in any multilink PPP service is available only to bandwidth that is not required for its own current local demands. Therefore, a remote RCG's-**86** bandwidth that is available for multilink services can change at any time. The dynamic reassignment of remote RCGs that participate in a multilink bundle is also required to prevent a remote RCG-**86** from receiving packets so slowly that the originating RCG-**85** interprets this delay as lost packets. When the initiating RCG-**85** determines that a packet has been lost, and it is performing packet reassembly, it will, itself, request that the remote computer retransmit the lost packet. The initiating RCG will not ask any remote RCG-**86** to perform retransmissions or any other kind of data computations or manipulations.

Refer to FIG. **8** for the following discussion. In areas where there are existing 802.11 network equipment such as Neighborhood Access Point-**93**, or where there is sufficient bandwidth requirements from an installed base of RCGs to warrant the deployment of a Neighborhood Access Point-**93**, the RCGs will automatically detect the presence of the compatible neighborhood access points and register with that equipment for transport services. In this case, an RCG has an alternative broadband service route in addition to the multilink option. An RCG can communicate directly with a local 802.11 Network Access Point-**93** that is connected to the PSTN or another carrier's network via some sort of high bandwidth backbone such as a T-Carrier or optical carrier connection (**T1**, T**3**, OC**3**, OC**12** etc.). The RCGs can communicate directly with neighborhood access points at their full 11/54 Mbps data rates to provide up to that full bandwidth to the uses This functionality is, of course, subject to the Network Access Point-**93** allowing access to its resources to the RCG according to the 802.11 wireless protocol.

This architecture is important since it provides an avenue to relieve the local Class 5 offices of congestion that can be caused by a wide spread deployment of RCGs within the Class 5 service area Since each RCG requires a constant 24/7 modem connection, this ties up the Class 5 switch in a fashion that it was not designed for. This could lead to wholesale Class 5 office expansions which would be extremely expensive, and potentially prohibitive for the Local Exchange Carriers (LECs). By deploying neighborhood access points that operate at 54 Mbps (802.11a/g), in areas where the RCG concentration starts placing too high of a demand on the local Class 5 office, the bandwidth from the RCGs can be aggregated by the neighborhood access points into large capacity backbones to relieve the switch congestion. In this case, the RCG POTS interface-**40** can be used solely as a lifeline connection, or when the 802.11 wireless LAN in which the RCG resides is congested. With this implementation, voice calls will be carried over the wireless interface as opposed to the POTS interface on which they would normally be carried. Also, the RCG modem-**41** connected to the POTS interface-**40** would not need to maintain a constant always on connection, it could be a dialed on demand connection and thereby relieving the local Class 5 office switch.

Bouncing or Hopping Traffic:

Refer to FIG. **9**. In areas where the density of RCGs is less than the arbitrary number of 32 RCGs within its transmission radius for multilink connections, the RCGs can bounce, or relay, the data traffic between each other to reach other RCGs located farther than the RCGs wireless transmission area Since the POTS data rate of 56 Kbps is miniscule as compared to the 11/54 Mbps 802.11 b/g transfer rate, the overhead associated with bouncing data traffic is not a concern. This will allow for the fastest possible data transfer across POTS lines for every RCG user.

RCGs can also communicate directly with an 802.11a Neighborhood Access Point-**93** device (such as that used in WI-FI networks) that is connected to a data network connection such as a DS**3** or OC**3** service via a Metro Access Point. Where an RCG has access to a broadband device such as an 802.11a type device, either directly or via a bounced signal across several RCGs, a direct high speed data connection can be used to transfer large files. When an RCG is communicat-

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ing directly with an 802.11a device, data transfer speeds up to the full 11/54 Mbps can be achieved to speed video transfers for such applications as video on demand.

RCG Router Tables:

The RCG continually monitors its 802.11b/g wireless interface for transmissions from other RCGs or 802.11a Access Points as well as other 802.11b/g wireless devices within the residence. The RCG provides a means to identify and store the addresses of other RCGs and Neighborhood Access Points within its local area The RCG creates routing tables, much like an IP router device, so that it knows which RCGs are local to itself, and how many hops will be needed to reach the maximum of 32 POTS lines or a Neighborhood Access Point. The RCG can then determine how to route its data transfers to gain the most efficient routing and network efficiencies.

The router tables in each RCG are continually updated by monitoring the 802.11 frames received from other RCGs or Network Access Points. The number of entries in the router tables can be limited to an arbitrary number of other RCGs but contains room for at least 32 entries. For each RCG listed in the router tables, certain information is kept such as signal strength, if the other device is another RCG or some other 802.11 compatible device, if the other RCG is reachable directly, or if it is accessed via another RCGs by hopping. In the case there RCG hopping is used, the address of each RCG that is hopped is stored in the routing table. When an RCG is first powered up, it monitors its 802.11 interface for a period of time to identify other RCGs or Neighborhood Access Point devices, or other Wi-Fi devices within its transmission area. When first deployed, the RCG will not have any entries in its routing tables. This condition can persist for some time, until another RCG or other 802.11 device is deployed within the former RCGs transmission range. In this state, the RCG can be used for wireless networking within the residence, connecting the local computer to the RCGs always on Internet connection as well as to other wireless devices within the home. When an 802.11 frame is received by an RCG that contains the address of an RCG whose address does not exist in the receiving RCG's router table (as is the case when a new RCG is first installed), the receiving RCG polls the transmitting RCG for its router table information. The received router information is reviewed for other RCG's or other 802.11 compatible devices that are not listed in its own router tables. A decision is made to use some, all, or none of the new route information in its router tables. There is no real limitation on the number of RCGs that can be "hopped" in order to build a complete router table or to reach many more RCGs, Neighborhood Access Points or Metro Access Points.

Equipment and Services Priorities:

Just as voice has priority over data transfers within a single RCG, local RCG traffic (both voice and data) has priority over remote transfer requests by other RCGs. If an RCG is currently using all of its available POTS bandwidth for its own purposes, it will deny any remote RCG's request for access to its POTS line. Only when there is available POTS bandwidth available will an RCG allow other RCGs access to its POTS line. It will, however, bounce the traffic to other RCGs within its transmission area if requested by the originating RCG. In this case, available wireless bandwidth of any RCG (that amount of the 11/54 Mbps not currently used for its own traffic) can be used to relay traffic between other RCGs that do have available POTS bandwidth. In the same fashion, excess wireless bandwidth of any RCG can be by other RCGs to access high speed backbones via Neighborhood or Metro Access Points.

RCGs can also access other 802.11 wireless networks (Wi-Fi for example) that happen to be deployed within their service areas. In this case, access agreements between the RCG service provider and the wireless network operator must be put into place. By remaining compatible with the 802.11 standards, the RCGs capabilities will benefit by the growing WI-FI network infrastructure, an the WI-FI network will benefit by the RCG network.

Voice Over POTS and Data Over Wireless:

Normally, all communications from an RCG will be transmitted over the local POTS line, or a multilink bundle made up of many remote RCG POTS lines. By default, all voice calls will be carried over the "local" POTS line-**40** to alleviate security/privacy concerns and only "data" will be transmitted via multilink bundles. Generally, since voice "data" is compressed locally by the RCG, the required bandwidth for a voice call is so small that it does not make for a good choice to route it over a multilink connection. However, it is possible to route voice calls entirely over another RCGs POTS line. It is also possible for an RCG to transmit voice data over POTS lines connected to other RCGs via multilink bundles or directly over its 802.11 wireless interface, and since the 802.11 specification does support the Wired Equivalent Privacy (WEP) specification, a secured connection can be made in this fashion.

Remote Upgradability

The RCG is designed with the capability for unassisted remote upgradability. The remote upgradability feature is not the same as the storing of operational parameters during the configuration process. This feature allows the system operator to add new features as they are developed, or to correct bugs remotely and without the users knowledge or involvement. This feature can also be used to install a complete new operating system (OS).

Key to the successful implementation of the Remote upgradability feature is that a completely fail-safe routine be implemented that can recover from any failure during the upgrade process and to re-initiate and monitor the upgrade process until it has successfully completed. This process is carried out by loading a boot loader program that is stored in non-volatile memory. The boot loader program provides the minimum capabilities to start up the RCG and connect into the system operator's diagnostics network to download fixes or a new OS. The boot loader program is technically part of the OS, but it cannot be over written by any upgrade process. It is responsible for detecting failure of the RCG and initiating a connection to the diagnostics network. Once connected with the diagnostics network, the boot loader will provide diagnostics support to help correct the RCG's operation and reconfigure the OS.

What is claimed:

1. A method for aggregating, sharing and dynamically routing and allocating bandwidth from a plurality of wired and wireless networks that are geographically disbursed over a wide area, and providing some or all of the aggregated bandwidth to any user on an on-demand basis, the method comprising the steps of:

developing and updating a network table that comprises a list of nearby RCGs, their bandwidth capabilities over local, remote and wireless connections, and their location with respect to a requesting RCG;

determining an optimum amount of bandwidth needed for an immediate data transfer needs of the requesting RCG;

determining which of the nearby RCGs should be contacted for access to unused bandwidth to support a transfer of the requesting RCG, based upon their unused local

bandwidth capacity, and a distance and a number of hops between the RCGs and the requesting RCG;

sending a request to the supporting RCGs asking for use of a portion of the unused bandwidth;

receiving responses from the supporting RCGs with information about how much bandwidth each selected RCG can share;

selecting which of the supporting RCGs to use for optimal use of needed bandwidth;

contacting the selected RCGs with control information for sending data to the requesting RCG;

sending packets of the data from the selected RCGs to the requesting RCG;

reassembling the packets of the data at the requesting RCG; and

relinquishing the bandwidth of each of the selected RCGs.

2. The method of claim **1**, further comprising the step of sending a request to a single supporting RCG that has sufficient unused bandwidth for satisfying the request of the requesting RCG.

3. The method of claim **1**, wherein each of the supporting RCGs can opt out of bandwidth sharing based upon local demand priority, and wherein local demand for bandwidth supersedes a request of a remote RCG for bandwidth sharing.

4. The method of claim **1**, further comprising the steps of:

dynamically reallocating shared bandwidth of the supporting RCGs during multi-link data transfers as supporting RCGs opt out of bandwidth sharing due to local bandwidth demands; and

enlisting additional supporting RCGs to provide additional bandwidth.

5. The method of claim **1**, further comprising the step of scheduling a data transfer to occur at a future date and time based upon at least one of anticipated network bandwidth availability, network congestion, and future notice of availability of the data of interest.

* * * * *

EXHIBIT 1009
U.S. Patent 8,861,349 ("'349 Patent")

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US008861349B2

(12) **United States Patent**
Delangis

(10) **Patent No.: US 8,861,349 B2**
(45) **Date of Patent: Oct. 14, 2014**

(54) **BROADBAND COMMUNICATIONS DEVICE**

(76) Inventor: **Eric M. Delangis**, Huntsville, AL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **13/531,294**

(22) Filed: **Jun. 22, 2012**

(65) **Prior Publication Data**

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(60) Provisional application No. 60/418,521, filed on Oct. 15, 2002.

(51) **Int. Cl.**

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H04J 3/16	(2006.01)
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H04L 12/54	(2013.01)
H04W 8/26	(2009.01)
H04W 28/06	(2009.01)
H04W 40/02	(2009.01)
H04W 72/04	(2009.01)
H04W 80/00	(2009.01)
H04W 84/12	(2009.01)
H04W 84/18	(2009.01)

(52) **U.S. Cl.**

CPC ***H04W 88/16*** (2013.01); ***H04L 12/5692*** (2013.01); *H04W 8/26* (2013.01); *H04W 28/06* (2013.01); *H04W 40/02* (2013.01); *H04W 72/04* (2013.01); *H04W 80/00* (2013.01); *H04W 84/12* (2013.01); *H04W 84/18* (2013.01)

USPC **370/230**; 370/468

(58) **Field of Classification Search**

USPC 370/230–235, 278, 282, 328, 338, 468, 370/477

See application file for complete search history.

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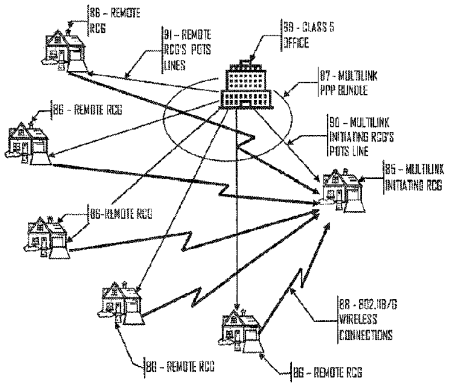
Primary Examiner — Hong Cho

(74) *Attorney, Agent, or Firm* — Clay McGurk; The Law Office of Clay McGurk

(57) **ABSTRACT**

The Residential Communications Gateway (RCG) is a broadband communications device that combines all voice, data and video communications to and from a typical residence or small business for transmission over a single, or a plurality of Plain Old Telephone Service (POTS) lines separately or in conjunction with, a wireless broadband backbone. The RCG does this by employing packetized data with Voice over Internet Protocol (VoIP) technologies combined with RF communications technologies. A key consideration to the design of the RCG is that no additional or special transmission equipment must be installed at the Central Office or anywhere else in the network to enable new calling features provided by the RCG as is the case with DSL and Cable systems. By eliminating the requirement for costly infrastructure enhancements, ubiquitous high speed communications and services can be deployed to every POTS subscriber.

20 Claims, 9 Drawing Sheets



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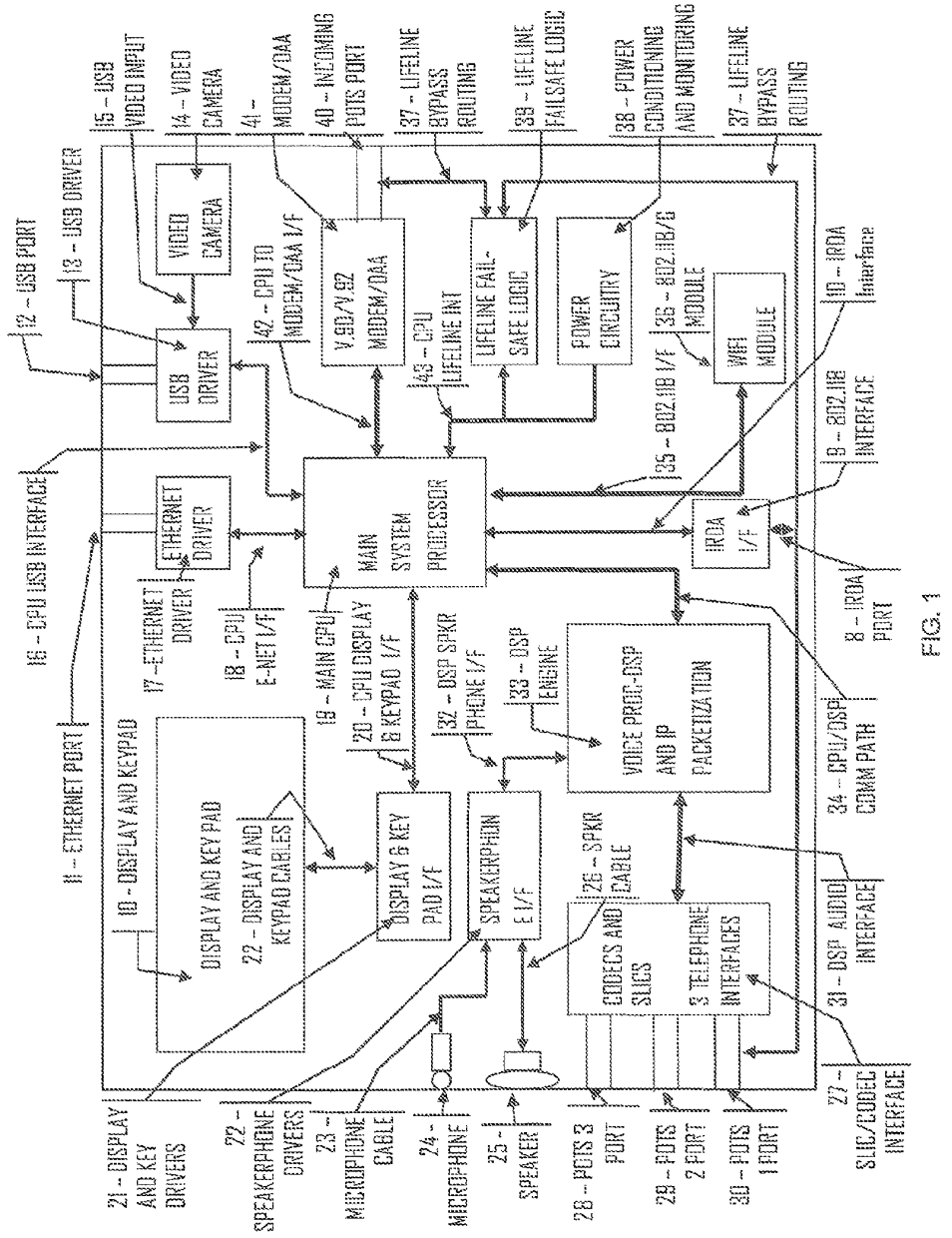


FIG. 1

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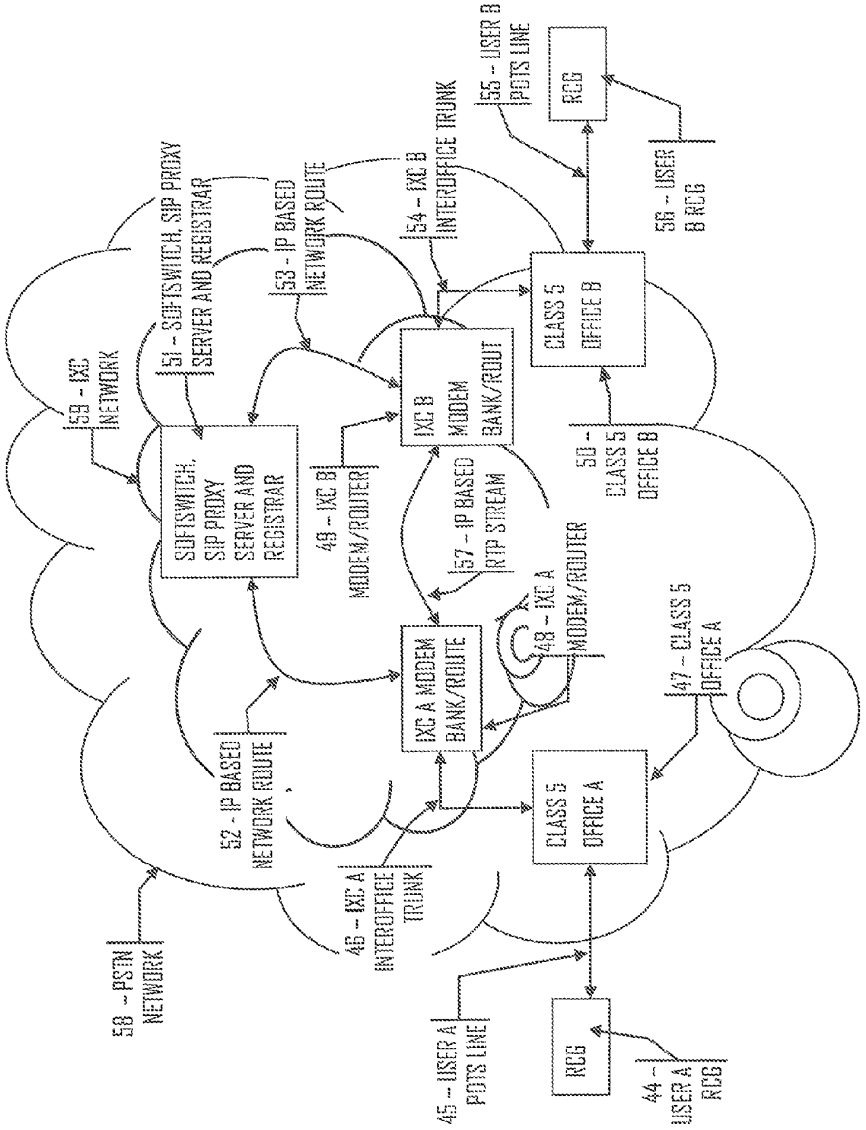


FIG. 2

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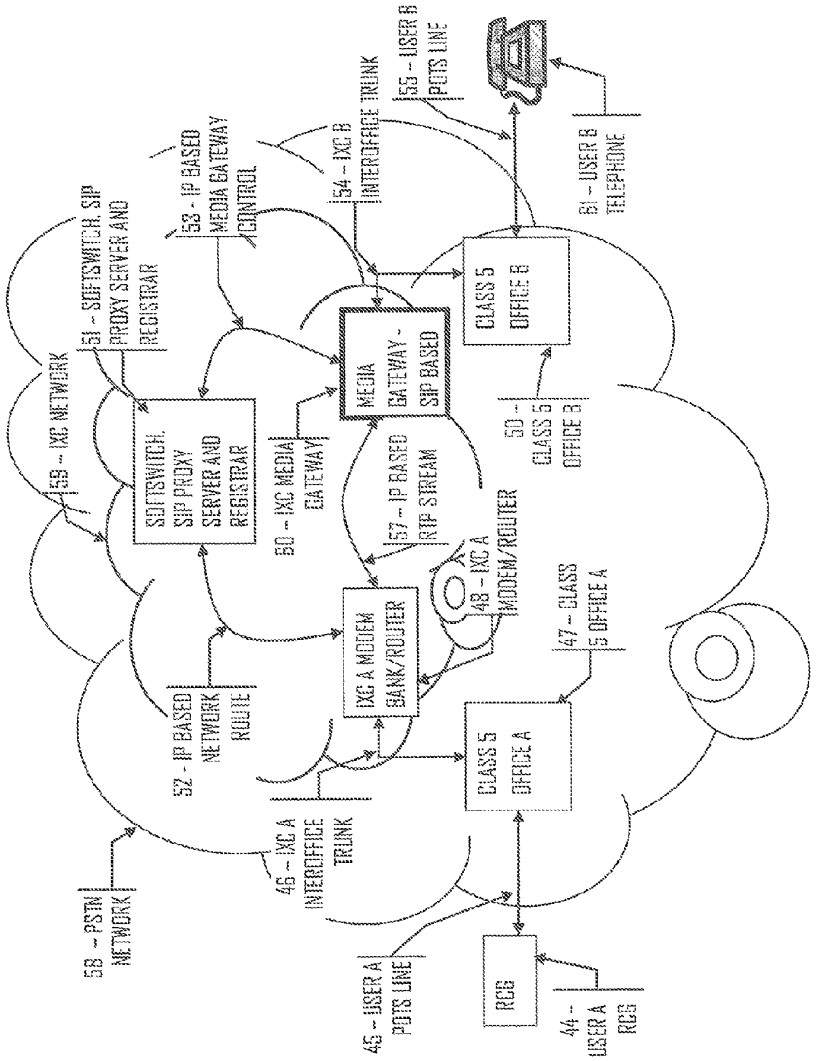


FIG. 3

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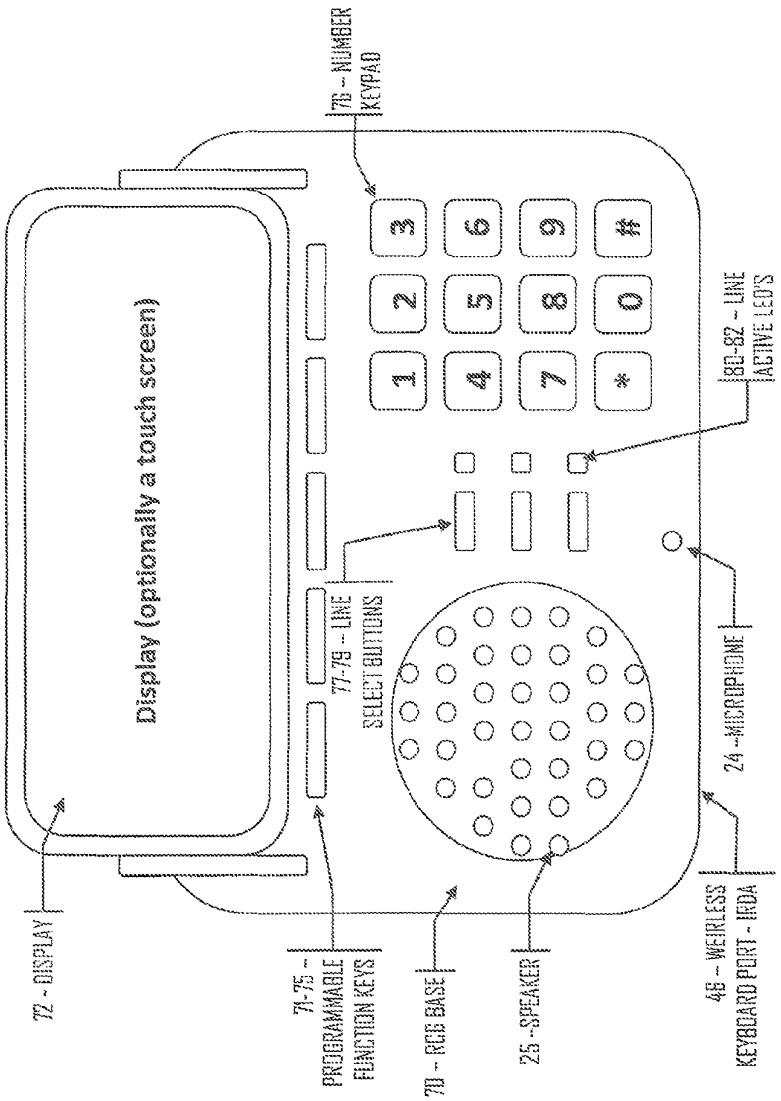

76 - NUMBER KEYPAD
Display (optionally a touch screen)
1
2
3
4
5
6
7
8
9
*
0
#
80-82 - LINE ACTIVE LED'S
77-79 - LINE SELECT BUTTONS
24 - MICROPHONE
72 - DISPLAY
71-75 - PROGRAMMABLE FUNCTION KEYS
70 - ROB BASE
25 - SPEAKER
46 - WEIRLESS KEYBOARD PORT - IRDA

FIG. 4

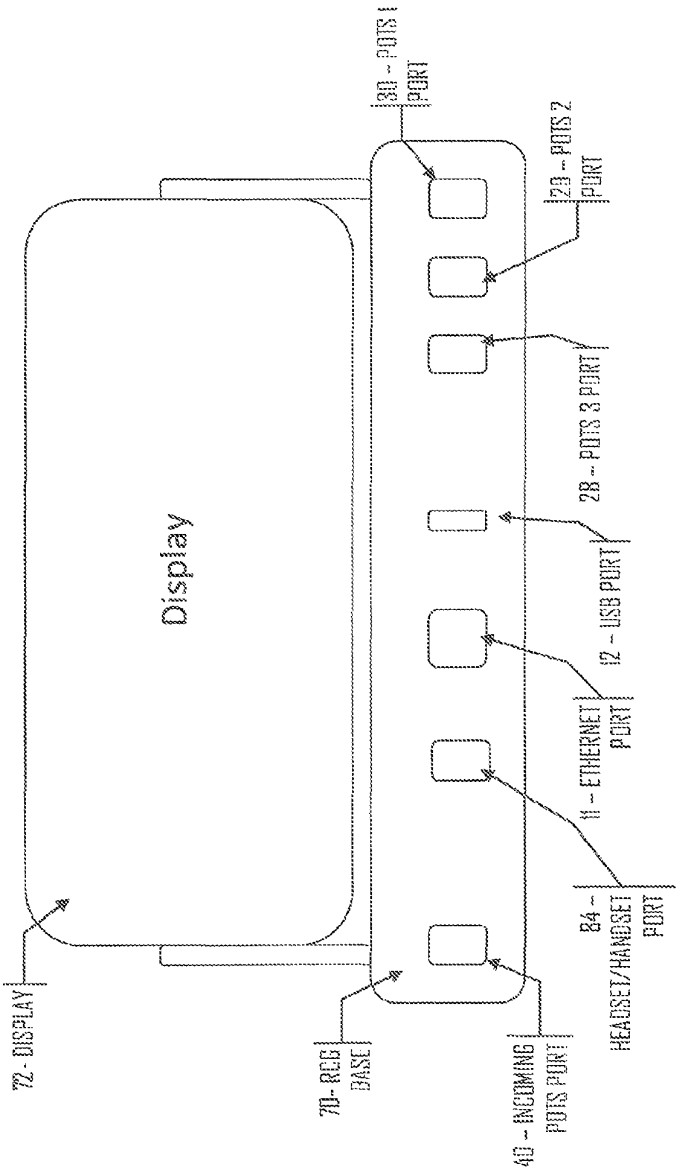

Display
72 - DISPLAY
70 - REG BASE
40 - INCOMING POTS PORT
84 - HEADSET/HANDSET PORT
11 - ETHERNET PORT
12 - USB PORT
28 - POTS 3 PORT
29 - POTS 2 PORT
30 - POTS 1 PORT

FIG. 5

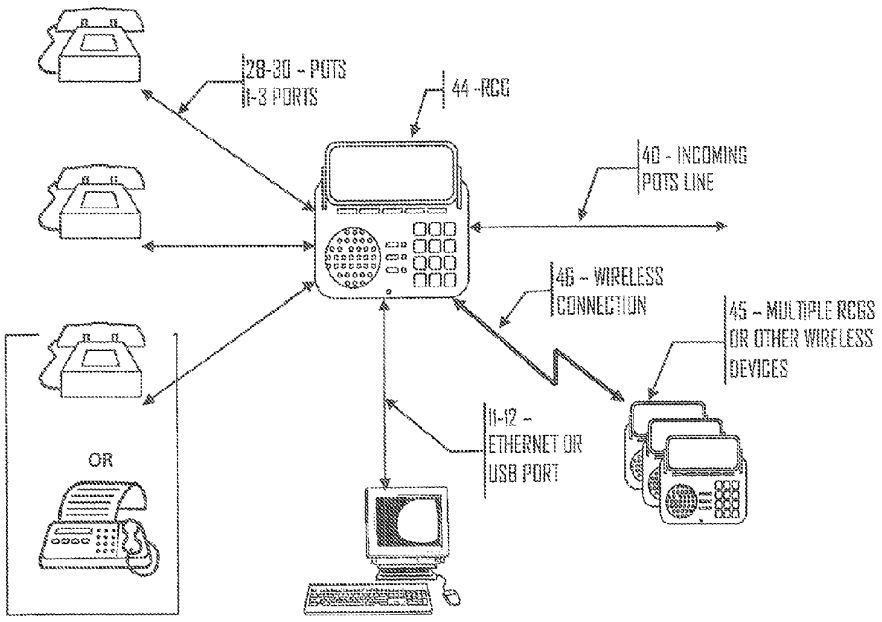

28-30 - POTS
1-3 PORTS
44 -RCC
40 - INCOMING
POTS LINE
46 - WIRELESS
CONNECTION
45 - MULTIPLE RCBS
OR OTHER WIRELESS
DEVICES
11-12 -
ETHERNET OR
USB PORT
OR

FIG. 6

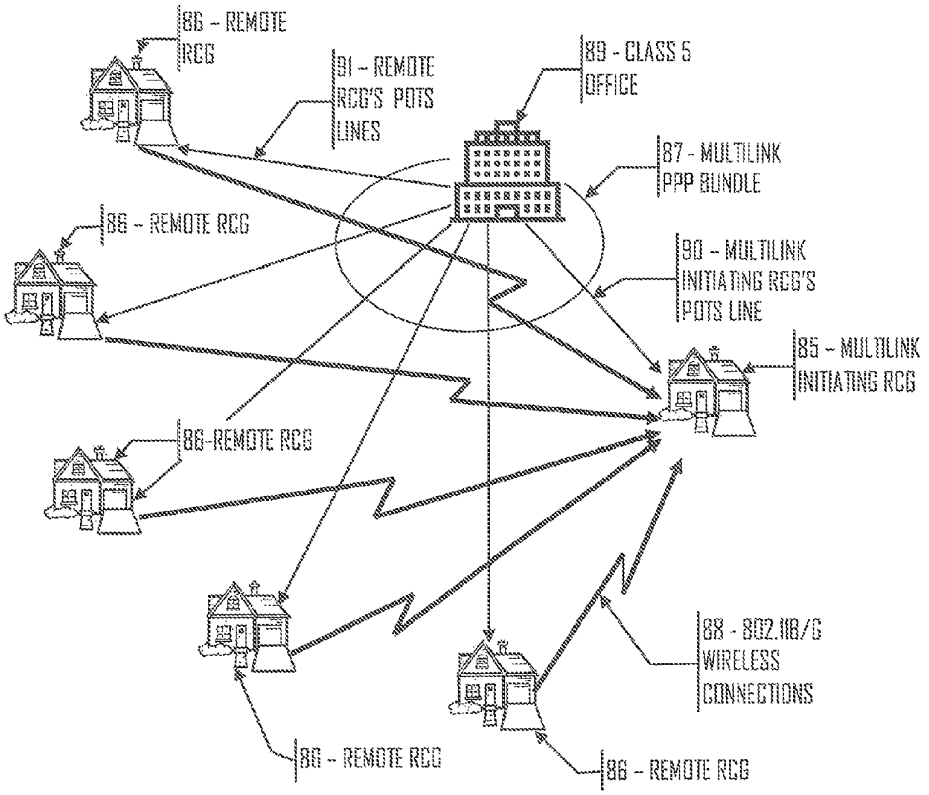

86 – REMOTE RCG
91 – REMOTE RCG'S POTS LINES
89 - CLASS 5 OFFICE
87 - MULTILINK PPP BUNDLE
86 – REMOTE RCG
90 – MULTILINK INITIATING RCG'S POTS LINE
85 – MULTILINK INITIATING RCG
86-REMOTE RCG
88 - 802.11B/G WIRELESS CONNECTIONS
86 – REMOTE RCG
86 – REMOTE RCG

FIG. 7

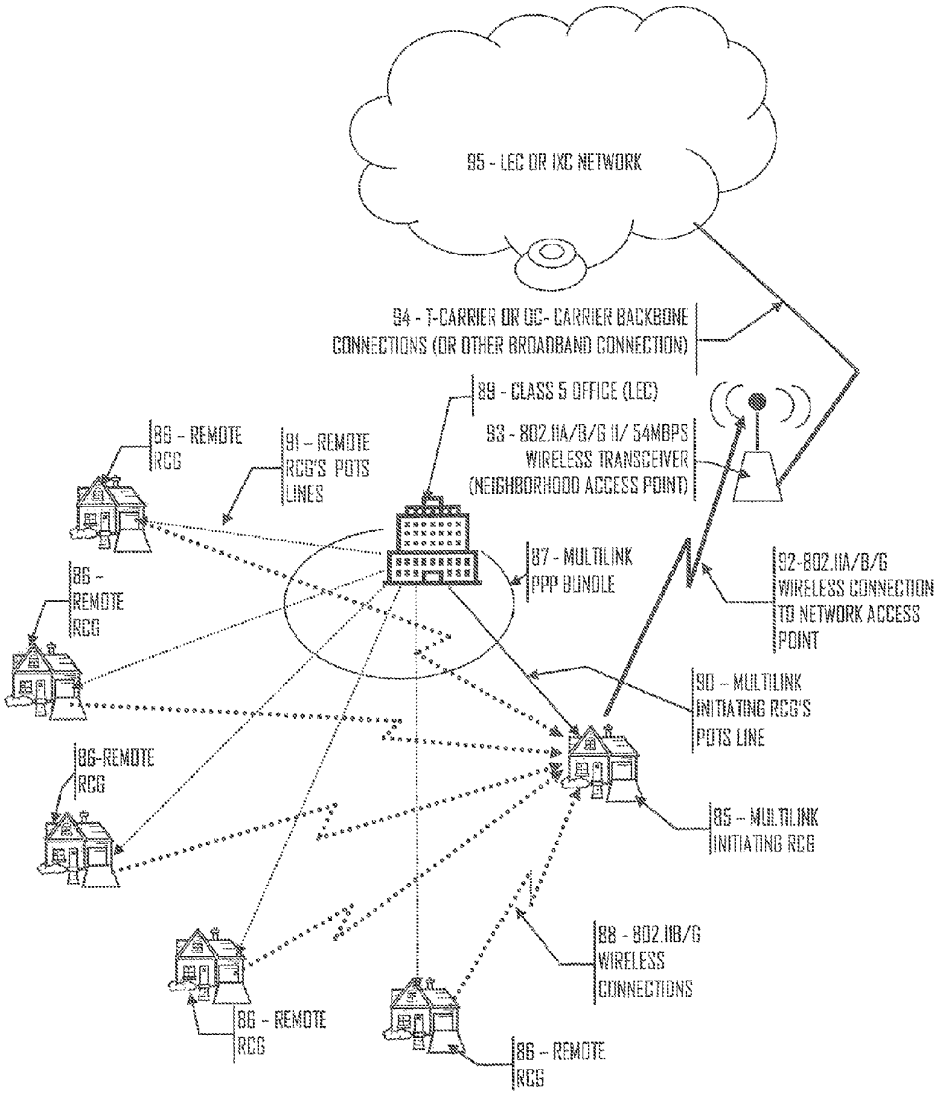

95 - LEC OR IXC NETWORK
94 - T-CARRIER OR UC- CARRIER BACKBONE CONNECTIONS (OR OTHER BROADBAND CONNECTION)
89 - CLASS 5 OFFICE (LEC)
93 - 802.11A/B/G II/ 54MBPS WIRELESS TRANSCEIVER (NEIGHBORHOOD ACCESS POINT)
86 - REMOTE RCG
91 - REMOTE RCG'S POTS LINES
87 - MULTILINK PPP BUNDLE
92-802.11A/B/G WIRELESS CONNECTION TO NETWORK ACCESS POINT
86 - REMOTE RCG
90 - MULTILINK INITIATING RCG'S POTS LINE
86-REMOTE RCG
85 - MULTILINK INITIATING RCG
88 - 802.11B/G WIRELESS CONNECTIONS
86 - REMOTE RCG
86 - REMOTE RCG

FIG. 8

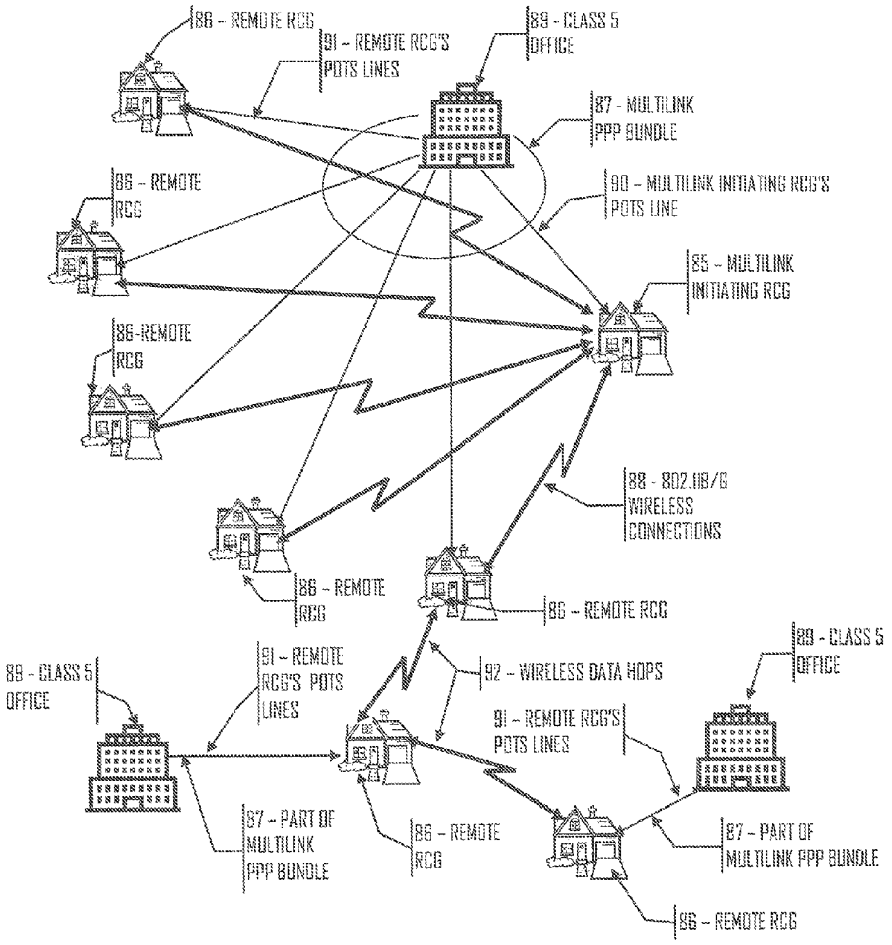

86 – REMOTE RCG
91 – REMOTE RCG'S POTS LINES
89 – CLASS 5 OFFICE
87 – MULTILINK PPP BUNDLE
86 – REMOTE RCG
90 – MULTILINK INITIATING RCG'S POTS LINE
85 – MULTILINK INITIATING RCG
86-REMOTE RCG
88 – 802.11B/G WIRELESS CONNECTIONS
86 – REMOTE RCG
86 – REMOTE RCG
89 – CLASS 5 OFFICE
91 – REMOTE RCG'S POTS LINES
92 – WIRELESS DATA HOPS
91 – REMOTE RCG'S POTS LINES
89 – CLASS 5 OFFICE
87 – PART OF MULTILINK PPP BUNDLE
86 – REMOTE RCG
87 – PART OF MULTILINK PPP BUNDLE
86 – REMOTE RCG

FIG. 9

BROADBAND COMMUNICATIONS DEVICE

RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 12/581,852 filed Oct. 19, 2009, now U.S. Pat. No. 8,228,801, which is a continuation of U.S. patent application Ser. No. 10/686,375 filed Oct. 14, 2003, now U.S. Pat. No. 7,606,156, which claims priority to U.S. Provisional Application Ser. No. 60/418,521, filed Oct. 15, 2002, all which are incorporated by reference herein.

BACKGROUND OF INVENTION

The primary function of the RCG is to provide a platform for Competitive Local Exchange Companies (CLECs) to compete with the Local Exchange Companies (LECs) for residential voice and data services. The LECs have a strangle hold on the "last mile" of copper over which almost all residential customers receive their communications services. Today, most CLECs resell the existing services that are offered by the LECs. CLECs make their money by purchasing these services from the LECs at a discount and marking them up to the customer. Since these services are regulated and controlled by the Public Utilities Commission (PUC) the pricing for these services to the CLECs is set. The monthly CLEC discount is approximately $5 to $6 per line per month for basic rate services. This means, in practicality, that a CLEC can only charge an additional $5 or $6 to the residential customer for basic rate services otherwise they would be more expensive than the LEC, and no one would buy the services from them; telephone customers would simply stay with the LEC.

To be competitive then, CLECs try to sell additional services such as call waiting, caller ID, etc. where they have as much as a 50% margin. Some CLECs also bundle long distance services with their packages as additional incentive to get residential customers to buy local telephone service from them. Since long distance fees are as low as pennies per minute to the customer, there is little profit in long distance for the CLECs. As it is, the pricing structure is such that the LECs will stay in control of the residential market, and the CLECs are nothing more than a marketing arm of the LEC. This structure also keeps the CLECs at an equal competitive advantage, or disadvantage, with respect to each other. The only thing that one CLEC could do to gain more customers is to be a better marketier. Since the CLECs are unable to discount their services because their margins are too slim as it is, the net effect is that the consumer looses by not really getting competition in the residential markets, and prices are kept artificially high.

For the CLECs to be truly competitive in the local telecommunications markets, they must be able to do more than simply resell the LECs services. CLECs must be able to offer many more features or services than those that the LEC provides, and they must be able to do this at a lower cost, in order to attract new customers.

So, what new services can the CLECs offer? As things stand today there are none, with the exception of DSL or Cable services which require tremendous infrastructure costs on behalf of the CLEC. However, by deploying an RCG in a residence, CLECs can offer advanced new calling features and services over the existing POTS line. Their costs for the POTS line from the LEC remains the same, but they can now charge for high bandwidth data services as well as additional calling and messaging features that the LECs cannot offer. This is their competitive advantage.

Competition:

Many companies are currently trying to provide VoIP services to residential customers over high-speed or broadband backbones such as DSL and cable modems, over Internet connections via a computer. The high-speed services require expensive infrastructure enhancements to the local telephone companies' facilities and cable plants, as well as expensive modems at the customer's end. These services are also difficult to deploy and too complicated for the average user. Internet based VoIP services suffer from Internet delays caused by a lack of true Quality of Service (QOS) capabilities across the Internet. Existing VoIP services also require access to a computer and a technical knowledge to be able to make it work. Because of these problems, VoIP services are primarily targeted at the corporate market place where private IP networks that can carry VoIP services with a true guaranteed QOS exist, or can be controlled.

The only available alternatives for the residential user for high speed services are DSL and cable modems. DSL and Cable based communications reach only a small segment of the population, and growth has failed to live up to initial expectations. The recent collapse of the internet boom has led to the failure of many DSL service providers and has effectively eliminated DSL as a potential service for most POTS users for the immediate future.

SUMMARY OF THE INVENTION

The RCG combines the capabilities and features of IP routers, Class 5 circuit switches and wireless LANs in a small stand-alone external modem like device. Additional capabilities for a hands-free speakerphone device with a large touch display are also detailed. The RCG can employ a large display with sufficient resolution to provide a functional user interface to access all of the advanced features offered by the RCG, but also to be able to provide video telephone services.

The device is placed in a residence and connected to the primary POTS line coming from the LEC. Up to three standard telephones or FAX machines (or any combination) are typically connected into the RCG. It also has a Universal Serial Bus (USB) and/or a 10-100 Ethernet interface for connection to a computer or a Local Area Network (LAN). In addition, it has an 802.11b/g wireless interface for wireless home networking as well as broadband-to-the-home services.

The system is installed in a customer's home by simply plugging it into the existing incoming telephone line that provides POTS services from the LEC. One or more standard telephones are then plugged into its three line-output jacks. This is the simplest and most basic usage. In this implementation, the user only is interested in gaining additional telephone lines into the household. No computer connection is required in order to use the system. However, if data communications are desired, then there are three additional interfaces for computer connectivity. Typically either an Ethernet port, USB port or firewire (IEEE 1394) port is used to connect to a PC or LAN. The 802.11b/g interface is for wireless communications between the RCG and PCs, other RCGs as well as any other types of compatible wireless devices. A version of the RCG includes a speakerphone and video camera to provided for video telephone services.

Services Provided by the RCG:

The following discussion refers to FIG. **1**. The RCG has a main system processor that is responsible for all house keeping and traffic routing tasks. The Main CPU **19** routes data to and from the Ethernet Port **11**, USB Port **12**, Modem/DAA **41**, DSP Engine **33**, 802.11b/g Module **36** and the Display and Keypad **10**.

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The RCG provides a total telecommunications communications services package for residential and small business customers. With the RCG, a CLEC can offer its customers dialtone for up to three separate telephone numbers per residence (the limit of three telephone numbers is an arbitrary number based upon typical residential usage and is not a limit imposed by the system), all local and long distance services, 24/7 always-on Internet access, a host of custom messaging and calling features, as well as Broadband access and lifeline service. All of these services can be offered over a customer's existing POTS line, and it doesn't require any network infrastructure build out like DSL and Cable services. Because there is no expensive network equipment required, it can be readily deployed throughout the country to expand the CLECs customer base quickly.

The RCG is designed to enhance, not replace, the existing telephone line, enabling it to provide new combined packetized voice and data services. Meanwhile, all existing telecommunications infrastructure and equipment will continue to work seamlessly with the RCG. Aside from simply installing the low cost RCG device in the home telephone wiring, no other equipment needs to be purchased by either the home owner or telephone companies. This eliminates the tremendously expensive infrastructure costs for communications companies that are trying to provide voice services using DSL or cable modems.

The RCG VIP Home Gateway Features:

Up to three telephone lines i.e. numbers, over a single POTS line and/or wireless connection.

Ethernet, USB and IEEE 1394 computer interfaces.

Full G1, G2 and G3 FAX support.

Full support for all CLASS services.

Broadband networking for home computers and appliances as well as wide area networking using a combination of a plurality POTS lines connected to a plurality of RCGs and/or a direct wireless connection to a wireless access point. (These interfaces allow smart devices to communicate to other devices within the home, or over the Internet through the RCG.)

Automated, remote upgradability and configuration. (Requires the customer to do nothing.)

Transparent user operation. (User doesn't have to know that any new technology is being employed)

100% compatible with existing public telephone system.

Video Telephone capabilities.

No local or long distance usage charges.

No Internet access fees.

Lower monthly communication costs.

Multiple telephone calls at the same time.

Voice messaging, follow me features, call forwarding, automatic call back, conferencing, custom call routing. Home networking capabilities, all CLASS calling features, high speed broadband networking, continuous 24/7 internet access, and many others.

All of these features are available even while connected to the Internet.

Very low cost of entry into the market, especially as compared to broadband alternatives.

New calling features that are not currently available to home users.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows the RCG functional block diagram with the preferred embodiment of an 802.11 wireless connection.

FIG. **2** shows the network topology for native RCG to RCG communications.

FIG. **3** shows the network topology for an RCG to PSTN call.

FIG. **4** shows the RCG top view with associated functions.

FIG. **5** shows the RCG rear view and associated connections.

FIG. **6** shows a typical application with peripheral equipment connections.

FIG. **7** shows an ad-hoc wireless LAN configuration with ppp multilink data distribution and wireless connectivity.

FIG. **8** shows an ad-hoc wireless LAN configuration with ppp multilink data distribution and wireless connectivity with connection to a broadband neighborhood access point (Wi-Fi hot spot).

FIG. **9** shows an ad-hoc wireless LAN configuration with ppp multilink data distribution and wireless connectivity with wireless data hopping with POTS connections through numerous different Class 5 offices.

DETAILED DESCRIPTION OF THE INVENTION

The preferred embodiment is detailed herein using the ubiquitous 802.11 wireless protocol. It is by no means insinuated that this is the only wireless scheme that can be used by this device; rather, it is intended that any wireless transmission scheme can be used for wireless communications between this device and other wireless devices as various applications may dictate.

System Initialization

Refer to FIGS. **1**, **2** and **3** for the following discussion. When the RCG is first plugged into an AC power outlet the Main CPU **19**, performs a Power-on Self Test (POST) routine. Once the POST completes and the RCG is connected to an active POTS line, connected to the LEC, by means of the Incoming POTS Port **40**, the RCG automatically initiates a modem connection via the Modem/DAA **41**, to a registration service via a toll free 800 telephone number. The registration service connects directly to the service provider's sales or customer service offices via a VoIP connection. An operator or an automated service answers the call and sets up a new account for the customer. Once the account is set up, the service provider's network automatically sends control information to the device to store the required routing and feature/service information in its non-volatile memory of its Main CPU **19**. As part of this information, a local dialup telephone number is sent to the device that it will use for local network access in the same fashion as a standard ISP connection is made from a home computer. The URL of the Softswitch/SIP Proxy Server and Registrar **51** that will be controlling this particular device is also stored at this time. During the service activation and configuration process, the customer service operator can send test requests to the device, as well as call into it on another telephone number (assuming an additional telephone number is part of the users class of service) or the speakerphone to verify that it is configured and working properly. The final step of the configuration and initialization process is to register the device with the appropriate Softswitch/SIP Proxy Server and Registrar **51** so that the Softswitch/SIP Proxy Server and Registrar **51** knows that it is the controlling SIP Proxy for this RCG. Also configured at this time is the username/password verification server (this is a standard network device and is not shown) that is used to allow the RCG's modem to make a connection onto the service provider's network. Once the RCG configuration is completed, it disconnects the call by hanging up the Modem/DAA **41**, then dials the new local network access number that had been sent during the configuration process and establishes a constant local network connection. This connection is

maintained continuously on a 24/7 basis, and is immediately reestablished whenever it drops. Should the RCG become unable to reestablish this connection after several tries, it will switch over to failsafe mode and inform the user via the Display and Keypad **10**. The RCG will try to reestablish the connection every few minutes until it finally succeeds.

By default, the first telephone port, POTS 1 Port **30**, is assigned as the termination port for the existing POTS service that is connected to Incoming POTS Port **40**. This is the existing telephone service that the user already has as his primary telephone service from his LEC. POTS 1 Port **30**, typically has connected to it a standard telephone set that does not require any power (other than that derived over the POTS interface) to operate properly. POTS 1 Port **30** is the Lifeline telephone port for the user. In the case that all power is lost to the RCG, POTS 1 Port **30** will fail to a direct connection to the Incoming POTS Port **40** telephone line that comes into the RCG from the LEC to provide uninterrupted telephone services to the user. In this state, however, none of the enhanced VoIP services of the RCG are available to the user since the user simply has a stand POTS telephone service to the LEC.

Two additional and unique telephone numbers can be assigned to the other two telephone ports, POTS 2 Port **29** and POTS 3 Port **28**, by the service provider at any time. These numbers are drawn from a pool of available telephone numbers assigned to the service provider. POTS 2 Port **29** and POTS 3 Port **28** must to have standard telephone numbers assigned to them so that the PSTN is able to route calls from its network to these ports. For calls originating from IP based telephones, these numbers are not necessarily needed since POTS 1 Port **30**, POTS 2 Port **29** and POTS 3 Port **28** are uniquely identifiable to IP networks via their IP addresses assigned through the Dynamic Host Configuration Protocol (DHCP) at the time that the RCG establishes a connection to the service provider's network. Since POTS 2 Port **29** and POTS 3 Port **28** must have a telephone number assigned to them, it is a matter of convenience to use the assigned telephone numbers as part of their SIP address for IP routing of their data. In this way, all three user POTS ports, POTS 1 Port **30**, POTS 2 Port **29** and POTS 3 Port **28** are all addressed the same manor.

At this point, the user is able to take advantage of all of the RCG's features that have been activated according to his service agreement. The user can at any time connect additional telephones, a computer or a computer network to the RCG. The user will only be able to use those telephone ports (POTS 1 Port **30**, POTS 2 Port **29** or POTS 3 Port **28**) that have been activated, and assigned unique telephone numbers by the service provider. Any type of standard telephone can be connected to the three POTS ports, POTS 1 Port **30**, POTS 2 Port **29** and POTS 3 Port **28**. In the event that a cordless telephone or a telephone that derives its power from an AC outlet is connected to POTS 1 Port **30**, the lifeline functionality of this port will be ineffective since the telephone itself will not operate once power is lost.

The speaker phone feature of the RCG, comprised of Speakerphone Drivers **22**, Microphone **24**, Speaker **25** and DSP Engine **33**, can be used on any of the activated telephone numbers and is by default enabled to operate on POTS 1 Port **30**. Once either of the other two telephone ports, POTS 2 Port **29** or POTS 3 Port **28**, is activated, the speakerphone function is activated for those lines as well. To use the speakerphone for any assigned telephone number, the user simply presses either the Line Select Button **79-81** for Line 1, Line2 or Line 3 on the face of the RCG, and the speakerphone function is activated on that line. This is convenient for answering any call directly at the RCG. The RCG may or may not have a number keypad for originating calls. This feature may be added or removed based upon the target market price points.

The determination as to which Inter Exchange Carrier (IXC) the RCG will route its data through is determined by any of a number of criteria including, but not limited to, whether the RCG is a private labeled product, or which carrier has the lowest cost routing, or if a specific carrier is specified by the customer, or and number of other considerations. The RCG can be programmed to change its routing path to any IXC at any time by the service provider. Complicated routing algorithms can be programmed into the RCG to control which IXC it will use at any time.

Failsafe Mode

During any time that the RCG is in failsafe mode i.e. Lifeline failsafe logic **39** is activated, the RCG will only be able to receive or initiate telephone calls via the telephone connected to its primary telephone port, POTS 1 Port **30** or through its speakerphone feature. In this condition, all activated telephone numbers are ported via the PSTN to the primary (first) telephone number for delivery to the user's telephone that is connected to POTS 1 Port **30**. While in failsafe mode, the modem is not activated, and the RCG appears to the local Class 5 office as a standard telephone, and the PSTN will route all incoming calls to the RCG as it normally would to any standard telephone.

Call Flow 1:

Dialed call origination from a telephone connected to an RCG POTS port and terminating at another user's RCG POTS port:

When a user picks up a telephone connected to any of the three POTS ports, POTS 1 Port **30**, POTS 2 Port **29** and POTS 3 Port **28**, an off hook condition is detected by the SLIC/CODEC Interface **27** that is connected to the DSP Engine **33** by way of the DSP Audio Interface **31**. The DSP Engine **33** responds by sending digitally generated dialtone to the appropriate POTS interface over the DSP Audio Interface **31**. (Note: all BORSCHT telephony functions are performed by the DSP Engine **33** and the SLIC/CODEC Interface **27**.) Upon hearing the dialtone, the user enters the desired telephone number on his telephone keypad. The Dual Tone Multi-Frequency (DTMF) digits that the user dials are decoded within the DSP Engine **33**. The dialed digits are transferred to the Main CPU **19** via the CPU/DSP Communications Path **34**. The Main CPU **19** polls the DSP Engine **33** approximately every two milliseconds looking for data. The Main CPU **19** polling rate varies according to the process that is being performed. The CPU/DSP Communications path **34** also can generate an interrupt to force data transfer between it and the Main CPU **19**.

The Main CPU **19** generates a SIP Invite IP packet using the dialed digits as the called destination address and the URL of its local controlling SIP Proxy Server which was programmed into the RCG during the configuration process. The Main CPU **19** passes this SIP packet off to the Modem/DAA **41** for transmission over the network. The RCG Modem/DAA **41** is connected to and communicating with a modem in a modem bank located in the Inter Exchange Carrier's (IXCs) facility. This facility may actually be located in the LEC's physical plant or it may be physically located at another location.

Referring to FIG. **2**, User A RCG **44** is connected via its modem to the LEC's local Class 5 Office A **47**. In this example, the service provider's connections to the IXC A Modem Bank & Router **48** are through IXC A Inter-Office Trunks **46**. The service provider may or may not be the IXC. If the service provider does not have its own network, then it will purchase capacity from an IXC and route its traffic to that

IXC's facilities. The SIP Invite IP Packet that is sent from User A RCG **44** transits the LEC's Class 5 Office A **47** facilities and is routed to the IXC A Modem Bank/Router **48** via the IXC A Inter-Office Trunks **46**. It is the job of the router to take the IP packet and route it on to its intended destination, in this case the appropriate SIP proxy server **51**. The router uses the URL for the Softswitch/SIP Proxy Server and Registrar **51** contained in the SIP Invite to know where to route the packet. (Note: The Softswitch, SIP Proxy Server and Registrar are logical devices that may reside in a single computer system, or may be implemented as completely separate devices. In this example, the Softswitch, SIP Proxy Server and Registrar are all shown as a single physical device running these three separate processes.) The IXC A Modem Bank/Router **48** sends the SIP Invite IP packet on to Softswitch/SIP Proxy Server and Registrar **51** via an IP based network route **52**.

The SIP Proxy Server process running on Softswitch/SIP Proxy Server and Registrar **51** performs a look up to determine the termination destination for the call using the dialed digits passed along in the SIP Invite IP packet. In this example, the terminating device for User B RCG **56** is via IXC B's Modem Bank/Router **49** then through Class 5 Office B **50** and over User B POTS line **55** and finally to User B RCG **56**. Not covered in detail here is the SIP message handling since it is completely covered in IETF RFC2543. This example shows that both the originating and terminating ends of this call are controlled by the same Softswitch/SIP Proxy Server and Registrar **51** device. Where the originating and terminating ends of a call are controlled by different Softswitch/SIP Proxy Server and Registrar devices, an additional level of SIP messaging is used between the two SIP Proxy Server processes of each of the Softswitch/SIP Proxy Server and Registrar devices to locate and control the terminating location of the call. Again, that information is covered in IETF RFC2543 and is repeated here.

After the call routing is setup using SIP, and User B answers the call, the Softswitch/SIP Proxy Server and Registrar **51** device sends IP address of the originating User A RCG **44** to the User B RCG **56** and the IP address of User B RCG **56** to User A RCG **44**. Once both RCG's have the other's IP address, they then communicate directly to each other using Real Time Protocol (RTP), and the Softswitch/SIP Proxy Server and Registrar **51** device is no longer part of the connection. This direct communication is shown as IP based RTP Stream **57** between IXC A Modem Bank/Router **48** and IXC B Modem Bank/Router **49**.

On the receiving end of the call, referring back to FIG. **2**, User B RCG **56** receives the SIP Invite data stream through its Modem/DAA **41** and passes it on to the Main CPU **19**. The Main CPU **19** reassembles the SIP IP packet and interrogates the header information to determine which POTS port, POTS 1 Port **30**, POTS 2 Port **29** and POTS 3 Port **28** the call is destined for based upon the dialed number contained in the SIP Invite message. The Main CPU **19** commands the DSP Engine **33** to control the SLIC/CODEC Interface **27** to apply ringing voltage to the selected POTS port to ring the phone. A corresponding SIP **180** (ringing) message is sent back to User A RCG **44** in the reverse direction. When the phone attached to the selected POTS port is answered, the offhook condition detected by the SLIC/CODEC Interface **27** is sent through the DSP Engine **33** to the Main CPU **19** that sends the SIP 200 OK message back to User A RCG **44** to let the RCG know that the call was answered by User B RCG **56** and to turn off the audible ringing tone for User B. Once the call is established, User A RCG **44** sends and ACK F12 SIP message to User B RCG **56** indicating that User A RCG **44** understands that the call setup has been completed.

The two RCGs now exchange SIP messages that include the type of voice encoding that will be used such as G.729, G.723.1, G.711 etc to configure their RTP streams so that they can reliably transfer the user information between them. At this point the call (voice data) is sent between both RCGs and a normal telephone conversation takes place between the user A and user B.

Call teardown is accomplished by either user hanging up their telephone. The RCG of the terminating end (the end that hangs up the phone first) detects the on-hook condition and sends a SIP Bye message to the other end. The other end upon receiving the SIP Bye message responds with an OK 200 SIP message and disables the appropriate POTS port that the user was using.

The Speakerphone interface can be used for either end of a telephone conversation in exactly the same way as described above except that the corresponding POTS port that the call was intended for is disabled if the call is answered via the speakerphone.

Call Flow 2:

Calls between an RCG device and a PSTN telephone:

Refer to FIG. **3** for the following discussion.

In the previous call example, the PSTN network had nothing to do since the call was over a previously established modem connection between two RCGs. In the cases where a call originates or terminates to a standard telephone serviced by a Class 5 office, the process is a bit more complicated.

When a call originates from a user via an RCG, such as User A RCG **44**, the call handling practices are exactly the same up to the point that the SIP Proxy Server process in the Softswitch, SIP Proxy Server and Registrar **51** performs a lookup to determine how to route the call. In this case, the SIP Proxy Server process determines that the call terminates at a standard PSTN telephone attached to the Class 5 Office B **50**. Since the call originates as a native VoIP service, it must be converted to a standard switched circuit based service to be able to be delivered to User B's telephone **61**. The conversion is performed by the IXC's Media Gateway **60** device. In this example, the SIP Proxy Server process routes the call via the IXC's Media Gateway **60** device instead of through the IXC B Modem Bank/Router **49** as before. The SIP Proxy Server process sends a SIP Invite to the IXC's Media Gateway **60** device, as well as other control information, to direct the Media Gateway **60** device to terminate the call and to apply the appropriate voice compression algorithm to the media stream to convert it between switched circuit PCM format and the selected VoIP protocol. At the same time, the Softswitch process of the Softswitch, SIP Proxy Server and Registrar **51** device sends commands to the Media Gateway **60** device to cause it to route the call's PCM data to a specific channel on the IXC B Interoffice Trunk **54**. The Softswitch process then generates an SS7 ISUP message that is sent over the PSTN SS7 signaling network to the Class 5 Office B informing it of the incoming call and on which circuit the call has been placed. It is up to the PSTN at this point to ring the User B telephone **61** and process the call between the IXC's Media Gateway and the User B Telephone **61**. The Softswitch process handles the signaling conversion between the PSTN's SS7 network and the IXC's SIP messaging, as well as any other proprietary signaling schemes utilized by the IXC to control its network. The standard SS7 call control messages, such as ringing, busy, ring back etc., all have a comparable SIP call flow control messages. The Softswitch simply maps the SS7 messages into SIP messages and visa-versa while routing the messages to the appropriate network equipment.

As in the case of a call between two RCGs, the RTP media stream (the actual call data) is routed directly be the IXC A Modem Bank/Router **48** and the IXC's Media Gateway **60** via an IP based RTP Stream **57**.

Again, call teardown is accomplished by either user hanging up their telephone. Depending which end hangs up the phone first, the associated network will generate the appropriate messages which will eventually make it back to the Softswitch process. The Softswitch process will relay the appropriate call control messages between the PSTN and the IXC's SIP based control system.

A telephone call originating from a PSTN telephone is configured and setup in the same fashion as the above description except that the originating messaging begins within the PSTN network instead of the IXC's network.

Personal Computer Based Communications:

Where the RCG is connected to a Personal Computer (PC) through either its USB Port **11** or Ethernet Port **12**, the RCG operates exactly as a cable or DSL type modem device. The RCG is simply a pass through for the computer's data. The RCG receives the IP packets (of whatever type) from the computer and sends the information unchanged to the Modem/DAA **41** interface for transmission over the Internet. Received information from the Internet is processed in the reverse way.

Dynamic Bandwidth Allocation:

When a modem connection is established between the RCG and the "Network", the total available bandwidth of this connection is used in a shared/prioritized fashion. Voice services (calls) take precedence over data services. Therefore, when no calls are in progress all of the available bandwidth is used by data type services such as surfing the Internet or uploading/downloading files. However, when a call is to be passed through the RCG, the required bandwidth for the call is deallocated from the data services and prioritized for the telephone call. This necessary because the Quality Of Service (QOS) is important for effective communications over electronic networks. Since the voice data is carried over a "data centric" network topology (an IP based network), call quality can suffer greatly. Every effort must be taken to eliminate or reduce the packet delay through every network element to be able to provide the best call quality. For data applications such as surfing the Internet or downloading files packet delay is acceptable and expected, and it does not affect the "quality" of the data.

Since all voice and data is transmitted as packets, there are no "time slots" or other type of "channelization" associated with the transmission of this data over either the POTS line or the wireless interface. Channelization of the voice data does occur within the SLIC/Codec Interface **27** but is converted into IP packets by the DSP engine—**33** and is handled as packets from that point on.

Regardless of whether the call is originating or terminating at the RCG, the bandwidth allocation process is the same. When the SIP call setup messages are processed, the type of voice compression that will be used is defined. The RCG Main CPU **19** handles the IP packet flow between the DSP Engine **33**, USB Port **12**, Ethernet Port **11**, 802.11b/g Module **36** and the Modem/DAA **41** devices giving priority to the voice packets to and from the DSP Engine **33** and the Modem/DAA **41** interfaces. Voice compression algorithms create IP packets at a specified number of packets per second. These packets are handled by a timed process in the RCG. This process is started during call setup so that the packets are handled at the correct rate based upon the compression algorithm's packet generation rate. There is no priority assigned between the voice packets of each of the three different POTS Ports **28-30**. When more than one voice call is in progress, they are handled in a round robin fashion based upon the packet rate for the compression algorithm used. If, for example, two calls are using a compression scheme that generates packets every 2 milliseconds, and the third generates packets every 4 milliseconds, then the calls utilizing the faster packet rate will be polled at twice the rate as the call using a slower packet rate but they are not given priority "over" the other call. Only when there are no voice packets ready for transmission to the Modem/DAA **41**, i.e. during the approximately 2 to 4 millisecond packetization period between packets, will any pending data packets received from the USB Port **12**, Ethernet Port **11** or the 802.11b/g Module **36** be sent to the Modem/DAA **41** for transmission over the network.

Thus, the POTS bandwidth is allocated on a per packet basis, not on a "time slot" or "channelization" or even a "frequency" basis as it the case with T-Carrier, DSL or channelized DSL systems. The same is true for the wireless interface, whether it is carrying pure data or voice.

Security is currently a big concern in today's networks, and especially with wireless 802.11 transmissions. For this reason, the RCG defaults to route voice data over the users POTS connection via Incoming POTS Port **40**. As security concerns regarding wireless communications transmissions are addressed and alleviated, voice call data can, and will, be routed over the wireless interface via the 802.11 b/g Module **36**.

FAX Transmission:

Group 1, 2 and 3 fax transmission is completely supported by the RCG. Fax transmission has the same priority as other voice communications. That is to say that FAX transmission is treated the same as a voice call and takes precedence over native IP data traffic.

Broadband Over POTS:

One of the primary functions of the RCG is to be able to transfer large files such as video files over the POTS lines to a residence. The ability to do this is limited by the maximum of 56 Kbps due to the design of the digital Class 5 office linecards and network transmission schemes based upon T carriers. Typical Class 5 linecard design samples the POTS lines at a rate of 8,000 samples per second. Typically, each sample is digitized into 12 to 16 bits by a codec device. The digitized sample is then companded to an 8 bit sample (1 byte) which makes up the PCM data stream that is transferred over the PSTN. Therefore, each POTS line is sampled at an effective rate of 64 Kbps. Since legacy T1 transmission equipment uses robbed-bit signaling, the maximum guaranteed transmission rate for the PSTN as a whole is 56 Kbps. Because of this limitation, standard POTS lines can only guarantee a maximum of 56 Kbps transfer rate under the best conditions. DSL equipment gets around this problem by installing DSL Access Multiplexing (DSLAM) equipment at the Class 5 office end of the POTS line. By routing around the linecard, as well as routing the data directly over the Internet or other private IP based networks, and therefore the 64 Kbps sampling rate, DSL is not bandwidth limited like PSTN traffic is. DSL, however, suffers from the very high costs associated with the purchase, installation, maintenance, floor lease costs, etc. DSL also suffers from very high deployment costs resulting from the labor intensive process to turn up each line. Each DSL "POTS" line must be inspected, conditioned and all load coils removed.

The RCG gets around the 56 Kbps POTS limitation as well as the DSL problems by using the standard POTS lines as they are, and not requiring any additional equipment to be installed at the Class 5 end of the POTS line. This technique simplifies deployment and drastically cuts costs.

Multilink PPP Connections:

Referring to FIG. **7**, the RCG implements broadband over POTS by employing an 802.11 b/g wireless interface to configure a multilink PPP bundle—**87** (per RFC 1990) comprised of the POTS lines connected to up to 32 RCGs. The limitation of 32 RCGs in a multilink PPP bundle is an arbitrary number and can be scaled up or down as required to support changes in network equipment capabilities. An 802.11b/g interface **87** is shown as the preferred embodiment, since its 11/54 Mbps interface is considered sufficient bandwidth at this time also, its transmission distances are sufficient for implementation of this device, as opposed to other shorter ranged wireless transmission schemes. However as time goes on, some other wireless interface may be more desirable. There is nothing special or specific to the 802.11 wireless interface that makes it particularly suited to this application. Any wireless interface scheme can be used to implement this device.

The 802.11b/g interface—**88** on an individual RCG is also used to provide a peer-to-peer wireless home networking environment to other 802.11 compatible wireless component within the residence (such as a hand-held computer device) while acting as an always on dialup Internet gateway over the POTS line—**40** for the other wireless devices. An RCG that is transferring a very large file can request the services of 31 (in this embodiment) other RCGs to assist in the file transfer using their respective POTS lines. A single RCG can therefore gain the combined bandwidth of up to 32 POTS lines transferring data at as much as 56 Kbps each to transfer information. This is roughly equivalent to a transfer rate of 1.79 Mpbs in the inbound direction (towards the RCG) and approximately 1.075 Mbps in the outbound direction (towards the PSTN).

The multilink PPP connection—**87** is initiated by an RCG when it determines that the file (or streaming service) that it is to download (receive) is of sufficient size or requires a minimum amount of bandwidth to justify the use of a multilink PPP connection. This determination can be made on many different criteria such as the file size, type of data being transmitted, the type of compression if any, a Quality-of-Service requirement or any other pertinent information. (Since a certain amount of overhead is required to set up a Multilink PPP connection, it doesn't make sense to use it for small or low data rate transfers.)

Multilink PPP bandwidth Allocation and Initialization:

Referring to FIG. **7**, an RCG—**85** that decides to initiate a multilink PPP session with a remote computer i.e. internet URL, requests a multilink PPP session with that URL resource via Link Control Protocol (LCP) session management. The initiating RCG **85** and the remote server computer (not shown) will negotiate the pertinent multilink parameters such as compression, packet size, sync/async, link quality monitoring, bit stuffing etc. As part of a successful multilink PPP session setup, the initiating RCG—**85** receives a multilink PPP session ID, or "magic number", which is used to identify this particular multilink PPP session and is also used for adding or removing links from the multilink bundle—**87**. Once the multilink bundle is setup, the initiating RCG—**85** begins data transfer across its POTS interface—**90** with the far end computer system. The initiating RCG—**85** then looks up the addresses of up to 31 (in this embodiment) other RCGs in its router tables to use for the multilink PPP transfer. (If a Neighborhood Access Point is available the RCG could request service through it instead of setting up a Multilink PPP connection—see FIG. **8**.) The initiating RCG—**85** determines the number of remote RCGs—**86** that it wants to use to get the desired bandwidth for the transfer and sends multilink PPP service requests via the 802.11 b/g wireless connections—**88** to the selected remote RCGs—**86**. The selected remote RCGs—**86** respond back to the initiating RCG with either an acceptance or denial of multilink PPP service request. This decision is made based upon the remote RCG's currently available POTS bandwidth and the current local demands for that bandwidth. The remote RCG **86** makes a decision to participate in a multilink PPP service for an initiating RCG if its POTS line **91** has a current average bandwidth utilization of less than some arbitrary limit such as 8 Kbps to 16 Kbps. This 8 Kbps to 16 Kbps bandwidth utilization represents about two concurrent voice conversations using standard voice compression techniques, or some small amount of data transmission occurring on the remote RCG's POTS interface—**91** or a combination thereof. Assuming that the remote RCG—**86** has a modem connection speed somewhere between 33 Kbps to 56 Kbps, this would leave approximately 17 Kbps to 40 Kbps of POTS bandwidth that the remote RCG—**86** could offer to the initiating RCG—**85** for use in its multilink PPP bundle **87**. Of course, if there is no activity on the remote RCG—**86** POTS line, then the entire bandwidth will be used for the multilink transfer. If the remote RCG—**86** accepts the multilink PPP service request from the initiating RCG—**85** it also sends its currently available bandwidth on its POTS line—**91** that the initiating RCG—**85** will have available to it for the multilink PPP transfers. The initiating RCG then selects which of the responding remote RCGs—**86** it will use for the multilink PPP bundle—**87** and sends them a multilink initialization packet containing the URL of the destination as well as the multilink PPP session ID (magic number) and any other pertinent information required for the remote RCG to join in the existing multilink PPP bundle—**87**. Each remote RCG POTS interface—**91** participating in a multilink PPP bundle, represents a logical "link" in the initiating RCG's multilink PPP bundle—**87**. The remote RCGs—**86** then send a multilink PPP packet (over their respective POTS lines—**91**) to the destination URL with the multilink PPP session ID and request to be added to that multilink PPP bundle—**87**. The destination URL accepts the request of each of the remote RCGs—**86** and begins sending data packets to each over their respective POTS lines—**91**. When the remote RCGs—**86** receive data packets sent over their respective POTS lines—**91**, that are destined for the multilink PPP bundle—**87**, they simply relay the data packets over their 802.11b/g interface—**88** to the initiating RCG—**85**. It is the responsibility of the initiating RCG—**85** to perform all housekeeping tasks associated with the multilink transfer such as detection of lost packets and data packet reassembly, if those functions are required. Typically, lost packet detection and retransmission and reassembly are performed at higher OSI layers by the requesting software such as a browser. The remote RCGs—**86** are simply data transport nodes and do not perform any data processing on data received over a multilink PPP bundle destined for another RCG.

The initiating RCG—**85** of the multilink PPP bundle—**87** continually monitors the bandwidth of each remote RCG's—**86** multilink link which together comprise its multilink bundle—**87**. When the available bandwidth for the multilink PPP link of an individual remote RCG—**86** falls below an arbitrary minimum set by the initiating RCG—**85**, the initiating RCG—**85** instructs the offending remote RCG, via its 802.11b/g wireless interface—**88**, to remove itself from the multilink bundle. The remote RCG—**86** will then notify the remote computer (URL) to be removed as a link in the current multilink bundle on which it is participating. Alternatively, a remote RCG—**86** can inform the initiating RCG—**85** of local

demands on its POTS bandwidth, and request that the initiating RCG—**85** remove it (the remote RCG—**86**) from the participation in the initiating RCG's multilink bundle—**87**. The remote RCG—**86** will not unilaterally remove itself from participation in a multilink bundle without prior notification to the Initiating RCG—**85**. The remote RCG—**86** must get authorization from the initiating RCG **85** to remove itself from the bundle, since the initiating RCG—**85** will have no way of knowing if the loss of data from that remote RCG is due to some sort of failure or from the remote RCG simply removing itself from participation in the multilink bundle—**87**. Also, for services that require a minimum Quality of Service (QOS) such as streaming video, the initiating RCG—**85** needs to control the multilink bundle—**87** bandwidth, and it can not do that if remote RCGs—**86** drop out of the multilink bundle—**87** at will. When a remote RCG—**86** requests to be removed from participation in a multilink bundle—**87**, the initiating RCG—**85** must immediately grant the request. If the initiating RCG—**85** were to not grant the request, then the remote RCG **86** could, in worst case, delay or drop incoming multilink packets destined for the initiating RCG—**85**. If this were to happen, the initiating RCG **85** will have missing packets and could over run its reassembly buffer (if reassembly is being performed by the RCG) causing catastrophic data loss and potentially have to restart the entire transmission. In the least case, the initiating RCG—**85** would have to initiate retransmission of potentially many packets which it assumes to be lost, but may simply be delayed by the remote RCG—**86**. Once a remote RCG—**86** has been removed from participating in a multilink bundle—**87**, the initiating RCG—**85** will then look up another remote RCG in its router tables that can be used to participate in the multilink PPP bundle—**87**, and request that the new remote RCG—**86** to join the existing multilink bundle—**87**. This is necessary to maintain a minimum Quality of Service. Since RCGs prioritize their bandwidth requirements based upon their own "local" service requirements, their participation in any multilink PPP service is available only to bandwidth that is not required for its own current local demands. Therefore, a remote RCG's—**86** bandwidth that is available for multilink services can change at any time. The dynamic reassignment of remote RCGs that participate in a multilink bundle is also required to prevent a remote RCG—**86** from receiving packets so slowly that the originating RCG—**85** interprets this delay as lost packets. When the initiating RCG—**85** determines that a packet has been lost, and it is performing packet reassembly, it will, itself, request that the remote computer retransmit the lost packet. The initiating RCG will not ask any remote RCG **86** to perform retransmissions or any other kind of data computations or manipulations.

Refer to FIG. **8** for the following discussion. In areas where there are existing 802.11 network equipment such as Neighborhood Access Point—**93**, or where there is sufficient bandwidth requirements from an installed base of RCGs to warrant the deployment of a Neighborhood Access Point—**93**, the RCGs will automatically detect the presence of the compatible neighborhood access points and register with that equipment for transport services. In this case, an RCG has an alternative broadband service route in addition to the multilink option. An RCG can communicate directly with a local 802.11 Network Access Point—**93** that is connected to the PSTN or another carrier's network via some sort of high bandwidth backbone such as a T-Carrier or optical carrier connection (T1, T3, OC3, OC12 etc.). The RCGs can communicate directly with neighborhood access points at their full 11/54 Mbps data rates to provide up to that full bandwidth to the user. This functionality is, of course, subject to the Network Access Point—**93** allowing access to its resources to the RCG according to the 802.11 wireless protocol.

This architecture is important since it provides an avenue to relieve the local class 5 offices of congestion that can be caused by a wide spread deployment of RCGs within the class 5 service area. Since each RCG requires a constant 24/7 modem connection, this ties up the class 5 switch in a fashion that it was not designed for. This could lead to wholesale class 5 office expansions which would be extremely expensive, and potentially prohibitive for the Local Exchange Carriers (LECs). By deploying neighborhood access points that operate at 54 Mbps (802.11a/g), in areas where the RCG concentration starts placing too high of a demand on the local class 5 office, the bandwidth from the RCGs can be aggregated by the neighborhood access points into large capacity backbones to relieve the switch congestion. In this case, the RCG POTS interface—**40** can be used solely as a lifeline connection, or when the 802.11 wireless LAN in which the RCG resides is congested. With this implementation, voice calls will be carried over the wireless interface as opposed to the POTS interface on which they would normally be carried. Also, the RCG modem **41** connected to the POTS interface **40** would not need to maintain a constant always on connection, it could be a dialed on demand connection and thereby relieving the local class 5 office switch.

Bouncing or Hopping Traffic:

Refer to FIG. **9**. In areas where the density of RCGs is less than the arbitrary number of 32 RCGs within its transmission radius for multilink connections, the RCGs can bounce, or relay, the data traffic between each other to reach other RCGs located farther than the RCGs wireless transmission area. Since the POTS data rate of 56 Kbps is miniscule as compared to the 11/54 Mbps 802.11b/g transfer rate, the overhead associated with bouncing data traffic is not a concern. This will allow for the fastest possible data transfer across POTS lines for every RCG user.

RCGs can also communicate directly with an 802.11a Neighborhood Access Point—**93** device (such as that used in WI-FI networks) that is connected to a data network connection such as a DS3 or OC3 service via a Metro Access Point. Where an RCG has access to a broadband device such as an 802.11a type device, either directly or via a bounced signal across several RCGs, a direct high speed data connection can be used to transfer large files. When an RCG is communicating directly with an 802.11a device, data transfer speeds up to the full 11/54 Mbps can be achieved to speed video transfers for such applications as video on demand.

RCG Router Tables:

The RCG continually monitors its 802.11b/g wireless interface for transmissions from other RCGs or 802.11a Access Points as well as other 802.11b/g wireless devices within the residence. The RCG provides a means to identify and store the addresses of other RCGs and Neighborhood Access Points within its local area. The RCG creates routing tables, much like an IP router device, so that it knows which RCGs are local to itself, and how many hops will be needed to reach the maximum of 32 POTS lines or a Neighborhood Access Point. The RCG can then determine how to route its data transfers to gain the most efficient routing and network efficiencies.

The router tables in each RCG are continually updated by monitoring the 802.11 frames received from other RCGs or Network Access Points. The number of entries in the router tables can be limited to an arbitrary number of other RCGs but contains room for at least 32 entries. For each RCG listed in the router tables, certain information is kept such as signal strength, if the other device is another RCG or some other

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802.11 compatible device, if the other RCG is reachable directly, or if it is accessed via another RCGs by hopping. In the case there RCG hopping is used, the address of each RCG that is hopped is stored in the routing table. When an RCG is first powered up, it monitors its 802.11 interface for a period of time to identify other RCGs or Neighborhood Access Point devices, or other Wi-Fi devices within its transmission area. When first deployed, the RCG will not have any entries in its routing tables. This condition can persist for some time, until another RCG or other 802.11 device is deployed within the former RCGs transmission range. In this state, the RCG can be used for wireless networking within the residence, connecting the local computer to the RCGs always on Internet connection as well as to other wireless devices within the home. When an 802.11 frame is received by an RCG that contains the address of an RCG whose address does not exist in the receiving RCG's router table (as is the case when a new RCG is first installed), the receiving RCG polls the transmitting RCG for its router table information. The received router information is reviewed for other RCG's or other 802.11 compatible devices that are not listed in its own router tables. A decision is made to use some, all, or none of the new route information in its router tables. There is no real limitation on the number of RCGs that can be "hopped" in order to build a complete router table or to reach many more RCGs, Neighborhood Access Points or Metro Access Points.

Equipment and Services Priorities:

Just as voice has priority over data transfers within a single RCG, local RCG traffic (both voice and data) has priority over remote transfer requests by other RCGs. If an RCG is currently using all of its available POTS bandwidth for its own purposes, it will deny any remote RCG's request for access to its POTS line. Only when there is available POTS bandwidth available will an RCG allow other RCGs access to its POTS line. It will, however, bounce the traffic to other RCGs within its transmission area if requested by the originating RCG. In this case, available wireless bandwidth of any RCG (that amount of the 11/54 Mbps not currently used for its own traffic) can be used to relay traffic between other RCGs that do have available POTS bandwidth. In the same fashion, excess wireless bandwidth of any RCG can be by other RCGs to access high speed backbones via Neighborhood or Metro Access Points.

RCGs can also access other 802.11 wireless networks (Wi-Fi for example) that happen to be deployed within their service areas. In this case, access agreements between the RCG service provider and the wireless network operator must be put into place. By remaining compatible with the 802.11 standards, the RCGs capabilities will benefit by the growing WI-FI network infrastructure, an the WI-FI network will benefit by the RCG network.

Voice Over POTS and Data Over Wireless:

Normally, all communications from an RCG will be transmitted over the local POTS line, or a multilink bundle made up of many remote RCG POTS lines. By default, all voice calls will be carried over the "local" POTS line—**40** to alleviate security/privacy concerns and only "data" will be transmitted via multilink bundles. Generally, since voice "data" is compressed locally by the RCG, the required bandwidth for a voice call is so small that it does not make for a good choice to route it over a multilink connection. However, it is possible to route voice calls entirely over another RCGs POTS line. It is also possible for an RCG to transmit voice data over POTS lines connected to other RCGs via multilink bundles or directly over its 802.11 wireless interface, and since the 802.11 specification does support the Wired Equivalent Privacy (WEP) specification, a secured connection can be made in this fashion.

Remote Upgradability

The RCG is designed with the capability for unassisted remote upgradability. The remote upgradability feature is not the same as the storing of operational parameters during the configuration process. This feature allows the system operator to add new features as they are developed, or to correct bugs remotely and without the users knowledge or involvement. This feature can also be used to install a complete new operating system (OS).

Key to the successful implementation of the Remote upgradability feature is that a completely fail-safe routine be implemented that can recover from any failure during the upgrade process and to re-initiate and monitor the upgrade process until it has successfully completed. This process is carried out by loading a boot loader program that is stored in non-volatile memory. The boot loader program provides the minimum capabilities to start up the RCG and connect into the system operator's diagnostics network to download fixes or a new OS. The boot loader program is technically part of the OS, but it cannot be over written by any upgrade process. It is responsible for detecting failure of the RCG and initiating a connection to the diagnostics network. Once connected with the diagnostics network, the boot loader will provide diagnostics support to help correct the RCG's operation and reconfigure the OS.

What is claimed is:

1. A method for increasing bandwidth and data throughput comprising the steps of:

sending a multilink request from a first device to a second device to join a multilink connection, the first device being connected at a first location to a network, the second device being connected at a second location to the network, the second location being geographically separate from the first location, the first device and the second device being configured for accessing the network; and

when the multilink request is accepted by the second device, receiving at the first device first data from the network at the first location and during the multilink connection, concurrently receiving second data over a wireless connection from the second device, the second data being received at the second location from the network.

2. The method of claim **1**, wherein the first location and the second location are physically isolated from each other.

3. The method of claim **1**, further comprising the step of aggregating the second data received over the wireless connection and the first data received over the connection at the first location.

4. The method of claim **1**, wherein a connection at the first location and a connection at the second location are network connection points.

5. The method of claim **1**, wherein the first device and the second device are consumer networking devices.

6. The method of claim **1**, further comprising the steps of: sending another multilink request from the first device to a third device, the third device being connected at a third location to the network, the third location being geographically different than the first location and the second location; and

when the another multilink request is accepted by the third device, concurrently receiving third data during the multilink connection over a second wireless connection between the first device and the third device.

7. The method of claim 6, further comprising the step of aggregating the first data, the second data and the third data.

8. The method of claim 1, wherein the first data and the second data are received as data packets.

9. The method of claim 1, wherein the network is the Internet.

10. The method of claim 1, wherein the second device is a wireless device.

11. The method of claim 1, wherein the network is one or a combination of a cable network, a telecommunication network, an optical network and a communications network.

12. The method of claim 1, wherein the wireless connection is a cellular connection, a satellite connection, a Wi-Fi connection, a WiMax connection or a Bluetooth connection.

13. A device comprising:

an interface that establishes a network connection at a first location to a first network and receives first data packets over the network connection;

a wireless interface that is configured to establish a wireless connection to a remote communications device, the remote communications device being connected at a second location to a second network; and

a processor that sends a multilink request over the wireless interface to the remote communications device to join the multilink connection, receives from the interface the first data packets from the first network and when the multilink request is accepted by the remote communications device, concurrently receives from the wireless interface second data packets from the second network, the second data packets being received at the second location from the second network.

14. The device of claim 13, wherein the device is one of a modem, cellular phone, a router, a computer, hotspot device and a tablet.

15. The device of claim 13, wherein the device is part of a home-based network system.

16. A method for providing broadband communications services, comprising:

sending to a remote host an inquiry in whether the remote host is able to support a multilink connection;

receiving first data packets over a first connection to the Internet;

when the remote host indicates that the multilink connection is supported, receiving second data packets over a second connection, the first data packets being concurrently received with the second data packets during the multilink connection; and

wherein the first data packets create a first data stream and the second data packets create a second data stream.

17. The method of claim 16, wherein the first data packets are received at a home-based network system, and wherein the second packets are received over the second connection at the home-based network system.

18. The method of claim 16, wherein the first data packets are received by a consumer-based network system, and wherein the second packets are received over the second connection at the consumer-based network system.

19. The method of claim 16, further comprising:

during the multilink connection, receiving data packets over a plurality of wireless connections, the data packets being concurrently received with the first data packets; and

aggregating the first data packets with the data packets.

20. A method for increasing bandwidth and data throughput comprising the steps of:

sending a multilink request from a first device to a second device to join a multilink connection the first device being connected at a first location to a first network, the wireless device being connected at a second location to the first network or a second network, the second location being geographically separate from the first location: and

when the multilink request is accepted by the second device, receiving at the first device first data from the first network at the first location and during the multilink connection, concurrently receiving second data over a wireless connection from the wireless device, the second data being received at the second location from the first network or the second network.

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EXHIBIT 1013

U.S. Patent 6,112,245 to Araujo *et al.* ("Araujo")

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United States Patent [19]

Araujo et al.

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[45] Date of Patent: Aug. 29, 2000

[54] **SESSION ESTABLISHMENT FOR STATIC LINKS IN POINT-TO-POINT PROTOCOL SESSIONS**

[75] Inventors: **Kenneth Araujo**, Sunnyvale; **Peter Si-Sheng Wang**, Cupertino, both of Calif.

[73] Assignee: **3Com Corporation**, Santa Clara, Calif.

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[58] **Field of Search** 709/203, 271–219, 709/227–232, 250, 236, 238, 245

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Primary Examiner—Zarni Maung

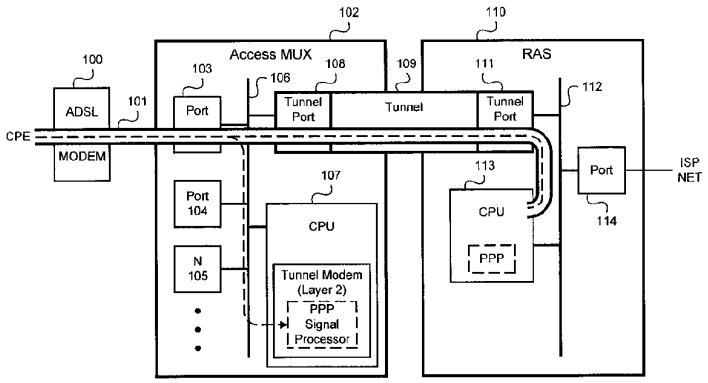
Assistant Examiner—Saleh Najjar

Attorney, Agent, or Firm—David J. Weitz; Wilson Sonsini; Goodrich & Rosati

[57] **ABSTRACT**

A constant access ADSL link, or an equivalent connection from a modem to a central office switch is enabled to establish sessions to individual end stations, such as individual Internet service providers. An in-band signaling channel within the Point-to-Point Protocol session employs a connection establishment and tear down protocol for session establishment and tear down to individual end stations with the end station coupled to the ADSL link. Such session establishment and tear down messages are associated with frames having an HDLC-like address of (hex)FF are terminated locally by the concentration/multiplexing equipment at the central office switch or other equipment provided by the telephone network access provider. As a result the session establishment, the access provider's concentration/multiplexing equipment returns a value other than (hex)FF to be used by the end station coupled to the ADSL link, in the HDLC address field to identify data associated with the particular PPP session. This HDLC address value will only have local significance across the ADSL link between the customer premises equipment and the access provider's concentration/multiplexing equipment. When PPP frames associated with the particular session are received from an ISP, the frames are encapsulated in HDLC-like frames with the HDLC address associated with the session by the access provider's equipment before deliver across the ADSL link.

24 Claims, 4 Drawing Sheets



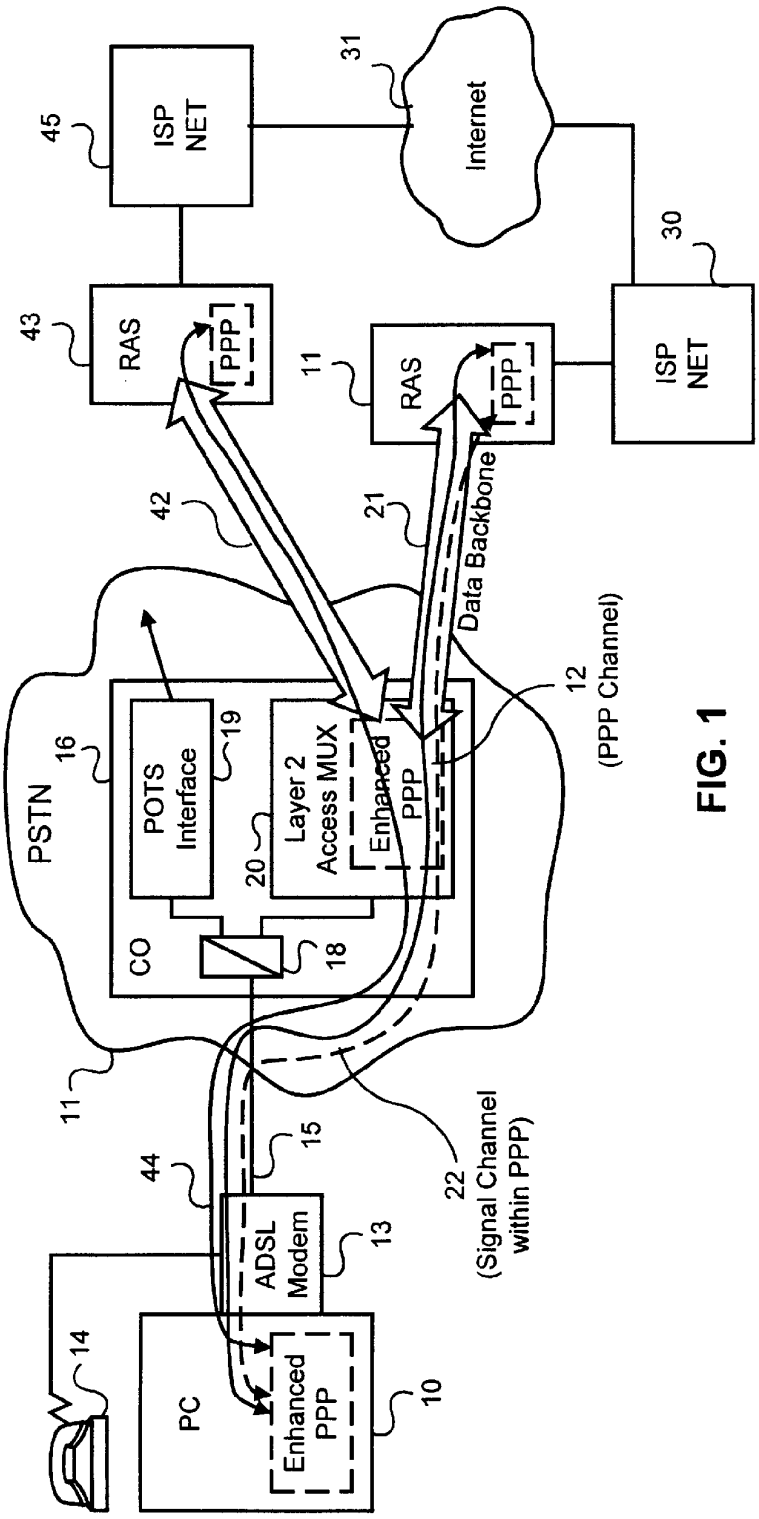

ISP NET
45
31
Internet
30
RAS
PPP
43
11
RAS
PPP
ISP NET
42
21
Data Backbone
12
(PPP Channel)
PSTN
16
POTS Interface
19
Layer 2 Access MUX
Enhanced PPP
20
CO
18
11
22
(Signal Channel within PPP)
44
15
ADSL Modem
13
14
PC
Enhanced PPP
10

FIG. 1

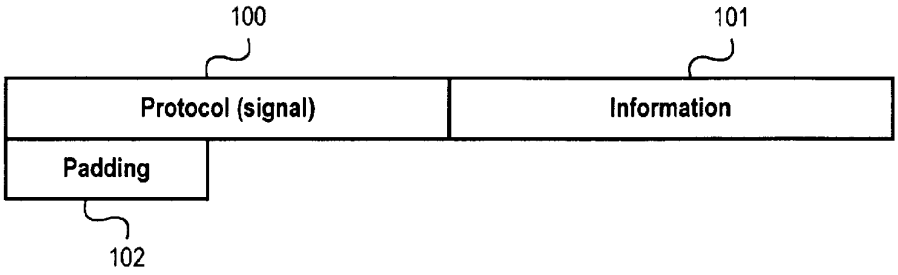

100
101
Protocol (signal)
Information
Padding
102

FIG. 2

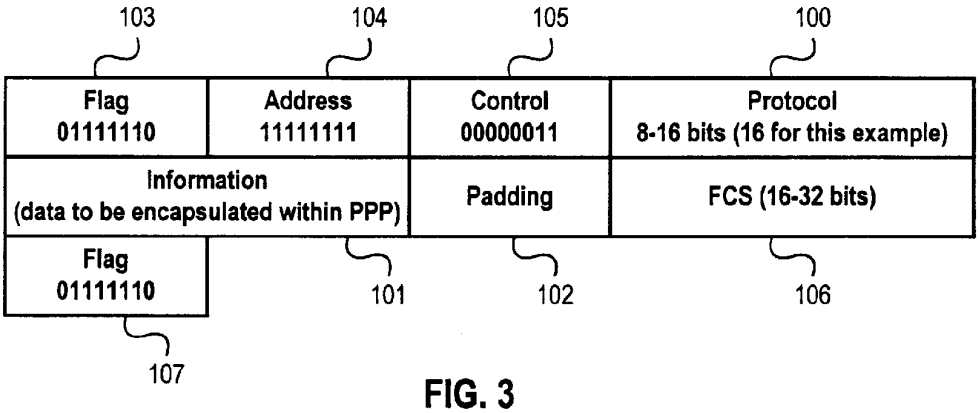

103
104
105
100
Flag
01111110
Address
11111111
Control
00000011
Protocol
8-16 bits (16 for this example)
Information
(data to be encapsulated within PPP)
Padding
FCS (16-32 bits)
Flag
01111110
101
102
106
107

FIG. 3

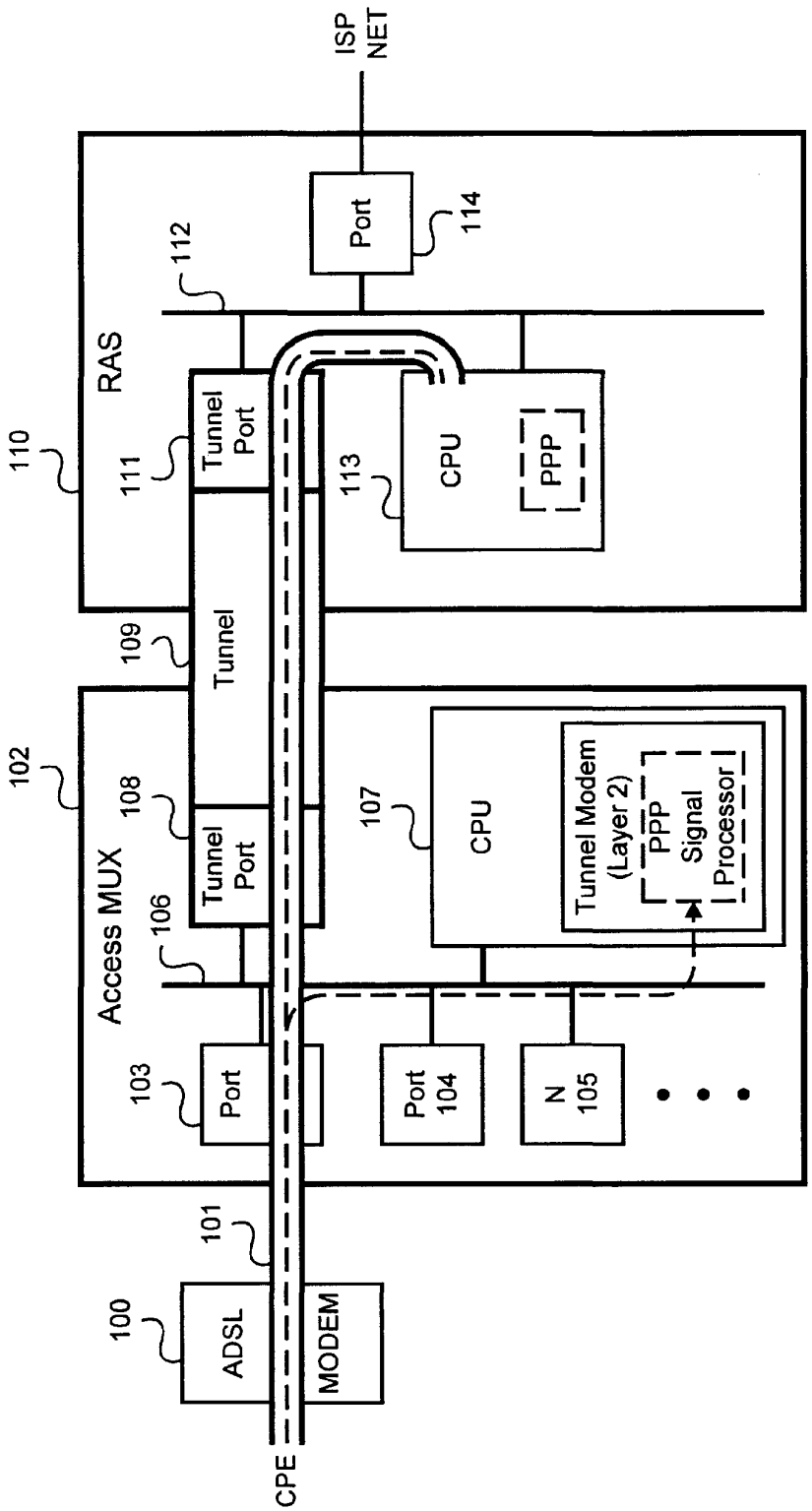

ISP NET
Port
114
112
RAS
110
Tunnel Port
111
CPU
PPP
113
Tunnel
109
102
Access MUX
108
Tunnel Port
107
CPU
Tunnel Modem (Layer 2)
PPP
Signal Processor
106
103
Port
Port 104
N 105
101
100
ADSL
MODEM
CPE

FIG. 4

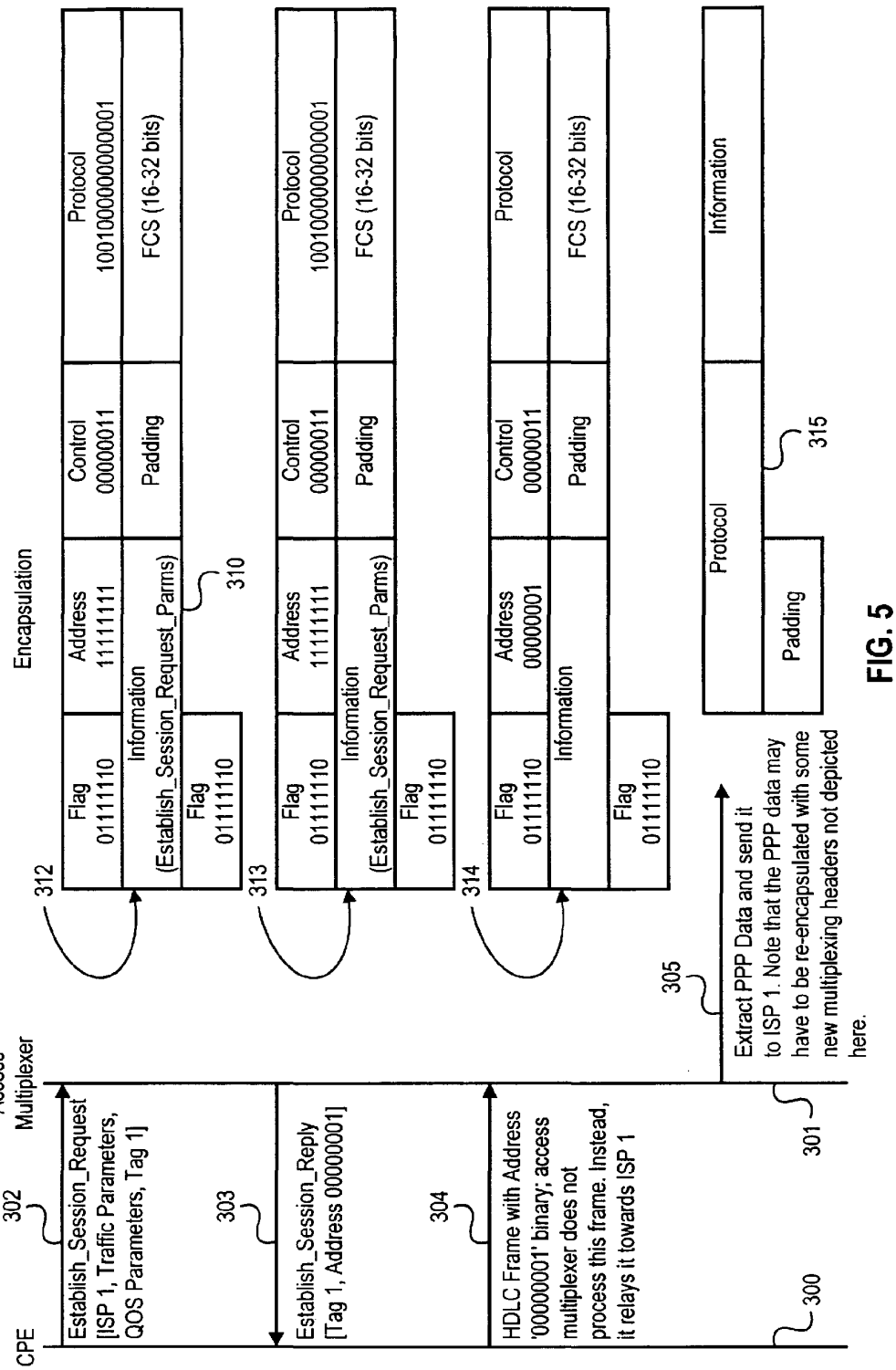


FIG. 5

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SESSION ESTABLISHMENT FOR STATIC LINKS IN POINT-TO-POINT PROTOCOL SESSIONS

RELATED APPLICATIONS

This application is related to non-provisional application, entitled "Point-to-Point Protocol With A Signaling Channel," by inventors, Kenneth Araujo and Peter Si-Sheng Wang, having Ser. No. 09/056,280, and filing date Apr. 7, 1998, which was filed on the same day as the instant application; and to non-provisional application, entitled "Distribution Of Protocol Processes From Network Elements To End Stations," by inventors, Kenneth Araujo, Peter Si-Sheng Wang and Cheng Chen having Ser. No. 09/056,281, and filing date Apr. 7, 1998, which was filed on the same day as the instant application; and to non-provisional application, entitled "Enabling Multicast Distribution Efficiencies In A Dialup Access Environment," by inventors Kenneth Araujo, Peter Si-Sheng and Cyndi Jung having Ser. No. 09/056,284, and filing date Apr. 7, 1998, which was filed on the same day as the instant application.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to data communications, and more particularly to techniques for improving the flexibility and useability of point-to-point communication protocols, such as the Point-to-Point Protocol (PPP), for static link modems, such as Asynchronous Digital Subscriber Loop ADSL modems.

2. Description of Related Art

The Point-to-Point Protocol, as it is defined, is used for transporting multi-protocol datagrams over point-to-point links. One version of the PPP is described in Request For Comments RFC 1661, published July 1994 by the Point-to-Point Protocol Working Group of the Internet Engineering Task Force IETF. The PPP consists of a specification for encapsulating multi-protocol datagrams, a link control protocol LCP for establishing, configuring and testing the datalink connection, and a family of network control protocols NCPs for establishing and configuring different network layer protocols. According to the PPP, network layer packets are referred to as datagrams. The datagrams are passed to the datalink layer in which they are encapsulated according to the PPP in a packet having a packet header. The packet including the PPP fields and the datagram is passed to the physical layer at which framing such as HDLC-like framing is appended to form a frame in the format received at the physical layer interface. So called HDLC-like framing is described in "PPP in HDLC-like Framing" RFC 1662 published July 1994 by the Point-to-Point Protocol Working Group of the IETF. Upon reception, the frame is stripped of its framing fields, and a packet is passed to the datalink layer. The packet is stripped of its control fields to produce a datagram. The datagram is passed to the network layer at which network layer headers and the like are processed. Use of the PPP provides a simple technique for encapsulating data from a variety of protocols and is used for example across telephone lines between end stations and Internet access providers.

PPP sessions are established between peers. In one typical environment, the peers include equipment located at a customer site referred to as customer premises equipment CPE, and a remote access server RAS operated by an Internet Service Provider ISP. The customer typically dials a telephone number to access the RAS of the Internet

Service Provider. For some modem types, such as the asynchronous digital subscriber loop ADSL (running PPP in HDLC framing over ADSL), the CPE has a static link to a RAS, without requiring dial up. In this case the central office switch is statically configured to direct ADSL traffic from a particular modem to a particular destination, such as a remote access server for an Internet Service Provider. The PPP is utilized to establish the peer to peer connection from the CPE to the RAS.

Thus, when a CPE is connected via ADSL to a central office switch and uses a protocol, such as the PPP over HDLC-like framing, without out-of-band session establishment, the user is limited to a single peer connection. Alternatively more, complex protocols, such as PPP over ATM on an ADSL link, provide a capability to set up more than one connection through the ATM procedures. However, it is desirable to provide this capability on simpler protocols.

SUMMARY OF THE INVENTION

According to the present invention, a technique is provided by which a constant access ADSL link, or an equivalent connection from a modem to a central office switch is enabled to establish sessions to individual end stations, such as individual Internet service providers. In particular, the invention applies an in-band signaling channel within the Point-to-Point Protocol session. The new PPP signaling channel employs a connection establishment and tear down protocol for session establishment and tear down to individual end stations with the end station coupled to the ADSL link. Such session establishment and tear down messages are associated with frames having an HDLC-like address of (hex)FF, and are terminated locally by the concentration/multiplexing equipment at the central office switch or other equipment provided by the telephone network access provider. Thus, such frames are used to provide local management in network intermediate devices for PPP sessions. As a result the session establishment, the access provider's concentration/multiplexing equipment returns a value other than (hex)FF to be used by the end station coupled to the ADSL link, in the HDLC address field to identify data associated with the particular PPP session. This HDLC address value will only have local significance across the ADSL link between the customer premises equipment and the access provider's concentration/multiplexing equipment. When PPP frames associated with the particular session are received from an ISP, the frames are encapsulated in HDLC-like frames with the HDLC address associated with the session by the access provider's equipment before delivery across the ADSL link. PPP data is extracted from frames received from the CPE, and the value of the HDLC address field in such frames is used to determine where the data should be forwarded. For cases where the CPE does not support the new PPP signaling channel, the access equipment will not continue attempting to establish/communicate via the new signaling channel with the CPE over frames which have an HDLC address of (hex)FF.

The protocol employed in the signaling channel associated with HDLC address (hex)FF includes messages (used as examples; other messages with equivalent functionality could also be used), such as the following:

1. An ESTABLISH_SESSION_REQUEST message, used to request that a session be established to a particular end point. Included in the message would be an address of the end point, traffic parameters, quality of service parameters, and other channel related information.

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2. An ESTABLISH_SESSION_REPLY message, sent in response to a previous ESTABLISH_SESSION_REQUEST message. If a positive response is received, the reply returns a session identifier to be used as the HDLC address in frames carrying data associated with this particular session. A negative response means that the ESTABLISH_SESSION_REQLEST failed.
3. A TEARDOWN_SESSION_REQUEST message, used to request that an existing session be torn down. This message carries the session ID.
4. A TEARDOWN_SESSION_REPLY message, sent in response to a previous TEARDOWN_SESSION_REQUEST message. This message signifies that a previous session has been successfully torn down.

The present invention can be characterized as a method operating in a system that includes a network having one or more intermediate devices, such as concentration/multiplexing equipment, coupled to end stations by respective links. The first end station is coupled across a link, such as an ADSL link, through a first intermediate device, such as an access provider's central office switch to the network. The method enables the first end station to establish point-to-point sessions according to a communication protocol such as the PPP to more than one other end station. The method comprises establishing a point-to-point session with a second end station according to the communication protocol. The establishment of the point-to-point session is done for example in response to an ESTABLISH SESSION REQUEST message from the first end station to the intermediate device. Next, the first intermediate device transmits information to the first end station identifying the session in a data frame formatted according to the communication protocol, so that the first end station is enabled to include a session identifier in data frames on the link formatted according to the communication protocol. Thus, the intermediate device sends a frame such as PPP frame to the first end station that carries in-band the session identifier for the point-to-point session which has been established with the second end station. At the intermediate device, data frames are detected on the link which are formatted according to the communication protocol of the session and which include the session identifier. Data from the data frames that include the session identifier is forwarded via a connection (logical and/or physical) to the second end station.

The step of transmitting information identifying the session according to one aspect of the invention includes providing a data frame that has a reserved field according to the communication protocol. The data frame sent from the intermediate device to the end station carries an indicator in the reserved field that the data frame includes the session identifier. The reserved field according to PPP implementation comprises for example the protocol field that is specified for PPP protocol identification functions. The vessel field could be something general like "signaling". Other following fields when processed, would indicate the signaling message involved as well as the associated parameters.

Also according to a PPP implementation, the data frames comprise HDLC-like framing fields that include an address field normally carrying a constant value, (hex)FF for frames on the ADSL link. The session identifier comprises a code in the address field on the link to the first end station from the intermediate device.

The method is extendable to more than one session. Thus, invention can be characterized as further including establishing a second point-to-point session with a third end station according to the communication protocol. The first intermediate device transmits information identifying the second session in a data frame formatted according to the communication protocol to the first end station. This enables the first end station to include a session identifier for the second session in data frames on the link. The first intermediate device detects data frames on the link that are formatted according to the communication protocol and include the second session identifier. Data from the data frames which include the second session identifier is forwarded via a connection (logical and/or physical) to the third end station.

The invention can also be characterized from the point-of-view of the end station. According to this aspect of the invention, the method includes signaling on the link the first intermediate device to setup a point-to-point session for carrying data frames formatted according to the communication protocol between the first end station and a second end station. At the first end station, a data frame is received from the first intermediate device including a session identifier for the session. Data frames formatted according to the communication protocol destined to the second end station are sent including the session identifier to enable the first intermediate device to forward the data from the data frame to the second end station in the session. As before, the signaling step involves providing a data frame including an indicator in a reserved field that the data frame includes a request to establish a session. According to one aspect of the invention, the reserved field comprises a protocol field specialized for PPP protocol identification functions. In one example, the protocol field indicates signaling in general, and passing following data fields is required to indicate the request to establish a session, and related parameters.

Furthermore, in another aspect of the invention, the session identifier in the step of sending comprises a code in a framing field of the frame. For example, the session identifier comprises a unique address in an address field normally carrying a constant value for frames on link, when the link comprises an HDLC-like framing link.

Accordingly, the present invention provides a technique for providing in-band session establishment for simple protocol such as PPP over ADSL, using HDLC-like framing.

Other aspects and advantages of the present invention can be seen upon review of the figures, the detailed description, and the claims which follow.

BRIEF DESCRIPTION OF THE FIGURES

FIG. **1** is a simplified diagram of an example network environment in which enhanced point-to-point protocol of the present invention is implemented.

FIG. **2** is a diagram of a packet formatted according to the point-to-point protocol enhanced according to the present invention.

FIG. **3** is a diagram of a frame formatting accorded to the HDLC-like framing over the point-to-point protocol.

FIG. **4** is a more detailed diagram of an example of a point-to-point communication channel including a signaling channel according to the present invention, where the point-to-point communication channel is established between customer premises equipment CPE and remote access server RAS.

FIG. **5** illustrates the process of establishing a session to an Internet Service Provider for a static link environment.

DETAILED DESCRIPTION

A detailed description of examples of the present invention is provided with reference to the figures, in which FIG. **1** illustrates a context in which the present invention is used.

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FIG. **1** illustrates a point-to-point connection between peer end stations, in this example a personal computer **10** and a remote access server **11**. The point-to-point communication session in this example is represented by the arrow **12** established according to the point-to-point protocol PPP. The personal computer **10** includes a modem **13**, which in a preferred embodiment is a high throughput modem such as an asynchronous digital subscriber loop ADSL modem. The modem **13** is connected to a telephone line which can be shared with a standard telephone equipment **14**. Alternatively, there could be a splitter that terminates the telephone line. One port is used for the telephone, the other port is used for the ADSL modem. The modem **13** is connected by a local loop medium such as link **15** to a central office switch **16** in the public switched telephone network PSTN represented by the cloud **17**. The central office switch **16** includes a splitter **18** by which data traffic is split, physically or logically, from voice traffic. The voice traffic is supplied to an interface for voice traffic through the network **17** such as a POTS (plain old telephone service) interface **19**. Data traffic is routed from splitter **18** to an access multiplexer **20** for connection to a data network managed by the telephone access provider. Alternatively, the access multiplexer could terminate the ADSL line. In its line card, it could include the functionality of the splitter. Interfaces out of the access multiplexer could contain several voice streams multiplexed together for delivery to the PSTN network. Similarly, one or more interfaces from the access multiplexer would allow for connectivity to the data network.

Typically the access multiplexer **20** operates at layer **2** of the network protocol stack, or otherwise operates as a network intermediate device. The access multiplexer **20** provides an edge device for a channel **21** through a data backbone network which is coupled to the remote access server **11**. The point-to-point session **12** is established from the personal computer **10** through the splitter **18** and access multiplexer **20**, across the channel **21**, such as an ATM virtual circuit, to the remote access server **11**. The remote access server **11** in this example is coupled to an Internet service provider network **30**, which includes for example a server "farm". The Internet service provider network is in turn coupled to the Internet **31**.

According to the present invention, the access multiplexer **20** also provides an edge device for a channel **41** through a channel **42** through a data backbone network which is coupled to the second remote access server **43**. A second point-to-point session **44** is established from the personal computer **10** through the splitter **18** and access multiplexer **20**, across the channel **42**, such as an ATM virtual circuit, to the second remote access server **43**. The remote access server **43** in this example is coupled to a second Internet service provider network **45**, which includes for example a server "farm". The Internet service provider network is in turn coupled to the Internet **31**.

The personal computer includes an enhanced point-to-point protocol module according to the present invention. Also the access multiplexer **20** includes an enhanced point-to-point protocol processing module to handle the signaling channel according to the present invention. The remote access server **11** includes a point-to-point protocol module (preferably but not necessarily enhanced according to the present invention) and operates as the end point, or peer, for the point-to-point session **12**. According to the present invention, a signaling channel within the point-to-point protocol session is included, represented by the dashed line **22**. The access multiplexer will continuously monitor for point-to-point frames (prior to establishment of the point-to-point session, during establishment of the point-to-point session, and upon establishment of the point-to-point session). For example, for the PPP-ATM-ADSL case, this monitoring could start once the CONNECT message was sent from the access mulitplexer to the CPE. Point-to-point protocol frames carrying a code indicating that they are signaling channel frames are then processed in the enhanced PPP module in the access multiplexer **20**.

The signaling channel is identified by a particular value or values in the protocol field of the standard PPP encapsulation, in a preferred example. Alternatively or in combination, other fields, such as the address field of the HDLC-like framing standard for PPP packets are used to identify signaling channel frames. The signaling channel can be used to achieve a number of functions referred to as edge functions, that are relevant to assisting the access multiplexer **20** in the management of network traffic. According to the present invention, for cases where the point-to-point link is used over static, constant access links such as ADSL, and in which the accompanying protocol stack has no signaling mechanism for out-of-band session establishment, the signaling channel, as an in-band part of the PPP, is used for setup of individual sessions to different ISPs or other peers.

The environment of FIG. **1** is a simplified depiction. In some environments, the remote access servers **11**, **43** are also coupled to the PSTN **17** through a central office switch. Also, the access multiplexing functions executed by the access multiplexer **20** and the data backbone **21** are implemented in some networks between intermediate devices other than central office switches to concentrate traffic over high bandwidth links within the PSTN, which may not be directly coupled to a central office switch. For example, the intermediate device at which the signaling channel is processed may be a router or an ATM switch located in the access provider network. Data from several access multiplexers may be aggregated in the intermediate device which processes the signaling channel.

In a PPP session, packets are formatted according to specifications defining the fields shown in FIG. **2**. The Protocol field **100** is one or two octets, and its value identifies the datagram encapsulated in the Information field **101** of the packet. For example, if the Protocol field has a value indicating IP, the Information field will contain an IP packet. The Protocol can have other defined values. For example, there is a value indicating a Link Control Protocol (LCP) frame. Such a packet is used by the end points of the PPP session, to agree upon encapsulation format options, handle varying limits on sizes of packets, etc.

The Information field **101** is zero or more octets. The Information field **101** contains the datagram for the protocol specified in the Protocol field **100**. The maximum length for the Information field **101**, including Padding **102**, but not including the Protocol field **100**, is termed the Maximum Receive Unit (MRU), which defaults to 1500 octets. By negotiation, consenting PPP implementations may use other values for the MRU.

When sending the PPP packet as shown in FIG. **2** over an ADSL link, which is a bit-synchronous link, the PPP packet is encapsulated within an HDLC frame as shown in FIG. **3**. The Protocol, Information, and Padding fields shown in FIG. **3** are the PPP fields that were described in FIG. **2**.

FIG. **3** shows the encapsulation of PPP within HDLC framing. An HDLC frame is started by a flag sequence **103** of '**01111110**' binary. It is followed by an Address field **104**;

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the only defined value according to the standard that the Address field can have is '11111111' binary. Following the Address field **104** is a Control field **105** with a value of '00000011' binary. Following the Control **105** field are the PPP Protocol field **100**, the PPP Information field **101**, and the PPP Padding **102**. This is followed by a Frame Check Sequence **106** for the HDLC frame which can be 16 bits or 32 bits. Finally, the HDLC frame is terminated by a closing Flag sequence **107** of '01111110' binary.

Frames belonging to the signaling channel will be identified via a special value, presently not assigned for other uses, of the Protocol field within the PPP encapsulation shown in FIG. **2**. For example, a Protocol Field of 16 bits with a value of '1001000000000001' binary could be used to identify a PPP frame associated with the signaling channel.

According to the present invention, the access multiplexer **20** includes resources for identifying PPP frames such as those illustrated in FIGS. **2–3** which carry a signaling protocol value in the protocol field. Such resources include, hardware comparators which compare data at a specific offset within each frame to one or more hard coded values, software resources which perform the comparison function, and combinations of hardware and software. Hardware comparators are preferred in systems requiring fast decisions, or in systems having low processing resources. Software comparison techniques provide greater flexibility and other advantages. In addition to resources for recognizing frames which are part of the signaling channel, the access multiplexer **20** includes an enhanced PPP module that performs the functions specified by this signaling channel frames.

FIG. **4** is representative of one example implementation of an access multiplexer and a remote access server according to the present invention. In FIG. **4**, an ADSL modem is coupled to customer premises equipment CPE as an end point of a point-to-point session **101**. The point-to-point session **101** is established through an access multiplexer **102**. The access multiplexer **102** includes a port **103** for communication with the modem **100**. Also, a plurality of other ports may be included in the access multiplexer **102** such as ports **104** and **105**. The ports **103–105** are coupled to a bus **106**. A central processing unit **107** is coupled to the bus **106**. The central processing unit **107** includes tunnel management resources for layer **2** tunneling and a point-to-point protocol signal channel processor. Also coupled to the bus **106** is a port **108** for connection across a backbone communication channel, such as a layer **2** tunnel protocol L2TP tunnel **109**. The CPU **107** monitors frames received on port **103** and performs edge functions for transferring the frames through the tunnel **109** to the destination, such as a remote access server **110**. The remote access server includes a tunnel port **111**, which is coupled to a backbone bus **112**. The backbone bus is coupled to a central processing unit **113** in the remote access server which includes a point-to-point protocol module. Also, the remote access server **110** includes a port **114** for connection to a local network, such as an Internet service provider network.

The ports **103–105** include filters for recognizing signaling channel frames and signaling the CPU **107** that PPP signaling processing is required. Alternatively, frames received on ports **103–105** are monitored by software executed by the CPU **107** for edge processing and for PPP signal channel processing.

The protocol stack PPP-ADSL stack contains no means for setting up individual sessions to different ISPs, and identifying via different encapsulation the data that is destined for a particular ISP. With the definition of the signaling channel, the access equipment is allowed to interact with CPE to determine the ISP that a user wishes to use for a particular session, and to allocate a unique value for the HDLC address field or other framing field that could be used by the CPE to encapsulate data for this session. Note that different PPP sessions to different ISPs each have their own associated signaling channel to realize advantages described earlier. The unique HDLC address is used by the access provider's concentration/multiplexing equipment for fast forwarding to the ISP that the data is destined for.

Suppose the Customer Premises Equipment (CPE) wishes to establish a session to Internet Service Provider **1** (ISP **1**). First, the CPE could go through the normal LCP negotiation with the Access Multiplexer. This LCP negotiation is used to automatically agree upon the encapsulation format options, handle varying limits on sizes of packets, detect a looped-back link and other common misconfiguration errors, and terminate the link. It would then follow the sequence of steps shown in the stick diagram in FIG. **5**. In FIG. **5**, the stick diagram shows the high level view of the exchanges occurring between the CPE **300** and the Access Multiplexer **301**. The Encapsulation part to the right of the stick diagram provides an example encoding of the HDLC frames exchanged between the CPE **300** and the Access Multiplexer **301** and the PPP frames exchanged between the Access Multiplexer **301** and the Remote Access Server (RAS) of some ISP.

First, the CPE **300** sends an Establish_Session_Request **302** to the Access Multiplexer **301**, requesting that a session be established to ISP **1**. Included in this request is a Tag parameter (e.g. in Information field **310**) so that the CPE can match a response from the access multiplexer to this request via the Tag. Also included is the Name and/or Address of the ISP, and other pertinent information relevant to the session to the particular ISP—for example, the Quality of Service (QOS) required for the session, and the bandwidth requirements for the session. The encapsulation **312** for the Establish_Session_Request comprises an HDLC Frame with an Address of '11111111' and has the Protocol field set to the value used for the Signaling Channel.

On receipt of the Establish_Session_Request **302**, the Access Multiplexer **301** on seeing that a frame with an Address of '11111111' with a Protocol field indicating the Signaling Channel has been received, knows that it needs to process the frame. It processes the frame and determines that the CPE is trying to establish a new session to ISP **1**. It checks to see if it can provide the session to ISP **1** at the required traffic parameter specifications and the requires QOS. If necessary, it may need to establish a new connection to ISP **1**. If everything goes fine, it returns an Establish_Session_Reply **303** to the CPE indicating that the request can be met, encapsulated as shown at **313**. It informs the CPE that future PPP data associated with this session to ISP **1** should be encapsulated within HDLC frames with an Address field of '00000001' binary. (If the session could not be established for some reason, the Access Multiplexer would return a negative response to the Establish Session Request.)

Future PPP data **304** for ISP **1** will be encapsulated within HDLC frames **314** with an Address field of '00000001' binary. When the Access Multiplexer **301** receives frames with such an address field, it immediately extracts PPP packet **315** and forwards it onwards on a connection to ISP **1**.

If the CPE now wants to establish a second session, this time to ISP **2**, it will go through the session establishment

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procedure again, this time using ISP **2**'s Name and Address in the Establish_Session_Request **302**. If this new session can be established, the Access Multiplexer **301** will return **303** a unique value to be used for the Address field of HDLC frames that contain PPP data destined for ISP **2**. For example, it could return a value of '00000010' binary. Now, whenever the Access Multiplexer **301** receives HDLC frames **304** with an Address field of '00000001' binary, it will extract the data and relay it to ISP **1**. When it receives HDLC frames with an Address field of '00000010' binary, it will extract the data and relay it to ISP **2**.

In the opposite direction, PPP data from ISP **1** received by the Access Multiplexer over a connection (physical and/or logical) associated with the first PPP session with CPE **300** will be encapsulated into HDLC frames with an Address field of '00000001' before being relayed to the CPE. Similarly, PPP data from ISP **2** received by the Access Multiplexer over a connection (physical and/or logical) associated with teh second PPP session with CPE **300** will be encapsulated into HDLC frames with an Address field of '00000010' before being relayed to the CPE.

Accordingly, the present invention provides an extension to the point-to-point protocol that allows for interactions between end points of the point-to-point session and intermediate network devices involved in the transfer of data between the end points. The channel is used to relieve congestion in the intermediate devices that arise due to edge function like protocol processing, multicast distribution, limited user visibility behind a NAT and the inability to dynamically select an Internet service provider or other end point for ADSL or related links.

The foregoing description of a preferred embodiment of the invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Obviously, many modifications and variations will be apparent to practitioners skilled in this art. It is intended that the scope of the invention be defined by the following claims and their equivalents.

What is claimed is:

1. In a system including a network having one or more intermediate devices coupled to end stations by respective links, including a first end station coupled across a link through a first intermediate device to the network, a method for enabling the first end station to establish point-to-point sessions according to a communication protocol to more than one other end station, comprising:

establishing a point-to-point session with a second end station according to the communication protocol;

transmitting from the first intermediate device to the first end station, information identifying the session in a data frame formatted according to the communication protocol, the data frame including a reserved field, so that the first end station is enabled to include a session identifier in the reserved field of respective data frames on the link formatted according to the communication protocol;

detecting in the first intermediate device data frames on the link formatted according to the communication protocol, and including the session identifier; and

forwarding data from said data frames including the session identifier in the session to the second end station.

2. The method of claim **1**, wherein the communication protocol comprises a Point-to-Point Protocol PPP.

3. The method of claim **2**, wherein the reserved field comprises a protocol field specified for PPP protocol identification functions.

4. The method of claim **2**, wherein the reserved field comprises a protocol field specified for PPP protocol identification functions, carrying a signaling channel code and a following field carrying the session identifier.

5. The method of claim **1**, wherein data frames formatted according to the communication protocol include a framing field, and the framing field comprises the reserved field, and the session identifier comprises a code in the framing field.

6. The method of claim **4**, wherein the data frames comprise HDLC-like framing fields including an address field normally carrying a constant value for frames on the link, and the address field comprises the reserved field, and wherein the session identifier comprises a code in the address field.

7. The method of claim **1**, wherein the communication protocol comprises a Point-to-Point Protocol PPP, and the data frames comprise HDLC-like framing fields including an address field normally carrying a constant value for all frames on the static link, and the address field comprises the reserved field, and said transmitting includes sending a data frame from the intermediate device to the end station including an indicator in a protocol field specified for PPP protocol identification functions that the frame carries a session identifier, and wherein in said detecting step the session identifier comprises a code in the address field.

8. The method of claim **1**, further including:

establishing a second point-to-point session with a third end station according to the communication protocol;

transmitting from the first intermediate device to the first end station information identifying the second session in a data frame formatted according to the communication protocol, so that the first end station is enabled to include a second session identifier in data frames on the link formatted according to the communication protocol;

detecting in the first intermediate device data frames on the link formatted according to the communication protocol, and including the second session identifier; and

forwarding data from said data frames including the second session identifier in the session to the third end station.

9. The method of claim **1**, wherein the establishing includes detecting a signal from the first end station, and in response initiating set up processes for establishing the session.

10. The method of claim **9**, wherein the signal from the first end station comprises a code in a reserved field of a data frame formatted according to the communication protocol.

11. The method of claim **10**, wherein the communication protocol comprises a Point-to-Point PPP, and the reserved field comprises a protocol field specified for PPP protocol identification functions, carrying a signaling channel code and a following field carrying the session identifier.

12. In a system including a network having one or more intermediate devices coupled to end stations by respective links, including a first end station coupled across an asynchronous digital subscriber loop ADSL link through a first intermediate device to the network, a method for enabling the first end station to establish point-to-point sessions according to a Point-to-Point Protocol PPP to more than one other end station, comprising:

establishing a PPP session with a second end station according to the PPP;

transmitting from the first intermediate device to the first end station, information in a data frame comprising

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HDLC-like framing fields with an address field normally carrying a constant value for frames on the ADSL link, the data frame including a signaling indicator in a protocol field specified for PPP protocol identification functions and additional data indicating that the data frame carries a session identifier identifying the session, so that the first end station is enabled to include a session identifier in the address field of data frames on the ADSL link formatted according to the PPP;

detecting in the first intermediate device data frames on the ADSL link formatted according to the PPP, comprising a code in the address field corresponding to the session identifier; and

forwarding data from said data frames including the session identifier in the session to the second end station.

13. The method of claim **12**, including:

establishing a second PPP session with a third end station according to the PPP;

transmitting from the first intermediate device to the first end station, information in a data frame comprising HDLC-like framing fields with an address field normally carrying a constant value for frames on the ADSL link, the data frame including a signaling indicator in a protocol field specified for PPP protocol identification functions and additional data indicating that the data frame carries a second session identifier identifying the second PPP session, so that the first end station is enabled to include the second session identifier in the address field of data frames on the ADSL link formatted according to the PPP;

detecting in the first intermediate device data frames on the ADSL link formatted according to the PPP, comprising a code in the address field corresponding to the second session identifier; and

forwarding data from said data frames including the second session identifier in the session to the third end station.

14. In a system including a network having one or more intermediate devices coupled to end stations by respective links, including a first end station coupled across a link through a first intermediate device to the network, a method for enabling the first end station to establish point-to-point session according to a communication protocol to more than one other end station, comprising:

signaling on the link the first intermediate device to set up a point-to-point session for carrying data frames formatted according to the communication protocol between the first end station and a second end station, the data frames including a reserved field, and including an indicator in the reserved field that a data frame includes a request to establish a session;

receiving a data frame from the first intermediate device including a session identifier for the session; and

sending data frames formatted according to the communication protocol including the session identifier to enable the first intermediate device to forward data from the data frame to the second end station in the session.

15. The method of claim **14**, wherein the communication protocol comprises a Point-to-Point Protocol PPP.

16. The method of claim **14**, wherein the data frames include a reserved field, and said signaling includes sending a data frame to the intermediate device from the first end station including an indicator in the reserved field that the data frame includes a request to establish the session.

17. The method of claim **14**, wherein the reserved field comprises a protocol field specified for PPP protocol identification functions.

18. The method of claim **14**, wherein the reserved field comprises a protocol field specified for PPP protocol identification functions, carrying a signaling channel code and a following field carrying the session identifier.

19. The method of claim **14**, wherein data frames formatted according to the communication protocol include a framing field, and in the sending step, the session identifier comprises a code in the framing field.

20. The method of claim **19**, wherein the data frames comprise HDLC-like framing fields including an address field normally carrying a constant value for frames on the link, and wherein the session identifier comprises a code in the address field.

21. The method of claim **14**, wherein the communication protocol comprises a Point-to-Point Protocol PPP, and the data frames comprise HDLC-like framing fields including an address field normally carrying a constant value for frames on the link, and said signaling includes sending a data frame to the intermediate device from the first end station including a signaling indicator in a protocol field specified for PPP protocol identification functions and the reserved field indicating that the data frame includes a request to establish the session.

22. The method of claim **14**, further including:

signaling on the link the first intermediate device to set up a second point-to-point session for carrying data frames formatted according to the communication protocol between the first end station and a third end station;

receiving a data frame from the first intermediate device including a second session identifier for the second session; and

sending data frames formatted according to the communication protocol including the second session identifier to enable the first intermediate device to forward the data frame to the third end station in the second session.

23. In a system including a network having one or more intermediate devices coupled to end stations by respective links, including a first end station coupled across an asynchronous digital subscriber loop ADSL link through a first intermediate device to the network, a method for enabling the first end station to establish point-to-point sessions according to a Point-to-Point Protocol PPP to more than one other end station, comprising:

signaling on the ADSL link the first intermediate device to set up a point-to-point session for carrying data frames formatted according to the PPP between the first end station and a second end station, the data frames comprising HDLC-like framing fields including an address field normally carrying a constant value for frames on the ADSL link, and said signaling includes sending a data frame to the intermediate device from the first end station including a signaling indicator in a protocol field specified for PPP protocol identification functions and additional data indicating that the data frame includes a request to establish a session;

receiving a data frame from the first intermediate device including a signaling indicator in a protocol field specified for PPP protocol identification functions and additional data indicating that the data frame includes a session identifier and including the session identifier; and

sending data frames formatted according to the PPP including the session identifier in the address field of

the HDLC-like framing fields, to enable the first intermediate device to forward data from the data frame to the second end station in the session.

24. The method of claim **23**, including:

signaling on the ADSL link the first intermediate device to set up a second point-to-point session for carrying data frames formatted according to the PPP between the first end station and a third end station, the data frames comprising HDLC-like framing fields including an address field normally carrying a constant value for frames on the ADSL link, said signaling including sending a data frame to the intermediate device from the first end station including a signaling indicator in a protocol field specified for PPP protocol identification functions and additional data indicating that the data frame includes a request to establish a session;

receiving a data frame from the first intermediate device including a signaling indicator in a protocol field specified for PPP protocol identification functions and additional data indicating that the data frame includes a session identifier and including the second session identifier; and

sending data frames formatted according to the PPP including the second session identifier in the address field of the HDLC-like framing fields, to enable the first intermediate device to forward data from the data frame to the third end station in the second session.

* * * * *

EXHIBIT 1014
U.S. Patent 5,774,660 to Brendel *et al.* ("Brendel")

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US005774660A

United States Patent [19]

Brendel et al.

[11] **Patent Number: 5,774,660**

[45] **Date of Patent: Jun. 30, 1998**

[54] **WORLD-WIDE-WEB SERVER WITH DELAYED RESOURCE-BINDING FOR RESOURCE-BASED LOAD BALANCING ON A DISTRIBUTED RESOURCE MULTI-NODE NETWORK**

[75] Inventors: **Juergen Brendel**, Redwood City; **Charles J. Kring**, Sunnyvale; **Zaide Liu**, Santa Clara; **Christopher C. Marino**, Mountain View, all of Calif.

[73] Assignee: **Resonate, Inc.**, Mountain View, Calif.

[21] Appl. No.: **691,006**

[22] Filed: **Aug. 5, 1996**

[51] **Int. Cl.**[6] **G06F 13/00**; G06F 17/30

[52] **U.S. Cl.** **395/200.31**; 395/200.32; 395/200.33; 395/200.36; 395/200.49; 395/200.56; 395/200.59; 395/200.66; 395/200.69; 395/670; 395/674; 395/675

[58] **Field of Search** 395/200.3–200.33, 395/200.36, 200.47–200.5, 200.54–200.6, 200.66, 200.69, 182.02, 182.08, 670–675

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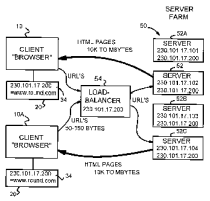
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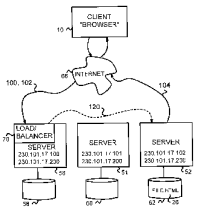
Primary Examiner—Parshotam S. Lall
Assistant Examiner—Bharat Barot
Attorney, Agent, or Firm—Stuart T. Auvinen

[57] **ABSTRACT**

A multi-node server transmits world-wide-web pages to network-based browser clients. A load balancer receives all requests from clients because they use a virtual address for the entire site. The load balancer makes a connection with the client and waits for the URL from the client. The URL specifies the requested resource. The load balancer waits to perform load balancing until after the location of the requested resource is known. The connection and URL request are passed from the load balancer to a second node having the requested resource. The load balancer re-plays the initial connection packet sequence to the second node, but modifies the address to that for the second node. The network software is modified to generate the physical network address of the second node, but then changes the destination address back to the virtual address. The second node transmits the requested resource directly to the client, with the virtual address as its source. Since all requests are first received by the load balancer which determines the physical location of the requested resource, nodes may contain different resources. The entire contents of the web site is not mirrored onto all nodes. Network bottlenecks are avoided since the nodes transmit the large files back to the client directly, bypassing the load balancer. Client browsers can cache the virtual address, even though different nodes with different physical addresses service requests.

16 Claims, 18 Drawing Sheets





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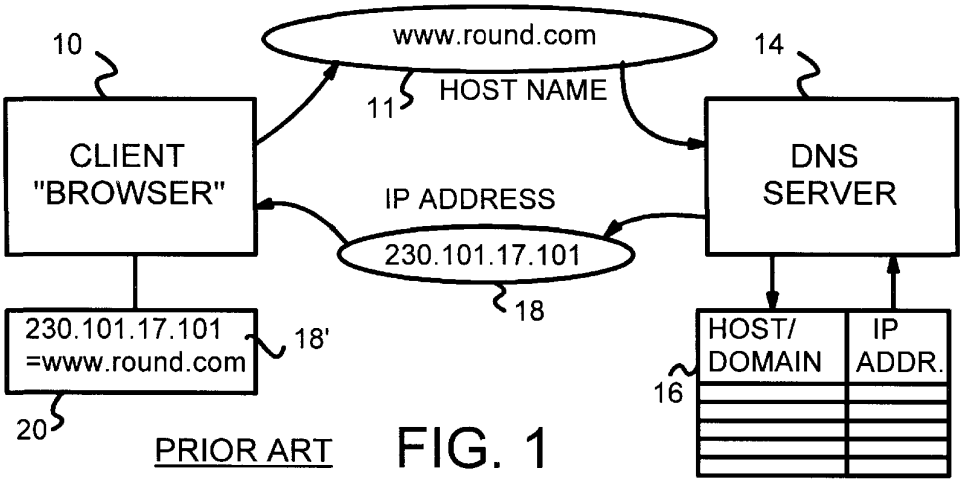
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PRIOR ART FIG. 1

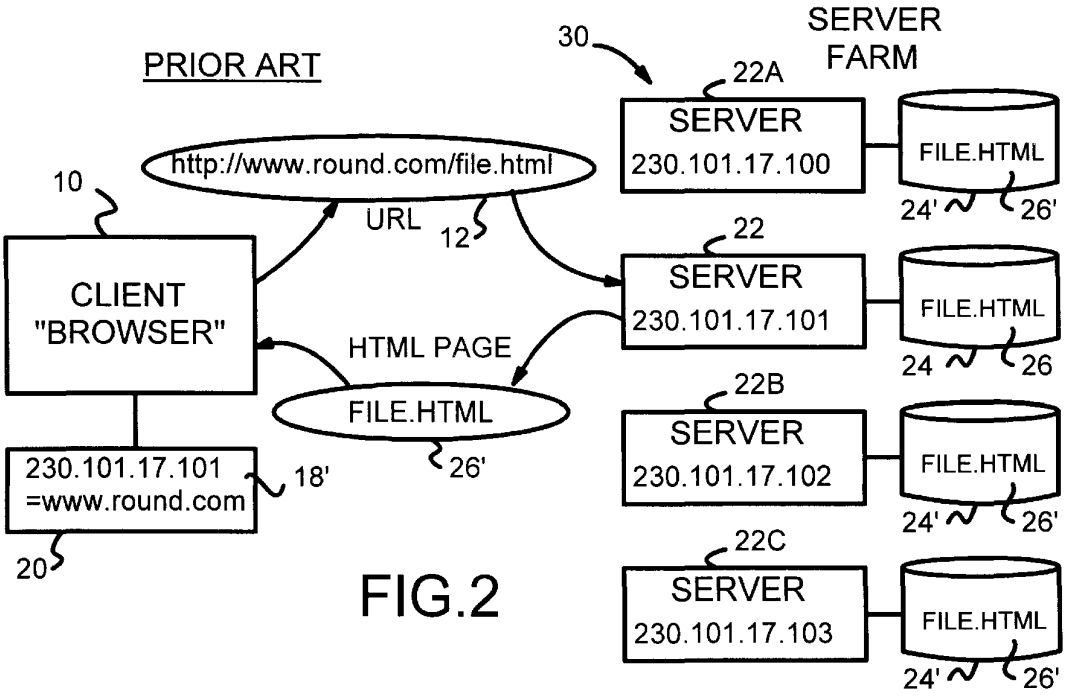


FIG.2

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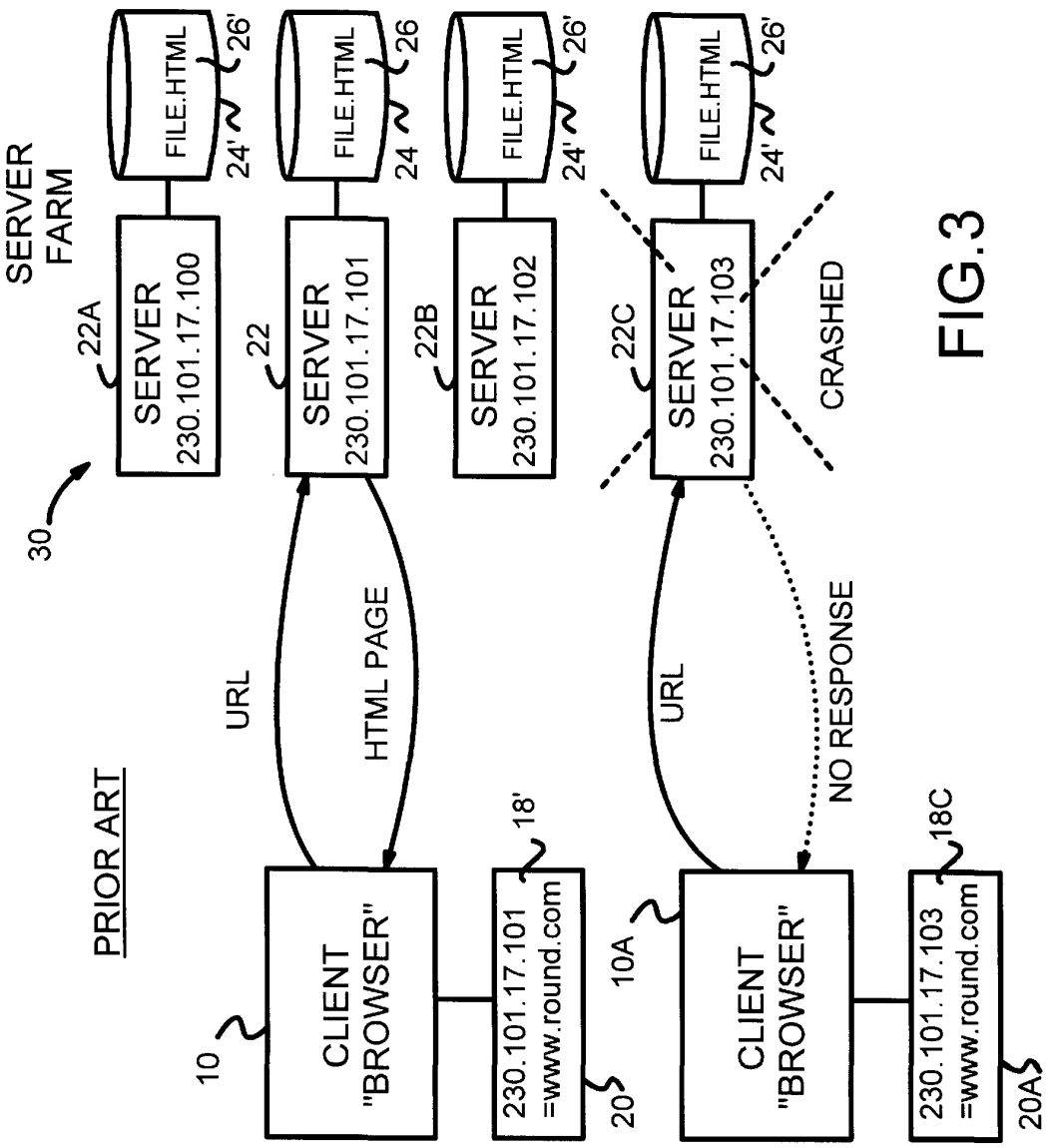


FIG.3

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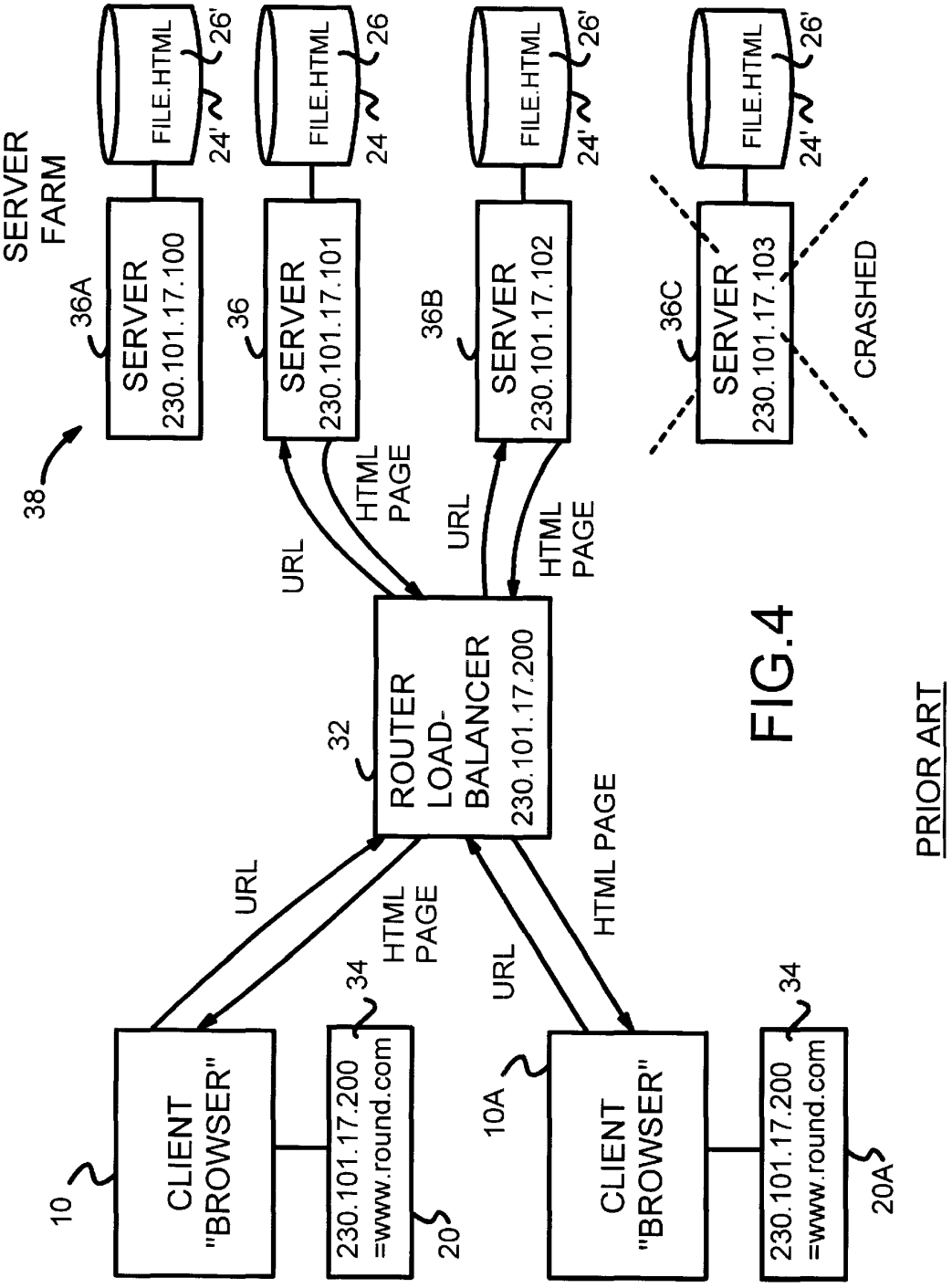


FIG.4

PRIOR ART

325

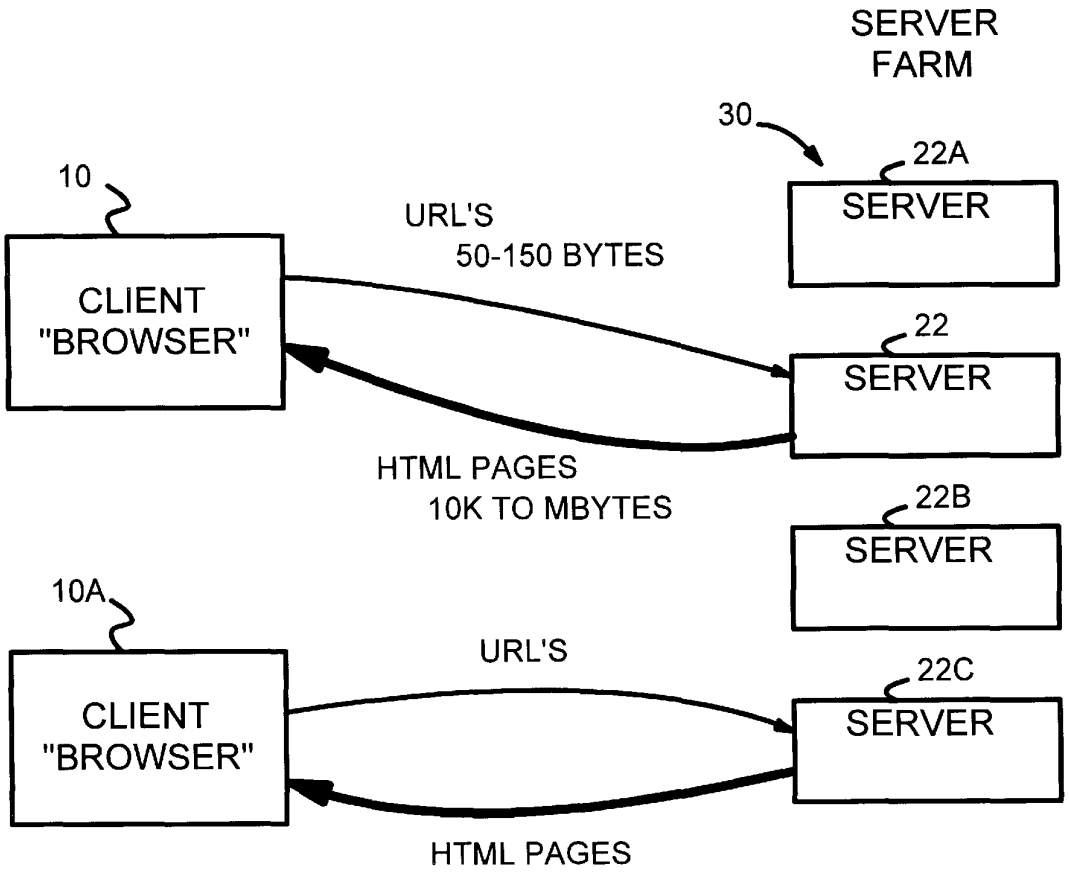

SERVER
FARM
30
22A
SERVER
10
URL'S
50-150 BYTES
CLIENT
"BROWSER"
22
SERVER
HTML PAGES
10K TO MBYTES
22B
SERVER
10A
URL'S
22C
CLIENT
"BROWSER"
SERVER
HTML PAGES

FIG.5

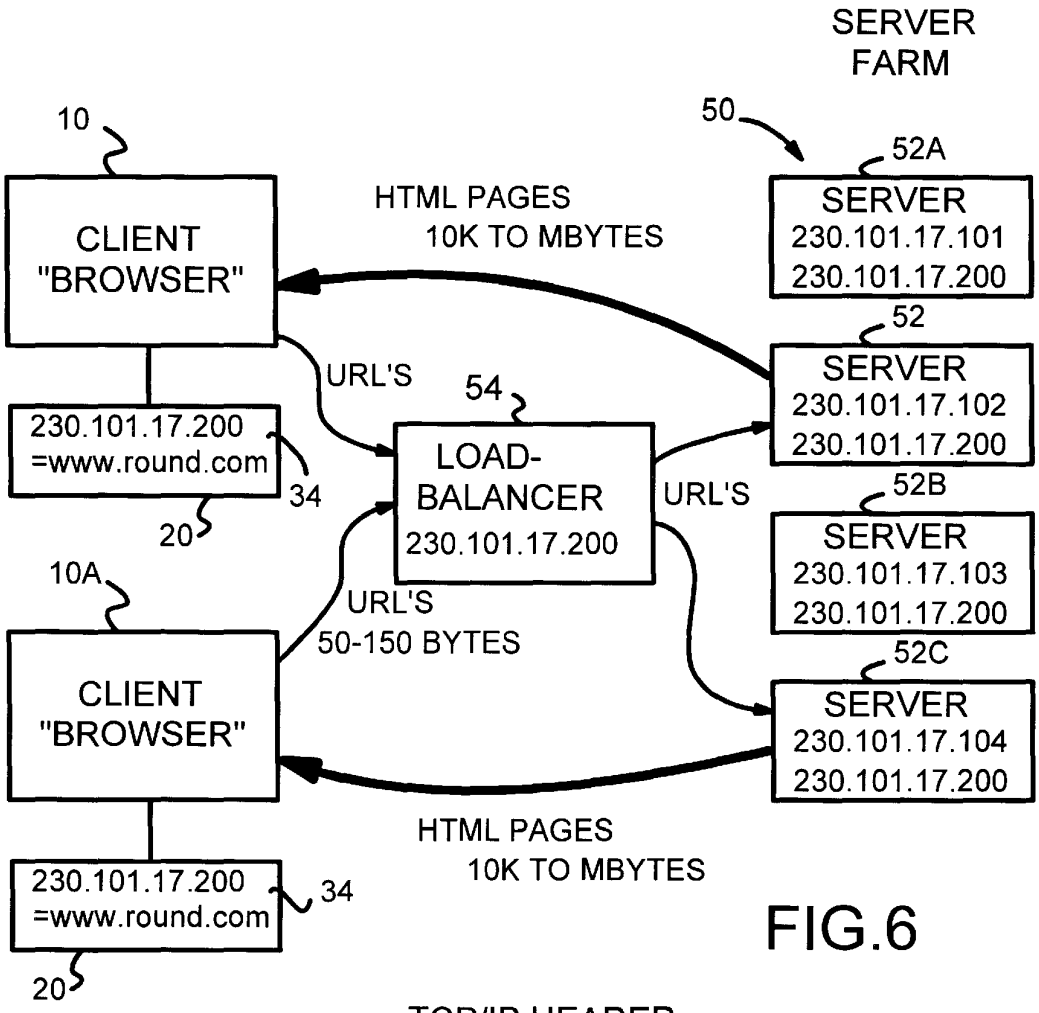

SERVER FARM
50
10
52A
CLIENT "BROWSER"
HTML PAGES 10K TO MBYTES
SERVER 230.101.17.101 230.101.17.200
52
URL'S
54
SERVER 230.101.17.102 230.101.17.200
230.101.17.200 =www.round.com
34
LOAD-BALANCER 230.101.17.200
URL'S
52B
20
SERVER 230.101.17.103 230.101.17.200
10A
URL'S 50-150 BYTES
52C
CLIENT "BROWSER"
SERVER 230.101.17.104 230.101.17.200
HTML PAGES 10K TO MBYTES
230.101.17.200 =www.round.com
34
20

FIG.6

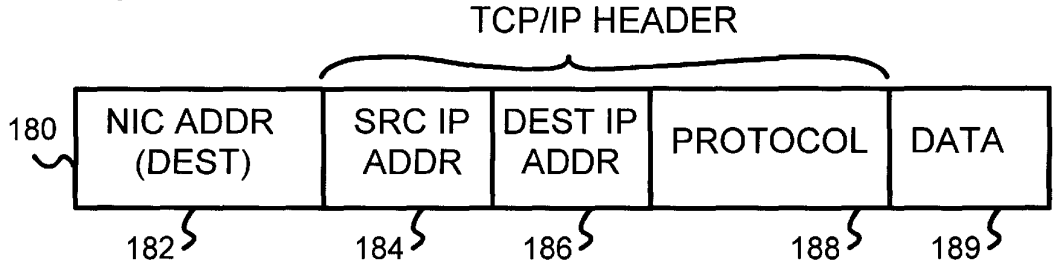

TCP/IP HEADER
180
NIC ADDR (DEST)
SRC IP ADDR
DEST IP ADDR
PROTOCOL
DATA
182
184
186
188
189

FIG.7

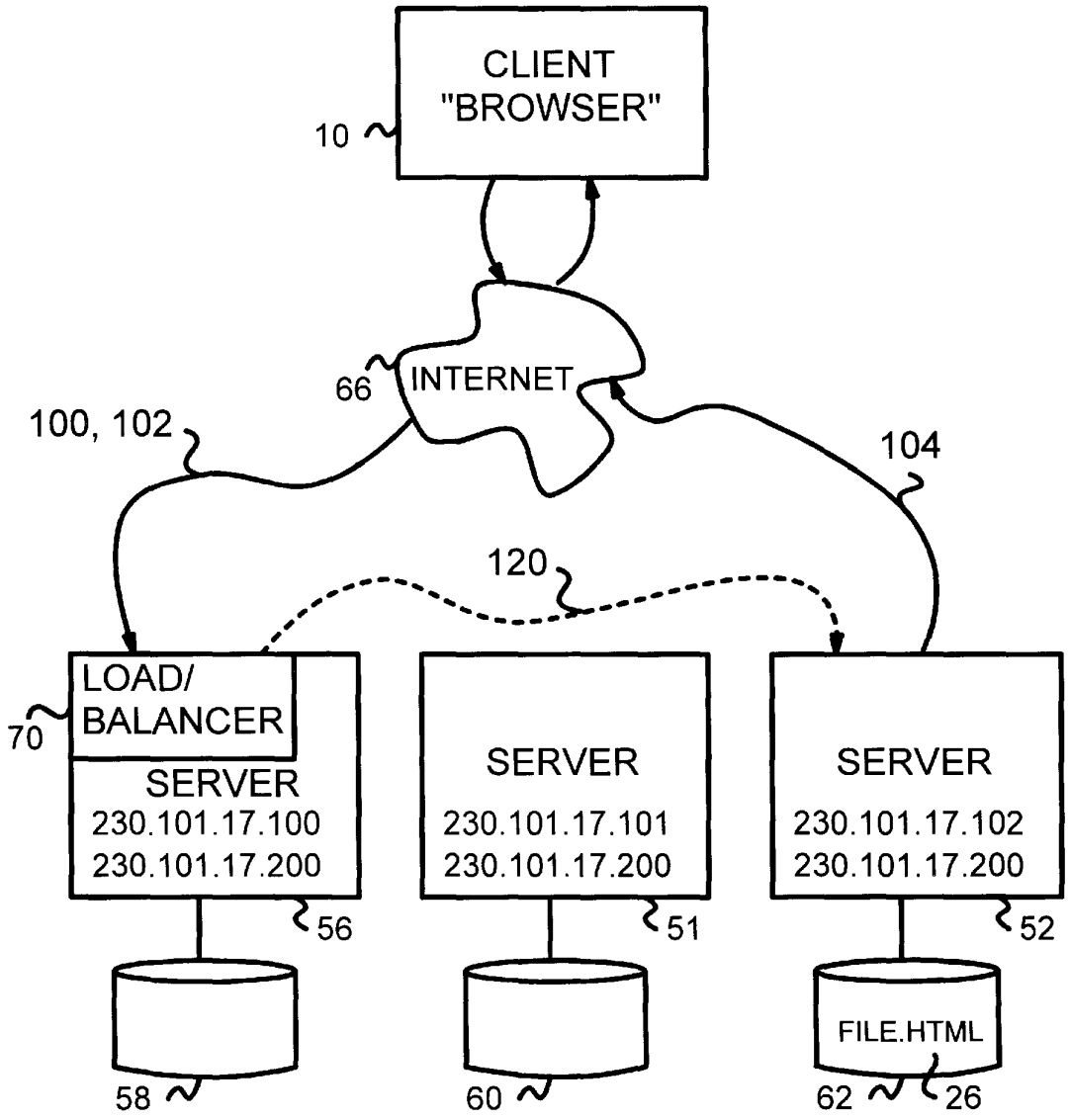

CLIENT
"BROWSER"
10
66
INTERNET
100, 102
104
120
LOAD/
BALANCER
70
SERVER
230.101.17.100
230.101.17.200
56
SERVER
230.101.17.101
230.101.17.200
51
SERVER
230.101.17.102
230.101.17.200
52
58
60
FILE.HTML
62
26

FIG.8

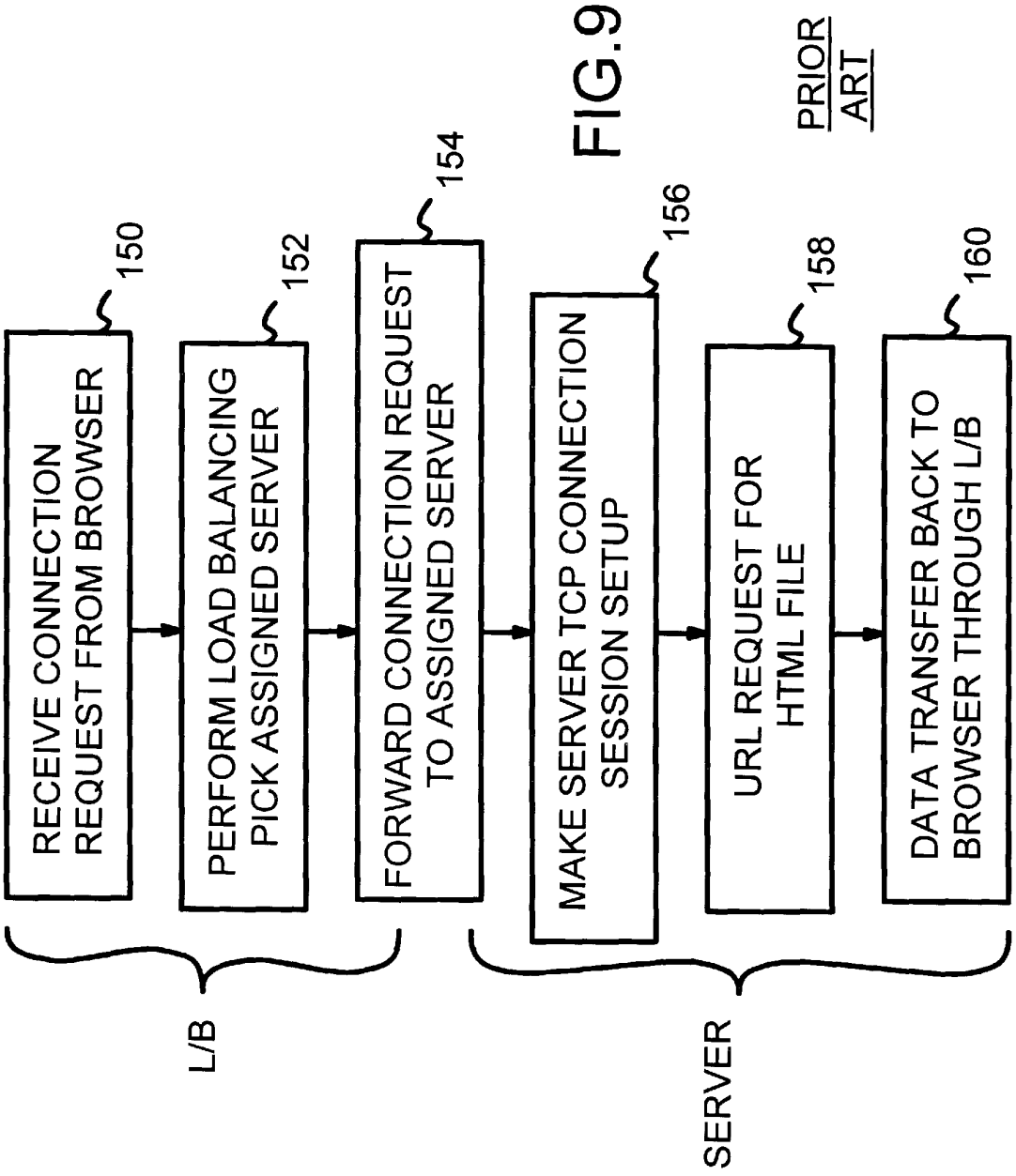


FIG.9

PRIOR ART

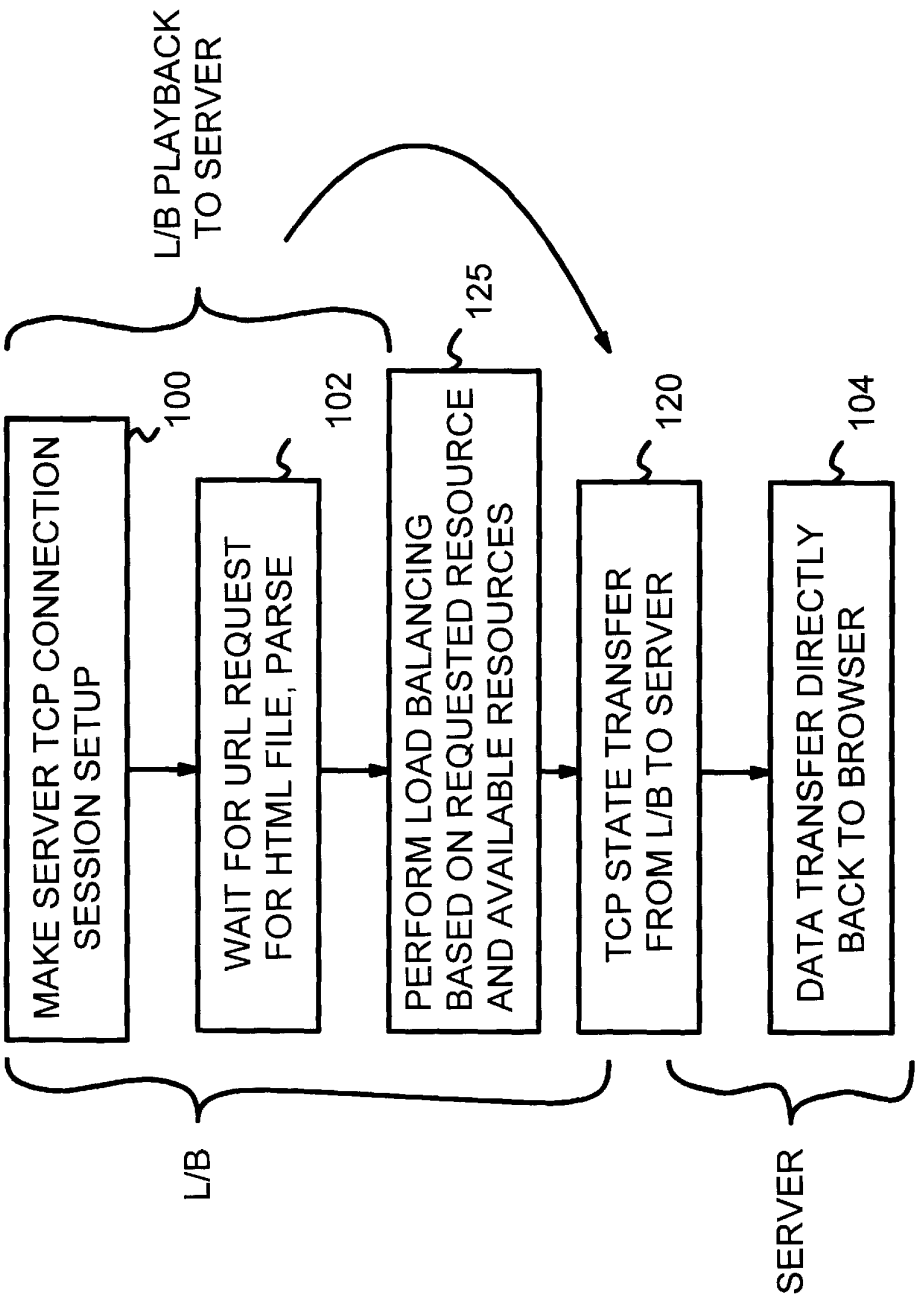

L/B PLAYBACK TO SERVER
MAKE SERVER TCP CONNECTION SESSION SETUP
100
WAIT FOR URL REQUEST FOR HTML FILE, PARSE
102
PERFORM LOAD BALANCING BASED ON REQUESTED RESOURCE AND AVAILABLE RESOURCES
125
TCP STATE TRANSFER FROM L/B TO SERVER
120
DATA TRANSFER DIRECTLY BACK TO BROWSER
104
L/B
SERVER

FIG.10

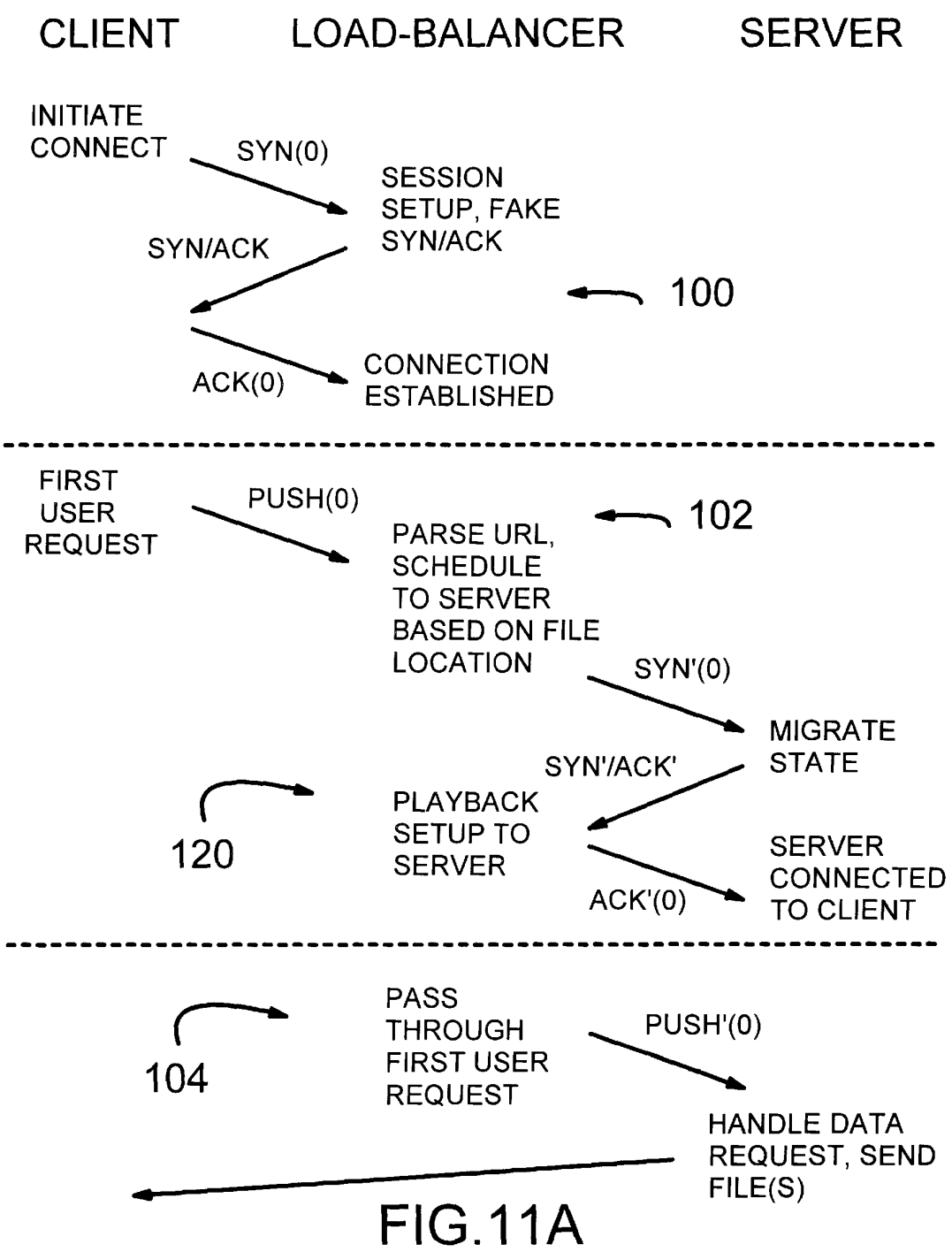

CLIENT
LOAD-BALANCER
SERVER
INITIATE CONNECT
SYN(0)
SESSION SETUP, FAKE SYN/ACK
SYN/ACK
100
ACK(0)
CONNECTION ESTABLISHED
FIRST USER REQUEST
PUSH(0)
102
PARSE URL, SCHEDULE TO SERVER BASED ON FILE LOCATION
SYN'(0)
MIGRATE STATE
SYN'/ACK'
120
PLAYBACK SETUP TO SERVER
SERVER CONNECTED TO CLIENT
ACK'(0)
104
PASS THROUGH FIRST USER REQUEST
PUSH'(0)
HANDLE DATA REQUEST, SEND FILE(S)

FIG.11A

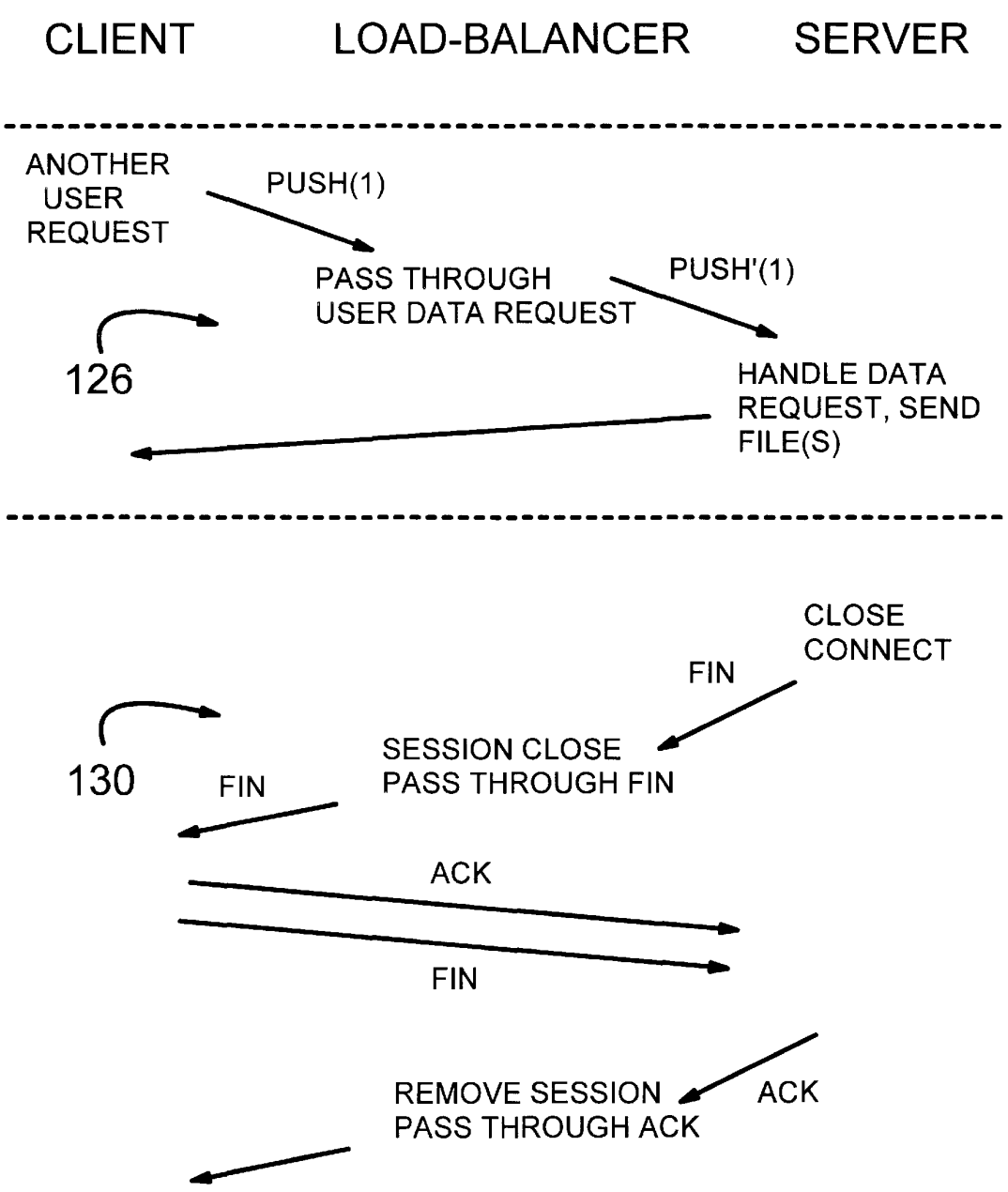

CLIENT
LOAD-BALANCER
SERVER
ANOTHER USER REQUEST
PUSH(1)
PASS THROUGH USER DATA REQUEST
PUSH'(1)
126
HANDLE DATA REQUEST, SEND FILE(S)
CLOSE CONNECT
FIN
SESSION CLOSE PASS THROUGH FIN
130
FIN
ACK
FIN
REMOVE SESSION PASS THROUGH ACK
ACK

FIG.11B

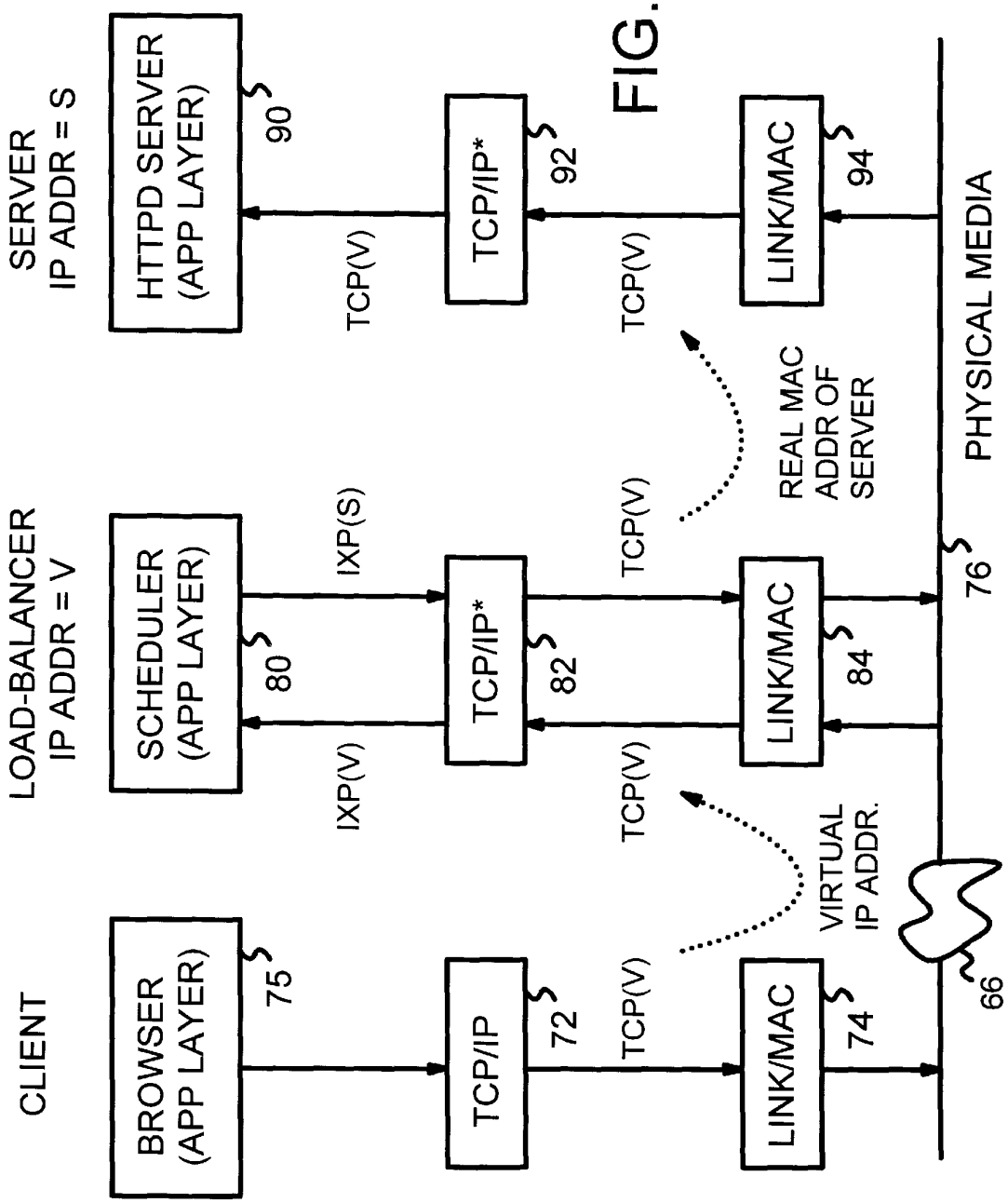

CLIENT
BROWSER (APP LAYER)
75
TCP/IP
72
LINK/MAC
74
LOAD-BALANCER IP ADDR = V
SCHEDULER (APP LAYER)
80
TCP/IP*
82
LINK/MAC
84
SERVER IP ADDR = S
HTTPD SERVER (APP LAYER)
90
TCP/IP*
92
LINK/MAC
94
PHYSICAL MEDIA
76
66
IXP(V)
IXP(S)
TCP(V)
TCP(V)
TCP(V)
TCP(V)
TCP(V)
TCP(V)
VIRTUAL IP ADDR.
REAL MAC ADDR OF SERVER

FIG.12

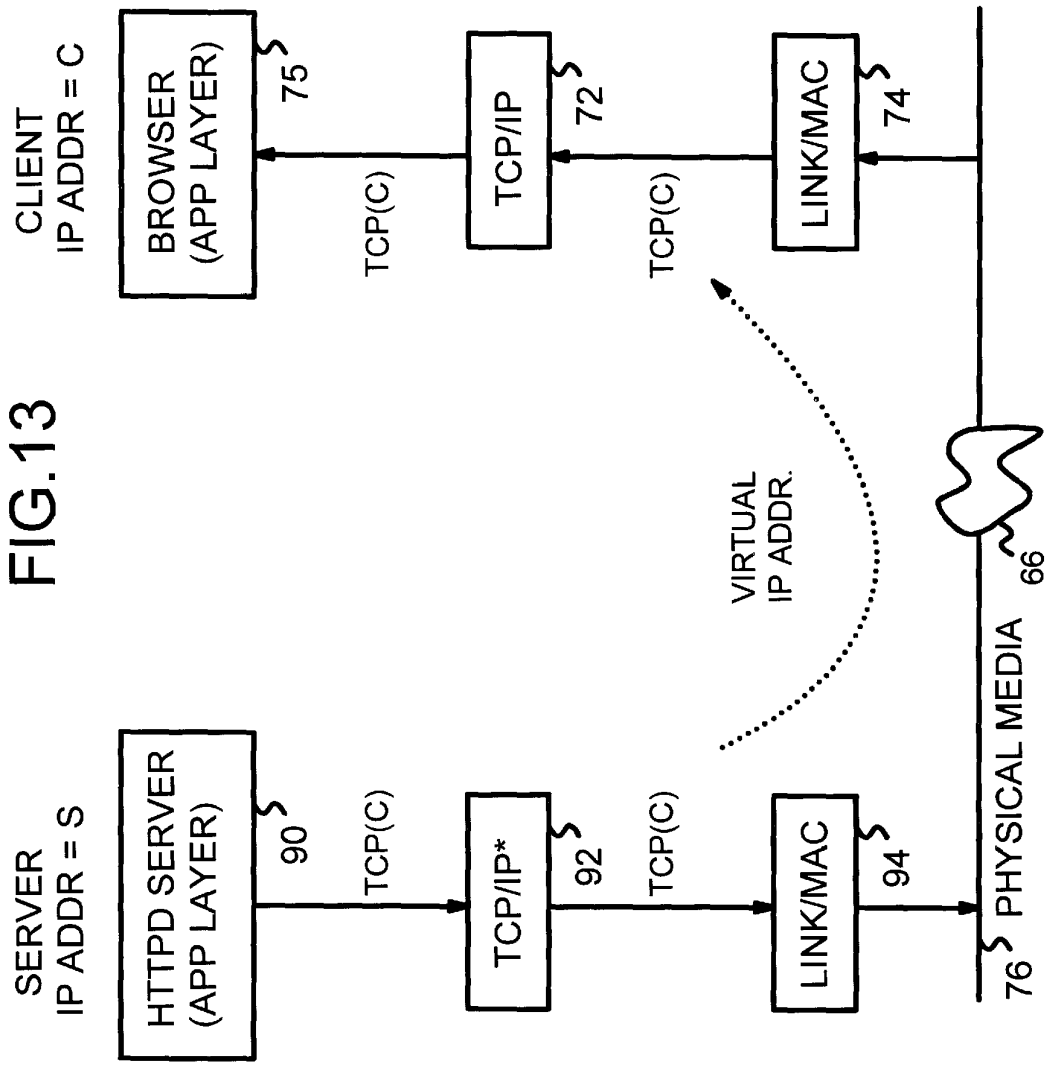

CLIENT
IP ADDR = C
BROWSER
(APP LAYER)
75
TCP(C)
TCP/IP
72
TCP(C)
LINK/MAC
74
VIRTUAL
IP ADDR.
66
PHYSICAL MEDIA
76
SERVER
IP ADDR = S
HTTPD SERVER
(APP LAYER)
90
TCP(C)
TCP/IP*
92
TCP(C)
LINK/MAC
94

FIG.13

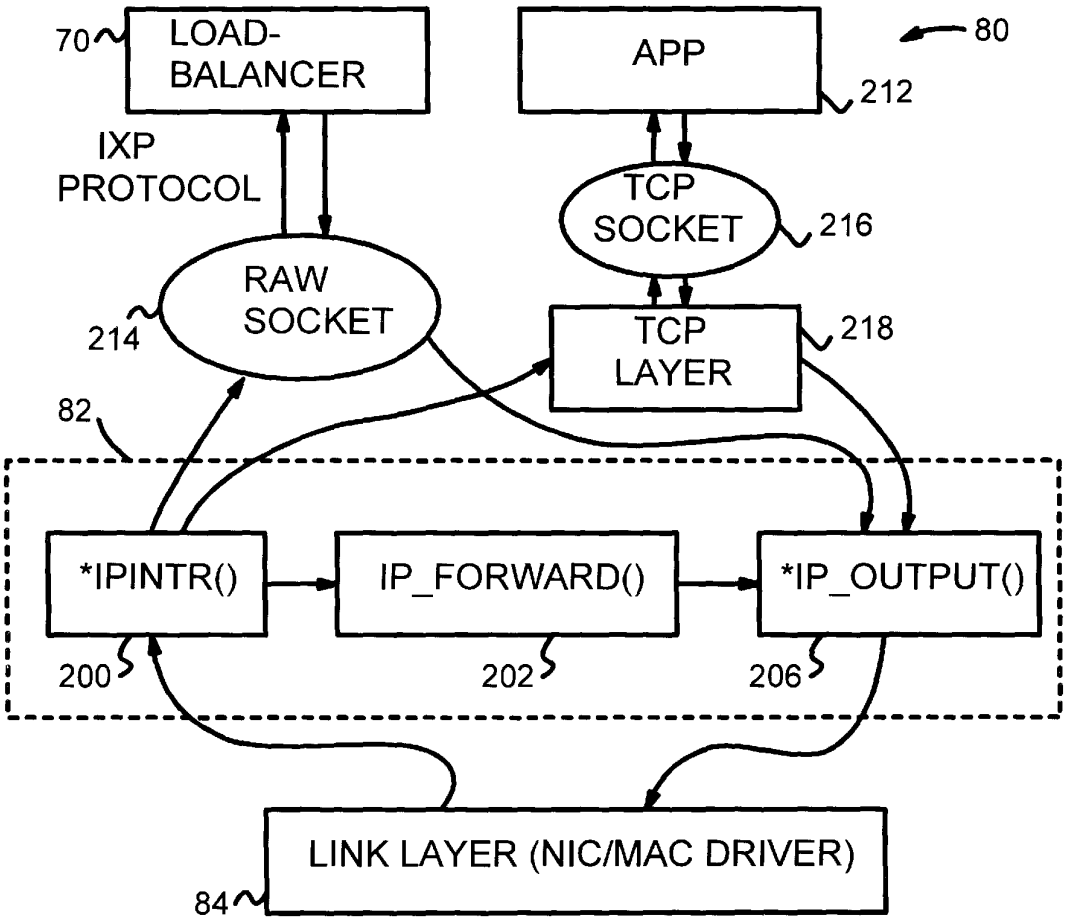

70
LOAD-
BALANCER
APP
80
212
IXP
PROTOCOL
TCP
SOCKET
216
RAW
SOCKET
214
TCP
LAYER
218
82
*IPINTR()
IP_FORWARD()
*IP_OUTPUT()
200
202
206
LINK LAYER (NIC/MAC DRIVER)
84

FIG.14

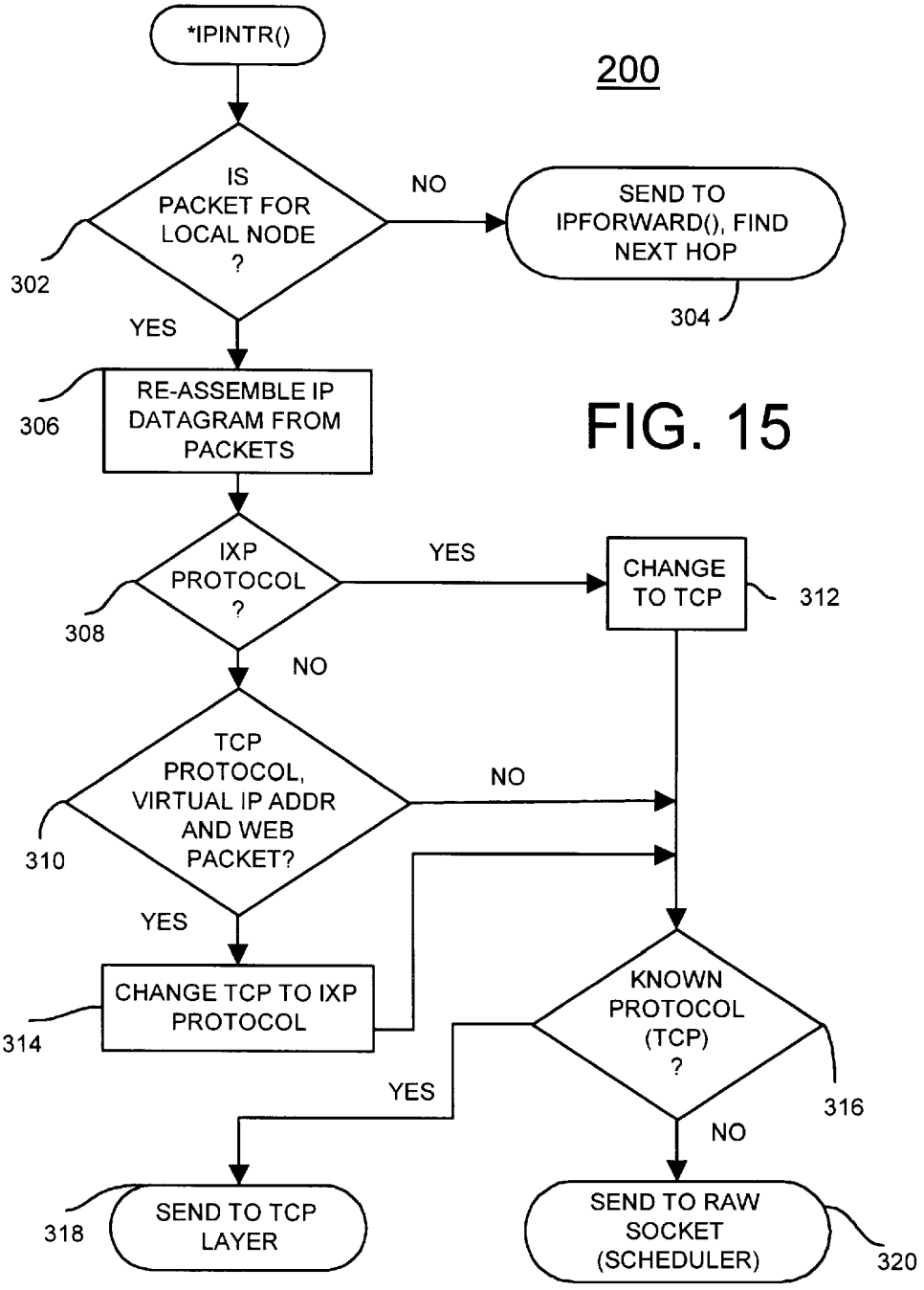

*IPINTR()
200
IS PACKET FOR LOCAL NODE ?
302
NO
SEND TO IPFORWARD(), FIND NEXT HOP
304
YES
RE-ASSEMBLE IP DATAGRAM FROM PACKETS
306
IXP PROTOCOL ?
308
YES
CHANGE TO TCP
312
NO
TCP PROTOCOL, VIRTUAL IP ADDR AND WEB PACKET?
310
NO
YES
CHANGE TCP TO IXP PROTOCOL
314
KNOWN PROTOCOL (TCP) ?
316
YES
NO
SEND TO TCP LAYER
318
SEND TO RAW SOCKET (SCHEDULER)
320

FIG. 15

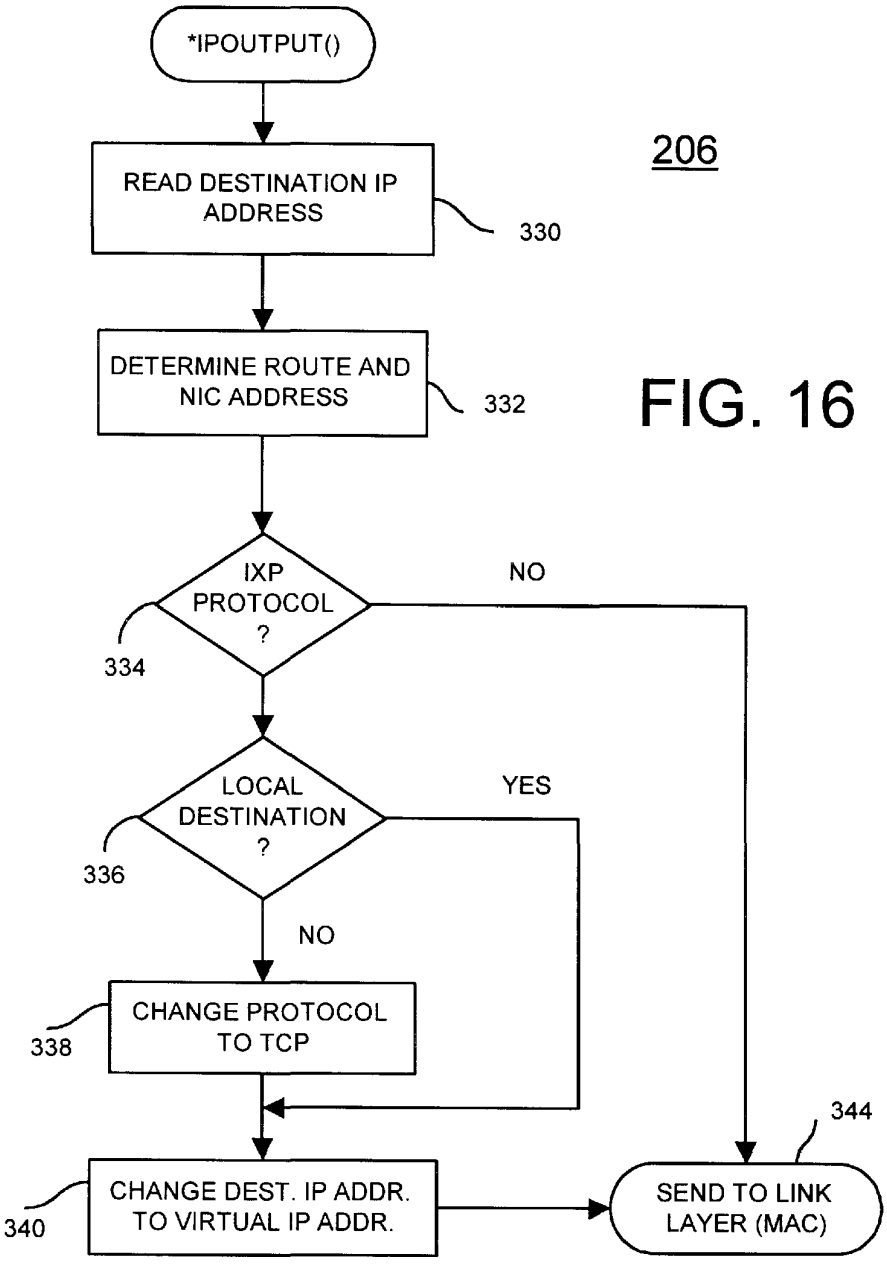

*IPOUTPUT()
206
READ DESTINATION IP ADDRESS
330
DETERMINE ROUTE AND NIC ADDRESS
332
IXP PROTOCOL ?
334
NO
LOCAL DESTINATION ?
336
YES
NO
CHANGE PROTOCOL TO TCP
338
344
CHANGE DEST. IP ADDR. TO VIRTUAL IP ADDR.
340
SEND TO LINK LAYER (MAC)

FIG. 16

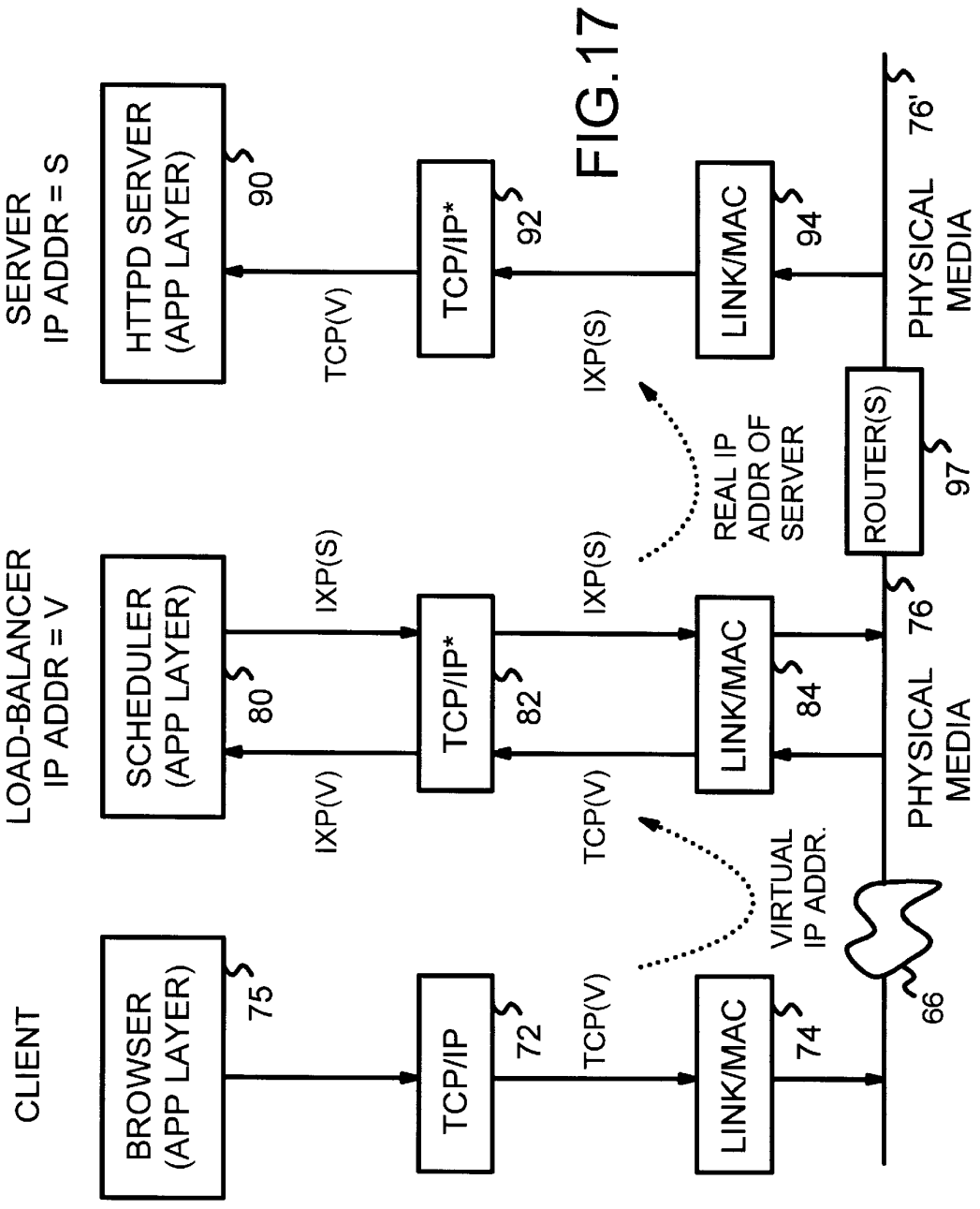
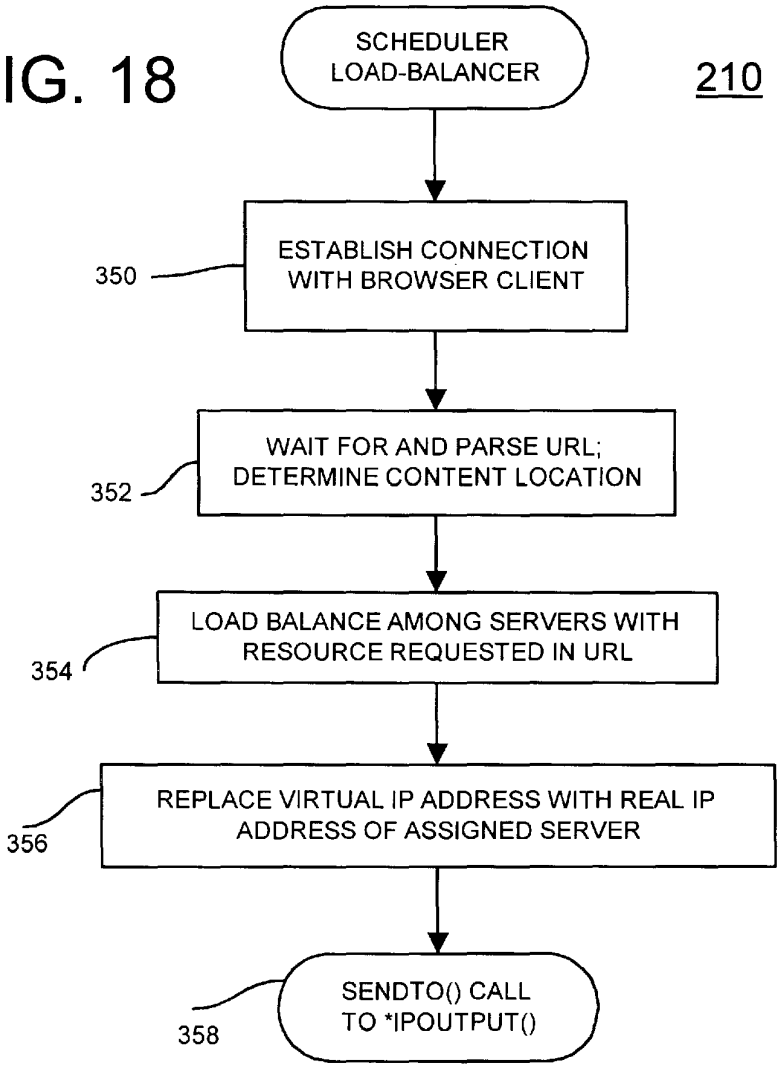

CLIENT
BROWSER (APP LAYER)
75
TCP/IP
72
LINK/MAC
74
TCP(V)
LOAD-BALANCER IP ADDR = V
SCHEDULER (APP LAYER)
80
TCP/IP*
82
LINK/MAC
84
IXP(V)
IXP(S)
VIRTUAL IP ADDR.
REAL IP ADDR OF SERVER
66
PHYSICAL MEDIA
76
ROUTER(S)
97
PHYSICAL MEDIA
76'
SERVER IP ADDR = S
HTTPD SERVER (APP LAYER)
90
TCP/IP*
92
LINK/MAC
94
TCP(V)
IXP(S)

FIG.17

FIG. 18


SCHEDULER
LOAD-BALANCER
210
ESTABLISH CONNECTION
WITH BROWSER CLIENT
350
WAIT FOR AND PARSE URL;
DETERMINE CONTENT LOCATION
352
LOAD BALANCE AMONG SERVERS WITH
RESOURCE REQUESTED IN URL
354
REPLACE VIRTUAL IP ADDRESS WITH REAL IP
ADDRESS OF ASSIGNED SERVER
356
SENDTO() CALL
TO *IPOUTPUT()
358

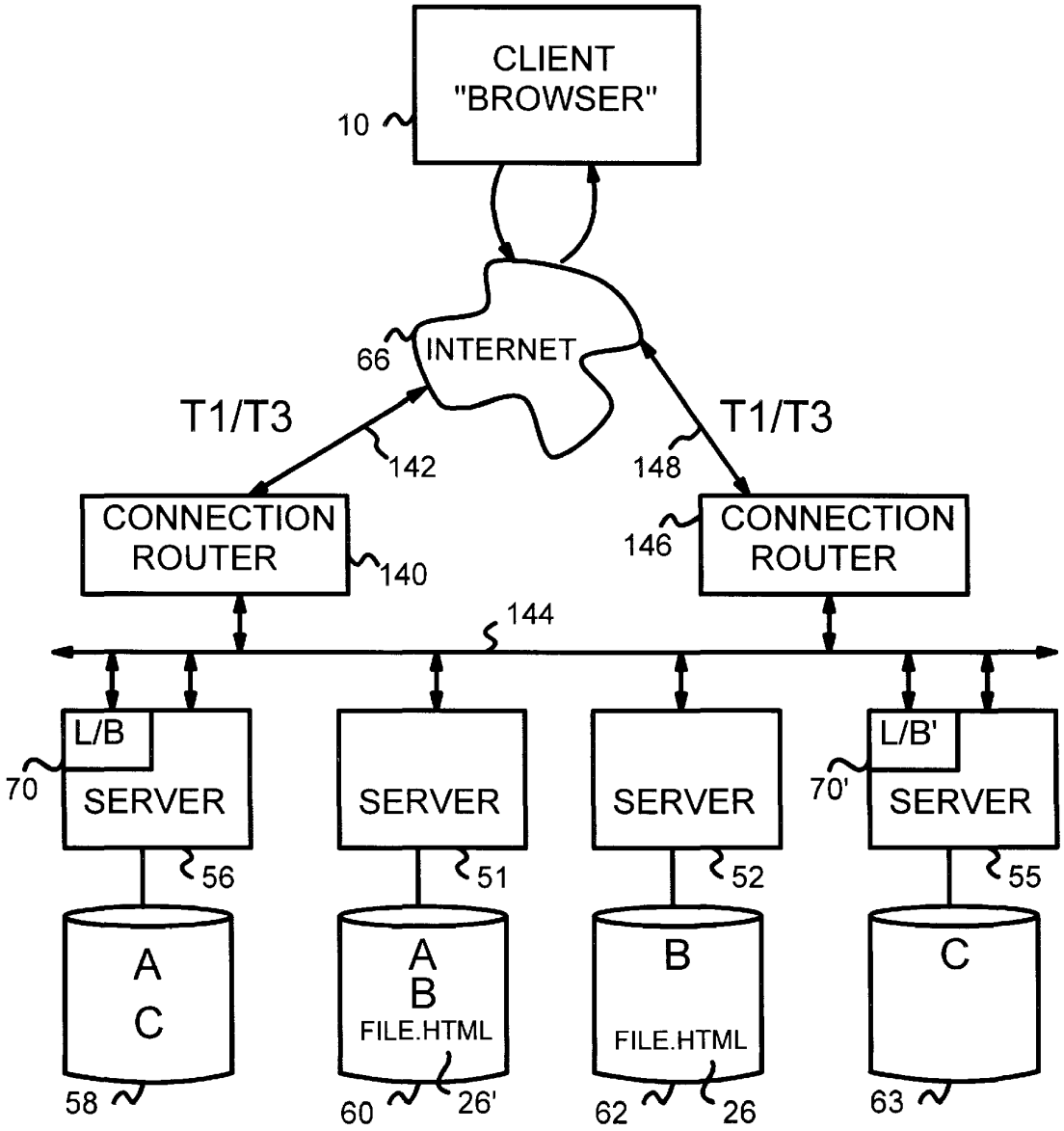

CLIENT
"BROWSER"
10
66
INTERNET
T1/T3
142
T1/T3
148
CONNECTION
ROUTER
140
CONNECTION
ROUTER
146
144
L/B
70
SERVER
56
SERVER
51
SERVER
52
L/B'
70'
SERVER
55
A
C
58
A
B
FILE.HTML
60
26'
B
FILE.HTML
62
26
C
63

FIG.19

WORLD-WIDE-WEB SERVER WITH DELAYED RESOURCE-BINDING FOR RESOURCE-BASED LOAD BALANCING ON A DISTRIBUTED RESOURCE MULTI-NODE NETWORK

BACKGROUND OF THE INVENTION—FIELD OF THE INVENTION

This invention relates to network servers, and more particularly to Internet Servers.

BACKGROUND OF THE INVENTION—DESCRIPTION OF THE RELATED ART

Use of the global network known as the Internet has skyrocketed. Advertisers commonly feature their Internet addresses in television, billboard, and magazine ads. Consumers with a remote computer can access the Internet using client software known as a browser. Explosive growth is occurring in the part of the Internet known as the World-Wide Web, or simply the "web". The web is a collection of millions of files or "web pages" of text, graphics, and other media which are connected by hyper-links to other web pages. These may physically reside on a computer system anywhere on the Internet—on a computer in the next room or on the other side of the world.

These hyper-links often appear in the browser as a graphical icon or as colored, underlined text. A hyper-link contains a link to another web page. Using a mouse to click on the hyper-link initiates a process which locates and retrieves the linked web page, regardless of the physical location of that page. Hovering a mouse over a hyper-link or clicking on the link often displays in a corner of the browser a locator for the linked web page. This locator is known as a Universal Resource Locator, or URL.

Background of URL's, IP Addresses, HTML, HTTP

The URL identifies a domain, a host within that domain, and sometimes a resource or file within a directory structure on the host computer. Domains can be thought of as a group of computers, such as all computers on a company's network. For example, the domain "ibm.com" identifies a domain for the commercial company IBM, which may include thousands of individual computers. Typically the URL identifies only those computers which are servers on the world-wide web by prefixing the domain with a host name. Thus the URL "http://www.ibm.com" identifies an individual host computer within the ibm.com domain which operates as a world-wide-web server for IBM. "HTTP" tells the host to use the hyper-text transfer protocol while delivering files over the Internet. The files delivered can be from resources such as database queries or execution of scripts by the host as well as traditional files.

A web server site may contain thousands of individual web pages. The location of the file or resource containing a desired page is identified by appending a directory-path file name to the host and domain names in the basic URL to form a new URL. Thus the URL "http://www.ibm.com/dira/dirb/dirc/intro.html" identifies a hyper-text markup-language (HTML) file called "intro.html" which resides on a host named "www" within the ibm.com domain. The file resides in the dira directory and the dirb/dirc subdirectory. Often this HTML file contains references to other files which are loaded automatically by the client's browser.

While the URL is used to locate a file on a host within a domain, it does not contain a physical address for the host computer. Addresses of computer machines on the Internet are specified using a 32-bit numeric identifier known as the

Internet-Protocol (IP) address. Each computer is typically assigned a different IP address so that no two machines have the same IP address. The IP address is often written as four decimal numbers separated by periods. Each decimal number represents an 8-bit binary number, from zero to 255 in decimal notation. Thus a computer in IBM's domain might have the IP address 209.180.55.2 while another computer in that domain might have the address 209.180.55.103.

Client Browsers Accessing Web Servers

FIG. **1** is a diagram of a client browser looking up the IP address of a host specified in a URL. Users of a remote computer use client software known as an Internet browser or simply a browser. Popular browsers include Netscape Navigator by Netscape Communications, Inc. of Mountain View, Calif. and Internet Explorer by Microsoft Corp. of Redmond, Wash., although many other browsers and other types of client software are used.

Browser **10** initiates a communication session with a remote server by the user selecting a URL, perhaps by mouse-clicking on a hyper link to a new web page. Host name **11**, "www.round.com", in the URL "http://www.round.com/file.html", is sent to domain-name-system (DNS) server **14**, which is a special Internet server with look-up table **16**. DNS server **14** is often a special server at an Internet Service Provider which contains most or all domain names on the entire Internet, or in a local region of the Internet. One DNS server may have to refer the request to another DNS server for unknown host-names.

DNS server **14** looks through look-up table **16** and finds an entry for the host www.round.com. This entry contains a physical IP address **18** for the web-server host in the domain round.com. This IP address **18 230.101.17.101** is returned to browser **10**. Browser **10** then stores this IP address in client cache **20** for future use, a process known as browser caching of the IP address.

Browser **10** then uses cached IP address **18'** to initiate a communication session with the remote computer which physically has the desired web page, the www.round.com server having the file.html file. FIG. **2** shows a browser using a cached IP address to retrieve a file from a remote server in a server farm. Browser **10** reads the cached IP address **18'** from client cache **20** and uses cached IP address **18'** to initiate a communication session with remote server **22**. Once the session with server **22** is established, URL **12** is sent to server **22**. Server **22** then accesses disk **24** which includes requested file **26**, the file.html web page. A file copy **26'** of requested file **26** is sent back to browser **10**, which re-constructs the web page from file copy **26'** and displays the web page to the user. Other files such as graphic image files may also be transferred which were not directly requested by the URL, but are referenced by the file.html file.

Server Farms for Large Web Sites Mirror Content

While some smaller web sites can be served from a single computer, larger web sites require multiple computer machines acting as servers. Some web sites receive as many as one million requests or "hits" per hour, requiring many workstation computers.

FIG. **2** shows server farm **30** which contains server **22** serving browser **10**, and servers **22**A, **22**B, **22**C which are servicing other browsers (not shown). Servers **22**A, **22**B, **22**C each contain their own disks **24'**, each with a copy of all the web pages in the site, including requested file **26**. Server farm **30** is basically a group of replicated servers which can service requests from multiple browsers. Each server has a copy of the entire web site. Any server can service any request since the content is "mirrored" on all servers.

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Each machine typically has its own unique IP address. Since a domain can have many computer machines with many IP addresses, some way to provide to a client one of the many server machines' IP address is needed. One simple approach is known as rotating DNS or DNS round-robin load-balancing.

DNS server **14** of FIG. **1** contains look-up table **16** which is used to return IP addresses to host-lookup requests from client browsers. Look-up table **16** contains entries for different host names. The entry for a host name specifies the IP addresses for that host and each entry can contain several IP addresses for that host. The entry for www.round.com host on the domain round.com contains four IP addresses:

230.101.17.100
230.101.17.101
230.101.17.102
230.101.17.103

for the four servers **22**A, **22**, **22**B, **22**C of server farm **30** serving the www.round.com web site. When a client requests a DNS look-up, one of these IP addresses is chosen in a round-robin fashion. Each time a different client looks up the host www.round.com, a different IP address is returned until all the available IP addresses are used. Then the first IP address is returned again. Thus the first browser is sent the IP address for server **22**A, the second browser is sent the IP address for server **22**, the third browser sent the IP address for server **22**B, and the four browser sent the IP address for server **22**C. The fifth browser request to DNS server **14** is sent the first server **22**A, and so on in a round-robin fashion.

Each DNS server operates independently of other DNS servers. Thus optimal load balancing is not always achieved.

Other more sophisticated assignment schemes have been used, such as "load-balancing DNS" which sends requests to servers based on a balancing algorithm which attempts to balance the load on each server. With this approach more powerful servers could be assigned more requests than weaker servers.

IP Addresses of Servers Cached on DNS Server

DNS servers **14** (FIG. **1**) often cache the results of domain-name lookups which were passed or forwarded to other DNS servers for completion. The administrator of the www.round.com web site has no way of actively updating the contents of many DNS caches containing IP addresses of servers in server farm **30**. Instead, the administrator must rely on the remote DNS servers periodically flushing their own cached IP addresses and looking up the www.round-.com host again. DNS servers may flush their cached IP addresses every few minutes or not for several weeks. IP addresses can thus remain in a DNS server's cache long after the server with the cached IP address is removed from service. The IP address of the removed server can continue to be assigned by the DNS server until the cached entry is replaced or flushed.

For the example in FIG. **3**, when server **22**C crashes, its IP address **230.101.17.103** remains in use in DNS server caches. Users that look-up the www.round.com host name can be assigned the IP address of crashed server **22**C. Users sent the IP address of crashed server **22**C are unable to access server farm **30**, even though several other servers **22**A, **22**, **22**B at server farm **30** are operational.

DNS Caching Blocks Some Users From Partially-Crashed Web Site

Several hours or even days may be required to flush the IP address of the crashed server **22**C from all DNS caches. Thus DNS servers can continue to send the IP address of the crashed server to browsers long after the server has crashed. Browsers attempting to use this IP address and connect with the crashed server receive no response from the www.round-.com web site. These browsers are frozen out of the www.round.com web site.

Since the browser itself caches the IP address from the DNS server until the browser application is closed, browsers can still attempt to access a crashed server after the crash has occurred. FIG. **3** shows a browser using a cached IP address to access a crashed server which is not responding. Browser **10**A had previously cached IP address **18**C for server **22**C for the www.round.com host. When browser **10**A attempts to connect to www.round.com, server **22**C is accessed. No response is received from server **22**C since the server is not functioning. To Browser **10**A, the web site www.round.com appears to be non-functional, even though to another browser **10**, the web site is functional.

Though the user of browser **10**A may repeatedly try to connect to the www.round.com web site, each time no response is received until server **22**C is fixed. Since DNS server **14** of FIG. **1** may continue to use the IP address of the crashed server **22**C, many users may be locked out from the web site, even though other users can access the site.

When browser **10**A also caches IP address **18**C, the browser may not be informed that the IP address is no longer valid even after DNS server updates its own cache. These browser caches may persist for several hours, preventing the user from accessing the web site. Should the server **22**C be removed from service permanently, perhaps being re-assigned to another web site, the user is effectively blocked from accessing the web site until the user flushes his IP cache, which may not occur until the user exits the browser application.

Of course, with a large server farm, the loss of one server blocks out only 1/N of the users, where N is the number of servers in the server farm. Thus for FIG. **3**, one-fourth of the current users are blocked out while ¾ths of the current users have access to the web site. One-fourth of the new users looking up the host on a DNS server which still uses the old IP address of the crashed server are also blocked from the web site.

Router-Based Web Site

An approach which mitigates some of these problems inserts a multiplexer or router between the browser clients and the server farm. FIG. **4** illustrates a router-based server farm. A single IP address of router **32**, **230.101.17.200**, is available to all DNS servers as the single IP address for the web site. Browser **10** caches this IP address as cached IP address **34**. Requests from browser **10** are sent to router **32** since cached IP address **34** points to router **32**.

Router **32** receives all packets in the transmission from browser **10**. Router **32** might be a dedicated personal computer (PC) which uses an algorithm to determine which of servers **36**A, **36**, **36**B, **36**C in server farm **38** should service the request from browser **10**. Router **32** may use a fairly complex load-balancing scheme which takes into account requests from other browsers and the capability of each server when some servers are powerful workstations while other servers are older, slower PC's.

All the packets in the session from browser **10** received by router **32** are re-transmitted to server **36**, with the destination IP address changed to the IP address for server **36**, **230.101.17.101**. Server **36** retrieves the requested file **26** from its local disk **24** and transmits it back to router **32**, which then re-transmits the file to browser **10**.

When a server crashes, such as crashed server **36**C, only those browsers which are currently connected to server **36**C experience server failure. Client caching of the router's IP

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address causes all new sessions to be routed to router **32**; only sessions in progress to crashed server **36**C receive no response from the web site. Thus when one of the servers fails, only 1/N of the currently active requests fail, where N is the number of servers. New requests do not fail since router **32** detects when crashed server **36**C is not functioning and no longer directs new requests to the down server.

A commercial embodiment of a router-based web server has been announced by SOS Corp. of New York, N.Y., under the name "HydraWEB", and product literature indicates that a patent is pending. A second commercial embodiment is the Cisco Local Director, manufactured by Cisco Systems of San Jose, Calif. Each server **36**A, **36**, **36**B, **36**C contains a local copy of all content on the web site on disks **24**, **24**'. Mirroring the full content of the site to all servers is a disadvantage for web sites with a large amount of content, because of the size and cost of the local disks. Certain web applications such as multimedia and video delivery can require a particularly large amount of disk space. These applications are expensive to implement and thus minimizing the number of copies at the server farm is desirable.

Another disadvantage with the router web site is that all data transfers go through router **32**. Since many web pages contain graphics or even video or sound, the amount of data transferred from the server through the router to the browser is large. Router **32** must be fast and efficient to handle load balancing and routing of incoming and outgoing packets. As the web site becomes more popular and traffic grows, router **32** can quickly become a bottleneck and limit performance of the web site. Router **32** is also a single point of failure.

Load-Balancing Granularity Determines Users Affected by Server Failure

For round-robin DNS, the IP address of the web server is assigned once to the client browser and all subsequent accesses use this IP address until the browser's client cache is purged. This is client-level load-balancing granularity, since each client is assigned one server machine for all requests from that client. When the assigned server crashes, the clients using that server are blocked for all future requests until the client application is closed.

The router-based web site has request-level load-balancing granularity. Servers are assigned to handle individual requests from browsers. When the assigned server crashes, the outstanding requests to the server are blacked out but clients can still access other servers in the farm.

Server Problems Plague the Internet

Many Internet users can testify to the utter frustration when the "SERVER NOT RESPONDING" error message is displayed on their browser while trying to connect to a web site. Users often blame the company which administers the unavailable web site. Web sites are not as fault-tolerant as possible despite large investments in replicated servers. An intelligently-designed web-site architecture with better fault-tolerance is needed.

It is desired to reduce the frequency of "SERVER NOT RESPONDING" messages that Internet users often receive. While many web sites use server architectures such as DNS round-robin and router-based load-balancing, a more efficient and fault-tolerant web-site architecture is desired. It is desired to avoid the data bottleneck and single point of failure at the router for router-based web sites. It is also desired to use inherent characteristics of web traffic to more efficiently design a web-site architecture. Mirroring the content of the entire web site to all servers at the site is undesirable, but having differing content on different servers is desired while still performing load balancing. A web site with request-level load-balancing granularity is desired so that fewer users experience a browser lock-up when a server at the web site fails. A web site that can use the standard DNS mechanism is desired to overcome the limitations of DNS caching and complex maintenance of round-robin DNS.

SUMMARY OF THE INVENTION

A web site sends resources to a browser on a client connected to a computer network. The web site has a network connection point for receiving incoming data packets from the computer network and for transmitting outgoing data packets to the computer network. A local network is coupled to the network connection point and transfers data packets. A plurality of network nodes contain web servers with resources. The plurality of network nodes is connected to the local network. The plurality of network nodes transmit the resources as outgoing data packets over the local network to the network connection point through the computer network to the client.

A balancer network node contains a load balancer that receives the incoming data packets transmitted over the local network from the network connection point. The load balancer determines an assigned server in the plurality of network nodes to respond to a request from the client contained in an incoming data packet. The load balancer transfers a connection to the client to the assigned server.

The balancer network node containing the load balancer is connected to the network connection point by the local network which is also connected to the plurality of network nodes. Thus the incoming data packets are routed to the balancer network node but outgoing data packets bypass the balancer network node.

In further aspects the balancer network node is in the plurality of network nodes containing web servers. The web site is addressable by one network address for all web servers in the plurality of network nodes containing web servers. Each network node in the plurality of network nodes contains only a portion of all the resources at the web site; all resources at the web site are not mirrored to all network nodes at the web site.

In still further aspects of the invention a content means stores an indication of which network nodes in the plurality of network nodes contain each resource. A URL means receives incoming data packets from the client which contain a request for a resource. A requested resource is determined from the incoming data packets. Compare means is coupled to the content means and is coupled to the URL means. It compares the requested resource to the indication of which network nodes in the plurality of network nodes contain each resource. A list of network nodes containing the requested resource is outputted.

Balancing means receives the list of network nodes containing the requested resource. It chooses as an assigned node one of the network nodes in the list of network nodes. Thus the load balancer chooses an assigned node based on the resources contained by each network node. The load balancer performs resource-based load balancing.

In other aspects a delay means in the load balancer delays assignment of the assigned node until an incoming data packet containing the request for the resource is received. Thus load balancing is delayed.

In other aspects the invention is a method which makes a connection and sets up a session between the client and a load balancer at a web site. The load balancer waits for a URL request from the client once the load balancer has made the connection with the client. It receives the URL request.

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from the client and decodes the URL request to determine a requested resource. An identifier for the requested resource is compared to identifiers for resources located on a plurality of nodes and a first subset of the plurality of nodes is determined which contain the requested resource. The URL request is assigned to an assigned node in the first subset of the nodes which contain the requested resource and the connection and the session setup are transferred to the assigned node which contains the requested resource. The assigned node reads the requested resource and transmits the requested resource to the client. Thus the assigned node is selected based on a location of the requested resource determined from the URL request.

In further aspects the packets received from the client are TCP/IP packets having a destination IP address which is a virtual IP address of the load balancer. The virtual IP address of the load balancer is changed in the packets to a real IP address of the assigned node and the packets are passed to a modified IP layer. The real IP address determines a physical route from the load balancer to the assigned node over a network and a physical network address is generated for the assigned node and the physical network address is attached to the packets. The real IP address in the packets is changed back to the virtual IP address of the load balancer before transmission of the packets with the physical network address. Thus the physical network address is generated from the real IP address of the assigned node, but the packets are transmitted to the assigned node containing the virtual IP address of the load balancer.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagram of a client browser looking up the IP address of a host specified in a URL.

FIG. **2** shows a browser using a cached IP address to retrieve a file from a remote server in a server farm.

FIG. **3** shows a browser using a cached IP address to access a crashed server which is not responding.

FIG. **4** illustrates a router-based server farm.

FIG. **5** highlights the asymmetric nature of data transfer at a world-wide-web site.

FIG. **6** is a diagram of a web server which asymmetrically routes incoming traffic through a load-balancer while bypassing the load-balancer for files transmitted back to client browsers.

FIG. **7** is a diagram of a TCP/IP packet transmitted through a local-area network (LAN).

FIG. **8** is a diagram illustrating TCP state migration of a connection from the load balancer to a server node.

FIG. **9** is a flowchart of processing a browser request by a prior-art router-based load balancer such as shown in FIG. **4**.

FIG. **10** is a flowchart showing load balancing and state migration delayed until the connection is made and the URL request received.

FIG. **11**A is a chart illustrating packets transferred among the browser, load balancer, and the assigned server when establishing the connection and transferring the connection to the assigned server which responds to the URL request.

FIG. **11**B shows the browser sending a second URL request, PUSH(**1**), to the load balancer, which is passed through to the assigned server as PUSH(**1**)'.

FIG. **12** is a diagram of network layers showing a packet sent from the client to the server which is intercepted by the load balancer.

FIG. **13** is a diagram of network layers transmitting packets from the server to the client browser.

FIG. **14** is a diagram of modifications to the IP layer for the load balancer's node.

FIG. **15** is a flowchart for a modified IP layer input module.

FIG. **16** is a flowchart of an IP layer output module which is modified for transmitting packets from the load balancer.

FIG. **17** highlights that the real IP address of the assigned server is used when multiple hops are required.

FIG. **18** is a flowchart of the operation of the load balancer.

FIG. **19** is a diagram of a fault-tolerant web site with a back-up load balancer and dual Internet connections.

DETAILED DESCRIPTION

The present invention relates to an improvement in Internet and Intranet server farms. The following description is presented to enable one of ordinary skill in the art to make and use the invention as provided in the context of a particular application and its requirements. Various modifications to the preferred embodiment will be apparent to those with skill in the art, and the general principles defined herein may be applied to other embodiments. Therefore, the present invention is not intended to be limited to the particular embodiments shown and described, but is to be accorded the widest scope consistent with the principles and novel features herein disclosed.

The inventors have realized that most traffic at web sites is inherently asymmetric. Users download huge amounts of data and graphics from a web site, but provide only small amounts of data in the form of requests to the web site. The amount of data flowing out of a web site far surpasses the trickle of data flowing into the site.

FIG. **5** highlights the asymmetric nature of data transfer at a world-wide-web site. Client browser **10** operates an Internet browser application which connects to server **22** in server farm **30**. Client browser **10**A also operates an Internet browser application which connects to server **22**C in server farm **30**, and other browsers (not shown) may also be connected to this and other servers **22**A, **22**B.

Browser **10** imbeds requests and commands and a small amount of data in URL's, which are transmitted to server **22**. Each URL contains about 50 to 150 bytes of information, excluding IP addresses and packet headers and other network overhead. A URL often contains information other than a requested file. For example, when the user of browser **10** mouse-clicks on a bitmap image displayed on a web page, the relative coordinates of the mouse's location when the mouse click occurred are included in the URL: http://www.round.com/cgi-bin/coo.cgi?**102**,**315**. Server **22** decodes the coordinates in the URL and determines where on the web page the user mouse-clicked.

The server then performs the action requested, such as opening and transmitting another web page to browser **10**.

Other information sometimes embedded in the URL includes passwords or search text that the user types in, or name and address information typed in. Since the amount of data that a user types in is limited, the number of bytes for this data is small.

Traffic from server **22** to browser **10** consists of large data files which are used to reconstruct the web pages on browser **10**. Since many web sites feature colorful graphics, large graphics files are typically transmitted from server **22** to browser **10**. As new types of media become commonplace

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sound, animation, and video files will accompany the graphics and HTML files being transmitted from server **22** to browser **10**. Smaller web pages may result in only 10 K-bytes of data returned to browser **10**, while more graphical web pages cause larger files to be transmitted, perhaps to several mega-bytes. Video and sound file can easily exceed several mega-bytes.

The result is that only 50 to 150 bytes of data are typically transmitted from browser **10** to server **22**, while tens or hundreds of thousands of bytes of data are transmitted in the reverse direction, from server **22** to browser **10**. In the near future, when sound and video become common, the reverse traffic will increase to several mega-bytes per 100-byte request. At that point the bandwidth of the reverse traffic will be about a thousand times the bandwidth from browser to server.

Outgoing Data Bypasses Load-Balancer

FIG. **6** is a diagram of a web server which asymmetrically routes incoming traffic through a load-balancer while bypassing the load-balancer for data transmitted back to client browsers. Browsers **10**, **10**A cache a virtual IP address **34** in client cache **20**. Virtual address **34** (**230**.**101**.**17**.**200**) is an IP address that identifies all servers at the web site. Unlike a conventional IP address which is unique to an individual host or server, the virtual IP address identifies the web site in its entirety.

External routers are configured to deliver all incoming URL's and network traffic from browsers **10**, **10**A to load-balancer **54**, which has the virtual IP address.

Load-balancer **54** keeps track of which requests are being processed by each server in server farm **50**, and attempts to balance the load of requests among the servers. As is subsequently discussed in more detail, load-balancer **54** establishes the connection with browser **10** and waits for the URL before performing load balancing and assigning the request to a server. The connection and the URL request is then migrated to the assigned server. For example, the request from browser **10** is assigned and migrated to server **52**, while the request form browser **10**A is assigned and migrated to server **52**C.

Unlike a router-based web site, the IP addresses of packets are not changed to the assigned server's local IP address. Instead, each server **52**A, **52**, **52**B, **52**C is assigned an additional IP address, the virtual IP address. A low-level Network-Interface Card (NIC) address is used to route the packets to the assigned server. Each server accepts any packet with either its local IP address or the virtual IP address. Incoming packets from the Internet backbone are routed to load-balancer **54** because they are given the NIC address of load balancer **54** by the Internet connection router (not shown).

Server **52** sends HTML files for the web page back to browser **10** by using the source IP address in the packets received from load-balancer **54**. Since load-balancer **54** does not modify the higher-level TCP/IP packets transmitted to server **52**, server **52** appears to be receiving these packets directly from browser **10**. Server **52** uses the browser's IP address as the destination IP address for outgoing packets, but the virtual IP address as the source address of these packets. Outgoing packets do not go through load-balancer **54**. The bandwidth of traffic through load balancer **54** is much less than through router **32** of FIG. **4** since only the relatively small incoming requests are routed through load balancer **54** while outgoing data bypasses load balancer **54**.

Load balancer **54** can handle multiple requests from multiple browsers since each request is relatively small. Outgoing packets from each server do not have to have their IP addresses altered since each server uses the virtual IP address as the source address of outgoing packets. Thus the larger outgoing traffic of large mega-byte-sized files is bypassed around load-balancer **54**. Multiple connections to the Internet can be provided for the outgoing traffic, since a single router/load-balancer is not required for all traffic.

NIC Address Encapsulated in TCP/IP Packet

FIG. **7** is a diagram of a standard TCP/IP packet transmitted through a local-area network (LAN). Packet **180** contains NIC address **182**, which contains the low-level NIC address (e.g. Ethernet's media-access-controller (MAC) address) of the next destination station in the route to the final destination indicated by destination IP address field **186**. Several destination stations may exist on the route to the station having the destination IP address. Each intermediate station reads the destination IP address and determines the next station in the route. The NIC address of this next station is changed to the NIC address for the next leg of the route, but the IP addresses are not changed.

The source station's IP address is contained in source IP address field **184**, while the packet's type or protocol is included in protocol field **188**. For Internet packets, the protocol is TCP, but other protocols may be used for local LAN traffic. The data being transmitted by the packet is contained in data field **189**. A frame checksum (not shown) may be appended. Source IP address field **184**, destination IP address field **186**, and protocol field **188** are the IP header attached to the data by the IP layer, while NIC address **182** is attached by the data-link layer. Packet **180** includes a TCP/IP header which includes flags indicating the type of packet (SYN, ACK, PUSH, RST, FIN). A sequence number is also included in the TCP/IP header to keep track of packets received.

Larger data files must be broken into several packets which are transmitted separately and then re-assembled. A typical Ethernet packet can contain up to 1500 bytes.

TCP Connection Migration—FIG. **8**

FIG. **8** is a diagram illustrating TCP state migration of a connection from the load balancer to a server node. Browser **10** connects through Internet **66** to load balancer **70** and sends a URL request **102** once the connection **100** is made. Load balancer **70** does not have to be a separate, dedicated router or PC, and is shown as a software application running on server **56**. Load balancer **70** can use many variations of balancing algorithms to determine which server **56**, **51**, **52** should service the new URL request **102**. Load balancer **70** determines that the request should be assigned to server **52**. The connection and URL request are migrated from load balancer **70** to server **52** using TCP state migration **120**. Server **52** accesses disk **62** to read requested file **26** and sends a copy of requested file **26** to browser **10** through Internet **66** as data transfer **104**.

Resource-Based Load Balancing

Each server **56**, **51**, **52** has a local disk **58**, **60**, **62**, which contains different content. For example, only disk **62** contains requested file **26**. Load balancer **70** maintains a directory table of the locations of different files and resources on the web site. Load balancer **70** determines that only server **52** and not servers **56**, **51** can handle the request. The entire content of the web site does not have to be mirrored to each server's hard disk as in the prior art. Some of the more frequently accessed files and resources, such as the home page, may be replicated to all servers, but less-frequently accessed files and pages may be located on a single node or a few nodes. Other web sites resources may include dedicated servers with specific resources such as databases of built-in application-programming-interfaces (API's) to inter-

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face with user-defined programs, or software licenses to run particular programs on particular servers.

Prior Art Load Balancing Performed Before URL is Parsed

FIG. **9** is a flowchart of processing a browser request by a prior-art router-based load balancer such as shown in FIG. **4**. The browser first attempts to make a connection with a server at the web site by sending a SYN packet which requests that a connection be made, step **150**. A SYN packet has its SYN flag set in the TCP header. The router/load balancer receives this request and performs load balancing based on the load of each server in the server farm. Load balancing selects an assigned server for this new request, step **152**. The router/load balancer then forwards packets to the assigned server, step **154**.

The assigned server then makes the connection with the browser, step **156**, by returning an SYN/ACK acknowledge packet to the browser by first routing it through the router. The browser responds with an ACK packet and then with a URL request, step **158**. This URL packet is received at the router and then re-transmitted to the assigned server. The assigned server parses the URL request to determine which files are requested and then transmits these files back to the browser through the router/load balancer, step **160**.

Steps **150**, **152**, **154** are performed by the router/load balancer while steps **156**, **158**, **160** are performed by the assigned server. The router passes packets from the server through to the client's browser.

URL File Request Arrives After Load Balancing in Prior Art

Since load balancing is performed as soon as the first SYN packet is received, before the URL is sent, such prior-art load balancing cannot take into account the resource or file which is requested by the URL. All servers must have the same content, since the URL arrives after the server assignment has been made. The invention overcomes these limitations by delaying the assignment of the server until after the URL has been received.

Simple router-based load balancing does not allow for resource-based load balancing because the requested resource or file is not known when the connection is first made. The requested file is known once the URL is received and parsed, which occurs after the connection is made. The browser does not send the URL until the connection has been made and the server responds with an acknowledgment packet. The router approach of FIGS. **4**, **9** forwards all packets to the assigned server, and the assigned server then makes the connection and sends the acknowledgment. Once the connection is made with the assigned server, then the browser sends the URL, which is forwarded by the router to the assigned server.

Delayed Load Balancing and TCP State Migration

FIG. **10** is a flowchart showing load balancing and state migration delayed until after the connection is made and the URL request received. The TCP connection **100** is made between the browser and the load balancer by exchanging SYN and ACK packets. Once this connection is made, the load balancer waits until the browser sends the URL which indicates which file or resource is requested. Once the URL request **102** is received, the load balancer parses the URL to determine which resource is being requested. Based on the resource requested from parsing the URL, the load balancer determines which servers are best suited to serve the request. The load balancer then performs load balancing among the servers that can serve the request, step **125**.

The load balancer then transfers the connection and the current TCP state to the assigned server, using TCP state migration **120**. TCP state migration is not simply forwarding packets through as they are received. Instead the packets received are stored by the load balancer and then played back to the assigned server. The assigned server accesses its local disk to read the requested file and sends a copy of the requested file to the browser through the Internet as data transfer **104**.

TCP State Migration—FIG. **11**A

FIG. **11**A is a chart illustrating packets transferred among the browser, load balancer, and the assigned server when establishing the connection and transferring the connection to the assigned server which responds to the URL request. A browser application running on a remote client initiates a connection by sending a synchronizing packet, SYN(**0**), to the virtual IP address of the web site. The SYN(**0**) packet is routed to the load balancer since it is an incoming packet, and the load balancer sets up a session with the browser by setting aside memory space and creating an entry in a session table. The load balancer replies with a SYN/ACK packet to the browser, and the browser replies with an acknowledgment packet, ACK(**0**). The SYN packet contains an initial sequence number which is determined by the browser's OS. The SYN/ACK packet contains acknowledgment number which is this initial sequence number incremented by one. At this point connection **100** has been established between the browser and the load balancer.

The load balancer saves all of the SYN and ACK packet information received. Since incoming packets are few and small in size, a large amount of storage is not necessary. The SYN and ACK packets are later played back to the assigned server for TCP state migration.

The browser then sends the first URL request **102** in a PUSH packet. A PUSH packet is identified by a PUSH flag being set in the TCP header. The load balancer parses the URL to get the file or resource name. Based on the requested resource, and the location of each resource in the web site, the load balancer determines which servers can serve the request, and then chooses the least busy of these servers as the assigned server.

The load balancer then transfers the condition or state of the connection to the assigned server in a process the inventors call "TCP state migration". TCP state migration is not visible to the browser since all transactions occur between the load balancer and the assigned server. The assigned server also uses the virtual IP address so the browser is not aware that the SYN/ACK came from the load balancer while the data comes from the assigned server.

TCP state migration **120** is performed by the load balancer playing back the SYN packet received from the browser and stored by the load balancer. The server responds with a SYN/ACK packet, which is intercepted and directed to the load balancer and not sent to the browser. The load balancer then sends the browser's stored ACK packet to the assigned server, and the assigned server is then connected directly to the browser, having the same TCP state as was established with the load balancer.

The load balancer then sends the packet(s) containing the URL request to the assigned server as packet PUSH(**0**)'. The server reads its local disk and sends the requested file to the browser as data transfer **104**.

The load balancer then enters a pass-through state. Any further packets from the browser such as ACK packets for the received packets are passed through to the assigned server. The assigned server normally closes the connection immediately after the data has been sent to the browser.

When the browser uses a "keep alive" mode, the server may not immediately close the connection. Additional requests may be sent to the assigned server. FIG. **11**B shows the browser sending a second URL request PUSH(**1**) to the

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load balancer, which is passed through to the assigned server as PUSH(1)'. The second request is then handled by the server by sending the requested files to the browser, step **126**. Further requests are handled in a similar manner.

Should one of these subsequent requests be for a file not located on the assigned server's local disk, a local network can be used by the assigned server to access the requested files from other servers on the local network.

Finally, the server closes the connection **130** by sending a finish (FIN) packet which is intercepted and sent to the load balancer, which passes it through to the client. The client replies with an acknowledgment, ACK, and a FIN packet indicating that the browser is closing its end of the connection. The load balancer removes the session entry and the server assignment, and the assigned server closes the connection.

Protocol and IP Address Changes—FIGS. **12**, **13**

FIG. **12** is a diagram of network layers showing a packet sent from the client to the server which is intercepted by the load balancer. A browser running on the application layer **75** of the client sends packets to a web site to establish a connection and to send the URL requesting a file. The browser application sends the data to be sent, the URL addressed to the virtual IP address V of the web site, to TCP/IP stack **72**. TCP/IP stack **72** is a stack of the standard TCP and IP layers, which are roughly equivalent to the session, transport, and network layers of the ISO network definition. TCP/IP stack packetizes the URL and adds headers and sends packets to link layer **74**, which is the driver for the network-interface controller (NIC). Link layer **74** sends the packets out to Internet **66**, perhaps through several routers, hubs, or switches (not shown).

The TCP/IP packets sent from the client have the virtual IP address V of the entire web site as their destination. These packets are shown as "TCP(V)" on the diagram.

The TCP(V) packets are received by the web site and routed to the node having the load balancer since the packets have the virtual IP address. These packets are received by the low-level link layer **84** and sent up to modified TCP/IP stack **82**. Modified TCP/IP stack **82** contains the standard TCP and IP modules with some modifications explained later. One modification is that incoming packets from the Internet have their protocol changed from TCP to a proprietary "IXP" protocol. Since this IXP protocol is unknown to the standard TCP and IP layers, it is sent directly up to application layer **80** containing the load balancer.

The load balancer in application layer **80** receives the modified IXP(V) packets with the IXP protocol and the virtual IP address V, and records the packets until the URL is received when it performs load balancing. The packets are then played back to the assigned server to perform TCP state migration as discussed in FIG. **11**A. The packets played back are sent from application layer **80** as IXP(S) packets, having the IXP protocol and the assigned server's IP address S. Modified TCP/IP stack **82** uses the server's IP address S to determine the NIC address and the routing information from network routing tables. Once the routing has been determined and the NIC address of the assigned server is found, modified TCP/IP stack **82** changes the protocol back to TCP and the IP address back to the virtual IP address V. The packets sent from modified TCP/IP stack **82** to link layer **84** are TCP(V) packets. Link layer **84** sends these packets out over media **76** with the NIC address that corresponds to the assigned server, but with the virtual IP address as its destination.

The NIC address routes the TCP(V) packets to the assigned server's link layer **94**, which passes the packets up to TCP/IP layer **92**, perhaps after comparing checksums for error detection. TCP/IP layer **92** is also modified to route SYN, ACK, RST, and FIN packets back to scheduler application layer **80** so the status of the connection can be monitored, as explained later. Normal data transfers to browsers use PUSH packets which are not routed to scheduler application layer **80**.

TCP/IP layer **92** recognizes the virtual IP address as a local IP address, so the packets are transferred up to application layer **90** after passing through the IP and TCP layers. Application layer **90** runs the httpd server software which is the standard web-site server software. Thus modified application server software is not needed.

FIG. **13** is a diagram of network layers transmitting data packets from the server to the client browser. The server application in application layer **90** reads the files requested by the URL packets received in FIG. **12**, and sends this data to TCP/IP layers **92** addressed to the IP address of the client, which was the source IP address of the incoming packets and was not changed. These packets use the TCP protocol and the client's IP address C, and are designated "TCP(C)". TCP/IP layer **92** uses the virtual IP address as the source address of these outgoing packets rather than the real IP address of the server. Since the incoming packets have the virtual IP address V as the destination IP address, the standard server software simply uses the destination IP address of incoming packets as the source IP address of outgoing packets. Link layer **94** receives these packets and sends them out over the local media **76** and eventually through Internet **66** to the client's link layer **74**. These packets are sent up through the client's TCP/IP stack **72** and to the browser in application layer **75** where they are displayed to the user.

Since the client received the virtual IP address as the source IP address in these packets, the client is unaware that the server is a different machine than the load-balancer, or other servers at the web site.

Modified IP layer—FIG. **14**

FIG. **14** is a diagram of modifications to the IP layer for the load balancer's node.

Unmodified link layer **84** passes packets received up to TCP/IP stack **82**, and specifically to IP input module **200** of the IP layer. IP input module **200** determines if the packet is destined for the local node or must be routed or forwarded to another node. Forwarded packets are transferred to IP forward module **202**, which prepares the packet for forwarding. Routing tables are consulted by forwarding module **202** to determine where to sent the packet next. Forwarded packets are then sent to IP output module **206**, which sends them down to link layer **84**.

Local packets are assembled together for IP datagrams, which are passed up to TCP module **218** when the packet's type or protocol is TCP. TCP module **218** transmits the datagram to applications **212** in application layer **80** using TCP socket **216**.

Local packets that are not of a known protocol such as TCP or UDP (User Datagram Protocol) have an unrecognized protocol. These datagrams are sent to raw socket **214**, bypassing TCP module **218**. Any applications in application layer **80** can listen to raw socket **214** and use the datagram, since raw sockets are a standard TCP/IP feature. Load balancer **70** is an application which listens to raw socket **214** for datagrams using the "IXP" protocol. Since the IXP protocol is not a defined protocol, no other applications should be looking for IXP datagrams. Thus using the IXP protocol allows use of raw socket **214** to bypass the TCP layer and send the datagrams directly to load balancer **70**.

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These datagrams are the connection packets and the URL originally from the client's browser.

Each server is modified to accept packets using the virtual IP address by aliasing a second IP address, thus using two IP addresses. For example, in UNIX, the command:

% ifconfig de**0 230.101.17.200** alias netmask Oxffffffff

specifies that a second IP address, the virtual IP address **230.101.17.200** is also an IP address for the node. Other operating systems also support IP address aliasing.

Modified IP Input Module—FIG. **15**

FIG. **15** is a flowchart for a modified IP layer input module. The server with the load balancer uses modified IP input module **200**. An asterisk is used to indicate that the module is modified from the generic ip_input() module. Steps **308**, **310**, **312**, and **314** are added steps which are not in the generic IP module.

All packets received from the media by the lower link layer are passed up to the IP layer which calls IP input module **200**. Step **302** tests to determine if the packet is for the local node by reading the destination IP address.

When step **302** determines that the destination IP address is not a local IP address, then the packet is being routed through the local node and the IP layer acts as a software router. The packet is passed to IP forward module **202** (step **304**) which prepares the packet for forwarding. The packet is then sent to IP output module **206** before being re-transmitted out the link layer to the destination or the next hop.

Step **302** determines that the packet is for the local node when the IP address is the virtual IP address or the real IP address for the server. The packet is stripped of its header information and possibly assembled with other packets to form the IP datagram, step **306**.

The assembled IP datagram from step **306** is normally sent up to the TCP layer (steps **316**, **318**) for the generic IP module. The invention performs additional steps before step **306** by modifying the generic IP input module to form modified IP input module **200**. Modified IP input module **200** checks the protocol to determine if it is the IXP protocol. Since incoming packets from the Internet always use the TCP protocol, incoming packets fail step **308** and are then tested by step **310** to determine if they are TCP packets with the virtual IP address and are world-wide-web packets. Thus step **310** looks for incoming packets. These incoming packets have their protocols changed from TCP to IXP, step **314**. The IXP protocol is not a recognized protocol, so step **316** causes these incoming packets to be sent to the raw socket, step **320**, so that the load balancer application can read these packets. Thus changing the protocol to the unrecognized IXP protocol forces the incoming packets to be sent directly to the load balancer. This allows all incoming packets from the Internet to be routed through the load balancer.

Other TCP packets which are not world-wide web packets fail step **310** and are not modified. These ordinary TCP packets are a known protocol, step **316**, and are sent to the TCP layer, step **318**.

Step **308**, which first checks for the IXP protocol, is used when the local node contains both the load balancer and the assigned server. This step can be deleted if the local node is used exclusively for the load balancer and cannot be an assigned web server.

Modified IP Output Module—FIG. **16**

FIG. **16** is a flowchart of an IP layer output module which is modified for transmitting packets from the load balancer. Modified IP output module **206** is a standard IP output module except that steps **334**, **336**, **338**, and **340** have been added.

Ordinary TCP packets which are received from IP forward module **202** or from an application and passed down through the TCP layer have their destination IP address read, step **330**, and their route determined by accessing routing tables, step **332**. The NIC address of the destination or the next hop to the destination is determined and prefixed to the packet. Ordinary TCP packets fail step **334** and are sent to the link layer, step **344**. The link layer then transmits them over the media, unless the NIC address is the local node. These local-destination packets are sent back up through the TCP/IP stack, perhaps to a different application.

Packets which have come from the load balancer application have the unrecognized IXP protocol rather than TCP, and are diverted by step **334** for special processing. When the load balancer assigns the server at the local node, step **336** detects that the destination is the local node, and the packets are passed to step **340**, with the IXP protocol intact. These IXP packets are passed back up to modified IP input module **200** and are detected as being for the local server as discussed in the next section.

Packets assigned to another node's server must be sent over the media to the assigned server. Since the assigned servers all use standard TCP/IP stacks, the IXP protocol must be changed back to TCP, step **338**. The destination IP address is set to the destination server's real IP address by the load balancer so that the destination's NIC address is generated by step **332** and prefixed to the packet. Since the NIC address has already been determined, the IP address can safely be changed back to the virtual IP address of the entire web site, step **340**. The destination servers are all configured to accept packets for the virtual IP address as well as for their real IP address. Thus the real NIC address routes these packets to their destinations, which accepts them.

Modified Network Software for Wide-Area Network Support

When the assigned server resides on the far side of a router or across a wide-area network (WAN), the previous embodiment does not allow packets to get to their final destination. The load balancer normally transmits packets with the physical NIC address of the assigned server, but with the virtual IP address. When the next hop is not the assigned server, such as when the load balancer and the assigned server are separated by a router, the router would route the packet back to the load balancer since the packets have the load balancer's virtual IP address.

FIG. **17** highlights that the real IP address of the assigned server is used when multiple hops are required. Multiple-hop data transmissions to the assigned server are supported by further modifying the network software. The destination IP address of the packets from the load balancer to the assigned server are further modified to have the assigned server's real IP address S rather than the virtual IP address V. Thus intermediate routers can use the real IP address S of the assigned server to route the packet to the assigned server.

When packets require multiple hops to reach the assigned server, the physical address of the next hop, intermediate router **97**, is determined as before, but the real IP address of the assigned server is retained in the destination IP address field of the IP header. To communicate the virtual address to the assigned server, the virtual IP address is appended to the end of the data in the packet and is sent to the assigned server using the IXP protocol. Packets with the IXP protocol are intercepted and recovered by the assigned server.

A comparison of FIG. **17** to FIG. **12** shows that transmission from load balancer's modified TCP/IP stack **82** to the assigned server's TCP/IP layer **92** uses IXP(S) packets rather than TCP(V) packets. Packets transmitted from the

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load balancer to the assigned server are transmitted from link layer **84** of the load balancer over physical media **76** to intermediate router **97**, then over physical media **76'** to link layer **94** of the assigned server. Thus the local network at the server farm can use intermediate routers between the load balancer and the assigned servers. The assigned servers can also be located remotely from the load balancer, such as over a WAN using this technique.

Added Steps When Assigned Server is Local

Incoming packets which are assigned to the load balancer node's server are passed up and down the local TCP/IP stack twice. These packets are first sent from the low-level link layer through the modified IP layer to the load balancer in the application layer, and then back down through the IP layer to the link layer. Step **336** of FIG. **16** detects that the local server is the destination and bypasses steps **338**, **340** so that the protocol is left as IXP.

The link layer recognizes that the NIC address is the local NIC address and does not transmit the packets. Instead the packets are sent back up to the IP layer. Step **308** of FIG. **15** detects these packets and changes the protocol back to TCP (step **312**) and then passes the TCP packets to the HTTPD server application through the generic TCP layer. This sequence only occurs for a packet that has been intercepted to the load balancer and assigned to the server on the local node.

IP Layer Modified for Servers

The IP layers of the servers are modified in a similar way as the IP layer of the load balancer. All incoming packets are not affected, only special outgoing packets. These special packets are for establishing or closing a connection. These packets need to be intercepted and received by the load balancer during TCP state migration and when the session is closed. The load balancer keeps track of the session with an entry in a session table, and this entry is removed when the session ends.

When the server closes a connection, it sends out a packet with the FIN flag set in the TCP header. When a transmission error occurs, a reset packet may be sent with the RST flag set. Likewise, when the server responds to the load balancer with the SYN/ACK packet during TCP state migration, the SYN and ACK flags are set. Normal data transfers to the browser are PUSH packets and do not have the SYN, ACK, RST, or FIN flags set.

The server's IP output module is modified to detect these special packets by looking at the SYN, ACK, RST, and FIN flags. If none of these TCP flags are set, normal IP processing occurs. However, if any of these special TCP flags are set, then modified IP processing occurs. The protocol is changed from TCP to a variation of IXP called IXCP, and the destination address (the browser's IP address) is stored and replaced with the load balancer's IP address. The IP layer looks up the load balancer's IP address in its routing tables and generates the NIC address for the load balancer's node. The browser's IP address which was stored then replaces the load balancer's IP address, and the packet, with the IXCP protocol, is sent to the load balancer.

The load balancer's IP layer processes these IXCP packets as shown in FIG. **15**, the tests of steps **308**, **310** fail, so that these IXCP packets are sent up to the load balancer through the raw socket. The load balancer can then alter its session table. FIN and RST packets are changed to TCP and the destination IP address changed to the browser to send out. SYN/ACK are not re-transmitted to the client.

Load Balancer—FIG. **18**

FIG. **18** is a flowchart of the operation of the load balancer. The load balancer is written for the application or user layer so that it can be easily modified. Writing the load balancer for a lower layer such as the IP layer puts the complex load balancing functions in the kernel, and any code modification could require that the system be shut down and rebooted. Having the load balancer in the application layer simplifies node management and allows code modifications to occur with minimal interruption. For performance reasons the inventors anticipate putting the load balancer into the kernel after being sufficiently debugged.

Incoming web packets from the Internet are passed up to load balancer **70** from modified IP input module **200** (FIG. **15**). The load balancer is sometimes called a scheduler since it assigns or schedules sessions from browser clients to a server.

The connection is first established with the browser client, step **350**, by exchanging packets as was explained in more detail in FIG. **11A**. These packets to the browser for establishing the connection are TCP packets with the browser client's IP address; they are not affected by the modifications to the IP output module since the TCP protocol is designated for these connection packets. The incoming and outgoing connection packets are saved and later played back to the assigned server for TCP state migration, as was also shown in FIG. **11A**.

Once the connection is established with the client, load balancer **70** waits for the URL and then parses the URL to determine the requested resource. For more complex URL's, such as those containing coordinates of an icon, load balancer **70** needs to decode the URL to determine what resource is being requested. This decoding is normally done by the HTTPD server software. The resource location is thus determined, step **352**, and resource-based load balancing can now be performed, step **354**. Load balancing occurs among those servers which contain the requested files or resource.

The virtual IP address of the destination for each packet is changed to the real IP address of the assigned server, step **356**, before each packet played back to the assigned server is sent to modified IP output module **206**. The real IP address is used to determine the real NIC address of the assigned server before the IP address is changed back to the virtual IP address by modified IP output module **206**. A sendto() call, step **358**, is used to send the packets to modified IP output module **206**.

Fault-Tolerant Web Site—FIG. **19**

FIG. **19** is a diagram of a fault-tolerant web site with a back-up load balancer and dual Internet connections. Browser **10** sends requests through Internet **66** with a virtual IP address for the whole web site. Incoming packets with the virtual IP address are routed to load balancer **70** over local LAN **144**. Local LAN **144** may contain routers, switches, and hubs when servers are located on separate network nodes. Local LAN **144** connects to Internet **66** through Internet connection **142** which directly connects to Internet connection router **140**, and through Internet connection **148**, which is connected to Internet connection router **146**.

Two separate connections **142**, **148** are provided to Internet **66** to provide a backup when one connection fails, either due to line problems or failure of a connection router or other hardware or software. Having two connections increases the bandwidth which is needed for larger web sites. Each connection **142**, **148** may be a slower T1 telecommunications connection, which supports 1.5 mega bits per second (Mbps), or a more powerful T3 connection which supports 45.5 Mbps. Other Internet connections may be used and mixed freely. Additional Internet connections may be added as demand increases simply by adding another connection router to connect the new connection to local LAN **144**.

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Since the load balancer is no longer in the router, several connection routers may be used and added or subtracted as needed without affecting load balancing. Standard routers and new technologies can be used. The connection router is not limited to having a certain operating system used by the load balancer. Should a connection router **140**, **146** fail, a backup connection router can continue to connect the web servers to Internet **66**. There is no single point of failure.

A backup load balancer **70'** is also provided to take over operation should primary load balancer **70** fail. These load balancers are located on separate servers to lessen the chance that both fail at the same time. Backup load balancer **70'** closely monitors primary load balancer **70** to detect a failure.

The content of the web site is not mirrored to each server's disk. However, to prevent the failure of one server from making some content unavailable, at least one backup copy is made of each file in the web site. For example, file.html **26** exists on disk **62** attached to server **52**, and a backup copy of file.html **26'** is located on disk **60** of server **51**. Load balancer **70** maintains a table or other data structure of all the locations of files in the web site which is used for load balancing. Software utilities may be used to replicate new files or delete all copies of old files. Access statistics of each file or directory of files can be kept to determine which files are more frequently used and should be replicated to more servers, and which files are infrequently used and only two copies should be kept.

Content A is located on disk **58** attached to server **56**, which is used for both load balancing and as a server. Content A is also located on disk **60** attached to server **51**. Content B is located on disk **60** and disk **62**, while content C is located on disk **58** and disk **63** accessed by server **55**, which also contains backup load balancer **70'**.

A failure of one disk or one server does not crash the entire web site, or even make unavailable some of its content, as all content is backed up on at least one other server. When a failure occurs, system maintenance software makes another backup copy of the lost files so that a second failure does not make some files unavailable.

Even a failure by load balancer **70** does not bring down the web site as backup load balancer **70'** is ready to take over load balancing. A failure by the Internet connection router also does not lock out the entire web site as a backup connection and router can be used.

ADVANTAGES OF THE INVENTION

Request-level load-balancer granularity is provided by the web site since a browser sees a failure only when the assigned server fails while processing the URL request. Since the entire web site uses a virtual IP address, client caching of the IP address causes no problems, as all new requests are routed to the load balancer, or the backup load balancer when the primary load balancer fails.

The invention provides a highly fault-tolerant web site. Such a web site greatly reduces the probability that a user gets the "SERVER NOT RESPONDING" error message when a server fails at the web site. Request-level granularity results in fewer browser users being caught when a server crashes; only those users having a current request being served by that server experience an error. Other requests in a session at that web site, and future sessions are not affected.

Servers and routers and even Internet connections can be added or removed without bringing down the web site. Thus a highly maintainable and expandable web site is continuously available to users. The load balancer itself is a user-level software program in the application layer which is more easily modified than lower-level kernel modules.

The standard TCP/IP layers are used except for modifications to the IP layer. This is an advantage since standard software is used as much as possible. The application layer runs the standard httpd server software. Modified server software is not needed. Having the load balancer in the application layer simplifies node management and allows code tweaks to occur with minimal interruption.

ALTERNATE EMBODIMENTS

Several other embodiments are contemplated by the inventors. For example various local networks may be used, including those which use token-ring or other NIC addresses rather than MAC address as the local or physical network address. Switches, hubs, and hardware or software-based routers can be inserted for larger networks.

Each server can process requests from multiple clients, especially when multitasking operating systems such as UNIX and Windows NT are used. While a connection through the public Internet has been described, the connection could also be made through private networks such as corporate networks known as Intranets. Intranets are just a subset of the larger Internet. Thus the web site could be behind a corporate firewall and not be visible to the users of the Internet.

The web site may be a "web-hoster" containing many web sites for different companies rather than a single web site. To support a variety of different sites the load balancer may be modified to accept multiple virtual IP addresses for support of "multi-homed" servers. Heterogeneous clusters could contain different types of servers with each server running different operating systems (OS's) such as UNIX, Windows/NT, SOLARIS, etc.

The web farm has been described as having a 'local' network, but this local network could be local only in the sense that it is not the Internet backbone. Servers in the web farm may be geographically remote, where some of the servers are located in one city while other servers are located in other cities. Load balancing may be performed not just based on content, but also geographically to minimize traffic on the network backbone. The parts of the web site in a city may be connected locally through one or more LAN's, while being connected to other cities using a WAN. The IXP protocol can be used for all packets sent from the load balancer to the assigned server, even when multiple hops are not required.

The invention has been described as a browser accessing a file on the server, but the file may actually be a resource which is not necessarily a traditional file. The file may be a program, applet, or script which is executed, or an interface into an SQL database or to fast or memory-intensive computational resource. Web servers support application-Programming Interfaces (API's) which enable servers to be compiled with unique capabilities for alternate types of server resources.

Since these resources are expensive to implement on all servers, it is desired to allocate just one or a few servers to handling requests for these resources. The invention waits to perform load-balancing and assign a server until after the URL has been parsed. Thus the invention is ideal for assigning specialty servers having these resources. The web site can be segregated by resource and still be load-balanced.

The invention may also be applied to other Internet traffic as well. The invention could be applied to a File-Transfer-Protocol (FTP) server, a rlogin server, or a telnet server, either as a stand-alone site or as part of a larger website.

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While delayed resource binding is preferred, other embodiments are contemplated. HTTP redirection from the scheduler to the assigned server may be used after the URL has been parsed. The load balancer sends the client the address of the assigned server and instructs the client to re-issue the URL request using the assigned server's address. Thus redirection is delayed until the URL is parsed and the requested content is determined.

The URL passed to web server can also be modified to reference relocated web pages without changing the links.

The foregoing description of the embodiments of the invention has been presented for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Many modifications and variations are possible in light of the above teaching. It is intended that the scope of the invention be limited not by this detailed description, but rather by the claims appended hereto.

We claim:

1. A web site for sending resources to a browser on a client connected to a computer network, the web site comprising:

a network connection point for receiving incoming data packets from the computer network and for transmitting outgoing data packets to the computer network;

local network, coupled to the network connection point, for transferring data packets;

a plurality of network nodes containing web servers with resources, the plurality of network nodes connected to the local network, the plurality of network nodes including means for transmitting the resources as outgoing data packets to the client, the plurality of network nodes including means for sending the outgoing data packets over the local network to the network connection point;

wherein the plurality of network nodes containing web servers together contain all resources at the web site, but each network node in the plurality of network nodes contains only a portion of all the resources at the web site;

a balancer network node containing a load balancer, receiving the incoming data packets transmitted over the local network from the network connection point, the load balancer for determining an assigned server in the plurality of network nodes for responding to a request from the client in an incoming data packet, the load balancer including means for transferring a connection to the client to the assigned server;

wherein the balancer network node containing the load balancer is connected to the network connection point by the local network which is also connected to the plurality of network nodes,

wherein network nodes are segregated to contain different resources, and wherein all resources at the web site are not mirrored to all network nodes at the web site,

wherein the load balancer further comprises:

content means for storing an indication of which network nodes in the plurality of network nodes contain each resource;

URL means, receiving incoming data packets from the client containing a request for a resource, for determining a requested resource from the incoming data packets;

compare means, coupled to the content means and coupled to the URL means, for comparing the requested resource to the indication of which network nodes in the plurality of network nodes contain each resource, and for outputting a list of network nodes containing the requested resource;

balancing means, receiving the list of network nodes containing the requested resource, for choosing as an assigned node one of the network nodes in the list of network nodes,

whereby the incoming data packets are routed to the balancer network node but outgoing data packets bypass the balancer network node and whereby the load balancer chooses an assigned node based on the resources contained by each network node, the load balancer performing resource-based load balancing.

2. The web site of claim **1** wherein the balancer network node is in the plurality of network nodes containing web servers.

3. The web site of claim **1** wherein the web site is addressable by one network address for all web servers in the plurality of network nodes containing web servers.

4. The web site of claim **1** further comprising:

delay means, in the load balancer, for delaying assignment of the assigned node until an incoming data packet containing the request for the resource is received,

whereby load balancing is delayed.

5. The web site of claim **1** further comprising:

redirect means, in the load balancer, for directing the client to issue a new URL request directly to the assigned node using an address of the assigned node provided by the load balancer to the client;

whereby the client is redirected to the assigned server by the load balancer.

6. A computer-implemented method of servicing requests for resources from a client by nodes containing different resources, the computer-implemented method comprising the steps of:

making a connection and setting up a session between the client and a load balancer at a web site for servicing requests from clients;

waiting for a URL request from the client once the load balancer has made the connection with the client;

receiving the URL request from the client and decoding the URL request to determine a requested resource;

comparing an identifier for the requested resource to identifiers for resources located on a plurality of nodes and determining a first subset of the plurality of nodes which contain the requested resource and a second subset of the plurality of nodes which do not contain the requested resource;

assigning the URL request to an assigned node in the first subset of the nodes which contain the requested resource, by determining the assigned node to be a server in the first subset of the nodes which is least busy processing requests, wherein the assigned node is not in the second subset;

transferring the connection and the session setup to the assigned node containing the requested resource by storing packets received from the client when establishing the connection and by transmitting the packets to the assigned node after the URL request is received;

reading the requested resource on the assigned node and transmitting the requested resource to the client,

whereby the assigned node is selected based on a location of the requested resource determined from the URL request and load balancing is performed among nodes

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having the requested resource and the connection is transferred from the load balancer to the assigned node by re-transmitting the packets to the assigned node.

7. The computer-implemented method of claim **6** wherein the packets received from the client are TCP/IP packets having a destination IP address being a virtual IP address of the load balancer, and wherein the step of transmitting the packets to the assigned node comprises:

changing the virtual IP address of the load balancer in the packets to a real IP address of the assigned node and passing the packets to a modified IP layer;

determining from the real IP address a physical route from the load balancer to the assigned node over a network and generating a physical network address for the assigned node and attaching the physical network address to the packets;

changing the real IP address in the packets back to the virtual IP address before transmission of the packets with the physical network address,

whereby the physical network address is generated from the real IP address of the assigned node, but the packets transmitted to the assigned node contain the virtual IP address of the load balancer.

8. The computer-implemented method of claim **6** wherein the packets received from the client are TCP/IP packets having a destination IP address being a virtual IP address of the load balancer, and wherein the step of transmitting the packets to the assigned node comprises:

changing the virtual IP address of the load balancer in the packets to a real IP address of the assigned node and passing the packets to a modified IP layer;

determining from the real IP address a physical route from the load balancer to an intermediate router in a path to the assigned node over a network and generating a physical network address of the intermediate router and attaching the physical network address of the intermediate router to the packets; and

transmitting packets having the real IP address of the assigned node as the destination IP address and the virtual IP address of the load balancer appended to data in the packet;

recovering the virtual IP address of the load balancer from the data in the packet when the packet is received by the assigned node,

whereby the physical network address of the intermediate router is generated from the real IP address of the assigned node, the load balancer and the assigned node being separated by the intermediate router.

9. The computer-implemented method of claim **7** wherein the load balancer is a program in an application layer above a TCP layer which is above the modified IP layer which is above a link layer, wherein the step of receiving the URL request from the client comprises:

receiving at least one TCP/IP packet from the client and assembling an IP datagram from the at least one TCP/IP packet in the modified IP layer;

changing a protocol for the IP datagram from TCP to an unrecognized protocol;

bypassing the TCP layer and transmitting the IP datagram to the load balancer in the application layer through a raw IP socket,

whereby the TCP layer is bypassed for incoming TCP/IP packets of the URL request.

10. The computer-implemented method of claim **9** wherein the step of transferring the connection and the session setup to the assigned node containing the requested resource further comprises:

passing the packets with the virtual IP address up through a modified IP layer and a standard TCP layer to a standard server application in an application layer on the assigned node, the assigned node being configured to accept packets with either the real IP address of the assigned node or the virtual IP address of the load balancer,

whereby the assigned node uses the modified IP layer and the standard server application.

11. The computer-implemented method of claim **10** wherein the step of transmitting the requested resource to the client from the assigned node comprises

transmitting the requested resource in TCP/IP outgoing packets which contain the virtual IP address of the load balancer as a source IP address but an IP address for the client as the destination IP address, wherein the TCP/IP outgoing packets bypass a node with the load balancer,

whereby incoming packets are routed to the load balancer but the outgoing packets bypass the node with the load balancer.

12. The computer-implemented method of claim **11** further comprising the steps of:

creating a session entry for the client in the load balancer when the URL request from the client is received by the load balancer;

updating the session entry for the client to indicate the assigned node when the load balancer assigns the URL request to the assigned node,

whereby the load balancer tracks sessions between clients and assigned nodes.

13. The computer-implemented method of claim **12** further comprising the steps of:

reading a FIN flag in the TCP/IP outgoing packets and determining that the TCP/IP outgoing packet is a FIN packet when the FIN flag is set;

changing the IP address of the client to the virtual IP address of the load balancer as the destination IP address for the FIN packet;

transmitting the FIN packet to the load balancer and closing the session entry for the client in the load balancer in response to the FIN packet;

re-transmitting from the load balancer the FIN packet to the client,

whereby FIN packets are intercepted by the load balancer.

14. A fault-tolerant server farm for serving resources to browser clients remotely located on a network, the resources containing links to other resources not located at the server farm but located on distant computers on the world-wide web, each link being a universal-resource locator (URL), the URL indicating a host name and a requested resource, the host name indicating a server farm on the network containing the requested resource, the fault-tolerant server farm comprising:

a network connection for transferring packets from the network to a local network;

a plurality of nodes, each node being a computer containing a disk and a connection to the local network;

a plurality of frequently-accessed resources stored on the disk for each node;

a plurality of less-frequently-accessed resources, each of the less-frequently-accessed resources stored on disks for at least two nodes but not stored on the disk for each node;

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a primary load balancer, residing on a primary node in the plurality of nodes, for receiving all incoming packets from the network connection, the primary load-balancer assigning URL requests from browser clients to nodes in the plurality of nodes, wherein the primary load balancer comprises:

storage means for storing at least a portion of connection incoming packets for establishing a connection between a browser client and the server farm;

reply means for generating acknowledgment packets to the browser client in response to the connection incoming packets;

URL decoder means, receiving a URL packet once the connection with the browser client is made, for decoding the URL to determine a requested resource requested by the browser client;

assignment means for selecting an assigned node in the plurality of nodes by not selecting nodes which have disks which do not contain the requested resource;

transfer means for transferring the connection to the assigned node by constructing packets using the storage means which stored at least a portion of connection incoming packets;

pass-through means for transferring incoming packets from the browser client to the assigned node once the connection has been transferred to the assigned node,

a secondary load balancer, residing on a secondary node in the plurality of nodes, for receiving all incoming packets from the network connection when the primary load balancer fails, the secondary load-balancer assigning URL requests from browser clients to nodes in the plurality of nodes,

whereby each node does not contain all resources at the server farm and the primary and secondary load balancers reside on nodes connected to the local network.

15. The fault-tolerant server farm of claim **14** further comprising:

balancing means, coupled to the primary load balancer and to the secondary load balancer, for assigning connection incoming packets to either the primary load balancer or to the secondary load balancer,

whereby load balancing is distributed between the primary load balancer and the secondary load balancer.

16. The fault-tolerant server farm of claim **15** wherein the network is the Internet, the fault-tolerant server farm further comprising:

a secondary Internet connection for transferring packets from the Internet to a local network,

whereby two Internet connections connect the local network to the Internet.

* * * * *

EXHIBIT 1016
U.S. Patent 7,315,900 to Ofelt *et al.* ("Ofelt")

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US007315900B1

(12) **United States Patent**
Ofelt et al.

(10) **Patent No.: US 7,315,900 B1**
(45) **Date of Patent: Jan. 1, 2008**

(54) **MULTI-LINK ROUTING**

(75) Inventors: **David Ofelt**, Redwood City, CA (US); **Steven Wilson Turner**, Menlo Park, CA (US); **Dennis Ferguson**, Mountain View, CA (US)

(73) Assignee: **Juniper Networks, Inc.**, Sunnyvale, CA (US)

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(51) **Int. Cl.**
G06F 15/173 (2006.01)
G06F 15/16 (2006.01)

(52) **U.S. Cl.** **709/238**; 709/245

(58) **Field of Classification Search** 709/238, 709/223, 225, 236, 250, 245; 370/389, 469, 370/254, 401, 230, 392
See application file for complete search history.

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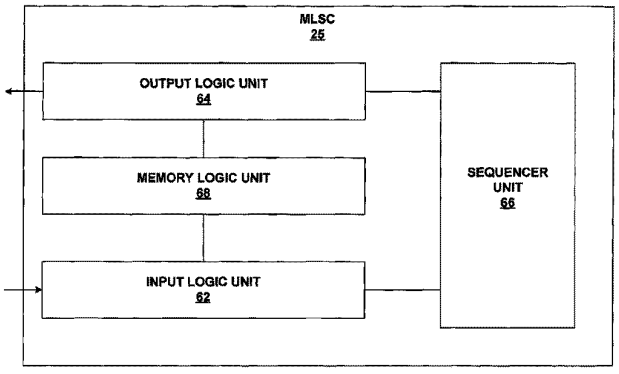
(Continued)

Primary Examiner—William Vaughn
Assistant Examiner—Kristie D. Shingles
(74) *Attorney, Agent, or Firm*—Shumaker & Sieffert, P.A.

(57) **ABSTRACT**

The invention is directed to techniques for supporting multi-link protocols within a computer network. In one embodiment, a method includes receiving a set of data blocks from a plurality of links in one or more interface cards according to a multi-link protocol and sending the data blocks to a multi-link service card for sequencing. The data blocks may then be sent to the one or more interface cards for communication to a destination device over a computer network. Implementing a multi-link service card may allow a network device, such as a router, to support multi-link protocols.

44 Claims, 13 Drawing Sheets



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FIGURE 1

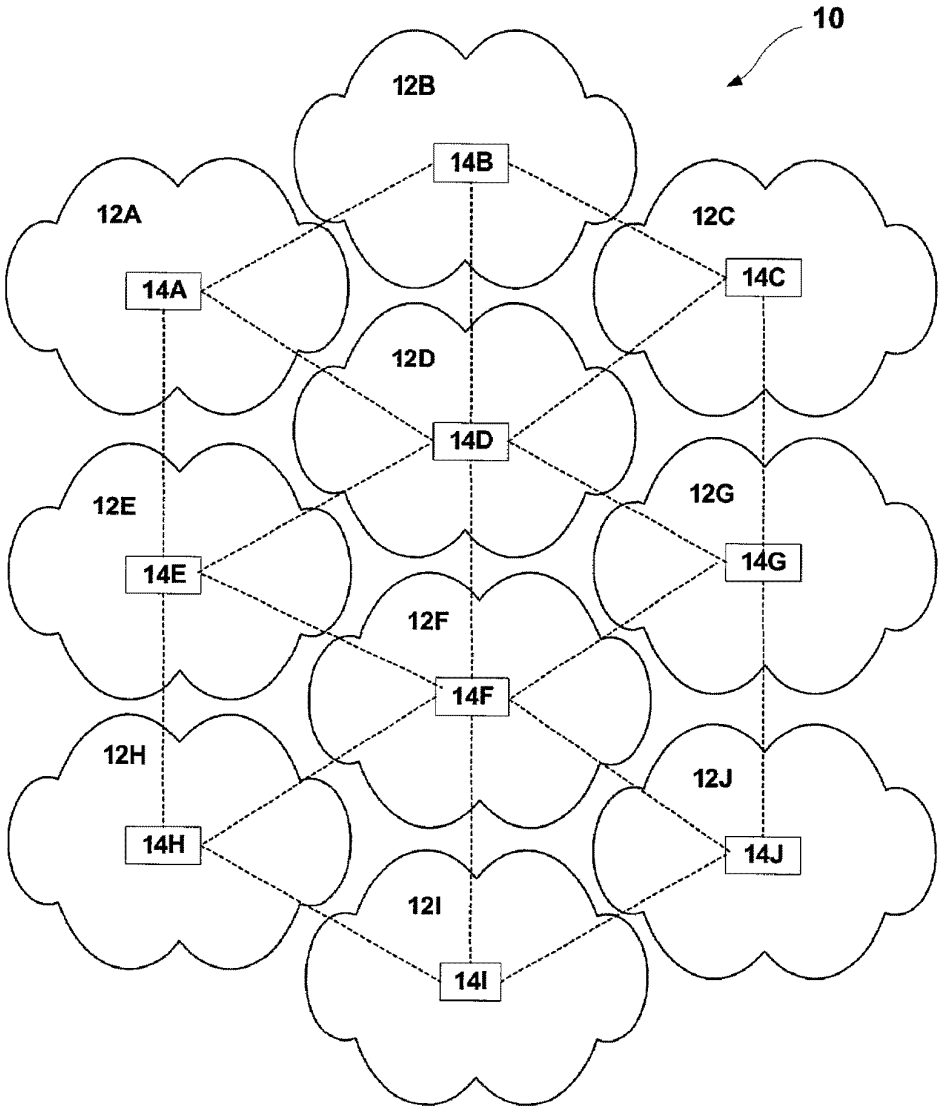

10
12B
14B
12A
12C
14A
14C
12D
14D
12E
12G
14E
14G
12F
14F
12H
12J
14H
14J
12I
14I

FIGURE 2A

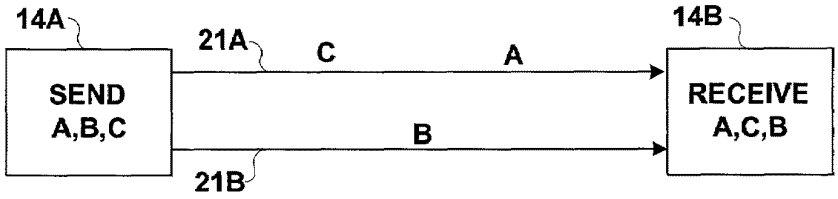


FIGURE 2B

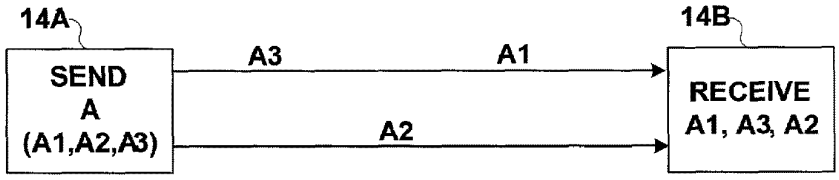


FIGURE 2C

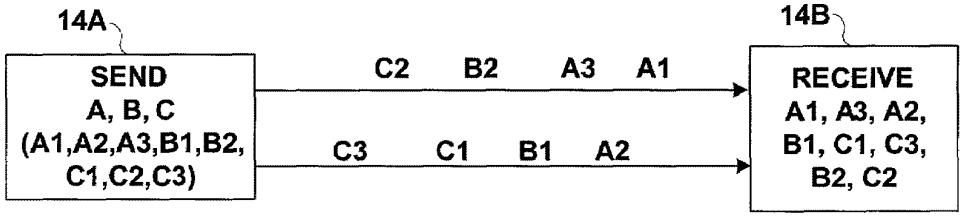


FIGURE 3

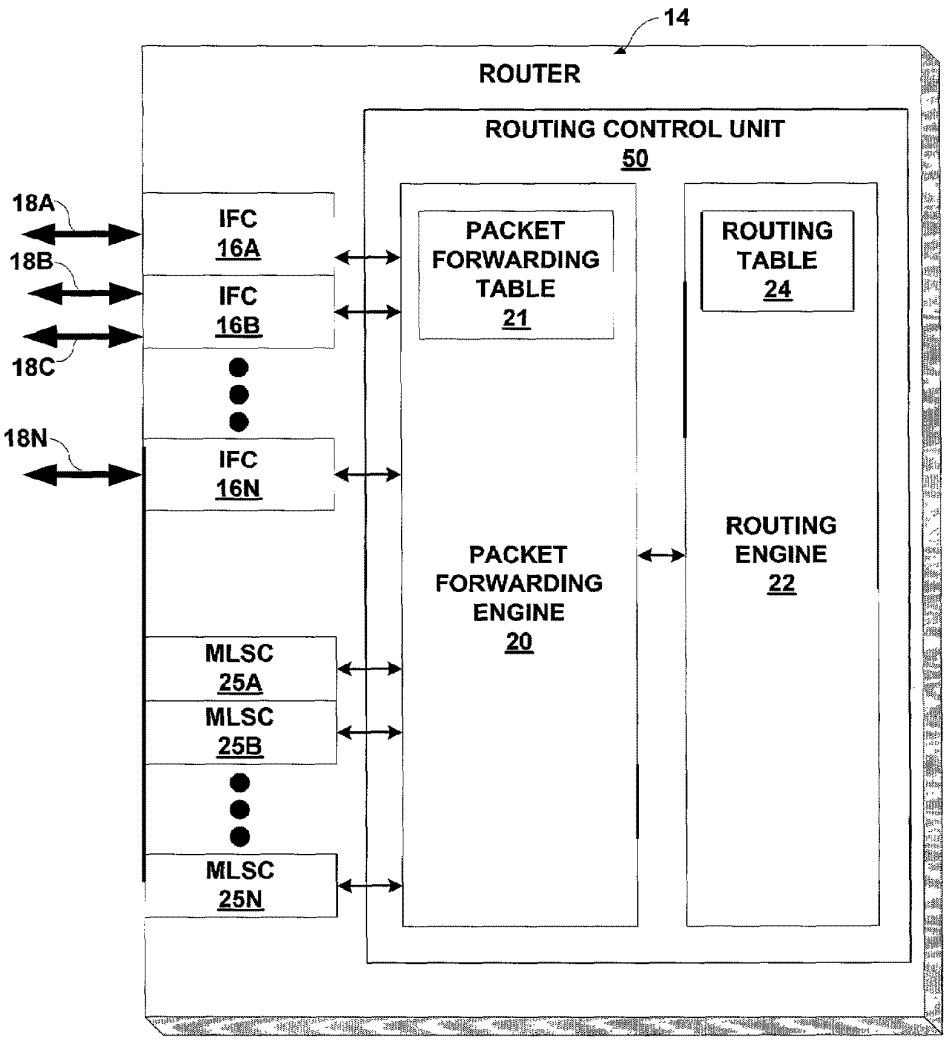

14
ROUTER
ROUTING CONTROL UNIT
50
18A
18B
18C
18N
IFC
16A
IFC
16B
IFC
16N
PACKET
FORWARDING
TABLE
21
ROUTING
TABLE
24
PACKET
FORWARDING
ENGINE
20
ROUTING
ENGINE
22
MLSC
25A
MLSC
25B
MLSC
25N

FIGURE 4

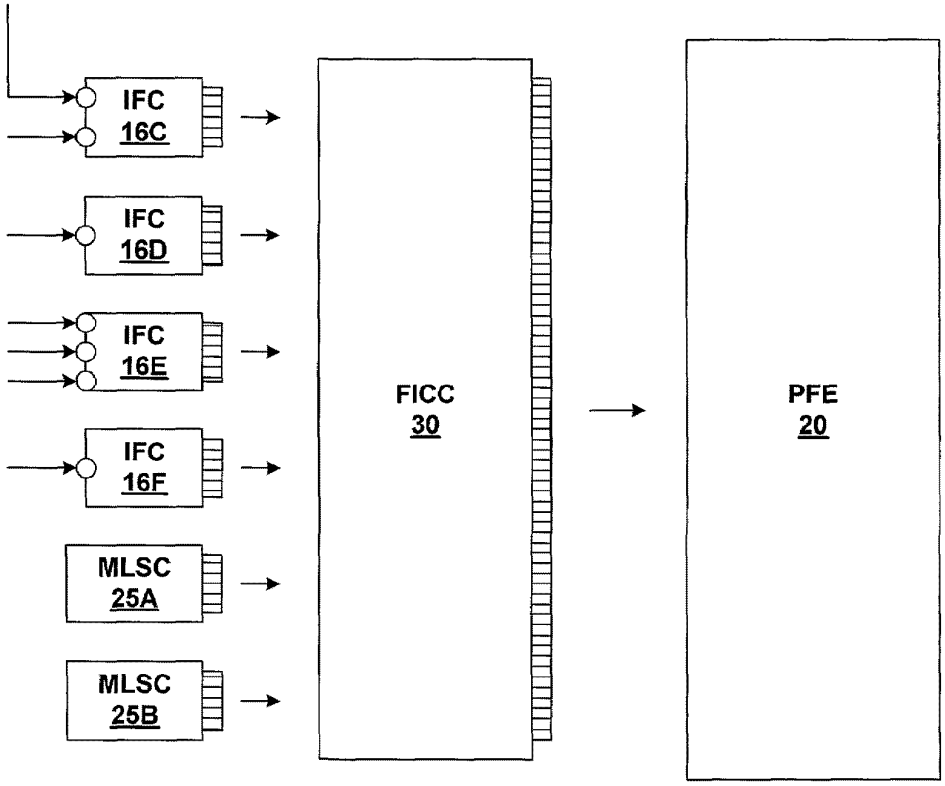


FIGURE 5A

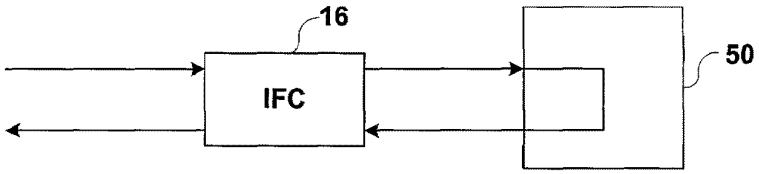


FIGURE 5B

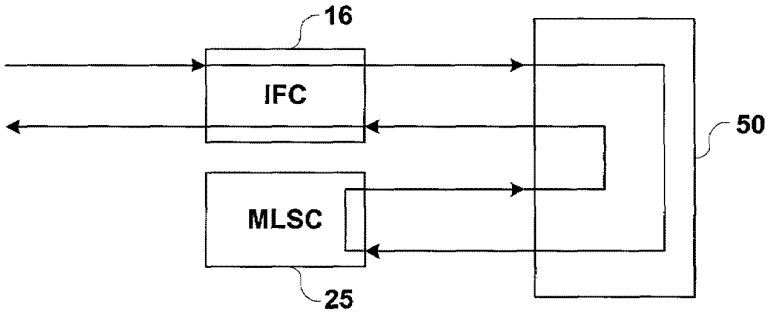


FIGURE 5C

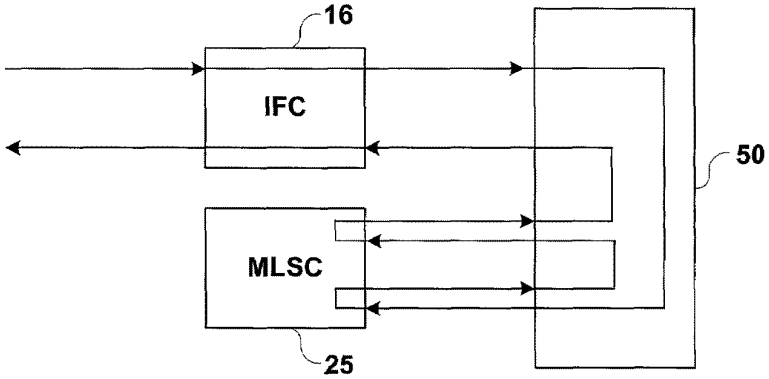
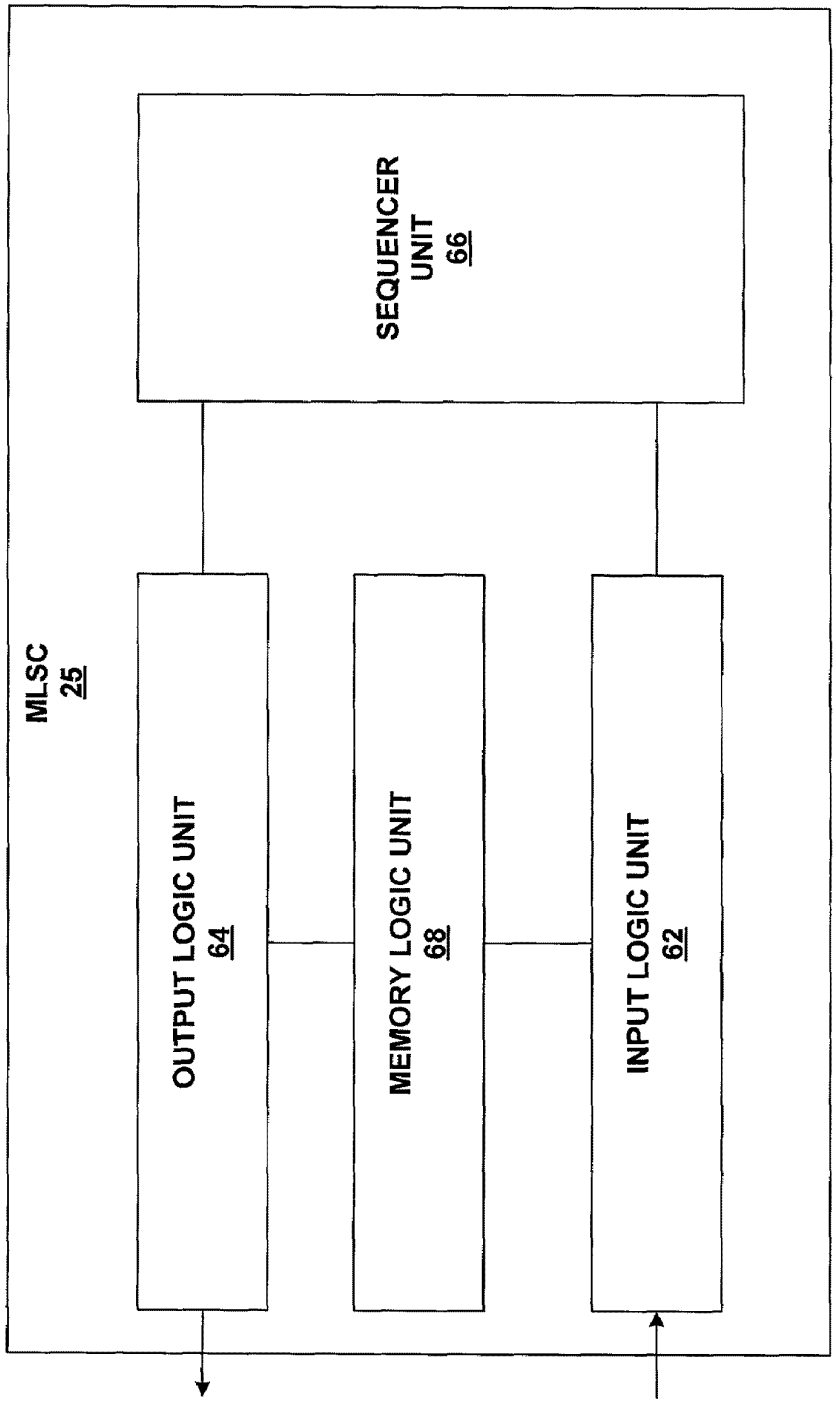


FIGURE 6


MLSC
25
SEQUENCER UNIT
66
OUTPUT LOGIC UNIT
64
MEMORY LOGIC UNIT
68
INPUT LOGIC UNIT
62

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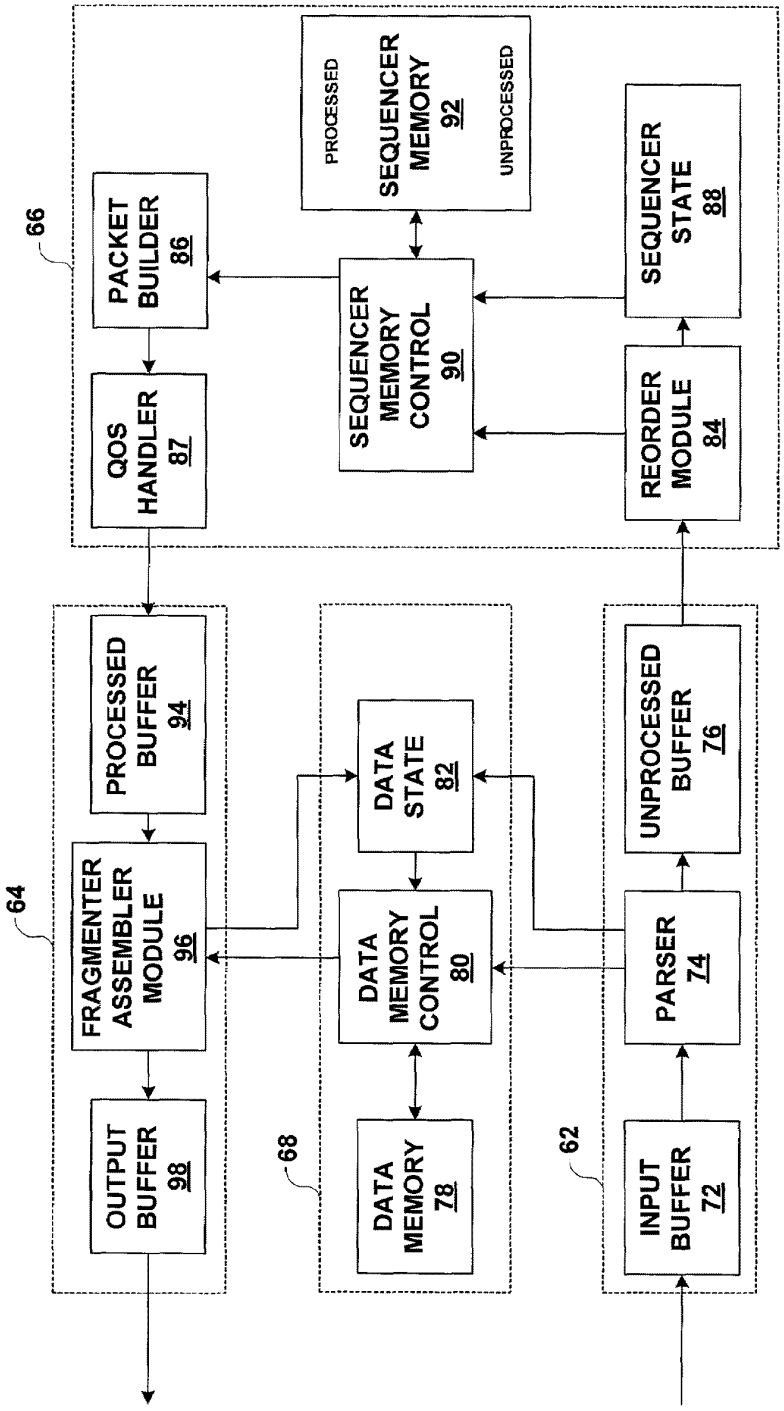


FIGURE 7

363

FIGURE 8A

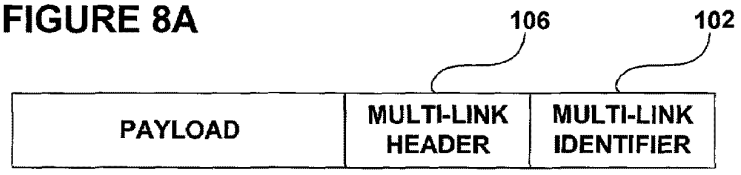


FIGURE 8B

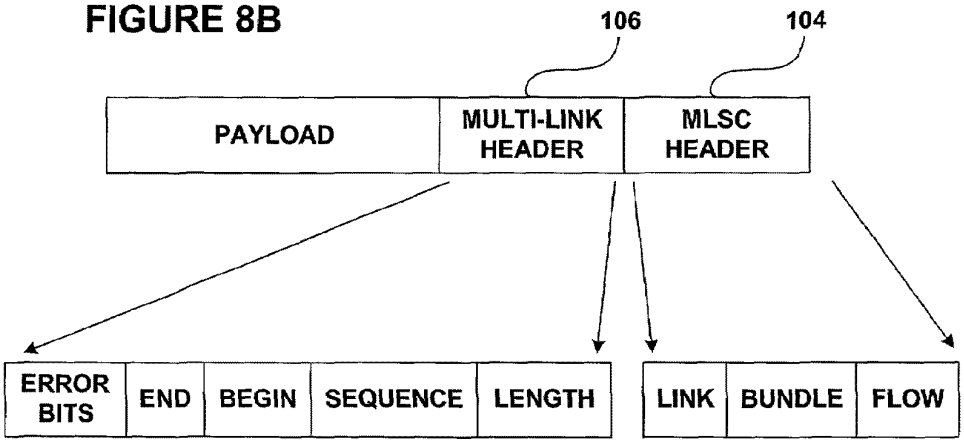


FIGURE 9

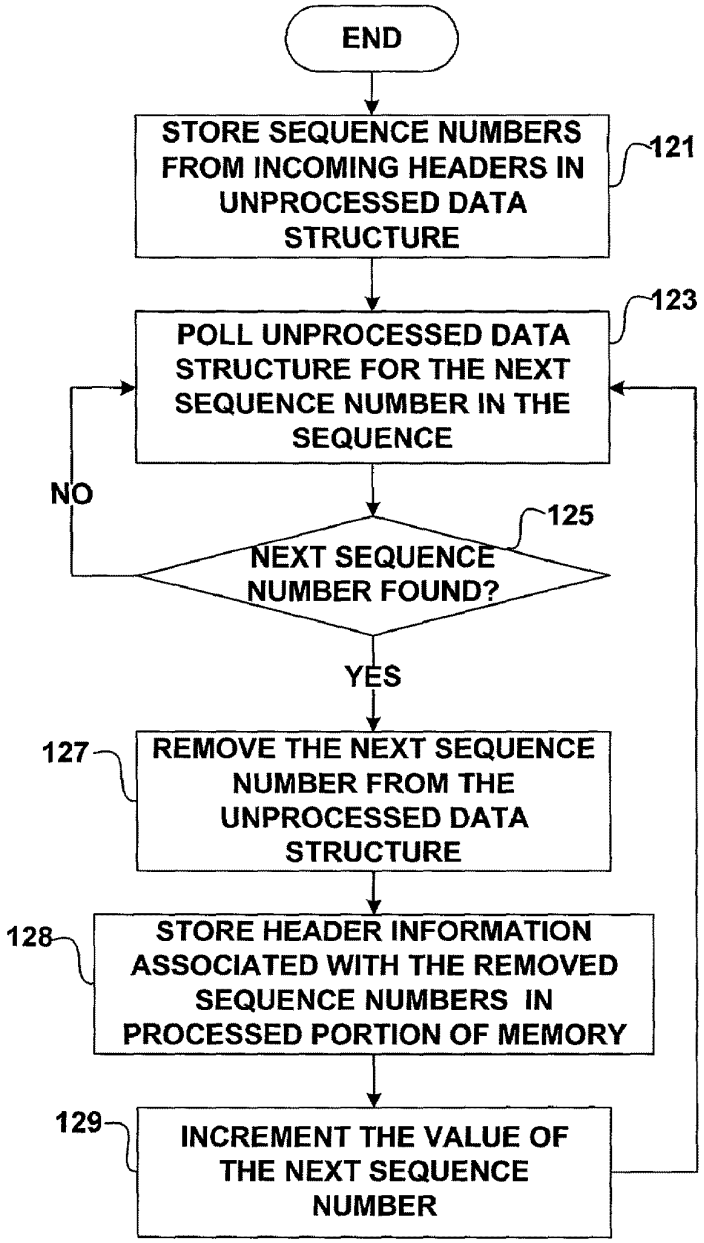

END
STORE SEQUENCE NUMBERS FROM INCOMING HEADERS IN UNPROCESSED DATA STRUCTURE
121
POLL UNPROCESSED DATA STRUCTURE FOR THE NEXT SEQUENCE NUMBER IN THE SEQUENCE
123
NO
NEXT SEQUENCE NUMBER FOUND?
125
YES
REMOVE THE NEXT SEQUENCE NUMBER FROM THE UNPROCESSED DATA STRUCTURE
127
STORE HEADER INFORMATION ASSOCIATED WITH THE REMOVED SEQUENCE NUMBERS IN PROCESSED PORTION OF MEMORY
128
INCREMENT THE VALUE OF THE NEXT SEQUENCE NUMBER
129

FIGURE 10

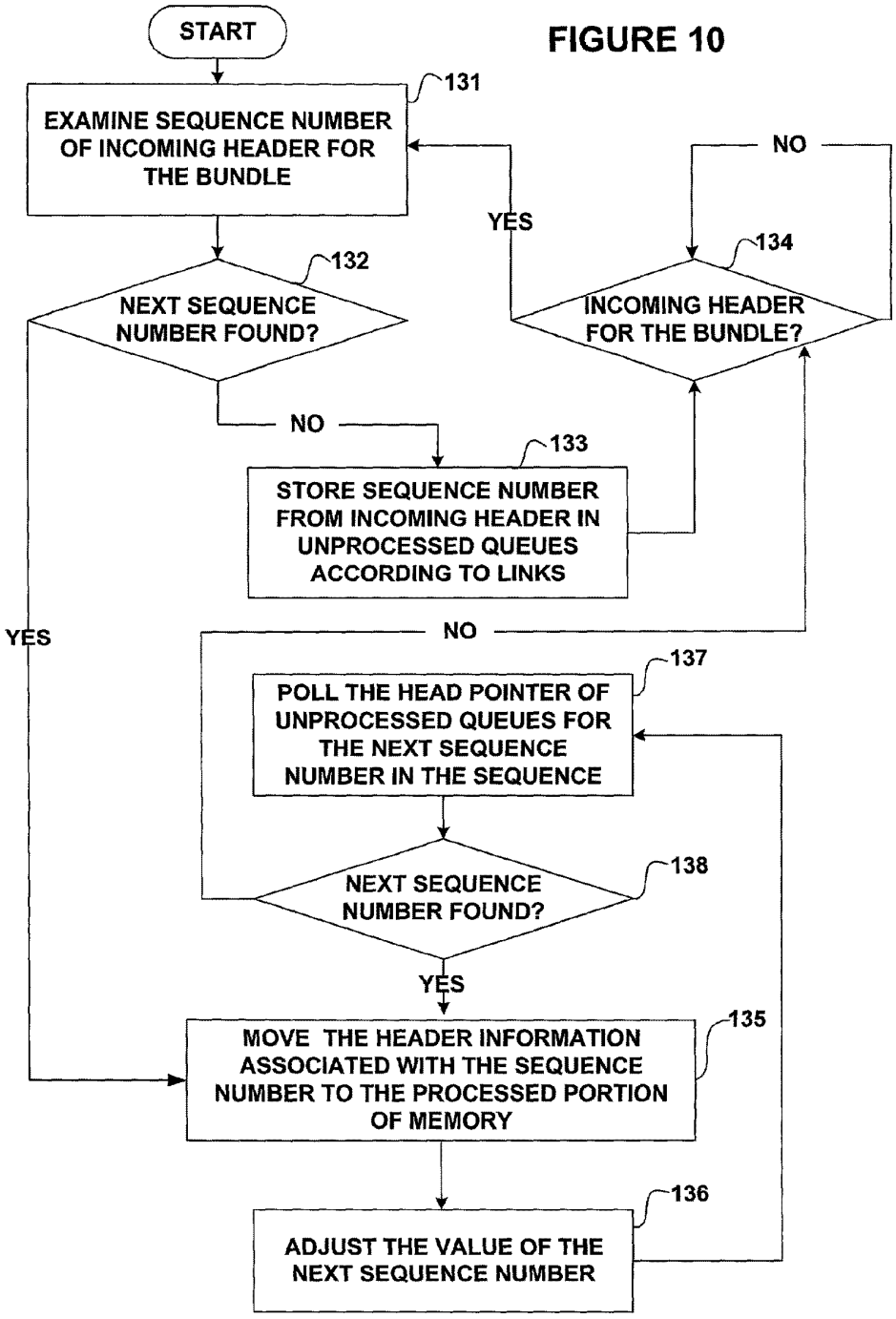

START
EXAMINE SEQUENCE NUMBER OF INCOMING HEADER FOR THE BUNDLE
131
NEXT SEQUENCE NUMBER FOUND?
132
NO
YES
INCOMING HEADER FOR THE BUNDLE?
134
NO
STORE SEQUENCE NUMBER FROM INCOMING HEADER IN UNPROCESSED QUEUES ACCORDING TO LINKS
133
YES
NO
POLL THE HEAD POINTER OF UNPROCESSED QUEUES FOR THE NEXT SEQUENCE NUMBER IN THE SEQUENCE
137
NEXT SEQUENCE NUMBER FOUND?
138
YES
MOVE THE HEADER INFORMATION ASSOCIATED WITH THE SEQUENCE NUMBER TO THE PROCESSED PORTION OF MEMORY
135
ADJUST THE VALUE OF THE NEXT SEQUENCE NUMBER
136

FIGURE 11

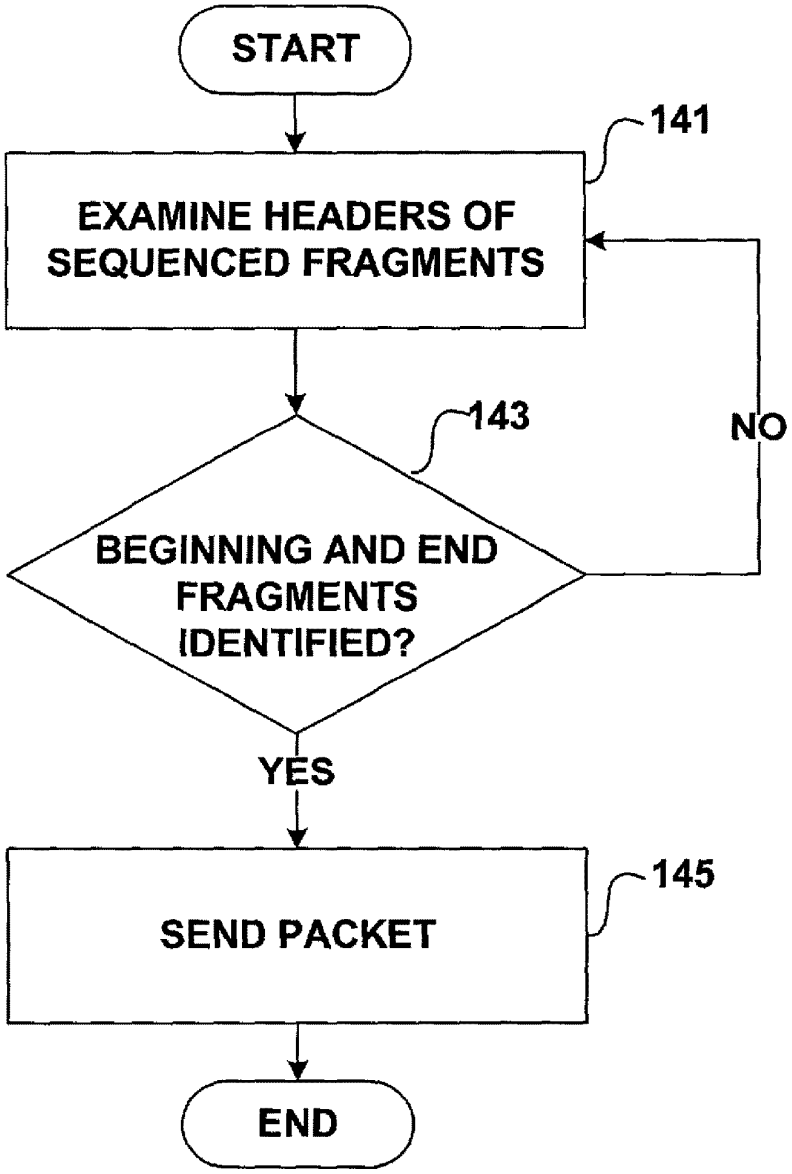

START
141
EXAMINE HEADERS OF SEQUENCED FRAGMENTS
143
NO
BEGINNING AND END FRAGMENTS IDENTIFIED?
YES
145
SEND PACKET
END

FIGURE 12

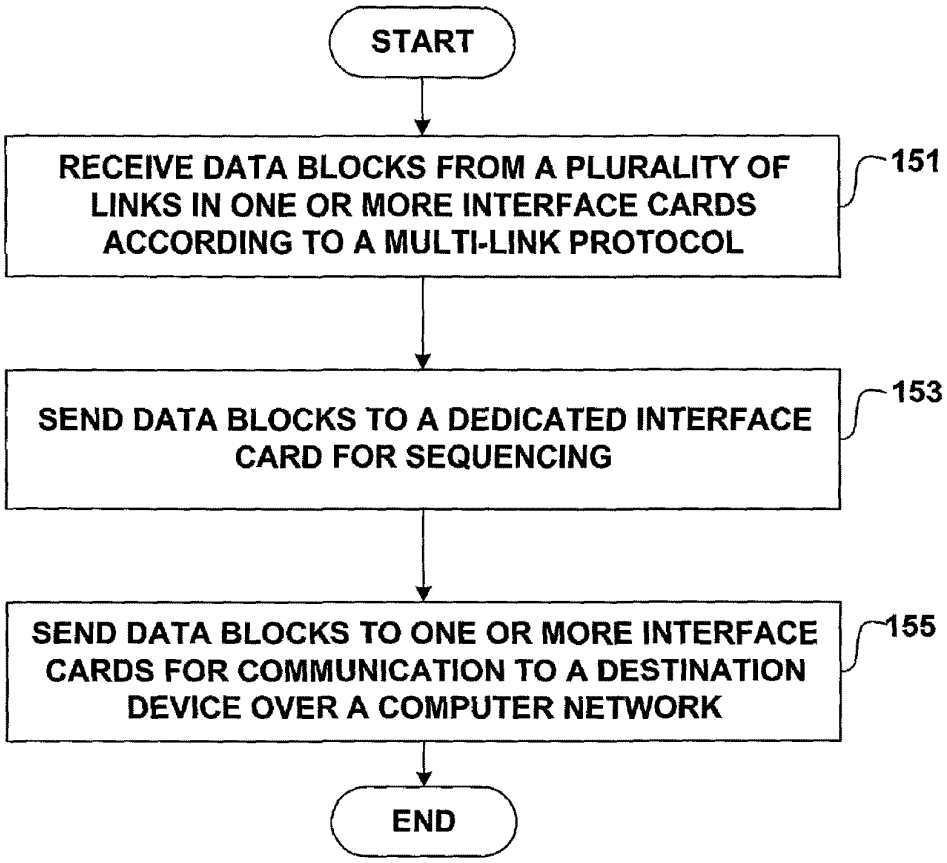
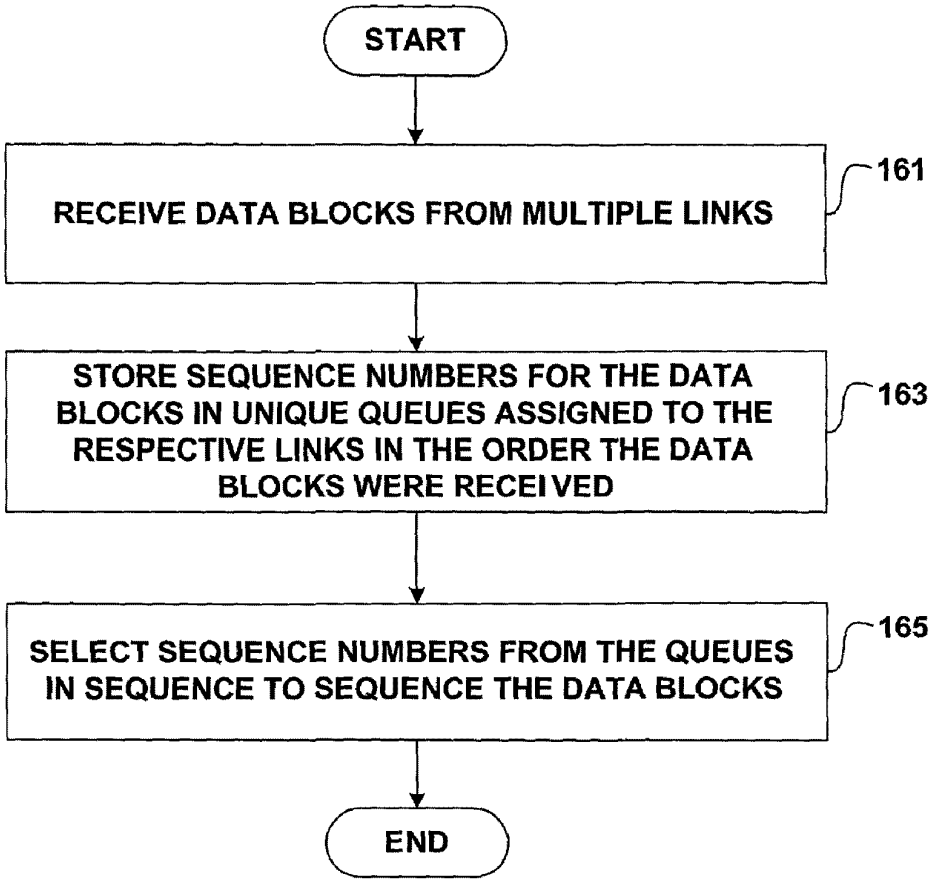

START
RECEIVE DATA BLOCKS FROM A PLURALITY OF LINKS IN ONE OR MORE INTERFACE CARDS ACCORDING TO A MULTI-LINK PROTOCOL
151
SEND DATA BLOCKS TO A DEDICATED INTERFACE CARD FOR SEQUENCING
153
SEND DATA BLOCKS TO ONE OR MORE INTERFACE CARDS FOR COMMUNICATION TO A DESTINATION DEVICE OVER A COMPUTER NETWORK
155
END

FIGURE 13


START
RECEIVE DATA BLOCKS FROM MULTIPLE LINKS
161
STORE SEQUENCE NUMBERS FOR THE DATA BLOCKS IN UNIQUE QUEUES ASSIGNED TO THE RESPECTIVE LINKS IN THE ORDER THE DATA BLOCKS WERE RECEIVED
163
SELECT SEQUENCE NUMBERS FROM THE QUEUES IN SEQUENCE TO SEQUENCE THE DATA BLOCKS
165
END

MULTI-LINK ROUTING

FIELD

The invention relates to routing data over computer networks and, more particularly, to supporting multi-link protocols in computer networks.

BACKGROUND

A computer network is a collection of interconnected computing devices that can exchange data and share resources. In a packet-based network, such as the Internet, the computing devices communicate data by dividing the data into small data blocks called packets, which are individually routed across the network from a source device to a destination device. The destination device extracts the data from the packets and assembles the data into its original form. Dividing the data into packets enables the source device to resend only those individual packets that may be lost during transmission.

Routing devices within the network, often referred to as routers, maintain tables of routing information that describe available routes through the network. A "route" can generally be defined as a unit of information that defines a path between two locations on the network. Upon receiving an incoming data packet, the router examines header information within the packet to identify the destination for the packet. Based on the header information, the router accesses the routing table, selects an appropriate route for the packet and forwards the packet accordingly.

The connection between two devices on a network is generally referred to as a link. The link may be a physical transmission line such as a copper wire, a coaxial cable, or any of a host of different fiber optic lines. In addition, the link may be wireless link. As networks grow in size and complexity, devices such as routers and switches can be used to manage and improve data transfer between the various computer devices in the network. Large computer networks, such as the Internet, may include a collection of networks connected by routers that are configured to route data between the networks and computer devices in those networks.

A variety of protocols have been developed to manage and improve data block transfer between the various devices and networks. One class of protocol that has been developed to improve data block transfer is referred to as "multi-link" protocol, in which a sequence of data can be transferred between two devices via more than one link. For example, a subset of the packets can be sent over one link, while the remaining packets in the sequence can be sent over one or more other links. In addition, multi-link protocol may allow a single packet to be transferred over more than one link. For example, the multi-link protocol may break a packet into even smaller data blocks, called fragments, and then send some fragments over one link and other fragments over one or more other links. Multi-link Point to Point Protocol (PPP) (RFC-1990) and Multi-link Frame Relay (FRF. 15 and FRF. 16) are two current protocols that allow multiple physical links to be treated by a router as a single logical link.

Communicating data blocks such as packets or fragments over multiple links can cause the data blocks to be received in a different sequence than the sequence in which they were transmitted, requiring the data blocks to be "re-sequenced" at the destination device. For example, assume packet A is fragmented into fragments A_1, A_2, and A_3. Packets A_1 and A_3 may be sent over link, while A_2 is sent over $link_2$. Due to differing propagation delays of $link_1$ and $link_2$, fragments A_1 and A_3 may be received from $link_1$ before fragment A_2 is received from $link_2$.

SUMMARY

In general, the invention provides a multi-link service card (MLSC) for use in a router. The MLSC allows the router to support multi-link protocols by directing the sequencing and/or assembly of inbound data blocks. In addition, the MLSC may direct the fragmentation of outbound data blocks or the division of a sequence of outbound data blocks for transmission over multiple links. In this manner, existing routers can easily be retrofitted with multi-link capabilities.

The router may include a number of interface cards (IFCs). The MLSC may be viewed by the router in the same way as the other IFCs. For this reason, the MLSC can be viewed as a virtual port of the router. The router may send data blocks to the virtual port and may receive data blocks from the virtual port. The virtual port may perform tasks that facilitate multi-link capabilities in the router.

In one embodiment, the invention provides a method that includes receiving data blocks in one or more interface cards according to a multi-link protocol and sending the data blocks to a service card for sequencing. The data blocks may be packets or fragments, and the service card may be a multi-link service card that is not directly coupled to any of the links. Alternatively, the multi-link service card may be integrated as part of an interface card. The method may also include sending the data blocks to the service card a second time for fragmentation before sending the data blocks to the interface cards for communication over the network.

In another embodiment, the invention provides a router that includes an interface card for receiving a set of data blocks from a source within a computer network according to a multi-link protocol, and a multi-link service card. The router may also include a routing control unit coupled to the interface card and the multi-link service card, to forward the set of data blocks from the interface card to the multi-link service card for sequencing. The router may include a plurality of interface cards and/or a plurality of multi-link service cards.

The routing control unit may include a packet forwarding engine coupled to the interface card and the multi-link service card. In addition, the routing control unit may include a interface card concentrator that couples the interface card and the multi-link service card to the packet forwarding engine. Moreover, the routing control unit may include a routing engine coupled to the packet forwarding engine. The routing control unit may forward sequenced data blocks to the multi-link service card for fragmentation.

In another embodiment, the invention provides a router that includes an interface card for receiving data blocks from a computer network and an interface card for sequencing the data blocks. In another embodiment, the invention provides a router that includes an interface card for receiving data blocks from a computer network and an interface card for fragmenting the data blocks.

In another embodiment, the invention provides a multi-link service card including an input logic unit that receives data blocks; a sequencer unit, coupled to the input logic unit, that sequences the data blocks; and an output logic unit, coupled to the sequencer unit, that sends sequenced data blocks. The multi-link service card may also include a

memory logic unit, coupled to the input logic unit and the output logic unit, that stores at least part of the data blocks during sequencing.

The input logic unit may include an input buffer, an unprocessed buffer and a parser. The output logic unit may include an output buffer, a processed buffer and a fragmenter-assembler module, and may fragment sequenced data blocks. The memory logic unit may include a memory device such as synchronous dynamic random access memory (SDRAM), a data memory control, and data state logic. The sequencer unit may include a reorder module, a packet builder that builds packets from sequenced data blocks, a sequencer memory device such as SDRAM, a sequencer memory control and sequencer state logic.

In another embodiment, a invention provides a method that includes receiving data blocks from multiple links, and storing sequence numbers of the data blocks in data queues in the order the data blocks were received. The data blocks received from each link may be stored in a unique queue assigned to the respective link. The method may also include selecting sequence numbers from each queue in sequence to sequence the data blocks. The method may also include polling head pointers associated with the queues for a particular sequence number and moving header information associated with the selected sequence numbers to a processed memory location.

Additional details of these and other embodiments are set forth in the accompanying drawings and the description below. Other features, objects and advantages will become apparent from the description and drawings, and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram illustrating an exemplary computer network.

FIGS. **2**A-**2**C are block diagrams illustrating exemplary communication of data blocks over multiple links according to a multi-link protocol.

FIG. **3** is a block diagram illustrating an example router consistent with the principles of the invention.

FIG. **4** illustrates a flexible interface card concentrator (FICC) for coupling a plurality of cards to a packet forwarding engine of the router.

FIGS. **5**A-**5**C are block diagrams illustrating data flow through the router consistent with the principles of the invention.

FIGS. **6** and **7** are block diagrams of a multi-link service card (MLSC) consistent with the principles of the invention.

FIGS. **8**A-**8**B illustrate an exemplary format of a data block.

FIGS. **9**-**13** are flow diagrams illustrating example modes of operation of the router consistent with the principles of the invention.

DETAILED DESCRIPTION

In general, the invention is directed to techniques for supporting multi-link protocols within a computer network. The techniques facilitate the sequencing of data blocks, such as packets, received from a multi-link connection by directing the blocks to a service card. Similarly, packets destined for transmission over a multi-link connection can be directed to the service card for partitioning and routing to one of the links. In addition, the service card can be used to fragment individual packets and route the fragments to one or more links, or reassemble fragmented packets. The service card can be used to enhance the capabilities of legacy routers. In particular, the service card can be added as an upgrade to routers that were not originally configured to support multi-link protocols. In this manner, the invention provides a flexible and efficient mechanism for supporting multi-link capabilities within a router.

FIG. **1** is a block diagram illustrating a computer network **10** in which a group of autonomous systems (AS) **12**A-**12**J are interconnected by a number of routers **14**A-**14**J. Each AS **12** may include any number of interconnected computer devices. Data blocks, such as packets or packet fragments, may be communicated through network **10** over respective communication links (indicated by dotted lines) that interconnect routers **14**A-**14**J. Each individual router **14** may transfer data blocks through network **10** according to a routing algorithm or a local routing table. In addition, each router **14** may maintain a routing table or algorithm that describes the available paths through network **10**. When a router **14** receives a packet, for example, the router **14** may select the "next hop" for the packet according to the routing table or algorithm, and may forward the packet over the appropriate link. The next hop for a packet is the next destination for the packet, given a particular route chosen by the router **14** sending the packet.

Multi-link protocols, such as Multi-Link PPP and Multi-Link Frame Relay, allow connected routers **14** to treat multiple links between one another as a single logical link. In other words, multi-link protocols allow data blocks of a sequence of data blocks to be transferred from one router **14** to another router **14** in parallel using multiple links. Using multiple links to transfer a sequence of data blocks can increase bandwidth and, therefore, improve the data transfer rate. However, communicating the data blocks over multiple links can cause the data blocks to be received in a different order than the order in which they were transmitted, requiring the data blocks to be re-sequenced.

As shown in FIG. **2**A, for example, a sequence of data blocks {A,B,C} sent by router **14**A over multiple links **21**A and **21**B may be received in temporal order as {A,C,B} by router **14**B. Router **14**A may simultaneously transmit the first two packets, A and B, over links **21**A and **21**B, followed by packet C on link **21**A. Due to differing propagation delays of links **21**A and **21**B, however, the packets may be received out of order. As shown, router **14**B may receive packets A and C before packet B, even though packet B was sent by router **14**A earlier in time than packet C.

Multi-link protocols may also be used to break single packets into packet fragments, and send the fragments over multiple links to improve throughput. This, however, raises the same problems addressed above. For example, differing propagation delays of the respective links may cause the fragments to be received out of order. FIG. **2**B, for instance, illustrates a scenario where an outbound packet A is fragmented into fragments {A**1**, A**2**, A**3**} before being sent over multiple links. As shown, fragment A**3** may be received before fragment A**2** even though fragment A**2** was sent earlier in time than packet A**3**. As packets are fragmented and sent over multiple links, the problem may compound, such that fragments for different packets overlap, as illustrated by FIG. **2**C.

Upon receiving the packets, router **14**B re-sequences the packets according to the techniques described herein. More specifically, as described in detail below, router **14**B includes a multi-link service card (MLSC) to ensure that data blocks, such as packets or fragments, are properly sequenced when they are received. In one configuration, router **14**B can receive one or more multi-link service cards

using ports designed to receive conventional interface cards (IFCs). Thus, each MLSC may have the same pin interconnection interface as a conventional IFC. In this manner, routers that were not originally adapted to support multi-link protocols can be more readily retrofitted with a multi-link service card, thus providing the device with multi-link capabilities.

FIG. **3** is a block diagram illustrating an example router **14** consistent with the principles of the invention. Router **14** includes one or more interface cards (IFCs) **16**A-**16**N for interfacing with network ports **18**A-**18**N. Each IFC **16** may include one or more network ports **18**. A network port **18** may include a single link, or alternatively a single network port may include a plurality of links. For instance, network port **18**A may be a T3 line. The T3 line may be treated as a single link, or the T3 line may be channelized, for example, into a number of T1 lines. In the later case, each T1 line in the channelized T3 line may be treated as a separate link for multi-link protocols.

Router **14** may use multi-link protocols to combine a plurality of physical links into a single logical link, referred to as a "bundle." The particular links that make up a particular bundle can be defined by router **14** and the multi-link protocol. For example, in accordance with some embodiments of the invention, router **14** may logically associate links connected to different physical ports as part of the same bundle. Indeed, router **14** may even logically associate links connected to ports of different IFCs **16** as being part of the same bundle.

Routing control unit **14** routes inbound packets received from a port **18** to an appropriate outbound port **18** in accordance with routing information stored in routing table **24**. In one embodiment, control unit **50** may comprise routing engine **22** and forwarding engine **20**. Routing engine **22** maintains routing information within routing table **24** to represent a network topology. Forwarding engine **20** analyzes routing table **24** prior to receiving packets and preselects routes to be used when forwarding packets. Forwarding engine **20** stores the selected routes in forwarding table **21**. Upon receiving an inbound packet, forwarding engine **20** examines information within the packet to identify the destination of the packet. Based on the destination, forwarding engine **20** selects an available route and forwards the packet to one of the IFC's **16**.

In accordance with the invention, router **14** may include one or more service cards such as multi-link service cards (MLSC) **25**A-**25**N. Each MLSC **25** facilitates the sequencing of data blocks, such as packets or fragments, that are received from a source via a multi-link connection. In addition, each MLSC **25** may facilitate fragmentation so that outgoing data blocks can be fragmented and sent over multiple links. Moreover, MLSC **25** may allow a stream of outbound data blocks to be divided for transmission over multiple links. For simplicity, many details of the operation of MLSC **25** will be provided by explaining the sequencing and assembling of fragments and the fragmentation of a packet into fragments. Of course, the same or similar techniques could be used to sequence packets, or to break up a large stream of packets for transmission over multiple links. In general, the methods and techniques for sequencing, assembly, fragmentation and division that are described in detail below can be implemented with any format of data blocks, including packets, fragments, or any other data block.

When a fragment is received from a multi-link source in one or more inbound ports **18**, routing control unit **50** examines header information within the fragment identifying the fragment as coming from a multi-link source, and identifies the destination of the fragment as MLSC **25**. Routing control unit **50** adds header information to the fragment that will be used by MLSC **25**, and forwards the fragment to MLSC **25**. In this manner, a collection of fragments that make up a packet are forwarded to the same MLSC **25**. MLSC **25** sequences the fragments and assembles the fragments into a sequenced packet. Once sequenced, the packet is forwarded from MLSC **25** back to routing control unit **50**. Upon receiving an inbound packet, routing control unit **50** identifies the destination of the packet to determine a route, determines the port associated with the route, adds appropriate header information to the packet, and forwards the packet to the appropriate port.

If the packet is to be forwarded over multiple links, it may need to be fragmented. MLSC **25** can be used to facilitate the fragmentation. Thus, if the packet is to be forwarded over multiple links, the packet may be forwarded back to MLSC **25** from routing control unit **50** for fragmentation. MLSC **25** may fragment the packet and then forward the fragments back to routing control unit **50**. Routing control unit **50** then identifies the destination of the fragments, determines the outgoing port for each fragment, adds appropriate header information to the fragments and forwards the fragments to the appropriate ports. In this manner, the fragments can be transmitted over multiple links according to a multi-link protocol.

As shown in FIG. **4**, router **14** may include a flexible interface card concentrator (FICC) **30** that receives plurality of cards and couples the cards to packet forwarding engine **20**. For instance, as shown in FIG. **4**, FICC **30** couples IFCs **16**C-**16**F and MLSCs **25**A and **25**B to packet forwarding engine **20**. FICC **30** may include memory for storing data blocks that are received. Packet forwarding engine **20** may remove header information from the data blocks stored in FICC **30** to facilitate the routing of the data blocks, regardless of which card received the data block.

When packet forwarding engine **20** directs FICC **30** to forward a data block to an MLSC **25**, possibly for sequencing, the MLSC **25** processes the data block and then communicates the data block back to FICC **30**. Packet forwarding engine **20** processes the data block in the same way as any other inbound data block. In this manner, a data block may make a plurality of trips through an MLSC **25** before being ultimately forwarded on to a destination device over the network. For example, inbound packets from a multi-link connection may be forwarded to an MLSC **25** for sequencing, and the sequenced packets may be again forwarded to an MLSC **25** a second time to be fragmented before being routed over the network.

In one embodiment, the MLSC **25** is integrated as part of an IFC **16**. For example, the card may have multiple logical ports. Some logical ports may be physically connected to other network devices via one or more links. Other logical ports may be virtual ports that are not connected to other network devices, but include the MLSC logic that is described in detail below.

FIGS. **5**A-**5**C are block diagrams illustrating three exemplary data flows through a router consistent with the principles of the invention. Routing control unit **50**, for example, may include a packet forwarding engine, a routing engine, and a flexible interface card concentrator (FICC), although the scope of the invention is not limited in that respect. FIG. **5**A illustrates the normal data flow through a router. Notably, FIG. **5**A illustrates how, during the normal data flow through a router, the data block is forwarded to router control unit **50** for processing and then forwarded back to a port of IFC **16**

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for transmission over the network. The incoming port and outgoing port often reside on different IFCs, however, only a single IFC **16** is illustrated for simplicity.

FIG. **5**B illustrates the data flow through a router when an MLSC **25** is used for either sequencing or fragmentation. FIG. **5**B illustrates that when MLSC **25** is used according to an embodiment of the invention, a data block may make multiple passes through router control unit **50**. For example, data blocks received from a plurality of links in one or more interface cards according to a multi-link protocol may be sent to router control unit **50**. The data blocks may then be sent out of router control unit **50** to one or more service cards, such as MLSC **25**, for sequencing. After sequencing, the sequenced data blocks may be sent back to router control unit **50** for routing, before being ultimately sent to one or more interface cards for communication to a destination device over a computer network.

FIG. **5**C illustrates the data flow of data blocks that are both sequenced and fragmented. For example, if fragments are received according to a multi-link protocol, the fragments may need to be sequenced and assembled into a sequenced packet. Then, if the sequenced packet is sent over the network according to a multi-link protocol, the packet may need to be fragmented. As shown in FIG. **5**C, the data flows through the MLSC **25** several times before being ultimately communicated over a computer network.

FIG. **6** is an exemplary block diagram of a multi-link service card (MLSC) **25** consistent with the principles of the invention. As shown, MLSC **25** may include an input logic unit **62** and an output logic unit **64** both coupled to a sequencer unit **66**. In addition, MLSC **25** may include a memory logic unit **68** coupled to the input logic unit **62** and the output logic unit **64**.

MLSC **25** may be used to sequence and assemble inbound data blocks, and may also be used to fragment outbound data blocks or to divide a stream of outbound data blocks for transmission over multiple links. For instance, MLSC **25** may be used to sequence and assemble inbound fragments into a packet, or to divide a packet into multiple fragments for transmission over multiple links. In addition, MLSC **25** may be used to sequence inbound packets, or to divide a stream of packets for transmission over multiple links. Although MLSC **25** may perform these operations using the same logic flow, it is easier to explain the operations in turn.

When fragments are received by MLSC **25** for sequencing, input logic unit **62** removes header information from the respective fragments and stores the remaining data, i.e., the payload, in memory logic unit **68**. The header information is forwarded to sequencer unit **66**, which sequences the fragments according to the header information and forwards the sequence to output logic unit **64**. Output logic unit **64** accesses memory logic unit **68** and outputs the fragments in sequence.

Sequencer unit **66** may also build the sequenced fragments into packets before forwarding the sequence on to output logic unit **64**. In such a case, output logic unit **64** may access memory logic unit **68** and output a sequenced packet.

When a data block is received by MLSC **25** to be divided for transmission over multiple links, input logic unit **62** removes header information from the data block and stores the payload in memory logic unit **68**. The header information is forwarded through the sequencer unit **66** to output logic unit **64**. Output logic unit **64** divides the data blocks into smaller data blocks, e.g., divides a packet into fragments, accesses memory logic unit **68**, and generates and assigns link identifiers and sequence numbers to the respective smaller data blocks. Multi-link headers can then be added to the respective smaller data blocks before the smaller data blocks are sent over the network according to the multi-link protocol.

FIG. **7** illustrates one exemplary implementation of MLSC **25** consistent with the principles of the invention. Input logic unit **62** may include an input buffer **72**, a parser **74**, and an unprocessed buffer **76**. Input buffer **72** temporarily stores incoming data blocks. Parser **74** removes header information from the respective data blocks, sends the remaining data, i.e., the payload, to memory logic unit **68**, and sends the header information to unprocessed buffer **76**. In addition, parser **74** may maintain and update a valid window for defining particular data blocks within a sequence of data blocks that will not cause problems in the sequencer unit **66**.

Memory logic unit **68** includes a data memory device **78**, such as synchronous dynamic random access memory (SDRAM) coupled to a data memory control **80**. Data memory control **80**, for example, may be an SDRAM controller that manages the data memory device **78**. Memory logic unit **68** may also include data state logic **82** for managing the data state in data memory **78**. Data state logic **82**, for example, may maintain the data structures within data memory device **78**, including the size and structure of queues. In addition, data state logic **82** manages the pointers of the queues and maps header information to memory locations in the data memory device **78**. For example, in one embodiment, separate queues are maintained for data received from each respective link of a bundle of links.

The header information stored in unprocessed buffer **76** is forwarded to sequencer unit **66** for sequencing. For example, sequencer unit **66** may include a reorder module **84** for sequencing incoming fragments. Sequencer unit **66** may also include a packet builder **86** that determines when a particular sequence of fragments comprises a packet, and then forwards the sequenced header information on to output logic module **64**. In some embodiments, sequence unit **66** may also include a quality of service (QOS) handler **87**.

Sequencer unit **66** may also include sequencer state logic **88**, sequencer memory control **90**, and sequencer memory device **92**. Sequencer memory device **92** may be a memory device such as SDRAM and sequencer memory control **90** may be an SDRAM controller for managing the sequencer memory device **92**. In one embodiment, sequencer memory device **92** and data memory device **78** are the same physical memory device, possibly partitioned into sequencer memory and data memory. Sequencer state logic **88**, for example, maintains and manages the data structures within the sequencer memory device **92**. Again, in one embodiment, separate queues are maintained for data received from each respective link of a bundle of links.

Output logic unit **64** may include a processed buffer **94** for temporarily storing sequenced sets of data, such as a sequenced packet. Output logic unit **64** also includes a fragmentor-assembler module **96** for accessing memory logic unit **68** and appending the appropriate header information to sequenced data blocks. The data blocks can then be temporarily stored in output buffer **98** before being sent out of MLSC **25**.

FIGS. **8**A-**8**B illustrate formats of an exemplary data block. In particular, FIG. **8**A illustrates the format of an exemplary data block received by a router **14** according to a multi-link protocol. Once received, router control unit **50** may remove header information such as multi-link identifier **102** to determine that the data block should be forwarded to

an MLSC **25** for sequencing. The routing control unit **50** may append an MLSC header **104** as shown in FIG. **8**B.

The MLSC header **104** and the multi-link header **106** are used by MLSC **25** to process data blocks. As shown in FIG. **8**B, MLSC header **104** may include bit fields defining the link, bundle and flow associated with the data block. The bundle field defines the bundle in which the data block was received. The link field defines the link within the bundle in which the data block was received, and the flow field defines whether the data block is being sent to MLSC **25** for sequencing or for fragmentation.

Multi-link header **106** is a header that was added to the data block when it was sent to router **14** according to a multi-link protocol. As shown, the multi-link header **106** may include a begin field defining the first data block of a set of data blocks, an end field defining the last data block of the set, a sequence field defining the number of blocks in the set, and an error bits field. MLSC **25** uses the MLSC header **104** and multi-link header **106** for sequencing and/or fragmentation, and uses the multi-link header **106** for packet building. Additional fields could also be added to MLSC header **104**. For example, a quality of service field could be added for prioritization of data blocks as described in greater detail below. In addition, a field could be added to define the protocol associated with the data blocks. These or other fields could be added, depending on the specific implementation.

Referring again to FIG. **7**, reorder module **84** causes data to be stored in at least one data structure for each bundle supported by the multi-link implementation. As data blocks are received, reorder module **84** stores sequence numbers of the header information associated with data blocks received from different bundles in the respective data structure for the bundle. Before the header information is sequenced, it is stored in the unprocessed portion of sequencer memory device **92**, e.g., in unprocessed queues. For each bundle, reorder module **84** continuously polls to see if the next sequence number in the sequence of data blocks for that bundle has been received. If so, reorder module **84** removes that sequence number from the data structure and causes the header information associated with that sequence number to be stored in the processed portion of sequencer memory device **92**, e.g., in a processed queue. Reorder module **84** then increments the sequence number for that bundle to look for the next data block for that bundle.

Packet builder **86** examines sequenced header information in the processed portion of sequencer memory device **92**. Once packet builder **86** detects sequenced header information of a full packet in the processed portion of sequencer memory device **92**, packet builder removes that header information and forwards it on to output logic unit **64**. Because reorder module **84** only causes sequenced header information to be stored in processed portion of sequencer memory device **92**, packet builder **86** can easily detect sequenced packets by searching for set beginning and end bits of the multi-link headers **106**. For example, when packet builder **86** detects a set beginning bit and a set end bit within a sequence stored in processed portion of sequencer memory device **92**, packet builder **86** knows that it has detected the headers of a sequenced packet. Thus, packet builder **86** can remove the sequenced header information defining the packet and forward it on to output logic unit **64**.

In some cases, quality of service (QOS) handling may also be performed in MLSC **25**. In those cases, packet builder **86** forwards the header information to QOS handler **87**, which performs quality of service handling prior to forwarding the header information on to output logic unit **64**. Quality of service handling is discussed in greater detail below. In general, quality of service processing can be applied when incoming data blocks need to be fragmented by MLSC **25**.

FIG. **9** is a flow diagram showing an exemplary operation of a sequencer unit **66** consistent with the principles of the invention. As shown, sequence numbers from incoming header information is stored in an unprocessed data structure (**121**). The unprocessed data structure is then polled (**123**) to search for the next sequence number in the sequence. If the next sequence number is found (yes branch of **125**), then the sequence number is removed from the unprocessed data structure (**127**) and header information associated with the removed sequence number is stored in the processed portion of memory (**128**), e.g., in a processed queue. The value of the next sequence number is then incremented (**129**) and the unprocessed data structure is again polled for the next sequence number (**123**). In this manner, data blocks can be sequenced using header information such as the bundle field and the sequence field (as shown in FIG. **8**B).

As discussed above, communicating data blocks such as packets or fragments over multiple links can cause the data blocks to be received in a different order than they were transmitted. However, one very powerful observation is that notwithstanding the fact that data blocks transmitted over multiple links may be received out of order; order is generally preserved on any given link. For this reason, maintaining a separate queue for each link in a given bundle can greatly enhance the speed at which data blocks can be sequenced.

If a separate queue is maintained for each link, the reorder module **84** can more easily poll for the next sequence number, and sequencer unit **66** may be able to move larger sets of sequenced data at a given time to the processed portion of sequencer memory device **92**. Sequence numbers associated with each individual link can be stored in unique queues. Because order is preserved on any given link, reorder module **84** can poll the head pointer of respective queues for the next sequence number. Moreover, reorder module **84** can save power by simply examining the sequence numbers of incoming headers for each bundle and then polling the head pointers of the queues of a particular bundle only after receiving a next sequence number.

FIG. **10** is a flow diagram illustrating exemplary operation of a sequencer unit **66** using separate queues for each link in a given bundle. As shown, for each bundle, the sequence number of an incoming header is examined (**131**). If the next sequence number is not found (no branch of **132**), the sequence number from the incoming header is stored in unprocessed queues according to links (**133**). The process may then wait until another incoming header is received for that bundle (yes branch of **134**).

If, after examining the sequence number of an incoming header (**131**), the next sequence number is found (yes branch of **132**), the header information associated with that sequence number is sent to the processed portion of memory (**135**) and the value of the next sequence number is incremented (**136**). The head pointers of the unprocessed queues are then polled for the next sequence number in the sequence (**137**). If the next sequence number is found (yes branch of **138**), the sequence number is pulled from the queue and the header information associated with that sequence number is moved to the processed portion of memory (**135**). The value of the next sequence number is then incremented (**136**) and the head pointer of the unprocessed queues are again polled for the next sequence number in the sequence (**137**). If the next sequence number is not found (no branch of **138**), the

process may then wait until another incoming header is received for that bundle (yes branch of **134**).

In operation, when a separate queue is maintained for each link in a bundle, a particular queue may continue to fill while the reorder module waits for the next sequence number for a given bundle. For example, assume the reorder module **84** is waiting for sequence number **15** of bundle one. If the queue associated with link one of bundle one contains sequence numbers **16-21**, it will continue to fill if additional sequence numbers are received as the reorder module continues to wait for sequence number **15** of bundle one. Eventually, sequence number **15** of bundle one may be received.

Once received, the header information associated with sequence number **15** will be immediately sent to the processed portion of memory, and the reorder module **84** will increment to search for sequence number **16**. Moreover, reorder module **84** will identify sequence number **16** of bundle one in the queue associated with link one of bundle one. As reorder module **84** continues to poll, sequence numbers **16-21** will be quickly removed from the unprocessed queue of link one bundle one, and the header information associated with those sequence numbers will be moved to the processed portion of memory. Reorder module **84** will then begin waiting for sequence number **22**.

Sequencer unit **66** may also implement a timer and may adjust the value of the next sequence number if too much time elapses. For example, if a data block becomes lost or corrupted during data transmission, it may not be received or identified by router **14**. The timer may ensure that the sequencer unit **66** does not continue to poll or wait for sequence numbers associated with lost or corrupted data blocks. In addition, if every queue for a particular bundle has a sequence number stored therein, and the process is still waiting for the next sequence number, the next sequence number can be incremented. In that case, the sequence number for which the process was waiting, was either lost, corrupted, or otherwise not received by the router **14**.

Sequence numbers having values less than the next sequence number may also be polled. If found, an error can be declared. In other words, if a sequence number having a value less than the next sequence number is detected, an error can be declared. In that case, packets may have been sent over a link out of order, or an error may have occurred during transmission.

Once fragments have been sequenced, they are stored, in sequence, in the processed portion of sequencer memory device **92**, e.g., in a processed queue. Packet builder **86** can then search for set beginning and end bits in the multi-link headers **106**. For example, when packet builder **86** detects a set beginning bit and a set end bit within a sequence stored in a processed queue in the processed portion of sequencer memory device **92**, packet builder **86** knows that it has detected header information for a sequenced packet. Thus, packet builder **86** can remove the sequenced header information and forward it on to output logic unit **64**.

FIG. **11** is a flow diagram illustrating the process of building a sequenced packet from sequenced fragments. As shown, headers of sequenced fragments are examined (**141**). When beginning and ending fragments of a packet are identified (yes branch of **143**), the packet can be sent (**145**). For example, the sequenced header information can be buffered and forwarded from sequencer unit **66** to output logic module **64**. The packet can then be assembled in the assembler-fragmenter module **96** before being forwarded out of MLSC **25** and ultimately sent over the network.

FIG. **12** is a flow diagram consistent with the principles of the invention. As shown, data blocks are received from a plurality of links in one or more interface cards according to a multi-link protocol (**151**). The data blocks are then sent to a service card, such as MLSC **25**, for sequencing (**153**). Once sequenced, the data blocks are sent to one or more interface cards for communication to a destination device over a computer network (**155**).

FIG. **13** is another flow diagram consistent with the principles of the invention. As shown, data blocks are received from multiple links (**161**). Sequence numbers for the data blocks are then stored in unique queues assigned to the respective links in the order the data blocks were received (**163**). Sequence numbers can then be selected from each queue, in sequence, to sequence the data blocks (**165**).

As mentioned above, in addition to sequencing, MLSC **25** may perform fragmentation. In this manner, MLSC **25** can enhance the multi-link protocol capabilities of a router by enabling the router to fragment packets, for example, according to a multi-link protocol.

Referring again to FIG. **7**, fragmenter-assembler module **64** can be used to perform fragmentation. The flow field of MLSC header **104** (as shown in FIG. 7B) can be used by MLSC **25** to determine whether the incoming data block is to be sequenced or fragmented. If the incoming data block is a fragment that needs to be sequenced, MLSC **25** will process the data block in the manner described above. However, if the incoming data block is a packet that needs to be fragmented, MLSC **25** may process the data block as described below.

When a packet is received by MLSC **25** for fragmentation, input logic unit **62** removes header information from the packet and stores the remaining data, i.e., the payload, in memory logic unit **68**. The header information is forwarded to sequencer unit **66**. The respective modules of sequencer unit **68**, such as reorder module **84** and packet builder **86**, identify the packet as a sequenced packet and forward it on to output logic unit **64**. Again, the flow field of the MLSC header (as shown in FIG. 7B) may identify whether the data block is a fragment that needs to be sequenced or a packet that needs to be fragmented.

After identifying the packet as a sequenced packet and forwarding the sequenced packet on to output logic unit **64**, the packet may be fragmented. For example, the fragmenter-assembler module **64** can fragment the packet by breaking the packet into smaller data blocks and generating and assigning link identifiers and sequence numbers to the respective data blocks. The fragmenter-assembler module **64** can then add multi-link headers on the respective data blocks. The fragmented data blocks can then be sent out of MLSC **25** to the routing control unit **50**, and ultimately sent to a destination device on the network according to the multi-link protocol.

In some cases, quality of service (QOS) handling of incoming packets that are to be fragmented by MLSC can also be performed within MLSC **25**. In those cases, packet builder **86** forwards the header information to QOS handler **87**, which performs quality of service handling prior to forwarding the header information on to output logic unit **64**. Quality of service handling can be used to give priority to particular packets, i.e., packets headed for a particular destination, packets coming from a particular source, or packets having particular characteristics. For example, packets associated with voice streaming can be given priority by the router. Providing quality of service handling can allow service providers, for example, to guarantee available band-

width for a subset of traffic flows, even when the router is receiving a total volume of incoming packets that exceed the router's output capacity.

QOS handler **87** maintains multiple queues per bundle. The number of queues per bundle depends on the implementation. When an incoming packet is received by MLSC, the respective modules of sequencer unit **68**, such as reorder module **84** and packet builder **86**, identify the packet as a sequenced packet and forward the header information on to QOS handler **87**. QOS handler then queues the header information according to whatever QOS discipline has been established. For example, header information associated with packets of a higher priority can be queued in a different queue than header information associated with packets of that same bundle having a lower priority. The header information associated with higher priority packets can then be forwarded to output logic unit **64** prior to the header information associated with the lower priority packets, in some cases, even if the header information associated with lower priority packets was received by the QOS handler **87** more recently. In this manner, the quality of service feature can be provided within MLSC **25**.

A given packet's priority can be established, for example, as part of the MLSC header (**104**, FIG. **8**B). For example, the MLSC header could include yet another field identifying priority of the data block. Alternatively, the flow field could be expanded to include additional bits. Routing control unit **50** (FIG. **3**) could set these bits with the appropriate priority information as part of the MLSC header. If the flow field identified the data block as a fragment, the additional bits would be irrelevant. However, if the flow field identified the data block as a packet, the additional bits could identify the priority of that packet. Header information could then be queued in QOS handler **87** according to priority. QOS handler **87** may include multiple queues per bundle, defining varying levels of priority. For example, eight different queues per bundle may be desirable. Header information queued in the highest priority queues could be forwarded to output logic module **64** prior to header information in the other queues. Alternatively, a more complex algorithm could determine which packets are forwarded to output logic module **64**, basing decisions on both the priority of the packet and the time when the header information was queued by QOS handler **87**.

A number of implementations and embodiments of the invention have been described. For instance, a multi-link service card (MLSC) has been described for use in a router. The MLSC may allow the router to support multi-link protocols by facilitating the sequencing, assembly, and/or fragmentation of data blocks such as packets or fragments, or the division of a stream of data blocks for transmission according to the multi-link protocol. Nevertheless, it is understood that various modifications may be made without departing from the spirit and scope of the invention. For example, the invention may be implemented to provide multi-link capabilities to various other network devices, such as switches. Moreover, the invention may be used to handle data blocks in formats other than packets or fragments. Accordingly, other implementations and embodiments are within the scope of the following claims.

The invention claimed is:

1. A method comprising:

receiving data packets from a plurality of links in one or more interface cards of a network device according to a multi-link protocol that allows multiple physical links to be treated by the network device as a single logical link;

prior to sequencing the data packets in the network device, performing a first routing operation to forward the data packets from the one or more interface cards to a multi-link service card of the network device in accordance with routing information that reflects a topology of a computer network, wherein the routing information identifies the multi-link service card as a destination for the data packets;

sequencing the data packets with the multi-link service card of the network device according to the multi-link protocol, wherein the multi-link service card of the network device facilitates support of the multi-link protocol by the network device; and

performing a second routing operation in accordance with the routing information to forward the sequenced data packets to the interface cards of the network device for communication over the computer network.

2. The method of claim **1**, wherein the multi-link service card is not directly coupled to any of the links.

3. The method of claim **1**, wherein the multi-link service card is integrated with one of the interface cards.

4. The method of claim **1**, further comprising:

sending the data packets from one or more interface cards to the destination device over multiple links according to the multi-link protocol.

5. The method of claim **4**, further comprising, prior to sending the sequenced data packets to the one or more interface cards:

sending the data packets to the multi-link service card for fragmentation.

6. The method of claim **1**, further comprising:

prioritizing the sequenced data packets to provide quality of service prior to sending the sequenced data packets to the interface cards.

7. The method of claim **1**, wherein the interface card and the multi-link service card comprise removable cards that may be inserted and removed from the network device.

8. A method comprising:

receiving a set of fragments at a network device from a plurality of links in one or more interface cards according to a multi-link protocol that allows multiple physical links to be treated by the network device as a single logical link, the set of fragments collectively comprising an unsequenced data packet;

performing a first routing operation in the network device in accordance with routing information to send the fragments to a multi-link service card of the network device for sequencing, wherein the routing information identifies the multi-link service card as a destination for the data packets and wherein the multi-link service card of the network device facilitates support of the multi-link protocol by the network device; and

performing a second routing operation in the network device in accordance with routing information to send the sequenced fragments as a sequenced data packet to the one or more interface cards of the network device for communication to a destination device over a computer network.

9. The method of claim **8**, wherein the multi-link service card is not directly coupled to any of the links.

10. The method of claim **8**, wherein the multi-link service card is integrated with one of the interface cards.

11. The method of claim **8**, further comprising:

sending the fragments from one or more interface cards to the destination device over multiple links according to the multi-link protocol.

12. The method of claim 11, further comprising, prior to sending the fragments from one or more interface cards:

sending the fragments to the multi-link service card for fragmentation.

13. A method comprising:

receiving a set of data blocks from a plurality of links in one or more interface cards of a network device according to a multi-link protocol that allows multiple physical links to be treated by the network device as a single logical link, and

performing a first routing operation in the network device to forward the data blocks from the interface cards to a first multi-link service card of the network device in accordance with routing information that reflects a topology of a computer network, wherein the routing information identifies the first multi-link service card of the network device as a destination for the data packets and wherein the first multi-link service card of the network device facilitates support of the multi-link protocol by the network device;

sequencing the data blocks in the first multi-link service card of the network device; and

performing a second routing operation in the network device in accordance with the routing information to forward the sequenced data blocks back to the one or more interface cards.

14. The method of claim 13, wherein the data blocks are fragments, the method further comprising building a packet from the fragments in the first multi-link service card.

15. The method of claim 14, further comprising fragmenting the packet in the first multi-link service card.

16. The method of claim 15, further comprising sending the fragmented packet to a destination device over a computer network.

17. The method of claim 13, wherein the first multi-link service card is not directly coupled to any links.

18. The method of claim 13, the method further comprising assembling the data blocks in a second multi-link service card.

19. The method of claim 13, further comprising prioritizing the data blocks in the first multi-link service card.

20. A router comprising:

one or more interface cards for receiving a Set of data blocks from a source within a computer network according to a multi-link protocol that allows multiple physical links to be treated by the network device as a single logical link,

a multi-link service card that facilitates support of the multi-link protocol by the router, and

a routing control unit coupled to the interface card and the multi-link service card, wherein the routing control unit performs routing operations based on routing information to select the multi-link service card as a destination and to forward the set of data blocks from the interface card to the multi-link service card for sequencing according to the multi-link protocol, and wherein following sequencing by the multi-link service card, the routing control unit selects one of the interface cards to forward the sequenced data blocks over the computer network.

21. The router of claim 20, wherein the routing control unit includes a packet forwarding engine coupled to the interface card and the multi-link service card.

22. The router of claim 21, wherein the routing control unit includes a interface card concentrator that couples the interface card and the multi-link service card to the packet forwarding engine.

23. The router of claim 21, wherein the routing control unit includes a routing engine coupled to the packet forwarding engine.

24. The router of claim 23, wherein the routing engine includes a routing table.

25. The router of claim 20, wherein the data blocks are data packets.

26. The router of claim 20, wherein the data blocks are data fragments.

27. The router of claim 20, further comprising a plurality of interface cards.

28. The router of claim 20, further comprising a plurality of multi-link service cards.

29. The router of claim 20, wherein the routing control unit forwards sequenced data blocks to the multi-link service card for fragmentation according to the multi-link protocol prior to selecting one of the interface cards to forward the sequenced data blocks over the computer network, and wherein fragments of the sequenced data blocks are sent over the computer network via the interface cards following the fragmentation according to the multi-link protocol.

30. A router comprising:

a plurality of cards, wherein the cards include interface cards for receiving data blocks from a computer network and a multi-link service card for sequencing the data blocks according to a multi-link protocol that allows multiple physical links to be treated by the router as a single logical link; and

a routing control unit coupled to the interface cards and the multi-link service card,

wherein the routing control unit maintains routing information that represents a topology of a network,

wherein the routing information represents the multi-link service card as a destination within the network, and

wherein the routing control unit performs routing operations based on routing information to forward the data blocks from the interface cards to the multi-link service card for sequencing according to the multi-link protocol and to forward sequenced data blocks from the multi-link service card to the interface cards for output to network destinations.

31. The router of claim 30, wherein the data blocks are data packets.

32. The router of claim 30, wherein the data blocks are data fragments.

33. A router comprising a plurality of cards, wherein the cards include interface cards for receiving data blocks from a computer network and a multi-link service card for fragmenting the data blocks according to a multi-link protocol that allows multiple physical links to be treated by the router as a single logical link; and

a routing control unit coupled to the interface cards and the multi-link service card,

wherein the routing control unit maintains routing information that represents a topology of a network,

wherein the routing information represents the multi-link service cards as destinations within the network, and

wherein the routing control unit performs routing operations based on routing information to forward the set of data blocks from the interface cards to the multi-link service card for fragmenting according to the multi-link protocol and to forward fragmented data blocks from the multi-link service card to the interface cards for output to network destinations.

34. The router of claim 33, wherein the data blocks are data packets.

35. A multi-link service card for insertion within a network device, the multi-link service card comprising:

an electrical interconnection interface for coupling the multi-link service card to the network device,

an input logic unit that receives data blocks from a control unit via the electrical interconnection interface in response to a first routing operation by the control unit of the network device,

a sequencer unit coupled to the input logic unit for sequencing the data blocks according to a multi-link protocol that allows multiple physical links to be treated by the network device as a single logical link, and

an output logic unit coupled to the sequencer that sends sequenced data blocks for processing by the control unit with a second routing operation, wherein the multi-link service card facilitates support of the multi-link protocol by the network device.

36. The multi-link service card of claim 35, further comprising:

a memory logic unit coupled to the input logic unit and the output logic unit for storing at least part of the data blocks during sequencing.

37. The multi-link service card of claim 35, wherein the output unit fragments sequenced data blocks.

38. The multi-link service card of claim 35, wherein the input logic unit includes an input buffer, an unprocessed buffer and a parser.

39. The multi-link service card of claim 35, wherein the output logic unit includes an output buffer, a processed buffer and a fragmenter-assembler module.

40. The multi-link service card of claim 35, wherein the memory logic unit includes a memory device, a data memory control, and data state logic.

41. The multi-link service card of claim 35, wherein the sequencer unit includes a reorder module.

42. The multi-link service card of claim 35, wherein the sequencer unit includes a packet builder for building packets from sequenced data blocks.

43. The multi-link service card of claim 35, wherein the sequencer unit includes a quality of service handler for prioritizing packets.

44. The multi-link service card of claim 35, wherein the sequencer unit includes a reorder module, a packet builder, a sequencer memory device, sequencer memory control and sequencer state logic.

* * * * *

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of Delangis	§	REQUEST FOR *Ex Parte*
	§	REEXAMINATION
U.S. Patent No.: 10,868,908	§	
	§	Attorney Docket No.: COM908
Issue Date: December 15, 2020	§	
	§	Customer No.: 165774
Filing Date: May 23, 2016	§	
	§	
Title: DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS	§	Real Party in Interest: Unified Patents, LLC

CERTIFICATE OF SERVICE

The undersigned certifies that copies of the following,

(1) *Request for Ex Parte Reexamination* Transmittal Form for U.S. Patent No. 10,868,908;

(2) *Request for Ex Parte Reexamination* of U.S. Patent No. 10,868,908;

(3) Power of Attorney;

(4) Information Disclosure Statement by Requester; and

(5) Exhibits 1001 through 1018, which include a copy of the patent to be reexamined as Exhibit 1001;

(6) Certificate of Service.

in their entirety were served on:

Harold McGurk
The Law Office of Clay McGurk
P.O. Box 1488
Orange, CA 92856

the attorney of record for the assignee of U.S. Patent No. 10,868,908, in accordance with 37 C.F.R. § 1.510(b)(5), on October 4, 2023, by the U.S. Postal Service Priority Express mail.

Dated: October 4, 2023

/Michelle Aspen/
Michelle Aspen
Unified Patents, LLC
michelle@unifiedpatents.com
Attorney for Third Party Requester
Registration No.: 75,665

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UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
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DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS

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Documents

TOTAL DOCUMENTS: 23

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
EX1001_US10868908.pdf	22	Copy of patent for which reexamination is requested	2502 KB
EX1002_File History_10868908.pdf	396	Non Patent Literature	14759 KB
EX1015_Sklower, 1996_rfc1990.pdf	25	Non Patent Literature	822 KB
EX1017_Beckman, 1995.pdf	12	Non Patent Literature	923 KB
EX1012_Simpson, 1994_rfc1661.pdf	55	Non Patent Literature	873 KB
EX1013_Araujo_US6112245.	13	Other reference-	1819 KB

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pdf		Patent/Application/Search Documents	
EX1018_Goleniewski, 2001.pdf	17	Non Patent Literature	944 KB
EX1014_Brendel_US5774660.pdf	34	Other reference-Patent/Application/Search Documents	2762 KB
EX1007_DeLangis-156.pdf	20	Other reference-Patent/Application/Search Documents	2123 KB
EX1006_Krishnan_US5809070.pdf	9	Other reference-Patent/Application/Search Documents	2093 KB
EX1004_Maurya_US6160808.pdf	20	Other reference-Patent/Application/Search Documents	3202 KB
EX1010_Briscoe, 2000.pdf	5	Non Patent Literature	362 KB
EX1009_DeLangis_349.pdf	21	Other reference-Patent/Application/Search Documents	2366 KB
EX1005_Low_WO1997022212A1.pdf	76	Foreign Reference	7390 KB
EX1011_Day, 1983.pdf	9	Non Patent Literature	5488 KB
EX1008_File History_13-531,294.pdf	275	Non Patent Literature	10938 KB
EX1016_Ofelt_7315900.pdf	25	Other reference-Patent/Application/Search Documents	2748 KB

COM908_Transmittal.pdf	4	Transmittal Letter	156 KB
COM908_COS.pdf	1	Reexam Certificate of Service	129 KB
COM908_POA.pdf	1	Power of Attorney	114 KB
COM908_IDS.pdf	2	Reexam - Info Disclosure Statement Filed by 3rd Party	344 KB
COM908_Request.pdf	56	Receipt of Original Ex Parte Reexam Request	2753 KB
EX1003_Geier_Declaration.pdf	75	Reexam - Affidavit/Declaration/Exhibit Filed by 3rd Party	2532 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
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COM908_IDS.pdf	81FDB0AC3D9B2924B9AC54091EE087358BC0C8F27340E11DAF4B000B5A9D5E09359BF76878D8722981BA8B849916CAD5F31BDA60FB01E0CC41D121C25C4825A1
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ELECTRONIC PAYMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
90/019,265	**10/04/2023 04:09:45 PM ET**	**COM908**

Title of Invention

DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS

Application Information

APPLICATION TYPE	Utility / ex parte reexam	PATENT #	10868908
CONFIRMATION #	3396	FILED BY	Ashley Cheung
PATENT CENTER #	62922746	AUTHORIZED BY	Michelle Aspen
CUSTOMER #	64828	FILING DATE	-
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	Eric M. Delangis

Payment Information

PAYMENT METHOD	PAYMENT TRANSACTION ID	PAYMENT AUTHORIZED BY
DA / 506990	**E202304G11198923**	**Ashley Cheung**

FEE CODE	DESCRIPTION	ITEM PRICE($)	QUANTITY	ITEM TOTAL($)
1812	REQUEST FOR EX PARTE REEXAM-NON-STREAMLINED	12600.00	1	12600.00
			TOTAL AMOUNT:	**$12,600.00**

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New International Application Filed with the USPTO as a Receiving Office

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Assignment Query System

Patent Assignment Abstract of Title

Total Assignments: 1

Application #: 15161787 **Filing Dt:** 05/23/2016 **Patent #:** 10868908 **Issue Dt:** 12/15/2020
PCT #: NONE **Intl Reg #:** **Publication #:** US20160269547 **Pub Dt:** 09/15/2016
Inventor: Eric M. Delangis
Title: DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS

Assignment: 1

Reel/Frame:	Received:	Recorded:	Mailed:	Pages:
056236 / 0492	05/13/2021	05/13/2021	05/14/2021	3

Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

Assignor: DELANGIS, ERIC **Exec Dt:** 05/13/2021

Assignee: COMPETITIVE ACCESS SYSTEMS, INC.
3019 CHARLES DRIVE
WYLIE, TEXAS 75098

Correspondent: CLAY MCGURK
THE LAW OFFICE OF CLAY MCGURK
PO BOX 1488
ORANGE, CA 92856

Search Results as of: 10/05/2023 06:30 AM

If you have any comments or questions concerning the data displayed, contact PRD / Assignments at 571-272-3350. v.2.6
Web interface last modified: Jun 26, 2017 v.2.6

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BIB DATA SHEET

CONFIRMATION NO. 3396

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
90/019,265	10/04/2023 RULE	370	3992	COM908

APPLICANTS

ERIC M. DELANIS, Residence Not Provided;
UNIFIED PATENTS LLC, CHEVY CHASE, MD;

INVENTORS

10868908, Residence Not Provided;
Unified Patents, LLC, Residence Not Provided;

**** CONTINUING DATA ***************************

This application is a REX of 15/161,787 05/23/2016 PAT 10868908
*which is a CON of 14/512,414 10/11/2014 PAT 9350649
which is a CON of 13/531,294 06/22/2012 PAT 8861349
which is a CON of 12/581,852 10/19/2009 PAT 8228801
which is a CON of 10/686,375 10/14/2003 PAT 7606156
which claims benefit of 60/418,521 10/15/2002

**** FOREIGN APPLICATIONS ***************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****

Foreign Priority claimed ❑ Yes ❑ No 35 USC 119(a-d) conditions met ❑ Yes ❑ No Verified and Acknowledged _____ Examiner's Signature	❑ Met after Allowance _____ Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
				17	5

ADDRESS

Harold McGurk
The Law Office of Clay McGurk
P.O. BOX 1488
Orange, CA 92856
UNITED STATES

TITLE

DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS

FILING FEE RECEIVED		
0.00	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	❑ All Fees ❑ 1.16 Fees (Filing) ❑ 1.17 Fees (Processing Ext. of time) ❑ 1.18 Fees (Issue) ❑ Other _____ ❑ Credit

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REEXAM CONTROL NUMBER	FILING OR 371 (c) DATE	PATENT NUMBER
90/019,265	10/04/2023	

CONFIRMATION NO. 3396
REEXAMINATION REQUEST NOTICE

Unified Patents, LLC
4445 Willard Ave.
Suite 600
Chevy Chase, MARYLAND 20815

OC000000063119931

NOTICE OF REEXAMINATION REQUEST FILING DATE

(Third Party Requester)

Requester is hereby notified that the filing date of the request for reexamination is 10/04/2023, the date that the filing requirements of 37 CFR § 1.510 were received.

A decision on the request for reexamination will be mailed within three months from the filing date of the request for reexamination. (See 37 CFR 1.515(a)).

A copy of the Notice is being sent to the person identified by the requester as the patent owner. Further patent owner correspondence will be the latest attorney or agent of record in the patent file. (See 37 CFR 1.33). Any paper filed should include a reference to the present request for reexamination (by Reexamination Control Number).

cc: Patent Owner
64828
Harold McGurk
The Law Office of Clay McGurk
P.O. BOX 1488
Orange, CA 92856

/rbell/

Legal Instruments Examiner
Central Reexamination Unit 571-272-7705; FAX No. 571-273-9900

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REEXAM CONTROL NUMBER	FILING OR 371 (c) DATE	PATENT NUMBER
90/019,265	10/04/2023	

CONFIRMATION NO. 3396

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The Law Office of Clay McGurk
P.O. BOX 1488
Orange, CA 92856

REEXAM ASSIGNMENT NOTICE

OC000000063119932

Date Mailed: 10/12/2023

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The above-identified request for reexamination has been assigned to Art Unit 3992. All future correspondence to the proceeding should be identified by the control number listed above and directed to the assigned Art Unit.

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NOTICE OF USPTO EX PARTE REEXAMINATION PATENT OWNER STATEMENT WAIVER PROGRAM

The USPTO has implemented a pilot program where, after a reexamination proceeding has been granted a filing date and before the examiner begins his or her review, the patent owner may orally waive the right to file a patent owner's statement. See *"Pilot Program for Waiver of Patent Owner's Statement in Ex Parte Reexamination Proceedings,"* 75 FR 47269 (August 5, 2010). One goal of the pilot program is to reduce the pendency of reexamination proceedings and improve the efficiency of the reexamination process.

Ordinarily when ex parte reexamination is ordered, the USPTO must wait until after the receipt of the patent owner's statement and the third party requester's reply, or after the expiration of the time period for filing the statement and reply (a period that can be as long as 5 to 6 months), before mailing a first determination of patentability. The USPTO's first determination of patentability is usually a first Office action on the merits or a Notice of Intent to Issue Reexamination Certificate (NIRC).

Under the pilot program, the patent owner's oral waiver allows the USPTO to act on the first determination of patentability immediately after determining that reexamination will be ordered, and in a suitable case issue the reexamination order and the first determination of patentability (which could be a NIRC if the claims under reexamination are confirmed) at the same time.

Benefits to the Patent Owner for participating in this pilot program include reduction in pendency.

To participate in this pilot program, Patent Owners may contact the USPTO's Central Reexamination Unit (CRU) at 571-272-7705. The USPTO will make the oral waiver of record in the reexamination file in an interview summary and a copy will be mailed to the patent owner and any third party requester.

cc: Third Party Requester(if any)
Unified Patents, LLC
4445 Willard Ave.
Suite 600
Chevy Chase, MARYLAND 20815

/rbell/

Legal Instruments Examiner
Central Reexamination Unit 571-272-7705; FAX No. 571-273-9900

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Kathi Vidal

Kathi Vidal
Under Secretary of Commerce for Intellectual Property and
Director of the United States Patent and Trademark Office

Derrick Brent
Deputy Under Secretary of Commerce for Intellectual Property and
Deputy Director of the United States Patent and Trademark Office

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BIB DATA SHEET

CONFIRMATION NO. 3396

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
90/019,265	10/04/2023 RULE	370	3992	COM908

APPLICANTS

COMPETITIVE ACCESS SYSTEMS INC(OWNER), Residence Not Provided;
UNIFIED PATENTS LLC, CHEVY CHASE, MD;

INVENTORS

10868908, Residence Not Provided;
Unified Patents, LLC, Residence Not Provided;

**** CONTINUING DATA ***************************

This application is a REX of 15/161,787 05/23/2016 PAT 10868908
*which is a CON of 14/512,414 10/11/2014 PAT 9350649
which is a CON of 13/531,294 06/22/2012 PAT 8861349
which is a CON of 12/581,852 10/19/2009 PAT 8228801
which is a CON of 10/686,375 10/14/2003 PAT 7606156
which claims benefit of 60/418,521 10/15/2002

**** FOREIGN APPLICATIONS ***************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****

Foreign Priority claimed ❑ Yes ❑ No 35 USC 119(a-d) conditions met ❑ Yes ❑ No Verified and Acknowledged _____ Examiner's Signature	❑ Met after Allowance _____ Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
				17	5

ADDRESS

Harold McGurk
The Law Office of Clay McGurk
P.O. BOX 1488
Orange, CA 92856
UNITED STATES

TITLE

DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS

FILING FEE RECEIVED		
0.00	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	❑ All Fees ❑ 1.16 Fees (Filing) ❑ 1.17 Fees (Processing Ext. of time) ❑ 1.18 Fees (Issue) ❑ Other _____ ❑ Credit

BIB (Rev. 05/07).

Reexamination	Application/Control No.	Applicant(s)/Patent Under Reexamination
	90/019,265	10868908
	Certificate Date	Certificate Number

Requester Correspondence Address: ☐ Patent Owner ☑ Third Party
Unified Patents, LLC 4445 Willard Ave. Suite 600 Chevy Chase, MD 20815

LITIGATION REVIEW ☑	JRP (examiner initials)	16 November 2023 (date)
Case Name		Director Initials
Competitive Access Systems, Inc. v. Oracle Corp. et al., 1:23cv00286, (W.D. Tex.)		

COPENDING OFFICE PROCEEDINGS	
TYPE OF PROCEEDING	**NUMBER**
Inter Partes Review (terminated 10/2/2023)	IPR2023-00584

/JOSEPH R POKRZYWA/ Primary Examiner, Art Unit 3992	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	90/019,265	10868908
	Examiner	Art Unit
	JOSEPH R POKRZYWA	3992

CPC - Searched*		
Symbol	**Date**	**Examiner**
H04M 3/007	11/13/2023	JRP
H04L 12/5692	11/13/2023	JRP
H04L 45/54	11/13/2023	JRP

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	**Date**	**Examiner**
reviewed underlying patent file wrapper for U.S. Pat. 10,868,908	11/13/2023	JRP
reviewed Patent Data Portal (PDP) for continuity data	11/13/2023	JRP
reviewed P-TACTS for AIA proceedings (found IPR2023-00584)	11/13/2023	JRP
reviewed IPR2023-00584 (termination on 10/2/2023)	11/13/2023	JRP

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**

/JOSEPH R POKRZYWA/ Primary Examiner, Art Unit 3992	

PTO/SB/08a (07-09)
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Substitute for form 1449/PTO				***Complete if Known***	
				Application Number	In Ex Parte Reexamination of U.S. Patent 10,868,908
INFORMATION DISCLOSURE STATEMENT *(Use as many sheets as necessary)*				Filing Date	Herewith
				First Named Inventor	Delangis
				Art Unit	TBD
				Examiner Name	TBD
Sheet	1	of	2	Attorney Docket Number	COM908

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.1	Document Number Number-Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
/J.R.P/	EX1004	6,160,808	12-12-2000	Maurya	
/J.R.P/	EX1006	5,809,070	09-15-2008	Krishnan *et al.*	
/J.R.P/	EX1007	7,606,156	10-20-2009	Delangis	
/J.R.P/	EX1009	8,861,349	10-14-2014	Delangis	
	EX1013	6,112,245	08-29-2000	Araujo *et al.*	
	EX1014	5,774,660	06-30-1998	Brendel *et al.*	
	EX1016	7,315,900	01-01-2008	Ofelt *et al.*	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.1	Foreign Patent Document Country Code3 –Number 4 –Kind Code5 (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T6
/J.R.P/	EX1005	WO 97/22212	06-19-1997	Low *et al.*		

Continued on next page

PTO/SB/08a (07-09)
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INFORMATION DISCLOSURE STATEMENT *(Use as many sheets as necessary)*				Filing Date	Herewith
				First Named Inventor	Delangis
				Art Unit	TBD
				Examiner Name	TBD
Sheet	2	of	2	Attorney Docket Number	COM908

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	~~1003~~	~~Declaration of JAMES GEIER (Oct. 4, 2023)~~	
	1010	BRISCOE, *Understanding the OSI 7-Layer Model*, PC Network Advisor Issue 120, pp. 13-14 (Jul. 2000)	
	1011	DAY and ZIMMERMAN, *The OSI Reference Model*, Proc. of the IEEE 71(12), 1334-1340 (Dec. 1983)	
	1012	SIMPSON, *The Point-to-Point Protocol*, Network Working Group, RFC 1661 (Jul. 1994), available at https://www.rfc-editor.org/rfc/rfc1661	
	1015	SKLOWER, *The PPP Multilink Protocol (MP)*, Network Working Group, RFC 1990 (Aug. 1996), available at https://www.rfc-editor.org/rfc/rfc1990.html	
	1017	BECKMAN, *Integrated Services Digital Network Tutorial*, ARC Electronics (1995), available at https://arcelect.com/isdn.htm	
	1018	GOLENIEWSKI, *Source for Communications Fundamentals, Data Networking and the Internet, and Next-Generation Networks*, Telecommunications Technology Fundamentals, Addison Wesley (Dec. 28, 2001), available at https://www.informit.com/ articles/article.aspx?p=24687	

Examiner Signature	/JOSEPH R POKRZYWA/	Date Considered	11/16/2023

*EXAMINER: Initial if reference considered whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.
This collection of information is required by 37 CFR 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.** *If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.*

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
90/019,265	10/04/2023	10868908	COM908	3396

64828 7590 01/02/2024

Harold McGurk
The Law Office of Clay McGurk
P.O. BOX 1488
Orange, CA 92856

EXAMINER	
POKRZYWA, JOSEPH R	

ART UNIT	PAPER NUMBER
3992	

MAIL DATE	DELIVERY MODE
01/02/2024	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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EX PARTE REEXAMINATION COMMUNICATION TRANSMITTAL FORM

REEXAMINATION CONTROL NO. *90/019,265* .

PATENT UNDER REEXAMINATION *10868908* .

ART UNIT *3992* .

Enclosed is a copy of the latest communication from the United States Patent and Trademark Office in the above identified *ex parte* reexamination proceeding (37 CFR 1.550(f)).

Where this copy is supplied after the reply by requester, 37 CFR 1.535, or the time for filing a reply has passed, no submission on behalf of the *ex parte* reexamination requester will be acknowledged or considered (37 CFR 1.550(g)).

PTOL-465 (Rev.07-04)

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Order Granting Request For Ex Parte Reexamination	Control No.	Patent Under Reexamination	
	90/019,265	10868908	
	Examiner	Art Unit	AIA (FITF) Status
	JOSEPH R POKRZYWA	3992	No

--The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

The request for *ex parte* reexamination filed 10/04/2023 has been considered and a determination has been made. An identification of the claims, the references relied upon, and the rationale supporting the determination are attached.

Attachments: a)☐ PTO-892, b)☑ PTO/SB/08, c)☐ Other: ____

1. ☑ The request for *ex parte* reexamination is GRANTED.

RESPONSE TIMES ARE SET AS FOLLOWS:

For Patent Owner's Statement (Optional): TWO MONTHS from the mailing date of this communication (37 CFR 1.530 (b)). **EXTENSIONS OF TIME ARE GOVERNED BY 37 CFR 1.550(c).**

For Requester's Reply (optional): TWO MONTHS from the **date of service** of any timely filed Patent Owner's Statement (37 CFR 1.535). **NO EXTENSION OF THIS TIME PERIOD IS PERMITTED.** If Patent Owner does not file a timely statement under 37 CFR 1.530(b), then no reply by requester is permitted.

/JOSEPH R POKRZYWA/ Primary Examiner, Art Unit 3992	/ERON J SORRELL/ Primary Examiner, Art Unit 3992	

cc:Requester (if third party requester)

DETAILED ACTION

Response to Request for ex parte Reexamination

1. The present application is being examined under the pre-AIA first to invent provisions.

2. Reexamination has been requested for claims 1-3, 5, 6, and 13-15 of U.S. Patent 10,868,908, issued to Eric M. DeLangis (hereafter "the '908 Patent").

3. A substantial new question affecting claims 1-3, 5, 6, and 13-15 of the '908 Patent is raised by the Third Party's request for *ex parte* reexamination.

4. The '908 Patent originally issued on December 15, 2020, with patented claims 1-17, being filed as U.S. Patent Application 15/161,787 (hereafter "the original '787 Application) on May 23, 2016. Here, the original '787 Application was filed as a continuation of U.S. Patent Application 14/512,414, filed on October 11, 2014, now U.S. Patent 9,350,649, which is a continuation of U.S. Patent Application 13/531,294, filed on June 22, 2012, now U.S. Patent 8,861,349, which is a continuation of U.S. Patent Application 12/581,852, filed on October 19, 2009, now U.S. Patent 8,228,801, which is a continuation of U.S. Patent Application 10/686,375, filed on October 14, 2003, now U.S. Patent 7,606,156. With this, the original '787 Application claims priority to provisional U.S. Application 60/418,521, filed on October 15, 2002.

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Listing of Prior Art

5. In the current Request for Reexamination filed October 4, 2023, the Third Party Requester alleges that claims 1-3, 5, 6, and 13-15 of the '908 Patent are unpatentable over the following references:

a. U.S. Patent 6,160,808, with the inventor of MAURYA, Sanjiv Kumar, which was filed on December 18, 1997 and issuing on December 12 2000 (noted as "Maurya");

b. International Patent Application Publication WO 97/22212, with the inventor of LOW, Colin *et al.*, being published on June 19, 1997 (noted as "Low");

c. U.S. Patent 5,809,070, with the inventor of KRISHNAN, Kalyan *et al.*, which was filed on August 9, 1996 and issuing September 15, 1998 (noted as "Krishnan"); and

d. U.S. Patent 7,606,156, with the inventor of DELANGIS, Eric M., which was filed on October 14, 2003, issuing on October 20, 2009 (noted as "DeLangis-156").

6. The Examiner notes that the references of Maurya, Low, and Krishnan were each not cited, nor discussed in the original prosecution that matured into the '908 Patent.

7. However, with respect to DeLangis-156, this reference is part of the chain of priority of the original '787 Application which matured into the '908 Patent. Here, the Requester contends that the chain of priority was broken, and another reference in the chain of priority, being U.S. Patent 8,861,349, lacks sufficient support for the challenged claims of the instant '908 Patent, whereby the earlier filed DeLangis-156 reference would then be available as prior art, therein viewing the DeLangis-156 reference in a new light, that being a prior art reference.

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Requester's Position

8. The Request indicates that the Third Party Requester alleges that:

SNQ#1. A substantial new question of ***claims 1, 2, 5, and 6*** of the '908 Patent is raised by the combination of Maurya and Low;

SNQ#2. A substantial new question of ***claims 1, 2, 5, 6, and 13-15*** of the '908 Patent is raised by the combination of Maurya, Krishnan, and Low;

SNQ#3. A substantial new question of ***claims 1, 2, 5, and 6*** of the '908 Patent is raised by the combination of Maurya, Low, and DeLangis-156; and

SNQ#4. A substantial new question of ***claims 1-3, 5, 6, and 13-15*** of the '908 Patent is raised by the combination of Maurya, Krishnan, Low, and DeLangis-156;

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Discussion of the Prosecution History and Patentable Subject Matter

9. Initially, it is noted that of the requested claims 1-3, 5, 6, and 13-15 of the '908 Patent, claims 1 and 13 of the '908 Patent are independent. Thus, the prosecution history of these claims will be analyzed to determine the perceived original patentable features during the original prosecution of these claims. Here, independent claims 1 and 13 of the '908 Patent matured from the corresponding claims of the original '787 Application, being renumbered from the original claims 41 and 53 of the application.

10. With this, looking into the prosecution history of the original '787 Application, a Notice of Allowance was mailed on August 12, 2020. But here, in review of the Notice of Allowance, the original Examiner did not provide any statement as to the reasons for allowance of the claims. Thus, looking further into the prosecution history, in an Office action dated March 10, 2020, the application claims 41 and 53 were indicated as being allowed. But once again, the original examiner did not provide a statement as to the reasons for allowing these claims.

11. Going back further into the prosecution history of the original '787 Application, an amendment to application claims 41 and 53 was filed on February 14, 2020. This amendment was in response to an Office action dated August 16, 2019, wherein application claims 41 and 53 were included in a rejection under 35 USC 112 first paragraph as failing to comply with the written description requirement, and additionally, independent claims 41 and 53 were also included in a rejection under 35 U.S.C. 103(a) as being unpatentable over the combination of Pung (U.S. Pat. App. Pub. 2002/0150099) in view of Banga (U.S. Pat. App. Pub. 2003/0135578).

With this, the amended features found in the amendment dated February 14, 2020 would appear to include the features that were subsequently deemed to be allowable.

12. Along this vein, in the amendment dated February 14, 2020, independent claim 41 was amended to recite the following limitations, with the added material shown underlined:

> 41. (Currently Amended) A client device for multilink data packet communication with a server, the client device comprising:
>
> a first network interface having a first data transfer rate associated with a first path from the server to the first network interface of the client device;
>
> a second network interface having a second data transfer rate associated with a second path from the server to the second network interface of the client device; and
>
> at least one processor configured to:
>
> transmit a first message through the first network interface to the server, wherein the first message includes a multilink request and a destination URL;
>
> transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification and the destination URL; and
>
> receive data packets from the server through the first and second network interfaces of the client device during the multilink session wherein the first data transfer rate and the second data transfer rate provide an increased data transfer rate of the first path and the second path from the server to the client device.

13. Additionally, in the amendment dated February 14, 2020, independent claim 53 was amended to recite the following limitations, with the added material shown underlined:

> 53. (Currently Amended) A first device comprising:
>
> a network interface; and
>
> at least one processor configured to:

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transmit a first message through the network interface to a second device, wherein the first message includes a multilink request and a destination URL, the network interface to the second device having a data transfer rate associated therewith;

transmit a second message through the network interface to a third device, wherein the second message includes a multilink session identification that is unique to the multilink session and the destination URL, the network interface to the third device having a data transfer rate associated therewith; and

receive the different data packets through the at least one network interface from the second device and from the third device during the multilink session,

wherein the data transfer rate associated with the network interface to the second device and the network interface to the third device provide an increased data transfer rate for the first device.

14. Therefore, the perceived patentable features of independent claims 41 and 53 in the original '787 Application revolve around the added elements in the amendment dated February 14, 2020. Here, as noted above, in the Office action following this amendment, the original examiner indicated that independent claims 41 and 53 were allowable, but rejected other independent claims. It is further noted that in the subsequently filed amendment to on June 10, 2020, being just before the Notice of Allowance dated August 12, 2020, the amendment added features to the other independent claims which advanced them to becoming allowable, but an error occurred in the writing of independent claim 41, with the claim written which left out the word "and" between the elements of a "multilink request" and a "destination URL" in line 9 and also in line 11. This led to the subsequent error in patented claim 1 of the '908 Patent, as discussed by the Requester on page 6 of the Request.

15. With this, the perceived allowable features of independent claim 1 of the '908 Patent, from the original prosecution of original application that matured into the '908 Patent, revolve

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around the features that require first and second network interfaces having respective first and second data transfer rates, with respective first and second paths between the server and the client device, and transmitting first and second messages through each of the respective first and second network interfaces, with the first message including a multilink request [and] a destination URL, and a second message including a multilink session identification [and] the destination URL, wherein the first data transfer rate and the second data transfer rate provide an increased data transfer rate of the first path and the second path from the server to the client device.

16. Similarly, the perceived allowable features of independent claim 13 of the '908 Patent, from the original prosecution of original application that matured into the '908 Patent, revolve around the features that require transmitting first and second messages through a network interface to different devices, with the first message including a multilink request and a destination URL, and the second message including a multilink session identification and the destination URL, with the network interface to the different devices having a data transfer rate associated therewith, and wherein the data transfer rate associated with the network interface to the second device and the network interface to the third device provide an increased data transfer rate for the first device.

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Discussion of Substantial New Question of Patentability

17. MPEP 2240 [R-07.2015] states, in part:

> *37 C.F.R. 1.515 Determination of the request for ex parte reexamination.*
>
> (a) Within three months following the filing date of a request for an *ex parte* reexamination, an examiner will consider the request and determine whether or not a substantial new question of patentability **affecting any claim** of the patent is raised by the request and the prior art cited therein, with or without consideration of other patents or printed publications. A statement and any accompanying information submitted pursuant to § 1.501(a)(2) will not be considered by the examiner when making a determination on the request. The examiner's determination will be based on the claims in effect at the time of the determination, will become a part of the official file of the patent, and will be given or mailed to the patent owner at the address provided for in § 1.33(c) and to the person requesting reexamination. [Emphasis added].

18. Further, the Examiner notes that because the '908 Patent was filed as multiple continuations of applications, dating back to October 14, 2003, the '908 Patent would now appear to be expired. With this, MPEP 2240 states, in part:

> … In making the determination of whether to order reexamination, the Office will determine the proper meaning of the patent claims by giving the claims their broadest reasonable interpretation consistent with the specification (see *In re Yamamoto,* 740 F.2d 1569 (Fed. Cir. 1984)), **except in the case of an expired patent (in a reexamination involving claims of an expired patent, claim construction is pursuant to the principle set forth by the court in *Phillips v. AWH Corp.,* 415 F.3d 1303, 1316, 75 USPQ2d 1321, 1329 (Fed. Cir. 2005) (words of a claim "are generally given their ordinary and customary meaning" as understood by a person of ordinary skill in the art in question at the time of the invention**, see *Ex parte Papst-Motoren,* 1 USPQ2d 1655 (Bd. Pat. App. & Inter. 1986)). If reexamination is ordered, the patent owner statement, if applicable, and any accompanying information submitted pursuant to 37 CFR 1.501(a)(2) will be considered during the examination stage to the fullest extent possible

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> when determining the scope of any claims of the patent which are subject to reexamination. [Emphasis added].

19. Thus, since the 908 Patent would be expired, the claim construction will be pursuant to the principle set forth by the court in *Phillips*, whereby the "words of a claim 'are generally given their ordinary and customary meaning' as understood by a person of ordinary skill in the art in question at the time of the invention."

SNQ#1

20. With respect to the Third Party Requester's proposed SNQ#1, noted above, the Requester alleges that a substantial new question of claims 1, 2, 5, and 6 of the '908 Patent is raised by the combination of Maurya and Low. It is agreed that the combination of Maurya and Low raises a substantial new question of patentability as to at least independent claim 1 of the '908 Patent.

21. In this regard, the reference of Maurya discloses a client device that is utilized for multilink data packet communication with a server, as seen in Fig. 6A, and read in the Abstract, wherein the client device includes communication interfaces that can have different data transfer rates, and having different paths between the server and the client device. Particularly, Maurya discloses a client device [being the client 605, which includes PC 610 connected through communication interfaces 612 to terminal adapters 620, as seen in Fig. 6A] for multilink data packet communication with a server [server 650, see Fig. 6A; also see col. 11, line 34-col. 12, line 10, wherein "With the above discussion of conventional multi-link PPP in mind , consider FIG. 6A which depicts a high level block diagram of illustrative multi-link client-server apparatus 600, which incorporates the teachings of the present invention. Here, client 605 is

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inter-connected to server 650 through multiple ISDN BRI (basic rate interface) lines 630."], the client device comprising:

a first network interface having a first data transfer rate associated with a first path from the server to the first network interface of the client device [one of the communication interfaces 612, combined with the ISDN BRI terminal adapter (TA) 1, 620_1, through path 615_1, as seen in Fig. 6A; also see col. 11, line 34-col. 13, line 8, wherein "In that regard, links 615, which comprise links 615_1, 615_2, . . . , 615_n, connect separate terminal adapters 620_1, 620_2, . . . , 620_n, respectively, to separate corresponding serial ports provided by communication interfaces 612. … ISDN connections are extended from terminal adapters 620, through public switched telephone network (PSTN) 640, to server 650 having corresponding identical terminal adapters 660, as DCE, and server computer 665, as DTE. Each one of terminal adapters 620 is connected through a separate pair of ISDN B-channels and the PSTN, to a separate corresponding one of terminal adapters 660, the latter terminal adapters collectively connected, via links 662, to server computer 665. Each of adapters 660 is illustratively identical to each of adapters 620."; also see col. 17, lines 36-57, wherein "However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."];

a second network interface having a second data transfer rate associated with a second path from the server to the second network interface of the client device [being another one of the communication interfaces 612, combined with the ISDN BRI terminal adapter 2, 620_2, through path 615_2, as seen in Fig. 6A; also see col. 11, line 34-col. 13, line 8, wherein "In that regard, links 615, which comprise links 615_1, 615_2, . . . , 615_n, connect separate terminal adapters

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620_1, 620_2, . . . , 620_n, respectively, to separate corresponding serial ports provided by communication interfaces 612. … ISDN connections are extended from terminal adapters 620, through public switched telephone network (PSTN) 640, to server 650 having corresponding identical terminal adapters 660, as DCE, and server computer 665, as DTE. Each one of terminal adapters 620 is connected through a separate pair of ISDN B-channels and the PSTN, to a separate corresponding one of terminal adapters 660, the latter terminal adapters collectively connected, via links 662, to server computer 665. Each of adapters 660 is illustratively identical to each of adapters 620."; also see col. 17, lines 36-57, wherein "However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."; also see col. 17, lines 36-57, wherein "However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."]; and

at least one processor configured to:

transmit a first message through the first network interface to the server, wherein the first message includes a multilink request [and] ***a destination IP address*** [see col. 7, line 22-39, wherein "At this point with no activity on the link, a link control protocol (LCP), which as part of the PPP protocol, exercises responsibility for establishing and configuring the link, remains in an initial or starting state."; also see col. 8, lines 20-59, wherein "FIG. 2 depicts a format of conventional generalized LCP packet 200. As shown, packet 200 is formed of eight-bit code field 210, eight-bit identifier field 220, sixteen-bit length field 230 and finally variable-length

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data field 240. This packet can be any one of several types, with the value of the code field, having values typically ranging from one to thirteen, specifying the type of any such packet. Of note, a value of one indicates that the packet is an LCP Configure Request packet. Such a request packet is sent by a PPP peer whenever that peer desires to change a configuration parameter, such as from a default value, associated with the link."; also see col. 9, lines 14-55, wherein "The endpoint discriminator packet identifies, by specifying an address, of an end system (an "endpoint"), then situated on an end of a link, that is transmitting this particular packet. ... For example, a class field having a value of illustratively zero, one or two specifies that the following address is a null class (i.e., the address is zero octets long), a locally assigned address, such as a serial number (having a length up to twenty octets), or an Internet Protocol (IP) address (having a length of four octets). Other classes of addresses exist. Inasmuch as the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention, I will omit any further details of the latter two aspects."];

transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification [and] ***the destination IP address*** [see col. 7, line 22-39; also see col. 8, lines 20-59, wherein "FIG. 2 depicts a format of conventional generalized LCP packet 200. As shown, packet 200 is formed of eight-bit code field 210, eight-bit identifier field 220, sixteen-bit length field 230 and finally variable-length data field 240. This packet can be any one of several types, with the value of the code field, having values typically ranging from one to thirteen, specifying the type of any such packet. Of note, a value of one indicates that the packet is an LCP Configure Request packet. Such a request packet is sent by a PPP peer whenever that peer desires to change a configuration parameter,

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such as from a default value, associated with the link."; also see col. 8, line 60-col. 9, line 67, wherein "Each specific option has to be separately negotiated between the PPP peers and appropriately acknowledged prior to its use. Inasmuch as the only values for this type field, i.e., the only configuration options, that are relevant to understanding the invention are 17, 18 and 19, which designate a multi-link MRRU (Multi-link Maximum Receive Reconstructed unit) request, **a multi-link Short Sequence Number** header request and a "multi-link endpoint discriminator" option, respectively (which will all be discussed in detail below in conjunction with FIG. 5). … Each such multi-link PPP packet contains a sequence number--which increases by one with each successive packet, inserted by the multi-link protocol."; also see col. 10, lines 6-53, wherein " These formats are depicted as long and short sequence number formats 510 and 550 having 24- and 12-bit sequence numbers, respectively. The specific format of the multi-link PPP packet to use in any situation can be specified by a PPP sender by transmitting an LCP Configuration Request message for a Multi-link Maximum Receive Reconstructed Unit (MRRU) format, i.e., designating long sequence number format 510, or a Multi-link Short Sequence Number Header format, i.e., designating short sequence number format 550, coupled with successful negotiations with its PPP peer therefor. Use of format 510 or 550 is requested by a type field having a value of 17 or 18, respectively, in an LCP Configure Request message, as noted above, transmitted by the PPP sender to its PPP peer."]; and

…

wherein the first data transfer rate and the second data transfer rate provide an increased data transfer rate of the first path and the second path from the server to the client device [see col. 2, line 32-col. 3, line 41, wherein "Second, as more users simultaneously contend for available network bandwidth at particular times, such as when the network experiences its peak

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daily loading, the network becomes increasingly congested. Hence, at these times, network traffic tends to slow which also tends to lengthen download time, thereby frustrating the users particularly those seeking relatively large files. … Once successfully negotiated between two PPP peers, then, at a transmitting peer, multi-link PPP segments a packetized data stream (i.e., a PPP frame) into segments (or fragments), forms a stream of multi-link PPP packets each containing one such a segment, and then assigns these multi-link PPP packets on an approximately equal basis, where practical, between two B channels in the BRI connection for transmission to a receiving PPP peer; here the two B channels form a pipe. Small packets may not be segmented and to accommodate links of different speeds (which is not the case with two ISDN B channels), the segments need not be of the same size nor do the same number of segments need to be transmitted over each link."; also see col. 17, lines 20-57, wherein "Hence, through the present invention, a link in an original multi-link bundle and carrying multi-link PPP packets can itself be effectively divided (demultiplexed) into substantially any number of different paths with these paths being remotely and correctly recombined (multiplexed) so as to appear to be a link of the original multi-link bundle. … Furthermore, if all multi-link PPP links in a bundle have same data transmission rate such as two B-channels in an ISDN line, then each terminal adapter can simply send its incoming multi-link PPP packets as outgoing multi-link PPP packets on alternating B-channels without the need to encapsulate these packets with multi-multi-link protocol headers….However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."].

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22. But here, the reference of Maurya dies not expressly disclose if the first and second messages include a multilink request **and a destination URL**, as currently recited in independent claim 1. However, the reference of Low discloses a client device that transmits messages through a network interface, whereby the message includes a multilink request [and] a destination URL [see Fig. 4, with the terminal 31 transmitting a message 38 to a server 32 that includes a request and a destination URL; also see page 11, line 12-page 13, line 15, wherein "A cornerstone of the WWW is its ability to address particular information resources by means of an Uniform Resource Locator (URL) that identifies a resource by location…By way of example, a full or 'absolute' URL will comprise the following elements:…the Internet host domain or IP address…This request includes a request method, and the 'Request-URI' (which is generally just the absolute path of the resource on the server as identified by the 'abs-path' element of the URI); the request may include additional data elements."; also see page 23, line 5-page 24, line 9].

23. With this, it would have been obvious for one of ordinary skill in the art to have include a destination URL in messages sent from the client to the server, as recognized by Low, within the first and second messages disclosed in Maurya. Thus, with respect to independent claim 1, the combination of Maurya and Low appear to describe the features that were deemed to be the patentable features in the original prosecution of the original '787 Application that matured into independent claim 1 of the '908 Patent. Thus, the combination of Maurya and Low is seen to raise a substantial new question of patentability as to at least claim 1 of the '908 Patent, which question was not present in a previous examination of the '908 Patent. The references of Maurya and Low were both not utilized in any rejection, nor were the references discussed in the original

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prosecution, as noted above. Thus, there is a substantial likelihood that a reasonable examiner would consider the teachings of the combination of Maurya and Low important in deciding whether or not at least independent claim 1 is patentable. Therefore, the combination of references of Maurya and Low is seen to raise a substantial new question of patentability as to at least independent claim 1 of the '908 Patent, as suggested in SNQ #1.

SNQ#2

24. With respect to the Third Party Requester's proposed SNQ#2, noted above, the Requester alleges that a substantial new question of claims 1, 2, 5, 6, and 13-15 of the '908 Patent is raised by the combination of Maurya, Krishnan, and Low. It is agreed that the combination of Maurya, Krishnan, and Low raises a substantial new question of patentability as to at least independent claim 1 of the '908 Patent.

25. Here, as discussed above in SNQ #1, the combination of Maurya and Low is seen to teach the features that were determined allowable in the original prosecution, and thus that combination raises a substantial new question of patentability as to at least claim 1 of the '908 Patent. Along this vein, the primary reference of Maurya is seen to disclose features that can be interpreted as being first and second interfaces, as discussed above in SNQ #1that being the communication interfaces 612 and the terminal adapters 620. With this, in SNQ #2, the Requester further introduces the additional secondary reference of Krishnan. In this regard, in the Request, the reference of Krishnan is discussed as further teaching of a client device that

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includes a first modem 12 and a second modems 14, which are interpreted as the claimed first network interface and the second network interface, respectively.

26. Particularly, Krishnan is seen as disclosing a client device [host computer 10, seen in Fig. 1] for multilink data packet communication with a server [see col. 2, lines 23-41, wherein "Host computer 10 is also programmed with link control software implementing a multi-link data communication protocol such as the Multi-Link Point-to-Point Protocol (MLPPP). MLPPP provides a method for a transmitting site to split a single high speed data stream into multiple parallel data streams which are multiplexed onto multiple low speed data links."], the client device comprising:

a first network interface [modem 12] having a first data transfer rate associated with a first path from the server to the first network interface of the client device [see col. 2, line 42-col. 3, line 14, wherein "For example, as the data rate increases beyond the capacity of modem 12 and PSTN line 16, a second PSTN connection may be established via modem 14 and PSTN line 18. Subsequently, as the data rate decreases to a level within the capacity of a single modem, modem 14 may be disconnected. ... For example, if the data transmission rates across PSTN links 16 and 18 are unequal, the link control software may transmit data proportional to the data rate of modems 12 and 14. Thus, if modem 12 transmits at 28.8 kbps and modem 14 transmits at only 14.4 kbps, link control the software may transmit twice as much data via modem 12 as via modem 14."];

a second network interface [modem 14] having a second data transfer rate associated with a second path from the server to the second network interface of the client device [see col. 2, line 42-col. 3, line 14, wherein "For example, as the data rate increases beyond the capacity of

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modem 12 and PSTN line 16, a second PSTN connection may be established via modem 14 and PSTN line 18. Subsequently, as the data rate decreases to a level within the capacity of a single modem, modem 14 may be disconnected. … For example, if the data transmission rates across PSTN links 16 and 18 are unequal, the link control software may transmit data proportional to the data rate of modems 12 and 14. Thus, if modem 12 transmits at 28.8 kbps and modem 14 transmits at only 14.4 kbps, link control the software may transmit twice as much data via modem 12 as via modem 14."]; and

receive data packets … through the first and second network interfaces of the client device during the multilink session wherein the first data transfer rate and the second data transfer rate provide an increased data transfer rate of the first path and the second path from the server to the client device [see Abstract; also see col. 1, lines 59-67, wherein "The modem also has a second port for connecting to a second modem in a daisy chain fashion. Additional multilink modems may be daisy-chained to provide three, four, or more PSTN links, thereby increasing the maximum data rate."; also see col. 2, line 30-col. 3, line 14, wherein "For example, as the data rate increases beyond the capacity of modem 12 and PSTN line 16, a second PSTN connection may be established via modem 14 and PSTN line 18. Subsequently, as the data rate decreases to a level within the capacity of a single modem, modem 14 may be disconnected."].

27. Thus, with respect independent claim 1, the reference of Krishnan provides further disclosure of first and second network interfaces having first and second data transfer rates, respectfully, and that the first data transfer rate and the second data transfer rate provide an increased data transfer rate of the first path and the second path, as required in independent claim

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1. With this, it would have been obvious to one of ordinary skill in the art at the time of the invention to have the specific structure of having first and second modems within the client device, as recognized by Krishnan, included in the "communication interfaces 612" described in Maurya.

28. Therefore, with respect to independent claim 1, the combination of Maurya, Krishnan, and Low appear to describe the features that were deemed to be the patentable features in the original prosecution of the original '787 Application that matured into independent claim 1 of the '908 Patent. Additionally, with respect to independent claim 13, as discussed above, the deemed patentable features in the original prosecution are similar to those addressed above regarding independent claim 1. With this, for the same reasons discussed above, the combination of Maurya, Krishnan, and Low also appears to describe the features that were deemed to be the patentable features in the original prosecution of the original '787 Application that matured into independent claim 13 of the '908 Patent.

29. Thus, the combination of Maurya, Krishnan, and Low is seen to raise a substantial new question of patentability as to at least claims 1 and 13 of the '908 Patent, which question was not present in a previous examination of the '908 Patent. The references of Maurya, Krishnan, and Low were each not utilized in any rejection, nor were the references discussed in the original prosecution, as noted above. Thus, there is a substantial likelihood that a reasonable examiner would consider the teachings of the combination of Maurya, Krishnan, and Low important in deciding whether or not at least independent claims 1 and 13 are patentable. Therefore, the combination of references of Maurya, Krishnan, and Low is seen to raise a

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substantial new question of patentability as to at least independent claims 1 and 13 of the '908 Patent, as suggested in SNQ #2.

SNQs #3 and #4

30. With respect to the Third Party Requester's proposed SNQ#3 and SNQ#4, noted above, the Requester alleges that a substantial new question of claims 1, 2, 5, and 6 of the '908 Patent is raised by the combination of Maurya, Low, and DeLangis-156, and that a substantial new question of claims 1-3, 5, 6, and 13-15 of the '908 Patent is raised by the combination of Maurya, Krishnan, Low, and DeLangis-156. Here, for the reasons discussed above in SNQs #1 and #2, the combinations of Maurya and Low, and of Maurya, Krishnan, and Low are seen to raise a substantial new question of patentability as to at least independent claim 1. Thus, it follows that it is agreed that the combination of Maurya, Low, and DeLangis-156, as well as Maurya, Krishnan, Low, and DeLangis-156 would raise a substantial new question of patentability as to at least independent claim 1 of the '908 Patent.

31. However, despite the above noted combinations raising an SNQ, it is noted that the reference of DeLangis-156 is not seen to be available as prior art, as the reference is part of the chain of priority of the original '787 Application that matured into the '908 Patent. Here, the disclosures of the earlier non-provisional applications in the chain of priority, as well as the disclosure of the provisional application 60/418,521, are seen to provide sufficient disclosure as to the features required independent claims 1 and 13 of the '908 Patent.

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32. In this regard, as discussed on pages 5 and 6 of the Request filed October 4, 2010, the Requester contends that "[t]he '908 Patent is not entitled to the priority date of applications filed before October 11, 2014, when U.S Patent 9,350,649 was filed, as the claims of the '908 Patent lack adequate written description support from earlier applications." Along this vein, on pages 12 and 13 of the Request, the Requester contends that the application in the chain of priority, U.S. App. 13/531,294, which matured to U.S. Pat. 8,861,349, fails to disclose the claimed first message sent by a device in independent claims 1 and 13. Here, on page 13 of the Request, the Requester states that the specification of U.S. App. 13/531,294 fails to provide support for the limitation that recites "transmit a first message through the first network interface to the server, wherein the first message includes a multilink request [and] a destination URL."

33. But looking at the U.S. Pat. 8,861,349, the reference states in col. 11, lines 46-50 that "Referring to FIG. 7, an RCG – 85 that decides to initiate a multilink PPP session with a remote computer i.e. internet URL, requests a multilink PPP session with that URL resource via Link Control Protocol (LCP) session management." This same discussion is also found in col. 12, lines 1-6 the instant '908 Patent, as well as on page 22 of the provisional application 60/418,521. Thus, the earlier applications in the chain of priority are seen to provide a sufficient disclosure as to this limitation that recites "transmit[ting] a first message through the first network interface to the server, wherein the first message includes a multilink request [and] a destination URL."

34. Continuing, on page 13 of the Request, the Requester also contends that the earlier application U.S. App. 13/531,294, which matured to U.S. Pat. 8,861,349, fails to disclose "a client device …comprising …at least one processor configured to **transmit a second message**

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…**to the server**, wherein the second message includes a multilink session identification [and] the destination URL" Here, the Requester states that the specification of U.S. Pat. 8,861,349 do not send a second message to a server, but rather to a second client device. Here, looking at Fig. 7 of the '349 (being the same as Fig. 7 of the instant '908 Patent, as well as in the provisional application 60/418,521), the multilink initiating occurs between the client device RCG 85 and what can be considered as a server 89, and eventually a second message occurs between the client device RCG 85 and the remote RCG 86 through the server 89. Thus, the earlier applications in the chain of priority are seen to provide a sufficient disclosure as to this limitation that recites "a client device …comprising …at least one processor configured to transmit a second message …to the server, wherein the second message includes a multilink session identification [and] the destination URL".

35. With this, the reference of DeLangis-156 is not seen to be considered as being a "prior art" reference, and is thus not considered in the determination as to raising an SNQ of patentability. Along this vein, without the reference of DeLangis-156, the proposed combination combinations in SNQs #3 and #4 are identical to that discussed above in SNQs #1 and #2. Thus, it follows that it is agreed that the combination of Maurya and Low, as well as Maurya, Krishnan, and Low would raise a substantial new question of patentability as to at least independent claim 1 of the '908 Patent.

35 U.S.C. § 325(d)

35 USC 325(d) states in part that "[i]n determining whether to institute or order a proceeding under this chapter, chapter 30, or chapter 31, the Director may take into account

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whether, and reject the petition or request because, the same or substantially the same prior art or arguments previously were presented to the Office.". Thus, in order for the Director to exercise discretion as to whether to Order a reexamination proceeding under chapter 30, the request must first be determined to be based on the same or substantially the same prior art or arguments that previously were presented to the Office.

A review of the post grant history of the '908 patent indicates that the patent was the subject of a single prior post grant challenge.

On March 1, 2023, Petitioner Unified Patents, LLC filed a petition seeking *inter partes* review of claims 1-3, 5, 6 and 13-15 of the '908 patent (IPR2023-00584), which asserted the following grounds as raising a reasonable likelihood in prevailing (RLP):

Ground	Claims	Challenge
1	1, 2, 5, 6	Obviousness over Maurya[6] and Low[7]
2	1, 2, 5, 6, 13–15	Obviousness over Maurya, Krishnan,[8] and Low
3	1, 2, 5, 6	Obviousness over Maurya, Low, and DeLangis-156[9]
4	1–3, 5–6, 13–15	Obviousness over Maurya, Krishnan, Low, and DeLangis-156

On October 2, 2023, the Patent Trial and Appeal Board (PTAB) issued a decision terminating the proceeding prior to institution in view of a joint motion by the parties to terminate the proceeding due to a settlement before institution.

A comparison between the prior art and arguments presented in the instant Request for ex parte reexamination of the '163 patent, indicates that the Request is based on the same prior art grounds that were previously presented to the Office in the prior terminated IPR petition.

Thus, the threshold under 35 USC 325(d) for the director to exercise discretion in determining whether to Order reexamination has been met.

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However, in view of the following facts, the Director declines to exercise such discretion to reject the reexamination request: 1) the fact that the prior denied IPR petition was terminated prior to institution based on a joint settlement agreement without the PTAB substantively reviewing the prior art presented in the petition, and 2) the fact that there has been no prior finding of abusive challenges to the '908 patent by third party requester.

Accordingly, *ex parte* reexamination is Ordered for the '908 patent, in view of the determination above that SNQ has been raised in the instant Request for Reexamination.

Conclusion

36. A substantial new question of patentability affecting claims 1-3, 5, 6, and 13-15 of U.S. Patent Number 10,868,908 is raised by the Request for *ex parte* reexamination. Thus, **claims 1-3, 5, 6, and 13-15** of U.S. Patent Number 10,868,908 are subject to reexamination and will be reexamined in response to the Request.

37. Extensions of time under 37 CFR 1.136(a) will not be permitted in these proceedings because the provisions of 37 CFR 1.136 apply only to "an applicant" and not to parties in a reexamination proceeding. Additionally, 35 U.S.C. 305 requires that *ex parte* reexamination proceedings "will be conducted with special dispatch" (37 CFR 1.550(a)). Extension of time in *ex parte* reexamination proceedings are provided for in 37 CFR 1.550(c).

38. The Patent Owner is reminded of the continuing responsibility under 37 CFR 1.565(a) to apprise the Office of any litigation activity, or other prior or concurrent proceeding, involving

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U.S. Patent 10,868,908 throughout the course of this reexamination proceeding. See MPEP §§ 2207, 2282, and 2286.

39. **All** correspondence relating to this *ex parte* reexamination proceeding should be directed:

By Mail to: Mail Stop *Ex Parte* Reexam
Central Reexamination Unit
Commissioner for Patents
United States Patent & Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

By hand: Customer Service Window
Randolph Building
401 Dulany Street
Alexandria, VA 22314

Any inquiry concerning this communication or earlier communications from the Reexamination Legal Advisor or Examiner, or as to the status of this proceeding, should be directed to the Central Reexamination Unit at telephone number (571) 272-7705.

Signed:

/JOSEPH R POKRZYWA/
Primary Examiner, Art Unit 3992
(571) 272-7410

Conferees:

/ERON J SORRELL/
Primary Examiner, Art Unit 3992

/ALEXANDER J KOSOWSKI/
Supervisory Patent Examiner, Art Unit 3992

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UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
90/019,265	**03/01/2024 06:13:36 PM Z ET**	**COM908**

Title of Invention

DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS

Application Information

APPLICATION TYPE	Utility / ex parte reexam	PATENT #	10868908
CONFIRMATION #	3396	FILED BY	Harold McGurk
PATENT CENTER #	64525378	FILING DATE	10/04/2023
CUSTOMER #	64828	FIRST NAMED INVENTOR	- 10868908
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	-

Documents

TOTAL DOCUMENTS: 1

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
90019265 Patent Owner Statement 3-1-2024.pdf	33	Reexam Timely Patent Owner's Stmnt in Resp to Order	486 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
90019265 Patent Owner Statement 3-1-2024.pdf	7CEB938F06FC88963D72AC72ED57B042E50E3A3E6BC0A186 DBEF2F45E2D27C92FCDCF4C74A13E897E496A3AD5AD56A8 706752AB3932AD99A25D8D471402F8602

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT TRIAL AND APPEAL BOARD

COMPETITIVE ACCESS SYSTEMS, INC.

Patent Owner.

Reexamination Control No. **90/019,265**

U.S. Patent No. **10,868,908**

Art Unit **2992**

PATENT OWNER STATEMENT

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I. INTRODUCTION

Patent Owner, Competitive Access Systems, Inc., submits this Patent Owner Statement ("POS") pursuant to 37 C.F.R. 1.530(b) & (c) to respond to the *Order Granting Request For Ex Parte Reexamination* ("Order"), issued on January 2, 2024, involving claims 1, 2, 5, 6, and 13-15 of U.S. Patent No. 10,868,908 (the "'908 Patent"). This deadline to submit the POS is March 2, 2024 (a Saturday). The POS is submitted before the two-month deadline of March 2, 2024 (a Saturday).

At the time of filing the priority application, the inventor, Eric Delangis, was living in a rural area with a limited, low bandwidth available to him for downloading data. At the same time, he recognized that many network connections of nearby devices were generally underused. Only a percentage of the total bandwidth available through those nearby connections was utilized at any given time such that the remaining bandwidth was available for use. Mr. Delangis sought a commercial product that could provide the increased bandwidth that he desired, but none was available.

In response, Mr. Delangis invented a multipath connection that routes data over several connections using multiple neighboring "network-edge" devices and combines the data for the intended data-requesting device. The multipath connection disclosed and claimed in the '908 Patent provides an increased bandwidth available to the data-requesting device by combining the excess bandwidth available from the

network-edge devices and also allows network-edge devices to be removed when their excess bandwidth becomes unavailable or added when their excess bandwidth becomes available.

To coordinate the multipath connection, the data-requesting device sends messages to the server and/or network-edge devices with the multilink request or a multilink session identification and a destination URL. In relying on a dynamically-changing network of network-edge devices, the destination URL is a required detail in coordinating the multipath connection.

II. SUBSTANTIAL NEW QUESTIONS OF PATENTABILITY

On page 4 of the Order, it sets forth four grounds for challenging various claims of the '908 Patent:

SNQ#1 asserts a substantial new question of claims 1, 2, 5 and 6 of the '908 Patent is raised by the combination of Maurya and Low;

SNQ#2 asserts a substantial new question of claims 1, 2, 5, 6 and 13-15 of the '908 Patent is raised by the combination of Maurya, Low, and Krishnan;

SNQ#3 asserts a substantial new question of claims 1, 2, 5, 6 of the '908 Patent is raised by the combination of Maurya, Low, and DeLangis-156; and

SNQ#4 asserts a substantial new question of claims 1, 2, 5, 6 and 13-15 of the '908 Patent is raised by the combination of Maurya, Krishnan, Low, and DeLangis-156.

On page 23, #35 of the Order, it was decided that "DeLangis-156 is not seen to be considered to being [sic] a 'prior art' reference, and is thus not considered in the determination as to raising an SNQ of patentability." The Order further states that "the combination of Maurya and Low, as well as Maurya, Krishnan and Low would raise a substantial new question of patentability as to at least independent claim 1 of the '908 Patent." This means that SNQ#3 and SNQ#4 are not pertinent due to their reliance on DeLangis-156. Thus, this POS responds to what is alleged in SNQ#1 and SNQ#2.

The Order considered SNQ#1 and SNQ#2 by adding to claim 1 of the '908 Patent, the word "and" which was missing between "a multilink request" and "a destination URL", and between "multilink session identification" and "a destination URL". Order, p. 8, #15.

On page 10, #19 of the Order, it recognized that the '908 Patent had expired. Patent Owner does not dispute this. No amendments for an expired patent are allowed. 37 C.F.R. § 1.530(j).

III. OVERVIEW

Patent Owner respectfully requests that the Examiner find claims 1, 2, 5 and 6 of the '908 Patent patentable over the combination of Maurya and Low, and for claims 1, 2, 5, 6 and 13-15 of the '908 Patent over the combination of Maurya, Krishnan and Low.

On page 16, #23 of the Order, it states it would have been obvious for one of ordinary skill in the art to include "a destination URL in messages sent from the client to the server, as recognized by Low, within the first and second messages disclosed in Maurya." However, Low is not analogous art due to its use of a URL page (referred to as a "phone page") to provision telephone services within a telephone communications system. Low is entirely unrelated to the problem addressed by the '908 Patent, which is to increase bandwidth available to a device. Even setting that fatal defect aside, the phone page URL of Low is not a destination URL that is included on a message coordinating a multipath connection as recited in the challenged claims.

IV. SUMMARY OF THE '908 PATENT

A. The Invention of the '908 Patent

The '908 Patent is directed to devices utilizing a multipath connection to increase bandwidth available to a receiving device by splitting data that is then routed over multiple device connections before being recombined for the receiving device. '908 Patent, 10:58-14:53, claims 1-17.

Living in rural Colorado, Eric Delangis, the inventor of the '908 Patent, was unable to obtain high-speed internet. Mr. Delangis recognized that there was unused bandwidth from the internet connections of nearby devices within the area, but that this bandwidth was not available for his own use. Unable to locate any commercial

solutions available to pool together the multiple internet connections of neighboring devices, Mr. Delangis developed the innovative claimed technology, routing data over several connections of neighboring devices through a multipath connection and combining the routed data at a receiving device. *Id.*, at 10:57-14:53.

As described in the '908 Patent, the multipath connection implements broadband through a multilink PPP bundle 87 comprised of connections between an initiating device 85[1] and other neighboring "network-edge" devices 86. *Id.*, at 11:25-41. Each network-edge device 86 assesses its available bandwidth based on the respective device's currently available bandwidth and the current local demands for that bandwidth, and determines whether it can join the multilink PPP bundle 87. *Id.*, at 12:26-46. The initiating device 85 then sends the multilink initialization packet containing the URL of the destination as well as the multilink PPP session ID (magic number) and any other pertinent information required for the remote RCG to join in the existing multilink PPP bundle 87. *Id.*, at 12:51-57. In response, each network-edge device 86 sends a multilink PPP packet to the destination URL with the multilink PPP session ID and requests to be added to the multilink PPP bundle 87. *Id.*, at 12:60-63. When the network-edge devices 86 receive data packets destined

[1] The '908 Patent refers to a residential communications gateway ("RCG") throughout the specification. For clarity, the term "RCG" is used interchangeably with "device" throughout this POS.

for the multilink PPP bundle 87, they simply relate the data packets to the initiating device 85. *Id.*, at 12:66-13:3.

Additionally, the initiating device 85 continually monitors the bandwidth of each network-edge device 86 that comprises the multilink bundle 87. *Id.*, at 13:13-16. When available bandwidth of an individual network-edge device 86 falls below a minimum set by the initiating device 85, the initiating device 85 instructs the respective network-edge device 86 to remove itself from the multilink bundle 87. *Id.*, at 13:16-23. Alternatively, a remote network-edge device 86 can request to be removed from the multilink bundle 87. *Id.*, at 13:24-36. Once a network-edge device 86 has been removed, the initiating device 85 looks for another network-edge device 86 in its router tables that can be used to participate in the multilink bundle 87 and send a request for that device 86 to join. *Id.*, 13:54-60. Because each network-edge device 86 prioritizes its local service requirements, its participation in a multilink PPP service is available only to bandwidth that is not required for its own current local demands, which are constantly changing. *Id.*, at 13:60-66. The multipath connection creates a dynamically adjusting network through which a data-requesting device, i.e., the initiating device 85, requests and receives data from a data source utilizing the excess bandwidth of an evolving number of network-edge devices 86.

The innovative multipath connection unlocks higher network speeds, increased availability, and greater efficiency. The effective bandwidth between the

sender and recipient of the data is improved by transmitting and receiving data over multiple communication channels and aggregating the transmitted data. *Id.*, at 11:42-56. In addition to increasing speeds, the multipath connection also enables data transfers over different connections when certain connections are unavailable, and utilizes bandwidth that otherwise is unused. *Id.*, at 12:1-14:9.

Both independent claims 1 and 13 recite similar elements, as shown below. Claim 1 is directed to a client device that includes first and second network interfaces, each having a data transfer rate associated with a path from a server to the respective network interface. The client device also includes a processor configured to transmit first and second messages to the server through the different network interfaces, the first message including a multilink request and a destination URL and the second message including a multilink session identification and the destination URL, and to receive data packets from the server through the different network interfaces.

On page 7, #14 of the Order, it was recognized that in claim 1 of the '908 Patent that the word "and", should not have been removed in the issued patent, first, between the elements of a "multilink request" and a "destination URL", and second, between the elements of a multilink session identification" and a "destination URL". The Order recognized the inclusion of the word "and" in these two places.

Claim 1: A client device for multilink data packet communication with a server, the client device comprising:

a first network interface having a first data transfer rate associated with a first path from the server to the first network interface of the client device;

a second network interface having a second data transfer rate associated with a second path from the server to the second network interface of the client device; and

at least one processor configured to:

transmit a first message through the first network interface to the server, wherein the first message includes a multilink request and a destination URL;

transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification and the destination URL; and

receive data packets from the server through the first and second network interfaces of the client device during the multilink session wherein the first data transfer rate and the second data transfer rate provide an increased data transfer rate of the first path and the second path from the server to the client device.

Claim 13 is directed to a first device that includes a network interface and a processor. The processor is configured to transmit first and second messages to second and third devices, respectively, through the network interface, the first message including a multilink request and a destination URL and the second message including a multilink session identification and the destination URL, and to

receive different data packets from the second device and the third device through the multilink session.

Claim 13: A first device comprising:

a network interface; and

at least one processor configured to:

transmit a first message through the network interface to a second device, wherein the first message includes a multilink request and a destination URL, the network interface to the second device having a data transfer rate associated therewith;

transmit a second message through the network interface to a third device, wherein the second message includes a multilink session identification that is unique to the multilink session and the destination URL, the network interface to the third device having a data transfer rate associated therewith; and

receive the different data packets through the at least one network interface from the second device and from the third device during the multilink session, wherein the data transfer rate associated with the network interface to the second device and the network interface to the third device provide an increased data transfer rate for the first device.

B. Claim Construction

On page 9, #18 of the Order, it specifies that the proper claim construction standard to be applied for an expired patent is articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303, 1316 (Fed. Cir. 2005) (words of a claim "are generally given their ordinary and customary meaning" as understood by a person of ordinary skill in the

art in question at the time of the invention…") Therefore, these claims should be "given their ordinary and customary meaning [and] that the ordinary and customary meaning of a claim term is the meaning that the term would have to a [POSITA] in question at the time of the invention, *i.e.*, as of the effective filing date of the patent application." *Phillips*, 415 F.3d at 1312-13.

C. Level of Ordinary Skill in the Art

Patent Owner asserts that a person of ordinary skill in the art ("POSITA") would be: a person having, at least by October 14, 2002: (1) at least an undergraduate degree in electrical engineering or closely related field, or similar advanced [post]-graduate education in this area; and (2) 2 or more years of experience with communications systems, with more experience substituting for less education and vice versa.

V. THE ORDER FAILS TO ESTABLISH THAT CLAIMS 1-2 AND 5-6 ARE OBVIOUS OVER MAURYA AND LOW, OR THAT CLAIMS 1-2, 5-6 AND 13-15 ARE OBVIOUS OVER MAURYA, LAW AND KRISHNAN

A. The Legal Framework For Responding To A Substantial New Question of Patentability

As per 37 C.F.R. § 1.515(a), "an examiner will consider the request and determine whether or not a substantial new question of patentability affecting any claim of the patent is raised by the request and the prior art cited therein, with or without consideration of other patents or printed publications." As per 37 C.F.R. §

1.530, any "statement filed by the patent owner shall clearly point out why the subject matter as claimed is not anticipated or rendered obvious by the prior art patents or printed publications, either alone or in any reasonable combinations." SNQ#1 and SNQ#2 are both relying on a combination of references, thus requiring a response to why the subject matter as claimed is not rendered obvious by the prior art patents or printed publications.

A claim is unpatentable under §103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) when in evidence, objective indicia of non-obviousness (i.e., secondary considerations). *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966). Further, an Order seeking to establish obviousness based on more than one reference, as is the case here, "must articulate sufficient reasoning with rationale underpinning to combine the teachings." *Wilson Elec., LLC. v. Cellphone-Mate, Inc.*, Case No. IPR2018-01778, Paper 10 at 15 (PTAB Apr. 23, 2019) (citing *KSR Int'l*, 550 U.S. at 418).

B. SNQ#1: The Order Does Not Establish that Claims 1, 2, 5, and 6 Would Have Been Obvious over Maurya and Low

Starting on page 10, #20 of the Order, it alleges that the combination of U.S. Patent No. 6,160,808 to Maurya ("Maurya") and International Publication No. WO97/22212 to Low ("Low") raises a substantial new question of patentability as to at least independent claim 1 of the '908 Patent. Claims 1, 2, 5, and 6 of the '908 Patent are not obvious over the combination of Maurya and Low.

In general, Low is not even analogous art to the '908 Patent and, therefore, cannot be used in an obviousness combination against it. Even if Low were analogous, SNQ#1 fails to demonstrate that Maurya and Low disclose all limitations of independent claim 1. Further, the Order fails to adequately explain why a POSITA would have and could have selected the particular components from Maurya and Low and combined them in the manner proposed to render the challenged claims obvious.

1. Asserted References

a. Maurya

Maurya is directed to a multi-link protocol that enables two peers to transmit data over multi-link transmission channels. Maurya, 5:7-6:12. Under conventional multi-link point-to-point (PPP) protocols, data is encapsulated into packets and transmitted through a network of single-link transmission channels between two

peers. Packets are assembled in order of receipt at the receiving peer, which works easily when using single-link transmission channels. Such conventional ordering is problematic when each transmission channel individually includes multiple links. Maurya, 3:66-4:35.

Conventional multi-link PPP packets include information that enables the multi-path connection, including a header portion identifying a multi-path connection, the encapsulated segmented data, and a sequence number. Maurya, 8:25-13 and Figs. 2 and 3. The sequence number increases by one with each successive packet and is used by the receiving peer to reassemble the segments into the proper order to reconstruct the data. *Id.*, at 3:28-35. When conventional single-link transmission channels are used between the peers, the sending peer distributes packets in a round-robin basis among the several links, and the receiving peer extracts the segments from the received packets for reassembling into the PPP frame based on the sequential sequence numbering. *Id.*

Maurya is directed to a multi-path protocol 600 that enables a multi-path connection over multi-link transmission channels 630_n, such as the example embodiment illustrated in Fig. 6A below. When multi-link transmission channels 630_n are used between the peers such as a PC client computer 610 and a server computer 665, the sending peer, e.g. PC client 610, sends streams of packets over interfaces 615 to a plurality of ISDN terminal adapters 620_n. Maurya, 11:38-45 and

Fig. 6A. The data packets are then sent over each channel 630_n to the respective ISDN terminal adapters 660_n, and then forwarded to the receiving peer, e.g. the server computer 665. *Id.*, at 11:40-12:10. Because each channel 630_n includes pairs of links 632, 634, conventional sequence numbering in standard packets sent over these links 632, 634 would result in gaps between packets sent to the receiving peer 665, which would be unable to reassemble the received packets. *Id.*, at 12:36-65.

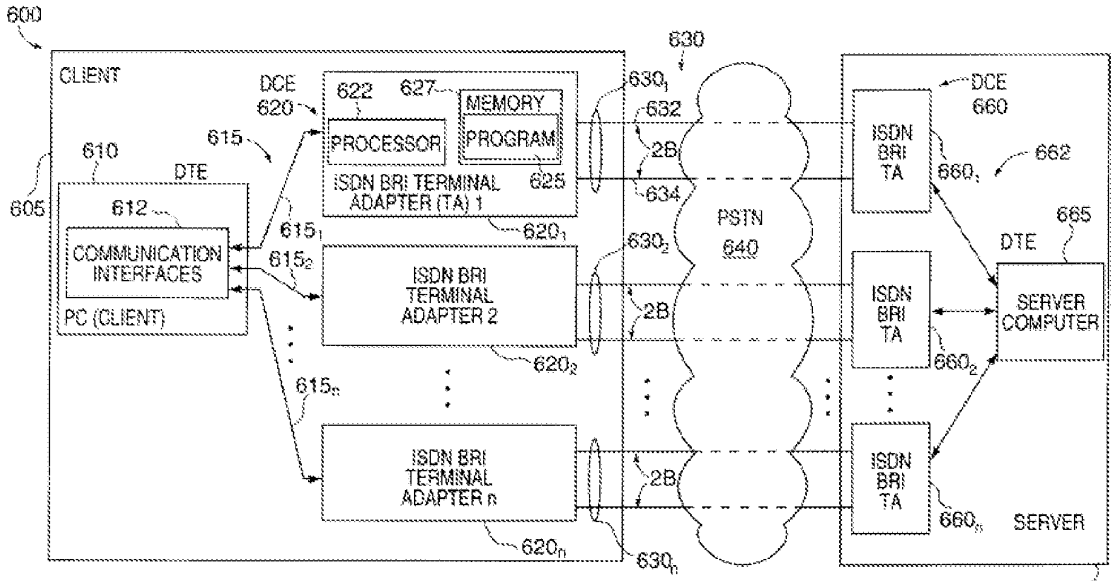


FIG. 6A

Fig. 6A of Maurya

The multi-link protocol of Maurya packetizes each individually-transmitted packet as the segmented data within a second layer of packetized data in the multi-link PPP stream, creating a "mult-multi link packet." *Id.*, at 15:22-56 and Fig. 6C.

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Once the multi-multi link packets are received at the receiving terminal adapter 660_n, wherein the receiving terminal adapter orders 660_n the packets based on the sequence number in its multi-multi link header, then strips each multi-multi link packet of its multi-multi link header, and finally transmits the packets in their proper order to the server computer 665. *Id.*, at 17:9-19.

Further, Maurya discloses the use of an endpoint discriminator value unique to the originating device (i.e., the device sending packetized data, such as PC 610) that is sent to each sending terminal adapter 620_n, which in turn sets the value of its own endpoint discriminator to match that of the sending peer 610. *Id.*, at 9:35-42 and 13:61-14:21. While each sending terminal adapter 620_n negotiates with a corresponding receiving terminal adaptor 660_n, each terminal adaptor 620_n sends the same endpoint discriminator value of the sending peer 610 to its receiving terminal adapter 660_n so that the server computer 665 will view all links as part of a common bundle. *Id.*

Fig. 6C reproduced below illustrates the process of packetizing a data packet 680 into a multi-multi link data packet 685. Each packet 680 includes a PPP header 503 and a multi-link protocol header 505, which provide information through various fields. *Id.*, 15:22-31. For example, a value of one in the type field indicates that the packet is an LCP Configure Request packet, sent by a PPP peer when that peer desires to change a configuration parameter associated with the link. *Id.*, at

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8:30-33. A value of 17, 18, or 19 in the type field indicates a multi-link maximum receive reconstructed unit request, a multi-link short sequence number header request, and a "multi-link endpoint discriminator" option, respectively. *Id.*, at 8:67-13:9.

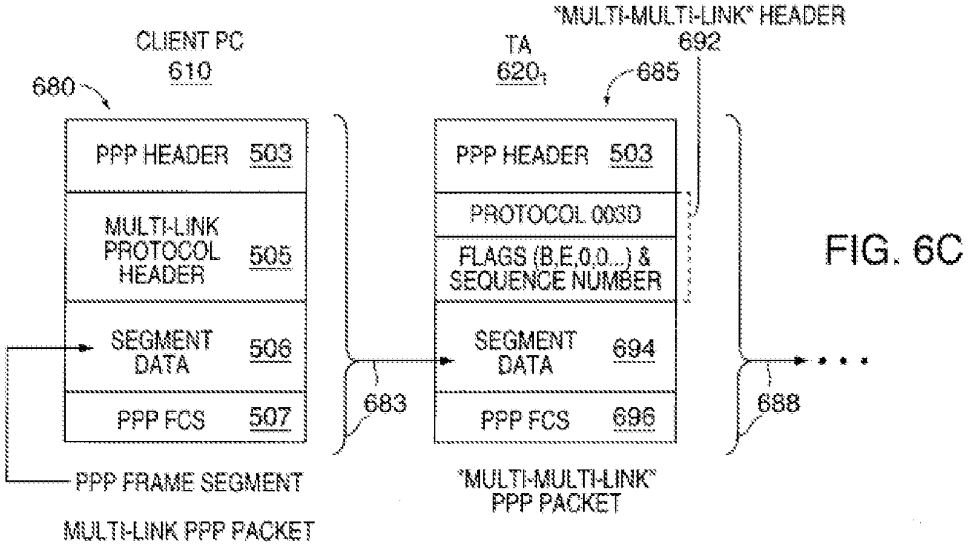


FIG. 6C

Fig. 6C of Maurya

b. Low

Low is directed to a switched telecommunication system that uses service resource items (URLs) to set up a network. Low, 1:7-9 and 2:2-16. Generally, the system of Low enables a user to access setup control logic for a channel through a public switched telephone network (PSTN). Low, 16:12-29.

Fig. 13, reproduced below, demonstrates this functionality with respect to a "personal number" service in which a first user can setup a single, unique,

unchanging personal phone number (a "Webtel" number) that can be used by others to reach the first user by phone, even when the first user changes their "real phone number" (a B-telNb). *Id.*, at 35:9-22. In this example, the system allots the first user a unique personal number that is associated with a dedicated "phone page," which associates the Webtel number with the first user's current real telephone number. *Id.*, at 35:19-22. The phone page is located at a URL, which, when accessed, returns the current real phone number. *Id.*, at 35:18-19. Accordingly, when another user calls the first user's Webtel number, the system accesses the phone page associated with the Webtel number, acquires the first user's current real phone number, and uses the current real phone number to complete the call. *Id.*, at 35:27-36:10.

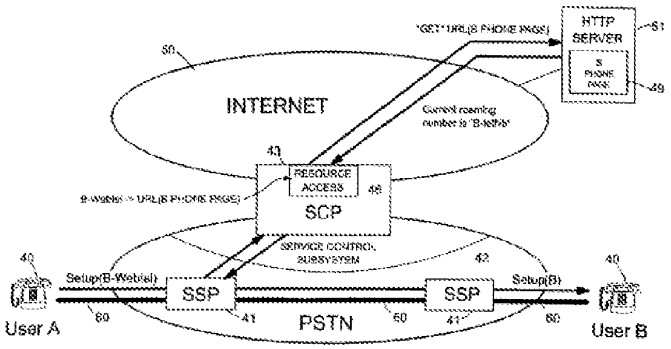


FIG. 13

Fig. 13 of Low

More specifically, when a phone call is made, the service switching point (SSP) generates a service request that is conveyed to the service control point (SCP).

Id., at 20:29-32. The service logic program running in the SCP is a skeleton form, being instantiated on receipt of a service request and then serving to initiate service resources access and to return the results of this access to the entity that made the service request. *Id.*, at 21:20-27. The association between the unique number and the URL of the phone page is stored in an association table accessible to SCP 43. Therefore, the SCP receives the unique number from the first user and locates the URL through a table. *Id.*, at 35:24-25.

2. Low Cannot be Considered For Obviousness Because It Is Non-Analogous Prior Art

As provided above, Low is directed to switched telecommunication systems that use service resource items (URLs) to set up a network in which a user may dial a first telephone number (Webtel number) and be connected to a second telephone number (B-telNb). Low, 1:7-9, 2:2-16, and *Id.*, at 35:9-36:10. The teachings in Low are not relevant to the problem solved in the '908 Patent and a POSITA would not look to Low when resolving the problem of transferring large data files in a low speed network, as described and claimed in the '908 Patent.

A reference may be used in an obviousness determination "only when analogous to the claimed invention." *In re Bigio*, 381 F.3d 1320, 1325 (Fed. Cir. 2004). A reference is analogous when (1) it is from the same field of endeavor, regardless of the problem addressed, or (2) if it is not from the same field of the

inventor's endeavor, it is reasonably pertinent to the particular problem with which the inventor is involved. Id.; see also *United Lab'ys Int'l, LLC v. Refined Techs., Inc.*, IPR2019-01544, Paper 9 at 11 (PTAB Jan. 22, 2022) (finding prior art related to oil well exploration was not analogous to claims directed to cleaning oil refineries); *Polygroup Limited v. Willis Elec. Co.*, IPR2016-01609, Paper 16 at 35 (PTAB Feb. 26, 2018) (finding that prior art related to electrical connections used in desk lamps was not analogous to claims directed to lighting for artificial trees), aff'd, *Polygroup Ltd. MCO v. Willis Elec. Co., Ltd*, 759 F. App'x 934, 942 (Fed. Cir. 2019).

As explained below, Low fails both prongs: it is not from the same field of endeavor as the '908 Patent, and it is not reasonably pertinent to the particular problem with which the inventor was involved in the '908 Patent.

First, the '908 Patent's field of invention is transferring large amounts of data over low bandwidth networks through a multipath connection, as shown in the title, claims, and specification. Maurya, 10:57-11:56 and Claims 1-17. The specification describes the problem arising in conventional low bandwidth networks by describing "one of the primary functions of the [inventive technology]" is to "be able to transfer large files such as video files over POTS lines to a residence. The ability to do this is limited by the maximum of 56 Kbps due to the design of the digital Class 5 office linecards and network transmission schemes based on T carriers." *Id.*, at 10:57-63.

The challenged claims recite network interfaces providing *data transfer rates* and a processor configured to provide "an increased data transfer rate." *Id.*, at Claims 1 and 13.

In contrast, Low's field of endeavor is a network that allows for forwarding phone calls through setup logic on the internet. Low, 1:7-9; 2:2-16; and 35:9-36:10. Whether art is analogous must consider "each reference's disclosure in view of the reality of the circumstances, and weigh those circumstances from the vantage point of the common sense likely to be exerted by one of ordinary skill in the art in assessing the scope of the endeavor." *Airbus S.A.S. v. Firepass Corp.*, 941 F.3d 1374, 1380 (Fed. Cir. 2019). Because Low relates to transferring phone calls over telephone channels, and does not relate in any manner to increasing the bandwidth available for transferring data through its networks, a POSITA would have understood Low is not in the same field of endeavor as the '908 Patent.

Second, Low is not reasonably pertinent to the particular problem with which the '908 Patent is involved. To show that a reference is "reasonably pertinent," it has to be shown that "an inventor would look to this particular art to solve the particular problem at hand." *Circuit Check, Inc. v. QXQ, Inc.*, 795 F.3d 1331, 1335-36 (Fed. Cir. 2015). The '908 Patent addresses the problem arising from transferring large data files over low bandwidth network connections to a device. Maurya, 10:57-11:56 and Claims 1-17. The '908 Patent explains that conventional connections are unable

to transfer large files due to limited speeds. *Id.* Consequently, "[one] of the primary functions of the RCG is to be able to transfer large files such as video files over the POTS lines to a residence." *Id.*, at 10:58-60.

In contrast, Low addresses problems associated only with telephone communication systems. Low explains in its background section basic telephone service networks, telephone numbering plans, and providing telephony services over the internet. Low, 2:19-16:10. Low states that the "object of the present invention [is] to provide a method of accessing a service resource item over a communications network *that facilitates the integration of the PSTN and the WWW*." *Id.*, at 16:8-10. Therefore, the POSITA would have understood the problem that Low was attempting to provide "a more synergistic relationship between [telephone companies] and [the world wide web]." *Id.*, at 1:14-16.

As noted above, the '908 Patent is clearly directed to improving data transfer performance, as evidenced by the title, the abstract, the claims, and the prosecution history. Therefore, Low would not have "logically… have commended itself to an inventor's attention in considering his problem." *In re ICON Health and Fitness, Inc.*, 496 F.3d 1374, 1379-80 (Fed. Cir. 2007) (quoting *In re Clay*, 966 F.2d 656, 659 (Fed. Cir. 1992)). Low fails to satisfy either prong of the analogous standard, and therefore cannot be considered in any obviousness determination.

3. Maurya and Low Fail to Disclose First and Second Messages That Include a Destination URL As Recited in Claims 1, 2, 5, and 6.

Each of Claims 1, 2, 5, and 6 specifies a client device comprising a processor configured to transmit a first message including a destination URL and to transmit a second message including the destination URL. To satisfy its burden of proving obviousness, one "cannot employ merely conclusory statements" and must instead articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness. *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016).

First, the Order recognizes the Maurya does not teach or suggest including a destination URL in the messages or packets of the multi-link connection disclosed therein and attempts to remedy this deficiency by pointing to the URL taught by Low. Order, p. 16, #22.

Second, the URL of Low is merely a "phone page" that, when accessed, returns the current real phone number of the user associated with the URL. Low, 35:18-19. The URL of Low is not a "destination" URL associated with any component of a multipath connection.

Third, Low does not teach or even suggest the use of a URL to be included in a message or packet as required under the challenged claims. Low instead discloses retrieving the URL of a user's phone page through a look-up table accessible to the

SCP 43. There is no message or packet or other data transferred in the system of Low that includes a URL.

Fourth, Maurya discloses specific packets that include all of the information needed to organize and enable the multi-link connection described therein. The packets 680, 685 of Maurya include a type field specifying the multi-path connection, a data segment including the encapsulated data itself, and an endpoint discriminator identifying the originator so that all data from the sending peer can be identified. There is no element in the packet of Maurya that could be substituted with the URL corresponding to a phone page as taught by Low.

The Order alleges that a destination URL would have been included in messages sent from the client to the server, as recognized by Low within the first and second messages disclosed in Maurya. Maurya, p. 16, #23. However, as described herein, Maurya discloses the LCP configuration packets that include *all information necessary* to create the multi-link connection described therein. Maurya, 8:30-33 and 8:67-13:9.

Fifth, each packet of Maurya includes encapsulated data in the segmented data portion 506, 694 of each packet 680, 685, respectively. As evidenced by the use of the type field and the endpoint discriminator, the receiving peer and the sending peer are identified within each packet. Because data is transferred directly from one peer to another in the system of Maurya, there is no need whatsoever to use a URL to

access a phone page as taught by Low or to access any other details of the multi-link connection as urged by the Order.

Thus, the Maurya-Low combination explicitly does not disclose "transmit a first message..., the first message including… a destination URL" and "transmit a second message..., the second message including… the destination URL" as required by claims 1, 2, 5, and 6 of the '908 Patent. For these reasons, SNQ#1 fails to rendered claims 1, 2 and 5-6 obvious over Maurya and Low, thus meaning that claims 1, 2 and 5-6 are patentable over Maurya and Low.

4. Order Fails To Explain A Motivation to Combine Maurya and Low.

According to the Order, it would have been obvious to add the URL of Low to the packet of Maurya. Order, p. 16, #22-23. This argument is fatally flawed for reasons of procedure as well as substance.

Procedurally, Maurya and Low are each from different fields of endeavor and there exists no motivation to combine them. Maurya is a multi-link protocol that enables data transfer through multiple-link transmission channels between peers to improve data transfer speed. Maurya, 5:7-6:12. Low is a switched telecommunication system for a telephone network. Low, 1:7-9 and 2:2-16. Although Maurya and Low are each concerned, in their own ways, with communication systems, this is not sufficient to establish that a POSITA would have

an objective reason to combine the references or that the resultant combination would have been obvious. Rejection of a claim based on obviousness cannot be sustained by mere conclusory statements; there must be some articulated reasoning with some rational underpinning to support the conclusion of obviousness.

In terms of substance, the Order has not demonstrated that there is motivation for a POSITA to combine these references. "A party that petitions the Board for a determination of obviousness must show that 'a skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention, and that the skilled artisan would have had a reasonable expectation of success in doing so.'" *Apotex Inc. v. Wyeth LLC*, IPR 2014-00115, Paper 94 at 11 (PTAB Apr. 20, 2015) (*citing Procter & Gamble Co. v. Teva Pharms. USA, Inc.*, 566 F.3d 989, 994 (Fed. Cir. 2009)).

Maurya discloses the LCP configuration packets that include *all information necessary* to create the multi-link connection described therein. Maurya, 8:30-33 and 8:67-13:9. Maurya continues to describe the contents of packets 680, 685 that are used in the multi-link protocol. *Id.*, at 15:22-31. Additionally, the system of Maurya is a complete solution because the multi-link connection transmits data directly from a sending peer to a receiving peer, there is no need whatsoever to access any information on the internet.

Further to Maurya's complete lack of need for a URL in its packets, the URL in the system of Low is merely a phone page that is translated by a service logic program into a currently available number in order to connect a call over a telephone line to a user. There is no information in the packet of Maurya that could be substituted with the phone page URL as taught by Low. The POSITA would have no reason whatsoever to include a phone page as disclosed in Low in the packet of Maurya because Maurya has no need to access a phone page.

The Order does not articulate a motivation and a meaningful, articulated explanation with rational underpinnings to support its conclusion of obviousness. As a preliminary matter, Low does not teach or even suggest the contents of packets. Further, the bare assertion of incorporating "destination URL" (Low) in "first and second messages" (Maurya) is not a sufficient reason to combine the references.

Further, as described above, Low teaches that its system accesses the URL immediately in response to a trigger event (e.g., a phone call from a user to the Webtel number), that access of the URL returns a phone number (i.e., the B-telNb), and that the returned phone number is then used to connect a telephone call. Maurya has no need for, and could not incorporate, any of these functions into its multi-multi link system.

The Order has failed to describe why a POSITA would incorporate the phone page URL of Low to modify the packets of Maurya to create a system in which a

Destination URL is included in both a first message and a second message sent between devices of a multipath connection to transfer data. For these reasons, claims 1, 2, 5 and 6 are not rendered obvious over Maurya and Low.

C. SNQ#2: The Order Does Not Establish that Claims 1, 2, 5, 6, and 13-15 Would Have Been Obvious over Maurya, Low, and Krishnan

1. Asserted Reference

a. Krishnan

U.S. Patent No. 5,809,070 to Krishnan ("Krishnan") is directed to systems and methods that provide high speed data transmission over multiple low speed communication links. Krishnan, 1:36-67. A host computer 10 is coupled to separate modems 12, 14 that communication over telephone lines 16, 18 to another computer. *Id.*, at 2:23-41. The host computer 10 is programmed to split a single, high-speed data stream into multiple low speed links of modems 12, 14. *Id.*

2. Krishnan Fails To Disclose First and Second Messages That Include a Destination URL As Recited in Claims 1 and 13

Similar to claim 1, claim 13 also recites "transmit[ting] a first message…, the first message including… a destination URL" and "transmit[ting] a second message…, the second message including… the destination URL." The Order does not rely on Krishnan to teach this claimed feature, but instead relies on Maurya-Low. Order, #26-29. Krishnan is relied upon for "disclosure of first and second network interfaces having first and second date transfer rates". Order, p. 19, #27. This has

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nothing to do with "first message" and "second message" having a "destination URL", which as discussed above, the Maurya-Low combination fails to disclose, teach, or suggest this claim element. *See* Section IV(B) above. Krishnan does not make up for the deficiency of the Maurya-Low combination. Therefore, the Order fails to establish that the proposed combination of Maurya, Low, and Krishnan disclosed at least this element as recited in independent claims 1 and 13.

3. Order Does Not Explain A Motivation to Combine Maurya, Low, and Krishnan

The Order does not rely on Krishnan to provide motivation to combine Low with Maurya. Order, p. 19-20, #27-28. As discussed above, the Order fails to establish that the skilled artisan would be motivated to add the URL of Low to the packet of Maurya. See Section IV(B). Therefore, the Order fails to establish motivation to combine Maurya, Low, and Krishnan.

VI. CONCLUSION

The Order does not describe or suggest that claims 1-2 and 5-6 are obvious over a combination of Maurya and Low, or that claims 1-2, 5-6 and 13-15 are obvious over a combination of Maurya, Low and Krishnan. For these reasons, the claims continue to be patentable over these three cited references. It is urged that the Reexamination Certificate be issued forthwith.

Patent Owner reserves the right to provide additional reasons why the claims are not rendered obvious over the combination of cited references. The Patent Owner further has additional arguments to refute the obviousness allegations and does not agree with what is further asserted in the Order.

Pursuant to 37 C.F.R. § 1.565(a), there is no litigation proceeding and no *inter partes* review proceeding involving the '908 Patent.

Dated: March 1, 2024

Respectfully submitted,

By: /H. C. McGurk IV/

H. C. McGurk IV
Reg. No. 34,964
Attorney For Patent Owner

LAW OFFICE OF CLAY MCGURK
PO Box 1488
Orange, CA 92856
claymcgurk@gmail.com
T: (949) 395-3942

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 1.530(c) and 37 C.F.R. § 1.248(a)(1), I hereby certify that on **March 1, 2024**, a true and correct copy of the ***Patent Owner Statement*** was caused to be delivered and/or served electronically on the following counsel of record at the following email addresses:

Michelle Aspen: michelle@unifiedpatents.com

Jessica L.A. Marks: jessica@unifiedpatents.com

/ Clay McGurk /

Clay McGurk, Attorney
LAW OFFICE OF CLAY MCGURK
PO Box 1488
Orange, CA 92856
claymcgurk@gmail.com
T: (949) 395-3942

UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
90/019,265	**04/30/2024 11:52:48 AM Z ET**	**COM908**

Title of Invention

DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS

Application Information

APPLICATION TYPE	Utility / ex parte reexam	PATENT #	10868908
CONFIRMATION #	3396	FILED BY	Ashley Cheung
PATENT CENTER #	65311938	FILING DATE	10/04/2023
CUSTOMER #	64828	FIRST NAMED INVENTOR	- 10868908
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Jessica Marks

Documents

TOTAL DOCUMENTS: 2

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
COS_COM908.pdf	1	Reexam Certificate of Service	109 KB
Reply_COM908.pdf	16	Reexam Timely Requester's Reply to an Owner's Statement	333 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
COS_COM908.pdf	75D0CB86055E3F378202F8C2703A5B8C4257B11C72312AD582 0E367CDB0445FC747863779BD26859A1EEB54C2726A0243214 6E42B4C2295CACADF3F3DBF02573

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Reply_COM908.pdf 5673DAAD895DEAADCA35BF74A691E32A278540C64BF6FAE5F2D872B38736B473E1B97C16B87F63E1B4290F8A6F100B8E9F8AD08190801AF673CA0FC3C38F4837

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of Delangis	§	Group Art Unit: 3992
	§	
Reexamination Control No.: 90/019,265	§	Examiner: Joseph R. POKRZYWA
Reexamination Filing Date: Oct. 4, 2023	§	
	§	
U.S. Patent No.: 10,868,908	§	Confirmation No.: 3396
Issue Date: December 15, 2020	§	
Filing Date: May 23, 2016	§	
	§	
Title: DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS	§	Requester Dkt. No.: COM908
	§	Requester Customer No.: 165774

REPLY TO COMPETITIVE ACCESS'S STATEMENT IN THE *EX PARTE* REEXAMINATION OF U.S. PATENT 10,868,908

Mail Stop "*Ex Parte* Reexam"
Attn: Central Reexamination Unit
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Pursuant to the provisions of 37 C.F.R. § 1.535, Unified Patents, LLC ("Requester") hereby submits this Reply to the Patent Owner Statement of Competitive Access ("Competitive Access's Statement") in *Ex parte* Reexamination 90/019,265. Competitive Access's Statement was served to Requester on March 1, 2024, setting the due date for this Reply of May 1, 2023. Requester believes no fee is due with this submission, however the Commissioner is hereby authorized to charge any fee deficiency or credit any over-payment to Deposit Account 50-6990.

The arguments presented in Competitive Access's Statement do not overcome the evidence presented in the Request. Accordingly, Requester maintains the Challenged Claims of U.S. Patent 10,868,908 ("the '908 Patent") are invalid over the prior art and evidence provided in the Request. Requester, therefore, requests that an Office Action rejecting claims 1-3, 5-6, and 13-15 be issued.

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I. INTRODUCTION

Although the Order Granting Request for *Ex Parte* Reexamination ("Order") has preliminarily determined that there is sufficient disclosure regarding transmitting a second message to the server from the first device (Order, 21-23), Requester submits that reconsideration of this decision is warranted. Additionally, Competitive Access's narrow interpretations of its disclosures and the prior art and its misunderstandings of the proposed rejections do not overcome the SNQs presented in the Request. Low is analogous prior art and the combination of Maurya and Low disclose sending a message to the server that "includes…a destination URL."

II. THE PRIORITY DATE AND HOW MAURYA AND LOW DISCLOSE SENDING A MESSAGE TO THE SERVER THAT "INCLUDES…A DESTINATION URL"

For the reasons presented below, Requester requests reconsideration of the priority date issues presented in the Request. *See, e.g.,* Request, Section D.1. The earlier disclosures to which the '908 Patent claims priority (which are identical to the '908 Patent's disclosure) do not provide written description support for sending a message "to the server" that "includes…the destination URL." But even if the Office disagrees with this conclusion, the following provides an analysis that is helpful to several issues in this case, including how the prior art discloses this element under the various definitions that have been raised in this case.

a. The Prior Applications Do Not Disclose Sending the Server Its Own Destination URL

Requester submits that the '908 Patent cannot claim priority to U.S. Application 13/531,294 (the "'294 Application," Ex. 1008) because the '294 Application does not disclose sending a message to the server that "includes…a destination URL." The '294 Application is identical to the '908 Patent's disclosure, and each of these disclosures fail to provide written description support for this element.

To understand this issue, a review of the disclosure is helpful. The client device of claim 1

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corresponds to the RCG-85 of Figure 7. Figure 7, which is common to the '908 Patent and the '294 application, is provided below. Ex. 1001, Fig. 8; Ex. 1008, 44. For ease of reference, citations are made to the '908 Patent's specification.

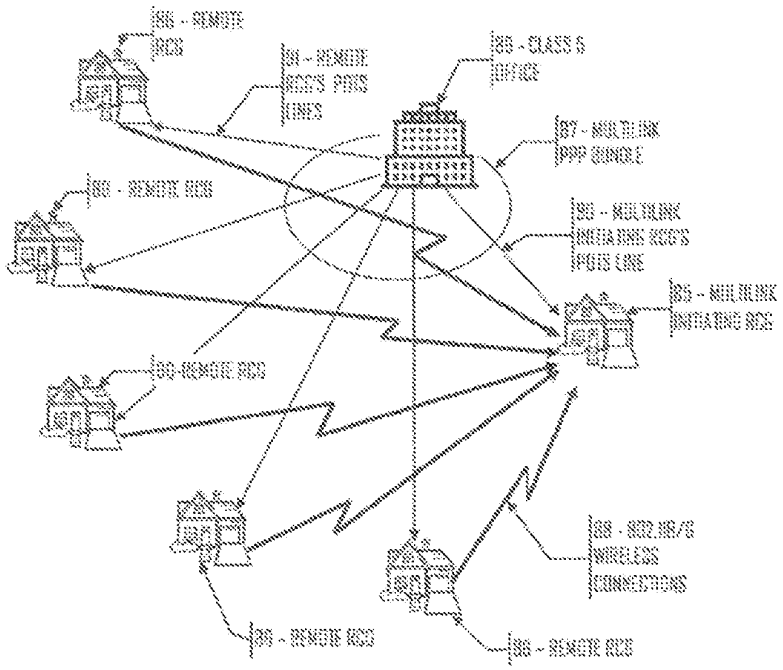


FIG. 7

RCG-85 has two interfaces: (1) a POTS interface to the server, and (2) an 802.11 b/g interface to other, remote RCG 86s. *See, e.g.,* Fig. 7, POTS line 90 and 802.11B/G 88. When RCG-85 decides to download a large file from the server, it sends a message over the POTS interface that is addressed to the remote server. Ex. 1001, 12:2-6. RCG-85's message to the server contains a "request[for] a multilink PPP session." 12:2-6.

After RCG-85 and the server negotiate the details of the session, the server sends a message to RCG-85. Ex. 1001, 12:6-14. The server's message to RCG-85 contains "a multilink session ID,"

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which RCG-85 uses to recruit other remote RCG-86s to assist with the transfer. Ex. 1001, 12:6-14. The server starts transferring data over the POTS interface to RCG-85. Ex. 1001, 12:14-16.

While RCG-85 is receiving data from the server over the POTS interface, it begins looking for available remote RCG-86 to assist with the transfer. Ex. 1001, 12:14-57. Once an appropriate remote RCG-86 is identified, RGC-85 sends RCG-86 a message over the 802.11 b/g interface. Ex. 1001, 12:51-57. The message from RCG-85 to RCG-86 contains (1) "the URL of the destination," i.e., the destination URL for the remote server so RCG-86 knows where to send the request to join the multilink session and (2) "the multilink session ID" so RCG-86 knows which multilink session it should join. Ex. 1001, 12:51-57.

Importantly, the "destination URL" is the '908 Patent's term for the address of the server, not the data within the server or the specific resource RCG-85 is trying to access. *See, e.g.,* Ex. 1001, 12:60-66, 12:2-5; Request, 12-14. That is, the "destination URL" is described as "accept[ing] the request of each of the remote RCGs-86 and begins sending data packets to each of their respective POTS lines-91." Ex. 1001, 12:60-66; *see also* 12:2-5 (initiating a session "with a remote computer i.e. internet URL" or "with that URL resource"). Thus, the "destination URL" refers to the address of server, not the resource or data within the server at least because the only server—not the resource or data itself—has the capability of performing these disclosed functions.

RCG-86 uses the destination URL to address its message session to the remote server. Ex. 1001, 60-63. RCG-86's message to the server (i.e., to the destination URL) contains (1) "the multilink PPP session ID" and (2) a "request to be added to that multilink PPP bundle-87." Ex. 1001, 12:60-63.

After receiving RCG-86's message, the remote server starts transferring data to RCG-86 through RCG-86's POTS interface. Ex. 1001, 12:63-66. And then RCG-86 sends its received data

packets to RCG-85 through RCG-85's 802.11 b/g interface. Ex. 1001, 12:66-13:3.

There is no disclosure of the RCG-85 client device transmitting the server's own URL within the message with the multilink request. The remote server's URL is only included in the message that is sent from RCG-85 to the other, remote RCG-86 so that the remote RCG-86 will know how to address its request to join a multilink session. And there is no disclosure of RCG-86 sending the server the server's own destination URL either. Instead, RCG-86 creates its own message containing the multilink PPP session ID and a request to join the session, which adds the destination URL to the message but does not include the URL in the message.

Requester submits that the Order has misinterpreted RCG-85's request to start "a multilink PPP session *with* [a] URL resource" (i.e., sending a message to a server) as an indication that the message contains that server's own URL. Order, 22; Ex. 1001, 12:2-5. This conflates information included in the address *added to* a message with the information that the message itself *includes*. Put another way, the URL added to a message represents the handling instructions for the message, not contents of the message itself.

Indeed, the '908 Patent's disclosure is consistent with Requester's understanding. The only time the server's URL is described as being included in the message is when it is sent from RCG-85 to RCG-86, when RCG-85 is instructing RCG-86 how to address RCG-86's own request to join the multilink. The '908 Patent describes how the "remote RCGs-86" then sends a request "*to* the destination URL" (i.e., it does not describe sending a message *including* the destination URL). And it separately describes the contents included in the message as "the multilink PPP session ID and request to be added to that multilink PPP bundle-87." Ex. 1001, 12:60-63.

And the reasons why the destination would be included with the message between RCG-85 and RCG-86 but only appended as the address to the other messages is evident in the operation of

the system. Only RCG-86 needs to be given the destination URL in the contents of the message so that it can use that URL to address its request to join the multilink session. The server, on the other hand, has no use for a message that contains its own URL.

Requester submits that the Order also misinterprets that RCG-85 will "eventually [send] a second message…and the remote RCG 86 through the server 89." Not even the message from RCG-86 to server 89 includes the server's own destination URL. RCG-85's message to RCG-86 contains the multilink session id and the server's destination URL. The is the only message that *includes* the server's destination URL. This allows RCG-86 to *address* a message to the server (at the destination URL), but the contents of that message to the server are "the multilink PPP session ID and request to be added to that multilink PPP bundle-87." Ex. 1001, 12:60-63. Thus, although RCG-85 sends a message to RCG-86 that prompts RCG-86 to send a message to the server, the two requests are distinct and contain different contents. There is no disclosure of *any* message to the server containing the destination URL within the message contents. Just like with RCG-85's request to the server, there is no purpose to sending the server its own destination URL because the server has no use for it. Thus, RCG-85 does not send any message to the server that includes the destination URL, even indirectly through RCG-86.

Further, as is relevant to claim 1, there is no disclosure that RCG-85 ever sends the multilink session ID and URL *back to* the server in a second message. Claim 1 is structured to require one device to send two messages to a server, but the specification only describes RCG-85 sending the *request* message to the server to set up a multilink session. That is, as a "part of a successfully multilink session setup…RCG-85 receives a multilink PPP session ID" and "data transfer [begins] across is POTS interface-90 with the far end computer system." Ex. 1001, 12:9-16. There is no need for RCG-85 to send back a second message with the multilink session ID (or the server's

own URL) because RCG-85 has already joined the session as the initiating client for that session. Instead, RCG-85 uses the multilink session ID and URL to send a second message to recruit a remote RCG-86 to assist in the data transfer, with RCG-86 using the information to create its own request message to join the session. Ex. 1009, 12:28-39.

RCG-85 would not need to send a second message to the server including the multilink session ID and URL, as it has already joined the session as part of its original request and the server's acknowledgment. Ex. 1009, 12:9-16. And nothing in the specification implies that message sent from RCG-85 to RCG-86 are then forwarded to the server. RCG-86 is not a conduit for RCG-85's messages; RCG-86 generates its own message to send to the server using the information in the message from RCG-85 (and, as explained above, even the message from RCG-86 to the server does not "include[]…the destination URL). Ex. 1001, 12:36-39. While this distinction may seem minor, the nuance is dispositive. The difference provides a different understanding of the functions of the messages being sent and of the operation of the devices in the system. Because no such description of a second message from the RCG-85 client to the server exists, claim 1 lacks adequate written description support to previous applications, and DeLangis-156 is prior art.

Accordingly, for these reasons and those presented in the Request, the '908 Patent cannot claim priority to any date before its own filing date of October 11, 2014, DeLangis-156 is prior art, and SNQs 3-4 present grounds for rejecting the Challenged Claims.

b. Maura and Low Disclose Sending the Server Its Own Destination URL in the Same Way that the '908 Patent Discloses, i.e., By Addressing the Message to the Server

As noted above, there is no disclosure to support the submission of a message "to the server" that contains the server's own "destination URL." Nevertheless, to the extent that *addressing* a message to a destination URL is found to support the claimed concept of the message *including* the destination URL, then Maurya in view of Low discloses this element.

As described in the Request (pp. 22-26), Maurya discloses how its "Configure Request" is sent to the server with a "Type" field that is used to configure the multilink, and Maurya discloses that the server successfully receives the request. Ex. 1004, 7:22-37, 8:60-9:9, 1:52-55. Maurya discloses that the links use HTML to communicate with server websites. Ex. 1004, 1:65-2:25. But Maurya does not include an explicit disclosure that the address is in the format of a URL. Requester submits that a POSITA would have understood that Maura addresses the request to the server resource using a URL (i.e., the URL for the server where the message is destined, e.g., the destination URL).

The Request also cites Low's explicit disclosure of a URLs when attempting to communication with a remote server over the internet, which corroborates a POSITA's knowledge of how to locate servers over the internet. Ex. 1005, 12:1-4 (providing the background information that on the "WWW," a URL "identifies a resource by location"); 18:6-7 (disclosing using URLs with HTTP servers).

Thus, Requester submits that, despite the '908 Patent using this terminology differently, to the extent addressing a message to the server constitutes the message including the server's destination URL, Maurya—or at least Maurya (as evidenced by Low)—discloses this concept.

c. Maura and Low Disclose Sending a Message including a Destination URL for the Desired Resource within the Server

As noted above, there is no disclosure to support the submission of a message "to the server" that includes the server's own "destination URL."

Moreover, to the extent the "destination URL" is intended to refer to the location of the resource or data within the server that RCG-85 is attempting to access, there is no support in the '908 Patent for this concept either. Again, the '908 Patent indicates that "destination URL" is the address of the server and discloses the contents of each message and only indicates that the

"destination URL" is only included in the message between RCG-85 and RCG-86. *See, e.g., supra,* Section II.a. As explained in the Request, although it may have been obvious that the location of the resource be included in the message to the server, a patent only provides support for "that which is disclosed," not what would have been obvious to disclose. Request, 13-14 (quoting *Lockwood v. Am. Airlines Inc.,* 107 F.3d 1565, 1571-72 (Fed. Cir. 1997)).

Nevertheless, Maurya not only discloses that the message is received by the server, indicating it was properly addressed to the server (*see* Section II.b. above), Maurya also discloses a "Configure Request" that is operational to access the resource and obtain the data within the server when a user clicks "on a hypertext link or otherwise select[ing] a web page." *E.g.,* Request, 22-26; Ex. 1004, 2:9-15, 7:22-37, 1:52-55, Fig. 3. That is, Maurya also discloses that its message contains the information required to locate the desired resource within the server, as indicated by the fact that the resource is provided in response to Maurya's request message.

To the extent there is any doubt that Maurya's request message includes a URL to identify the resource for its disclosed HTML links (Ex. 1004, 1:65-2:25), a POSITA would turn to Low, which provides background information on how the internet, e.g., the "WWW" operates, explaining "particular information resources" are identified "by means of an [*sic*] Uniform Resource Identifier (URL) that will generally be…a Uniform Resource Locator (URL)." *E.g.,* Request, 24; Ex. 1005, 12:1-4.

Moreover, providing further detail of the contents of a message for requesting data, Low explains that the server to which the message is sent may require the "Request-URI" so that "server 31 [to] then access[] the resource 36." Ex. 1005, 12:20-29. As expounded upon in the Request, "Low simply provides additional context that Maurya lacks regarding what happens when a user clicks on a link on a web browser." Request, 25; *see also* Request at 24-26.

Thus, Maurya in view of Low disclose sending a message to the server that "includes…a destination URL."

III. THE STATEMENT'S ATTACKS ON SNQS 1 AND 2 DO NOT OVERCOME THE EVIDENCE PROVIDED IN THE REQUEST

a. Low Is Analogous Art

Low is analogous art for at least the reasons presented in the Request, namely,

> Low is in the field of endeavor of the '908 Patent because it relates to methods of accessing resources through a switched telecommunications system, including using the point-to-point protocol to allow users to communicate with an internet service provider (ISP) via a public telephone system. *Low* (EX1005), 1:7-9; *see also* 11:21-26, 46:23-27. Low is also reasonably pertinent to one problem concerning the inventors of the '908 Patent, such as the ability to provide users with communication and data services not provided by local exchange companies. '908 Patent (EX1001), 1:67-2:6. For example, Low discloses that its invention provides enhanced services to a user through different types of communications systems to provide a more "synergistic relationship" between the world of telephone networks and internet-based information services. Low (EX1005), 2:1-16.

Competitive Access alleges Low is not analogous art by presenting overly narrow definitions of what qualifies as analogous and overly narrow descriptions of Low's disclosure.

First, inherent to Competitive Access's argument is an incorrect assumption that Low must be in the same field and/or pertinent to the same problem faced by the inventor. But this is contrary to the framework set out in *KSR Int'l. Co. v. Teleflex,* 550 U.S. 398 (2007), which advocated a broad interpretation of analogous art. Indeed, even art "in a field of endeavor other than that of the inventor" or that "solves a problem which is different from that which the inventor was trying to solve" may be "considered for the purposes of 35 U.S.C. 103." MPEP § 2141.II.A.2. Accordingly, Requester submits that Low qualifies as analogous art for the reasons presented in the Request and herein, regardless of whether it is in the same field and/or pertinent to the same problem faced by the inventor.

Second, Low is in fact in the same field of endeavor as the '908 Patent. Competitive Access argues that the field of the '908 Patent is "transferring large amounts of data over low bandwidth networks through a multipath connection." Statement, 30. But this is only one intended use for the devices described in certain parts of the specification. Neither the title nor the claims are so narrow as to require the transfer of only "large amounts of data" or only the use "low bandwidth networks." Ex. 1001, Title, Claims. Instead, the claims of the '908 Patent broadly recite accessing resources using "multilink communications," e.g., multilink point-to-point communications over a communications network. Ex. 1001, Claims; Statement, 5 (recognizing the '908 Patent's disclosure of "multilink PPP bundle.").

Considering Low, it describes "point-to-point" or PPP systems, which includes multilink PPP systems. Ex. 1005, 1:7-9; *see also* 11:21-26, 46:23-27; Ex. 1003, ¶36 (MLPPP "was a well-known implementation of the point-to-point protocol"). Thus, Low's disclosure of the operation of PPP systems is in the field of endeavor because multilink PPP systems use PPP protocols, and Low provides certain background details for PPP protocols. Moreover, Low's communications operate "with an internet service provider (ISP) via a public telephone system," i.e., using a communications network. Ex. 1005, 1:7-9; *see also* 11:21-26, 46:23-27.

Competitive Access's characterization of Low as merely "forwarding phone calls through setup logic on the internet" or "transferring phone calls over telephone channels" (Statement, 20) ignores Low's disclosures of setting up a computer network that is logically *distinct from* the telephone infrastructure (Ex. 1005, Abstract), and of its disclosures as to how point-to-point communication networks operate (e.g., of the use of URLs to locate resources) (Ex. 1005, 12:1-4). Request, 9. That is, Low provides an extensive disclosure of how PTSN and PLMN networks (more basic telephone networks for "providing communication services") can operate to provide

"information services" using the "World Wide Web" and "Internet-based" networks. Ex. 1005, 4:2-13. Describing Low as only disclosing a "telephone channel" for "transferring phone calls" overlooks the majority of Low's disclosure on internet operations. *See, e.g.,* Ex. 1005, 9:11-15:2 (reviewing the operation of the WWW), 15:4-16:10 (reviewing operation of "WWW and the Telephone Network"), 16:13-58:23 (accessing internet resources using, e.g., PTSN or PLMN, infrastructure).

Third, Low is also reasonably pertinent at least one problem concerning the inventors of the '908 Patent. Competitive Access incorrectly argues (1) that the only problem that the '908 Patent's inventors were concerned with was "the problem arising from transferring large files over low bandwidth network connections to a device," and (2) that Low is not pertinent to this particular problem as identified in the Statement. Statement, 20-21.

Taking the second prong first, Low *is* pertinent to even the problem identified in the Statement. As the Statement describes, Low discloses "providing telephone services over the internet" by "integration of the PSTN and the WWW." Statement, 21 (second emphasis omitted). The provision of telephony services includes the transfer of real-time voice data and/or voicemail files, i.e., transferring large files. And providing them over an "integrated PSTN and WWW" network is a low bandwidth network.

Moreover, the problem identified in the Statement is not the only problem the inventors were concerned with. For example, the inventors of the '908 Patent were concerned with "ability to provide users with communication and data services not provided by local exchange companies," which Low also addresses. Request, 9 (citing Ex. 1001, 1:67-2:6 (discussing providing "calling features and services over the existing POTS line" that the "LECs cannot offer")).

Thus, for at least the reasons presented in the Request and herein, Low is analogous prior art.

b. Competitive Access Misunderstands the Proposed Combination of Maurya and Low

The Order correctly understands that the proposed combination in the Request for the "destination URL" as relying on Maurya's disclosure of "a destination IP address [see col. 7, line 22-39" (Order, 12), and on Low's disclosure of an IP address in the format of a URL (Order, 16). *See also, e.g.,* Request, 23-25. Moreover, the fact that Low uses a URL in the contents of a packet to obtain a resource at a server in a PPP environment is further evidence that Lows "destination URL" is used in a similar manner to and is compatible with the teachings of Maurya's "destination IP address."

Competitive Access appears to argue that a "destination URL" must be a URL that is used in a multilink connection. Statement, 22. Requester disagrees at least because this interpretation would read in limitations from the specification, read out other limitations from the claims, and/or would impermissibly limit the term an intended use for a "destination URL." Moreover, there is no support in the specification for such a "multilink URL" that is designed to be specific to a multilink connection or how such a "multilink URL" would differ from any other URL. Other elements in the claims identify the use of a multilink connection with separate physical routes, or paths; there is nothing unique about the URL itself that identifies it as a "multipath URL" other than the fact that it is used in a particular manner, i.e., in the manner that is specified by the claims. And because its use in a multilink connection is recited in the other elements of the claims, there is no need to read those elements into this term and render those elements meaningless.

Moreover, Competitive Access's argument that the combination cannot be made also fails because it advocates the bodily incorporation of Low's destination URL in a particular PPP system into Maurya's system. Statement, 27-28 (referring to Low's "phone page" embodiment and look-up tables instead of the portions of Low cited in the Request). Competitive Access is attacking a fictional combination that is not proposed in the Request and that is not relied upon in the Order.

That is, the Order correctly understood that the Request is presenting Low as an example of the format that Maurya's multilink PPP message to the server would take, i.e., Maurya's destination IP address would be formatted as a destination URL, and Low confirms that this had been done in the context of PPP communications.

c. The Statement Presents Largely Irrelevant Arguments Regarding Motivations

A POSITA would have been motivated to combine the teachings of Maurya and Low for the reasons presented in the Request. *See, e.g.,* Request, 22-26 (regarding motivations for element [1.3.1]).

The Statement, however, makes conclusory statements about Maurya that do not refute the motivations provided in the Request and cite to portions of Low that are not relevant.

For example, the Statement concludes there is a "complete lack of need for a URL in its packets" for Maurya. Statement, 25-26. But the Statement does not address Maurya's disclosure that "each PPP peer connected to one end of the link will send LCP configuration packets to the other end to establish and test the link." Ex. 1004, 1:52-55, 7:22-37, Fig. 6A (showing communication over a PSTN network to a server computer); Request, 22-23. And Competitive Access's allegations that there is a "complete lack of need for a URL in [Maurya's] packets" is directly contradicted by Maurya's disclosure of accessing HTML links to visit websites via a web browser. Request, 22 (citing Ex. 1004, 1:65-2:25).

Additionally, the Statement consistently refers to portions of Low that are not cited in the Request or Order. *See, e.g.,* Statement, 26 (focusing on Low's disclosure of a phone call from a user, returning a phone number to the user, etc., and other elements not relied upon in the Request). The Request, however, largely relies on Low's background disclosures of how to access information on the internet, e.g., details of the PPP protocols provided, for example, at Ex. 1005, 12:1-4, 1:7-9, 11:21-26, Figure 4 (labeled as "prior art"). Thus, there is no failure or oversight by

the Order—there is no allegation that Low's phone page URL should be incorporated, and thus no need to explain why one would do so. In other words, the Order did not "describe why a POSITA would incorporate the phone page URL of Low to modify the packets of Maurya" because it did not need to, as such is irrelevant to the SNQs presented in the Order.

Thus, many of Competitive Access's arguments are directed to irrelevant portions of the references and combinations that are not contemplated in the Request or Order.

d. The Statement Does Not Present Any Arguments Specific to SNQ 2

The Statement does not present any arguments specific to SNQ 2, instead relying on the arguments regarding the combination of Maurya and Low and their teachings of sending a message to the server "including…a destination URL." Statement, 27-28. Therefore, for the reasons presented above, the Request presents sufficient support for SNQs 1 and 2 and the Order properly ordered reexamination on both of these grounds.

IV. CONCLUSION

Requester believes no fee is due with this submission, however the Commissioner is hereby authorized to charge any fee deficiency or credit any over-payment to Deposit Account 50-6990.

Please direct all correspondence in this matter to the undersigned.

Dated: April 30, 2024

Respectfully submitted,

By: /*Jessica L.A. Marks*/
Jessica L.A. Marks (Reg. No. 67,451)
Unified Patents, LLC
4445 Willard Avenue, Suite 600
Chevy Chase, MD 20815
202.847.5260
jessica@unifiedpatents.com

Counsel for Requester Unified Patents, LLC

RED HAT 1051
RED HAT V. CAS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of Delangis	§	Group Art Unit: 3992
	§	
Reexamination Control No.: 90/019,265	§	Examiner: Joseph R. POKRZYWA
Reexamination Filing Date: Oct. 4, 2023	§	
	§	
U.S. Patent No.: 10,868,908	§	Confirmation No.: 3396
Issue Date: December 15, 2020	§	
Filing Date: May 23, 2016	§	
	§	
Title: DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS	§	Requester Dkt. No.: COM908
	§	Requester Customer No.: 165774

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Attn: Central Reexamination Unit
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

CERTIFICATE OF SERVICE

In accordance with 37 C.F.R. §§ 1.535 and 1.248(a)(4), the undersigned certifies that a copy of Requester's Reply to Competitive Access's Statement in the *Ex parte* Reexamination of U.S. Patent 10,868,908 (Control No. 90/019,265) was served on April 30, 2024 on the following correspondence address of record for Reexamination Control No. 90/019,265 via U.S. Postal Service Priority Express mail:

Harold McGurk, Attorney
The Law Office of Clay McGurk
P.O. BOX 1488
ORANGE, CA 92856

Dated: April 30, 2024

Respectfully submitted,

By: /*Jessica L.A. Marks*/
Jessica L.A. Marks (Reg. No. 67,451)
Unified Patents, LLC
4445 Willard Avenue, Suite 600
Chevy Chase, MD 20815
202.847.5260
jessica@unifiedpatents.com

Counsel for Requester Unified Patents, LLC

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Litigation Search Report CRU 3999

Reexamination Control No. 90/019,265

To:	ENGLE, Tricia	**From:**	GRAVES, Monica A.
Location:	OCRU	**Location:**	OCRU
Art Unit:	3992	**Phone:**	2-7253
Date:	15 May 2024	**E-mail:**	monica.graves@uspto.gov

Search Notes

US PATENT NO: 11,383,797 - See Attached

1. Performed a KeyCite Search in Westlaw, which retrieves all history on the patent including any litigation.
2. Performed a search on the patent in Lexis CourtLink for any open dockets or closed cases.
3. Performed a search in Lexis in the Federal Courts and Administrative Materials databases for any cases found.
4. Performed a search in Lexis in the IP Journal and Periodicals database for any articles on the patent.
5. Performed a search in Lexis in the news databases for any articles about the patent or any articles about litigation on this patent.

Paper No. 20240515

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Citing References (7)

Treatment	Title	Date	Type	Depth	Headnote(s)
—	**1. MODULAR ELECTRICALLY MOTORIZED WATERCRAFT HAS HULL MODULE, DRIVELINE MODULE AND ELECTRIC POWER MODULE THAT CONSTITUTE INDEPENDENT SUB-ASSEMBLIES IN FORM OF MODULES WHICH ARE ASSEMBLED TO FORM WATERCRAFT** Out Of Plan DWPI 2019-58552S+ ... EP patent number EP 4223625 A Previously issued patent number US 2021371053 A Previously issued patent number US 2022306248 A Continuation of US patent number US 11383797 B Continuation of US patent number US 11383797 B Based on WO EP or JP-A (OPI) patent WO 2019129687 A Based on WO ...	Dec. 27, 2017	DWPI	—	—
—	**2. WATERPROOF CONTAINER HAVING A WATERPROOF ELECTRICAL CONNECTOR** Out Of Plan US PAT 11801919 , U.S. PTO Utility A watercraft and a waterproof electronics container are provided. The watercraft includes a flotation portion. A strut is removably affixed to a portion of the watercraft. A first... ... Montague B63B 1/242 cited by examiner US United States US 11091232 B1 2021/08 Montague B63B 32/10 cited by examiner US United States US 11383797 B2 2022/07 Werner B63H 11/08 cited by examiner US United States US 20010042498 A1 2001/11 Burnham cited by applicant US United ...	Oct. 31, 2023	Patents	—	—
—	**3. ELECTRIC MOTORISED WATERCRAFT AND DRIVELINE SYSTEM** Out Of Plan US PAT 11780538+ , U.S. PTO Utility An electrically motorized watercraft may include a hull module and a driveline system. The driveline system may include an electric power module and a driveline module. The... ... Primary Examiner (Department):Avila, Stephen P Avila Stephen P 3617 Priority Information Related Information:This application is a Continuation of Application No. 16/957,694, now Patent No. 11,383,797 , a National Stage Entry of PCT/EP2018/086494, issued on 2018/12/21 US US Previously published as US 2022/0306248 A1, published ...	Oct. 10, 2023	Patents	—	—
—	**4. ELECTRONICALLY PROPELLED SURFBOARD** Out Of Plan US PAT D995678 , U.S. PTO Design ... 10836457 B2 2020/11 Geislinger cited by applicant US United States US 10981633 B2 2021/04 Lind et al.cited by applicant US United States US 11383797 B2 2022/07 Werner cited by applicant US United States US 20020077007 A1 2002/06 Dagenais et al.cited by applicant US United States ...	Aug. 15, 2023	Patents	—	—

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Treatment	Title	Date	Type	Depth	Headnote(s)
—	**5. ELECTRIC SURFBOARD** Out Of Plan US PAT D989208 , U.S. PTO Design ... 04 Lind B63B 32/40 cited by examiner US United States US D954882 S 2022/06 Guo D21/769 cited by examiner US United States US 11383797 B2 2022/07 Werner B63H 11/08 cited by examiner US United States US D967317 S 2022/10 Daszkowski D21/301 cited by examiner ...	June 13, 2023	Patents	—	—
—	**6. MOTORIZED WATERCRAFT** Out Of Plan US PAT 11608144 , U.S. PTO Utility A motorized watercraft may include an elongated hull extending along a longitudinal central axis (L) and a propulsion system. The propulsion system may include a drive module. The... ... States US D882010 S 2020/04 Vermillion cited by applicant US United States US 10647392 B2 2020/05 Trewern cited by applicant US United States US 11383797 B2 2022/07 Werner B63H 11/08 cited by examiner US United States US 20020077007 A1 2002/06 Dagenais et al.cited by applicant ...	Mar. 21, 2023	Patents	—	—
—	**7. ELECTRIC MOTORISED WATERCRAFT AND DRIVELINE SYSTEM** Out Of Plan US PAT APP 20220306248 , U.S. PTO Application An electrically motorized watercraft may include a hull module and a driveline system. The driveline system may include an electric power module and a driveline module. The... ... corporation Limhamn, Sweden Limhamn Sweden Priority information Related Information:This application is a Continuation of Application No. 16/957,694, filed on 2020/06/24, now Patent No. 11,383,797 , a National Stage Entry of PCT/EP2018/086494, issued on 2018/12/21 US US Priority Application(s):SE SE 1751655-0 2017 ...	Sep. 29, 2022	Patents	—	—

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User Name: Monica Graves
Date and Time: Wednesday, May 15, 2024 6:48:00 PM EDT
Job Number: 224402747

Documents (10)

1. *Ex. A, B, C, D - Part 1 of 2 : Proceeding Number : 2747-1*
   Client/Matter: -None-
   Search Terms: 11383797 or 11,383,797
   Search Type: Terms and Connectors
   Narrowed by:

Content Type	Narrowed by
	-None-

2. *OPENING BRIEF FOR APPELLANTS/PLAINTIFFS*
   Client/Matter: -None-
   Search Terms: 11383797 or 11,383,797
   Search Type: Terms and Connectors
   Narrowed by:

Content Type	Narrowed by
	-None-

3. *Messages to Heaven greeting cards*
   Client/Matter: -None-
   Search Terms: 11383797 or 11,383,797
   Search Type: Terms and Connectors
   Narrowed by:

Content Type	Narrowed by
	-None-

4. *US Patent Issued to Ride Awake on July 12 for "Electric motorized watercraft and driveline system" (Swedish Inventor)*
   Client/Matter: -None-
   Search Terms: 11383797 or 11,383,797
   Search Type: Terms and Connectors
   Narrowed by:

Content Type	Narrowed by
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5. *Pavement of Jalan Talud, Tukamasea Village, Kec. Bantimurung*
   Client/Matter: -None-

Search Terms: 11383797 or 11,383,797
Search Type: Terms and Connectors
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6. *HOMO SAPIENS / CHICO II*
Client/Matter: -None-
Search Terms: 11383797 or 11,383,797
Search Type: Terms and Connectors
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Content Type	Narrowed by
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7. *HOMO SAPIENS / CHICO II*
Client/Matter: -None-
Search Terms: 11383797 or 11,383,797
Search Type: Terms and Connectors
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	-None-

8. *No Headline In Original*
Client/Matter: -None-
Search Terms: 11383797 or 11,383,797
Search Type: Terms and Connectors
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9. *No Headline In Original*
Client/Matter: -None-
Search Terms: 11383797 or 11,383,797
Search Type: Terms and Connectors
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10. *No Headline In Original*
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Mallinckrodt plc

20-12522

US Bankruptcy Court for the District of Delaware

June 7, 2021, Filed

Reporter

State: US-DE

Type: Unknown

Title

Ex. A, B, C, D - Part 1 of 2 ; Proceeding Number : 2747-1

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JOHNSON v. JESSUP

CASE NO. 19-1421

UNITED STATES COURT OF APPEALS FOR THE FOURTH CIRCUIT

August 19, 2019

Reporter
2019 U.S. 4TH CIR. BRIEFS LEXIS 1482

SETI JOHNSON, et al., on behalf of themselves and those similarly situated, Appellants/Plaintiffs, v. TORRE JESSUP, Commissioner, Division of Motor Vehicles, Appellee/Defendant.

Type: Brief

Prior History: On Appeal from the United States District Court for the Middle District of North Carolina Case No. 1:18-cv-00467.

Counsel

Nusrat J. Choudhury, Rodkangyil O. Danjuma, AMERICAN CIVIL LIBERTIES, UNION FOUNDATION, New York, NY, Jeffrey Loperfido, SOUTHERN COALITION FOR SOCIAL JUSTICE, Durham, NC, Samuel Brooke, Danielle Davis, SOUTHERN POVERTY LAW, Montgomery, AL, Emily Early, Kristi Graunke, SOUTHERN POVERTY LAW, Decatur, GA, Attorneys for Appellants /Plaintiffs.

Irena Como, Emily Seawell, Sneha Shah, AMERICAN CIVIL LIBERTIES, UNION OF NORTH CAROLINA, LEGAL FOUNDATION, Raleigh, NC, Attorneys for Appellants /Plaintiffs.

Title

OPENING BRIEF FOR APPELLANTS/PLAINTIFFS

Text

INTRODUCTION

Hundreds of thousands of individuals have had their driver's licenses revoked simply because they cannot afford to pay fines and costs for North Carolina traffic tickets. *Section 20-24.1 of the North Carolina General Statutes* mandates the automatic, indefinite revocation of a driver's license when a person fails to pay traffic fines and costs. But the law does not require a hearing or any other inquiry into an individual's ability to pay and does not require a determination of willful nonpayment before the Division of Motor Vehicles ("DMV") indefinitely revokes a license. In a state where nine out of ten people rely on a driver's license to pursue their livelihoods, those revoked under this wealth-based system are robbed of a crucial means of self-sufficiency and pushed deeper into poverty.

Plaintiffs filed this lawsuit on behalf of themselves and thousands of similarly situated individuals to challenge the constitutionality of Section 20-24.1 and the manner in which the DMV revokes driver's licenses for non-payment of traffic fines and costs. J.A. 230; 235. Plaintiffs' Amended Complaint asserts that the statute and DMV policy and practice violate the due process and equal protection right against punishment for inability to pay, as articulated under *Bearden v Georgia, 461 U.S. 660 (1983)*, and the procedural due process right to adequate pre-deprivation notice. J.A. 230; 267-68. Plaintiffs moved for class certification and a preliminary injunction with accompanying record evidence. J.A. 5. Defendant moved for a judgment on the pleadings on Plaintiffs' *Bearden* claim, and opposed Plaintiffs' motions for class certification and a preliminary injunction. *Id.*

The district court order that is before this Court granted Defendant judgment on the pleadings as to Plaintiffs' *Bearden* claim and denied Plaintiffs a preliminary injunction, concluding that Plaintiffs had not shown a likelihood of success on the merits of the *Bearden* or procedural due process notice claim. [1] J.A. 401; 430.

[1] The district court also denied Plaintiffs' request for a preliminary injunction based on their claim that Section 20-24.1 violates their procedural due process right to a pre-revocation opportunity to be heard. While Plaintiffs are not appealing this ruling, they maintain it was erroneous and intend to pursue discovery to develop a fuller factual record showing that Section 20-24.1's reference to a potential hearing fails to ensure that people who cannot afford to pay traffic fines and costs are provided a pre-deprivation hearing before being punished with indefinite license revocation.

As set forth below, the district court's rulings were predicated on a misapplication of established due process and equal protection precedent and constitute reversible errors of law. This Court should therefore reverse the district court's order dismissing Plaintiffs' *Bearden* claim and denying Plaintiffs' request for a preliminary injunction and remand this case with instructions to enter the requested preliminary injunction and reinstate Plaintiffs' *Bearden* claim.

JURISDICTIONAL STATEMENT

This appeal arises from a federal class action lawsuit challenging a North Carolina state law that requires the automatic revocation of the driver's licenses of those who cannot afford to pay their traffic fines and costs. On March 31, 2019, the district court entered an order (the "Order") denying Plaintiffs' Second Motion for a Preliminary Injunction, finding that Appellants/Plaintiffs ("Plaintiffs") were unlikely to succeed on the merits of their claims. Joint Appendix ("J.A.") 401; 417. The Order also granted in part Defendant-Appellee's ("Defendant") Motion for Judgment on the Pleadings and dismissed Plaintiffs' claim challenging Defendant's automatic and indefinite revocation of their driver's licenses as punishment for their inability to pay under *Bearden v. Georgia, 461 U.S. 660 (1983)* (the " *Bearden* claim"), finding Plaintiffs failed to state a plausible claim. J.A. 401. The district court had jurisdiction over Plaintiffs' claims pursuant to *28 U.S.C. § 1331*.

Plaintiffs filed a timely notice of appeal on April 17, 2019, and seek appellate review of the district court's: (1) denial of a preliminary injunction and (2) dismissal of Plaintiffs' *Bearden* claim. J.A. 437. This Court has jurisdiction over this appeal pursuant to *28 U.S.C. § 1292(a)(1)*.

Section 1292(a)(1) establishes jurisdiction over the appeal from the district court's Order because it is an "[i]nterlocutory order[ ]. . . refusing [an] injunction[ ]." *28 U.S.C. § 1292(a)(1)*; *see also Doe v. Charleston Area Med. Ctr., Inc., 529 F.2d 638, 641 n.5 (4th Cir. 1975)*. Furthermore, this Court has jurisdiction over the appeal from the district court's Order dismissing Plaintiffs' *Bearden* claim because the district court denied the preliminary injunction based on its dismissal of that claim. Therefore, the dismissal is "intimately bound up" with the denial of the preliminary injunction. *Nationsbank Corp. v. Herman, 174 F.3d 424, 427 (4th Cir. 1999)*; *Fran Welch Real Estate Sales, Inc. v. Seabrook Island Co., Inc., 809 F.2d 1030, 1032 (4th Cir. 1987)*.

STATEMENT OF ISSUES PRESENTED

1. Whether, in seeking a preliminary injunction, Plaintiffs are likely to prevail on the merits of their claim that *N.C.G.S. § 20-24.1* violates the due process and equal protection right against punishment for inability to pay recognized in *Bearden v. Georgia, 461 U.S. 660 (1983)*, because the statute mandates automatic, indefinite revocation of driver's licenses for nonpayment without a prior determination that nonpayment was willful?

2. Whether Plaintiffs pled a plausible claim that Section 20-24.1 violates the due process and equal protection right against punishment for inability to pay recognized in *Bearden* because the statute mandates automatic, indefinite revocation of driver's licenses for nonpayment without a prior determination that nonpayment was willful?

3. Whether, in seeking a preliminary injunction, Plaintiffs are likely to succeed on the merits of the claim that Defendant's enforcement of Section 20-24.1 violates procedural due process by failing to provide adequate notice that informs people of all options to reinstate their driver's licenses under Section 20-24.1 when they are unable to pay traffic fines and costs?

4. Whether Plaintiffs satisfy the remaining elements for a preliminary injunction: they will suffer irreparable harm absent an injunction; the threatened injury to Plaintiffs outweighs the potential harm of an injunction to Defendant; and an injunction favors the public interest?

STATEMENT OF THE CASE

I. The DMV Automatically and Indefinitely Revokes Driver's Licenses for Failure to Pay Fines and Costs Pursuant to Section 20-24.1.

Section 20-24.2 of the North Carolina General Statutes requires courts to report to the DMV the name of any individual who fails to pay traffic fines and costs within 40 days of the due date. *N.C.G.S. § 20-24.2(a)(2)*; J.A. 306 P 1. When the DMV receives this notice, Section 20-24.1 requires the DMV to immediately revoke the driver's license and send a revocation order to the driver. § 20-24.1(a); J.A. 306-07 PP 2, 4. This process is automatic, and Section 20-24.1 provides that the license revocation will become effective 60 days from the date it is mailed or personally delivered to the individual. § 20-

24.1(a).

Section 20-24.1 does not allow the DMV to conduct-and the DMV does not conduct-a hearing to determine an individual's ability to pay before entering a revocation order for failure to pay. *See id.*; J.A. 308 P 8. Nor does Section 20-24.1 allow the DMV to determine-and the DMV does not determine-whether an individual willfully failed to pay before entering a revocation order. *See id.* Moreover, the DMV lacks any information as to whether any state court conducts an inquiry into a person's ability to pay before entering the revocation order. *Id.* P 9.

After the revocation order is automatically entered, Section 20-24.1 permits the order to be deleted from the individual's driving record, but places the burden on individuals to petition the court for this action by showing that: a) they are not the person whose license should be revoked; b) the fines and costs were paid; or c) that the failure to pay was not willful and the person made a bona fide effort to pay and the fines and costs should be remitted. *See* § 20-24.1(b)(2)-(4); J.A. 308 P 11. If individuals make such a showing within 60 days of receiving the revocation order, they can avoid any additional fees; if they do so after 60 days, they must pay an additional restoration fee. *See* § 20-24.1(c).

The DMV's revocation of the driver's licenses of those unable to pay traffic fines and costs is indefinite and absolute. It is indefinite because the revocation will not end until a person secures restoration under Section 20-24.1(b), and thus can and often does extend for years. *See* § 20-24.1(b). It is absolute because during this time the driver is completely prohibited from driving-for example, there is no limited driving privilege available. *See generally id.* This can lead to much more severe treatment than that received by drivers facing revocation for public safety reasons. For example, a driver convicted of impaired driving also faces revocation, but is still eligible for a limited driving privilege that permits driving for "essential" reasons such as employment, maintaining the person's household, accessing education, emergency medical care, and religious worship. N.C.G.S. § 20-179.3. Moreover, the driving restrictions for impaired driving never last longer than one year. *Id.* § 20-19(c1). Those whose licenses are revoked for unpaid fines and costs are not provided any of these protections.

II. The DMV Sends Notices to Drivers to Induce Payment.

The DMV sends impacted individuals a standard boilerplate revocation order, labeled an "Official Notice," that informs individuals that their driving privilege is scheduled for an indefinite revocation on a specified date. J.A. 307 P 4. This effective revocation date is approximately 60 days from the date of the Notice. *Id.* The Parties stipulate that the Official Notice (hereinafter, the "Revocation Notice" or "Notice") in the record is the standard notice the DMV currently uses and has used in the past. J.A. 307 P 5. A copy of this Notice appears below:

[SEE IMAGE IN ORIGINAL]

DMV Notice (Jan. 10, 2018), J.A. 13-15; 19; 307 P 5.

The Notice alerts individuals that their "driving privilege is scheduled for an indefinite suspension" because of "failure to pay a fine." *Id.* It tells the individual to "comply" with the citation to avoid the indefinite revocation but does not describe what "comply," "complied," or "compliance" means beyond payment of the underlying citation. *Id.* The Notice then says that the DMV itself "cannot accept payments for fines and costs imposed by the courts," referring the person to the court for payment. *Id.*

Aside from directing the individual to pay the court, the notice does not give any other instructions. *Id.* The DMV does not provide any information on how to obtain a hearing or indicate that other options beyond full payment are available to cancel the revocation order under Section 20-24.1(b). Nor is there any mention that a person's ability to pay will be a relevant, critical issue at any hearing sought under Section 20-24.1. *Id.*

Plaintiffs understood the Notice to require full payment to avoid indefinite revocation. J.A. 10 P 9-11; *271 P 10*; 272 P 8. Moreover, when Plaintiffs Seti Johnson and Marie Bonhomme-Dicks asked the district attorney's office and court, respectively, if there were anything they could do to avoid having their licenses revoked, they were told the only option was to pay in full. J.A. 10 P 6; *271 P 8*.

III. This Revocation Process Pushes Individuals Further into Poverty and Causes Irreparable Injury.

The number of people adversely affected by Section 20-24.1 is staggering. The parties have not engaged in discovery on this issue, but Defendant himself conceded that more than 264,000 people had been revoked under the statute. J.A. 278-79 P 5. On the eve of the preliminary injunction hearing, Defendant submitted more data showing that in the three years from June 1,

2015, to May 31, 2018, 198,406 North Carolina residents received a revocation order. J.A. 312-13. Of these, 130,597 were not able to pay off their fines and costs before the 60-day grace period ended, and 62,788 were never able to pay off their fines and costs. *Id.*

The impact on the hundreds of thousands who have indefinitely lost their licenses for failure to pay is severe-particularly in North Carolina, where 1.5 million people live in poverty, [2] and public transportation is sparse. [3]

Plaintiffs are unable to pay outstanding fines and costs for traffic tickets due to their limited economic means. They therefore face imminent revocation or have already had their driver's licenses revoked because of their inability to pay; and will suffer, or are suffering, the consequences of the loss of their driver's licenses. They are fathers, mothers, and grandparents who rely on their driver's licenses for work, to obtain food, to take their children and grandchildren to school, to attend their place of worship, and to get their children to medical appointments critical for their development. *J.A. 11 P 16*; *15 P 21*; *244 P 47*; *272 P 2*; *247 P 62*; *270 P 6*.

Plaintiffs have limited income and often are only able to find work in part-time, temporary jobs. J.A. 11 PP 12-14; *15 P 23*; *247 P 61*; *270 P 3*. As a result, some Plaintiffs must resort to extreme measures for money, including donating plasma, to try to make ends meet for themselves and their families. *J.A. 247 P 61*; *270 P 4*.

North Carolina's revocation of Plaintiffs' driver's licenses for their inability to pay makes it even more difficult for Plaintiffs to resolve their court debt. Defendant's enforcement of Section 20-24.1 snares Plaintiffs and those similarly situated in a vicious cycle of poverty. Plaintiffs have lost job opportunities that would permit them to pay off their court debts while supporting their families. *J.A. 14 P 19*; *270 P 3*; *271 P 11*. They are also cut off from critical forms of community engagement and support, such as attending church and similar activities that provide emotional and sometimes financial support. J.A. 15 PP 21, 24; *271 P 11*; 314 P 6.

[2] U.S. Census Bureau, *Quick Facts North Carolina*, https://www.census.gov/quickfacts/NC, J.A. 33-36; 309 P 15.

[3] Tazra Mitchell, *Connecting Workers to Jobs through Reliable and Accessible Public Transit*, Policy & Progress, N.C. Justice Center (Nov, 2012), https://goo.gl/aQF5S, J.A. 103-04.

Plaintiffs' experiences are typical of the many others confronting revocation orders due to poverty. The inability to drive makes it nearly impossible to sustain a livelihood or provide for one's family. [4] For example, in North Carolina a driver's license is a "very common requirement" to obtain employment, including most jobs that "can actually lift people out of poverty." [5] Nearly 92% of residents travel to work by car and only 1.1% travel to work by public transit. [6] Reliable, accessible public transit remains scarce in the state, where the vast majority of counties are rural. [7] Public transit services in urban areas also provide limited access to jobs. [8]

Thus, lack of transportation options remains a common barrier to obtaining and maintaining employment for many North Carolinians. Revocations for failure to pay make it even more difficult to find and keep employment, and create an unjust and impossible dilemma: drive illegally and risk further punishment, or stay home, lose employment, curtail community and spiritual engagements with family and friends, and forgo the ability to provide for one's basic daily needs.

SUMMARY OF ARGUMENT

The Supreme Court has long "confront[ed], in diverse settings, the 'age-old problem' of '[p]roviding equal justice for poor and rich, weak and powerful alike.'" *M.L.B. v. S.L.J.*, *519 U.S. 102, 110 (1996)* (quoting *Griffin v. Illinois*, *351 U.S. 12, 16 (1956)*). The Court's concern about "the disparate treatment of indigents in

[4] Sandra Gustitus, *et al., Access to Driving and License Suspension Policies for the Twenty-First Century Economy* 4 (2008), http://bit.ly/2Z8IqsM ("Access to driving-including . . . a valid driver's license-is vital to economic security . . . .").

[5] *See, e.g.*, Alana Semuels, No Driver's License, No Job, The Atlantic (June 15, 2016), https://goo.gl/xQvLJ, J.A. 38-44; Stephen Bingham, *et al., Stopped, Fined, Arrested: Racial Bias in Policing and Traffic Courts in California*, J.A. 46-96.

[6] U.S. Dep't of Transp., Bureau of Transp. Stats., *NORTH CAROLINA Transportation by the Numbers* 2 (2016), https://goo.gl/aM6NWv, J.A. 98-101.

[7] *See* Mitchell, *supra* note 3, J.A. 103-04 (noting scarcity of public transit options); Chandra T. Taylor and J. David Farren et al., *Beyond the Bypass: Addressing Rural North Carolina's Most Important Transportation Needs*, So. Envtl. Law Ctr. 1 (2012), http://bit.ly/31PQbQt, J.A. 106-22.

[8] Mitchell, note 3, J.A. 103-04.

the criminal process" has "heightened rather than weakened" over time. *Williams v. Illinois*, 399 U.S. 235, 241 (1970). In *Bearden v. Georgia*, 461 U.S. 660 (1983), the Supreme Court recognized that it is impermissible to impose punishment solely for inability to pay and articulated four factors to balance when reviewing such sanctions: "[1] the nature of the individual interest affected, [2] the extent to which it is affected, [3] the rationality of the connection between" the policy or practice and the state's "purpose," and [4] "the existence of alternative means for effectuating the purpose." *Id.* at 666-67 (quotations omitted).

In violation of this precedent, Section 20-24.1 imposes an automatic and indefinite sanction based solely on inability to pay. *See* N.C.G.S. § 20-24.1(b). The DMV sends drivers a revocation order in the form of a misleading notice informing them that their licenses are scheduled for indefinite revocation for non-payment of traffic fines and costs, and further provides that the only option is to pay in full. Unsurprisingly, hundreds of thousands of low-income people have had their driver's licenses revoked.

The district court erred in denying Plaintiffs' preliminary injunction on these facts for three independent reasons:

First, the district court erroneously held that the constitutional protection against punishment for inability to pay applies only when there is a fundamental right at stake. This error contravenes Supreme Court precedent which has never limited this doctrine to fundamental rights. *Bearden* squarely applies whenever a state sanctions individuals solely due to their inability to pay, as North Carolina does. Under *Bearden*, Section 20-24.1 violates equal protection and due process.

Second, in the alternative, the district court erred in finding that Section 20-24.1 survives rational basis review. Though "on its face the statute extends to all defendants an apparently equal opportunity" to pay their tickets to avoid the punishment of an indefinite driver's license revocation, this is an "illusory choice . . . for any indigent who, by definition, is without funds." *Williams*, 399 U.S. at 242. Thus, the statute's classification does not single out those who do not pay their tickets, but rather those who cannot exercise the choice of paying their tickets to avoid the sanction driver's license revocation. Because punishing those unable to pay to incentivize collections of unpaid fines and costs is not rationally related to a legislative government interest, the statute is unconstitutional.

Third, the district court erred in finding that Plaintiffs were unlikely to succeed on their claim that the DMV's misleading Notice violates procedural due process. The district court incorrectly reasoned that the notice automatically comports with due process merely because it references Section 20-24.1. To the contrary, for notice to be constitutionally sufficient, the Supreme Court requires a comprehensive reasonableness analysis: notice must be " *reasonably calculated, under all the circumstances*, to apprise interested parties of the pendency of the action and afford them an opportunity to present their objections." *Mullane v. Cent. Hanover Bank & Tr. Co.*, 339 U.S. 306, 314 (1950) (emphases added). Notice must also "be of such nature as to convey the required information." *Id.* The Notice fails to meet this standard because it advises that the *only* way to prevent the indefinite revocation of their driver's license is to pay the outstanding fines and costs, while omitting any explanation of alternatives to payment to prevent the indefinite revocation under Section 20-24.1.

For each of these reasons, the district court wrongly concluded that Plaintiffs were unlikely to prevail on the merits. Because Plaintiffs have met the remaining elements for a preliminary injunction, this Court should reverse and remand with direction to issue a preliminary injunction. Additionally, because the Court wrongly dismissed the *Bearden* claim, it should reverse and remand with instruction to reinstate that claim.

ARGUMENT

I. Standard of Review

The Court reviews the district court's denial of a preliminary injunction for abuse of discretion. *E. Tenn. Natural Gas Co. v. Sage*, 361 F.3d 808, 828 (4th Cir. 2004). Factual determinations are reviewed for clear error and legal conclusions are reviewed de novo. *Id.* The district court's conclusion that Plaintiffs are unlikely to prevail on the merits is a legal conclusion and reviewed de novo. *Id.* For a preliminary injunction, Plaintiffs must show that: "(1) they are likely to succeed on the merits, (2) they are likely to suffer irreparable harm, (3) the balance of hardships tips in their favor, and (4) the injunction is in the public interest." *Pashby v. Delia*, 709 F.3d 307, 320 (4th Cir. 2013) (citation omitted).

The Court reviews de novo the district court's grant of a motion for judgment on the pleadings pursuant to *Rule 12(c) of the Federal Rules of Civil Procedure*. *Drager v.*

PLIVA USA, Inc., 741 F.3d 470, 474 (4th Cir. 2014) (citations and quotations omitted). Like a Rule 12(b)(6) motion, a motion for judgment on the pleadings should be granted only "if, after accepting all well-pleaded allegations in the plaintiff's complaint as true and drawing all reasonable factual inferences from those facts in the plaintiff's favor, it appears certain that the plaintiff cannot prove any set of facts in support of his claim entitling him to relief." *Id.*

II. Section 20-24.1 Violates Equal Protection and Due Process by Sanctioning Those Unable to Pay Traffic Fines and Costs.

North Carolina punishes indigent people for failing to do the impossible: pay their traffic fines and costs when they lack the means to do so. A long line of Supreme Court decisions has held that the state cannot sanction people solely due to their inability to pay. Doing so "would be little more than punishing a person for his poverty" in violation of the right to due process and equal protection. Bearden, 461 U.S. at 671, 673. Section 20-24.1 and the DMV's enforcement of the statute violates these rights by entering a revocation order without ensuring a pre-deprivation determination occurs that the individual could pay and willfully did not. The district court erred as a matter of law in dismissing Plaintiffs' *Bearden* claim on the theory that *Bearden's* analysis is triggered by the loss of a fundamental right only. The Supreme Court's wealth-discrimination doctrine has never been limited to fundamental rights and the district court's holding squarely conflicts with binding precedent from the *Bearden* line of cases. The decision below is due to be reversed.

A. *Bearden*'s analysis applies where the state seeks to sanction a person solely due to inability to pay.

The Supreme Court's decision in *Bearden* provides the controlling analysis applicable to Section 20-24.1. *Bearden* involved a probationer whose poverty prevented him from paying fines and restitution that were a condition of his probation. Bearden, 461 U.S. at 662-63. He was jailed for nonpayment without consideration of whether he could actually pay. Id. at 663. The Supreme Court reversed on due process and equal protection grounds. Id. at 664-74.

Bearden is part of a long line of cases establishing the basic principle that the state may not sanction people who are unable to pay. Id. at 671-72; *see also* Alexander v. Johnson, 742 F.2d 117, 126 (4th Cir. 1984) ("The indigent defendant[ ] . . . is protected against heightened civil or criminal penalties based solely on his inability to pay."). These cases all "confront[ ], in diverse settings, the 'age-old problem' of '[p]roviding equal justice for poor and rich, weak and powerful alike.'" M.L.B. v. S.L.J., 519 U.S. 102, 110 (1996) (quoting Griffin v. Illinois, 351 U.S. 12, 16 (1956)).

In *Griffin v. Illinois*, the foundational "equal justice" case, the Court held that "[t]here can be no equal justice where the kind of trial a man gets depends on the amount of money he has." 351 U.S. at 19. The Court subsequently pronounced a "basic command that justice be applied equally to all persons." Williams v. Illinois, 399 U.S. 235, 241 (1970).

The Court's concern about "the disparate treatment of indigents in the criminal process" has "heightened rather than weakened" over time. *Id.* Thus, in *Bearden*, the Court held that a court must "inquire into the reasons for the failure to pay" and "determine that alternate punishment is not adequate" before sanctioning a person for nonpayment. Bearden, 461 U.S. at 672-74. Imposing sanctions for nonpayment when a person cannot pay is "fundamentally unfair" under these circumstances. Id. at 668-69; *see also* Tate v. Short, 401 U.S. 395, 398 (1993) (imprisonment "solely because of his indigency" constitutes "unconstitutional discrimination"); Williams, 399 U.S. at 241 (extending imprisonment because of unpaid "fine or court costs" is "impermissible discrimination that rests on ability to pay"). Doing so amounts to punishing people "solely by reason of their indigency." Williams, 399 U.S. at 242.

These decisions applied both equal protection and due process analyses when determining whether the sanction at issue was warranted: the Due Process Clause guards against practices that are "fundamentally unfair or arbitrary," and the Equal Protection Clause protects people from being "invidiously denied . . . a substantial benefit" available to those with the financial resources to pay. Bearden, 461 U.S. 665-66. In *Bearden*, the Court synthesized and built on this precedent, explaining that "[d]ue process and equal protection principles converge" when defendants are treated differently based on their wealth. 461 U.S. at 665. The decision formally eschewed the traditional framework for equal protection and due process claims that would otherwise apply outside the context of punishment for inability to pay.

Because shoehorning the cases into "the equal protection framework is a task too Procrustean to be rationally accomplished," the Supreme Court did not

consider whether a fundamental right or suspect classification was at issue. *Bearden*, 461 U.S. at 666 n.8. It further held that neither strict scrutiny nor rational basis is the appropriate standard of review and rejected "easy slogans or pigeonhole analysis." *Id.* at 666. Instead, the Court required a "careful inquiry" into four relevant factors: "[1] the nature of the individual interest affected, [2] the extent to which it is affected, [3] the rationality of the connection between" the policy or practice and the state's "purpose," and [4] "the existence of alternative means for effectuating the purpose." *Id.* at 666-67 (quotations omitted); *see also* *Alexander*, 742 F.2d at 123 n.8 (recognizing *Bearden* four-factor balancing test for analyzing hybrid due process/equal protection claim); *see also* *M.L.B.*, 519 U.S. at 120-21 (surveying the *Bearden/Griffin* line of cases and explaining that, "[i]n line with those decisions, we inspect the character and intensity of the individual interest at stake, on the one hand, and the State's justification for its exaction, on the other.").

Here, the district court disregarded the *Bearden* line of cases, reasoning incorrectly that the Supreme Court's wealth discrimination doctrine applies only where "a state has deprived persons of *fundamental rights* because of their indigency-specifically, incarcerating them or denying them access to the courts when they cannot make a certain payment." J.A. 397 (emphasis added); *see also* *Fowler v. Benson*, 924 F.3d 247, 261 (6th Cir. 2019) (describing *Bearden* as limited to incarceration). This was erroneous.

Contrary to the district court's analysis, the *Bearden* line of cases has never been limited to the deprivation of fundamental rights. Instead, it applies where the state sanctions an individual solely due to inability to pay. Supreme Court authority makes this clear. In *Griffin*, for example, the Supreme Court stressed that there was no right to the interest at issue-an appeal. 351 U.S. at 18. As the Court explained, "a State is not required by the Federal Constitution to provide . . . a right to appellate review at all," but if it does provide such review, it cannot do so "in a way that discriminates against some convicted defendants on account of their poverty." *Id.*

Furthermore, the Supreme Court has stated directly that the prohibition against punishment for inability to pay is not limited to incarceration. *M.L.B.*, 519 U.S. at 111 (" *Griffin*'s principle has not been confined to cases in which imprisonment is at stake."). In *Mayer v. City of Chicago*, 404 U.S. 189 (1971), where a fine but no incarceration was at issue, the Court held that "the invidiousness of the discrimination . . . is not erased by any differences in the sentences that may be imposed." *Id.* at 197. The Court explained that "[a] fine may bear as heavily on an indigent accused as forced confinement." *Id.* In fact, the Court specifically mentioned the loss of a professional license as a "collateral consequence[ ]" that could be "even more serious" than confinement. *Id.* And the Supreme Court has also observed that "[l]osing one's driver's license is more serious for some individuals than a brief stay in jail." *Argersinger v. Hamlin*, 407 U.S. 25, 48 (1972).

Moreover, the logic of *Bearden* itself makes clear that its protections are not triggered by the existence of a fundamental right: *Bearden* eschewed traditional equal protection analysis, delineating instead a multi-part analysis that explicitly considers "the nature of the individual interest affected . . . ." *Bearden*, 461 U.S. at 666-67; *see also* *M.L.B.*, 519 U.S. at 120-21. Had *Bearden* been limited to fundamental rights, the Court would not have needed to require a "careful inquiry" into "the nature of the interest affected." *Id.* *Bearden*'s first factor would have been entirely superfluous-the "careful inquiry" would always yield the same result: that the relevant interest is a fundamental right. Moreover, had the Court sought to reach only rights protected as fundamental under the Constitution, a more straightforward strict scrutiny analysis would have been applied in *Bearden*. *See, e.g.*, *Harper v. Va. State Bd. of Elections*, 383 U.S. 663, 670 (1966) (noting court has "long been mindful" that restrictions of fundamental rights are closely scrutinized).

The Supreme Court's decisions in *San Antonio Independent School District v. Rodriguez*, 411 U.S. 1 (1973), and *M.L.B.*, 519 U.S. 102, further clarify that the *Bearden* line of cases is not limited to cases involving the deprivation of fundamental rights. In *Rodriguez*, the Supreme Court evaluated an equal protection challenge to the inadequate funding of Texas school systems based on wealth, finding that education is not a fundamental right. 411 U.S. at 37. Rather than distinguish *Griffin* because there is no fundamental right to education, the Court instead noted that it would likely be unconstitutional if public education was "made available by the State only to those able to pay a tuition assessed against each pupil" because those unable to pay "the prescribed sum . . . would be absolutely precluded from receiving an education." *Id.* at 25 n.60. Texas's program was upheld because the constitutional challenge rested on a contention that plaintiffs were "receiving a poorer quality education" than students in wealthier districts as opposed to "no public education" at

all. *Id. at 23*. If, as the district court erroneously concluded, *Griffin* and *Bearden* only applied to fundamental rights, then the Court's recognition that a fee-based education system would fit within the *Griffin* line of cases was entirely baseless. Moreover, in contrast to the facts of *Rodriguez*, here the deprivation is tied to the person's (in)ability to pay and is absolute, *see supra* p. 8, and fits squarely under *Griffin* and its progeny.

Similarly, in *M.L.B.*, the Supreme Court's detailed historical analysis demonstrates that the *Griffin/Bearden* line of cases was predicated not on fundamental rights, but on protection from state sanctions based on inability to pay. There, the Court applied *Griffin* and its progeny to constitutional claims raised by an impoverished mother who could not afford the fees to appeal the termination of her parental rights in a civil proceeding. The Court was careful to distinguish between cases seeking "to alleviate the consequences of differences in economic circumstances that existed apart from state action," which do not trigger application of *Bearden*, from cases where "the State's devastatingly adverse action" is applied solely on the poor because of their poverty, which do. *M.L.B., 519 U.S. at 125*; *see id. at 114-16* (discussing *United States v. Kras, 409 U.S. 434 (1973)* (finding no applicability to accessing courts for bankruptcy), and *Ortwein v. Schwab, 410 U.S. 656 (1973)* (same for appealing welfare benefit reduction)). By contrast, where the State is imposing a sanction because of one's inability to pay, *Bearden*'s analysis applies. *See M.L.B., 519 U.S. at 125* ("Like a defendant resisting criminal conviction, she seeks to be spared from the State's devastatingly adverse action. That is the very reason we have paired her case with *Mayer*, not with *Ortwein* or *Kras*.").

This Court has also recognized that *Bearden* provides the correct framework to evaluate allegations that those unable to pay are being disproportionately sanctioned because of their poverty. In *Alexander v. Johnson*, the Fourth Circuit considered a challenge to a practice of conditioning parole on the repayment of attorneys' fees. *742 F.2d at 123*. Although "there is no fundamental right to parole," *Moss v. Clark, 886 F.2d 686, 690 (4th Cir. 1989)*, the *Alexander* court still emphasized that "in cases such as this" the "traditional principles of equal protection and due process converge," and "the constitutionality of the program can only be determined by careful scrutiny of such factors as 'the nature of the individual interest affected, the rationality of the connection between legislative means and purpose, [and] the existence of alternative means for effectuating the purpose . . . .'" *742 F.2d at 123 n.8* (quoting *Bearden, 461 U.S. at 666-67*). [9]

Finally, another circuit has offered an alternative rationale for why *Bearden* does not apply to a statute mandating driver's license suspension: because one's interest in liberty is purportedly protected to a greater extent than one's interest in property, including a driver's license. *See Fowler, 924 F.3d at 261* (citation omitted). This holding is erroneous. There is no categorical distinction between the type of procedural due process protection owed based on whether the affected private interest is property or liberty. *See Zinermon v. Burch, 494 U.S. 113, 132 (1990)* (noting no "support in precedent for a categorical distinction between a deprivation of liberty and one of property") (citing *Lynch v. Household Finance Corp., 405 U.S. 538, 552 (1972)* ("[T]he dichotomy between personal liberties and property rights is a false one." (other citations omitted)). Indeed, there are times when the deprivation of a property interest imparts more harm than the deprivation of a liberty interest, further undermining the categorical rule adopted in *Fowler*. *See Angersinger, 407 U.S. at 48* ("Losing one's driver's license is more serious for some individuals than a brief stay in jail." (Powell, J., concurring)).

In sum, the district court erred as a matter of law in rejecting the application of *Bearden* to North Carolina's indefinite wealth-based revocation of driver's licenses. For purposes of applying *Bearden*, the revocation of driver's licenses for inability to pay fines and costs from a criminal sentence is directly equivalent to the revocation of probation for inability to pay fines from a criminal sentence: *Bearden*'s analysis applies whenever the State imposes "adverse consequences against indigent defendants solely because of their financial circumstances, regardless of whether those adverse consequences take the form of incarceration, reduced access to court procedures, or some other burden." U.S. Stmt. of Interest, *Stinnie*, No. 3:16-cv-00044, 2016 WL 6892275, at *15-16 (W.D. Va. Nov. 7, 2016), J.A. 221. The multi-factored inquiry articulated in *Bearden* is appropriate where the state imposes

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[9] The *Alexander* court ultimately declined to engage in a "detailed discussion of these factors" because it relied on related Supreme Court precedent that explicitly addresses attorney fee recoupment statutes. *See 742 F.2d at 123 n.8* (citing *Jamas v. Stranne, 407 U.S. 128 (1972)*; *Fuller v. Oregon, 417 U.S. 40 (1974)*).

"sanctions of the *Williams* genre," which are "wholly contingent on one's ability to pay." *M.L.B.*, 519 U.S. at 127; *Rodriguez*, 411 U.S. at 23 (heightened scrutiny applies when "lack of personal resources" causes "an absolute deprivation of [a] desired benefit").

B. Under *Bearden*, Section 20-24.1 violates equal protection and due process.

Applying the multi-factor "careful inquiry" articulated in *Bearden*, Defendant's automatic, indefinite driver's license revocation system is unconstitutional because (1) it affects a substantial property interest in a driver's license; (2) the extent of the effect on the interest is substantial because the deprivation is indefinite; (3) there is no rational connection between the policy and the state's "purpose;" and (4) there are alternative means for effectuating the state's purpose. *See* *Bearden*, 461 U.S. at 666.

1. Section 20-24.1 deeply impairs Plaintiffs' substantial property interest in their driver's licenses.

Plaintiffs have a substantial property interest in their driver's licenses because they rely on their licenses as a means of economic survival. *See* *Mackey v. Montrym*, 443 U.S. 1, 11 (1979). A person's means of support enjoys heightened significance as a property interest. *See* *Cleveland Bd. of Educ. v. Loudermill*, 470 U.S. 532, 539 (1985); *Bell v. Burson*, 402 U.S. 535, 539 (1971); *Goldberg v. Kelly*, 397 U.S. 254, 264 (1970). A driver's license is "essential in the pursuit of a livelihood." *Bell*, 402 U.S. at 539; *see also* *Miller v. Anckaitis*, 436 F.2d 115, 120 (3d Cir. 1970) (license indispensable "for virtually everyone who must work for a living"); U.S. Stmt. of Interest, *Stinnie*, 2016 WL 6892275, at *9, J.A. 215. The interest of people in their driver's licenses is therefore "substantial." *Scott v. Williams*, 924 F.2d 56, 59 (4th Cir. 1991).

The need to access and legally operate a vehicle is particularly acute in North Carolina, where public transportation is limited, and nine out of ten residents need a car for employment. *Supra* pp. 11-13. Absent a valid driver's license, North Carolinians like Plaintiffs have extremely limited avenues for economic survival.

2. The private interest is substantially affected.

Defendant's automatic, indefinite revocation of Plaintiffs' driver's licenses completely bars them from driving, and therefore is absolute. After the license is revoked, an individual must stop driving or run an immediate risk of further criminal sanctions, including possible imprisonment, for driving on a revoked license. *See* N.C.G.S. §§ 20-28(a), 15A-1340.23. This process inhibits the ability of low-income persons to pursue a livelihood and support their families because a person with a revoked driver's license "is at an extraordinary disadvantage in both earning and maintaining material resources." *See* *Purkey*, 2017 WL 4418134, at *9. Plaintiffs are also inhibited in fulfilling the basic necessities of life, including picking up their children from school and going to a grocery store to purchase food for family members. Indeed, the punishment for those unable to pay can be more severe than it is for those who endanger public safety by, for example, driving while impaired; the latter group is eligible for a limited driving privilege that allows them to go to work, maintain their household, seek emergency medical care, and attend religious worship, among other things, and their revocation can never last more than one year. N.C.G.S. §§ 20-179.3, 20-19(c1); *see also supra* p. 8. Those revoked for failing to pay are afforded none of these protections.

3. The legislative means of Section 20-24.1 and its purpose are not rationally related.

Defendant and the district court contend that the purpose of Section 20-24.1(a)(2) is to ensure compliance with court orders by incentivizing payment of unpaid fines and costs. J.A. 400. But as explained in *Bearden*, when determining whether legislative means are rationally related to legislative purpose, it "is of critical importance" whether the statutory scheme accounts for the reason for nonpayment *before* sanctioning a person for failure to pay. 461 U.S. at 668. Section 20-24.1 fails to do so.

Revoking licenses of those who cannot afford to pay fines and costs is not rationally related to collecting money, because punishing "someone who through no fault of his own is unable to [pay] will not make [payment] suddenly forthcoming." *Id.* at 670. Moreover, such a practice is counterproductive because suspending driving privileges actually undermines these individuals' ability to earn money to pay their fines and costs, amounting to "little more than punishing a person for his poverty." *Id.* at 671; *see also* *Purkey*, 2017 WL 4418134, at *9 ("[T]aking an individual's driver's license away to try to make her more likely to pay a fine is not using a shotgun to do the job of a rifle: it is using a shotgun to treat a broken arm. There is no rational basis for that.").

Nor is the process laid out in Section 20-24.1(b) adequate to remedy this discriminatory effect. The statute envisions that drivers may obtain relief from the automatic revocation order if they "demonstrate to the court that [their] failure to pay the penalty, fine, or costs was not willful and that [they are] making a good faith effort to pay or that the penalty, fine, or costs should be remitted." N.C.G.S. § 20-24.1(b)(4). Yet, in practice this process is illusory: no Plaintiff was told of any alternative to payment in full, and the two Plaintiffs who specifically inquired if they had any other options available to them were told that they did not. J.A. 10 P 6; 270 P 8.

Even assuming *arguendo* that the hearing is available to Plaintiffs, and even assuming *arguendo* drivers were actually informed about the hearing-but *see infra* pp. 41-49 (discussing how the DMV Notice misleads drivers into believing their only option to lift the revocation order is full payment)-the hearing process is still insufficient to satisfy due process and equal protection. The Supreme Court held in *Bearden* that a court "must inquire" into the person's ability to pay and determine if the person is unable to pay *before* enforcing a sanction. 461 U.S. at 672. In short, if the state is going to sanction someone for nonpayment, it must *first* be assured that the nonpayment was willful. Thus, courts have consistently held that it is impermissible to put the onus on the defendant to affirmatively seek out the protection of an ability-to-pay hearing. *See* Cain v. City of New Orleans, 281 F. Supp. 3d 624, 652 (E.D. La. 2017) ("[T]here is no authority for the proposition that a criminal defendant must raise the issue of her inability to pay. . . . [A] contrary rule, requiring the criminal defendant to raise the issue on her own, would undermine *Bearden*'s command that a criminal defendant not be [punished] solely because of her indigence."); *West v. City of Santa Fe, Texas*, No. 3:16-CV-0309, 2018 WL 4047115, at *9 (S.D. Tex. Aug. 16, 2018) ("The Court strongly disagrees that the burden rests with [defendants] to bring the inability to pay issue to the Court's attention."); *Rucker v. Spokane Cty.*, No. CV-12-5157, 2013 WL 6181258, at *5 (E.D. Wash. Nov. 26, 2013) ("Because due process requires the court to inquire into Nason's reason for nonpayment, and because the inquiry must come at the time of the collection action or sanction, ordering Nason to report to jail without a contemporaneous inquiry into his ability to pay violated due process." (quoting State v. Nason, 233 P.3d 848 (Wash. 2010)); De Luna v. Hidalgo Cty., Tex., 853 F. Supp. 2d 623, 648 (S.D. Tex. 2012) ("The process in place in Hidalgo County clearly risks that defendants who do not think to 'speak up' during arraignment about their inability to pay fines may be jailed solely by reason of their indigency, which the Constitution clearly prohibits. . . . Rather, due process requires a forum in which defendants' reasons for failing to pay are considered before committing them to jail [because] some indigent persons will not directly raise their inability to pay and will be incarcerated solely, and unconstitutionally, because they are indigent."); Smith v. Whatcom Cty. Dist. Court, 52 P.3d 485, 492 (Wash. 2002) ("[T]he court may place the burden on the defendant to prove inability to pay," but "this does not eliminate the court's duty to inquire, which *Bearden* plainly demands."). [10]

Section 20-24.1(b) suffers from the same defect; it requires the drivers to seek a hearing in order to lift the automatic revocation order, in contravention of the directive in *Bearden* that this inquiry happen prior to the imposition of a sanction. And the real-world consequence of putting the burden on the defendant is clear: the statute has forced over 130,000 individuals to live with a revoked license in just the last three years alone. *See* supra p. 12.

Because Section 20-24.1 does not ensure that the sanction of a revoked license is reserved to those who cannot pay, it is inevitably "punishing a person for his poverty." 461 U.S. at 671. This sanction has no rational relationship to the goal of increasing collections of fines and costs.

4. Alternative means exist to effectuate the State's legislative purpose.

To the extent there is a legislative purpose of trying to achieve compliance with the requirement to pay traffic fines and costs by those unable to pay, there are clear alternatives. For example, North Carolina could extend

[10] Moreover, a suspension under Section 20-24.1, like civil contempt, "seeks only to 'coerce[e] the defendant to do' what a court had previously ordered him to do." Turner v. Rogers, 564 U.S. 431, 441 (2011) (modifications in original, citation omitted); *see also* Williams, 399 U.S. at 240, 243 (Jailing a defendant for nonpayment is not part of the original sentence but "a coercive means of collecting or 'working out' a fine"). Just as civil contempt is impermissible when the individual is "unable to comply," Turner, 564 U.S. at 442, a driver's license suspension is unconstitutional without an ability to pay hearing and findings. *See also* United States v. Rylander, 460 U.S. 752, 757 (1983) (contempt order improper "[w]here compliance is impossible"); Maggio v. Zeitz, 333 U.S. 56, 64 (1948) (even wrongful acts do not "warrant issuance of an order which creates a duty impossible of performance").

the time to pay, reduce payment amounts, or utilize a graduated payment plan to elicit payment of traffic fines and costs. *See* Tate v. Short, 401 U.S. 395, 400 n.5 (1993). The State could also create alternatives, including the performance of public service or completion of traffic safety classes. *See* U.S. Stmt. of Interest, *Stinnie*, 2016 WL 6892275, at *19; J.A. 225; Bearden, 461 U.S. at 671 ("Punishment and deterrence can often be served fully by alternative means to incarceration, including an extension of time to pay or reduction of the amount owed."). [11]

C. Under rational basis, Section 20-24.1 violates equal protection.

Even if this Court does not follow the mandate of *Bearden* and applies rational basis, Section 20-24.1 still falters. Rational basis is a deferential standard, yet it is not "toothless." Schweiker v. Wilson, 450 U.S. 221, 234 (1981). The law still must be " *rationally related* to a legitimate state interest" to withstand scrutiny. City of New Orleans v. Dukes, 427 U.S. 297, 303 (1976) (emphasis added). Because there is no rational connection between the classification created-those who cannot pay-and the government interest in collecting revenue, the statute is irrational and thus, unconstitutional.

1. Section 20-24.1 establishes a classification based on inability to pay.

"The first task of a court in evaluating an equal protection claim under the rational relation test is to identify with particularity the precise classification alleged to be irrational." Murillo v. Bambrick, 681 F.2d 898, 906 (3d Cir. 1982). The district court failed to engage in any analysis of the classification at issue, instead simply assuming that Section 20-24.1's classification is between those who *do* and *do not pay* their traffic fines and costs. *See* J.A. 400. This analysis is fundamentally erroneous because it miscomprehends the classification at issue, and led to the court's ultimate, erroneous conclusion that Section 20-24.1 is rationally related to furthering an interest in court debt collection. *See* J.A. 401.

As the Supreme Court has explained, "a law nondiscriminatory on its face may be grossly discriminatory in its operation." *See* Griffin, 351 U.S. at 17 n.11. [12] Here, the statue discriminates between those who *can afford to pay* and those who cannot. This is because those who cannot pay are subject to automatic and indefinite revocation, while those with means can simply pay their fines and costs.

The Supreme Court's reasoning in Williams v. Illinois, 399 U.S. 235 (1970), underscores why the district court's understanding of the classification at issue is incorrect. In *Williams*, the challenged statute authorized a fine and a maximum period of incarceration, and subjected defendants who did not pay the fine to an additional period of confinement beyond the statutory maximum. The Court recognized that "on its face the statute extends to all defendants an apparently equal opportunity" to avoid further punishment, but then observed that this was an "illusory choice . . . for any indigent who, by definition, is without funds." 399 U.S. at 242. The Court explained that "[s]ince only a convicted person with access to funds can avoid the increased imprisonment, the Illinois statute in operative effect exposes only indigents to the risk of imprisonment beyond the statute maximum." *Id.*; *see also* Tate, 401 U.S. at 399. In this way, the facially neutral statute sanctions only those unable to pay.

Here, as in *Williams*, Section 20-24.1 creates a classification based on inability to pay because it "in operative effect exposes only indigents to the risk of" indefinite license revocation. Williams, 399 U.S. at 242. And the real world confirms this classification. Defendant's own evidence establishes that in the last three years, at least 130,597 North Carolina residents

[11] The district court characterized the state's indefinite revocation of driver's licenses as a type of alternative means of punishment to payment and incarceration, as alluded to in *Bearden*. J.A. 399-400. This is error. In North Carolina, the indefinite revocation of driver's licenses under Section 20-24.1 is not itself an *alternative* to payment that one cannot afford-it does not replace the financial penalty that is owed. Rather, it is an *additional* punishment-the person still owes the fees and fines, but now is also sanctioned with being legally prohibited from driving and will owe additional money to the DMV in order to reinstate the license. By contrast, in *Bearden*, the Court offered examples of alternatives like extending the time to pay, reducing the fine, or requiring "some form of labor or public service *in lieu of the fine*." Bearden, 461 U.S. at 672 (emphasis added). In other words, *Bearden's* "alternative means" language is referring to a *substitute* to immediate payment or incarceration.

[12] *Griffin* and *Williams*, cited herein, applied a heightened level of scrutiny. They are still relevant to identifying the appropriate classification at issue, however, because identifying the classification is the first step of any equal protection analysis, regardless of the level of scrutiny ultimately applied.

received the revocation order and were unable to pay their court debt before the effective date of suspension, and at least 62,788 have never been able to pay it off. J.A. 312-13. [13] The "practical effect" of this statutory classification is to punish those unable to pay. *See U.S. Dep't of Agric. v. Moreno*, 413 U.S. 528, 537 (1973) (focusing on the "practical effect" of classification to conclude it did not further a legitimate governmental interest).

Thus, to withstand even the lenient scrutiny of rational basis review, Section 20-24.1 must have a rational relationship between its means-depriving indigent people of their licenses when they cannot afford to pay traffic fines and costs-and its end, collecting unpaid traffic fines and costs. As detailed below, it does not.

2. There is no logical connection between punishing a person unable to pay with indefinite driver's license revocation and the government's interest in collecting money.

To survive the rational basis test, a law must be " *rationally related* to a legitimate state interest." *Dukes*, 427 U.S. at 303 (emphasis added). The relationship between the classification and the interest offered by the government may not be "so attenuated as to render the distinction arbitrary or irrational." *City of Cleburne, Tex. v. Cleburne Living Center*, 473 U.S. 432, 446 (1985); *see also Smith Setzer & Sons, Inc. v. S.C. Procurement Review Panel*, 20 F.3d 1311, 1320 (4th Cir. 1994) (asking "whether it was 'reasonable for the lawmakers to believe that use of the challenged classification would promote [the stated] purpose'" (citation omitted)). A law is invalid if the classification is "so discontinuous with the reasons offered for it" that any pretense of rationality cannot be sustained. *Romer v. Evans*, 517 U.S. 620, 632 (1996).

The Supreme Court's decisions striking down laws under rational basis review illustrate the importance of demonstrating a logical connection between the challenged action and the government interest offered to support it. *See, e.g., Cleburne*, 473 U.S. at 449-50 (no logical connection between denying permit to proposed group home based on its large size when similarly-sized homes were routinely granted permits); *Williams v. Vermont*, 472 U.S. 14, 24-25 (1985) (no logical connection between taxing cars purchased out of state before residents moved to the state and the government interest in encouraging in-state car purchases); *Zobel v. Williams*, 457 U.S. 55, 61-63 (1982) (no logical connection between larger payments based on length of prior residency and the government interest in incentivizing individuals to move to Alaska). Moreover, the court must evaluate the logic of the government's interest in light of record evidence. *See Romer*, 517 U.S. at 632-33 (stating laws must be "grounded in a sufficient factual context" to allow court "to ascertain some relation between the classification and the purpose it served").

Given that the purported purpose of Section 20-24.1 is to compel payment of traffic fines and costs but the real-world effect is to revoke the licenses of those unable to pay, *see* *supra* p. 37, it follows that the statute draws a classification that does not advance that purpose. "No person . . . can be threatened or coerced into doing the impossible, and no person can be threatened or coerced into paying money that she does not have and cannot get." *Robinson v. Purkey*, No. 3:17-cv-1263, 2017 WL 4418134, at *8 (M.D. Tenn. 2017), *appeal filed*, No. 18-6121 (6th Cir.); *see also Bearden*, 461 U.S. at 670 ("Revoking the probation of someone who through no fault of his own is unable to make restitution will not make restitution suddenly forthcoming."). In other words, there is simply no logical connection between revoking the driver's license of people who cannot afford to pay and the state's interest in eliciting payment.

Moreover, revoking the driver's licenses of people who presently lack the funds to pay is actually counterproductive. "[T]he ability to drive is crucial to the debtor's ability to actually establish the economic self-sufficiency that is necessary to be able to pay the relevant obligations." *Purkey*, 2017 WL 4418134, at *9; *see also Bell*, 402 U.S. at 539 (driver's licenses "may become essential in the pursuit of a livelihood"). Also, punishing people for their inability to pay "may have the perverse effect of inducing the [impoverished] to use illegal means to acquire funds to pay in order to avoid revocation." *Bearden*, 461 U.S. at 670-71. Thus, the classification is far from "reasonable." *Smith Setzer & Sons, Inc.*, 20 F.3d at 1320.

Plaintiffs' own experiences and uncontested evidence

[13] That an additional 55,336 received a revocation order and paid off the fines and costs during the grace period before the suspension went into effect, J.A. 312 P 4, is inconsequential. Even these individuals received an automatic revocation order. And as noted above, *Williams* rejected the idea that some being able to pay alters the analysis-the critical consideration is whether the sanction is ultimately premised on the ability to pay. 399 U.S. at 242. Here, it is.

affirms that this is especially true in North Carolina, where public transportation is very limited and the overwhelming majority of residents must drive to work. *See* supra pp. 12-13. This is certainly true of Plaintiffs, whose livelihoods would be imperiled if they were unable to drive-and with it, their ability to pay off the fines and costs owed. *See id.* This is hardly surprising as "one needs only to observe the details of ordinary life to understand that an individual who cannot drive is at an extraordinary disadvantage in both earning and maintaining material resources." Purkey, 2017 WL 4418134, at *9. Revoking a license is "not merely out of proportion to the underlying purpose of ensuring payment, but affirmatively destructive of that end." *Id.*; *see also* Argersinger, 407 U.S. at 48 ("Losing one's driver's license is more serious for some individuals than a brief stay in jail." (Powell, J., concurring)).

Section 20-24.1 fails rational basis review because it simply is not logical for lawmakers to believe that punishing those unable to pay by stripping them of their ability to drive would promote the goal of collecting unpaid fines and costs. *See* Smith Setzer & Sons, Inc., 20 F.3d at 1320. The district court thus erred in dismissing Plaintiffs' equal protection claim for failure to state a claim, and erred in failing to find that Plaintiffs are likely to prevail, whether under a heightened standard or rational basis review.

III. The License Revocation Process for Non-Payment Violates Due Process Because it Fails to Provide Sufficient Notice.

The district court incorrectly concluded that Plaintiffs were unlikely to succeed on the merits of their due process notice claim simply because the Notice cites Section 20-24.1, and that this allegedly obviates the need for individualized notice of the alternatives to full payment. J.A. 433-35. As detailed below, by relying solely on the citing to and public availability of Section 20-24.1, the district court misconstrued Supreme Court precedent and disregarded its obligation to perform a holistic assessment of whether the Notice reasonably conveyed the necessary information to enable people to invoke their rights under Section 20-24.1.

Adequate notice is "a vital corolary [sic] to one of the most fundamental requisites of due process-the right to be heard." Schroeder v. City of New York, 371 U.S. 208, 212 (1962). Notice is necessary to allow a person to choose "whether to appear or default, acquiesce or contest." Mullane v. Cent. Hanover Bank & Tr. Co., 339 U.S. 306, 314 (1950). The standard for determining the sufficiency of notice-the " *Mullane* standard"-involves a holistic reasonableness analysis: notice must be " *reasonably calculated, under all the circumstances*, to apprise interested parties of the pendency of the action; afford them an opportunity to present their objections" and "to convey the required information." *Id.* (emphases added); Memphis Light, Gas & Water Div. v. Craft, 436 U.S. 1, 14 (1978); Goldberg v. Kelly, 397 U.S. 254, 268-69 (1970). Accordingly, adequacy of notice depends on the factual circumstances at issue.

Generally, a person must be able to learn of her rights through the notice, including the substantive standard to be applied at a hearing. Grayden v. Rhodes, 345 F.3d 1225, 1243 (11th Cir. 2003); Nnebe v. Daus, 931 F.3d 66, 88-89 (2d Cir. 2019), *affirming* & *reversing in part*, 184 F. Supp. 3d 54, 74 (S.D.N.Y. 2016); *see also* Sourovelis v. City of Philadelphia, 246 F. Supp. 3d 1058, 1076 (E.D. Pa. 2017). Notice also should apprise individuals of the "critical issue" to be considered at a hearing. For example, in Turner v. Rogers, 564 U.S. 431 (2011), the Supreme Court found that notice was sufficient where the recipient was advised that ability to pay would be a critical issue in a contempt proceeding concerning unpaid child support. *See* id. at 447.

Moreover, to be adequate, "notice requires *accuracy* in the description of legal rights and options available to parties." Dealy v. Heckler, 616 F. Supp. 880, 886 (W.D. Mo. 1984) (emphasis added, citation omitted); McCutchrey v. Boise Cascade Home & Land Corp., 71 F.R.D. 62, 67-68 (N.D. Cal. 1976). Federal circuits throughout the country, including this Court, have repeatedly confirmed this principle.

For example, in Mallette v. Arlington Cty. Employees' Supplemental Ret. Sys. II, 91 F.3d 630 (4th Cir. 1996), this Court recognized that notice that is "affirmatively misleading" is unconstitutional. Id. at 641. [14] In *Mallette* the applicant was aware of a hearing on her application for retirement benefits based on disability, was aware of the standard to be applied at the hearing, and appeared and provided written testimony. *Id.* Still, this Court found the process insufficient because the retirement system had implied to the applicant that the application would be approved without revealing that it

[14] This Court recognized that under both *Mullane* and *Matthews*, an affirmatively misleading notice violates due process for failing to convey the information required to ensure defense against a deprivation. See Mallette at 641-42 (applying Mullane 339 US at 314, and Matthews, 424 U.S. at 335).

would oppose the application at the hearing. *Id.*

Similarly, in *Walters v. Reno*, 145 F.3d 1032 (9th Cir. 1998), the Ninth Circuit held that a form that failed to notify immigrants that they were required to request an additional hearing to prevent deportation was not constitutionally sufficient notice, as it "lulls the alien into a false sense of procedural security." *Id.* at 1043. According to the court, the notice should have told the immigrants how they could "take advantage" of the law's procedures. *Id. See also United States v. Charleswell*, 456 F.3d 347, 356-57 (3d Cir. 2006) (finding notice unconstitutional because it misled reader into believing only one agency option existed to contest an adverse order, while obscuring a statutory right "to direct judicial review in the appropriate court of appeals"); *Convers v. City of Chicago*, No. 12 C 06144, 2015 WL 1396177, at *5-6 (N.D. Ill. Mar. 24, 2015) (finding notice misleading because it indicated property owners may have more than 30 days to reclaim seized property when in fact they had only 30 days); *Bulland v. Bowen*, 673 F. Supp. 638, 641 (D. Mass. 1987) (notice providing incomplete information regarding statute of limitations was insufficient); *Nnebe*, 931 F.3d at 88-89, *aff'ing* & *rev'ing in part*, 184 F. Supp. 3d at 74 (same where notices failed to convey factors considered in suspending taxi license); *Noah v. McDonald*, 28 Vet. App. 120, 131-32 (2016) (same regarding deadline to submit evidence).

This obligation to provide accurate notice applies regardless of whether individualized notice is constitutionally required or state-law remedies are publicly published. *See Convers*, 2015 WL 1396177, at *5-6 (citing *West Covina* but emphasizing that "any individualized notice provided- *whether required or not*- cannot be misleading." (emphases added, citation omitted)). The Seventh Circuit, for example, reversed a lower court's grant of summary judgment for a city that provided "misleading and incomplete information" in its notice-even when the state law remedies were publicly available. *Gates v. City of Chi.*, 623 F.3d 389, 401 (7th Cir. 2010). This Court has reached the same conclusion. *See Mallette*, 91 F.3d at 635-36, 641 (describing robust statutory scheme but finding violation because of "affirmatively misleading" notice).

The district court did not engage with this *Mullane* analysis. Instead, the court focused only on the fact that Section 20-24.1 is cited in the Notice, and that Section 20-24.1 is publicly available. J.A. 433-35 (relying on *City of West Covina v. Perkins*, 525 U.S. 234, 242 (1999)). This myopic focus on a single sentence of the Notice was error. Indeed, under the district court's reasoning, *any* notice-even a misleading one-would be constitutionally adequate merely by citing a publicly available source that sets forth the state's redress procedures. That is contrary to the law. *See Gates*, 623 F.3d at 401 ("[T]he City may not mislead arrestees about the necessary procedures for the return of their [property] . . . ."); *Mallette*, 91 F.3d at 635-36, 641 (describing robust statutory scheme and finding error because notice misled).

West Covina has no application to this case. In *West Covina*, the Supreme Court held that the police's provision of post-deprivation notice of the seizure of personal property, pursuant to a valid warrant in a criminal investigation, satisfied due process because public state laws explained the procedures available to recover property. 525 U.S. at 241, 242. The Court held that in the post-deprivation context, the government need not always provide affirmative notice of the right to, and procedures for requesting, a hearing. *Id.*

However, *West Covina* "does not stand for the . . . proposition that statutory notice is *always* sufficient to satisfy due process." *Grayden*, 345 F.3d at 1242-44 (emphasis added) (citing *West Covina*, 525 U.S. at 242). Nor does it absolve the government from the requirement in *Mullane* that notice must be "reasonably calculated, under all the circumstances," to convey the required information. *Mullane*, 339 U.S. at 314; *see Grayden*, 345 F.3d at 1244 (" *West Covina*, while citing *Mullane*, did not mention the 'reasonably calculated' standard or apply it. Based on the Court's endorsement of the *Mullane* standard in *Dunsenberry v. United States, . . . three years after the decision in West Covina*, we believe that our 'reasonably calculated' analysis is not controlled by the Court's decision in *West Covina*." (emphasis added)); *see also Dusenbery v. United States*, 534 U.S. 161, 167-68 (2002).

Accordingly, numerous courts have continued to apply the *Mullane* standard since *West Covina*, despite redress procedures appearing in public documents. *Accord Martinez-De Bolorquez v. Ashcroft*, 365 F.3d 800 (9th Cir. 2004) (recognizing that whether affirmative notice beyond publicly-available documents is necessary depends on circumstances of case); *e.g., Grayden*, 345 F.3d at 1243 (11th Cir. 2003) (same); *Bentley v. Atlantic County, New Jersey*, No. 05-2942, 2008 WL 11383797, at *2 (D. N.J. Apr. 16, 2008) (same, without citing *Mullane*). The district court therefore erred in automatically concluding, under *West Covina*, that the DMV notice is constitutionally adequate simply

because it cites Section 20-24.1. [15]

The district court's failure to engage in the *Mullane* analysis was fatal: when the Notice is considered in totality, it fails *Mullane*'s "holistic reasonableness" standard. The Notice does not provide any meaningful opportunity to choose "whether to appear or default, acquiesce or contest," *Mullane, 339 U.S. at 314*, because it makes clear that the only way to lift the revocation order is to pay in full. The Notice tells individuals that their license is being indefinitely revoked "for failure to pay [the] fine," and that they must "comply" with the underlying citation to lift the revocation order. It further directs the person to the court for payment, stating explicitly that the DMV cannot accept payment on the court's behalf. And as the district court even observed, the Notice does not address any alternative to payment under Section 20-24.1(b), much less the possibility to request a hearing to show that non-payment was not willful. *See* J.A. 432.

Consequently, a typical reader would interpret the Notice's demand for "compliance" to mean that the citation must be fully paid and that such payment is the sole avenue to lift the revocation order. That is exactly how Plaintiffs interpreted the Notice. *See* Smoot Decl., J.A. 13-14 PP 8-9, 18; Yarborough Decl., J.A. 272 PP 7-8; Johnson Decl., J.A. 11 PP 15, 17. And this is exactly what the court systems told those who inquired into whether there was any option other than payment in full to lift the revocation order. J.A. 10-11 PP 6, 10, 11; 13-14 PP 6, 16; *270 P.3*. Because the Notice obscures the availability of any options other than full payment of fines and costs to lift the revocation order entered under Section 20-24.1, Plaintiffs did not-and indeed, reasonably could not-read "comply" as giving them an option to contest the revocation based on a showing of non-willful non-payment-a factual showing that was not contested in the district court.

Such "affirmatively misleading" notice is unconstitutional. *Mallette, 91 F.3d at 941*; *Wallers, 145 F.3d at 1049* (finding misleading notice that obscured availability of relief unconstitutional); *Charleswell, 456 F.3d at 356-57* (finding misleading notice that obscured alternatives to be unconstitutional); *see also* *supra pp. 43-45* (collecting cases).

In sum, to satisfy procedural due process, notice must be accurate and reasonably inform people of their legal rights based on the factual circumstances-a standard the district court failed to apply. Here, Defendant's misleading Notice fails these requirements because it does not reasonably apprise Plaintiffs of their rights regarding revocations under Section 20-24.1. It is therefore unconstitutional.

IV. The Remaining Requirements for a Preliminary Injunction Are Satisfied.

A. Plaintiffs will suffer immediate, irreparable injury without a preliminary injunction.

Plaintiffs will suffer immediate irreparable injury absent the entry of a preliminary injunction. Where, as here, a constitutional right is being violated, irreparable injury is assumed. *Ross v. Meese, 818 F.2d 1132, 1135 (4th Cir. 1987)*; *Messmer v. Harrison*, No. 5:15-CV-97, *2015 WL 1885082, at *2 (E.D.N.C. Apr. 24, 2015)* (collecting cases). The Court "will not be able to make a driver whole" for any economic harm or inconvenience caused by an erroneously revoked license. *See Mackey, 443 U.S. at 11*.

Without a driver's license, Plaintiffs and those similarly situated will continue to be trapped in a vicious cycle of poverty and prevented from pursuing economic opportunities permitting them to provide for their families' basic needs and to ultimately pay off the fines and costs they owe. Here, the inability to drive impedes their ability to work, access groceries and medical care, care for and support their families, and be active community members. *See* *supra pp. 12-13*; *see* also *Ariz. Dream Act Coal. v. Brewer, 855 F.3d 957, 978 (9th Cir, 2017)*. These injuries cannot be redressed through damages and are irreparable. *See id.* (noting loss of opportunity to pursue employment constitutes irreparable harm (citations omitted)); *Purkey, 2017 WL 4418134, at *10* (same); *see also Padberg v. McGrath-*

[15] *West Covina* is also inapposite because the plaintiffs there, unlike Plaintiffs here, did not contest the initial deprivation of their property or the state law procedures for seeking to recover their property-a fact dispositive to the Court's ruling on the sufficiency of statutory notice. *See West Covina, 525 U.S. at 240-41*. Specifically, the Court's finding that due process did not mandate individualized notice of state law procedures turned not only on the public availability of state law procedures, but on the absence of a due process challenge to those procedures. *See id. at 241* ("In prior cases in which we have held that *post-deprivation state-law remedies were sufficient to satisfy the demands of due process* and *the laws were public and available*, we have not concluded that the State must provide further information about those procedures." (emphases added)). Thus, because of the facial challenge Plaintiffs raise against the sufficiency of Section 20-24.1, *West Covina* has no place in this case.

McKechnie, 108 F. Supp. 2d 177, 183 (E.D.N.Y. 2000) (finding irreparable injury where deprivation of license "imminently threaten[ed]" plaintiff's "continued subsistence, an injury . . . which could not be adequately compensated by a monetary award"); *cf. Reynolds v. Giuliani*, 35 F. Supp. 2d 331, 339 (S.D.N.Y. 1999) ("To indigent persons, the loss of even a portion of subsistence benefits constitutes irreparable injury." (citation omitted)).

B. The threatened injury to Plaintiffs outweighs any potential harm injunctive relief might cause to Defendant, and an injunction serves the public interest.

The threat of injury to Plaintiffs considerably outweighs any potential harm to Defendant, and the requested injunction would serve the public interest. Plaintiffs are being denied a critical ability to support themselves and their families. *See supra* pp. 11-13; *see also Bell*, 402 U.S. at 539. By contrast, Defendant is being asked to comply with the law; this is not a cognizable hardship. *Giovani Carandola, Ltd. v. Bason*, 303 F.3d 507, 521 (4th Cir. 2002); *see also Messmer*, 2015 WL 1885082, at *2. Any administrative costs associated with affording pre-deprivation hearings and sufficient notice are outweighed by the harms to Plaintiffs' ability to drive to keep their jobs, support their families, and meet other critically important basic needs.

Moreover, Section 20-24.1's revocation scheme does not serve the State's interest in collecting fines and costs when the person cannot pay. *See* supra pp. 30-33. And because Plaintiffs are not challenging the underlying judgments to pay traffic fines and costs, the State can enforce the judgments through alternative measures other than indefinite license revocations. *See* supra p. 34.

An injunction also serves the public interest. "[U]pholding constitutional rights surely serves the public interest." *Centro Tepeyac v. Montgomery Cty.*, 722 F.3d 184, 191 (4th Cir. 2013) (citation omitted); *Giovani Carandola, Ltd.*, 303 F.3d at 521 (same). Granting the injunction would enable Plaintiffs to drive, which would permit them to obtain and retain employment, meet their and their families' daily needs, and ultimately pay off their unpaid court debt.

CONCLUSION

"Appellate courts have the power to vacate and remand a denial of a preliminary injunction with specific instructions for the district court to enter an injunction." *League of Women Voters of N. Carolina v. North Carolina*, 769 F.3d 224, 248 (4th Cir. 2014) (citations omitted) (ordering entry of injunction of same-day registration voting requirements even though district court ruled solely on likelihood of success of claim).

Accordingly, in consideration of the foregoing arguments, the Court should: **(1)** conclude that Plaintiffs are likely to prevail on their *Bearden* and notice claims, that they will suffer irreparable injury absent a preliminary injunction, that the balancing of hardships tips in their favor, and that the injunction is in the public interest; **(2)** reverse the district court's order dismissing Plaintiffs' equal protection and due process claim under *Bearden* and denying Plaintiffs' request for a preliminary injunction with respect to that claim, [16] and **(3)** remand with instructions for the district court to enter a preliminary injunction to:

(a) enjoin Section 20-24.1(a)(2) and (b)(3)-(4);

(b) bar the DMV from revoking licenses for non-payment under Section 20-24.1(a)(2); and

(c) lift current license revocations entered under Section 20-24.1(a)(2) and reinstate those licenses without charging a reinstatement fee if there are no other bases for the license revocation pending the ultimate determination of the merits of Plaintiffs' claims.

STATEMENT REGARDING ORAL ARGUMENT

Oral argument is warranted here to assist the Court in resolving the important legal questions presented by this appeal-questions that bear on what findings and procedural protections are required before the State may sanction an individual for failing to pay traffic fines and costs by revoking their driver's license.

Dated: August 19, 2019

Respectfully Submitted,

/s/ Samuel Brooke
Samuel Brooke

[16] Because other portions of the order are not being appealed, including the denial of other parts of Defendant's Motion for Judgment on the Pleadings and the grant of Plaintiffs' Motion for Class Certification, those portions of the order should remain in force.

Danielle Davis
SOUTHERN POVERTY LAW CENTER
400 Washington Avenue
Montgomery, AL 36130
Tel.: 334-956-8200

Emily Early
Kristi Graunke
SOUTHERN POVERTY LAW CENTER
150 E. Ponce de Leon Ave., Ste. 340
Decatur, GA 30030
Tel.: 404-521-6700

Nusrat J. Choudhury
Rodkangyil O. Danjuma
AMERICAN CIVIL LIBERTIES UNION FOUNDATION
125 Broad Street, 18th Floor
New York, NY 10004
Tel.: 212-519-7876

Jeffrey Loperfido
SOUTHERN COALITION FOR SOCIAL JUSTICE
1415 West Highway 54, Ste. 101
Durham, NC 27707
Tel.: 919-794-4213

Irena Como
Emily Seawell
Sneha Shah
AMERICAN CIVIL LIBERTIES UNION OF NORTH CAROLINA LEGAL FOUNDATION
3801 Barrett Drive
Raleigh, NC 27609
Tel.: 919-834-3466

Attorneys for Appellants/Plaintiffs

CERTIFICATE OF COMPLIANCE

This brief complies with the type-volume limitation of *Federal Rule of Appellate Procedure 32(a)(7)(B)*. According to the word-count feature of the word-processing program with which it was prepared (Microsoft Word)-the brief contains 12,436 words, excluding portions exempted by Rule 32(f). This brief complies with the typeface requirements of Rule 32(a)(5) and the type-style requirements of Rule 32(a)(6), because it has been prepared in a proportionally spaced typeface using Microsoft Word 2016 in 14-point Times New Roman font.

Date: August 19, 2019

/s/ Samuel Brooke
Samuel Brooke

Attorneys for Appellant/Plaintiffs

CERTIFICATE OF SERVICE

I hereby certify that on this date I electronically filed the foregoing Opening Brief with the Clerk of the Court for the United States Court of Appeals for the Fourth Circuit by using the appellate CM/ECF system, which will send a copy of the foregoing to all registered counsel of record.

Date: August 19, 2019

/s/ Samuel Brooke
Samuel Brooke

Attorneys for Appellants/Plaintiffs

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created: 1999

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US Patent Issued to Ride Awake on July 12 for "Electric motorized watercraft and driveline system" (Swedish Inventor)

US Fed News

July 13, 2022 Wednesday GENERAL_EDIT_CORRECTION ERROR Document ID 373 Has error Validate old format failed - Input Date Invalid - 00:44: Unparseable date: "00:44" EST

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Length: 187 words

Dateline: ALEXANDRIA, Va.

Body

ALEXANDRIA, Va., July 13 -- United States ***Patent*** no. ***11,383,797***, issued on July 12, was assigned to Ride Awake AB (Limhamn, Sweden).

"Electric motorized watercraft and driveline system" was invented by Philip Werner (Malmo, Sweden). According to the abstract* released by the U.S. ***Patent*** & Trademark Office: "In one aspect of the invention, there is provided a modular electrically motorized watercraft (10), the watercraft comprising a hull module (20) and a driveline system (60). The driveline system (60) comprises an electric power module (50) and a driveline module (30). The driveline module (30) is configured to be arranged at an underside of the hull module (20)." The ***patent*** was filed on Dec. 21, 2018, under Application No. 16/957,694. *For further information, including images, charts and tables, please visit: http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&p=1&u=%2Fnetahtml%2FPTO%2Fsearch-bool.html&r=1&f=G&l=50&co1=AND&d=PTXT&s1=11383797&OS=11383797&RS=11383797 For any query with respect to this article or any other content requirement, please contact Editor at contentservices@htlive.com

Load-Date: July 13, 2022

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Monica Graves

RED HAT 1051
RED HAT V. CAS

Pavement of Jalan Talud, Tukamasea Village, Kec. Bantimurung

Tenders Monitor Africa-Asia

October 10, 2018 Wednesday

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albawaba

Length: 352 words

Body

Company : PEMERINTAH DAERAH KABUPATEN MAROS

Address : Kec. Bantimurung - Maros (Kab.)

Country : Indonesia

Location : Indonesia

Tender_No : 3137250

Value : IDR 300000000

Dead line : 2018-10-17

Local International : International

Funding Agency : No

Description : Tenders are invited for Pavement of Jalan Talud, Tukamasea Village, Kec. Bantimurung

Procurement Method: General e-Tender

Qualification Method: Postqualification

Document Method: One File

Evaluation Method: Elimination System

Budget: 2018 - APBD

Package Ceiling Price: Rp 300.000.000,00

Self Estimated Price: Rp 294.674.466,99

Term of Payment: Lump Sum

Budget Allocation: Single Year

Funding Source: Self Procurement

Location of Work: Kec. Bantimurung - Maros (Kab.)

Postqualification announcement: Start: October 9, 2018 15:00 - Until: October 16, 2018 16:00

Download bidding document: Start: October 9, 2018 15:01 - Until: October 16, 2018 16:00

Prebid Meeting: Start: October 12, 2018 10:00 - Until: October 12, 2018 13:00

Upload bid document: Start: October 13, 2018 08:00 - Until: October 17, 2018 10:00

Bid document opening: Start: October 17, 2018 10:01 - Until: October 17, 2018 23:59

Proposal evaluation: Start: October 17, 2018 10:01 - Until: October 19, 2018 23:59

Qualification document evaluation: Start: October 17, 2018 10:01 - Until: October 19, 2018 23:59

Qualification verification: Start: October 22, 2018 08:00 - Until: October 22, 2018 16:00

Upload minutes of bidding result: Start: October 23, 2018 08:00 - Until: October 23, 2018 23:59

Winner appointment: Start: October 23, 2018 08:00 - Until: October 23, 2018 23:59

Winner announcement: Start: October 23, 2018 08:00 - Until: October 23, 2018 23:59

Refutation period of Bidding result: Start: October 24, 2018 08:00 - Until: October 26, 2018 16:00

Winner appointment letter: Start: October 26, 2018 16:01 - Until: October 29, 2018 08:00

Contract signing: Start: October 30, 2018 08:00 - Until: November 2, 2018 16:00

[Disclaimer: The above text is machine translated. For accurate information kindly refer the original document.]

Document : http://www.bidsinfo.com/adminexe/documents/-ID2~20181010-***11383797***.html

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HOMO SAPIENS / CHICO II

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Table1 (*Return to related document text*)

ID	***11383797***
Description	DE HOMO SAPIENS A HOMO INVERSIS. ANTES DE DAR EL PASO UN HOMO INVERSIS TAMBIEN FUE AHORRADOR. CAMBIA TELEFONO: 902888815
Price	$12.0 USD
Media Type	Print
Country	Spain
Source	EL MUNDO

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HOMO SAPIENS / CHICO II

Table1 (*Return to related document text*)

ID	***11383797***
Description	DE HOMO SAPIENS A HOMO INVERSIS. ANTES DE DAR EL PASO UN HOMO INVERSIS TAMBIEN FUE AHORRADOR. CAMBIA TELEFONO: 902888815
Price	$12.0 USD
Media Type	Print
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Section: JUDICIAL; Pg. 472

Length: 588 words

Body

2ª VARA DE FAMÍLIA DA COMARCA DE PARNAMIRIM

JUIZ (A) DE DIREITO DANIELLA SIMONETTI MEIRA PIRES DE ARAUJO

EDITAL DE INTIMAÇÃO DE ADVOGADOS

ADV: MAX MILYANO BEZERRA DE MORAIS (OAB 0008165A/RN), DANIEL MELO DE LACERDA (OAB 8564/RN) -

Processo: 0803361-21.2017.8.20.5124 - ALIMENTOS - LEI ESPECIAL Nº 5.478/68 - Revisão - AUTOR: F.A.A. - RÉU: J.A.N. - Dessa forma, não tendo sido comprovado, nesse momento processual, qualquer alteração nas condições em que os alimentos foram ficados/acordados INDEFIRO a tutela provisória de urgência requerida.Intimem-se.Intime-se, ainda, o autor, por seu Advogado, para que, no prazo de 15 (quinze) dias, manifeste-se acerca das preliminares levantadas na contestação de ID nº ***11383797***, consoante determina o art. 351 do CPC/2015.Após, voltem os autos conclusos.

REP: 2ª Defensoria Cível de Parnamirim - Processo: 0811115-14.2017.8.20.5124 - DIVÓRCIO LITIGIOSO - Dissolução -

REQUERENTE: R.P.G.D.L. - REQUERIDO: J.A.D.L. - ATO ORDINATÓRIO CERTIFICO e dou fé que, com permissão do artigo 152, § 2º, do NCPC, e Provimento nº 10-CJ/TJRN, de 04/07/2005, expeço o presente ato com o fim de intimar as partes a comparecerem a audiência de CONCILIAÇÃO/MEDIAÇÃO, no CEJUSC/PARNAMIRIM/RN, localizado na Rua Suboficial Farias, 280, Monte Castelo, Parnamirim/RN, CEP 59.140-255, no dia 02.02.2018 às 10 horas, na sala CEJUSC - SALA ÚNICA.Remeto o presente ato, nesta data, ao Diário da Justiça Eletrônico para a devida publicação, devendo a Secretaria expedir os devidos expedientes.Parnamirim/RN, 08.01.2018 BALTAZAR ANDRADE MARINHOChefe de Secretaria

ADV: AMARO ANIZIO DA COSTA (OAB 0003028A/RN) -

Processo: 0813591-25.2017.8.20.5124 - DIVÓRCIO LITIGIOSO -Dissolução - REQUERENTE: S.M.D.A. - REQUERIDO: M.A.D.L. - DEFIRO, à parte requerente, os benefícios da assistência judiciária gratuita, conforme requerido na exordial.Na tentativa de uma solução amigável para o litígio e em consonância com o disposto no art. 694 do CPC e na Resolução 012/2007-TJ/RN, aprazo para o dia 07 de fevereiro de 2018, pelas 13:30h sessão de conciliação entre as partes, a ser realizada na sala de audiências deste Juízo.Intime-se a parte autora e seus Advogados.CITE-SE para requerida para, querendo, no prazo e na forma da lei, apresentar contestação ao pedido inicial, sob pena de revelia; e, INTIME-A para que compareça a sessão de conciliação acima aprazada, esclarecendo que o prazo para apresentar a contestação fluirá a partir da data acima aprazada.DESPACHO COM FORÇA DE MANDADO.

REP: 2ª Defensoria Cível de Parnamirim - Processo: 0813581-78.2017.8.20.5124 - ALIMENTOS - LEI ESPECIAL Nº 5.478/68 -Alimentos - AUTOR: O.F. - RÉU: W.S. - DEFIRO, à parte requerente, os benefícios da assistência judiciária gratuita, conforme requerido na exordial.Na tentativa de uma solução amigável para o litígio e em consonância com o disposto no art. 694 do CPC e na Resolução 012/2007-TJ/RN, aprazo para o dia 31 de janeiro de 2018, pelas 15:30h sessão de conciliação entre as partes, a ser realizada na sala de audiências deste Juízo.Intime-se a parte autora e seus Advogados.CITE-SE para requerida para, querendo, no prazo e na forma da lei, apresentar contestação ao pedido inicial, sob pena de revelia; e, INTIME-A para que compareça a sessão de conciliação acima aprazada, esclarecendo que o prazo para apresentar a contestação fluirá a partir da data acima aprazada.DESPACHO COM FORÇA DE MANDADO.

Monica Graves

MAX MILYANO BEZERRA DE MORAIS (OAB 0008165A/RN)

DANIEL MELO DE LACERDA (OAB 8564/RN)

AMARO ANIZIO DA COSTA (OAB 0003028A/RN)

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Section: CADERNO NORMAL EXECUTIVO; Pg. 85

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EXERC 00873954068/2016 - 184,20 - 11405109-8 - IPVA -**554147299-72 -** 11405285-0 - IPVA - RENAVAM / EXERC 0087406 **44 -** 11429858-1 - IPVA - RENAVAM / EXERC 00894117076/ 190,96 - **ADRIANO RAMOS - 029594049-20 -** 11395204-0 -RENAVAM / EXERC 00865136254/2015 - 339,31 - **ADRIANO RA** 00938422154/2016 - 185,50 - 11484294-0 - IPVA - RENAVA **BERNARDO - 059471349-85 -** 11424612-3 - IPVA - RENAV EXERC 00889372861/2015 - 188,73 - 11381101-3 - IPVA - REN EXERC 00852444087/2015 - 166,39 - **ADRIANO REZEND** 00928675181/2016 - 203,63 - 11471223-0 - IPVA - RENAVAM 11505589-5 - IPVA - RENAVAM / EXERC 00955079519/2016 **ADRIANO RIBEIRO - 048745619-00 -** 11480475-4 - IPVA RENAVAM / EXERC 00935546588/2015 - 185,94 - **ADRIAN** 00911431357/2016 - 303,86 - 11450564-1 - IPVA - RENAVAM 11436612-9 - IPVA - RENAVAM / EXERC 00900091797/2016 - RENAVAM / EXERC 00945315970/2016 - 178,47 - 1149317 **RIBEIRO DE MELLO - 087179209-57 -** 11532308-3 - IPV RENAVAM / EXERC 00978239725/2015 - 230,52 - **ADRIANO RI** 00892347503/2016 - 223,44 - 11427999-4 - IPVA - RENAV **830846309-68 -** 11465802-2 - IPVA - RENAVAM / EXER 00923983899/2015 - 129,33 - **ADRIANO RICARDO - 95468935 ADRIANO RICARDO PEREIRA FAGUNDES - 058109839** 11538453-8 - IPVA - RENAVAM / EXERC 00983843686/2015 RENAVAM / EXERC 00921602804/2016 - 151,81 - 11462837

ROBERTO - 009047749-96 - 11535070-6 - IPVA - RENAV EXERC 00980673992/2015 - 184,89 - **ADRIANO ROBERT** 01017360526/2016 - 174,19 - 11548806-6 - IPVA - RENAVAM 11486507-9 - IPVA - RENAVAM / EXERC 00940333295/2016 **ADRIANO ROCHA DA CRUZ - 063725949-19 -** 11431620-2 RENAVAM / EXERC 00895578930/2015 - 260,12 - **ADRIAN** EXERC 00916847128/2016 - 111,18 - **ADRIANO RODRIG** 00971706263/2016 - 168,23 - 11525119-8 - IPVA - RENAVAM **064183979-08 -** 11475531-1 - IPVA - RENAVAM / EXER 00931946476/2015 - 212,20 - **ADRIANO RODRIGO PORTO** 163,10 - 11447191-7 - IPVA - RENAVAM / EXERC 009088630 - RENAVAM / EXERC 00927226359/2016 - 161,79 - 1146975 **RODRIGUES - 061309029-21 -** 11537117-7 - IPVA - RENAVA **13 -** 11452301-1 - IPVA - RENAVAM / EXERC 00912829320/ 150,39 - **ADRIANO RODRIGUES - 023287349-60 -** 11383273 **RODRIGUES - 028791189-64 -** 11385194-5 - IPVA - RENAV EXERC 00855742747/2015 - 149,78 - **ADRIANO RODRIGUE** - 156,55 - 11535154-0 - IPVA - RENAVAM / EXERC 00980724 **64 -** 11401520-2 - IPVA - RENAVAM / EXERC 00870766260/ 110,15 - **ADRIANO RODRIGUES CAVALCANTE - 0155467 ADRIANO RODRIGUES DA SILVA - 061609089-79 -** 1142 **RODRIGUES DA SILVA - 758916469-00 -** 11460561-1 - IP RENAVAM / EXERC 00919548873/2015 - 164,76 - **ADRIANO R** EXERC 00949411949/2016 - 151,81 - 11498514-7 - IPVA - R **CAMPOS - 056394209-60 -** 11397330-7 - IPVA - RENAVAM **- 005640839-09 -** 11398697-2 - IPVA - RENAVAM / EXE 00868297208/2015 - 166,39 - **ADRIANO RODRIGUES DE** 00907409709/2016 - 132,88 - 11445314-5 - IPVA - RENAVAM **- 026763279-76 -** 11521921-9 - IPVA - RENAVAM / EXE 00968801170/2015 - 221,71 - **ADRIANO RODRIGUES DE** 00896067157/2016 - 147,03 - **ADRIANO RODRIGUES D** 00958021228/2016 - 168,23 - 11509154-9 - IPVA - RENAVA **067818049-01 -** 11396372-7 - IPVA - RENAVAM / EXER 00866229329/2015 - 197,43 - **ADRIANO ROGERIO DUZ**-184,89 - **ADRIANO ROGERIO LAVORATO - 026457119** 11525092-2 - IPVA - RENAVAM / EXERC 00971681279/2015 IPVA - RENAVAM / EXERC 00889856842/2016 - 138,25 - 114 **ROLFH SIEG - 883212749-00 -** 11440604-0 - IPVA - RENA EXERC 00903433540/2015 - 121,52 - **ADRIANO ROQUE DO** 00893066052/2016 - 119,58 - 11428788-1 - IPVA - RENAV **049616679-43 -** 11532279-6 - IPVA - RENAVAM / EXERC 11539500-9 - IPVA - RENAVAM / EXERC 00984741070/2016 **ADRIANO ROSA DA SLVA - 270903598-75 -** 11438370-8 -RENAVAM /

EXERC 00901478814/2015 - 179,03 - **ADRIANO** 00867024852/2016 - 145,93 - 11397208-4 - IPVA - RENAVAM 11396888-5 - IPVA - RENAVAM / EXERC 00866699619/2016 **ADRIANO SAMPAIO - 044320409-80 -** 11484217-6 - IPV RENAVAM / EXERC 00938358030/2015 - 177,76 - **ADRIAN** EXERC 00864983166/2016 - 145,93 - 11395012-9 - IPVA - REN **074384289-82 -** 11473734-8 - IPVA - RENAVAM / EXERC 00 11511310-0 - IPVA - RENAVAM / EXERC 00959871403/2016 **ADRIANO SAQUETTO - 047659989-08 -** 11415148-3 - IPV RENAVAM / EXERC 00881637084/2015 - 179,03 - **ADRIAN** 00930246802/2016 - 151,81 - 11473399-7 - IPVA - RENAVAM **03388084/0001-70 -** 11382698-3 - IPVA - RENAVAM / EX 11484689-9 - IPVA - RENAVAM / EXERC 00938731700/2016 **ADRIANO SIDNEI HOFFMANN - 083871159-67 -** 11432796 **- 049050549-07 -** 11437138-6 - IPVA - RENAVAM / EXERC 11398521-6 - IPVA - RENAVAM / EXERC 00868170127/2015 RENAVAM / EXERC 00935115374/2016 - 161,79 - 11479925-4 RENAVAM / EXERC 00942197143/2016 - 161,79 - 11489157 **DE PAULA - 038451019-11 -** 11496619-3 - IPVA - RENAV

RENAVAM / EXERC 00873954068/2015 - 207,89 - **ADRIANO P**

3680/2015 - 151,01 - **ADRIANO RAFAEL SOUZA DA SILVA** 2016 - 181,19 - 11429859-0 - IPVA - RENAVAM / EXERC 0089411 IPVA - RENAVAM / EXERC 00865136254/2016 - 306,49 - 11395205

MOS PIMENTA - 284766678-84 - 11484293-1 - IPVA - RENAV M / EXERC 00938422154/2015 - 203,18 - **ADRIANO RANGEL RODR** AM / EXERC 00889372861/2016 - 172,29 - 11424613-1 - IPVA - AVAM / EXERC 00852444087/2016 - 145,93 - 11381102-1 - IPVA -**E BARROSO - 077128779-80 -** 11471222-1 - IPVA - RENAVA

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- RENAVAM / EXERC 00935546588/2016 - 163,10 - 11480476 **O RIBEIRO - 063358449-58 -** 11450563-3 - IPVA - RENAVAM / EXERC 00911431357/2015 - 337,14 - **ADRIANO RIBEIRO - 07895** - 147,03 - **ADRIANO RIBEIRO DA SILVA - 055177999-30 -** 114931

3-0 - IPVA - RENAVAM / EXERC 00945315970/2015 - 191,40 A - RENAVAM / EXERC 00978239725/2016 - 213,00 - 11532309

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9-53 - 11464063-8 - IPVA - RENAVAM / EXERC 00922557748/201 **-01 -** 11538452-0 - IPVA - RENAVAM / EXERC 00983843686/2016

- 199,50 - **ADRIANO RIOS VILAR - 059171499-09 -** 11462836 -9 - IPVA - RENAVAM / EXERC 00921602804/2015 - 166,56 AM / EXERC 00980673992/2016 - 168,23 - 11535071-4 - IPVA -**O DA SILVA - 855651729-34 -** 11548805-8 - IPVA - RENAVA

/ EXERC 01017360526/2015 - 449,09 - **ADRIANO ROCHA - 011207** - 193,35 - 11486508-7 - IPVA - RENAVAM / EXERC 00940333295/201 - IPVA - RENAVAM / EXERC 00895578930/2016 - 233,41 - 11431621 **O ROCHA GUTERVIL - 038999759-52 -** 11457171-7 - IPVA - R **O DA SILVA - 075568859-76 -** 11525118-0 - IPVA - RENAVA

/ EXERC 00971706263/2015 - 184,89 - **ADRIANO RODRIGO DE** C 00931946476/2016 - 189,96 - 11475532-0 - IPVA - RENAVA **- 009732199-04 -** 11447190-9 - IPVA - RENAVAM / EXERC 00908863 04/2015 - 185,94 - **ADRIANO RODRIGUES - 067096159-01 -** 11469

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- 171,89 - **ADRIANO ROGERIO SCHENKEL - 066262929-94**-25147-0 - IPVA - RENAVAM / EXERC 00889856842/2015 - 157,64 VAM / EXERC 00903433540/2016 - 107,42 - 11440605-8 - IPVA -**S SANTOS - 064418539-22 -** 11428787-3 - IPVA - RENAVA AM / EXERC 00893066052/2015 - 135,01 - **ADRIANO ROSA DA** 00978202740/2015 - 106,14 - **ADRIANO ROSA DA SILVA - 06851124** - 154,09 - 11539501-7 - IPVA - RENAVAM / EXERC 00984741070/201 IPVA - RENAVAM / EXERC 00901478814/2016 - 157,01 - 1143837 **ROSA DE MELO - 062938059-76 -** 11397207-6 - IPVA - RENAV / EXERC 00867024852/2015 - 166,39 - **ADRIANO S ANTUNES - 009** - 136,22 - 11396889-3 - IPVA - RENAVAM / EXERC 00866699619/201 A - RENAVAM / EXERC 00938358030/2016 - 161,79 - 11484218 **O SANTANA DA SILVA - 052776349-75 -** 11395011-0 - IPVA -AVAM / EXERC 00864983166/2015 - 166,39 - **ADRIANO SANTOS** 930537564/2016 - 303,86 - **ADRIANO SANTOS DE MORAES - 080** - 165,44 - 11511311-9 - IPVA - RENAVAM / EXERC 00959871403/201 A - RENAVAM / EXERC 00881637084/2016 - 157,01 - 11415149

O SCHAIA - 073764909-73 - 11473398-9 - IPVA - RENAVA / EXERC 00930246802/2015 - 166,56 - **ADRIANO SCHEIFER E** ERC 00853781257/2015 - 339,31 - **ADRIANO SCHNEIDER - 050** - 161,79 - 11484690-2 - IPVA - RENAVAM / EXERC 00938731700/201 -4 - IPVA - RENAVAM / EXERC 00896735559/2016 - 147,03 - **ADRI** 00900478292/2016 - 147,03 - **ADRIANO SILVA BARBOSA - 04** - 151,01 - **ADRIANO SILVA DE ARAUJO - 058991279-88 -** 11479924 - IPVA - RENAVAM / EXERC 00935115374/2015 - 177,76 - 11489156 6 - IPVA - RENAVAM / EXERC 00942197143/2015 - 177,76 - **ADRI** AM / EXERC 00948138424/2016 - 303,86 - 11496620-7 - IPVA

RESTES -- 319056698 7076/2015 --9 - IPVA -AM / EXERC

IGUES RENAVAM / RENAVAM / M / EXERC

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SOARES-M / EXERC

5 - 217,83 -- 174,99 --0 - IPVA -- **ADRIANO** RENAVAM / M / EXERC

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MATES-M / EXERC

004/2016 -750-8 - IPVA - **ADRIANO - 009372469** 320/2015 -- **ADRIANO** RENAVAM /

830/2016 **- 091482759** 260/2015 -6 - 145,58 -- **ADRIANO** -0 - IPVA -RENAVAM / **IGUES DE OLIVEIRA**

/ EXERC M / EXERC **QUADROS** M / EXERC

/ EXERC

/ EXERC **S FELIS**-M / EXERC

21/2015 -- 151,86 -11425146-1 -- **ADRIANO** RENAVAM / M / EXERC

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SOARES-M / EXERC

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/ EXERC

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Reexamination	Application/Control No.	Applicant(s)/Patent Under Reexamination
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/JOSEPH R POKRZYWA/ Primary Examiner, Art Unit 3992	

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	Examiner	Art Unit
	JOSEPH R POKRZYWA	3992

CPC - Searched*		
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H04M 3/007	11/13/2023	JRP
H04L 12/5692	11/13/2023	JRP
H04L 45/54	11/13/2023	JRP

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US Classification - Searched*			
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Search Notes		
Search Notes	**Date**	**Examiner**
reviewed underlying patent file wrapper for U.S. Pat. 10,868,908	11/13/2023	JRP
reviewed Patent Data Portal (PDP) for continuity data	11/13/2023	JRP
reviewed P-TACTS for AIA proceedings (found IPR2023-00584)	11/13/2023	JRP
reviewed IPR2023-00584 (termination on 10/2/2023)	11/13/2023	JRP
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/JOSEPH R POKRZYWA/ Primary Examiner, Art Unit 3992	

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	JOSEPH R POKRZYWA	3992

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Harold McGurk
The Law Office of Clay McGurk
P.O. BOX 1488
Orange, CA 92856

EXAMINER	
POKRZYWA, JOSEPH R	

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ART UNIT *3992* .

Enclosed is a copy of the latest communication from the United States Patent and Trademark Office in the above identified *ex parte* reexamination proceeding (37 CFR 1.550(f)).

Where this copy is supplied after the reply by requester, 37 CFR 1.535, or the time for filing a reply has passed, no submission on behalf of the *ex parte* reexamination requester will be acknowledged or considered (37 CFR 1.550(g)).

PTOL-465 (Rev.07-04)

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Office Action in Ex Parte Reexamination	**Control No.** 90/019,265	**Patent Under Reexamination** 10868908	
	Examiner JOSEPH R POKRZYWA	**Art Unit** 3992	**AIA (FITF) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

a. ☑ Responsive to the communication(s) filed on 01 March 2024.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

b. ☐ This action is made FINAL.

c. ☐ A statement under 37 CFR 1.530 has not been received from the patent owner.

A shortened statutory period for response to this action is set to expire 2 month(s) from the mailing date of this letter. Failure to respond within the period for response will result in termination of the proceeding and issuance of an *ex parte* reexamination certificate in accordance with this action. 37 CFR 1.550(d). **EXTENSIONS OF TIME ARE GOVERNED BY 37 CFR 1.550(c).** If the period for response specified above is less than thirty (30) days, a response within the statutory minimum of thirty (30) days will be considered timely.

Part I THE FOLLOWING ATTACHMENT(S) ARE PART OF THIS ACTION:

1. ☐ Notice of References Cited by Examiner, PTO-892.
2. ☐ Information Disclosure Statement, PTO/SB/08.
3. ☐ Interview Summary, PTO-474.
4. ☐ _____.

Part II SUMMARY OF ACTION

1a. ☑ Claims 1-3,5-6 and 13-15 are subject to reexamination.
1b. ☑ Claims 4,7-12 and 16-17 are not subject to reexamination.
2. ☐ Claims _____ have been canceled in the present reexamination proceeding.
3. ☐ Claims _____ are patentable and/or confirmed.
4. ☑ Claims 1-3,5-6 and 13-15 are rejected.
5. ☐ Claims _____ are objected to.
6. ☐ The drawings, filed on _____ are acceptable.
7. ☐ The proposed drawing correction, filed on _____ has been (7a) ☐ approved (7b) ☐ disapproved.
8. ☐ Acknowledgment is made of the priority claim under 35 U.S.C. 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the certified copies have
   1 ☐ been received.
   2 ☐ not been received.
   3 ☐ been filed in Application No. _____.
   4 ☐ been filed in reexamination Control No. _____.
   5 ☐ been received by the International Bureau in PCT application No. _____.
   * See the attached detailed Office action for a list of the certified copies not received.
9. ☐ Since the proceeding appears to be in condition for issuance of an *ex parte* reexamination certificate except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte* Quayle, 1935 C.D. 11, 453 O.G. 213.
10. ☐ Other: _____

cc: Requester (if third party requester)

DETAILED ACTION

Brief Summary

1. This is a non-final Office action regarding the reexamination of U.S. Application 90/019,265, being a reexamination of U.S. Patent 10,868,908, issued to Eric M. DeLangis (hereafter "the '908 Patent").

2. The '908 Patent originally issued on December 15, 2020, with patented claims 1-17, being filed as U.S. Patent Application 15/161,787 (hereafter "the original '787 Application") on May 23, 2016. The original '787 Application was filed as a continuation of U.S. Application 14/512,414, filed on October 11, 2014, now U.S. Patent 9,350,649, which is a continuation of U.S. Application 13/531,294, filed on June 22, 2012, now U.S. Patent 8,861,349, which is a continuation of U.S. Application 12/581,852, filed on October 19, 2009, now U.S. Patent 8,228,801, which is a continuation of U.S. Application 10/686,375, filed on October 14, 2003, now U.S. Patent 7,606,156. The original '787 Application claims priority to provisional U.S. Application 60/418,521, filed on October 15, 2002.

3. Reexamination of patented claims 1-3, 5, 6, and 13-15 of the '908 Patent was ordered on January 2, 2024, whereby a substantial new question was raised by the Third Party's request for *ex parte* reexamination filed October 4, 2023. Subsequently, the Patent Owner filed a Patent Owner Statement pursuant to 37 CFR 1.530 on March 1, 2024. In response, the Third Party Requester filed a Reply on April 30, 2024.

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4. Further, the Examiner notes that because the '908 Patent was filed as multiple continuations of applications, dating back to October 14, 2003, the '908 Patent would now appear to be expired. With this, MPEP 2240 states, in part:

> ... In making the determination of whether to order reexamination, the Office will determine the proper meaning of the patent claims by giving the claims their broadest reasonable interpretation consistent with the specification (see *In re Yamamoto,* 740 F.2d 1569 (Fed. Cir. 1984)), **except in the case of an expired patent (in a reexamination involving claims of an expired patent, claim construction is pursuant to the principle set forth by the court in *Phillips v. AWH Corp.,* 415 F.3d 1303, 1316, 75 USPQ2d 1321, 1329 (Fed. Cir. 2005) (words of a claim "are generally given their ordinary and customary meaning" as understood by a person of ordinary skill in the art in question at the time of the invention**, see *Ex parte Papst-Motoren,* 1 USPQ2d 1655 (Bd. Pat. App. & Inter. 1986)). If reexamination is ordered, the patent owner statement, if applicable, and any accompanying information submitted pursuant to 37 CFR 1.501(a)(2) will be considered during the examination stage to the fullest extent possible when determining the scope of any claims of the patent which are subject to reexamination. [Emphasis added].

5. Thus, since the '908 Patent would be expired, the claim construction will be pursuant to the principle set forth by the court in *Phillips*, whereby the "words of a claim 'are generally given their ordinary and customary meaning' as understood by a person of ordinary skill in the art in question at the time of the invention."

6. The present application is being examined under the pre-AIA first to invent provisions.

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Response to Patent Owner's Statement and Requester's Reply

7. Patent Owner's arguments filed March 1, 2024 in the Patent Owner Statement pursuant to 37 CFR 1.530 and the Third Party Requester's Reply filed April 30, 2024, have been fully considered.

8. First, the Examiner finds the arguments presented in the Patent Owner Statement filed March 1, 2024 unpersuasive. Initially, in the Patent Owner's Statement filed March 1, 2024, beginning on page 10, and throughout the Statement, the Patent Owner argues that the Order fails to establish that claims 1-2 and 5-6 are obvious over Maurya and Low, or that claims 1-2, 5-6 and 13-15 are obvious over Maurya, Law and Krishnan. But in this regard, in the Order dated January 2, 2024, the Examiner determined that the Request raised a substantial new question of patentability as to at least claim 1 of the '908 Patent. Here, a determination as to patentability or unpatentability of the claims is not made in the decision on the request.

9. Particularly, the Examiner notes that MPEP 2240 states, in part:

> 35 U.S.C. 303 requires that within 3 months following the filing of a request for reexamination filed under 35 U.S.C. 302, the Director of the USPTO **will determine whether or not the request raises a "substantial new question of patentability" affecting any claim of the patent** of which reexamination is desired.
>
> ...
>
> The decision on the request for reexamination filed under 35 U.S.C. 302 has as its object either the granting or denial of an order for reexamination. This decision is based on whether or not "a substantial new question of patentability" is found. **A determination as to patentability/unpatentability of the claims is not made in the decision on the request; rather, this determination will be made during the examination stage of the reexamination proceedings if reexamination is ordered. Accordingly, no *prima facie* case of unpatentability need be found to grant an order for reexamination.**

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> ...
> The decision on the request for reexamination should discuss all of the patent claims requested for reexamination. The examiner should limit the discussion of those claims in the order for reexamination as to whether a substantial new question of patentability has been raised. **The examiner SHOULD NOT reject claims in the order for reexamination.** Rather, any rejection of the claims will be made in the first Office action (on the patentability of the claims) that is issued after the expiration of the time for submitting any patent owner statement and requester reply that follow the examiner's order. [Emphasis added].

10. With this, the determination within the Order dated January 2, 2024, that the Request for Reexamination filed October 4, 2023, raised a substantial new question of patentability, is seen to be proper.

11. Second, in the Patent Owner's Statement filed March 1, 2024, the Patent Owner also argues, beginning on page 12, that the secondary reference of Low is not analogous art to the '908 Patent, and therefore cannot be used in an obviousness combination against it. Here, on page 19 of the Statement, the Patent Owner further argues that "Low fails both prongs: it is not from the same field of endeavor as the '908 Patent, and it is not reasonably pertinent to the particular problem with which the inventor was involved in the '908 Patent." But in response, the Examiner does not find this argument by the Patent Owner persuasive, and the Examiner generally agrees with the discussion in the Third Party Requester's Reply dated April 30, 2024 on pages 9-14.

12. Along this vein, MPEP 2141.01(a) states, in part:

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> … A reference is analogous art to the claimed invention if: **(1) the reference is from the same field of endeavor as the claimed invention (even if it addresses a different problem)**; or (2) the reference is reasonably pertinent to the problem faced by the inventor (even if it is not in the same field of endeavor as the claimed invention). **Note that "same field of endeavor" and "reasonably pertinent" are two separate tests for establishing analogous art; it is not necessary for a reference to fulfill both tests in order to qualify as analogous art.** [Emphasis added].

13. In this regard, the prior art reference of Low is seen to be from the same field of endeavor as the claimed invention, although Low addresses a different problem than that described in the '908 Patent. Here, in review of the '908 Patent, in the "Background of the Invention" and the "Summary of the Invention" in cols. 1 and 2, the '908 Patent discusses "To be competitive then, CLECs try to sell additional services such as call waiting, caller ID, etc. where they have as much as a 50% margin. Some CLECs also bundle long distance services with their packages as additional incentive to get residential customers to buy local telephone service from them. … Many companies are currently trying to provide VoIP services to residential customers over high-speed or broadband backbones such as DSL and cable modems, over Internet connections via a computer. … The RCG combines the capabilities and features of IP routers, Class 5 circuit switches and wireless LANs in a small stand-alone external modem like device."

14. Similarly, in reviewing the prior art of Low, on page 2 of Low, in the "Background of the Invention", the reference states "Telecommunication companies running PSTNs (Public Switched Telephone Networks) and PLMNs (Public Land Mobile Networks) are in business of providing communication services and in doing so are providing increasing built-in intelligence in the form of 'IN services' such as 800 number services and call forwarding. In contrast, the World Wide Web (WWW), which has seen explosive growth in recent times, is an example of an

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Internet-based global network providing complex information services. …The present invention proposes technologies for a more synergetic relationship between these two worlds …" Here, this description in the '908 Patent and this description in Low appear to be describing similar issues in their respective Backgrounds.

15. Additionally, in the '908 Patent, the specification describes a system of multilink communications, disclosing various networks such as a PSTN and the Internet, for use with a telephone and also for a Personal Computer [see the '908 Patent, col. 9, lines 34-47]. Similarly, the reference of Low discloses a system that allows multilink communications having multiple networks, including a "telecom network" and the "Internet", as seen in Figs. 4 and 6 of Low. Thus, while the reference of Low goes on to define an invention that solves a different problem than that defined in the '908 Patent, the Low reference and the '908 Patent are still seen to be from the same field of endeavor. Thus, the Low reference is seen to be analogous art to the claimed invention of the '908 Patent, and the reliance of Low in a rejection under 35 U.S.C. 103 would therefore be proper.

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16. Continuing, with respect to the Third Party Requester's Reply filed April 30, 2024, regarding the priority date of the'908 Patent on pages 1-9 of the Reply, the Examiner understands the points discussed by the Third Party Requester, but the points are unpersuasive. Here, as read in col. 12, lines 1-66, the '908 Patent states "Referring to FIG. 7, an RCG—85 that decides to initiate a multilink PPP session with a remote computer i.e. internet URL, requests a multilink PPP session with that URL resource via Link Control Protocol (LCP) session management. … **The initiating RCG then selects which of the responding remote RCGs—86 it will use for the multilink PPP bundle—87 and sends them a multilink initialization packet containing the URL of the destination as well as the multilink PPP session ID (magic number)** and any other pertinent information required for the remote RCG to join in the existing multilink PPP bundle—87. Each remote RCG POTS interface—91 participating in a multilink PPP bundle, represents a logical "link" in the initiating RCG's multilink PPP bundle—87. The remote RCGs—86 then send a multilink PPP packet (over their respective POTS lines—91) to the destination URL with the multilink PPP session ID and request to be added to that multilink PPP bundle—87. The destination URL accepts the request of each of the remote RCGs—86 and begins sending data packets to each over their respective POTS lines—91."

17. This section in the specification of the '908 Patent appears to describe messages that include "a multilink session identification and the destination URL", as currently claimed in claim 1 and claim 13 of the '908 Patent. With this, the chain of priority of the original '787 Application that matured into the '908 Patent is not seen to be broken.

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18. This description of having messages that include "a multilink session identification and the destination URL" is similarly found in the prior U.S. Pat. 8,861,349, as well as in the disclosure of the provisional application 60/418,521. In this regard, in the Request, the Third Party Requester contended that the application in the chain of priority, U.S. App. 13/531,294, which matured to U.S. Pat. 8,861,349, failed to disclose the claimed first message sent by a device in independent claims 1 and 13.

19. But as discussed above, and also as discussed in the Order dated January 2, 2024 on pages 21-23, the reference of U.S. Patent 7,606,156, being noted as "DeLangis-156" in the Request, is still not seen to be available as prior art. Here, the disclosures of the earlier non-provisional applications in the chain of priority, as well as the disclosure of the provisional application 60/418,521, are seen to provide **sufficient disclosure as to the features required independent claims 1 and 13** of the '908 Patent.

Claim Rejections - 35 USC § 103

20. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis (i.e., changing from AIA to pre-AIA) for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

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21. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

22. **Claims 1-3, 5-6, and 13-15** is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,160,808, issued to MAURYA, Sanjiv Kumar (noted herein as "Maurya", being cited in the Request for Reexamination), in view of International Patent Application Publication WO 97/22212, with the inventor of LOW, Colin *et al.*, being published on June 19, 1997 (noted herein as "Low", being cited in the Request for Reexamination).

Regarding ***claim 1***, Maurya discloses a client device [being the client 605, which includes PC 610 connected through communication interfaces 612 to terminal adapters 620, as seen in Fig. 6A] for multilink data packet communication with a server [server 650, see Fig. 6A; also see col. 11, line 34-col. 12, line 10, wherein "With the above discussion of conventional multi-link PPP in mind , consider FIG. 6A which depicts a high level block diagram of illustrative multi-link client-server apparatus 600, which incorporates the teachings of the present invention. Here, client 605 is inter-connected to server 650 through multiple ISDN BRI (basic rate interface) lines 630."], the client device comprising:

a first network interface having a first data transfer rate associated with a first path from the server to the first network interface of the client device [one of the communication interfaces 612, combined with the ISDN BRI terminal adapter (TA) 1, 620_1, through path 615_1, as seen in Fig. 6A; also see col. 11, line 34-col. 13, line 8, wherein "In that regard, links 615, which

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comprise links 615_1, 615_2, . . . , 615_n, connect separate terminal adapters 620_1, 620_2, . . . , 620_n, respectively, to separate corresponding serial ports provided by communication interfaces 612. … ISDN connections are extended from terminal adapters 620, through public switched telephone network (PSTN) 640, to server 650 having corresponding identical terminal adapters 660, as DCE, and server computer 665, as DTE. Each one of terminal adapters 620 is connected through a separate pair of ISDN B-channels and the PSTN, to a separate corresponding one of terminal adapters 660, the latter terminal adapters collectively connected, via links 662, to server computer 665. Each of adapters 660 is illustratively identical to each of adapters 620."; also see col. 17, lines 36-57, wherein "However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."];

a second network interface having a second data transfer rate associated with a second path from the server to the second network interface of the client device [being another one of the communication interfaces 612, combined with the ISDN BRI terminal adapter 2, 620_2, through path 615_2, as seen in Fig. 6A; also see col. 11, line 34-col. 13, line 8, wherein "In that regard, links 615, which comprise links 615_1, 615_2, . . . , 615_n, connect separate terminal adapters 620_1, 620_2, . . . , 620_n, respectively, to separate corresponding serial ports provided by communication interfaces 612. … ISDN connections are extended from terminal adapters 620, through public switched telephone network (PSTN) 640, to server 650 having corresponding identical terminal adapters 660, as DCE, and server computer 665, as DTE. Each one of terminal adapters 620 is connected through a separate pair of ISDN B-channels and the PSTN, to a separate corresponding one of terminal adapters 660, the latter terminal adapters collectively

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connected, via links 662, to server computer 665. Each of adapters 660 is illustratively identical to each of adapters 620."; also see col. 17, lines 36-57, wherein "However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."; also see col. 17, lines 36-57, wherein "However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."]; and

at least one processor configured to:

transmit a first message through the first network interface to the server, wherein the first message includes a multilink request ***[and] a destination IP address*** [see col. 7, line 22-39, wherein "At this point with no activity on the link, a link control protocol (LCP), which as part of the PPP protocol, exercises responsibility for establishing and configuring the link, remains in an initial or starting state."; also see col. 8, lines 20-59, wherein "FIG. 2 depicts a format of conventional generalized LCP packet 200. As shown, packet 200 is formed of eight-bit code field 210, eight-bit identifier field 220, sixteen-bit length field 230 and finally variable-length data field 240. This packet can be any one of several types, with the value of the code field, having values typically ranging from one to thirteen, specifying the type of any such packet. Of note, a value of one indicates that the packet is an LCP Configure Request packet. Such a request packet is sent by a PPP peer whenever that peer desires to change a configuration parameter, such as from a default value, associated with the link."; also see col. 9, lines 14-55, wherein "The endpoint discriminator packet identifies, by specifying an address, of an end system (an

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"endpoint"), then situated on an end of a link, that is transmitting this particular packet. … For example, a class field having a value of illustratively zero, one or two specifies that the following address is a null class (i.e., the address is zero octets long), a locally assigned address, such as a serial number (having a length up to twenty octets), or an Internet Protocol (IP) address (having a length of four octets). Other classes of addresses exist. Inasmuch as the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention, I will omit any further details of the latter two aspects."];

transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification ***[and] the destination IP address*** [see col. 7, line 22-39; also see col. 8, lines 20-59, wherein "FIG. 2 depicts a format of conventional generalized LCP packet 200. As shown, packet 200 is formed of eight-bit code field 210, eight-bit identifier field 220, sixteen-bit length field 230 and finally variable-length data field 240. This packet can be any one of several types, with the value of the code field, having values typically ranging from one to thirteen, specifying the type of any such packet. Of note, a value of one indicates that the packet is an LCP Configure Request packet. Such a request packet is sent by a PPP peer whenever that peer desires to change a configuration parameter, such as from a default value, associated with the link."; also see col. 8, line 60-col. 9, line 67, wherein "Each specific option has to be separately negotiated between the PPP peers and appropriately acknowledged prior to its use. Inasmuch as the only values for this type field, i.e., the only configuration options, that are relevant to understanding the invention are 17, 18 and 19, which designate a multi-link MRRU (Multi-link Maximum Receive Reconstructed unit) request, **a multi-link Short Sequence Number** header request and a "multi-link endpoint discriminator"

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option, respectively (which will all be discussed in detail below in conjunction with FIG. 5). … Each such multi-link PPP packet contains a sequence number--which increases by one with each successive packet, inserted by the multi-link protocol."; also see col. 10, lines 6-53, wherein "These formats are depicted as long and short sequence number formats 510 and 550 having 24- and 12-bit sequence numbers, respectively. The specific format of the multi-link PPP packet to use in any situation can be specified by a PPP sender by transmitting an LCP Configuration Request message for a Multi-link Maximum Receive Reconstructed Unit (MRRU) format, i.e., designating long sequence number format 510, or a Multi-link Short Sequence Number Header format, i.e., designating short sequence number format 550, coupled with successful negotiations with its PPP peer therefor. Use of format 510 or 550 is requested by a type field having a value of 17 or 18, respectively, in an LCP Configure Request message, as noted above, transmitted by the PPP sender to its PPP peer."]; and

receive data packets from the server through the first and second network interfaces of the client device during the multilink session [see col. 10, line 6-col. 11, line 28; also see col. 14, lines 22-57, wherein "As a result, server computer 665, by virtue of the common endpoint discriminator associated the application executing at client PC 610 and with every ISDN BRI (B channel pair) emanating from client 605, will then, through conventional multi-link protocol processing correctly view links 630 as a common bundle, i.e., a pipe, for packets generated by and destined to this application and handle packets appearing thereon as multi-link PPP packets."; also see col. 14, line 61-col. 15, line 11, wherein "First, a transmitting side device which transmits (e.g., any of devices 620 or 660) an incoming packet need not split any of these incoming packets but can alternate these packets between each of its physical links, i.e., applies these packets in a round-robin (or other predefined) fashion among its outgoing links. In this

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scenario, no changes need to be made to the contents of each of these incoming packets to transmit that packet through one or more levels in a hierarchy of multi-link PPP devices. A receiving side device merely passes the multi-link packets it receives to its associated DTE in increasing order of the sequence numbers of the packets its received, while ignoring beginning and ending flags in the multi-link header of each such packet."]

wherein the first data transfer rate and the second data transfer rate provide an increased data transfer rate of the first path and the second path from the server to the client device [see col. 2, line 32-col. 3, line 41, wherein "Second, as more users simultaneously contend for available network bandwidth at particular times, such as when the network experiences its peak daily loading, the network becomes increasingly congested. Hence, at these times, network traffic tends to slow which also tends to lengthen download time, thereby frustrating the users particularly those seeking relatively large files. … Once successfully negotiated between two PPP peers, then, at a transmitting peer, multi-link PPP segments a packetized data stream (i.e., a PPP frame) into segments (or fragments), forms a stream of multi-link PPP packets each containing one such a segment, and then assigns these multi-link PPP packets on an approximately equal basis, where practical, between two B channels in the BRI connection for transmission to a receiving PPP peer; here the two B channels form a pipe. Small packets may not be segmented and to accommodate links of different speeds (which is not the case with two ISDN B channels), the segments need not be of the same size nor do the same number of segments need to be transmitted over each link."; also see col. 17, lines 20-57, wherein "Hence, through the present invention, a link in an original multi-link bundle and carrying multi-link PPP packets can itself be effectively divided (demultiplexed) into substantially any number of different paths with these paths being remotely and correctly recombined (multiplexed) so as to

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appear to be a link of the original multi-link bundle. … Furthermore, if all multi-link PPP links in a bundle have same data transmission rate such as two B-channels in an ISDN line, then each terminal adapter can simply send its incoming multi-link PPP packets as outgoing multi-link PPP packets on alternating B-channels without the need to encapsulate these packets with multi-multi-link protocol headers….However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."].

With this, as discussed above, Maurya is seen to disclose that the first and second messages include a multilink request and a destination IP address. But in this regard, the reference of Maurya does not expressly disclose if the first and second messages include a multilink request **and a destination URL**, as currently recited in independent claim 1.

However, the reference of Low discloses a client device that transmits messages through a network interface, whereby the message includes a multilink request [and] a destination URL [see Fig. 4, with the terminal 31 transmitting a message 38 to a server 32 that includes a request and a destination URL; also see page 11, line 12-page 13, line 15, wherein "A cornerstone of the WWW is its ability to address particular information resources by means of an Uniform Resource Locator (URL) that identifies a resource by location…By way of example, a full or 'absolute' URL will comprise the following elements:…the Internet host domain or IP address…This request includes a request method, and the 'Request-URI' (which is generally just the absolute path of the resource on the server as identified by the 'abs-path' element of the

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URI); the request may include additional data elements."; also see page 23, line 5-page 24, line 9].

With this, it would have been obvious for one of ordinary skill in the art to have include a destination URL in messages sent from the client to the server, as recognized by Low, within the first and second messages disclosed in Maurya. Maurya and Low are combinable because they are from the same field of endeavor, both being systems that perform multilink data packet communication. At the time of the invention, it would have been obvious to one of ordinary skill in the art to have the client device of Maurya include the functionality that "the first and second messages include a multilink request **and a destination URL**", as recognized by Low. The suggestion/motivation for doing so would be that the client device of Maurya would conform with known protocols for communicating packets in systems utilizing point-to-point protocol (PPP), as discussed by Low in page 11, lines 21-page 12, line 28 which states "In this case, the user terminal 34 will generally communicate with the ISP 33 over the public telephone system using a modem and employing either SLIP (Serial Line Interface Protocol) or PPP (Point-to-Point Protocol). These protocols allow Internet packets to traverse ordinary telephone lines. ...A cornerstone of the WWW is its ability to address particular information resources by means of an Uniform Resource Identifier (URI) that will generally be either a Uniform Resource Locator that identifies a resource by location, or a Uniform Resource Name (URN) that can be resolved into an URL." Here, Low describes that utilizing URLs for PPP communication of packets between user terminals and Internet service providers was well known, and thus, this modification of Maurya with the functionality taught in Low would easily be implemented with these well-known teachings, as exemplified by Low, and would yield predictable results. In this regard,

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Maurya specifically states in col. 9, lines 42-55 that "Other classes of addresses exist. Inasmuch as the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention, I will omit any further details of the latter two aspects." Therefore, it would have been obvious to combine the teachings of Low of using a URL with the client device described in Maurya to obtain the invention specified in independent claim 1.

Regarding ***claim 2***, Maurya and Low disclose the client device discussed above in claim 1, and Maurya further teaches wherein the at least one processor further is configured to transmit the first message and the second message to at least one server [see Figs. 6A-8; also see col. 14, lines 22-60, wherein "Hence, for client-server apparatus 600 shown in FIG. 6A and through the teachings of my invention, a client application executing at client PC 610, during the course of configuring links 615 connecting the PC with terminal adapters 620, will establish its own endpoint discriminator value which, in turn, it will supply, via LCP Endpoint Discriminator packets during LCP negotiations, to each of terminal adapters 620. ...As a result, server computer 665, by virtue of the common endpoint discriminator associated the application executing at client PC 610 and with every ISDN BRI (B channel pair) emanating from client 605, will then, through conventional multi-link protocol processing correctly view links 630 as a common bundle, i.e., a pipe, for packets generated by and destined to this application and handle packets appearing thereon as multi-link PPP packets."],

wherein the at least one server is a device providing the data packets, or a device that manages the client device and another device that is providing data to the client device [see Figs. 6A-8, which illustrates the server computer 665; also see col. 14, lines 22-60, wherein "As a

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result, server computer 665, by virtue of the common endpoint discriminator associated the application executing at client PC 610 and with every ISDN BRI (B channel pair) emanating from client 605, will then, through conventional multi-link protocol processing correctly view links 630 as a common bundle, i.e., a pipe, for packets generated by and destined to this application and handle packets appearing thereon as multi-link PPP packets."].

Regarding ***claim 3***, Maurya and Low disclose the client device discussed above in claim 1, and Maurya further teaches wherein a server provides the multilink session identification that is unique to the multilink session [see col. 5, lines 7-58, wherein "In accordance with my specific inventive teachings, setting identical endpoint discriminators is readily accomplished during LCP negotiations wherein **a multi-link PPP originator, such as, e.g., a server or a client application executing at a PC, assigns itself a unique endpoint discriminator value and informs all its immediate PPP peers**, such as neighboring terminal adapters, by sending the latter, via a first bundle of outgoing links, an LCP Endpoint Discriminator packet containing this value. Each of these immediate PPP peers, rather than assigning itself a unique endpoint discriminator value, assumes the value that has been provided to it in the LCP Endpoint Discriminator packet it receives from the originating device, as its own endpoint discriminator. Each of these peers then, in turn, sends an LCP Endpoint Discriminator packet containing its endpoint discriminator value (i.e., that of the originating multi-link PPP system), via a second bundle of outgoing links, to its immediate PPP peers, and so forth until all hierarchically inter-connected multi-link PPP peers at one end of the pipe and which fan-out from the originator have set their endpoint discriminator to a single common value, i.e., the endpoint discriminator of the multi-link PPP originator. Each multi-link PPP device situated in a final, e.g. m^{th}, level of

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hierarchically organized multi-link PPP peers supplies the common endpoint discriminator value, through an associated LCP Endpoint Discriminator packet and via a separate physical link in the pipe, to its remote multi-link PPP peer at the other end of the pipe. Consequently, all the links in this pipe will be viewed, by the multi-link protocol, as part of a common bundle."; also see col. 13, line 61-col. 14, line 60; also see col. 16, lines 9-55, wherein "Once this occurs, then process 700 progresses to step 730. **At this step, each of far-end terminal adapters 660 takes the endpoint discriminator value (the contents of both class field 430 and address field 440 shown in FIG. 4) sent by server computer 665 as part of an LCP Multi-link Endpoint Discriminator Option packet as its own endpoint discriminator**. Thereafter, this particular terminal adapter then negotiates with its near-end PPP peer, i.e., one of terminal adapters 620, and also negotiates to perform multi-link PPP with server computer 665, via links 662. During the course of LCP negotiations, **the far-end terminal adapter sends its peer near-end adapter an LCP Multi-link Endpoint Discriminator Option packet containing the endpoint discriminator value of the former adapter, i.e., that associated with the server computer**."].

Regarding ***claim 5***, Maurya and Low disclose the client device discussed above in claim 1, and Maurya further teaches wherein each of the first network interface and the second network interface is **one or more of** cellular interface, Wi-Fi interface, a wireless interface, a cable interface, a wired interface, an Ethernet interface, a Bluetooth interface, a near-field communication interface, and an optical interface [see col. 11, line 34-col. 12, line 31, wherein "Here, client 605 is inter-connected to server 650 through multiple ISDN BRI (basic rate interface) lines 630. … Client 605 is formed of client PC 610, as DTE (data terminating equipment), **connected, through internal communication interfaces 612, typically separate**

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serial ports (not specifically identified), and via corresponding links 615, to multiple identical ISDN BRI terminal adapters 620 as DCE (data circuit terminating equipment)."; also see col. 3, lines 15-65; with this, these teachings in Maurya are seen to disclose a "wired interface"].

Regarding ***claim 6***, Maurya and Low disclose the client device discussed above in claim 1, and Maurya further teaches wherein the processor is configured to reorder the one or more data packets that are received over the at least two or more network interfaces of the client device during the multilink session [see col. 12, lines 32-65, wherein "In particular, as discussed above and depicted in FIG. 5, each multi-link PPP packet generated by client PC 610, shown in FIG. 6A, would contain a sequence number which increments by one from each multi-link PPP packet to the next in a common PPP frame. To ensure proper ordering, each of terminal adapters 660 would buffer each incoming multi-link PPP packet it receives, via links 630, from its corresponding PPP peer in adapters 620, and then reorder its received packets based on their sequence numbers, and then transmit only properly reordered packets to server computer 665. Inasmuch as PC 610 is distributing the multi-link PPP packets, typically in sequential round-robin fashion, amongst terminal adapters 620, each one of terminal adapters 660 would receive packets having sequence numbers that increment not by the value one but by the integer value n; hence, skipping intervening sequence numbers. Under conventional multi-link protocol processing, if incoming multi-link PPP packets were received by any given terminal adapter, such as in adapters 660, but with gaps in their sequence numbers, then each of these terminal adapters would simply buffer these incoming packets pending receipt of those packets containing the missing (here skipped) sequence numbers."; also see col. 14, line 61-col. 16, line 5, wherein

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"To ensure proper re-ordering, upon ultimate reception at a far-end location, of multi-link PPP packets that are to be transmitted at each level, either of two approaches can be used inasmuch as both peer devices (in, e.g., adapters 620 and 660) realize that they are performing multi-multi-link PPP. First, a transmitting side device which transmits (e.g., any of devices 620 or 660) an incoming packet need not split any of these incoming packets but can alternate these packets between each of its physical links, i.e., applies these packets in a round-robin (or other predefined) fashion among its outgoing links. … Second, if either side at any level in the hierarchy desires to split its incoming multi-link packets, then each multi-link PPP device situated at that level encapsulates its incoming multi-link PPP packets as segment data into new outgoing multi-link PPP packets, which I refer to as "multi-multi-link" PPP packets. … Multi-multi-link header 692, has an identical format as that of header 505, but contains beginning and ending (B and E) flags and a sequence number pertinent to the segment data contained within packet 685. FCS field 696 serves the same function and is identical in format to FCS field 507 but has a value associated with the contents of: PPP link layer header 503, protocol and sequence number fields in header 692 and segment data 694."].

Regarding ***claim 13***, Maurya discloses a first device [being the client 605, which includes PC 610 connected through communication interfaces 612 to terminal adapters 620, as seen in Fig. 6A] comprising:

a network interface [being the communication interfaces 612, as seen in Fig. 6A; also see col. 11, line 34-col. 13, line 8, wherein "In that regard, links 615, which comprise links 615_1, 615_2, . . . , 615_n, connect separate terminal adapters 620_1, 620_2, . . . , 620_n, respectively, to separate corresponding serial ports provided by communication interfaces 612. … ISDN

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connections are extended from terminal adapters 620, through public switched telephone network (PSTN) 640, to server 650 having corresponding identical terminal adapters 660, as DCE, and server computer 665, as DTE. Each one of terminal adapters 620 is connected through a separate pair of ISDN B-channels and the PSTN, to a separate corresponding one of terminal adapters 660, the latter terminal adapters collectively connected, via links 662, to server computer 665. Each of adapters 660 is illustratively identical to each of adapters 620."; also see col. 17, lines 36-57, wherein "However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."]; and

at least one processor configured to:

transmit a first message through the network interface to a second device [with the second device seen as being one of the DCEs 660, such as DCE 660_1, as seen in Fig. 6A], wherein the first message includes a multilink request and a destination ***IP address***, the network interface to the second device having a data transfer rate associated therewith [see col. 7, line 22-39, wherein "At this point with no activity on the link, a link control protocol (LCP), which as part of the PPP protocol, exercises responsibility for establishing and configuring the link, remains in an initial or starting state."; also see col. 8, lines 20-59, wherein "FIG. 2 depicts a format of conventional generalized LCP packet 200. As shown, packet 200 is formed of eight-bit code field 210, eight-bit identifier field 220, sixteen-bit length field 230 and finally variable-length data field 240. This packet can be any one of several types, with the value of the code field, having values typically ranging from one to thirteen, specifying the type of any such packet. Of note, a value of

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one indicates that the packet is an LCP Configure Request packet. Such a request packet is sent by a PPP peer whenever that peer desires to change a configuration parameter, such as from a default value, associated with the link."; also see col. 9, lines 14-55, wherein "The endpoint discriminator packet identifies, by specifying an address, of an end system (an "endpoint"), then situated on an end of a link, that is transmitting this particular packet. … For example, a class field having a value of illustratively zero, one or two specifies that the following address is a null class (i.e., the address is zero octets long), a locally assigned address, such as a serial number (having a length up to twenty octets), or an Internet Protocol (IP) address (having a length of four octets). Other classes of addresses exist. Inasmuch as the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention, I will omit any further details of the latter two aspects."];

transmit a second message through the network interface **to a third device [**with the third device seen as being another one of the DCEs 660, such as DCE 660_2, as seen in Fig. 6A**]**, wherein the second message includes a multilink session identification that is unique to the multilink session and the destination ***IP address***, the network interface to the third device having a data transfer rate associated therewith [see col. 7, line 22-39; also see col. 8, lines 20-59, wherein "FIG. 2 depicts a format of conventional generalized LCP packet 200. As shown, packet 200 is formed of eight-bit code field 210, eight-bit identifier field 220, sixteen-bit length field 230 and finally variable-length data field 240. This packet can be any one of several types, with the value of the code field, having values typically ranging from one to thirteen, specifying the type of any such packet. Of

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note, a value of one indicates that the packet is an LCP Configure Request packet. Such a request packet is sent by a PPP peer whenever that peer desires to change a configuration parameter, such as from a default value, associated with the link."; also see col. 8, line 60-col. 9, line 67, wherein "Each specific option has to be separately negotiated between the PPP peers and appropriately acknowledged prior to its use. Inasmuch as the only values for this type field, i.e., the only configuration options, that are relevant to understanding the invention are 17, 18 and 19, which designate a multi-link MRRU (Multi-link Maximum Receive Reconstructed unit) request, **a multi-link Short Sequence Number** header request and a "multi-link endpoint discriminator" option, respectively (which will all be discussed in detail below in conjunction with FIG. 5). … Each such multi-link PPP packet contains a sequence number--which increases by one with each successive packet, inserted by the multi-link protocol."; also see col. 10, lines 6-53, wherein "These formats are depicted as long and short sequence number formats 510 and 550 having 24- and 12-bit sequence numbers, respectively. The specific format of the multi-link PPP packet to use in any situation can be specified by a PPP sender by transmitting an LCP Configuration Request message for a Multi-link Maximum Receive Reconstructed Unit (MRRU) format, i.e., designating long sequence number format 510, or a Multi-link Short Sequence Number Header format, i.e., designating short sequence number format 550, coupled with successful negotiations with its PPP peer therefor. Use of format 510 or 550 is requested by a type field having a value of 17 or 18, respectively, in an LCP Configure Request message, as noted above, transmitted by the PPP sender to its PPP peer."]; and

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receive the different data packets through the at least one network interface from the second device and from the third device during the multilink session [see col. 10, line 6-col. 11, line 28; also see col. 14, lines 22-57, wherein "As a result, server computer 665, by virtue of the common endpoint discriminator associated the application executing at client PC 610 and with every ISDN BRI (B channel pair) emanating from client 605, will then, through conventional multi-link protocol processing correctly view links 630 as a common bundle, i.e., a pipe, for packets generated by and destined to this application and handle packets appearing thereon as multi-link PPP packets."; also see col. 14, line 61-col. 15, line 11, wherein "First, a transmitting side device which transmits (e.g., any of devices 620 or 660) an incoming packet need not split any of these incoming packets but can alternate these packets between each of its physical links, i.e., applies these packets in a round-robin (or other predefined) fashion among its outgoing links. In this scenario, no changes need to be made to the contents of each of these incoming packets to transmit that packet through one or more levels in a hierarchy of multi-link PPP devices. A receiving side device merely passes the multi-link packets it receives to its associated DTE in increasing order of the sequence numbers of the packets its received, while ignoring beginning and ending flags in the multi-link header of each such packet."],

wherein the data transfer rate associated with the network interface to the second device and the network interface to the third device provide an increased data transfer rate for the first device [see col. 2, line 32-col. 3, line 41, wherein "Second, as more users simultaneously contend for available network bandwidth at particular times, such as when the network experiences its peak daily loading, the network becomes increasingly congested. Hence, at these times, network traffic tends to slow which also tends to

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lengthen download time, thereby frustrating the users particularly those seeking relatively large files. … Once successfully negotiated between two PPP peers, then, at a transmitting peer, multi-link PPP segments a packetized data stream (i.e., a PPP frame) into segments (or fragments), forms a stream of multi-link PPP packets each containing one such a segment, and then assigns these multi-link PPP packets on an approximately equal basis, where practical, between two B channels in the BRI connection for transmission to a receiving PPP peer; here the two B channels form a pipe. Small packets may not be segmented and to accommodate links of different speeds (which is not the case with two ISDN B channels), the segments need not be of the same size nor do the same number of segments need to be transmitted over each link."; also see col. 17, lines 20-57, wherein "Hence, through the present invention, a link in an original multi-link bundle and carrying multi-link PPP packets can itself be effectively divided (demultiplexed) into substantially any number of different paths with these paths being remotely and correctly recombined (multiplexed) so as to appear to be a link of the original multi-link bundle. … Furthermore, if all multi-link PPP links in a bundle have same data transmission rate such as two B-channels in an ISDN line, then each terminal adapter can simply send its incoming multi-link PPP packets as outgoing multi-link PPP packets on alternating B-channels without the need to encapsulate these packets with multi-multi-link protocol headers….However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."].

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With this, as discussed above, Maurya is seen to disclose that the first and second messages include a multilink request and a destination IP address. But in this regard, the reference of Maurya does not expressly disclose if the first and second messages include a multilink request and a **destination URL**, as currently recited in independent claim 13.

However, the reference of Low discloses a first device that transmits messages through a network interface, whereby the message includes a multilink request and a destination URL [see Fig. 4, with the terminal 31 transmitting a message 38 to a server 32 that includes a request and a destination URL; also see page 11, line 12-page 13, line 15, wherein "A cornerstone of the WWW is its ability to address particular information resources by means of an Uniform Resource Locator (URL) that identifies a resource by location…By way of example, a full or 'absolute' URL will comprise the following elements:…the Internet host domain or IP address…This request includes a request method, and the 'Request-URI' (which is generally just the absolute path of the resource on the server as identified by the 'abs-path' element of the URI); the request may include additional data elements."; also see page 23, line 5-page 24, line 9].

With this, it would have been obvious for one of ordinary skill in the art to have include a destination URL in messages sent from the client to the server, as recognized by Low, within the first and second messages disclosed in Maurya. Maurya and Low are combinable because they are from the same field of endeavor, both being systems that perform multilink data packet communication. At the time of the invention, it would have been obvious to one of ordinary skill

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in the art to have the client device of Maurya include the functionality that "the first and second messages include a multilink request **and a destination URL**", as recognized by Low. The suggestion/motivation for doing so would be that the client device of Maurya would conform with known protocols for communicating packets in systems utilizing point-to-point protocol (PPP), as discussed by Low in page 11, lines 21-page 12, line 28 which states "In this case, the user terminal 34 will generally communicate with the ISP 33 over the public telephone system using a modem and employing either SLIP (Serial Line Interface Protocol) or PPP (Point-to-Point Protocol). These protocols allow Internet packets to traverse ordinary telephone lines. ...A cornerstone of the WWW is its ability to address particular information resources by means of an Uniform Resource Identifier (URI) that will generally be either a Uniform Resource Locator that identifies a resource by location, or a Uniform Resource Name (URN) that can be resolved into an URL." Here, Low describes that utilizing URLs for PPP communication of packets between user terminals and Internet service providers was well known, and thus, this modification of Maurya with the functionality taught in Low would easily be implemented with these well-known teachings, as exemplified by Low, and would yield predictable results. In this regard, Maurya specifically states in col. 9, lines 42-55 that "Other classes of addresses exist. Inasmuch as the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention, I will omit any further details of the latter two aspects." Therefore, it would have been obvious to combine the teachings of Low of using a URL with the client device described in Maurya to obtain the invention specified in independent claim 13.

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Regarding ***claim 14***, Maurya and Low disclose the first device discussed above in claim 13, and Maurya further teaches wherein the first device and the second device are separate devices or separate parts of the same device [see Fig. 6A, whereby the client 605, which includes PC 610 with communication interfaces 612, is separate from the DCE 660_1, being located at the server 650].

Regarding ***claim 15***, Maurya and Low disclose the first device discussed above in claim 13, and Maurya further teaches wherein the first device is **one of** a cell phone, a tablet, a switch, a server, a network device, a router, a computer, a Wi-Fi device, a Wi-Max device, a mobile communication device, a wireless communications device, a near-field communications device, and a Bluetooth device [see Fig. 6A, whereby the client 605 includes PC 610, which is seen to be "a computer" , as well as a "network device"].

Extensions of Time

23. Extensions of time under 37 CFR 1.136(a) will not be permitted in these proceedings because the provisions of 37 CFR 1.136 apply only to "an applicant" and not to parties in a reexamination proceeding. Additionally, 35 U.S.C. 305 requires that reexamination proceedings "will be conducted with special dispatch" (37 CFR 1.550(a)). Extension of time in *ex parte* reexamination proceedings are provided for in 37 CFR 1.550(c).

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Submissions

24. In order to ensure full consideration of any amendments, affidavits or declarations, or other documents as evidence of patentability, such documents must be submitted in response to this Office action. Submissions after the next Office action, which is intended to be a final action, will be governed by the requirements of 37 CFR 1.116, after final rejection and 37 CFR 41.33 after appeal, which will be strictly enforced.

Conclusion

25. The Patent Owner is reminded of the continuing responsibility under 37 CFR 1.565(a) to apprise the Office of any litigation activity, or other prior or concurrent proceeding, involving U.S. Patent 10,868,908 throughout the course of this reexamination proceeding. See MPEP §§ 2207, 2282, and 2286.

26. **All** correspondence relating to this *ex parte* reexamination proceeding should be directed:

By Mail to: Mail Stop *Ex Parte* Reexam
Central Reexamination Unit
Commissioner for Patents
United States Patent & Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

By FAX to: (571) 273-9900
Central Reexamination Unit

By hand: Customer Service Window

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Randolph Building
401 Dulany Street
Alexandria, VA 22314

Any inquiry concerning this communication or earlier communications from the Reexamination Legal Advisor or Examiner, or as to the status of this proceeding, should be directed to the Central Reexamination Unit at telephone number (571) 272-7705.

Signed:

/JOSEPH R POKRZYWA/
Primary Examiner, Art Unit 3992
(571) 272-7410

Conferees:

/ERON J SORRELL/
Primary Examiner, Art Unit 3992
/MICHAEL FUELLING/
Supervisory Patent Examiner, Art Unit 3992

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 90/019,265	Filing Date 10/04/2023	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

	(Column 1)	(Column 2)			
FOR	NUMBER FILED	NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $480 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	08/13/2024	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 17	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 5	Minus	*** 5	= 0		x $480 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/RHONDA BELL/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
90/019,265	**08/13/2024 05:59:24 PM Z ET**	**COM908**

Title of Invention

DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS

Application Information

APPLICATION TYPE	Utility / ex parte reexam	PATENT #	10868908
CONFIRMATION #	3396	FILED BY	Joshua Brooks
PATENT CENTER #	66771026	FILING DATE	10/04/2023
CUSTOMER #	64828	FIRST NAMED INVENTOR	- 10868908
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Clare Frederick

Documents

TOTAL DOCUMENTS: 2

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
Reexam 908 POA.pdf	2	Power of Attorney	70 KB
3725791.00005 - Response to NFOA dated 2024.06.13.pdf	23	Amendment/Request for Reconsideration-After Non-Final Rejection	855 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
Reexam 908 POA.pdf	5B6DF409B2E5EC0113927C25CD930121A756A5C4B9BE4AD14F3C2F32DFA7C646AA6E7D35687F9EBC1F78FBA47CE8D441E008668423F7CC503AED2B45402BC4EC
3725791.00005 - Response to NFOA dated 2024.06.13.pdf	82CBFB5AFB8F73DFA82745A848D29F9644045BBBCE176407CD7ACAE280F9E8AB6BC599A855DD599F00F8598B71A3AE573

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This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

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Control Number(s)	90/019,265
Filing Date(s)	2023-10-04
First Named Inventor	Eric. M Delangis
Title	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
Patent Number	10868908
Examiner Name	
Attorney Docket No(s)	3725791.00005

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Signature of Inventor or Patent Owner	Eric M. Delangis	Date	8/12/24
Name	Eric M. Delangis	Telephone	970-310-3576
Title and Company	Inventor		

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Owner:	Competitive Access Systems, Inc.
Reexam Control No.:	90/019,265
Conf. No.:	3396
Filed:	October 4, 2023
Title:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
Art Unit:	3992
Examiner:	Joseph R. Pokrzywa
Docket No.:	COM908

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Alexandria, VA 22313-1450

RESPONSE TO NON-FINAL OFFICE ACTION
IN *EX PARTE* REEXAMINATION PROCEEDING

Examiner:

Applicant provides this Response in reply to the Non-Final Office Action dated June 13, 2024. **A Listing of the Claims** begins on page 2 of this paper. **Remarks** begin on page 7 of this paper.

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Listing of Claims:

Claim 1 (original): A client device for multilink data packet communication with a server, the client device comprising:

a first network interface having a first data transfer rate associated with a first path from the server to the first network interface of the client device;

a second network interface having a second data transfer rate associated with a second path from the server to the second network interface of the client device; and

at least one processor configured to:

transmit a first message through the first network interface to the server, wherein the first message includes a multilink request a destination URL;

transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification the destination URL; and

receive data packets from the server through the first and second network interfaces of the client device during the multilink session wherein the first data transfer rate and the second data transfer rate provide an increased data transfer rate of the first path and the second path from the server to the client device.

Claim 2 (original): The client device of claim 1, wherein the at least one processor further is configured to transmit the first message and the second message to at least one server, wherein the at least one server is a device providing the data packets, or a device that manages the client device and another device that is providing data to the client device.

Claim 3 (original): The client device of claim 1, wherein a server provides the multilink session identification that is unique to the multilink session.

Claim 4 (original): The client device of claim 1, wherein the first information is comprised of at least one of an Internet address associated with the first network interface,

and the second information is comprised of at least one of an Internet address associated with the second network interface.

Claim 5 (original): The client device of claim 1, wherein each of the first network interface and the second network interface is one or more of cellular interface, Wi-Fi interface, a wireless interface, a cable interface, a wired interface, an Ethernet interface, a Bluetooth interface, a near-field communication interface, and an optical interface.

Claim 6 (original): The client device of claim 1, wherein the processor is configured to reorder the one or more data packets that are received over the at least two or more network interfaces of the client device during the multilink session.

Claim 7 (original): The client device of claim 1, wherein the client device is one of a cell phone, a tablet, a switch, a server, a network device, a router, a computer, a Wi-Fi device, a Wi-Max device, a wireless device, a mobile communication device, a near-field communications device, and a Bluetooth device.

Claim 8 (original): A server for multilink communication with a device, the server comprising:

at least one server network interface; and

one or more processors coupled to the at least one server network interface and configured to:

receive a first multilink packet over the at least one server network interface, the first multilink packet comprised of a request for a multilink communication and first information associated with first network communication interface of the device that is capable of being used by the device to receive data packets;

sending a data packet including the multilink session identification to the first network communication interface of the device;

receive a second multilink packet over the at least one server network interface, the second multilink packet comprised of the multilink session identification and second

information associated with a second network communication interface of the device that is capable of being used by the device to receive data packets; and

send different groups of data packets over the at least one server network interface to the first network communication interface of the device and to the second network communication interface of the device, wherein each of the different groups of data packets includes the multilink session identification.

Claim 9 (original): The server of claim 8, wherein the one or more processors is further configured to send the multilink session identification that is unique to the data packets being sent to the first network communication interface and the second network communication interface.

Claim 10 (original): The server of claim 8, wherein the one or more processors is further configured to:

receive a third multilink packet, the third multilink packet is comprised of multilink information associated with a third network communication interface of the device that is capable of being used by the device to receive data packets; and

send different groups of data packets to the first network communication interface of the device, the second network communication interface of the device and the third network communication interface of the device.

Claim 11 (original): The server of claim 8, wherein the one or more processors is further configured to receive a multilink packets comprised of multilink information associated with which one of the first network communication interface of the device, the second network communication interface of the device and the third network communication interface of the device is to be removed from the multilink session.

Claim 12 (original): The server of claim 8, wherein the one or more processors is further configured to receive different multilink packets over the at least one server network interface at different periods of time.

Claim 13 (original): A first device comprising:

a network interface; and

at least one processor configured to:

transmit a first message through the network interface to a second device, wherein the first message includes a multilink request and a destination URL, the network interface to the second device having a data transfer rate associated therewith;

transmit a second message through the network interface to a third device, wherein the second message includes a multilink session identification that is unique to the multilink session and the destination URL, the network interface to the third device having a data transfer rate associated therewith; and

receive the different data packets through the at least one network interface from the second device and from the third device during the multilink session, wherein the data transfer rate associated with the network interface to the second device and the network interface to the third device provide an increased data transfer rate for the first device.

Claim 14 (original): The first device of claim 13, wherein the first device and the second device are separate devices or separate parts of the same device.

Claim 15 (original): The first device of claim 13, wherein the first device is one of a cell phone, a tablet, a switch, a server, a network device, a router, a computer, a Wi-Fi device, a Wi-Max device, a mobile communication device, a wireless communications device, a near-field communications device, and a Bluetooth device.

Claim 16 (original): A first device for multilink communication, comprising:

at least one network interface; and

one or more processors coupled to the at least one network interface and configured to:

receiving one or more multilink packets where each multilink packet comprises information associated with one or more of a plurality of network communication interfaces of a second device that are capable of being used to receive data packets;

during a multilink session

splitting up data from a data source into different groups of data packets; and

controlling a data server where the data server sends the different groups of data packets from the data server to different network communication interfaces of the second device, wherein each of the different groups of data packets includes the multilink session identification.

Claim 17 (original): A client device for multilink communication, the client device comprising:

a first network interface having a first data transfer rate associated therewith;

a second network interface having a second data transfer rate associated therewith; and

at least one processor and configured to:

transmit a first message through the first network interface to at least one server, wherein the first message includes a multilink request and a destination URL;

transmit a second message through the second network interface to the at least one server, wherein the second message includes a multilink session identification that is unique to the multilink session and the destination URL; and

receive concurrently the different data packets from the server through the first network interface and the second network interface of the client device during the multilink session, wherein the first data transfer rate and the second data transfer rate provide an increase in the data transfer rate of the client device.

REMARKS

Applicant submits this Response in reply to the Non-Final Office Action dated June 13, 2024. The Commissioner is hereby authorized to charge Deposit Account 02-1818 for any additional fees which are due and owing. If any such charges are applied, please indicate Attorney Docket No. 3725791.00005 on the account statement.

Claims 1-3, 5, 6, and 13-15 are subject to the reexamination and stand rejected. Patent Owner respectfully traverses the rejections. No new matter has been introduced.

Patent Owner has served this Response to the third-party requester and has attached a certificate of service to this Response.

A. Introduction

Claims 1-3, 5-6, and 13-15 currently stand rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,160,808, issued to Maurya ("Maurya") in view of WO 97/22212, with the inventor of Low ("Low"). Patent Owner contends that the claimed invention is not obvious over the combination of Maurya and Low and respectfully requests the rejections to be withdrawn.

Each of the claims at issue requires a first message that includes: (i) a multilink request; and (ii) a destination URL, and a second message that includes: (iii) a multilink session identification; and the destination URL. In other words, the two messages must include three distinct claim elements:

1. a multilink request;
2. a destination URL; and
3. a multilink session identification.

No combination of Maurya and Low disclose, teach, or otherwise render obvious the claim element "**multilink session identification**." Accordingly, claims 1-3, 5-6, and 13-15 are patentable over the combination of Maurya and Low.

B. The '908 Patent

The '908 Patent is directed to devices utilizing a multipath connection to increase bandwidth available to a receiving device by splitting data that is then routed over multiple device connections before being recombined for the receiving device.

Independent Claims 1 and 13 recite similar elements, as shown below. Claim 1 is

directed to a client device that includes first and second network interfaces, each having a data transfer rate associated with a path from a server to the respective network interface. The client device also includes a processor configured to transmit first and second messages to the server through the different network interfaces, the first message including a multilink request and a destination URL and the second message including a multilink session identification and the destination URL, and to receive data packets from the server through the different network interfaces.

> Claim 1: A client device for multilink data packet communication with a server, the client device comprising:
>
> a first network interface having a first data transfer rate associated with a first path from the server to the first network interface of the client device;
>
> a second network interface having a second data transfer rate associated with a second path from the server to the second network interface of the client device; and
>
> at least one processor configured to:
>
> transmit **a first message** through the first network interface to the server, wherein the first message includes **a multilink request a destination URL**;
>
> transmit **a second message** through the second network interface to the server, wherein the second message includes **a multilink session identification the destination URL**; and
>
> receive data packets from the server through the first and second network interfaces of the client device during the multilink session wherein the first data transfer rate and the second data transfer rate provide an increased data transfer rate of the first path and the second path from the server to the client device.

Claim 13 is directed to a first device that includes a network interface and a processor. The processor is configured to transmit first and second messages to second and third

devices, respectively, through the network interface, the first message including a multilink request and a destination URL and the second message including a multilink session identification and the destination URL, and to receive different data packets from the second device and the third device through the multilink session.

Claim 13: A first device comprising:

a network interface; and

at least one processor configured to:

transmit **a first message** through the network interface to a second device, wherein the first message includes **a multilink request** and **a destination URL**, the network interface to the second device having a data transfer rate associated therewith;

transmit **a second message** through the network interface to a third device, wherein the second message includes **a multilink session identification** that is unique to the multilink session and **the destination URL**, the network interface to the third device having a data transfer rate associated therewith; and

receive the different data packets through the at least one network interface from the second device and from the third device during the multilink session, wherein the data transfer rate associated with the network interface to the second device and the network interface to the third device provide an increased data transfer rate for the first device.

As shown, each of the claims at issue requires a first message that includes: (i) a multilink request; and (ii) a destination URL, and a second message that includes: (iii) a multilink session identification; and the destination URL. In other words, the two messages must include three distinct claim elements:

1. a multilink request;
2. a destination URL; and
3. a multilink session identification.

An example detailing these three claim elements is provided with the description of FIG. 7 starting at column 12, line 2, and continuing through column 13, line 18. In this example, the claimed multilink request ("requests a multilink PPP session") and destination URL ("URL") are first described at column 12, lines 2-4:

> Referring to FIG. 7, an RCG—85 that decides to initiate a multilink PPP session with a remote computer i.e. internet URL, **requests a multilink PPP session** with that **URL** resource via Link Control Protocol (LCP) session management.

In this example, the claimed multilink session identification is first described in column 12, lines 9-14:

> As part of a successful multilink PPP session setup, the initiating RCG—85 receives **a multilink PPP session ID**, or "magic number", which is used to identify this particular multilink PPP session and is also used for adding or removing links from the multilink bundle—87.

Additionally, this example describes how additional links are added to an ongoing multilink session in column 12, lines 51-66:

> The initiating RCG then selects which of the responding remote RCGs—86 it will use for the multilink PPP bundle—87 and sends them a multilink initialization packet containing **the URL of the destination** as well as **the multilink PPP session ID** (magic number) and any other pertinent information required for the remote RCG to join in the existing multilink PPP bundle—87. Each remote RCG POTS interface—91 participating in a multilink PPP bundle, represents a logical "link" in the initiating RCG's multilink PPP bundle—87. The remote RCGs—86 then send a multilink PPP packet (over their respective POTS lines—91) to the destination URL with the multilink PPP session ID and request to be added to that multilink PPP bundle—87. The destination URL accepts the request of each of the remote RCGs—86 and begins sending data packets to each over their respective POTS lines—91.

C. Maurya

Maurya teaches a technique for transmitting incoming multi-link point-to-point (PPP) packet traffic over multiple outgoing links in a multi-link bundle. Specifically, Maurya teaches multi-link communication between a client and a server. In doing so, Maurya combines multiple ISDN communication links that are each connected to a corresponding ISDN terminal adapter (ISDN TA) located on the client side of the communication and sends streams of data from the client through the multiple ISDN communication links and corresponding ISDN TAs to the server. An exemplary illustration of Maurya's teachings is

provided in FIG. 6A reproduced below:

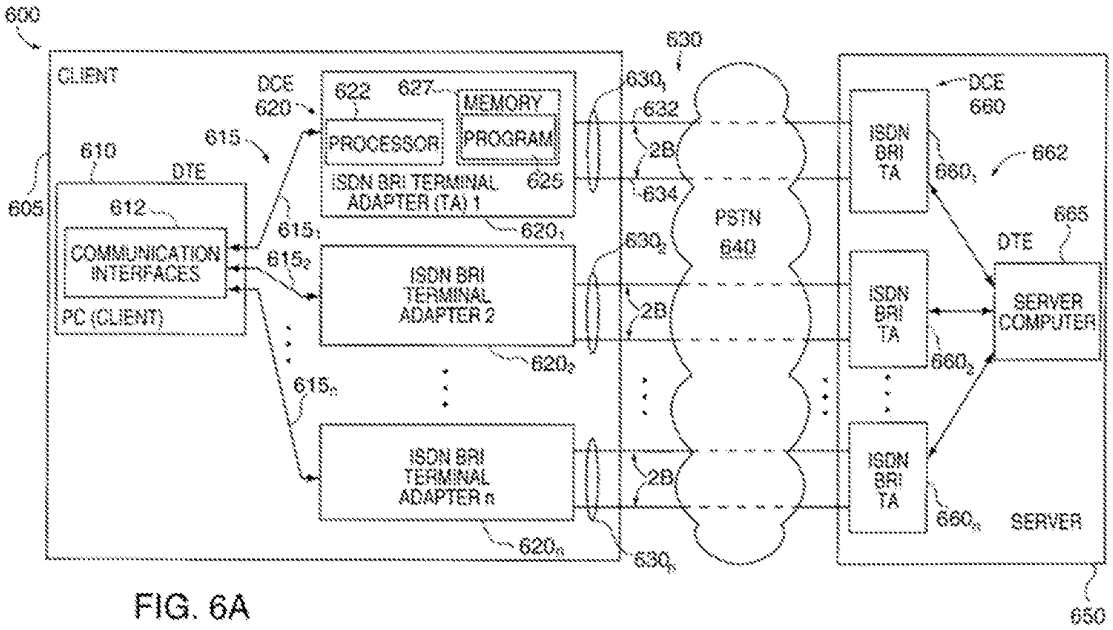


FIG. 6A

Maurya teaches the use of an endpoint discriminator value unique to the originating device that is sent to each sending terminal adapter 620_n, which in turn sets the value of its own endpoint discriminator to match that of the sending peer 610. While each sending terminal adapter 620_n negotiates with a corresponding receiving terminal adaptor 660_n, each terminal adaptor 620_n sends the same endpoint discriminator value of the sending peer 610 to its receiving terminal adapter 660_n. (Maurya, 9:35-49 and 13: 61-14:21).

As a result, in Maurya, all the links in the multilink bundle have the same physical link address (*i.e.*, endpoint discriminator). In contrast, each endpoint (*e.g.*, RCG) in the '908 Patent has its own unique link address. ('908 Patent, 12:16-23).

D. Low

Low is directed to a switched telecommunication system that uses service resource items (URLs) to set up a network. *See, e.g.*, Ex. 1005, 1:7-9 and 2:2-16. Generally, the system of Low enables a user to access setup control logic for a channel through a public switched telephone network (PSTN). Ex. 1005, 16:12-29. Fig. 13, reproduced below, demonstrates this functionality with respect to a "personal number" service in which a first user can setup a

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single, unique, unchanging personal phone number (a "Webtel" number) that can be used by others to reach the first user by phone, even when the first user changes their "real phone number" (a B-telNb). *Id.*, at 35:9-22. In this example, the system allots the first user a unique personal number that is associated with a dedicated "phone page," which associates the Webtel number with the first user's current real telephone number. *Id.*, at 35:19-22. The phone page is located at a URL, which, when accessed, returns the current real phone number. *Id.*, at 35:18-19. Accordingly, when another user calls the first user's Webtel number, the system accesses the phone page associated with the Webtel number, acquires the first user's current real phone number, and uses the current real phone number to complete the call. *Id.*, at 35:27-36:10.

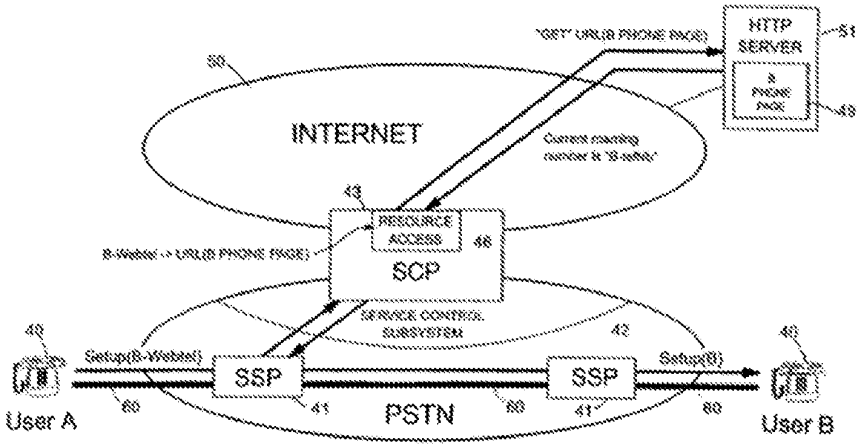


FIG. 13

Id., Fig. 13. More specifically, when a phone call is made, the service switching point (SSP) generates a service request that is conveyed to the service control point (SCP). *Id.*, at 20:29-32. The service logic program running in the SCP is a skeleton form, being instantiated on receipt of a service request and then serving to initiate service resources access and to return the results of this access to the entity that made the service request. *Id.*, at 21:20-27. The association between the unique number and the URL of the phone page is stored in an association table accessible to SCP 43. *Id.*, at 35:24-25. Therefore, the SCP receives the unique

number from the first user and locates the URL through a table. *Id*.

E. Validity of the '908 Patent

Claims 1-3, 5-6, and 13-15 currently stand rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Maurya in view of Low. For the following reasons, Patent Owner contends that the claimed invention is not obvious over the combination of Maurya and Low and respectfully requests the rejections to be withdrawn:

1. the Examiner does not present any argument that the cited art discloses a multilink session identification;
2. the endpoint discriminator taught by Maurya is not a multilink session identification, nor does it render obvious the use of a multilink session identification claimed in the '908 Patent; and
3. Low does not disclose, teach, or render obvious a second message that includes: a multilink session identification; and the destination URL.

Accordingly, no combination of the cited art renders claims 1-3, 5-6, and 13-15 obvious.

a. The Office Action Fails To Point To Any Disclosure Of A Multilink Session Identification

As provided in MPEP 2143.03, "All words in a claim must be considered in judging the patentability of that claim against the prior art." In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). Examiners must consider all claim limitations when determining patentability of an invention over the prior art. In re Gulack, 703 F.2d 1381, 1385, 217 USPQ 401, 403-04 (Fed. Cir. 1983). However, in the Office Action dated June 13, 2024, the Examiner fails to address Patent Owners claim limitation "a multilink session identification."

On Page 16 of the Office Action, the Examiner states:

> With this, as discussed above, Maurya is seen to disclose that the first and second messages include a multilink request and a destination IP address. But in this regard, the reference of Maurya does not expressly disclose if the first and second messages include a multilink request **and a destination URL**, as currently recited in independent claim 1.

In this statement, the Examiner implies that both the first and second messages require **a multilink request** and a destination URL and fails to acknowledge the second

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message must include **a multilink session identification** and a destination URL. The Examiner's statement, in combination with the Office Action's failure to provide any evidence or argument that the cited art discloses or teaches a multilink session identification, demonstrates that the rejections in the Office Action fail to address each of the claim limitations.

Accordingly, the Patent Owner submits that the rejections in the Office Action are improper and respectfully requests the Examiner allow claims 1-3, 5-6, and 13-15.

b. A Multi-Link Short Sequence Number Header Request Is Not A Multilink Session Identification And Is Not An Endpoint Discriminator

As noted above, Patent Owner respectfully submits that the Office Action fails to identify what element in Maurya the Examiner believes renders obvious the claimed multilink session identification. However, the Examiner addresses the broader claim limitation in which the multilink session identification claim term is found starting with the second paragraph of page 13 to the first paragraph of page 14, reproduced here for the convenience of the Examiner:

> transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification ***[and] the destination IP address*** [see col. 7, line 22-39; also see col. 8, lines 20-59, wherein "FIG. 2 depicts a format of conventional generalized LCP packet 200. As shown, packet 200 is formed of eight-bit code field 210, eight-bit identifier field 220, sixteen-bit length field 230 and finally variable-length data field 240. This packet can be any one of several types, with the value of the code field, having values typically ranging from one to thirteen, specifying the type of any such packet. Of note, a value of one indicates that the packet is an LCP Configure Request packet. Such a request packet is sent by a PPP peer whenever that peer desires to change a configuration parameter, such as from a default value, associated with the link."; also see col. 8, line 60-col. 9, line 67, wherein "Each specific option has to be separately negotiated between the PPP peers and appropriately acknowledged prior to its use. Inasmuch as the only values for this type field, i.e., the only configuration options, that are relevant to understanding the invention are 17, 18 and 19, which designate a multi-link MRRU (Multi-link Maximum Receive Reconstructed unit) request, **a multi-link Short Sequence Number** header request and a "multi-link endpoint discriminator"

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> option, respectively (which will all be discussed in detail below in conjunction with FIG. 5). . . . Each such multi-link PPP packet contains a sequence number—which increases by one with each successive packet, inserted by the multi-link protocol."; also see col. 10, lines 6-53, wherein "These formats are depicted as long and short sequence number formats 510 and 550 having 24- and 12-bit sequence numbers, respectively. The specific format of the multi-link PPP packet to use in any situation can be specified by a PPP sender by transmitting an LCP Configuration Request message for a Multi-link Maximum Receive Reconstructed Unit (MRRU) format, i.e., designating long sequence number format 510, or a Multi-link Short Sequence Number Header format, i.e., designating short sequence number format 550, coupled with successful negotiations with its PPP peer therefor. Use of format 510 or 550 is requested by a type field having a value of 17 or 18, respectively, in an LCP Configure Request message, as noted above, transmitted by the PPP sender to its PPP peer."]; and

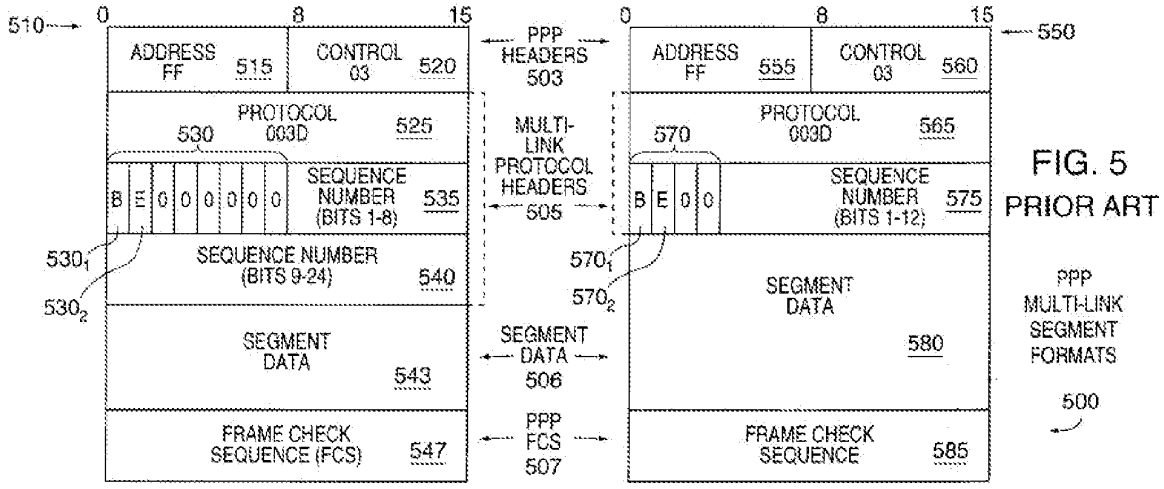
For claim 13, the "multilink session identification" is similarly addressed on pages 24 and 25.

Based on the excerpt provided above, it is unclear whether the Office intends to equate the claimed multilink session identification to Maurya's multi-link Short Sequence Number header request or to Maurya's endpoint discriminator. The multilink session identification is neither.

i. Maurya's Multi-Link Short Sequence Number Header Request Is Not A Multilink Session Identification

Maurya describes that each multi-link PPP packet contains a "sequence number – which increases by one with each successive packet." (Maurya, 9:53-67). The purpose of the sequence numbers is to order the packets sent. (Maurya, 4:7-12; "[t]o ensure proper ordering … it receives and then reorder its received packets based on their sequence numbers…"). The sequence number can either be in a short sequence number format or in a long sequence number format. Both are shown in Fig. 5 (reproduced below) and are described in Maurya starting on col. 10, line 6 to the end of col. 10:

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As shown in Fig. 5, a multi-link Short Sequence Number (575) is part of a packet having a short sequence number format (550). This multi-link Short Sequence Number (575) is used for ordering the packets after receipt on the receiving side.

The '908 patent does not use the "multilink session identification" for anything associated with re-ordering packets or as referred to as "reassembly" of packets in the '908 patent. (*See,* '908, 12:9-14; "As part of a successful multilink PPP session setup, the initiating RCG—85 receives a multilink PPP session ID, or "magic number", which is used to identify this particular multilink PPP session and is also used for adding or removing links from the multilink bundle—87.")

As shown, Maurya's multi-link Short Sequence Number is for ordering messages within a session and the '908 Patent's multilink session identification is for distinguishing between sessions. Accordingly, Maurya's multi-link Short Sequence Number is distinctly different in purpose and function from the claimed multilink session identification.

ii. Maurya's Endpoint Discriminator Is Not A Multilink Session Identification

Although the Office Action does not make any argument that Maurya teaches the multilink session identification claim element in claims 1-3, 5-6, and 13-15, Patent Owner hereby addresses the argument presented in the Request for *Ex Parte* Reexamination of U.S. Patent 10,868,908 filed by Unified Patents, LLC on October 4, 2023, (the "Unified Patents

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Request") that Maurya's endpoint discriminator value acts as a multilink session identification.

1. Unified Patents' Argument

The Unified Patents Request incorrectly argues that Maurya's endpoint discriminator (or endpoint identifier) is equivalent to the claimed multilink session identification. Starting on page 26, the Unified Patents Request argues that Maurya's "client PC requires **each peer** to send the client's unique endpoint discriminator, or endpoint identifier (i.e., *multilink session identification*) when initiating a link." The Unified Patents Request further argues that the "endpoint discriminator option allows different peers, such as the terminal adapters, to join a link by specifying an endpoint discriminator of an endpoint system." The Unified Patents Request then provides the following:

> Maurya explains that one drawback to conventional PPP systems is that multiple outgoing links connected to the same endpoint system, such as a client, still may have different endpoint discriminators; this results in the endpoint system at the opposite end of the pipe, such as a server, as viewing each network device as separate instead of as part of a common bundle of links terminating at one system, resulting in packets not being properly reassembled at the client PC.

(Maurya, 13:23-46).

As noted in the Unified Patents Request, "Maurya purports to solve this problem by creating a 'multi-multi' link protocol in which a client directs each peer at the end of one pipe to 'share a common endpoint discriminator value.'"

Citing its expert's declaration, on Page 28, the Unified Patents Request argues:

> A POSA would have recognized that Maurya's endpoint discriminator, also called an endpoint identifier (id., 9:39-40, 10:22-25, 13:19-21), is a *multilink session identification* because it identifies the session using LCP configuration packets, which were used to add and remove devices from a link.

As shown below, the Unified Patents Request argument is incorrect and Maurya does not teach the claimed multilink session identification. Accordingly, no combination of Maurya and Low renders obvious claims 1-3, 5-6, and 13-15.

2. Why The Unified Patents' Argument Is Wrong

Maurya's endpoint discriminator and the '908 Patent's multilink session identification are different in both form and operation. In fact, the '908 Patent's multilink

session identification solves problems that cannot be solved by Maurya's endpoint discriminator. Accordingly, Maurya's endpoint discriminator is not equivalent to and cannot render obvious the '908 Patent's claimed multilink session identification.

In the seven-layer OSI Model, Maurya's endpoint discriminator is a Layer 2 PPP LCP identifier used to associate multiple communication link equipment ports with a physical multilink bundle. In other words, Maurya endpoint discriminator helps its system to initially construct a multilink data link layer (*i.e.*, Layer 2 in the OSI Model) prior to any data being transmitted over the multilink connection. This is demonstrated, in part, in Maurya's description in column 1, lines 52-64:

> Before any data is transmitted over a PPP link, each PPP peer connected to one end of the link will send LCP configuration packets to the other end to establish and test the link; thus, ensuring the link is fully operational. Once the LCP protocol has successfully completed its negotiations, the PPP peers then negotiate the necessary NCPs to properly configure the link for the different network layer protocols that are to be used; with a different NCP being negotiated for each different network layer protocol. Once the NCP(s), for the various network layer protocols, have been successfully negotiated and configured at both PPP peers, then PPP packet traffic containing encapsulated data, using the network layer protocols, can commence over that link.

Maurya's endpoint discriminator is used in this LCP configuration process prior to data being sent over the multilink connection. For example, as described in column 9, lines 35-42:

> As depicted in FIG. 4, an LCP Configure Request packet specifies a multi-link endpoint discriminator option whenever the type field of the LCP Configure Request packet is set to value nineteen, as is field 410. Identification of the endpoint system (commonly referred to as either an "endpoint discriminator" or "endpoint identifier") is accomplished through class field 430 and address field 440, which collectively contain data carried by this packet.

Further description of Maurya's LCP negotiation is presented with reference to FIG. 7, in which Maurya teaches, "[o]nce these [LCP] negotiations are successfully concluded, then process 700 progresses to step 760 at which the links between the near and far-end terminal adapters all enter network (data transmission) state 140 (see FIG. 1) during which communicate packetized data can be transported between the client PC and the server computer." (Maurya, 16:47-53).

As shown, Maurya requires all links to be provisioned and configured to operate the

same before any data transfers can commence. Maurya does not provide any disclosure or teaching of how such an endpoint discriminator could be used to dynamically add or remove links to an existing multilink communication session.

In contrast, the '908 Patent's claimed multilink request, multilink session identification, and destination URL are solutions for managing multilink communication over an existing link layer. Accordingly, the multilink session identification can be used to dynamically add and remove links in an existing multilink communication session, as described in column 12, lines 51-66, of the '908 Patent:

> The initiating RCG then selects which of the responding remote RCGs—86 it will use for the multilink PPP bundle—87 and sends them a multilink initialization packet containing **the URL of the destination** as well as **the multilink PPP session ID** (magic number) and any other pertinent information required for the remote RCG to join in the existing multilink PPP bundle—87. Each remote RCG POTS interface—91 participating in a multilink PPP bundle, represents a logical "link" in the initiating RCG's multilink PPP bundle—87. The remote RCGs—86 then send a multilink PPP packet (over their respective POTS lines—91) to the destination URL with the multilink PPP session ID and request to be added to that multilink PPP bundle—87. The destination URL accepts the request of each of the remote RCGs—86 and begins sending data packets to each over their respective POTS lines—91.

Column 13, line 13, through column 14, line 9, further describes the dynamic nature of the '908 system detailing how remote RCGs can be added and removed from existing sessions, including column 13, lines 54-59:

> Once a remote RCG—86 has been removed from participating in a multilink bundle—87, the initiating RCG—85 will then look up another remote RCG in its router tables that can be used to participate in the multilink PPP bundle—87, and request that the new remote RCG—86 to join the existing multilink bundle—87.

This is quite an improvement from the "fixed pairs of systems" type networks taught by Maurya and a direct benefit of the multilink session identification operating above the Layer 2 endpoint discriminator used in Maurya.

The invention claimed in the '908 Patent is a solution to additional limitations in Maurya's system. For example, the endpoint discriminator value of Maurya cannot be used to differentiate between various multilink sessions occurring between Maurya's PC client and server—any data sent between the PC client and server is treated as part of a single

session. As a result, the Maurya system does not support multiple concurrent sessions between the PC client and the server. However, incorporating the '908 Patent's multilink session identification into the Maurya system would enable multiple concurrent multilink sessions between Maurya's client PC and server where each distinct session would be identified and distinguished by the multilink session identification. Hypothetically, if one were to implement the '908 Patent's multilink session identification on top of the Maurya OSI Layer 2 link layer, Maurya's sending device could send data through different, identifiable multilink sessions (even over an identical set of ISDN communication links and ISDN TAs on the client side) and Maurya's receiving device could associate received data with individually identifiable multilink sessions. The fact that Maurya cannot run concurrent sessions using only its endpoint discriminator and the fact that the inclusion of the '908 Patent's claimed multilink session identification would provide expanded functionality for the Maurya system demonstrates that Maurya's endpoint discriminator is not equivalent to the claimed multilink session identification.

As shown, not only is Maurya's endpoint discriminator not equivalent to the claimed multipath session identification, incorporation of the claimed multipath session identification into Maurya would result in an improvement to the functionality of the Maurya system. Accordingly, the Patent Owner submits that the combination of Maurya and Low fails to render obvious claims 1-3, 5-6, and 13-15 and respectfully requests the Examiner allow the claims over the cited art.

c. Low Does Not Teach a Multilink Session Identification

In the Office Action, claims 1-3, 5-6, and 13-15 are rejected based on a combination of Maurya and Low. As shown above, Maurya does not teach a second message that includes a multilink session identification. Patent Owner respectfully submits that the Examiner does not present any evidence or argument that Low teaches a second message that includes a multilink session identification. Therefore, Low does not remedy Maurya's failure to render the claims obvious.

As noted above, Low is directed to call setup in telephone systems. Low does not include any teachings related to multilink communications. As a result, Low does not teach any mechanism for identifying or distinguishing between different multilink sessions in a

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multilink communication system. Accordingly, Low does not teach the multilink session identification element missing from Maurya.

Accordingly, without waiving any additional arguments related to patentability, the Patent Owner submits that, for at least the reasons above, the combination of Maurya and Low fails to render obvious claims 1-3, 5-6, and 13-15 and respectfully requests the Examiner allow the claims over the cited art.

F. Conclusion

Patent Owner respectfully submits that no combination of Maurya and Low discloses, teaches, or otherwise renders obvious claims 1-3, 5-6, and 13-15 and the pre-AIA 35 U.S.C. 103(a) rejection of these claims has been overcome. Accordingly, Patent Owner requests the Examiner allow claims 1-3, 5-6, and 13-15.

Conclusion

An earnest endeavor has been made to place this application in condition for formal allowance, and allowance is courteously solicited. If the Examiner has any questions regarding this Response, Patent Owner respectfully requests that the Examiner contact the undersigned.

Respectfully submitted,

K&L Gates LLP

By: /M. Clare Frederick/
M. Clare Frederick
Reg. No. 66,608
Telephone No. (312) 807-4335
Customer No. 29156

Dated: August 13, 2024

Certificate of Service

I HEREBY CERTIFY that on the 13th day of August, 2024, a copy of the foregoing Response has been served on the Third Party Requester listed below by first class mail, postage prepaid:

Attn: Michelle Aspen
Unified Patents, LLC
4445 Willard Ave., Suite 600
Chevy Chase, MD 20815

Respectfully submitted,

K&L Gates LLP

By: **/M. Clare Frederick/**
M. Clare Frederick
Reg. No. 66,608
Telephone No. (312) 807-4335
Customer No. 29156

Dated: August 13, 2024

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BIB DATA SHEET

CONFIRMATION NO. 3396

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
90/019,265	10/04/2023 RULE	370	3992	COM908

APPLICANTS

COMPETITIVE ACCESS SYSTEMS INC(OWNER), Residence Not Provided;
UNIFIED PATENTS LLC, CHEVY CHASE, MD;

INVENTORS

10868908, Residence Not Provided;
Unified Patents, LLC, Residence Not Provided;

**** CONTINUING DATA ***************************

This application is a REX of 15/161,787 05/23/2016 PAT 10868908
*which is a CON of 14/512,414 10/11/2014 PAT 9350649
which is a CON of 13/531,294 06/22/2012 PAT 8861349
which is a CON of 12/581,852 10/19/2009 PAT 8228801
which is a CON of 10/686,375 10/14/2003 PAT 7606156
which claims benefit of 60/418,521 10/15/2002

**** FOREIGN APPLICATIONS ***************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****

Foreign Priority claimed ❑ Yes ❑ No 35 USC 119(a-d) conditions met ❑ Yes ❑ No Verified and Acknowledged _____ Examiner's Signature	❑ Met after Allowance _____ Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
				17	5

ADDRESS

K&L Gates LLP-ADMINRPL
P.O. Box 1135
CHICAGO, IL 60690
UNITED STATES

TITLE

DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS

FILING FEE RECEIVED		
0.00	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	❑ All Fees ❑ 1.16 Fees (Filing) ❑ 1.17 Fees (Processing Ext. of time) ❑ 1.18 Fees (Issue) ❑ Other _____ ❑ Credit

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
90/019,265	10/04/2023	10868908	COM908

CONFIRMATION NO. 3396

29156
K&L Gates LLP-ADMINRPL
P.O. Box 1135
CHICAGO, IL 60690

POA ACCEPTANCE LETTER

OC000000076521989

Date Mailed: 08/15/2024

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/13/2024.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/rbell/

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
90/019,265	10/04/2023	10868908	COM908

CONFIRMATION NO. 3396

POWER OF ATTORNEY NOTICE

OC000000076521869

64828
Harold McGurk
The Law Office of Clay McGurk
P.O. BOX 1488
Orange, CA 92856

Date Mailed: 08/15/2024

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/13/2024.

- The Power of Attorney to you in this application has been revoked by the applicant. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/rbell/

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Reexamination	Application/Control No.	Applicant(s)/Patent Under Reexamination
	90/019,265	10868908
	Certificate Date	Certificate Number

Requester Correspondence Address: ☐ Patent Owner ☑ Third Party
Unified Patents, LLC 4445 Willard Ave. Suite 600 Chevy Chase, MD 20815

LITIGATION REVIEW ☑	JRP (examiner initials)	16 November 2023 (date)
Case Name		Director Initials
Competitive Access Systems, Inc. v. Oracle Corp. et al., 1:23cv00286, (W.D. Tex.)		

COPENDING OFFICE PROCEEDINGS	
TYPE OF PROCEEDING	**NUMBER**
Inter Partes Review (terminated 10/2/2023)	IPR2023-00584

/JOSEPH R POKRZYWA/ Primary Examiner, Art Unit 3992	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	90/019,265	10868908
	Examiner	Art Unit
	JOSEPH R POKRZYWA	3992

CPC - Searched*		
Symbol	**Date**	**Examiner**
H04M 3/007	11/13/2023	JRP
H04L 12/5692	11/13/2023	JRP
H04L 45/54	11/13/2023	JRP

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	**Date**	**Examiner**
reviewed underlying patent file wrapper for U.S. Pat. 10,868,908	11/13/2023	JRP
reviewed Patent Data Portal (PDP) for continuity data	11/13/2023	JRP
reviewed P-TACTS for AIA proceedings (found IPR2023-00584)	11/13/2023	JRP
reviewed IPR2023-00584 (termination on 10/2/2023)	11/13/2023	JRP
review prosecution history	06/03/2024	JRP
review prosecution history	09/20/2024	JRP

/JOSEPH R POKRZYWA/ Primary Examiner, Art Unit 3992	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	90/019,265	10868908
	Examiner	Art Unit
	JOSEPH R POKRZYWA	3992

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/JOSEPH R POKRZYWA/ Primary Examiner, Art Unit 3992	

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
90/019,265	10/04/2023	10868908	COM908	3396

29156 7590 10/02/2024

K&L Gates LLP-ADMINRPL
P.O. Box 1135
CHICAGO, IL 60690

EXAMINER	
POKRZYWA, JOSEPH R	

ART UNIT	PAPER NUMBER
3992	

MAIL DATE	DELIVERY MODE
10/02/2024	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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Unified Patents, LLC
4445 Willard Ave.
Suite 600
Chevy Chase, MD 20815

EX PARTE REEXAMINATION COMMUNICATION TRANSMITTAL FORM

REEXAMINATION CONTROL NO. *90/019,265* .

PATENT UNDER REEXAMINATION *10868908* .

ART UNIT *3992* .

Enclosed is a copy of the latest communication from the United States Patent and Trademark Office in the above identified *ex parte* reexamination proceeding (37 CFR 1.550(f)).

Where this copy is supplied after the reply by requester, 37 CFR 1.535, or the time for filing a reply has passed, no submission on behalf of the *ex parte* reexamination requester will be acknowledged or considered (37 CFR 1.550(g)).

PTOL-465 (Rev.07-04)

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DETAILED ACTION

Brief Summary

1. This is a final Office action regarding the reexamination of U.S. Application 90/019,265, being a reexamination of U.S. Patent 10,868,908, issued to Eric M. DeLangis (hereafter "the '908 Patent").

2. The '908 Patent originally issued on December 15, 2020, with patented claims 1-17, being filed as U.S. Patent Application 15/161,787 (hereafter "the original '787 Application") on May 23, 2016. The original '787 Application was filed as a continuation of U.S. Application 14/512,414, filed on October 11, 2014, now U.S. Patent 9,350,649, which is a continuation of U.S. Application 13/531,294, filed on June 22, 2012, now U.S. Patent 8,861,349, which is a continuation of U.S. Application 12/581,852, filed on October 19, 2009, now U.S. Patent 8,228,801, which is a continuation of U.S. Application 10/686,375, filed on October 14, 2003, now U.S. Patent 7,606,156. The original '787 Application claims priority to provisional U.S. Application 60/418,521, filed on October 15, 2002.

3. Reexamination of patented claims 1-3, 5, 6, and 13-15 of the '908 Patent was ordered on January 2, 2024, whereby a substantial new question was raised by the Third Party's request for *ex parte* reexamination filed October 4, 2023. Subsequently, the Patent Owner filed a Patent Owner Statement pursuant to 37 CFR 1.530 on March 1, 2024. In response, the Third Party Requester filed a Reply on April 30, 2024.

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4. Further, the Examiner notes that because the '908 Patent was filed as multiple continuations of applications, dating back to October 14, 2003, the '908 Patent would now appear to be expired. With this, MPEP 2240 states, in part:

> ... In making the determination of whether to order reexamination, the Office will determine the proper meaning of the patent claims by giving the claims their broadest reasonable interpretation consistent with the specification (see *In re Yamamoto,* 740 F.2d 1569 (Fed. Cir. 1984)), **except in the case of an expired patent (in a reexamination involving claims of an expired patent, claim construction is pursuant to the principle set forth by the court in *Phillips v. AWH Corp.,* 415 F.3d 1303, 1316, 75 USPQ2d 1321, 1329 (Fed. Cir. 2005) (words of a claim "are generally given their ordinary and customary meaning" as understood by a person of ordinary skill in the art in question at the time of the invention**, see *Ex parte Papst-Motoren,* 1 USPQ2d 1655 (Bd. Pat. App. & Inter. 1986)). If reexamination is ordered, the patent owner statement, if applicable, and any accompanying information submitted pursuant to 37 CFR 1.501(a)(2) will be considered during the examination stage to the fullest extent possible when determining the scope of any claims of the patent which are subject to reexamination. [Emphasis added].

5. Thus, since the '908 Patent would be expired, the claim construction will be pursuant to the principle set forth by the court in *Phillips*, whereby the "words of a claim 'are generally given their ordinary and customary meaning' as understood by a person of ordinary skill in the art in question at the time of the invention."

6. The present application is being examined under the pre-AIA first to invent provisions.

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Claim Rejections - 35 USC § 103

7. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis (i.e., changing from AIA to pre-AIA) for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

8. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. **Claims 1-3, 5-6, and 13-15** is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,160,808, issued to MAURYA, Sanjiv Kumar (noted herein as "Maurya", being cited in the previous Office action), in view of International Patent Application Publication WO 97/22212, with the inventor of LOW, Colin *et al.*, being published on June 19, 1997 (noted herein as "Low", being cited in the previous Office action).

Regarding ***claim 1***, Maurya discloses a client device [being the client 605, which includes PC 610 connected through communication interfaces 612 to terminal adapters 620, as seen in Fig. 6A] for multilink data packet communication with a server [server 650, see Fig. 6A; also see col. 11, line 34-col. 12, line 10, wherein "With the above discussion of conventional multi-link PPP in mind , consider FIG. 6A which depicts a high level block diagram of illustrative multi-

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link client-server apparatus 600, which incorporates the teachings of the present invention. Here, client 605 is inter-connected to server 650 through multiple ISDN BRI (basic rate interface) lines 630."], the client device comprising:

a first network interface having a first data transfer rate associated with a first path from the server to the first network interface of the client device [one of the communication interfaces 612, combined with the ISDN BRI terminal adapter (TA) 1, 620_1, through path 615_1, as seen in Fig. 6A; also see col. 11, line 34-col. 13, line 8, wherein "In that regard, links 615, which comprise links 615_1, 615_2, . . . , 615_n, connect separate terminal adapters 620_1, 620_2, . . . , 620_n, respectively, to separate corresponding serial ports provided by communication interfaces 612. … ISDN connections are extended from terminal adapters 620, through public switched telephone network (PSTN) 640, to server 650 having corresponding identical terminal adapters 660, as DCE, and server computer 665, as DTE. Each one of terminal adapters 620 is connected through a separate pair of ISDN B-channels and the PSTN, to a separate corresponding one of terminal adapters 660, the latter terminal adapters collectively connected, via links 662, to server computer 665. Each of adapters 660 is illustratively identical to each of adapters 620."; also see col. 17, lines 36-57, wherein "However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."];

a second network interface having a second data transfer rate associated with a second path from the server to the second network interface of the client device [being another one of the communication interfaces 612, combined with the ISDN BRI terminal adapter 2, 620_2, through path 615_2, as seen in Fig. 6A; also see col. 11, line 34-col. 13, line 8, wherein "In that

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regard, links 615, which comprise links 615_1, 615_2, . . . , 615_n, connect separate terminal adapters 620_1, 620_2, . . . , 620_n, respectively, to separate corresponding serial ports provided by communication interfaces 612. … ISDN connections are extended from terminal adapters 620, through public switched telephone network (PSTN) 640, to server 650 having corresponding identical terminal adapters 660, as DCE, and server computer 665, as DTE. Each one of terminal adapters 620 is connected through a separate pair of ISDN B-channels and the PSTN, to a separate corresponding one of terminal adapters 660, the latter terminal adapters collectively connected, via links 662, to server computer 665. Each of adapters 660 is illustratively identical to each of adapters 620."; also see col. 17, lines 36-57, wherein "However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."; also see col. 17, lines 36-57, wherein "However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."]; and

at least one processor configured to:

transmit a first message through the first network interface to the server, wherein the first message includes a multilink request ***[and] a destination IP address*** [see col. 7, line 22-39, wherein "At this point with no activity on the link, a link control protocol (LCP), which as part of the PPP protocol, exercises responsibility for establishing and configuring the link, remains in an initial or starting state."; also see col. 8, lines 20-59, wherein "FIG. 2 depicts a format of conventional generalized LCP packet 200. As shown, packet 200 is formed of eight-bit code

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field 210, eight-bit identifier field 220, sixteen-bit length field 230 and finally variable-length data field 240. This packet can be any one of several types, with the value of the code field, having values typically ranging from one to thirteen, specifying the type of any such packet. Of note, a value of one indicates that the packet is an LCP Configure Request packet. Such a request packet is sent by a PPP peer whenever that peer desires to change a configuration parameter, such as from a default value, associated with the link."; also see col. 9, lines 14-55, wherein "The endpoint discriminator packet identifies, by specifying an address, of an end system (an "endpoint"), then situated on an end of a link, that is transmitting this particular packet. … For example, a class field having a value of illustratively zero, one or two specifies that the following address is a null class (i.e., the address is zero octets long), a locally assigned address, such as a serial number (having a length up to twenty octets), or an Internet Protocol (IP) address (having a length of four octets). Other classes of addresses exist. Inasmuch as the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention, I will omit any further details of the latter two aspects."];

transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification ***[and] the destination IP address*** [see col. 7, line 22-39; also see col. 8, lines 20-59, wherein "FIG. 2 depicts a format of conventional generalized LCP packet 200. As shown, packet 200 is formed of eight-bit code field 210, eight-bit identifier field 220, sixteen-bit length field 230 and finally variable-length data field 240. This packet can be any one of several types, with the value of the code field, having values typically ranging from one to thirteen, specifying the type of any such packet. Of note, a value of one indicates that the packet is an LCP Configure Request packet. Such a request

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packet is sent by a PPP peer whenever that peer desires to change a configuration parameter, such as from a default value, associated with the link."; also see col. 8, line 60-col. 9, line 67, wherein "Each specific option has to be separately negotiated between the PPP peers and appropriately acknowledged prior to its use. Inasmuch as the only values for this type field, i.e., the only configuration options, that are relevant to understanding the invention are 17, 18 and 19, which designate a multi-link MRRU (Multi-link Maximum Receive Reconstructed unit) request, **a multi-link Short Sequence Number** header request and a "multi-link endpoint discriminator" option, respectively (which will all be discussed in detail below in conjunction with FIG. 5). … Each such multi-link PPP packet contains a sequence number--which increases by one with each successive packet, inserted by the multi-link protocol."; also see col. 10, lines 6-53, wherein "These formats are depicted as long and short sequence number formats 510 and 550 having 24- and 12-bit sequence numbers, respectively. The specific format of the multi-link PPP packet to use in any situation can be specified by a PPP sender by transmitting an LCP Configuration Request message for a Multi-link Maximum Receive Reconstructed Unit (MRRU) format, i.e., designating long sequence number format 510, or a Multi-link Short Sequence Number Header format, i.e., designating short sequence number format 550, coupled with successful negotiations with its PPP peer therefor. Use of format 510 or 550 is requested by a type field having a value of 17 or 18, respectively, in an LCP Configure Request message, as noted above, transmitted by the PPP sender to its PPP peer."]; and

receive data packets from the server through the first and second network interfaces of the client device during the multilink session [see col. 10, line 6-col. 11, line 28; also see col. 14, lines 22-57, wherein "As a result, server computer 665, by virtue of the common endpoint discriminator associated the application executing at client PC 610 and with every ISDN BRI (B

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channel pair) emanating from client 605, will then, through conventional multi-link protocol processing correctly view links 630 as a common bundle, i.e., a pipe, for packets generated by and destined to this application and handle packets appearing thereon as multi-link PPP packets."; also see col. 14, line 61-col. 15, line 11, wherein "First, a transmitting side device which transmits (e.g., any of devices 620 or 660) an incoming packet need not split any of these incoming packets but can alternate these packets between each of its physical links, i.e., applies these packets in a round-robin (or other predefined) fashion among its outgoing links. In this scenario, no changes need to be made to the contents of each of these incoming packets to transmit that packet through one or more levels in a hierarchy of multi-link PPP devices. A receiving side device merely passes the multi-link packets it receives to its associated DTE in increasing order of the sequence numbers of the packets its received, while ignoring beginning and ending flags in the multi-link header of each such packet."]

wherein the first data transfer rate and the second data transfer rate provide an increased data transfer rate of the first path and the second path from the server to the client device [see col. 2, line 32-col. 3, line 41, wherein "Second, as more users simultaneously contend for available network bandwidth at particular times, such as when the network experiences its peak daily loading, the network becomes increasingly congested. Hence, at these times, network traffic tends to slow which also tends to lengthen download time, thereby frustrating the users particularly those seeking relatively large files. … Once successfully negotiated between two PPP peers, then, at a transmitting peer, multi-link PPP segments a packetized data stream (i.e., a PPP frame) into segments (or fragments), forms a stream of multi-link PPP packets each containing one such a segment, and then assigns these multi-link PPP packets on an approximately equal basis, where practical, between two B channels in the BRI connection for

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transmission to a receiving PPP peer; here the two B channels form a pipe. Small packets may not be segmented and to accommodate links of different speeds (which is not the case with two ISDN B channels), the segments need not be of the same size nor do the same number of segments need to be transmitted over each link."; also see col. 17, lines 20-57, wherein "Hence, through the present invention, a link in an original multi-link bundle and carrying multi-link PPP packets can itself be effectively divided (demultiplexed) into substantially any number of different paths with these paths being remotely and correctly recombined (multiplexed) so as to appear to be a link of the original multi-link bundle. … Furthermore, if all multi-link PPP links in a bundle have same data transmission rate such as two B-channels in an ISDN line, then each terminal adapter can simply send its incoming multi-link PPP packets as outgoing multi-link PPP packets on alternating B-channels without the need to encapsulate these packets with multi-multi-link protocol headers….However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."].

With this, as discussed above, Maurya is seen to disclose that the first and second messages include a multilink request and a destination IP address. But in this regard, the reference of Maurya does not expressly disclose if the first and second messages include a multilink request **and a destination URL**, as currently recited in independent claim 1.

However, the reference of Low discloses a client device that transmits messages through a network interface, whereby the message includes a multilink request [and] a destination URL

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[see Fig. 4, with the terminal 31 transmitting a message 38 to a server 32 that includes a request and a destination URL; also see page 11, line 12-page 13, line 15, wherein "A cornerstone of the WWW is its ability to address particular information resources by means of an Uniform Resource Locator (URL) that identifies a resource by location…By way of example, a full or 'absolute' URL will comprise the following elements:…the Internet host domain or IP address…This request includes a request method, and the 'Request-URI' (which is generally just the absolute path of the resource on the server as identified by the 'abs-path' element of the URI); the request may include additional data elements."; also see page 23, line 5-page 24, line 9].

With this, it would have been obvious for one of ordinary skill in the art to have include a destination URL in messages sent from the client to the server, as recognized by Low, within the first and second messages disclosed in Maurya. Maurya and Low are combinable because they are from the same field of endeavor, both being systems that perform multilink data packet communication. At the time of the invention, it would have been obvious to one of ordinary skill in the art to have the client device of Maurya include the functionality that "the first and second messages include a multilink request **and a destination URL**", as recognized by Low. The suggestion/motivation for doing so would be that the client device of Maurya would conform with known protocols for communicating packets in systems utilizing point-to-point protocol (PPP), as discussed by Low in page 11, lines 21-page 12, line 28 which states "In this case, the user terminal 34 will generally communicate with the ISP 33 over the public telephone system using a modem and employing either SLIP (Serial Line Interface Protocol) or PPP (Point-to-Point Protocol). These protocols allow Internet packets to traverse ordinary telephone lines. …A

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cornerstone of the WWW is its ability to address particular information resources by means of an Uniform Resource Identifier (URI) that will generally be either a Uniform Resource Locator that identifies a resource by location, or a Uniform Resource Name (URN) that can be resolved into an URL." Here, Low describes that utilizing URLs for PPP communication of packets between user terminals and Internet service providers was well known, and thus, this modification of Maurya with the functionality taught in Low would easily be implemented with these well-known teachings, as exemplified by Low, and would yield predictable results. In this regard, Maurya specifically states in col. 9, lines 42-55 that "Other classes of addresses exist. Inasmuch as the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention, I will omit any further details of the latter two aspects." Therefore, it would have been obvious to combine the teachings of Low of using a URL with the client device described in Maurya to obtain the invention specified in independent claim 1.

Regarding ***claim 2***, Maurya and Low disclose the client device discussed above in claim 1, and Maurya further teaches wherein the at least one processor further is configured to transmit the first message and the second message to at least one server [see Figs. 6A-8; also see col. 14, lines 22-60, wherein "Hence, for client-server apparatus 600 shown in FIG. 6A and through the teachings of my invention, a client application executing at client PC 610, during the course of configuring links 615 connecting the PC with terminal adapters 620, will establish its own endpoint discriminator value which, in turn, it will supply, via LCP Endpoint Discriminator packets during LCP negotiations, to each of terminal adapters 620. ...As a result, server computer 665, by virtue of the common endpoint discriminator associated the application

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executing at client PC 610 and with every ISDN BRI (B channel pair) emanating from client 605, will then, through conventional multi-link protocol processing correctly view links 630 as a common bundle, i.e., a pipe, for packets generated by and destined to this application and handle packets appearing thereon as multi-link PPP packets."],

wherein the at least one server is a device providing the data packets, or a device that manages the client device and another device that is providing data to the client device [see Figs. 6A-8, which illustrates the server computer 665; also see col. 14, lines 22-60, wherein "As a result, server computer 665, by virtue of the common endpoint discriminator associated the application executing at client PC 610 and with every ISDN BRI (B channel pair) emanating from client 605, will then, through conventional multi-link protocol processing correctly view links 630 as a common bundle, i.e., a pipe, for packets generated by and destined to this application and handle packets appearing thereon as multi-link PPP packets."].

Regarding ***claim 3***, Maurya and Low disclose the client device discussed above in claim 1, and Maurya further teaches wherein a server provides the multilink session identification that is unique to the multilink session [see col. 5, lines 7-58, wherein "In accordance with my specific inventive teachings, setting identical endpoint discriminators is readily accomplished during LCP negotiations wherein **a multi-link PPP originator, such as, e.g., a server or a client application executing at a PC, assigns itself a unique endpoint discriminator value and informs all its immediate PPP peers**, such as neighboring terminal adapters, by sending the latter, via a first bundle of outgoing links, an LCP Endpoint Discriminator packet containing this value. Each of these immediate PPP peers, rather than assigning itself a unique endpoint discriminator value, assumes the value that has been provided to it in the LCP Endpoint

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Discriminator packet it receives from the originating device, as its own endpoint discriminator. Each of these peers then, in turn, sends an LCP Endpoint Discriminator packet containing its endpoint discriminator value (i.e., that of the originating multi-link PPP system), via a second bundle of outgoing links, to its immediate PPP peers, and so forth until all hierarchically inter-connected multi-link PPP peers at one end of the pipe and which fan-out from the originator have set their endpoint discriminator to a single common value, i.e., the endpoint discriminator of the multi-link PPP originator. Each multi-link PPP device situated in a final, e.g. m^{th}, level of hierarchically organized multi-link PPP peers supplies the common endpoint discriminator value, through an associated LCP Endpoint Discriminator packet and via a separate physical link in the pipe, to its remote multi-link PPP peer at the other end of the pipe. Consequently, all the links in this pipe will be viewed, by the multi-link protocol, as part of a common bundle."; also see col. 13, line 61-col. 14, line 60; also see col. 16, lines 9-55, wherein "Once this occurs, then process 700 progresses to step 730. **At this step, each of far-end terminal adapters 660 takes the endpoint discriminator value (the contents of both class field 430 and address field 440 shown in FIG. 4) sent by server computer 665 as part of an LCP Multi-link Endpoint Discriminator Option packet as its own endpoint discriminator**. Thereafter, this particular terminal adapter then negotiates with its near-end PPP peer, i.e., one of terminal adapters 620, and also negotiates to perform multi-link PPP with server computer 665, via links 662. During the course of LCP negotiations, **the far-end terminal adapter sends its peer near-end adapter an LCP Multi-link Endpoint Discriminator Option packet containing the endpoint discriminator value of the former adapter, i.e., that associated with the server computer**."].

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Regarding ***claim 5***, Maurya and Low disclose the client device discussed above in claim 1, and Maurya further teaches wherein each of the first network interface and the second network interface is **one or more of** cellular interface, Wi-Fi interface, a wireless interface, a cable interface, a wired interface, an Ethernet interface, a Bluetooth interface, a near-field communication interface, and an optical interface [see col. 11, line 34-col. 12, line 31, wherein "Here, client 605 is inter-connected to server 650 through multiple ISDN BRI (basic rate interface) lines 630. … Client 605 is formed of client PC 610, as DTE (data terminating equipment), **connected, through internal communication interfaces 612, typically separate serial ports (not specifically identified), and via corresponding links 615**, to multiple identical ISDN BRI terminal adapters 620 as DCE (data circuit terminating equipment)."; also see col. 3, lines 15-65; with this, these teachings in Maurya are seen to disclose a "wired interface"].

Regarding ***claim 6***, Maurya and Low disclose the client device discussed above in claim 1, and Maurya further teaches wherein the processor is configured to reorder the one or more data packets that are received over the at least two or more network interfaces of the client device during the multilink session [see col. 12, lines 32-65, wherein "In particular, as discussed above and depicted in FIG. 5, each multi-link PPP packet generated by client PC 610, shown in FIG. 6A, would contain a sequence number which increments by one from each multi-link PPP packet to the next in a common PPP frame. To ensure proper ordering, each of terminal adapters 660 would buffer each incoming multi-link PPP packet it receives, via links 630, from its corresponding PPP peer in adapters 620, and then reorder its received packets based on their sequence numbers, and then transmit only properly reordered packets to server computer

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665. Inasmuch as PC 610 is distributing the multi-link PPP packets, typically in sequential round-robin fashion, amongst terminal adapters 620, each one of terminal adapters 660 would receive packets having sequence numbers that increment not by the value one but by the integer value n; hence, skipping intervening sequence numbers. Under conventional multi-link protocol processing, if incoming multi-link PPP packets were received by any given terminal adapter, such as in adapters 660, but with gaps in their sequence numbers, then each of these terminal adapters would simply buffer these incoming packets pending receipt of those packets containing the missing (here skipped) sequence numbers."; also see col. 14, line 61-col. 16, line 5, wherein "To ensure proper re-ordering, upon ultimate reception at a far-end location, of multi-link PPP packets that are to be transmitted at each level, either of two approaches can be used inasmuch as both peer devices (in, e.g., adapters 620 and 660) realize that they are performing multi-multi-link PPP. First, a transmitting side device which transmits (e.g., any of devices 620 or 660) an incoming packet need not split any of these incoming packets but can alternate these packets between each of its physical links, i.e., applies these packets in a round-robin (or other predefined) fashion among its outgoing links. … Second, if either side at any level in the hierarchy desires to split its incoming multi-link packets, then each multi-link PPP device situated at that level encapsulates its incoming multi-link PPP packets as segment data into new outgoing multi-link PPP packets, which I refer to as "multi-multi-link" PPP packets. … Multi-multi-link header 692, has an identical format as that of header 505, but contains beginning and ending (B and E) flags and a sequence number pertinent to the segment data contained within packet 685. FCS field 696 serves the same function and is identical in format to FCS field 507 but has a value associated with the contents of: PPP link layer header 503, protocol and sequence number fields in header 692 and segment data 694."].

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Regarding ***claim 13***, Maurya discloses a first device [being the client 605, which includes PC 610 connected through communication interfaces 612 to terminal adapters 620, as seen in Fig. 6A] comprising:

a network interface [being the communication interfaces 612, as seen in Fig. 6A; also see col. 11, line 34-col. 13, line 8, wherein "In that regard, links 615, which comprise links 615_1, 615_2, . . . , 615_n, connect separate terminal adapters 620_1, 620_2, . . . , 620_n, respectively, to separate corresponding serial ports provided by communication interfaces 612. … ISDN connections are extended from terminal adapters 620, through public switched telephone network (PSTN) 640, to server 650 having corresponding identical terminal adapters 660, as DCE, and server computer 665, as DTE. Each one of terminal adapters 620 is connected through a separate pair of ISDN B-channels and the PSTN, to a separate corresponding one of terminal adapters 660, the latter terminal adapters collectively connected, via links 662, to server computer 665. Each of adapters 660 is illustratively identical to each of adapters 620."; also see col. 17, lines 36-57, wherein "However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."]; and

at least one processor configured to:

transmit a first message through the network interface to a second device [with the second device seen as being one of the DCEs 660, such as DCE 660_1, as seen in Fig. 6A], wherein the first message includes a multilink request and a destination ***IP address***, the network interface to the second device having a data transfer rate associated therewith

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[see col. 7, line 22-39, wherein "At this point with no activity on the link, a link control protocol (LCP), which as part of the PPP protocol, exercises responsibility for establishing and configuring the link, remains in an initial or starting state."; also see col. 8, lines 20-59, wherein "FIG. 2 depicts a format of conventional generalized LCP packet 200. As shown, packet 200 is formed of eight-bit code field 210, eight-bit identifier field 220, sixteen-bit length field 230 and finally variable-length data field 240. This packet can be any one of several types, with the value of the code field, having values typically ranging from one to thirteen, specifying the type of any such packet. Of note, a value of one indicates that the packet is an LCP Configure Request packet. Such a request packet is sent by a PPP peer whenever that peer desires to change a configuration parameter, such as from a default value, associated with the link."; also see col. 9, lines 14-55, wherein "The endpoint discriminator packet identifies, by specifying an address, of an end system (an "endpoint"), then situated on an end of a link, that is transmitting this particular packet. … For example, a class field having a value of illustratively zero, one or two specifies that the following address is a null class (i.e., the address is zero octets long), a locally assigned address, such as a serial number (having a length up to twenty octets), or an Internet Protocol (IP) address (having a length of four octets). Other classes of addresses exist. Inasmuch as the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention, I will omit any further details of the latter two aspects."];

transmit a second message through the network interface **to a third device [**with the third device seen as being another one of the DCEs 660, such as DCE 660_2, as seen in

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Fig. 6A], wherein the second message includes a multilink session identification that is unique to the multilink session and the destination ***IP address***, the network interface to the third device having a data transfer rate associated therewith [see col. 7, line 22-39; also see col. 8, lines 20-59, wherein "FIG. 2 depicts a format of conventional generalized LCP packet 200. As shown, packet 200 is formed of eight-bit code field 210, eight-bit identifier field 220, sixteen-bit length field 230 and finally variable-length data field 240. This packet can be any one of several types, with the value of the code field, having values typically ranging from one to thirteen, specifying the type of any such packet. Of note, a value of one indicates that the packet is an LCP Configure Request packet. Such a request packet is sent by a PPP peer whenever that peer desires to change a configuration parameter, such as from a default value, associated with the link."; also see col. 8, line 60-col. 9, line 67, wherein "Each specific option has to be separately negotiated between the PPP peers and appropriately acknowledged prior to its use. Inasmuch as the only values for this type field, i.e., the only configuration options, that are relevant to understanding the invention are 17, 18 and 19, which designate a multi-link MRRU (Multi-link Maximum Receive Reconstructed unit) request, **a multi-link Short Sequence Number** header request and a "multi-link endpoint discriminator" option, respectively (which will all be discussed in detail below in conjunction with FIG. 5). … Each such multi-link PPP packet contains a sequence number--which increases by one with each successive packet, inserted by the multi-link protocol."; also see col. 10, lines 6-53, wherein "These formats are depicted as long and short sequence number formats 510 and 550 having 24- and 12-bit sequence numbers, respectively. The specific format of the multi-link PPP packet to use in any situation can be specified by a PPP sender by

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transmitting an LCP Configuration Request message for a Multi-link Maximum Receive Reconstructed Unit (MRRU) format, i.e., designating long sequence number format 510, or a Multi-link Short Sequence Number Header format, i.e., designating short sequence number format 550, coupled with successful negotiations with its PPP peer therefor. Use of format 510 or 550 is requested by a type field having a value of 17 or 18, respectively, in an LCP Configure Request message, as noted above, transmitted by the PPP sender to its PPP peer."]; and

receive the different data packets through the at least one network interface from the second device and from the third device during the multilink session [see col. 10, line 6-col. 11, line 28; also see col. 14, lines 22-57, wherein "As a result, server computer 665, by virtue of the common endpoint discriminator associated the application executing at client PC 610 and with every ISDN BRI (B channel pair) emanating from client 605, will then, through conventional multi-link protocol processing correctly view links 630 as a common bundle, i.e., a pipe, for packets generated by and destined to this application and handle packets appearing thereon as multi-link PPP packets."; also see col. 14, line 61-col. 15, line 11, wherein "First, a transmitting side device which transmits (e.g., any of devices 620 or 660) an incoming packet need not split any of these incoming packets but can alternate these packets between each of its physical links, i.e., applies these packets in a round-robin (or other predefined) fashion among its outgoing links. In this scenario, no changes need to be made to the contents of each of these incoming packets to transmit that packet through one or more levels in a hierarchy of multi-link PPP devices. A receiving side device merely passes the multi-link packets it receives to its associated

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DTE in increasing order of the sequence numbers of the packets its received, while ignoring beginning and ending flags in the multi-link header of each such packet."],

wherein the data transfer rate associated with the network interface to the second device and the network interface to the third device provide an increased data transfer rate for the first device [see col. 2, line 32-col. 3, line 41, wherein "Second, as more users simultaneously contend for available network bandwidth at particular times, such as when the network experiences its peak daily loading, the network becomes increasingly congested. Hence, at these times, network traffic tends to slow which also tends to lengthen download time, thereby frustrating the users particularly those seeking relatively large files. … Once successfully negotiated between two PPP peers, then, at a transmitting peer, multi-link PPP segments a packetized data stream (i.e., a PPP frame) into segments (or fragments), forms a stream of multi-link PPP packets each containing one such a segment, and then assigns these multi-link PPP packets on an approximately equal basis, where practical, between two B channels in the BRI connection for transmission to a receiving PPP peer; here the two B channels form a pipe. Small packets may not be segmented and to accommodate links of different speeds (which is not the case with two ISDN B channels), the segments need not be of the same size nor do the same number of segments need to be transmitted over each link."; also see col. 17, lines 20-57, wherein "Hence, through the present invention, a link in an original multi-link bundle and carrying multi-link PPP packets can itself be effectively divided (demultiplexed) into substantially any number of different paths with these paths being remotely and correctly recombined (multiplexed) so as to appear to be a link of the original multi-link bundle. … Furthermore, if all multi-link PPP links in a bundle have

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same data transmission rate such as two B-channels in an ISDN line, then each terminal adapter can simply send its incoming multi-link PPP packets as outgoing multi-link PPP packets on alternating B-channels without the need to encapsulate these packets with multi-multi-link protocol headers….However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."].

With this, as discussed above, Maurya is seen to disclose that the first and second messages include a multilink request and a destination IP address. But in this regard, the reference of Maurya does not expressly disclose if the first and second messages include a multilink request and a **destination URL**, as currently recited in independent claim 13.

However, the reference of Low discloses a first device that transmits messages through a network interface, whereby the message includes a multilink request and a destination URL [see Fig. 4, with the terminal 31 transmitting a message 38 to a server 32 that includes a request and a destination URL; also see page 11, line 12-page 13, line 15, wherein "A cornerstone of the WWW is its ability to address particular information resources by means of an Uniform Resource Locator (URL) that identifies a resource by location…By way of example, a full or 'absolute' URL will comprise the following elements:…the Internet host domain or IP address…This request includes a request method, and the 'Request-URI' (which is generally just the absolute path of the resource on the server as identified by the 'abs-path' element of the

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URI); the request may include additional data elements."; also see page 23, line 5-page 24, line 9].

With this, it would have been obvious for one of ordinary skill in the art to have include a destination URL in messages sent from the client to the server, as recognized by Low, within the first and second messages disclosed in Maurya. Maurya and Low are combinable because they are from the same field of endeavor, both being systems that perform multilink data packet communication. At the time of the invention, it would have been obvious to one of ordinary skill in the art to have the client device of Maurya include the functionality that "the first and second messages include a multilink request **and a destination URL**", as recognized by Low. The suggestion/motivation for doing so would be that the client device of Maurya would conform with known protocols for communicating packets in systems utilizing point-to-point protocol (PPP), as discussed by Low in page 11, lines 21-page 12, line 28 which states "In this case, the user terminal 34 will generally communicate with the ISP 33 over the public telephone system using a modem and employing either SLIP (Serial Line Interface Protocol) or PPP (Point-to-Point Protocol). These protocols allow Internet packets to traverse ordinary telephone lines. ...A cornerstone of the WWW is its ability to address particular information resources by means of an Uniform Resource Identifier (URI) that will generally be either a Uniform Resource Locator that identifies a resource by location, or a Uniform Resource Name (URN) that can be resolved into an URL." Here, Low describes that utilizing URLs for PPP communication of packets between user terminals and Internet service providers was well known, and thus, this modification of Maurya with the functionality taught in Low would easily be implemented with these well-known teachings, as exemplified by Low, and would yield predictable results. In this regard,

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Maurya specifically states in col. 9, lines 42-55 that "Other classes of addresses exist. Inasmuch as the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention, I will omit any further details of the latter two aspects." Therefore, it would have been obvious to combine the teachings of Low of using a URL with the client device described in Maurya to obtain the invention specified in independent claim 13.

Regarding ***claim 14***, Maurya and Low disclose the first device discussed above in claim 13, and Maurya further teaches wherein the first device and the second device are separate devices or separate parts of the same device [see Fig. 6A, whereby the client 605, which includes PC 610 with communication interfaces 612, is separate from the DCE 660_1, being located at the server 650].

Regarding ***claim 15***, Maurya and Low disclose the first device discussed above in claim 13, and Maurya further teaches wherein the first device is **one of** a cell phone, a tablet, a switch, a server, a network device, a router, a computer, a Wi-Fi device, a Wi-Max device, a mobile communication device, a wireless communications device, a near-field communications device, and a Bluetooth device [see Fig. 6A, whereby the client 605 includes PC 610, which is seen to be "a computer" , as well as a "network device"].

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Response to Arguments

10. Patent Owner's arguments filed August 13, 2024 have been fully considered but they are not persuasive.

11. First, the Examiner notes that claims 1-3, 5-6, and 13-15 of the '908 Patent are currently subject to reexamination, whereby these claims 1-3, 5-6, and 13-15 of the '908 Patent each stand rejected under 35 U.S.C. 103(a) as being unpatentable over Maurya in view of Low. No amendments to the claims have been made, and the claims are in their original form. Further, of the claims subject to reexamination in this proceeding, claims 1 and 13 are independent, and these claims will be discussed below.

12. With this, beginning on page 13 of the Remarks dated August 13, 2024, the Patent Owner summarizes that the Examiner has not presented any argument that the cited art discloses a multilink session identification, that the endpoint discriminator taught by Maurya is not a multilink session identification, nor does it render obvious the use of a multilink session identification claimed in the '908 Patent, and that Low does not disclose, teach, or render obvious a second message that includes: a multilink session identification; and the destination URL.

13. In this regard, the specific argued limitations of independent claim 1 of the '908 Patent recites:

> "1. A client device for multilink data packet communication with a server, the client device comprising:
>
> ... at least one processor configured to:

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> …
>
> transmit a first message through the first network interface to the server, wherein the first message includes a multilink request [sic] a destination URL;
>
> transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification [*sic*] the destination URL; …"

14. Further, the specific argued limitations of independent claim 13 of the '908 Patent recites:

> "13. A first device comprising:
>
> … at least one processor configured to:
>
> …
>
> transmit a first message through the network interface to a second device, wherein the first message includes a multilink request and a destination URL, … ;
>
> transmit a second message through the network interface to a third device, wherein the second message includes a multilink session identification that is unique to the multilink session and the destination URL, …"

15. With this, in reviewing the instant claim language of claim 1, in its entirety, the claimed term of a "multilink session identification" is not specifically defined, as well as not specifically recited further. But in lines 17-19 of claim 1, the claim does recite "receive data packets … during the multilink session". Thus, in reviewing claim 1, as a whole, the multilink session identification is seen to have the plain and ordinary meaning of the term "identification", such that the multilink session identification identifies a multilink session, with this multilink session subsequently being used to receive data packets. Further, the Examiner notes that dependent claim 3 further defines the "multilink session identification", requiring "a server provides the multilink session identification that is unique to the multilink session." This feature is

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specifically recited in independent claim 13, as noted above. With this, these claims require that the multilink session identification is unique, so as to identify the particular multilink session.

16. Looking further into the specification of the '908 Patent, in col. 12, line 1-col. 13, line 12, the '908 Patent is seen to describe the above noted claimed second message. Along this vein, in col. 12, lines 9-14, the '908 Patent states that "As part of a successful multilink PPP session setup, the initiating RCG - 85 receives a multilink PPP session ID, or "magic number", which is used to identify this particular multilink PPP session and is also used for adding or removing links from the multilink bundle - 87." Additionally, in col.. 12, lines 51-60, the '908 Patent states "The initiating RCG then selects which of the responding remote RCGs - 86 it will use for the multilink PPP bundle - 87 and sends them a multilink initialization packet containing the URL of the destination as well as the multilink PPP session ID (magic number) and any other pertinent information required for the remote RCG to join in the existing multilink PPP bundle - 87." Thus, with this, the claimed "multilink session identification" within the second message appears to be defined in the specification of the '908 Patent as a "magic number" that is described as being used "to identify this particular multilink PPP session and is also used for adding or removing links from the multilink bundle".

17. With this, referring back to the Remarks dated August 13, 2024 (hereafter "the Remarks"), on pages 13 and 14, the Patent Owner argues that the Office action fails to point to any disclosure of a "multilink session identification". In this regard, in review of the instant cited rejection and the claimed elements noted above, the combination of Maurya and Low is still seen to teach the limitation regarding the claimed "multilink session identification", such

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that Maurya teaches of the claimed "second message", which "includes a multilink session identification" and the combination of Maurya and Low teach that the second message includes the destination URL.

18. Particularly, with respect to Maurya, upon review of the reference, Maurya states in the Abstract that "Specifically, during LCP negotiations, a multi-link PPP originator assigns itself **a unique endpoint discriminator value and informs all its immediate PPP peers by sending the latter, via a first bundle of outgoing links, an LCP Endpoint Discriminator packet containing this value.** Each of these immediate PPP peers assumes, as its endpoint discriminator, the value that has been provided to it in the LCP Endpoint Discriminator packet it receives from the originator and then sends an LCP Endpoint Discriminator packet containing **this same endpoint discriminator value**, via a second bundle of outgoing links, to all of its immediate PPP peers." Here, this "unique endpoint discriminator value", as described in the Abstract, appears to be used to identify the particular multilink PPP session, being required by the plain meaning of the claim term, and consistent with the "multilink session identification" described in the specification of the '908 Patent.

19. Further, as discussed in col. 9, lines 14-55, Maurya states "The endpoint discriminator packet identifies, by specifying an address, of an end system (an "endpoint"), then situated on an end of a link, that is transmitting this particular packet. This peer can be an existing system, i.e., one whose address has already been specified through prior LCP negotiations to its communicating peer, though using another, i.e., existing, link to that peer, or a different system altogether. If the data contained in this packet identifies the end system as an existing system

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(i.e., previously so identified), then, through the PPP protocol, **the link will be joined to an existing bundle of links, so as to form a "pipe" among which multi-link PPP packets** will be distributed for transport between the end system peer and its peer. Alternatively, if the data contained in packet 400 **differs from that of any existing system**, then the PPP protocol **assumes a new bundle of links exists and assigns the link to this new bundle**. … **Identification** of the endpoint system (commonly referred to as either an **"endpoint discriminator" or "endpoint identifier")** is accomplished through class field 430 and address field 440, which collectively contain data carried by this packet. … For example, a class field having a value of illustratively zero, one or two specifies that the following address is a null class (i.e., the address is zero octets long), a locally assigned address, such as a serial number (having a length up to twenty octets), or an Internet Protocol (IP) address (having a length of four octets)."

20. Thus, the "endpoint discriminator" value (also described as the "endpoint identifier") described in Maurya is clearly seen to identify a particular multilink PPP session and is also used for **adding or** removing **links from the multilink bundle**, being the defining function of the "multilink session identification", as discussed in the specification of the '908 Patent.

21. In an additional interpretation, in col. 8, line 65-col. 9, line 13, Maurya also discloses that "Each specific option has to be separately negotiated between the PPP peers and appropriately acknowledged prior to its use. Inasmuch as the only values for this type field, i.e., the only configuration options, that are relevant to understanding the invention are 17, 18 and 19, which designate a multi-link MRRU (Multi-link Maximum Receive Reconstructed unit) request, a

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multi-link Short Sequence Number header request and a "multi-link endpoint discriminator" option, respectively (which will all be discussed in detail below in conjunction with FIG. 5). … **Each such multi-link PPP packet contains a sequence number--which increases by one with each successive packet**, inserted by the multi-link protocol." In this regard, the multi-link Short Sequence Number can also be interpreted as a "multi-link session identification", as each packet in the multi- link contains this sequence number, which "identifies" the multilink session, as described in the specification of the '908 Patent.

22. With these sections discussed above, Maurya is also seen to disclose at least one processor configured to "transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification [*sic*] *[and]* the destination IP address". In addition, in col. 9, lines 35-55, Maurya also states that "Other classes of addresses exist. Inasmuch as the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention, I will omit any further details of the latter two aspects." But in this regard, the reference of Maurya does not expressly disclose if the first and second messages include a multilink session identification *[and]* a **destination URL**, as currently recited in independent claim 1, and similarly in claim 13.

23. But the secondary reference of Low discloses a client device that transmits messages through a network interface, whereby one message includes a destination URL, as seen in Fig. 4, with the terminal 31 transmitting a message 38 to a server 32 that includes a destination URL. In addition, as read on page 11, line 12-page 13, line 15, Low states "A cornerstone of the WWW is

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its ability to address particular information resources by means of an Uniform Resource Locator (URL) that identifies a resource by location…By way of example, a full or 'absolute' URL will comprise the following elements:…the Internet host domain or IP address…This request includes a request method, and the 'Request-URI' (which is generally just the absolute path of the resource on the server as identified by the 'abs-path' element of the URI); the request may include additional data elements."

24. With this, it would have been obvious for one of ordinary skill in the art to have include a destination URL, as recognized by Low, within the second message disclosed by Maurya. The suggestion/motivation for doing so would be that the client device of Maurya would conform with known protocols for communicating packets in systems utilizing point-to-point protocol (PPP), as discussed by Low in page 11, lines 21-page 12, line 28. Here, Low describes that utilizing URLs for PPP communication of packets between user terminals and Internet service providers was well known, and thus, this modification of Maurya with the functionality taught in Low would easily be implemented with these well-known teachings, as exemplified by Low, and would yield predictable results.

25. Continuing, on pages 14 and 15 of the Remarks, the Patent Owner argues that a "multi-link short sequence number header request is not a multilink session identification and is not an endpoint discriminator." But here, the multi-link short sequence number header request is not

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being equated to a multilink session identification. Rather, as discussed above, the multi-link Short Sequence Number can be interpreted as a "multi-link session identification", as each packet in the multi- link contains this sequence number, which "identifies" the multilink session, as described in the specification of the '908 Patent. Again, in col. 8, line 65-col. 9, line 13, Maurya discloses that "Each specific option has to be separately negotiated between the PPP peers and appropriately acknowledged prior to its use. Inasmuch as the only values for this type field, i.e., the only configuration options, that are relevant to understanding the invention are 17, 18 and 19, which designate a multi-link MRRU (Multi-link Maximum Receive Reconstructed unit) request, a multi-link Short Sequence Number header request and a "multi-link endpoint discriminator" option, respectively (which will all be discussed in detail below in conjunction with FIG. 5). … **Each such multi-link PPP packet contains a sequence number--which increases by one with each successive packet**, inserted by the multi-link protocol

26. In additional, as discussed in col. 9, lines 14-55, Maurya states "The endpoint discriminator packet identifies, by specifying an address, of an end system (an "endpoint"), then situated on an end of a link, that is transmitting this particular packet. This peer can be an existing system, i.e., one whose address has already been specified through prior LCP negotiations to its communicating peer, though using another, i.e., existing, link to that peer, or a different system altogether. If the data contained in this packet identifies the end system as an existing system (i.e., previously so identified), then, through the PPP protocol, **the link will be joined to an existing bundle of links, so as to form a "pipe" among which multi-link PPP packets** will be distributed for transport between the end system peer and its peer. Alternatively,

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if the data contained in packet 400 **differs from that of any existing system**, then the PPP protocol **assumes a new bundle of links exists and assigns the link to this new bundle**. … **Identification** of the endpoint system (commonly referred to as either an **"endpoint discriminator" or "endpoint identifier")** is accomplished through class field 430 and address field 440, which collectively contain data carried by this packet. … For example, a class field having a value of illustratively zero, one or two specifies that the following address is a null class (i.e., the address is zero octets long), a locally assigned address, such as a serial number (having a length up to twenty octets), or an Internet Protocol (IP) address (having a length of four octets)."

27. Thus, "multi-link Short Sequence Number" or the "endpoint discriminator" value (also described as the "endpoint identifier"), each described in Maurya, are seen to identify a particular multilink PPP session, being the defining function of the "multilink session identification" discussed in the specification of the '908 Patent.

28. Continuing, on pages 15 and 16 of the Remarks, the Patent Owner argues that Maurya's multi-link short sequence number header request is not a multilink session identification. But again, the multi-link short sequence number header request is not being equated to a multilink session identification. Rather, as discussed above, the multi-link Short Sequence Number can be interpreted as a "multi-link session identification", as each packet in the multi- link contains this sequence number, which "identifies" the multilink session, as described in the specification of the '908 Patent.

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29. In addition, on page 16 of the Remarks, the Patent Owner points to Fig. 5 of Maurya, and recognizes that "This multi-link Short-Sequence Number (575) is used for ordering the packets after receipt on the receiving side." The Patent Owner then posits on page 16 that "The '908 patent does not use the 'multilink session identification' for anything associated with re-ordering packets or as referred to as 'reassembly' of packets in the '908 patent. ...As shown, Maurya's multi-link Short Sequence Number is for ordering messages within a session and the '908 Patent's multilink session identification is for distinguishing between sessions. Accordingly, Maurya's multi-link Short Sequence Number is distinctly different in purpose and function from the claimed multilink session identification. "

30. But in response, utilizing a multilink session identification to distinguish between sessions is not particularly recited in the claims. Rather, claim 1 does not recite any specific purpose for a "multilink session identification", other than perhaps identifying a multilink session. Despite Patent Owner's contention, there simply is no requirement for a specific purpose and function of the claimed multilink session identification in the current claim language. If the Patent Owner wishes that this feature be considered in interpreting the current claim language, then the claims must be amended accordingly. Again, as discussed above, the multi-link Short Sequence Number can be interpreted as a "multi-link session identification", as each packet in the multi-link contains this sequence number, which "identifies" the multilink session, being consistent with the discussion provided within the specification of the '908 Patent.

31. Continuing, on page 16 of the Remarks, the Patent Owner begins arguing that Maurya's Endpoint discriminator is not a multilink session identification. In this regard, on pages 17 and

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18, the Patent Owner argues that "Maurya's endpoint discriminator and the '908 Patent's multilink session identification are different in both form and operation. In fact, the '908 Patent's multilink session identification solves problems that cannot be solved by Maurya's endpoint discriminator." In this regard, the Patent Owner states on page 19 of the Remarks that "Accordingly, the multilink session identification can be used to dynamically add and remove links in an existing multilink communication session, as described in column 12, lines 51-66, of the '908 Patent". In addition, the Patent Owner further argues that "Column 13, line 13 through column 14, line 9, further describes the dynamic nature of the '90 system detailing how remote RCGs can be added and removed from existing sessions..."

32. But here, it is improper to import limitations from the specification into the claims. In this regard, MPEP 2111.01(II) states, in part:

"II. IT IS IMPROPER TO IMPORT CLAIM LIMITATIONS FROM THE SPECIFICATION

> "Though understanding the claim language may be aided by explanations contained in the written description, **it is important not to import into a claim limitations that are not part of the claim.** For example, a particular embodiment appearing in the written description may not be read into a claim when the claim language is broader than the embodiment." *Superguide Corp. v. DirecTV Enterprises, Inc.*, 358 F.3d 870, 875, 69 USPQ2d 1865, 1868 (Fed. Cir. 2004). See also *Liebel-Flarsheim Co. v. Medrad Inc.*, 358 F.3d 898, 906, 69 USPQ2d 1801, 1807 (Fed. Cir. 2004) (discussing recent cases wherein the court expressly rejected the contention that if a patent describes only a single embodiment, the claims of the patent must be construed as being limited to that embodiment); *E-Pass Techs., Inc. v. 3Com Corp.*, 343 F.3d 1364, 1369, 67 USPQ2d 1947, 1950 (Fed. Cir. 2003) ("Interpretation of descriptive statements in a patent's written description is a difficult task, as an inherent tension exists as to whether a statement is a clear lexicographic definition or a description of a preferred embodiment. The problem is to **interpret claims 'in view of the specification' without unnecessarily importing limitations from the specification into the claims**."); *Altiris Inc. v. Symantec*

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> *Corp.*, 318 F.3d 1363, 1371, 65 USPQ2d 1865, 1869-70 (Fed. Cir. 2003) (Although the specification discussed only a single embodiment, the court held that it was improper to read a specific order of steps into method claims where, as a matter of logic or grammar, the language of the method claims did not impose a specific order on the performance of the method steps, and the specification did not directly or implicitly require a particular order). …"

33. Here, the functions of adding or removing remote RCGs, as argued, is not particularly claimed. If the Patent Owner wishes that these functions be considered in interpreting the current claim language, then the claims must be amended accordingly.

34. Again, Maurya states in the Abstract that "Specifically, during LCP negotiations, a multi-link PPP originator assigns itself **a unique endpoint discriminator value and informs all its immediate PPP peers by sending the latter, via a first bundle of outgoing links, an LCP Endpoint Discriminator packet containing this value.** Each of these immediate PPP peers assumes, as its endpoint discriminator, the value that has been provided to it in the LCP Endpoint Discriminator packet it receives from the originator and then sends an LCP Endpoint Discriminator packet containing **this same endpoint discriminator value**, via a second bundle of outgoing links, to all of its immediate PPP peers."

35. Further, as also discussed in col. 9, lines 14-55, Maurya states "The endpoint discriminator packet identifies, by specifying an address, of an end system (an "endpoint"), then situated on an end of a link, that is transmitting this particular packet. This peer can be an existing system, i.e., one whose address has already been specified through prior LCP negotiations to its communicating peer, though using another, i.e., existing, link to that peer, or a

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different system altogether. If the data contained in this packet identifies the end system as an existing system (i.e., previously so identified), then, through the PPP protocol, **the link will be joined to an existing bundle of links, so as to form a "pipe" among which multi-link PPP packets** will be distributed for transport between the end system peer and its peer. Alternatively, if the data contained in packet 400 **differs from that of any existing system**, then the PPP protocol **assumes a new bundle of links exists and assigns the link to this new bundle**. … **Identification** of the endpoint system (commonly referred to as either an **"endpoint discriminator" or "endpoint identifier"**) is accomplished through class field 430 and address field 440, which collectively contain data carried by this packet. … For example, a class field having a value of illustratively zero, one or two specifies that the following address is a null class (i.e., the address is zero octets long), a locally assigned address, such as a serial number (having a length up to twenty octets), or an Internet Protocol (IP) address (having a length of four octets)." Thus, the "unique endpoint discriminator value" (also described as the "endpoint identifier") disclosed in Maurya is clearly seen to identify a particular multilink PPP session and is also used for adding or removing links from the multilink bundle, being consistent with the functionality described in the specification of the '908 Patent.

36. Continuing, on pages 20 and 21 of the Remarks, the Patent Owner argues that the secondary reference of Low does not teach a multilink session identification. But with this, the Examiner notes that the reference of Low is not being relied on to teach the claimed "multilink session identification".

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37. As discussed above, Maurya is seen to disclose at least one processor configured to "transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification [*sic*] *[and]* the destination IP address". But in this regard, the reference of Maurya does not expressly disclose if the first and second messages include a multilink session identification *[and]* a **destination URL**, as currently recited in independent claim 1, and similarly in claim 13.

38. But the secondary reference of Low discloses a client device that transmits messages through a network interface, whereby one message includes a destination URL, as seen in Fig. 4, with the terminal 31 transmitting a message 38 to a server 32 that includes a destination URL. In addition, as read on page 11, line 12-page 13, line 15, Low states "A cornerstone of the WWW is its ability to address particular information resources by means of an Uniform Resource Locator (URL) that identifies a resource by location…By way of example, a full or 'absolute' URL will comprise the following elements:…the Internet host domain or IP address…This request includes a request method, and the 'Request-URI' (which is generally just the absolute path of the resource on the server as identified by the 'abs-path' element of the URI); the request may include additional data elements."

39. With this, it would have been obvious for one of ordinary skill in the art to have include a destination URL, as recognized by Low, within the second message disclosed by Maurya. The suggestion/motivation for doing so would be that the client device of Maurya would conform with known protocols for communicating packets in systems utilizing point-to-point protocol

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(PPP), as discussed by Low in page 11, lines 21-page 12, line 28. In addition, in col. 9, lines 35-55, Maurya also states that "Other classes of addresses exist. Inasmuch as the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention, I will omit any further details of the latter two aspects." In this regard, Low describes that utilizing URLs for PPP communication of packets between user terminals and Internet service providers was well known, and thus, this modification of Maurya with the functionality taught in Low would easily be implemented with these well-known teachings, as exemplified by Low, and would yield predictable results.

40. Therefore, for the above reasons, the combination of Maurya and Low are seen to disclose the limitation that recites "transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification [*sic*] *[and]* the destination IP address", as recited in independent claim 1, and similarly in independent claim 13. Thus, for the above reasons, the rejection of claims 1 and 13, as well as dependent claims 2-3, 5-6, and 13-15, under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Maurya in view of Low, is maintained and repeated herein.

Conclusion

41. The Patent Owner is reminded of the continuing responsibility under 37 CFR 1.565(a) to apprise the Office of any litigation activity, or other prior or concurrent proceeding, involving U.S. Patent 10,868,908 throughout the course of this reexamination proceeding. See MPEP §§ 2207, 2282, and 2286.

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42. **THIS ACTION IS MADE FINAL.**

A shortened statutory period for response to this action is set to expire TWO MONTHS from the mailing date of this action.

Extensions of time under 37 CFR 1.136(a) do not apply in reexamination proceedings. The provisions of 37 CFR 1.136 apply only to "an applicant" and not to parties in a reexamination proceeding. Further, in 35 U.S.C. 305 and in 37 CFR 1.550(a), it is required that reexamination proceedings "will be conducted with special dispatch within the Office."

Extensions of time in reexamination proceedings are provided for in 37 CFR 1.550(c). A request for extension of time must specify the requested period of extension and it must be accompanied by the petition fee set forth in 37 CFR 1.17(g). Any request for an extension in a third party requested ex parte reexamination must be filed on or before the day on which action by the patent owner is due, and the mere filing of a request will not effect any extension of time. A request for an extension of time in a third party requested ex parte reexamination will be granted only for sufficient cause, and for a reasonable time specified. Any request for extension in a patent owner requested ex parte reexamination (including reexamination ordered under 35 U.S.C. 257) for up to two months from the time period set in the Office action must be filed no later than two months from the expiration of the time period set in the Office action. A request for an extension in a patent owner requested ex parte reexamination for more than two months from the time period set in the Office action must be filed on or before the day on which action by the patent owner is due, and the mere filing of a request for an extension for more than two months will not effect the extension. The time for taking action in a patent owner requested ex parte reexamination will not be extended for more than two months

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from the time period set in the Office action in the absence of sufficient cause or for more than a reasonable time.

The filing of a timely first response to this final rejection will be construed as including a request to extend the shortened statutory period for an additional two months. In no event, however, will the statutory period for response expire later than SIX MONTHS from the mailing date of the final action. See MPEP § 2265.

43. **All** correspondence relating to this *ex parte* reexamination proceeding should be directed:

By Mail to: Mail Stop *Ex Parte* Reexam
Central Reexamination Unit
Commissioner for Patents
United States Patent & Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

By FAX to: (571) 273-9900
Central Reexamination Unit

By hand: Customer Service Window
Randolph Building
401 Dulany Street
Alexandria, VA 22314

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Any inquiry concerning this communication or earlier communications from the Reexamination Legal Advisor or Examiner, or as to the status of this proceeding, should be directed to the Central Reexamination Unit at telephone number (571) 272-7705.

Signed:

/JOSEPH R POKRZYWA/
Primary Examiner, Art Unit 3992
(571) 272-7410

Conferees:

/ERON J SORRELL/
Primary Examiner, Art Unit 3992
/MICHAEL FUELLING/
Supervisory Patent Examiner, Art Unit 3992

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Office Action in Ex Parte Reexamination	**Control No.** 90/019,265	**Patent Under Reexamination** 10868908	
	Examiner JOSEPH R POKRZYWA	**Art Unit** 3992	**AIA (FITF) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

a. ☑ Responsive to the communication(s) filed on 13 August 2024.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

b. ☑ This action is made FINAL.

c. ☐ A statement under 37 CFR 1.530 has not been received from the patent owner.

A shortened statutory period for response to this action is set to expire 2 month(s) from the mailing date of this letter. Failure to respond within the period for response will result in termination of the proceeding and issuance of an *ex parte* reexamination certificate in accordance with this action. 37 CFR 1.550(d). **EXTENSIONS OF TIME ARE GOVERNED BY 37 CFR 1.550(c).** If the period for response specified above is less than thirty (30) days, a response within the statutory minimum of thirty (30) days will be considered timely.

Part I THE FOLLOWING ATTACHMENT(S) ARE PART OF THIS ACTION:

1. ☐ Notice of References Cited by Examiner, PTO-892.
2. ☐ Information Disclosure Statement, PTO/SB/08.
3. ☐ Interview Summary, PTO-474.
4. ☐ _____.

Part II SUMMARY OF ACTION

1a. ☑ Claims 1-3,5-6 and 13-15 are subject to reexamination.

1b. ☑ Claims 4,7-12 and 16-17 are not subject to reexamination.

2. ☐ Claims _____ have been canceled in the present reexamination proceeding.

3. ☐ Claims _____ are patentable and/or confirmed.

4. ☑ Claims 1-3,5-6 and 13-15 are rejected.

5. ☐ Claims _____ are objected to.

6. ☐ The drawings, filed on _____ are acceptable.

7. ☐ The proposed drawing correction, filed on _____ has been (7a) ☐ approved (7b) ☐ disapproved.

8. ☐ Acknowledgment is made of the priority claim under 35 U.S.C. 119(a)-(d) or (f).

   a) ☐ All b) ☐ Some* c) ☐ None of the certified copies have

   1 ☐ been received.

   2 ☐ not been received.

   3 ☐ been filed in Application No. _____.

   4 ☐ been filed in reexamination Control No. _____.

   5 ☐ been received by the International Bureau in PCT application No. _____.

   * See the attached detailed Office action for a list of the certified copies not received.

9. ☐ Since the proceeding appears to be in condition for issuance of an *ex parte* reexamination certificate except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte* Quayle, 1935 C.D. 11, 453 O.G. 213.

10. ☐ Other: _____

cc: Requester (if third party requester)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Reexam Control No.:	**90/019,265**
Patent Owner:	Competitive Access Systems, Inc.
Conf. No.:	3396
Filed:	October 4, 2023
Title:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
Art Unit:	3992
Examiner:	Joseph R. Pokrzywa
Docket No.:	COM908

PETITION TO WITHDRAW FINALITY OF OFFICE ACTION

Director of the United States Patent and Trademark Office
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22314-1450

Pursuant to 37 C.F.R. § 1.181, this Petition respectfully requests that the Office withdraw the finality of the Office Action dated October 2, 2024, in an *ex parte* reexamination and reissue the office action as a non-final office action with a new two-month deadline for response ("Petition"). Pursuant to 37 C.F.R. § 1.182, Petitioner respectfully requests that the Office expedite this Petition as the Office Action relates to a patent subject to *ex parte* reexamination with a December 2, 2024, deadline to file a Notice of Appeal ("Request").

U.S. Patent 10,868,908 ("'908 Patent") is involved in an *ex parte* reexamination (as identified above). The following events are relevant to this Petition:

1. On June 13, 2024, the Office issued a non-final office action ("NFOA") (attached as **Exhibit 1**). The NFOA rejected claims 1-3, 5-6, and 13-15 under pre-AIA 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,160,808, issued to Maurya ("Maurya") in view of WO 97/22212, with the inventor of Low ("Low"). Maurya and Low were the only prior art references used in the NFOA.
2. On August 13, 2024, the Patent Owner submitted a response to the non-final office action ("Response") (attached as **Exhibit 2**).
3. On October 2, 2024, the Office issued a final office action ("FOA") (attached as **Exhibit 3**).

4. The deadline to file a Notice of Appeal in response to the FOA is December 2, 2024.

Patent Owner requests that the Director withdraw the finality of the Office Action dated October 2, 2024, and reissue the office action as a non-final office action with a new two-month deadline for response because: (1) the Office has made new rejections based on the two references; and (2) the Office failed to provide any acknowledgment of, or response to, important arguments presented in the Response.

First Grounds for Petition: The Final Office Action Includes New Grounds for Rejection

The finality of the FOA was improper because new grounds for rejection were introduced that were not previously raised in the NFOA, including new claim interpretations for the term "multilink session identification" that appears in independent claims 1 and 13.

Independent claims 1 and 13 of the '908 Patent include the following language, specifically the term "multilink session identification" (emphasis added):

> **Claim 1**: transmit a second message through the second network interface to the server, wherein the second message includes **a multilink session identification** [and] the destination URL;
>
> **Claim 13**: transmit a second message through the network interface to a third device, wherein the second message includes **a multilink session identification** that is unique to the multilink session and the destination URL, the network interface to the third device having a data transfer rate associated therewith; and

The following quote from pages 13-14 of the NFOA includes what was stated related to the term "multilink session identification" in the NFOA for claim 1:

> transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification ***[and] the destination IP address*** [see col. 7, line 22-39; also see col. 8, lines 20-59, wherein "FIG. 2 depicts a format of conventional generalized LCP packet 200. As shown, packet 200 is formed of eight-bit code field 210, eight-bit identifier field 220, sixteen-bit length field 230 and finally variable-length data field 240. This packet can be any one of several types, with the value of the code field, having values typically ranging from one to thirteen, specifying the type of any such packet. Of note, a value of one indicates that the packet is an LCP Configure Request packet. Such a request packet is sent by a PPP peer whenever that peer desires to change a configuration parameter, such as from a default value, associated with the link."; also see col. 8, line 60-col. 9, line 67, wherein "Each specific option has to be

separately negotiated between the PPP peers and appropriately acknowledged prior to its use. Inasmuch as the only values for this type field, i.e., the only configuration options, that are relevant to understanding the invention are 17, 18 and 19, which designate a multi-link MRRU (Multi-link Maximum Receive Reconstructed unit) request, **a multi-link Short Sequence Number** header request and a "multi-link endpoint discriminator" option, respectively (which will all be discussed in detail below in conjunction with FIG. 5)...Each such multi-link PPP packet contains a sequence number--which increases by one with each successive packet, inserted by the multi-link protocol."; also see col. 1 0, lines 6-53, wherein "These formats are depicted as long and short sequence number formats 510 and 550 having 24-and 12-bit sequence numbers, respectively. The specific format of the multi-link PPP packet to use in any situation can be specified by a PPP sender by transmitting an LCP Configuration Request message for a Multi-link Maximum Receive Reconstructed Unit (MRRU) format, i.e., designating long sequence number format 5 10, or a Multi-link Short Sequence Number Header format, i.e., designating short sequence number format 550, coupled with successful negotiations with its PPP peer therefor. Use of format 510 or 550 is requested by a type field having a value of 17 or 18, respectively, in an LCP Configure Request message, as noted above, transmitted by the PPP sender to its PPP peer."; and ...

The following quote from pages 24-25 of the NFOA includes what was stated related to the term "multilink session identification" in the NFOA for claim 13:

transmit a second message through the network interface **to a third device** [with the third device seen as being another one of the DCEs 660, such as DCE 660_2, as seen in Fig. 6A], wherein the second message includes a multilink session identification that is unique to the multilink session and the destination **IP address**, the network interface to the third device having a data transfer rate associated therewith [see col. 7, line 22-39; also see col. 8, lines 20-59, wherein "FIG. 2 depicts a format of conventional generalized LCP packet 200. As shown, packet 200 is formed of eight-bit code field 210, eight-bit identifier field 220, sixteen-bit length field 230 and finally variable-length data field 240. This packet can be any one of several types, with the value of the code field, having values typically ranging from one to thirteen, specifying the type of any such packet. Of note, a value of one indicates that the packet is an LCP Configure Request packet. Such a request packet is sent by a PPP peer whenever that peer desires to change a configuration parameter, such as from a default value, associated with the link."; also see col. 8, line 60-col. 9, line 67, wherein "Each specific option has to be separately negotiated between the PPP peers and appropriately acknowledged prior to its use. Inasmuch as the only values for this type field, i.e., the only configuration options, that are relevant to understanding the invention are 17, 18 and 19, which designate a multi-link MRRU (Multi-link Maximum Receive Reconstructed unit) request, **a multi-link Short Sequence Number** header request and a "multi-link endpoint discriminator" option, respectively (which will

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> all be discussed in detail below in conjunction with FIG. 5). … Each such multi-link PPP packet contains a sequence number--which increases by one with each successive packet, inserted by the multi-link protocol."; also see col. 10, lines 6-53, wherein "These formats are depicted as long and short sequence number formats 510 and 550 having 24- and 12-bit sequence numbers, respectively. The specific format of the multi-link PPP packet to use in any situation can be specified by a PPP sender by transmitting an LCP Configuration Request message for a Multi-link Maximum Receive Reconstructed Unit (MRRU) format, i.e., designating long sequence number format 510, or a Multi-link Short Sequence Number Header format, i.e., designating short sequence number format 550, coupled with successful negotiations with its PPP peer therefor. Use of format 5 10 or 550 is requested by a type field having a value of 17 or 1 8, respectively, in an LCP Configure Request message, as noted above, transmitted by the PPP sender to its PPP peer."]; and …

These sections in the NFOA are devoid of analysis as to what terms from the prior art references Maurya and Low the Examiner believes are equivalent or equated to the claimed "multilink session identification." In fact, there is no discussion in the NFOA that correlates to what appears on page 33 of the FOA, section 27:

> Thus, "mutli-link Short Sequence Number" or the "endpoint discriminator" value (also described as the "endpoint identifier") each described in Maurya, are seen to identify a particular multilink PPP session, being the defining function of the "multilink session identification" discussed in the specification of the '908 Patent.

The NFOA is never clear that in the rejection of independent claims 1 and 13 the Office is equating the "multilink session identification" to either the "multi-link Short Sequence Number" or the "endpoint discriminator value."

In the recitations from the NFOA quoted above, the Office references "**a multi-link Short Sequence Number** header request" and a "multi-link endpoint discriminator option." But, in the NFOA, neither of these terms are identified by the Office as being equated to a "multilink session identification," as recited in independent claims 1 and 13. There is no statement, explicit or implicit, in the NFOA that the Office believes the "multilink session identification" is equivalent to Maurya's "multi-link Short Sequence Number" or "endpoint discriminator value." Without such a defining statement in the NFOA, the rejections in the FOA are new. Moreover, the cited portions from the NFOA refer to "a multi-link Short Sequence Number header request," but never to a "multi-link Short Sequence Number," and a "multi-link endpoint discriminator option," but never to a "multi-link endpoint discriminator value." The Office's evolving terminology and

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characterizations highlight the fact that the argument made in the FOA is not the same argument that was made in the NFOA.

The lack of clarity as to the rejections in the NFOA was expressed in Patent Owner's Response. On page 15 of the Response, Patent Owner stated it is "unclear whether the Office intends to equate the claimed multilink session identification to Maurya's multi-link Short Sequence Number or to Maurya's endpoint discriminator." The Response then discussed on pages 15-16 why the multilink session identification was not equivalent to the "multi-link short sequence number." Then, on page 16, subsection ii, the Response states "[a]lthough the Office Action does not make any argument that Maurya teaches the multilink session identification claim element in independent claims 1-3, 5-6, and 13-15," the Response discussed the arguments presented in the "Request for Ex Parte Reexamination" by a third-party requester. The Response never addressed the idea that the "multilink session identification" was equivalent to the "endpoint discriminator value," nor was that argument presented in the NFOA for the rejection of claims 1 and 13. As such, the arguments that a "multilink session identification" is equivalent to a "multi-link Short Sequence Number" or to an "endpoint discriminator value" as described in Maurya are new rejections.

These new rejections require the Patent Owner to address substantially different arguments as presented in the FOA than those previously presented in the NFOA, and as such, the FOA should be designated a non-final office action as is warranted under MPEP §§ 706.07(a) and 1207.03(a). MPEP § 1207.03(a) stipulates that a final rejection is improper when new grounds are introduced. According to MPEP §§ 706.07(a) and 1207.03(a), an Office Action should be designated as final only if the rejection is based on issues previously raised by the examiner in earlier office actions. Since the new rejections in the FOA present arguments that were not part of the NFOA, there has been no opportunity to respond to the new grounds of rejection. This improper finality of the FOA limits the Patent Owner's ability to fully address the rejections in this important *ex parte* reexamination.

For the reasons set forth above, the Patent Owner respectfully requests that the Director withdraw the finality of the final office action dated October 2, 2024, and reissue the office action as a non-final office action to allow for proper prosecution of the patent in the *ex parte* reexamination proceeding.

Second Grounds for Petition: The Final Office Action Failed to Address Patentee's OSI Model-Related Arguments Made in the Response

In addition, the FOA should be designated a non-final office action because the Office failed to address or respond to the important arguments discussed on pages 17-20 of the Response. The Office addresses pages 15 and 16 of the Response on pages 33-37, sections 28-35, of the FOA. Then, the Office addresses pages 20-21 of the Response on page 37, section 36 of the FOA. However, the Office skipped over pages 17-20 of the Response and failed to provide any response to Patent Owner's OSI-related arguments anywhere in the FOA. This skipped portion of the Response is particularly relevant for how a person of ordinary skill in the art would understand the invention in terms of the OSI model (Open Systems Interconnection model). The '908 Patent multilink protocol uses different OSI layers to accomplish what is shown in the first embodiment of the system shown in Fig. 7 of the '908 Patent, the second embodiment of the invention as shown in Fig. 8 of the '908 Patent, and the third embodiment of the invention as shown in Fig. 9 of the '908 Patent. A person of ordinary skill in the art's understanding of the OSI model is needed to understand the protocol described in the '908 Patent's specification and distinguish it from the prior art. As understood by a person of ordinary skill in the art, the '908 Patent's protocol creates a multilink bundle from different connections across one or more networks using OSI layers 3-7.

Evidence of this can be seen in dependent claim 5 of the '908 Patent, in which the first network interface and the second network interface may be any of a cellular interface, a Wi-Fi interface, a wireless interface, a cable interface, a wired interface, an Ethernet interface, a Bluetooth interface, a near-field communication interface, and an optical interface. Accordingly, the first network interface and second network interface may be devices that are connected over different networks, not a single homogeneous network, as described in Maurya. In contrast, Maurya's disclosure describes only an OSI layer 2 implementation of a multilink bundle and multilink system. This difference is a significant fact distinguishing the '908 Patent from the prior art. Thus, the Office should have provided a response to these important arguments.

This Petition respectfully requests that the Office withdraw the finality of the FOA dated October 2, 2024, and reissue the office action as a non-final office action with a new two-month deadline for response.

Respectfully Submitted,

K&L Gates LLP

By: /M. Clare Frederick/
M. Clare Frederick
Reg. No. 66,608
Telephone No. (312) 807-4335
Customer No. 29156

Dated: October 30, 2024

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Alexandria, VA 22313 - 1450
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APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
90/019,265	**10/31/2024 05:44:33 PM Z ET**	**COM908**

Title of Invention

DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS

Application Information

APPLICATION TYPE	Utility / ex parte reexam	PATENT #	10868908
CONFIRMATION #	3396	FILED BY	Joshua Brooks
PATENT CENTER #	67785757	FILING DATE	10/04/2023
CUSTOMER #	29156	FIRST NAMED INVENTOR	- 10868908
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Clare Frederick

Documents

TOTAL DOCUMENTS: 5

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
3725791-00005_Exh3.pdf	44	Reexam Miscellaneous Incoming Letter	2921 KB
3725791-00005_Exh2.pdf	22	Reexam Miscellaneous Incoming Letter	15523 KB
3725791-00005_Exh1.pdf	35	Reexam Miscellaneous Incoming Letter	22273 KB
3725791.00005_Petition to Withdraw Finality of Office Action.pdf	7	Petition for review by the Office of Petitions	170 KB
3725791.00005_Request to Expedite under 37 CFR Section 1.182.pdf	2	Petition for review by the Office of Petitions	128 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
3725791-00005_Exh3.pdf	92B2A748DCB9965F7208DADC7358BB623FD6CD9D2C011D8F E60950255A8C255B8B0A9E180E3F8F35EB39519059AF1BDD1 EB21496CD209685BABF1FA090372522
3725791-00005_Exh2.pdf	0E25FA15CAECF15495D5472DBFB5F5D733D6F486978522BD9 5C9204C7683DE47361D65F85F6C608A825EBE6346BE82963B A6D41686674AA7E25A580354DFD3A9
3725791-00005_Exh1.pdf	56B21B0099E478932AD7077A9353BFD0A27D06F85B6F310E1 A9E185F5B3A2B9DEF9990FD631DECADA7454C615132082EA 35603F443386F489205ACC6A0C80753
3725791.00005_Petition to Withdraw Finality of Office Action.pdf	29D7146388EE86BAA48CF90206A0210FCF07D89FB7A0A117E 8630B424CC40AFBCBEFFB6715452B094D20CDD20FF20170D A0BBB1B9327EA29A398D8945A438C35
3725791.00005_Request to Expedite under 37 CFR Section 1.182.pdf	EBB94E9F6BB199CB8FABC01DBF82276038AC3547F6C6FB12 84148F7FCE6BB9050D427D23340FDC0C38BC0758A82E34BA E240E6F9ED7B810F5628C1E4C09CF15E

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
90/019,265	10/09/2023	10868908	COM9908	3396

29156 7590 10/02/2024
K&L Gates LLP-ADMINRPL
P.O. Box 1135
CHICAGO, IL 60690

EXAMINER	
POKRZYWA, JOSEPH R	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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EX PARTE REEXAMINATION COMMUNICATION TRANSMITTAL FORM

REEXAMINATION CONTROL NO. *90/019,265* .

PATENT UNDER REEXAMINATION *10868908* .

ART UNIT *3992* .

Enclosed is a copy of the latest communication from the United States Patent and Trademark Office in the above identified *ex parte* reexamination proceeding (37 CFR 1.550(f)).

Where this copy is supplied after the reply by requester, 37 CFR 1.535, or the time for filing a reply has passed, no submission on behalf of the *ex parte* reexamination requester will be acknowledged or considered (37 CFR 1.550(g)).

PTOL-465 (Rev.07-04)

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DETAILED ACTION

Brief Summary

1. This is a final Office action regarding the reexamination of U.S. Application 90/019,265, being a reexamination of U.S. Patent 10,868,908, issued to Eric M. DeLangis (hereafter "the '908 Patent").

2. The '908 Patent originally issued on December 15, 2020, with patented claims 1-17, being filed as U.S. Patent Application 15/161,787 (hereafter "the original '787 Application") on May 23, 2016. The original '787 Application was filed as a continuation of U.S. Application 14/512,414, filed on October 11, 2014, now U.S. Patent 9,350,649, which is a continuation of U.S. Application 13/531,294, filed on June 22, 2012, now U.S. Patent 8,861,349, which is a continuation of U.S. Application 12/581,852, filed on October 19, 2009, now U.S. Patent 8,228,801, which is a continuation of U.S. Application 10/686,375, filed on October 14, 2003, now U.S. Patent 7,606,156. The original '787 Application claims priority to provisional U.S. Application 60/418,521, filed on October 15, 2002.

3. Reexamination of patented claims 1-3, 5, 6, and 13-15 of the '908 Patent was ordered on January 2, 2024, whereby a substantial new question was raised by the Third Party's request for *ex parte* reexamination filed October 4, 2023. Subsequently, the Patent Owner filed a Patent Owner Statement pursuant to 37 CFR 1.530 on March 1, 2024. In response, the Third Party Requester filed a Reply on April 30, 2024.

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4. Further, the Examiner notes that because the '908 Patent was filed as multiple continuations of applications, dating back to October 14, 2003, the '908 Patent would now appear to be expired. With this, MPEP 2240 states, in part:

> In making the determination of whether to order reexamination, the Office will determine the proper meaning of the patent claims by giving the claims their broadest reasonable interpretation consistent with the specification (see *In re Yamamoto*, 740 F.2d 1569 (Fed. Cir. 1984)), **except in the case of an expired patent (in a reexamination involving claims of an expired patent, claim construction is pursuant to the principle set forth by the court in *Phillips* v. *AWH Corp.*, 415 F.3d 1303, 1316, 75 USPQ2d 1321, 1329 (Fed. Cir. 2005) (words of a claim "are generally given their ordinary and customary meaning" as understood by a person of ordinary skill in the art in question at the time of the invention**, see *Ex parte Papst-Motoren*, 1 USPQ2d 1655 (Bd. Pat. App. & Inter. 1986)). If reexamination is ordered, the patent owner statement, if applicable, and any accompanying information submitted pursuant to 37 CFR 1.501(a)(2) will be considered during the examination stage to the fullest extent possible when determining the scope of any claims of the patent which are subject to reexamination. [Emphasis added].

5. Thus, since the '908 Patent would be expired, the claim construction will be pursuant to the principle set forth by the court in *Phillips*, whereby the "words of a claim 'are generally given their ordinary and customary meaning' as understood by a person of ordinary skill in the art in question at the time of the invention."

6. The present application is being examined under the pre-AIA first to invent provisions.

Claim Rejections - 35 USC § 103

7. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis (i.e., changing from AIA to pre-AIA) for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

8. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. **Claims 1-3, 5-6, and 13-15** is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,160,808, issued to MAURYA, Sanjiv Kumar (noted herein as "Maurya", being cited in the previous Office action), in view of International Patent Application Publication WO 97/22212, with the inventor of LOW, Colin *et al.*, being published on June 19, 1997 (noted herein as "Low", being cited in the previous Office action).

Regarding ***claim 1***, Maurya discloses a client device [being the client 605, which includes PC 610 connected through communication interfaces 612 to terminal adapters 620, as seen in Fig. 6A] for multilink data packet communication with a server [server 650, see Fig. 6A; also see col. 11, line 34-col. 12, line 10, wherein "With the above discussion of conventional multi-link PPP in mind , consider FIG. 6A which depicts a high level block diagram of illustrative multi-

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link client-server apparatus 600, which incorporates the teachings of the present invention. Here, client 605 is inter-connected to server 650 through multiple ISDN BRI (basic rate interface) lines 630."], the client device comprising:

a first network interface having a first data transfer rate associated with a first path from the server to the first network interface of the client device [one of the communication interfaces 612, combined with the ISDN BRI terminal adapter (TA) 1, 620_1, through path 615_1, as seen in Fig. 6A; also see col. 11, line 34-col. 13, line 8, wherein "In that regard, links 615, which comprise links 615_1, 615_2, . . . , 615_n, connect separate terminal adapters 620_1, 620_2, . . . , 620_n, respectively, to separate corresponding serial ports provided by communication interfaces 612. . . . ISDN connections are extended from terminal adapters 620, through public switched telephone network (PSTN) 640, to server 650 having corresponding identical terminal adapters 660, as DCE, and server computer 665, as DTE. Each one of terminal adapters 620 is connected through a separate pair of ISDN B-channels and the PSTN, to a separate corresponding one of terminal adapters 660, the latter terminal adapters collectively connected, via links 662, to server computer 665. Each of adapters 660 is illustratively identical to each of adapters 620."; also see col. 17, lines 36-57, wherein "However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."];

a second network interface having a second data transfer rate associated with a second path from the server to the second network interface of the client device [being another one of the communication interfaces 612, combined with the ISDN BRI terminal adapter 2, 620_2, through path 615_2, as seen in Fig. 6A; also see col. 11, line 34-col. 13, line 8, wherein "In that

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regard, links 615, which comprise links 615_1, 615_2, . . . , 615_n, connect separate terminal adapters 620_1, 620_2, . . . , 620_n, respectively, to separate corresponding serial ports provided by communication interfaces 612. ... ISDN connections are extended from terminal adapters 620, through public switched telephone network (PSTN) 640, to server 650 having corresponding identical terminal adapters 660, as DCE, and server computer 665, as DTE. Each one of terminal adapters 620 is connected through a separate pair of ISDN B-channels and the PSTN, to a separate corresponding one of terminal adapters 660, the latter terminal adapters collectively connected, via links 662, to server computer 665. Each of adapters 660 is illustratively identical to each of adapters 620."; also see col. 17, lines 36-57, wherein "However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used,"; also see col. 17, lines 36-57, wherein "However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."]; and

at least one processor configured to:

transmit a first message through the first network interface to the server, wherein the first message includes a multilink request ***[and] a destination IP address*** [see col. 7, line 22-39, wherein "At this point with no activity on the link, a link control protocol (LCP), which as part of the PPP protocol, exercises responsibility for establishing and configuring the link, remains in an initial or starting state."; also see col. 8, lines 20-39, wherein "FIG. 2 depicts a format of conventional generalized LCP packet 200. As shown, packet 200 is formed of eight-bit code

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field 210, eight-bit identifier field 220, sixteen-bit length field 230 and finally variable-length data field 240. This packet can be any one of several types, with the value of the code field, having values typically ranging from one to thirteen, specifying the type of any such packet. Of note, a value of one indicates that the packet is an LCP Configure Request packet. Such a request packet is sent by a PPP peer whenever that peer desires to change a configuration parameter, such as from a default value, associated with the link."; also see col. 9, lines 14-55, wherein "The endpoint discriminator packet identifies, by specifying an address, of an end system (an "endpoint"), then situated on an end of a link, that is transmitting this particular packet. ... For example, a class field having a value of illustratively zero, one or two specifies that the following address is a null class (i.e., the address is zero octets long), a locally assigned address, such as a serial number (having a length up to twenty octets), or an Internet Protocol (IP) address (having a length of four octets). Other classes of addresses exist. Inasmuch as the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention, I will omit any further details of the latter two aspects."];

transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification ***[and] the destination IP address*** [see col. 7, line 22-39; also see col. 8, lines 20-59, wherein "FIG. 2 depicts a format of conventional generalized LCP packet 200. As shown, packet 200 is formed of eight-bit code field 210, eight-bit identifier field 220, sixteen-bit length field 230 and finally variable-length data field 240. This packet can be any one of several types, with the value of the code field, having values typically ranging from one to thirteen, specifying the type of any such packet. Of note, a value of one indicates that the packet is an LCP Configure Request packet. Such a request

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packet is sent by a PPP peer whenever that peer desires to change a configuration parameter, such as from a default value, associated with the link."; also see col. 8, line 60-col. 9, line 67, wherein "Each specific option has to be separately negotiated between the PPP peers and appropriately acknowledged prior to its use. Inasmuch as the only values for this type field, i.e., the only configuration options, that are relevant to understanding the invention are 17, 18 and 19, which designate a multi-link MRRU (Multi-link Maximum Receive Reconstructed unit) request, **a multi-link Short Sequence Number** header request and a "multi-link endpoint discriminator" option, respectively (which will all be discussed in detail below in conjunction with FIG. 5). … Each such multi-link PPP packet contains a sequence number--which increases by one with each successive packet, inserted by the multi-link protocol."; also see col. 10, lines 6-53, wherein "These formats are depicted as long and short sequence number formats 510 and 550 having 24- and 12-bit sequence numbers, respectively. The specific format of the multi-link PPP packet to use in any situation can be specified by a PPP sender by transmitting an LCP Configuration Request message for a Multi-link Maximum Receive Reconstructed Unit (MRRU) format, i.e., designating long sequence number format 510, or a Multi-link Short Sequence Number Header format, i.e., designating short sequence number format 550, coupled with successful negotiations with its PPP peer therefor. Use of format 510 or 550 is requested by a type field having a value of 17 or 18, respectively, in an LCP Configure Request message, as noted above, transmitted by the PPP sender to its PPP peer."]; and

receive data packets from the server through the first and second network interfaces of the client device during the multilink session [see col. 10, line 6-col. 11, line 28; also see col. 14, lines 22-57, wherein "As a result, server computer 665, by virtue of the common endpoint discriminator associated the application executing at client PC 610 and with every ISDN BRI (B

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channel pair) emanating from client 605, will then, through conventional multi-link protocol processing correctly view links 630 as a common bundle, i.e., a pipe, for packets generated by and destined to this application and handle packets appearing thereon as multi-link PPP packets."; also see col. 14, line 61-col. 15, line 11, wherein "First, a transmitting side device which transmits (e.g., any of devices 620 or 660) an incoming packet need not split any of these incoming packets but can alternate these packets between each of its physical links, i.e., applies these packets in a round-robin (or other predefined) fashion among its outgoing links. In this scenario, no changes need to be made to the contents of each of these incoming packets to transmit that packet through one or more levels in a hierarchy of multi-link PPP devices. A receiving side device merely passes the multi-link packets it receives to its associated DTE in increasing order of the sequence numbers of the packets its received, while ignoring beginning and ending flags in the multi-link header of each such packet"]

wherein the first data transfer rate and the second data transfer rate provide an increased data transfer rate of the first path and the second path from the server to the client device [see col. 2, line 32-col. 3, line 41, wherein "Second, as more users simultaneously contend for available network bandwidth at particular times, such as when the network experiences its peak daily loading, the network becomes increasingly congested. Hence, at these times, network traffic tends to slow which also tends to lengthen download time, thereby frustrating the users particularly those seeking relatively large files. ... Once successfully negotiated between two PPP peers, then, at a transmitting peer, multi-link PPP segments a packetized data stream (i.e., a PPP frame) into segments (or fragments), forms a stream of multi-link PPP packets each containing one such a segment, and then assigns these multi-link PPP packets on an approximately equal basis, where practical, between two B channels in the BRI connection for

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transmission to a receiving PPP peer; here the two B channels form a pipe. Small packets may not be segmented and to accommodate links of different speeds (which is not the case with two ISDN B channels), the segments need not be of the same size nor do the same number of segments need to be transmitted over each link."; also see col. 17, lines 20-57, wherein "Hence, through the present invention, a link in an original multi-link bundle and carrying multi-link PPP packets can itself be effectively divided (demultiplexed) into substantially any number of different paths with these paths being remotely and correctly recombined (multiplexed) so as to appear to be a link of the original multi-link bundle. … Furthermore, if all multi-link PPP links in a bundle have same data transmission rate such as two B-channels in an ISDN line, then each terminal adapter can simply send its incoming multi-link PPP packets as outgoing multi-link PPP packets on alternating B-channels without the need to encapsulate these packets with multi-multi-link protocol headers…However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."].

With this, as discussed above, Maurya is seen to disclose that the first and second messages include a multilink request and a destination IP address. But in this regard, the reference of Maurya does not expressly disclose if the first and second messages include a multilink request **and a destination URL**, as currently recited in independent claim 1.

However, the reference of Low discloses a client device that transmits messages through a network interface, whereby the message includes a multilink request [and] a destination URL

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[see Fig. 4, with the terminal 31 transmitting a message 38 to a server 32 that includes a request and a destination URL; also see page 11, line 12-page 13, line 15, wherein "A cornerstone of the WWW is its ability to address particular information resources by means of an Uniform Resource Locator (URL) that identifies a resource by location…By way of example, a full or 'absolute' URL will comprise the following elements:…the Internet host domain or IP address…This request includes a request method, and the 'Request-URI' (which is generally just the absolute path of the resource on the server as identified by the 'abs-path' element of the URI), the request may include additional data elements."; also see page 23, line 5-page 24, line 9].

With this, it would have been obvious for one of ordinary skill in the art to have include a destination URL in messages sent from the client to the server, as recognized by Low, within the first and second messages disclosed in Maurya. Maurya and Low are combinable because they are from the same field of endeavor, both being systems that perform multilink data packet communication. At the time of the invention, it would have been obvious to one of ordinary skill in the art to have the client device of Maurya include the functionality that "the first and second messages include a multilink request **and a destination URL**", as recognized by Low. The suggestion/motivation for doing so would be that the client device of Maurya would conform with known protocols for communicating packets in systems utilizing point-to-point protocol (PPP), as discussed by Low in page 11, lines 21-page 12, line 28 which states "In this case, the user terminal 34 will generally communicate with the ISP 33 over the public telephone system using a modem and employing either SLIP (Serial Line Interface Protocol) or PPP (Point-to-Point Protocol). These protocols allow Internet packets to traverse ordinary telephone lines. …A

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cornerstone of the WWW is its ability to address particular information resources by means of an Uniform Resource Identifier (URI) that will generally be either a Uniform Resource Locator that identifies a resource by location, or a Uniform Resource Name (URN) that can be resolved into an URL." Here, Low describes that utilizing URLs for PPP communication of packets between user terminals and Internet service providers was well known, and thus, this modification of Maurya with the functionality taught in Low would easily be implemented with these well-known teachings, as exemplified by Low, and would yield predictable results. In this regard, Maurya specifically states in col. 9, lines 42-55 that "Other classes of addresses exist. Inasmuch as the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention, I will omit any further details of the latter two aspects." Therefore, it would have been obvious to combine the teachings of Low of using a URL with the client device described in Maurya to obtain the invention specified in independent claim 1.

Regarding ***claim 2***, Maurya and Low disclose the client device discussed above in claim 1, and Maurya further teaches wherein the at least one processor further is configured to transmit the first message and the second message to at least one server [see Figs. 6A-8; also see col. 14, lines 22-60, wherein "Hence, for client-server apparatus 600 shown in FIG. 6A and through the teachings of my invention, a client application executing at client PC 610, during the course of configuring links 615 connecting the PC with terminal adapters 620, will establish its own endpoint discriminator value which, in turn, it will supply, via LCP Endpoint Discriminator packets during LCP negotiations, to each of terminal adapters 620. …As a result, server computer 665, by virtue of the common endpoint discriminator associated the application

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executing at client PC 610 and with every ISDN BRI (B channel pair) emanating from client 605, will then, through conventional multi-link protocol processing correctly view links 630 as a common bundle, i.e., a pipe, for packets generated by and destined to this application and handle packets appearing thereon as multi-link PPP packets."],

wherein the at least one server is a device providing the data packets, or a device that manages the client device and another device that is providing data to the client device [see Figs. 6A-8, which illustrates the server computer 665; also see col. 14, lines 22-60, wherein "As a result, server computer 665, by virtue of the common endpoint discriminator associated the application executing at client PC 610 and with every ISDN BRI (B channel pair) emanating from client 605, will then, through conventional multi-link protocol processing correctly view links 630 as a common bundle, i.e., a pipe, for packets generated by and destined to this application and handle packets appearing thereon as multi-link PPP packets."].

Regarding ***claim 3***, Maurya and Low disclose the client device discussed above in claim 1, and Maurya further teaches wherein a server provides the multilink session identification that is unique to the multilink session [see col. 5, lines 7-58, wherein "In accordance with my specific inventive teachings, setting identical endpoint discriminators is readily accomplished during LCP negotiations wherein **a multi-link PPP originator, such as, e.g., a server or a client application executing at a PC, assigns itself a unique endpoint discriminator value and informs all its immediate PPP peers**, such as neighboring terminal adapters, by sending the latter, via a first bundle of outgoing links, an LCP Endpoint Discriminator packet containing this value. Each of these immediate PPP peers, rather than assigning itself a unique endpoint discriminator value, assumes the value that has been provided to it in the LCP Endpoint

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Discriminator packet it receives from the originating device, as its own endpoint discriminator. Each of these peers then, in turn, sends an LCP Endpoint Discriminator packet containing its endpoint discriminator value (i.e., that of the originating multi-link PPP system), via a second bundle of outgoing links, to its immediate PPP peers, and so forth until all hierarchically inter-connected multi-link PPP peers at one end of the pipe and which fan-out from the originator have set their endpoint discriminator to a single common value, i.e., the endpoint discriminator of the multi-link PPP originator. Each multi-link PPP device situated in a final, e.g. m^{th}, level of hierarchically organized multi-link PPP peers supplies the common endpoint discriminator value, through an associated LCP Endpoint Discriminator packet and via a separate physical link in the pipe, to its remote multi-link PPP peer at the other end of the pipe. Consequently, all the links in this pipe will be viewed, by the multi-link protocol, as part of a common bundle."; also see col. 13, line 61-col. 14, line 60; also see col. 16, lines 9-55, wherein "Once this occurs, then process 700 progresses to step 730. **At this step, each of far-end terminal adapters 660 takes the endpoint discriminator value (the contents of both class field 430 and address field 440 shown in FIG. 4) sent by server computer 665 as part of an LCP Multi-link Endpoint Discriminator Option packet as its own endpoint discriminator**. Thereafter, this particular terminal adapter then negotiates with its near-end PPP peer, i.e., one of terminal adapters 620, and also negotiates to perform multi-link PPP with server computer 665, via links 662. During the course of LCP negotiations, **the far-end terminal adapter sends its peer near-end adapter an LCP Multi-link Endpoint Discriminator Option packet containing the endpoint discriminator value of the former adapter, i.e., that associated with the server computer**."].

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Regarding ***claim 5***, Maurya and Low disclose the client device discussed above in claim 1, and Maurya further teaches wherein each of the first network interface and the second network interface is **one or more of** cellular interface, Wi-Fi interface, a wireless interface, a cable interface, a wired interface, an Ethernet interface, a Bluetooth interface, a near-field communication interface, and an optical interface [see col. 11, line 34-col. 12, line 31, wherein "Here, client 605 is inter-connected to server 650 through multiple ISDN BRI (basic rate interface) lines 630. … Client 605 is formed of client PC 610, as DTE (data terminating equipment), **connected, through internal communication interfaces 612, typically separate serial ports (not specifically identified), and via corresponding links 615**, to multiple identical ISDN BRI terminal adapters 620 as DCE (data circuit terminating equipment)."; also see col. 3, lines 15-65; with this, these teachings in Maurya are seen to disclose a "wired interface"].

Regarding ***claim 6***, Maurya and Low disclose the client device discussed above in claim 1, and Maurya further teaches wherein the processor is configured to reorder the one or more data packets that are received over the at least two or more network interfaces of the client device during the multilink session [see col. 12, lines 32-65, wherein "In particular, as discussed above and depicted in FIG. 5, each multi-link PPP packet generated by client PC 610, shown in FIG. 6A, would contain a sequence number which increments by one from each multi-link PPP packet to the next in a common PPP frame. To ensure proper ordering, each of terminal adapters 660 would buffer each incoming multi-link PPP packet it receives, via links 630, from its corresponding PPP peer in adapters 620, and then reorder its received packets based on their sequence numbers, and then transmit only properly reordered packets to server computer

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665. Inasmuch as PC 610 is distributing the multi-link PPP packets, typically in sequential round-robin fashion, amongst terminal adapters 620, each one of terminal adapters 660 would receive packets having sequence numbers that increment not by the value one but by the integer value n; hence, skipping intervening sequence numbers. Under conventional multi-link protocol processing, if incoming multi-link PPP packets were received by any given terminal adapter, such as in adapters 660, but with gaps in their sequence numbers, then each of these terminal adapters would simply buffer these incoming packets pending receipt of those packets containing the missing (here skipped) sequence numbers."; also see col. 14, line 61-col. 16, line 5, wherein "To ensure proper re-ordering, upon ultimate reception at a far-end location, of multi-link PPP packets that are to be transmitted at each level, either of two approaches can be used inasmuch as both peer devices (in, e.g., adapters 620 and 660) realize that they are performing multi-multi-link PPP. First, a transmitting side device which transmits (e.g., any of devices 620 or 660) an incoming packet need not split any of these incoming packets but can alternate these packets between each of its physical links, i.e., applies these packets in a round-robin (or other predefined) fashion among its outgoing links. … Second, if either side at any level in the hierarchy desires to split its incoming multi-link packets, then each multi-link PPP device situated at that level encapsulates its incoming multi-link PPP packets as segment data into new outgoing multi-link PPP packets, which I refer to as "multi-multi-link" PPP packets. … Multi-multi-link header 692, has an identical format as that of header 505, but contains beginning and ending (B and E) flags and a sequence number pertinent to the segment data contained within packet 685. FCS field 696 serves the same function and is identical in format to FCS field 507 but has a value associated with the contents of: PPP link layer header 503, protocol and sequence number fields in header 692 and segment data 694."].

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Regarding ***claim 13***, Maurya discloses a first device [being the client 605, which includes PC 610 connected through communication interfaces 612 to terminal adapters 620, as seen in Fig. 6A] comprising:

a network interface [being the communication interfaces 612, as seen in Fig. 6A; also see col. 11, line 34-col. 13, line 8, wherein "In that regard, links 615, which comprise links 615_1, 615_2, . . . , 615_n, connect separate terminal adapters 620_1, 620_2, . . . , 620_n, respectively, to separate corresponding serial ports provided by communication interfaces 612. … ISDN connections are extended from terminal adapters 620, through public switched telephone network (PSTN) 640, to server 650 having corresponding identical terminal adapters 660, as DCE, and server computer 665, as DTE. Each one of terminal adapters 620 is connected through a separate pair of ISDN B-channels and the PSTN, to a separate corresponding one of terminal adapters 660, the latter terminal adapters collectively connected, via links 662, to server computer 665. Each of adapters 660 is illustratively identical to each of adapters 620."; also see col. 17, lines 36-57, wherein "However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."]; and

at least one processor configured to:

transmit a first message through the network interface to a second device [with the second device seen as being one of the DCEs 660, such as DCE 660_1, as seen in Fig. 6A], wherein the first message includes a multilink request and a destination ***IP address***, the network interface to the second device having a data transfer rate associated therewith

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[see col. 7, line 22-39, wherein "At this point with no activity on the link, a link control protocol (LCP), which as part of the PPP protocol, exercises responsibility for establishing and configuring the link, remains in an initial or starting state."; also see col. 8, lines 20-59, wherein "FIG. 2 depicts a format of conventional generalized LCP packet 200. As shown, packet 200 is formed of eight-bit code field 210, eight-bit identifier field 220, sixteen-bit length field 230 and finally variable-length data field 240. This packet can be any one of several types, with the value of the code field, having values typically ranging from one to thirteen, specifying the type of any such packet. Of note, a value of one indicates that the packet is an LCP Configure Request packet. Such a request packet is sent by a PPP peer whenever that peer desires to change a configuration parameter, such as from a default value, associated with the link."; also see col. 9, lines 14-55, wherein "The endpoint discriminator packet identifies, by specifying an address, of an end system (an "endpoint"), then situated on an end of a link, that is transmitting this particular packet. … For example, a class field having a value of illustratively zero, one or two specifies that the following address is a null class (i.e., the address is zero octets long), a locally assigned address, such as a serial number (having a length up to twenty octets), or an Internet Protocol (IP) address (having a length of four octets). Other classes of addresses exist. Inasmuch as the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention, I will omit any further details of the latter two aspects."];

transmit a second message through the network interface **to a third device** [with the third device seen as being another one of the DCEs 660, such as DCE 660_2, as seen in

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Fig. 6A], wherein the second message includes a multilink session identification that is unique to the multilink session and the destination ***IP address***, the network interface to the third device having a data transfer rate associated therewith [see col. 7, line 22-39; also see col. 8, lines 20-59, wherein "FIG. 2 depicts a format of conventional generalized LCP packet 200. As shown, packet 200 is formed of eight-bit code field 210, eight-bit identifier field 220, sixteen-bit length field 230 and finally variable-length data field 240. This packet can be any one of several types, with the value of the code field, having values typically ranging from one to thirteen, specifying the type of any such packet. Of note, a value of one indicates that the packet is an LCP Configure Request packet. Such a request packet is sent by a PPP peer whenever that peer desires to change a configuration parameter, such as from a default value, associated with the link."; also see col. 8, line 60-col. 9, line 67, wherein "Each specific option has to be separately negotiated between the PPP peers and appropriately acknowledged prior to its use. Inasmuch as the only values for this type field, i.e., the only configuration options, that are relevant to understanding the invention are 17, 18 and 19, which designate a multi-link MRRU (Multi-link Maximum Receive Reconstructed unit) request, **a multi-link Short Sequence Number** header request and a "multi-link endpoint discriminator" option, respectively (which will all be discussed in detail below in conjunction with FIG. 5). … Each such multi-link PPP packet contains a sequence number--which increases by one with each successive packet, inserted by the multi-link protocol."; also see col. 10, lines 6-53, wherein "These formats are depicted as long and short sequence number formats 510 and 550 having 24- and 12-bit sequence numbers, respectively. The specific format of the multi-link PPP packet to use in any situation can be specified by a PPP sender by

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transmitting an LCP Configuration Request message for a Multi-link Maximum Receive Reconstructed Unit (MRRU) format, i.e., designating long sequence number format 510, or a Multi-link Short Sequence Number Header format, i.e., designating short sequence number format 550, coupled with successful negotiations with its PPP peer therefor. Use of format 510 or 550 is requested by a type field having a value of 17 or 18, respectively, in an LCP Configure Request message, as noted above, transmitted by the PPP sender to its PPP peer."]; and

receive the different data packets through the at least one network interface from the second device and from the third device during the multilink session [see col. 10, line 6-col. 11, line 28; also see col. 14, lines 22-57, wherein "As a result, server computer 665, by virtue of the common endpoint discriminator associated the application executing at client PC 610 and with every ISDN BRI (B channel pair) emanating from client 605, will then, through conventional multi-link protocol processing correctly view links 630 as a common bundle, i.e., a pipe, for packets generated by and destined to this application and handle packets appearing thereon as multi-link PPP packets."; also see col. 14, line 61-col. 15, line 11, wherein "First, a transmitting side device which transmits (e.g., any of devices 620 or 660) an incoming packet need not split any of these incoming packets but can alternate these packets between each of its physical links, i.e., applies these packets in a round-robin (or other predefined) fashion among its outgoing links. In this scenario, no changes need to be made to the contents of each of these incoming packets to transmit that packet through one or more levels in a hierarchy of multi-link PPP devices. A receiving side device merely passes the multi-link packets it receives to its associated

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DTE in increasing order of the sequence numbers of the packets its received, while ignoring beginning and ending flags in the multi-link header of each such packet."],

wherein the data transfer rate associated with the network interface to the second device and the network interface to the third device provide an increased data transfer rate for the first device [see col. 2, line 32-col. 3, line 41, wherein "Second, as more users simultaneously contend for available network bandwidth at particular times, such as when the network experiences its peak daily loading, the network becomes increasingly congested. Hence, at these times, network traffic tends to slow which also tends to lengthen download time, thereby frustrating the users particularly those seeking relatively large files. ... Once successfully negotiated between two PPP peers, then, at a transmitting peer, multi-link PPP segments a packetized data stream (i.e., a PPP frame) into segments (or fragments), forms a stream of multi-link PPP packets each containing one such a segment, and then assigns these multi-link PPP packets on an approximately equal basis, where practical, between two B channels in the BRI connection for transmission to a receiving PPP peer; here the two B channels form a pipe. Small packets may not be segmented and to accommodate links of different speeds (which is not the case with two ISDN B channels), the segments need not be of the same size nor do the same number of segments need to be transmitted over each link."; also see col. 17, lines 20-57, wherein "Hence, through the present invention, a link in an original multi-link bundle and carrying multi-link PPP packets can itself be effectively divided (demultiplexed) into substantially any number of different paths with these paths being remotely and correctly recombined (multiplexed) so as to appear to be a link of the original multi-link bundle. ... Furthermore, if all multi-link PPP links in a bundle have

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same data transmission rate such as two B-channels in an ISDN line, then each terminal adapter can simply send its incoming multi-link PPP packets as outgoing multi-link PPP packets on alternating B-channels without the need to encapsulate these packets with multi-multi-link protocol headers…However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."].

With this, as discussed above, Maurya is seen to disclose that the first and second messages include a multilink request and a destination IP address. But in this regard, the reference of Maurya does not expressly disclose if the first and second messages include a multilink request and a **destination URL**, as currently recited in independent claim 13.

However, the reference of Low discloses a first device that transmits messages through a network interface, whereby the message includes a multilink request and a destination URL [see Fig. 4, with the terminal 31 transmitting a message 38 to a server 32 that includes a request and a destination URL; also see page 11, line 12-page 13, line 15, wherein "A cornerstone of the WWW is its ability to address particular information resources by means of an Uniform Resource Locator (URL) that identifies a resource by location…By way of example, a full or 'absolute' URL will comprise the following elements:…the Internet host domain or IP address…This request includes a request method, and the 'Request-URI' (which is generally just the absolute path of the resource on the server as identified by the 'abs-path' element of the

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URI); the request may include additional data elements."; also see page 23, line 5-page 24, line 9].

With this, it would have been obvious for one of ordinary skill in the art to have include a destination URL in messages sent from the client to the server, as recognized by Low, within the first and second messages disclosed in Maurya. Maurya and Low are combinable because they are from the same field of endeavor, both being systems that perform multilink data packet communication. At the time of the invention, it would have been obvious to one of ordinary skill in the art to have the client device of Maurya include the functionality that "the first and second messages include a multilink request **and a destination URL**", as recognized by Low. The suggestion/motivation for doing so would be that the client device of Maurya would conform with known protocols for communicating packets in systems utilizing point-to-point protocol (PPP), as discussed by Low in page 11, lines 21-page 12, line 28 which states "In this case, the user terminal 34 will generally communicate with the ISP 33 over the public telephone system using a modem and employing either SLIP (Serial Line Interface Protocol) or PPP (Point-to-Point Protocol). These protocols allow Internet packets to traverse ordinary telephone lines. ... A cornerstone of the WWW is its ability to address particular information resources by means of an Uniform Resource Identifier (URI) that will generally be either a Uniform Resource Locator that identifies a resource by location, or a Uniform Resource Name (URN) that can be resolved into an URL." Here, Low describes that utilizing URLs for PPP communication of packets between user terminals and Internet service providers was well known, and thus, this modification of Maurya with the functionality taught in Low would easily be implemented with these well-known teachings, as exemplified by Low, and would yield predictable results. In this regard,

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Maurya specifically states in col. 9, lines 42-55 that "Other classes of addresses exist. Inasmuch as the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention, I will omit any further details of the latter two aspects." Therefore, it would have been obvious to combine the teachings of Low of using a URL with the client device described in Maurya to obtain the invention specified in independent claim 13.

Regarding ***claim 14***, Maurya and Low disclose the first device discussed above in claim 13, and Maurya further teaches wherein the first device and the second device are separate devices or separate parts of the same device [see Fig. 6A, whereby the client 605, which includes PC 610 with communication interfaces 612, is separate from the DCE 660_1, being located at the server 650].

Regarding ***claim 15***, Maurya and Low disclose the first device discussed above in claim 13, and Maurya further teaches wherein the first device is **one of** a cell phone, a tablet, a switch, a server, a network device, a router, a computer, a Wi-Fi device, a Wi-Max device, a mobile communication device, a wireless communications device, a near-field communications device, and a Bluetooth device [see Fig. 6A, whereby the client 605 includes PC 610, which is seen to be "a computer" , as well as a "network device"].

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Response to Arguments

10. Patent Owner's arguments filed August 13, 2024 have been fully considered but they are not persuasive.

11. First, the Examiner notes that claims 1-3, 5-6, and 13-15 of the '908 Patent are currently subject to reexamination, whereby these claims 1-3, 5-6, and 13-15 of the '908 Patent each stand rejected under 35 U.S.C. 103(a) as being unpatentable over Maurya in view of Low. No amendments to the claims have been made, and the claims are in their original form. Further, of the claims subject to reexamination in this proceeding, claims 1 and 13 are independent, and these claims will be discussed below.

12. With this, beginning on page 13 of the Remarks dated August 13, 2024, the Patent Owner summarizes that the Examiner has not presented any argument that the cited art discloses a multilink session identification, that the endpoint discriminator taught by Maurya is not a multilink session identification, nor does it render obvious the use of a multilink session identification claimed in the '908 Patent, and that Low does not disclose, teach, or render obvious a second message that includes: a multilink session identification; and the destination URL.

13. In this regard, the specific argued limitations of independent claim 1 of the '908 Patent recites:

> "1. A client device for multilink data packet communication with a server, the client device comprising:
>
> ... at least one processor configured to:

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> ...
>
> transmit a first message through the first network interface to the server, wherein the first message includes a multilink request [sic] a destination URL;
>
> transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification [sic] the destination URL; ..."

14. Further, the specific argued limitations of independent claim 13 of the '908 Patent recites:

> "13. A first device comprising:
>
> ... at least one processor configured to:
>
> ...
>
> transmit a first message through the network interface to a second device, wherein the first message includes a multilink request and a destination URL, ... ;
>
> transmit a second message through the network interface to a third device, wherein the second message includes a multilink session identification that is unique to the multilink session and the destination URL, ..."

15. With this, in reviewing the instant claim language of claim 1, in its entirety, the claimed term of a "multilink session identification" is not specifically defined, as well as not specifically recited further. But in lines 17-19 of claim 1, the claim does recite "receive data packets ...during the multilink session". Thus, in reviewing claim 1, as a whole, the multilink session identification is seen to have the plain and ordinary meaning of the term "identification", such that the multilink session identification identifies a multilink session, with this multilink session subsequently being used to receive data packets. Further, the Examiner notes that dependent claim 3 further defines the "multilink session identification", requiring "a server provides the multilink session identification that is unique to the multilink session." This feature is

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specifically recited in independent claim 13, as noted above. With this, these claims require that the multilink session identification is unique, so as to identify the particular multilink session.

16. Looking further into the specification of the '908 Patent, in col. 12, line 1-col. 13, line 12, the '908 Patent is seen to describe the above noted claimed second message. Along this vein, in col. 12, lines 9-14, the '908 Patent states that "As part of a successful multilink PPP session setup, the initiating RCG - 85 receives a multilink PPP session ID, or "magic number", which is used to identify this particular multilink PPP session and is also used for adding or removing links from the multilink bundle - 87." Additionally, in col.. 12, lines 51-60, the '908 Patent states "The initiating RCG then selects which of the responding remote RCGs - 86 it will use for the multilink PPP bundle - 87 and sends them a multilink initialization packet containing the URL of the destination as well as the multilink PPP session ID (magic number) and any other pertinent information required for the remote RCG to join in the existing multilink PPP bundle - 87." Thus, with this, the claimed "multilink session identification" within the second message appears to be defined in the specification of the '908 Patent as a "magic number" that is described as being used "to identify this particular multilink PPP session and is also used for adding or removing links from the multilink bundle".

17. With this, referring back to the Remarks dated August 13, 2024 (hereafter "the Remarks"), on pages 13 and 14, the Patent Owner argues that the Office action fails to point to any disclosure of a "multilink session identification". In this regard, in review of the instant cited rejection and the claimed elements noted above, the combination of Maurya and Low is still seen to teach the limitation regarding the claimed "multilink session identification", such

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that Maurya teaches of the claimed "second message", which "includes a multilink session identification" and the combination of Maurya and Low teach that the second message includes the destination URL.

18. Particularly, with respect to Maurya, upon review of the reference, Maurya states in the Abstract that "Specifically, during LCP negotiations, a multi-link PPP originator assigns itself **a unique endpoint discriminator value and informs all its immediate PPP peers by sending the latter, via a first bundle of outgoing links, an LCP Endpoint Discriminator packet containing this value.** Each of these immediate PPP peers assumes, as its endpoint discriminator, the value that has been provided to it in the LCP Endpoint Discriminator packet it receives from the originator and then sends an LCP Endpoint Discriminator packet containing **this same endpoint discriminator value**, via a second bundle of outgoing links, to all of its immediate PPP peers." Here, this "unique endpoint discriminator value", as described in the Abstract, appears to be used to identify the particular multilink PPP session, being required by the plain meaning of the claim term, and consistent with the "multilink session identification" described in the specification of the '908 Patent.

19. Further, as discussed in col. 9, lines 14-55, Maurya states "The endpoint discriminator packet identifies, by specifying an address, of an end system (an "endpoint"), then situated on an end of a link, that is transmitting this particular packet. This peer can be an existing system, i.e., one whose address has already been specified through prior LCP negotiations to its communicating peer, though using another, i.e., existing, link to that peer, or a different system altogether. If the data contained in this packet identifies the end system as an existing system

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(i.e., previously so identified), then, through the PPP protocol, **the link will be joined to an existing bundle of links, so as to form a "pipe" among which multi-link PPP packets** will be distributed for transport between the end system peer and its peer. Alternatively, if the data contained in packet 400 **differs from that of any existing system**, then the PPP protocol **assumes a new bundle of links exists and assigns the link to this new bundle**. ... **Identification** of the endpoint system (commonly referred to as either an **"endpoint discriminator" or "endpoint identifier"**) is accomplished through class field 430 and address field 440, which collectively contain data carried by this packet. ... For example, a class field having a value of illustratively zero, one or two specifies that the following address is a null class (i.e., the address is zero octets long), a locally assigned address, such as a serial number (having a length up to twenty octets), or an Internet Protocol (IP) address (having a length of four octets)."

20. Thus, the "endpoint discriminator" value (also described as the "endpoint identifier") described in Maurya is clearly seen to identify a particular multilink PPP session and is also used for **adding or** removing **links from the multilink bundle**, being the defining function of the "multilink session identification", as discussed in the specification of the '908 Patent.

21. In an additional interpretation, in col. 8, line 65-col. 9, line 13, Maurya also discloses that "Each specific option has to be separately negotiated between the PPP peers and appropriately acknowledged prior to its use. Inasmuch as the only values for this type field, i.e., the only configuration options, that are relevant to understanding the invention are 17, 18 and 19, which designate a multi-link MRRU (Multi-link Maximum Receive Reconstructed unit) request, a

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multi-link Short Sequence Number header request and a "multi-link endpoint discriminator" option, respectively (which will all be discussed in detail below in conjunction with FIG. 5). . . . **Each such multi-link PPP packet contains a sequence number--which increases by one with each successive packet**, inserted by the multi-link protocol." In this regard, the multi-link Short Sequence Number can also be interpreted as a "multi-link session identification", as each packet in the multi- link contains this sequence number, which "identifies" the multilink session, as described in the specification of the '908 Patent.

22. With these sections discussed above, Maurya is also seen to disclose at least one processor configured to "transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification [*sic*] *[and]* the destination IP address". In addition, in col. 9, lines 35-55, Maurya also states that "Other classes of addresses exist. Inasmuch as the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention, I will omit any further details of the latter two aspects." But in this regard, the reference of Maurya does not expressly disclose if the first and second messages include a multilink session identification *[and]* a **destination URL**, as currently recited in independent claim 1, and similarly in claim 13.

23. But the secondary reference of Low discloses a client device that transmits messages through a network interface, whereby one message includes a destination URL, as seen in Fig. 4, with the terminal 31 transmitting a message 38 to a server 32 that includes a destination URL. In addition, as read on page 11, line 12-page 13, line 15, Low states "A cornerstone of the WWW is

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its ability to address particular information resources by means of an Uniform Resource Locator (URL) that identifies a resource by location…By way of example, a full or 'absolute' URL will comprise the following elements:…the Internet host domain or IP address…This request includes a request method, and the 'Request-URI' (which is generally just the absolute path of the resource on the server as identified by the 'abs-path' element of the URI); the request may include additional data elements."

24. With this, it would have been obvious for one of ordinary skill in the art to have include a destination URL, as recognized by Low, within the second message disclosed by Maurya. The suggestion/motivation for doing so would be that the client device of Maurya would conform with known protocols for communicating packets in systems utilizing point-to-point protocol (PPP), as discussed by Low in page 11, lines 21-page 12, line 28. Here, Low describes that utilizing URLs for PPP communication of packets between user terminals and Internet service providers was well known, and thus, this modification of Maurya with the functionality taught in Low would easily be implemented with these well-known teachings, as exemplified by Low, and would yield predictable results.

25. Continuing, on pages 14 and 15 of the Remarks, the Patent Owner argues that a "multi-link short sequence number header request is not a multilink session identification and is not an endpoint discriminator." But here, the multi-link short sequence number header request is not

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being equated to a multilink session identification. Rather, as discussed above, the multi-link Short Sequence Number can be interpreted as a "multi-link session identification", as each packet in the multi- link contains this sequence number, which "identifies" the multilink session, as described in the specification of the '908 Patent. Again, in col. 8, line 65-col. 9, line 13, Maurya discloses that "Each specific option has to be separately negotiated between the PPP peers and appropriately acknowledged prior to its use. Inasmuch as the only values for this type field, i.e., the only configuration options, that are relevant to understanding the invention are 17, 18 and 19, which designate a multi-link MRRU (Multi-link Maximum Receive Reconstructed unit) request, a multi-link Short Sequence Number header request and a "multi-link endpoint discriminator" option, respectively (which will all be discussed in detail below in conjunction with FIG. 5). ... **Each such multi-link PPP packet contains a sequence number--which increases by one with each successive packet**, inserted by the multi-link protocol

26. In additional, as discussed in col. 9, lines 14-55, Maurya states "The endpoint discriminator packet identifies, by specifying an address, of an end system (an "endpoint"), then situated on an end of a link, that is transmitting this particular packet. This peer can be an existing system, i.e., one whose address has already been specified through prior LCP negotiations to its communicating peer, though using another, i.e., existing, link to that peer, or a different system altogether. If the data contained in this packet identifies the end system as an existing system (i.e., previously so identified), then, through the PPP protocol, **the link will be joined to an existing bundle of links, so as to form a "pipe" among which multi-link PPP packets** will be distributed for transport between the end system peer and its peer. Alternatively,

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if the data contained in packet 400 **differs from that of any existing system**, then the PPP protocol **assumes a new bundle of links exists and assigns the link to this new bundle**. … **Identification** of the endpoint system (commonly referred to as either an **"endpoint discriminator" or "endpoint identifier"**) is accomplished through class field 430 and address field 440, which collectively contain data carried by this packet. … For example, a class field having a value of illustratively zero, one or two specifies that the following address is a null class (i.e., the address is zero octets long), a locally assigned address, such as a serial number (having a length up to twenty octets), or an Internet Protocol (IP) address (having a length of four octets)."

27. Thus, "multi-link Short Sequence Number" or the "endpoint discriminator" value (also described as the "endpoint identifier"), each described in Maurya, are seen to identify a particular multilink PPP session, being the defining function of the "multilink session identification" discussed in the specification of the '908 Patent.

28. Continuing, on pages 15 and 16 of the Remarks, the Patent Owner argues that Maurya's multi-link short sequence number header request is not a multilink session identification. But again, the multi-link short sequence number header request is not being equated to a multilink session identification. Rather, as discussed above, the multi-link Short Sequence Number can be interpreted as a "multi-link session identification", as each packet in the multi- link contains this sequence number, which "identifies" the multilink session, as described in the specification of the '908 Patent.

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29. In addition, on page 16 of the Remarks, the Patent Owner points to Fig. 5 of Maurya, and recognizes that "This multi-link Short-Sequence Number (575) is used for ordering the packets after receipt on the receiving side." The Patent Owner then posits on page 16 that "The '908 patent does not use the 'multilink session identification' for anything associated with re-ordering packets or as referred to as 'reassembly' of packets in the '908 patent. . . . As shown, Maurya's multi-link Short Sequence Number is for ordering messages within a session and the '908 Patent's multilink session identification is for distinguishing between sessions. Accordingly, Maurya's multi-link Short Sequence Number is distinctly different in purpose and function from the claimed multilink session identification."

30. But in response, utilizing a multilink session identification to distinguish between sessions is not particularly recited in the claims. Rather, claim 1 does not recite any specific purpose for a "multilink session identification", other than perhaps identifying a multilink session. Despite Patent Owner's contention, there simply is no requirement for a specific purpose and function of the claimed multilink session identification in the current claim language. If the Patent Owner wishes that this feature be considered in interpreting the current claim language, then the claims must be amended accordingly. Again, as discussed above, the multi-link Short Sequence Number can be interpreted as a "multi-link session identification", as each packet in the multi-link contains this sequence number, which "identifies" the multilink session, being consistent with the discussion provided within the specification of the '908 Patent.

31. Continuing, on page 16 of the Remarks, the Patent Owner begins arguing that Maurya's Endpoint discriminator is not a multilink session identification. In this regard, on pages 17 and

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18, the Patent Owner argues that "Maurya's endpoint discriminator and the '908 Patent's multilink session identification are different in both form and operation. In fact, the '908 Patent's multilink session identification solves problems that cannot be solved by Maurya's endpoint discriminator." In this regard, the Patent Owner states on page 19 of the Remarks that "Accordingly, the multilink session identification can be used to dynamically add and remove links in an existing multilink communication session, as described in column 12, lines 51-66, of the '908 Patent". In addition, the Patent Owner further argues that "Column 13, line 13 through column 14, line 9, further describes the dynamic nature of the '90 system detailing how remote RCGs can be added and removed from existing sessions..."

32. But here, it is improper to import limitations from the specification into the claims. In this regard, MPEP 2111.01(II) states, in part:

"II. IT IS IMPROPER TO IMPORT CLAIM LIMITATIONS FROM THE SPECIFICATION

> "Though understanding the claim language may be aided by explanations contained in the written description, **it is important not to import into a claim limitations that are not part of the claim.** For example, a particular embodiment appearing in the written description may not be read into a claim when the claim language is broader than the embodiment." *Superguide Corp. v. DirecTV Enterprises, Inc.*, 358 F.3d 870, 875, 69 USPQ2d 1865, 1868 (Fed. Cir. 2004). See also *Liebel-Flarsheim Co. v. Medrad Inc.*, 358 F.3d 898, 906, 69 USPQ2d 1801, 1807 (Fed. Cir. 2004) (discussing recent cases wherein the court expressly rejected the contention that if a patent describes only a single embodiment, the claims of the patent must be construed as being limited to that embodiment); *E-Pass Techs., Inc. v. 3Com Corp.*, 343 F.3d 1364, 1369, 67 USPQ2d 1947, 1950 (Fed. Cir. 2003) ("Interpretation of descriptive statements in a patent's written description is a difficult task, as an inherent tension exists as to whether a statement is a clear lexicographic definition or a description of a preferred embodiment. The problem is to **interpret claims 'in view of the specification' without unnecessarily importing limitations from the specification into the claims.**"); *Altiris Inc. v. Symantec*

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> *Corp.*, 318 F.3d 1363, 1371, 65 USPQ2d 1865, 1869-70 (Fed. Cir. 2003) (Although the specification discussed only a single embodiment, the court held that it was improper to read a specific order of steps into method claims where, as a matter of logic or grammar, the language of the method claims did not impose a specific order on the performance of the method steps, and the specification did not directly or implicitly require a particular order). . . ."

33. Here, the functions of adding or removing remote RCGs, as argued, is not particularly claimed. If the Patent Owner wishes that these functions be considered in interpreting the current claim language, then the claims must be amended accordingly.

34. Again, Maurya states in the Abstract that "Specifically, during LCP negotiations, a multi-link PPP originator assigns itself **a unique endpoint discriminator value and informs all its immediate PPP peers by sending the latter, via a first bundle of outgoing links, an LCP Endpoint Discriminator packet containing this value.** Each of these immediate PPP peers assumes, as its endpoint discriminator, the value that has been provided to it in the LCP Endpoint Discriminator packet it receives from the originator and then sends an LCP Endpoint Discriminator packet containing **this same endpoint discriminator value**, via a second bundle of outgoing links, to all of its immediate PPP peers."

35. Further, as also discussed in col. 9, lines 14-55, Maurya states "The endpoint discriminator packet identifies, by specifying an address, of an end system (an "endpoint"), then situated on an end of a link, that is transmitting this particular packet. This peer can be an existing system, i.e., one whose address has already been specified through prior LCP negotiations to its communicating peer, though using another, i.e., existing, link to that peer, or a

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different system altogether. If the data contained in this packet identifies the end system as an existing system (i.e., previously so identified), then, through the PPP protocol, **the link will be joined to an existing bundle of links, so as to form a "pipe" among which multi-link PPP packets** will be distributed for transport between the end system peer and its peer. Alternatively, if the data contained in packet 400 **differs from that of any existing system**, then the PPP protocol **assumes a new bundle of links exists and assigns the link to this new bundle**. … **Identification** of the endpoint system (commonly referred to as either an **"endpoint discriminator" or "endpoint identifier"**) is accomplished through class field 430 and address field 440, which collectively contain data carried by this packet. … For example, a class field having a value of illustratively zero, one or two specifies that the following address is a null class (i.e., the address is zero octets long), a locally assigned address, such as a serial number (having a length up to twenty octets), or an Internet Protocol (IP) address (having a length of four octets)." Thus, the "unique endpoint discriminator value" (also described as the "endpoint identifier") disclosed in Maurya is clearly seen to identify a particular multilink PPP session and is also used for adding or removing links from the multilink bundle, being consistent with the functionality described in the specification of the '908 Patent.

36. Continuing, on pages 20 and 21 of the Remarks, the Patent Owner argues that the secondary reference of Low does not teach a multilink session identification. But with this, the Examiner notes that the reference of Low is not being relied on to teach the claimed "multilink session identification".

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37. As discussed above, Maurya is seen to disclose at least one processor configured to "transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification [*sic*] *[and]* the destination IP address". But in this regard, the reference of Maurya does not expressly disclose if the first and second messages include a multilink session identification *[and]* a **destination URL**, as currently recited in independent claim 1, and similarly in claim 13.

38. But the secondary reference of Low discloses a client device that transmits messages through a network interface, whereby one message includes a destination URL, as seen in Fig. 4, with the terminal 31 transmitting a message 38 to a server 32 that includes a destination URL. In addition, as read on page 11, line 12-page 13, line 15, Low states "A cornerstone of the WWW is its ability to address particular information resources by means of an Uniform Resource Locator (URL) that identifies a resource by location…By way of example, a full or 'absolute' URL will comprise the following elements:…the Internet host domain or IP address…This request includes a request method, and the 'Request-URI' (which is generally just the absolute path of the resource on the server as identified by the 'abs-path' element of the URI); the request may include additional data elements."

39. With this, it would have been obvious for one of ordinary skill in the art to have include a destination URL, as recognized by Low, within the second message disclosed by Maurya. The suggestion/motivation for doing so would be that the client device of Maurya would conform with known protocols for communicating packets in systems utilizing point-to-point protocol

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(PPP), as discussed by Low in page 11, lines 21-page 12, line 28. In addition, in col. 9, lines 35-55, Maurya also states that "Other classes of addresses exist. Inasmuch as the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention, I will omit any further details of the latter two aspects." In this regard, Low describes that utilizing URLs for PPP communication of packets between user terminals and Internet service providers was well known, and thus, this modification of Maurya with the functionality taught in Low would easily be implemented with these well-known teachings, as exemplified by Low, and would yield predictable results.

40. Therefore, for the above reasons, the combination of Maurya and Low are seen to disclose the limitation that recites "transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification [*sic*] *[and]* the destination IP address", as recited in independent claim 1, and similarly in independent claim 13. Thus, for the above reasons, the rejection of claims 1 and 13, as well as dependent claims 2-3, 5-6, and 13-15, under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Maurya in view of Low, is maintained and repeated herein.

Conclusion

41. The Patent Owner is reminded of the continuing responsibility under 37 CFR 1.565(a) to apprise the Office of any litigation activity, or other prior or concurrent proceeding, involving U.S. Patent 10,868,908 throughout the course of this reexamination proceeding. See MPEP §§ 2207, 2282, and 2286.

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42. **THIS ACTION IS MADE FINAL.**

A shortened statutory period for response to this action is set to expire TWO MONTHS from the mailing date of this action.

Extensions of time under 37 CFR 1.136(a) do not apply in reexamination proceedings. The provisions of 37 CFR 1.136 apply only to "an applicant" and not to parties in a reexamination proceeding. Further, in 35 U.S.C. 305 and in 37 CFR 1.550(a), it is required that reexamination proceedings "will be conducted with special dispatch within the Office."

Extensions of time in reexamination proceedings are provided for in 37 CFR 1.550(c). A request for extension of time must specify the requested period of extension and it must be accompanied by the petition fee set forth in 37 CFR 1.17(g). Any request for an extension in a third party requested ex parte reexamination must be filed on or before the day on which action by the patent owner is due, and the mere filing of a request will not effect any extension of time. A request for an extension of time in a third party requested ex parte reexamination will be granted only for sufficient cause, and for a reasonable time specified. Any request for extension in a patent owner requested ex parte reexamination (including reexamination ordered under 35 U.S.C. 257) for up to two months from the time period set in the Office action must be filed no later than two months from the expiration of the time period set in the Office action. A request for an extension in a patent owner requested ex parte reexamination for more than two months from the time period set in the Office action must be filed on or before the day on which action by the patent owner is due, and the mere filing of a request for an extension for more than two months will not effect the extension. The time for taking action in a patent owner requested ex parte reexamination will not be extended for more than two months

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from the time period set in the Office action in the absence of sufficient cause or for more than a reasonable time.

The filing of a timely first response to this final rejection will be construed as including a request to extend the shortened statutory period for an additional two months. In no event, however, will the statutory period for response expire later than SIX MONTHS from the mailing date of the final action. See MPEP § 2265.

43. **All** correspondence relating to this *ex parte* reexamination proceeding should be directed:

By Mail to: Mail Stop *Ex Parte* Reexam
Central Reexamination Unit
Commissioner for Patents
United States Patent & Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

By FAX to: (571) 273-9900
Central Reexamination Unit

By hand: Customer Service Window
Randolph Building
401 Dulany Street
Alexandria, VA 22314

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Any inquiry concerning this communication or earlier communications from the Reexamination Legal Advisor or Examiner, or as to the status of this proceeding, should be directed to the Central Reexamination Unit at telephone number (571) 272-7705.

Signed:

/JOSEPH R POKRZYWA/
Primary Examiner, Art Unit 3992
(571) 272-7410

Conferees:

/ERON J SORRELL/
Primary Examiner, Art Unit 3992
/MICHAEL FUELLING/
Supervisory Patent Examiner, Art Unit 3992

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Office Action in Ex Parte Reexamination	Control No. 90/019,265	Patent Under Reexamination 10868908	
	Examiner JOSEPH R POKRZYWA	Art Unit 3992	AIA (FITF) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

a. ☑ Responsive to the communication(s) filed on 13 August 2024.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

b. ☑ This action is made FINAL.

c. ☐ A statement under 37 CFR 1.530 has not been received from the patent owner.

A shortened statutory period for response to this action is set to expire 2 month(s) from the mailing date of this letter. Failure to respond within the period for response will result in termination of the proceeding and issuance of an *ex parte* reexamination certificate in accordance with this action. 37 CFR 1.550(d). **EXTENSIONS OF TIME ARE GOVERNED BY 37 CFR 1.550(c).** If the period for response specified above is less than thirty (30) days, a response within the statutory minimum of thirty (30) days will be considered timely.

Part I THE FOLLOWING ATTACHMENT(S) ARE PART OF THIS ACTION:

1. ☐ Notice of References Cited by Examiner, PTO-892.
2. ☐ Information Disclosure Statement, PTO/SB/08.
3. ☐ Interview Summary, PTO-474.
4. ☐ _____.

Part II SUMMARY OF ACTION

1a. ☑ Claims 1-3,5-6 and 13-15 are subject to reexamination.
1b. ☑ Claims 4,7-12 and 16-17 are not subject to reexamination.
2. ☐ Claims _____ have been canceled in the present reexamination proceeding.
3. ☐ Claims _____ are patentable and/or confirmed.
4. ☑ Claims 1-3,5-6 and 13-15 are rejected.
5. ☐ Claims _____ are objected to.
6. ☐ The drawings, filed on _____ are acceptable.
7. ☐ The proposed drawing correction, filed on _____ has been (7a) ☐ approved (7b) ☐ disapproved.
8. ☐ Acknowledgment is made of the priority claim under 35 U.S.C. 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the certified copies have
      1 ☐ been received.
      2 ☐ not been received.
      3 ☐ been filed in Application No. _____.
      4 ☐ been filed in reexamination Control No. _____.
      5 ☐ been received by the International Bureau in PCT application No. _____.
   * See the attached detailed Office action for a list of the certified copies not received.
9. ☐ Since the proceeding appears to be in condition for issuance of an *ex parte* reexamination certificate except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte* Quayle, 1935 C.D. 11, 453 O.G. 213.
10. ☐ Other: _____.

cc: Requester (if third party requester)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Reexam Control No.:	**90/019,265**
Patent Owner:	Competitive Access Systems, Inc.
Conf. No.:	3396
Filed:	October 4, 2023
Title:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
Art Unit:	3992
Examiner:	Joseph R. Pokrzywa
Docket No.:	COM908

REQUEST TO EXPEDITE PETITION PURSUANT TO 37 C.F.R. § 1.182

Director of the United States Patent and Trademark Office
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22314-1450

Patent owner concurrently submits a petition, pursuant to 37 C.F.R. § 1.181, requesting the Office withdraw the finality of the Office Action dated October 2, 2024, in an *ex parte* reexamination and reissue the office action as a non-final office action with a new two-month deadline for response ("Petition"). Pursuant to 37 C.F.R. § 1.182, Petitioner hereby respectfully requests that the Office expedite the Petition as the Office Action relates to a patent subject to *ex parte* reexamination with a December 2, 2024, deadline to file a Notice of Appeal ("Request").

U.S. Patent 10,868,908 ("'908 Patent") is involved in an *ex parte* reexamination (as identified above). The following events are relevant to this Petition:

1. On June 13, 2024, the Office issued a non-final office action ("NFOA") (attached as **Exhibit 1**). The NFOA rejected claims 1-3, 5-6, and 13-15 under pre-AIA 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,160,808, issued to Maurya ("Maurya") in view of WO 97/22212, with the inventor of Low ("Low"). Maurya and Low were the only prior art references used in the NFOA.
2. On August 13, 2024, the Patent Owner submitted a response to the non-final office action ("Response") (attached as **Exhibit 2**).
3. On October 2, 2024, the Office issued a final office action ("FOA") (attached as **Exhibit 3**).

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4. The deadline to file a Notice of Appeal in response to the FOA is December 2, 2024.

In the concurrent Petition, Patent Owner requests that the Director withdraw the finality of the Office Action dated October 2, 2024, and reissue the office action as a non-final office action with a new two-month deadline for response. Due to the timing of the deadline for the Notice of Appeal, Patent Owner hereby respectfully requests that the Office expedite the Petition.

The Director is authorized to charge the fee for this Petition under 37 C.F.R. § 1.182 as set forth in 37 C.F.R. § 1.17(f) (fee code 1462) to Deposit Account No. 02-1818. If such a withdrawal is made, please indicate the Attorney Docket No. 3725791.00005 on the account statement.

Respectfully Submitted,

K&L Gates LLP

By: /M. Clare Frederick/
M. Clare Frederick
Reg. No. 66,608
Telephone No. (312) 807-4335
Customer No. 29156

Dated: October 31, 2024

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
90/019,265	10/04/2023	10868908	COM908	3396

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Harold McGurk
The Law Office of Clay McGurk
P.O. BOX 1488
Orange, CA 92856

EXAMINER	
POKRZYWA, JOSEPH R	

ART UNIT	PAPER NUMBER
3992	

MAIL DATE	DELIVERY MODE
06/13/2024	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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EX PARTE REEXAMINATION COMMUNICATION TRANSMITTAL FORM

REEXAMINATION CONTROL NO. *90/019,265* .

PATENT UNDER REEXAMINATION *10868908* .

ART UNIT *3992* .

Enclosed is a copy of the latest communication from the United States Patent and Trademark Office in the above identified *ex parte* reexamination proceeding (37 CFR 1.550(f)).

Where this copy is supplied after the reply by requester, 37 CFR 1.535, or the time for filing a reply has passed, no submission on behalf of the *ex parte* reexamination requester will be acknowledged or considered (37 CFR 1.550(g)).

PTOL-465 (Rev.07-04)

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Office Action in Ex Parte Reexamination	Control No. 90/019,265	Patent Under Reexamination 10868908	
	Examiner JOSEPH R POKRZYWA	Art Unit 3992	AIA (FITF) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

a. ☑ Responsive to the communication(s) filed on 01 March 2024.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

b. ☐ This action is made FINAL.

c. ☐ A statement under 37 CFR 1.530 has not been received from the patent owner.

A shortened statutory period for response to this action is set to expire 2 month(s) from the mailing date of this letter. Failure to respond within the period for response will result in termination of the proceeding and issuance of an *ex parte* reexamination certificate in accordance with this action. 37 CFR 1.550(d). **EXTENSIONS OF TIME ARE GOVERNED BY 37 CFR 1.550(c).** If the period for response specified above is less than thirty (30) days, a response within the statutory minimum of thirty (30) days will be considered timely.

Part I THE FOLLOWING ATTACHMENT(S) ARE PART OF THIS ACTION:

1. ☐ Notice of References Cited by Examiner, PTO-892.
2. ☐ Information Disclosure Statement, PTO/SB/08.
3. ☐ Interview Summary, PTO-474.
4. ☐ _____.

Part II SUMMARY OF ACTION

1a. ☑ Claims 1-3,5-6 and 13-15 are subject to reexamination.
1b. ☑ Claims 4,7-12 and 16-17 are not subject to reexamination.
2. ☐ Claims _____ have been canceled in the present reexamination proceeding.
3. ☐ Claims _____ are patentable and/or confirmed.
4. ☑ Claims 1-3,5-6 and 13-15 are rejected.
5. ☐ Claims _____ are objected to.
6. ☐ The drawings, filed on _____ are acceptable.
7. ☐ The proposed drawing correction, filed on _____ has been (7a) ☐ approved (7b) ☐ disapproved.
8. ☐ Acknowledgment is made of the priority claim under 35 U.S.C. 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the certified copies have
   1 ☐ been received.
   2 ☐ not been received.
   3 ☐ been filed in Application No. _____.
   4 ☐ been filed in reexamination Control No. _____.
   5 ☐ been received by the International Bureau in PCT application No. _____.
   * See the attached detailed Office action for a list of the certified copies not received.
9. ☐ Since the proceeding appears to be in condition for issuance of an *ex parte* reexamination certificate except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte* Quayle, 1935 C.D. 11, 453 O.G. 213.
10. ☐ Other: _____

cc: Requester (if third party requester)

DETAILED ACTION

Brief Summary

1. This is a non-final Office action regarding the reexamination of U.S. Application 90/019,265, being a reexamination of U.S. Patent 10,868,908, issued to Eric M. DeLangis (hereafter "the '908 Patent").

2. The '908 Patent originally issued on December 15, 2020, with patented claims 1-17, being filed as U.S. Patent Application 15/161,787 (hereafter "the original '787 Application") on May 23, 2016. The original '787 Application was filed as a continuation of U.S. Application 14/512,414, filed on October 11, 2014, now U.S. Patent 9,350,649, which is a continuation of U.S. Application 13/531,294, filed on June 22, 2012, now U.S. Patent 8,861,349, which is a continuation of U.S. Application 12/581,852, filed on October 19, 2009, now U.S. Patent 8,228,801, which is a continuation of U.S. Application 10/686,375, filed on October 14, 2003, now U.S. Patent 7,606,156. The original '787 Application claims priority to provisional U.S. Application 60/418,521, filed on October 15, 2002.

3. Reexamination of patented claims 1-3, 5, 6, and 13-15 of the '908 Patent was ordered on January 2, 2024, whereby a substantial new question was raised by the Third Party's request for *ex parte* reexamination filed October 4, 2023. Subsequently, the Patent Owner filed a Patent Owner Statement pursuant to 37 CFR 1.530 on March 1, 2024. In response, the Third Party Requester filed a Reply on April 30, 2024.

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4. Further, the Examiner notes that because the '908 Patent was filed as multiple continuations of applications, dating back to October 14, 2003, the '908 Patent would now appear to be expired. With this, MPEP 2240 states, in part:

> ... In making the determination of whether to order reexamination, the Office will determine the proper meaning of the patent claims by giving the claims their broadest reasonable interpretation consistent with the specification (see *In re Yamamoto,* 740 F.2d 1569 (Fed. Cir. 1984)), **except in the case of an expired patent (in a reexamination involving claims of an expired patent, claim construction is pursuant to the principle set forth by the court in *Phillips v. AWH Corp.*, 415 F.3d 1303, 1316, 75 USPQ2d 1321, 1329 (Fed. Cir. 2005) (words of a claim "are generally given their ordinary and customary meaning" as understood by a person of ordinary skill in the art in question at the time of the invention**, see *Ex parte Papst-Motoren,* 1 USPQ2d 1655 (Bd. Pat. App. & Inter. 1986)). If reexamination is ordered, the patent owner statement, if applicable, and any accompanying information submitted pursuant to 37 CFR 1.501(a)(2) will be considered during the examination stage to the fullest extent possible when determining the scope of any claims of the patent which are subject to reexamination. [Emphasis added].

5. Thus, since the '908 Patent would be expired, the claim construction will be pursuant to the principle set forth by the court in *Phillips*, whereby the "words of a claim 'are generally given their ordinary and customary meaning' as understood by a person of ordinary skill in the art in question at the time of the invention."

6. The present application is being examined under the pre-AIA first to invent provisions.

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Response to Patent Owner's Statement and Requester's Reply

7. Patent Owner's arguments filed March 1, 2024 in the Patent Owner Statement pursuant to 37 CFR 1.530 and the Third Party Requester's Reply filed April 30, 2024, have been fully considered.

8. First, the Examiner finds the arguments presented in the Patent Owner Statement filed March 1, 2024 unpersuasive. Initially, in the Patent Owner's Statement filed March 1, 2024, beginning on page 10, and throughout the Statement, the Patent Owner argues that the Order fails to establish that claims 1-2 and 5-6 are obvious over Maurya and Low, or that claims 1-2, 5-6 and 13-15 are obvious over Maurya, Law and Krishnan. But in this regard, in the Order dated January 2, 2024, the Examiner determined that the Request raised a substantial new question of patentability as to at least claim 1 of the '908 Patent. Here, a determination as to patentability or unpatentability of the claims is not made in the decision on the request.

9. Particularly, the Examiner notes that MPEP 2240 states, in part:

> 35 U.S.C. 303 requires that within 3 months following the filing of a request for reexamination filed under 35 U.S.C. 302, the Director of the USPTO **will determine whether or not the request raises a "substantial new question of patentability" affecting any claim of the patent** of which reexamination is desired.
>
> ...
>
> The decision on the request for reexamination filed under 35 U.S.C. 302 has as its object either the granting or denial of an order for reexamination. This decision is based on whether or not "a substantial new question of patentability" is found. **A determination as to patentability/unpatentability of the claims is not made in the decision on the request; rather, this determination will be made during the examination stage of the reexamination proceedings if reexamination is ordered. Accordingly, no *prima facie* case of unpatentability need be found to grant an order for reexamination.**

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> ...
>
> The decision on the request for reexamination should discuss all of the patent claims requested for reexamination. The examiner should limit the discussion of those claims in the order for reexamination as to whether a substantial new question of patentability has been raised. **The examiner SHOULD NOT reject claims in the order for reexamination.** Rather, any rejection of the claims will be made in the first Office action (on the patentability of the claims) that is issued after the expiration of the time for submitting any patent owner statement and requester reply that follow the examiner's order. [Emphasis added].

10. With this, the determination within the Order dated January 2, 2024, that the Request for Reexamination filed October 4, 2023, raised a substantial new question of patentability, is seen to be proper.

11. Second, in the Patent Owner's Statement filed March 1, 2024, the Patent Owner also argues, beginning on page 12, that the secondary reference of Low is not analogous art to the '908 Patent, and therefore cannot be used in an obviousness combination against it. Here, on page 19 of the Statement, the Patent Owner further argues that "Low fails both prongs: it is not from the same field of endeavor as the '908 Patent, and it is not reasonably pertinent to the particular problem with which the inventor was involved in the '908 Patent." But in response, the Examiner does not find this argument by the Patent Owner persuasive, and the Examiner generally agrees with the discussion in the Third Party Requester's Reply dated April 30, 2024 on pages 9-14.

12. Along this vein, MPEP 2141.01(a) states, in part:

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> ... A reference is analogous art to the claimed invention if: **(1) the reference is from the same field of endeavor as the claimed invention (even if it addresses a different problem)**; or (2) the reference is reasonably pertinent to the problem faced by the inventor (even if it is not in the same field of endeavor as the claimed invention). **Note that "same field of endeavor" and "reasonably pertinent" are two separate tests for establishing analogous art; it is not necessary for a reference to fulfill both tests in order to qualify as analogous art.** [Emphasis added].

13. In this regard, the prior art reference of Low is seen to be from the same field of endeavor as the claimed invention, although Low addresses a different problem than that described in the '908 Patent. Here, in review of the '908 Patent, in the "Background of the Invention" and the "Summary of the Invention" in cols. 1 and 2, the '908 Patent discusses "To be competitive then, CLECs try to sell additional services such as call waiting, caller ID, etc. where they have as much as a 50% margin. Some CLECs also bundle long distance services with their packages as additional incentive to get residential customers to buy local telephone service from them. ... Many companies are currently trying to provide VoIP services to residential customers over high-speed or broadband backbones such as DSL and cable modems, over Internet connections via a computer. ... The RCG combines the capabilities and features of IP routers, Class 5 circuit switches and wireless LANs in a small stand-alone external modem like device."

14. Similarly, in reviewing the prior art of Low, on page 2 of Low, in the "Background of the Invention", the reference states "Telecommunication companies running PSTNs (Public Switched Telephone Networks) and PLMNs (Public Land Mobile Networks) are in business of providing communication services and in doing so are providing increasing built-in intelligence in the form of 'IN services' such as 800 number services and call forwarding. In contrast, the World Wide Web (WWW), which has seen explosive growth in recent times, is an example of an

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Internet-based global network providing complex information services. ...The present invention proposes technologies for a more synergetic relationship between these two worlds ..." Here, this description in the '908 Patent and this description in Low appear to be describing similar issues in their respective Backgrounds.

15. Additionally, in the '908 Patent, the specification describes a system of multilink communications, disclosing various networks such as a PSTN and the Internet, for use with a telephone and also for a Personal Computer [see the '908 Patent, col. 9, lines 34-47]. Similarly, the reference of Low discloses a system that allows multilink communications having multiple networks, including a "telecom network" and the "Internet", as seen in Figs. 4 and 6 of Low. Thus, while the reference of Low goes on to define an invention that solves a different problem than that defined in the '908 Patent, the Low reference and the '908 Patent are still seen to be from the same field of endeavor. Thus, the Low reference is seen to be analogous art to the claimed invention of the '908 Patent, and the reliance of Low in a rejection under 35 U.S.C. 103 would therefore be proper.

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16. Continuing, with respect to the Third Party Requester's Reply filed April 30, 2024, regarding the priority date of the'908 Patent on pages 1-9 of the Reply, the Examiner understands the points discussed by the Third Party Requester, but the points are unpersuasive. Here, as read in col. 12, lines 1-66, the '908 Patent states "Referring to FIG. 7, an RCG—85 that decides to initiate a multilink PPP session with a remote computer i.e. internet URL, requests a multilink PPP session with that URL resource via Link Control Protocol (LCP) session management. … **The initiating RCG then selects which of the responding remote RCGs—86 it will use for the multilink PPP bundle—87 and sends them a multilink initialization packet containing the URL of the destination as well as the multilink PPP session ID (magic number)** and any other pertinent information required for the remote RCG to join in the existing multilink PPP bundle—87. Each remote RCG POTS interface—91 participating in a multilink PPP bundle, represents a logical "link" in the initiating RCG's multilink PPP bundle—87. The remote RCGs—86 then send a multilink PPP packet (over their respective POTS lines—91) to the destination URL with the multilink PPP session ID and request to be added to that multilink PPP bundle—87. The destination URL accepts the request of each of the remote RCGs—86 and begins sending data packets to each over their respective POTS lines—91."

17. This section in the specification of the '908 Patent appears to describe messages that include "a multilink session identification and the destination URL", as currently claimed in claim 1 and claim 13 of the '908 Patent. With this, the chain of priority of the original '787 Application that matured into the '908 Patent is not seen to be broken.

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18. This description of having messages that include "a multilink session identification and the destination URL" is similarly found in the prior U.S. Pat. 8,861,349, as well as in the disclosure of the provisional application 60/418,521. In this regard, in the Request, the Third Party Requester contended that the application in the chain of priority, U.S. App. 13/531,294, which matured to U.S. Pat. 8,861,349, failed to disclose the claimed first message sent by a device in independent claims 1 and 13.

19. But as discussed above, and also as discussed in the Order dated January 2, 2024 on pages 21-23, the reference of U.S. Patent 7,606,156, being noted as "DeLangis-156" in the Request, is still not seen to be available as prior art. Here, the disclosures of the earlier non-provisional applications in the chain of priority, as well as the disclosure of the provisional application 60/418,521, are seen to provide **sufficient disclosure as to the features required independent claims 1 and 13** of the '908 Patent.

Claim Rejections - 35 USC § 103

20. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis (i.e., changing from AIA to pre-AIA) for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

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21. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

22. **Claims 1-3, 5-6, and 13-15** is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,160,808, issued to MAURYA, Sanjiv Kumar (noted herein as "Maurya", being cited in the Request for Reexamination), in view of International Patent Application Publication WO 97/22212, with the inventor of LOW, Colin *et al.*, being published on June 19, 1997 (noted herein as "Low", being cited in the Request for Reexamination).

Regarding ***claim 1***, Maurya discloses a client device [being the client 605, which includes PC 610 connected through communication interfaces 612 to terminal adapters 620, as seen in Fig. 6A] for multilink data packet communication with a server [server 650, see Fig. 6A; also see col. 11, line 34-col. 12, line 10, wherein "With the above discussion of conventional multi-link PPP in mind , consider FIG. 6A which depicts a high level block diagram of illustrative multi-link client-server apparatus 600, which incorporates the teachings of the present invention. Here, client 605 is inter-connected to server 650 through multiple ISDN BRI (basic rate interface) lines 630."], the client device comprising:

a first network interface having a first data transfer rate associated with a first path from the server to the first network interface of the client device [one of the communication interfaces 612, combined with the ISDN BRI terminal adapter (TA) 1, 620_1, through path 615_1, as seen in Fig. 6A; also see col. 11, line 34-col. 13, line 8, wherein "In that regard, links 615, which

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comprise links 615_1, 615_2, . . . , 615_n, connect separate terminal adapters 620_1, 620_2, . . . , 620_n, respectively, to separate corresponding serial ports provided by communication interfaces 612. … ISDN connections are extended from terminal adapters 620, through public switched telephone network (PSTN) 640, to server 650 having corresponding identical terminal adapters 660, as DCE, and server computer 665, as DTE. Each one of terminal adapters 620 is connected through a separate pair of ISDN B-channels and the PSTN, to a separate corresponding one of terminal adapters 660, the latter terminal adapters collectively connected, via links 662, to server computer 665. Each of adapters 660 is illustratively identical to each of adapters 620."; also see col. 17, lines 36-57, wherein "However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."];

a second network interface having a second data transfer rate associated with a second path from the server to the second network interface of the client device [being another one of the communication interfaces 612, combined with the ISDN BRI terminal adapter 2, 620_2, through path 615_2, as seen in Fig. 6A; also see col. 11, line 34-col. 13, line 8, wherein "In that regard, links 615, which comprise links 615_1, 615_2, . . . , 615_n, connect separate terminal adapters 620_1, 620_2, . . . , 620_n, respectively, to separate corresponding serial ports provided by communication interfaces 612. … ISDN connections are extended from terminal adapters 620, through public switched telephone network (PSTN) 640, to server 650 having corresponding identical terminal adapters 660, as DCE, and server computer 665, as DTE. Each one of terminal adapters 620 is connected through a separate pair of ISDN B-channels and the PSTN, to a separate corresponding one of terminal adapters 660, the latter terminal adapters collectively

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connected, via links 662, to server computer 665. Each of adapters 660 is illustratively identical to each of adapters 620."; also see col. 17, lines 36-57, wherein "However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."; also see col. 17, lines 36-57, wherein "However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."]; and

at least one processor configured to:

transmit a first message through the first network interface to the server, wherein the first message includes a multilink request ***[and] a destination IP address*** [see col. 7, line 22-39, wherein "At this point with no activity on the link, a link control protocol (LCP), which as part of the PPP protocol, exercises responsibility for establishing and configuring the link, remains in an initial or starting state."; also see col. 8, lines 20-59, wherein "FIG. 2 depicts a format of conventional generalized LCP packet 200. As shown, packet 200 is formed of eight-bit code field 210, eight-bit identifier field 220, sixteen-bit length field 230 and finally variable-length data field 240. This packet can be any one of several types, with the value of the code field, having values typically ranging from one to thirteen, specifying the type of any such packet. Of note, a value of one indicates that the packet is an LCP Configure Request packet. Such a request packet is sent by a PPP peer whenever that peer desires to change a configuration parameter, such as from a default value, associated with the link."; also see col. 9, lines 14-55, wherein "The endpoint discriminator packet identifies, by specifying an address, of an end system (an

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"endpoint"), then situated on an end of a link, that is transmitting this particular packet. … For example, a class field having a value of illustratively zero, one or two specifies that the following address is a null class (i.e., the address is zero octets long), a locally assigned address, such as a serial number (having a length up to twenty octets), or an Internet Protocol (IP) address (having a length of four octets). Other classes of addresses exist. Inasmuch as the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention, I will omit any further details of the latter two aspects."];

transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification ***[and] the destination IP address*** [see col. 7, line 22-39; also see col. 8, lines 20-59, wherein "FIG. 2 depicts a format of conventional generalized LCP packet 200. As shown, packet 200 is formed of eight-bit code field 210, eight-bit identifier field 220, sixteen-bit length field 230 and finally variable-length data field 240. This packet can be any one of several types, with the value of the code field, having values typically ranging from one to thirteen, specifying the type of any such packet. Of note, a value of one indicates that the packet is an LCP Configure Request packet. Such a request packet is sent by a PPP peer whenever that peer desires to change a configuration parameter, such as from a default value, associated with the link."; also see col. 8, line 60-col. 9, line 67, wherein "Each specific option has to be separately negotiated between the PPP peers and appropriately acknowledged prior to its use. Inasmuch as the only values for this type field, i.e., the only configuration options, that are relevant to understanding the invention are 17, 18 and 19, which designate a multi-link MRRU (Multi-link Maximum Receive Reconstructed unit) request, **a multi-link Short Sequence Number** header request and a "multi-link endpoint discriminator"

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option, respectively (which will all be discussed in detail below in conjunction with FIG. 5). ... Each such multi-link PPP packet contains a sequence number--which increases by one with each successive packet, inserted by the multi-link protocol."; also see col. 10, lines 6-53, wherein "These formats are depicted as long and short sequence number formats 510 and 550 having 24- and 12-bit sequence numbers, respectively. The specific format of the multi-link PPP packet to use in any situation can be specified by a PPP sender by transmitting an LCP Configuration Request message for a Multi-link Maximum Receive Reconstructed Unit (MRRU) format, i.e., designating long sequence number format 510, or a Multi-link Short Sequence Number Header format, i.e., designating short sequence number format 550, coupled with successful negotiations with its PPP peer therefor. Use of format 510 or 550 is requested by a type field having a value of 17 or 18, respectively, in an LCP Configure Request message, as noted above, transmitted by the PPP sender to its PPP peer."]; and

receive data packets from the server through the first and second network interfaces of the client device during the multilink session [see col. 10, line 6-col. 11, line 28; also see col. 14, lines 22-57, wherein "As a result, server computer 665, by virtue of the common endpoint discriminator associated the application executing at client PC 610 and with every ISDN BRI (B channel pair) emanating from client 605, will then, through conventional multi-link protocol processing correctly view links 630 as a common bundle, i.e., a pipe, for packets generated by and destined to this application and handle packets appearing thereon as multi-link PPP packets."; also see col. 14, line 61-col. 15, line 11, wherein "First, a transmitting side device which transmits (e.g., any of devices 620 or 660) an incoming packet need not split any of these incoming packets but can alternate these packets between each of its physical links, i.e., applies these packets in a round-robin (or other predefined) fashion among its outgoing links. In this

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scenario, no changes need to be made to the contents of each of these incoming packets to transmit that packet through one or more levels in a hierarchy of multi-link PPP devices. A receiving side device merely passes the multi-link packets it receives to its associated DTE in increasing order of the sequence numbers of the packets its received, while ignoring beginning and ending flags in the multi-link header of each such packet."]

wherein the first data transfer rate and the second data transfer rate provide an increased data transfer rate of the first path and the second path from the server to the client device [see col. 2, line 32-col. 3, line 41, wherein "Second, as more users simultaneously contend for available network bandwidth at particular times, such as when the network experiences its peak daily loading, the network becomes increasingly congested. Hence, at these times, network traffic tends to slow which also tends to lengthen download time, thereby frustrating the users particularly those seeking relatively large files. ... Once successfully negotiated between two PPP peers, then, at a transmitting peer, multi-link PPP segments a packetized data stream (i.e., a PPP frame) into segments (or fragments), forms a stream of multi-link PPP packets each containing one such a segment, and then assigns these multi-link PPP packets on an approximately equal basis, where practical, between two B channels in the BRI connection for transmission to a receiving PPP peer; here the two B channels form a pipe. Small packets may not be segmented and to accommodate links of different speeds (which is not the case with two ISDN B channels), the segments need not be of the same size nor do the same number of segments need to be transmitted over each link."; also see col. 17, lines 20-57, wherein "Hence, through the present invention, a link in an original multi-link bundle and carrying multi-link PPP packets can itself be effectively divided (demultiplexed) into substantially any number of different paths with these paths being remotely and correctly recombined (multiplexed) so as to

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appear to be a link of the original multi-link bundle. ... Furthermore, if all multi-link PPP links in a bundle have same data transmission rate such as two B-channels in an ISDN line, then each terminal adapter can simply send its incoming multi-link PPP packets as outgoing multi-link PPP packets on alternating B-channels without the need to encapsulate these packets with multi-multi-link protocol headers....However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."].

With this, as discussed above, Maurya is seen to disclose that the first and second messages include a multilink request and a destination IP address. But in this regard, the reference of Maurya does not expressly disclose if the first and second messages include a multilink request **and a destination URL**, as currently recited in independent claim 1.

However, the reference of Low discloses a client device that transmits messages through a network interface, whereby the message includes a multilink request [and] a destination URL [see Fig. 4, with the terminal 31 transmitting a message 38 to a server 32 that includes a request and a destination URL; also see page 11, line 12-page 13, line 15, wherein "A cornerstone of the WWW is its ability to address particular information resources by means of an Uniform Resource Locator (URL) that identifies a resource by location...By way of example, a full or 'absolute' URL will comprise the following elements:...the Internet host domain or IP address...This request includes a request method, and the 'Request-URI' (which is generally just the absolute path of the resource on the server as identified by the 'abs-path' element of the

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URI); the request may include additional data elements."; also see page 23, line 5-page 24, line 9].

With this, it would have been obvious for one of ordinary skill in the art to have include a destination URL in messages sent from the client to the server, as recognized by Low, within the first and second messages disclosed in Maurya. Maurya and Low are combinable because they are from the same field of endeavor, both being systems that perform multilink data packet communication. At the time of the invention, it would have been obvious to one of ordinary skill in the art to have the client device of Maurya include the functionality that "the first and second messages include a multilink request **and a destination URL**", as recognized by Low. The suggestion/motivation for doing so would be that the client device of Maurya would conform with known protocols for communicating packets in systems utilizing point-to-point protocol (PPP), as discussed by Low in page 11, lines 21-page 12, line 28 which states "In this case, the user terminal 34 will generally communicate with the ISP 33 over the public telephone system using a modem and employing either SLIP (Serial Line Interface Protocol) or PPP (Point-to-Point Protocol). These protocols allow Internet packets to traverse ordinary telephone lines. ... A cornerstone of the WWW is its ability to address particular information resources by means of an Uniform Resource Identifier (URI) that will generally be either a Uniform Resource Locator that identifies a resource by location, or a Uniform Resource Name (URN) that can be resolved into an URL." Here, Low describes that utilizing URLs for PPP communication of packets between user terminals and Internet service providers was well known, and thus, this modification of Maurya with the functionality taught in Low would easily be implemented with these well-known teachings, as exemplified by Low, and would yield predictable results. In this regard,

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Maurya specifically states in col. 9, lines 42-55 that "Other classes of addresses exist. Inasmuch as the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention, I will omit any further details of the latter two aspects." Therefore, it would have been obvious to combine the teachings of Low of using a URL with the client device described in Maurya to obtain the invention specified in independent claim 1.

Regarding ***claim 2***, Maurya and Low disclose the client device discussed above in claim 1, and Maurya further teaches wherein the at least one processor further is configured to transmit the first message and the second message to at least one server [see Figs. 6A-8; also see col. 14, lines 22-60, wherein "Hence, for client-server apparatus 600 shown in FIG. 6A and through the teachings of my invention, a client application executing at client PC 610, during the course of configuring links 615 connecting the PC with terminal adapters 620, will establish its own endpoint discriminator value which, in turn, it will supply, via LCP Endpoint Discriminator packets during LCP negotiations, to each of terminal adapters 620. ...As a result, server computer 665, by virtue of the common endpoint discriminator associated the application executing at client PC 610 and with every ISDN BRI (B channel pair) emanating from client 605, will then, through conventional multi-link protocol processing correctly view links 630 as a common bundle, i.e., a pipe, for packets generated by and destined to this application and handle packets appearing thereon as multi-link PPP packets."],

wherein the at least one server is a device providing the data packets, or a device that manages the client device and another device that is providing data to the client device [see Figs. 6A-8, which illustrates the server computer 665; also see col. 14, lines 22-60, wherein "As a

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result, server computer 665, by virtue of the common endpoint discriminator associated the application executing at client PC 610 and with every ISDN BRI (B channel pair) emanating from client 605, will then, through conventional multi-link protocol processing correctly view links 630 as a common bundle, i.e., a pipe, for packets generated by and destined to this application and handle packets appearing thereon as multi-link PPP packets."].

Regarding ***claim 3***, Maurya and Low disclose the client device discussed above in claim 1, and Maurya further teaches wherein a server provides the multilink session identification that is unique to the multilink session [see col. 5, lines 7-58, wherein "In accordance with my specific inventive teachings, setting identical endpoint discriminators is readily accomplished during LCP negotiations wherein **a multi-link PPP originator, such as, e.g., a server or a client application executing at a PC, assigns itself a unique endpoint discriminator value and informs all its immediate PPP peers**, such as neighboring terminal adapters, by sending the latter, via a first bundle of outgoing links, an LCP Endpoint Discriminator packet containing this value. Each of these immediate PPP peers, rather than assigning itself a unique endpoint discriminator value, assumes the value that has been provided to it in the LCP Endpoint Discriminator packet it receives from the originating device, as its own endpoint discriminator. Each of these peers then, in turn, sends an LCP Endpoint Discriminator packet containing its endpoint discriminator value (i.e., that of the originating multi-link PPP system), via a second bundle of outgoing links, to its immediate PPP peers, and so forth until all hierarchically inter-connected multi-link PPP peers at one end of the pipe and which fan-out from the originator have set their endpoint discriminator to a single common value, i.e., the endpoint discriminator of the multi-link PPP originator. Each multi-link PPP device situated in a final, e.g. m^{th}, level of

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hierarchically organized multi-link PPP peers supplies the common endpoint discriminator value, through an associated LCP Endpoint Discriminator packet and via a separate physical link in the pipe, to its remote multi-link PPP peer at the other end of the pipe. Consequently, all the links in this pipe will be viewed, by the multi-link protocol, as part of a common bundle."; also see col. 13, line 61-col. 14, line 60; also see col. 16, lines 9-55, wherein "Once this occurs, then process 700 progresses to step 730. **At this step, each of far-end terminal adapters 660 takes the endpoint discriminator value (the contents of both class field 430 and address field 440 shown in FIG. 4) sent by server computer 665 as part of an LCP Multi-link Endpoint Discriminator Option packet as its own endpoint discriminator**. Thereafter, this particular terminal adapter then negotiates with its near-end PPP peer, i.e., one of terminal adapters 620, and also negotiates to perform multi-link PPP with server computer 665, via links 662. During the course of LCP negotiations, **the far-end terminal adapter sends its peer near-end adapter an LCP Multi-link Endpoint Discriminator Option packet containing the endpoint discriminator value of the former adapter, i.e., that associated with the server computer**."].

Regarding ***claim 5***, Maurya and Low disclose the client device discussed above in claim 1, and Maurya further teaches wherein each of the first network interface and the second network interface is **one or more of** cellular interface, Wi-Fi interface, a wireless interface, a cable interface, a wired interface, an Ethernet interface, a Bluetooth interface, a near-field communication interface, and an optical interface [see col. 11, line 34-col. 12, line 31, wherein "Here, client 605 is inter-connected to server 650 through multiple ISDN BRI (basic rate interface) lines 630. ... Client 605 is formed of client PC 610, as DTE (data terminating equipment), **connected, through internal communication interfaces 612, typically separate**

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serial ports (not specifically identified), and via corresponding links 615, to multiple identical ISDN BRI terminal adapters 620 as DCE (data circuit terminating equipment)."; also see col. 3, lines 15-65; with this, these teachings in Maurya are seen to disclose a "wired interface"].

Regarding ***claim 6***, Maurya and Low disclose the client device discussed above in claim 1, and Maurya further teaches wherein the processor is configured to reorder the one or more data packets that are received over the at least two or more network interfaces of the client device during the multilink session [see col. 12, lines 32-65, wherein "In particular, as discussed above and depicted in FIG. 5, each multi-link PPP packet generated by client PC 610, shown in FIG. 6A, would contain a sequence number which increments by one from each multi-link PPP packet to the next in a common PPP frame. To ensure proper ordering, each of terminal adapters 660 would buffer each incoming multi-link PPP packet it receives, via links 630, from its corresponding PPP peer in adapters 620, and then reorder its received packets based on their sequence numbers, and then transmit only properly reordered packets to server computer 665. Inasmuch as PC 610 is distributing the multi-link PPP packets, typically in sequential round-robin fashion, amongst terminal adapters 620, each one of terminal adapters 660 would receive packets having sequence numbers that increment not by the value one but by the integer value n; hence, skipping intervening sequence numbers. Under conventional multi-link protocol processing, if incoming multi-link PPP packets were received by any given terminal adapter, such as in adapters 660, but with gaps in their sequence numbers, then each of these terminal adapters would simply buffer these incoming packets pending receipt of those packets containing the missing (here skipped) sequence numbers."; also see col. 14, line 61-col. 16, line 5, wherein

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"To ensure proper re-ordering, upon ultimate reception at a far-end location, of multi-link PPP packets that are to be transmitted at each level, either of two approaches can be used inasmuch as both peer devices (in, e.g., adapters 620 and 660) realize that they are performing multi-multi-link PPP. First, a transmitting side device which transmits (e.g., any of devices 620 or 660) an incoming packet need not split any of these incoming packets but can alternate these packets between each of its physical links, i.e., applies these packets in a round-robin (or other predefined) fashion among its outgoing links. … Second, if either side at any level in the hierarchy desires to split its incoming multi-link packets, then each multi-link PPP device situated at that level encapsulates its incoming multi-link PPP packets as segment data into new outgoing multi-link PPP packets, which I refer to as "multi-multi-link" PPP packets. … Multi-multi-link header 692, has an identical format as that of header 505, but contains beginning and ending (B and E) flags and a sequence number pertinent to the segment data contained within packet 685. FCS field 696 serves the same function and is identical in format to FCS field 507 but has a value associated with the contents of: PPP link layer header 503, protocol and sequence number fields in header 692 and segment data 694."].

Regarding ***claim 13***, Maurya discloses a first device [being the client 605, which includes PC 610 connected through communication interfaces 612 to terminal adapters 620, as seen in Fig. 6A] comprising:

a network interface [being the communication interfaces 612, as seen in Fig. 6A; also see col. 11, line 34-col. 13, line 8, wherein "In that regard, links 615, which comprise links 615_1, 615_2, . . . , 615_n, connect separate terminal adapters 620_1, 620_2, . . . , 620_n, respectively, to separate corresponding serial ports provided by communication interfaces 612. … ISDN

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connections are extended from terminal adapters 620, through public switched telephone network (PSTN) 640, to server 650 having corresponding identical terminal adapters 660, as DCE, and server computer 665, as DTE. Each one of terminal adapters 620 is connected through a separate pair of ISDN B-channels and the PSTN, to a separate corresponding one of terminal adapters 660, the latter terminal adapters collectively connected, via links 662, to server computer 665. Each of adapters 660 is illustratively identical to each of adapters 620."; also see col. 17, lines 36-57, wherein "However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."]; and

at least one processor configured to:

transmit a first message through the network interface to a second device [with the second device seen as being one of the DCEs 660, such as DCE 660_1, as seen in Fig. 6A], wherein the first message includes a multilink request and a destination ***IP address***, the network interface to the second device having a data transfer rate associated therewith [see col. 7, line 22-39, wherein "At this point with no activity on the link, a link control protocol (LCP), which as part of the PPP protocol, exercises responsibility for establishing and configuring the link, remains in an initial or starting state."; also see col. 8, lines 20-59, wherein "FIG. 2 depicts a format of conventional generalized LCP packet 200. As shown, packet 200 is formed of eight-bit code field 210, eight-bit identifier field 220, sixteen-bit length field 230 and finally variable-length data field 240. This packet can be any one of several types, with the value of the code field, having values typically ranging from one to thirteen, specifying the type of any such packet. Of note, a value of

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one indicates that the packet is an LCP Configure Request packet. Such a request packet is sent by a PPP peer whenever that peer desires to change a configuration parameter, such as from a default value, associated with the link."; also see col. 9, lines 14-55, wherein "The endpoint discriminator packet identifies, by specifying an address, of an end system (an "endpoint"), then situated on an end of a link, that is transmitting this particular packet. ... For example, a class field having a value of illustratively zero, one or two specifies that the following address is a null class (i.e., the address is zero octets long), a locally assigned address, such as a serial number (having a length up to twenty octets), or an Internet Protocol (IP) address (having a length of four octets). Other classes of addresses exist. Inasmuch as the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention, I will omit any further details of the latter two aspects."];

transmit a second message through the network interface **to a third device** [with the third device seen as being another one of the DCEs 660, such as DCE 660_2, as seen in Fig. 6A], wherein the second message includes a multilink session identification that is unique to the multilink session and the destination ***IP address***, the network interface to the third device having a data transfer rate associated therewith [see col. 7, line 22-39; also see col. 8, lines 20-59, wherein "FIG. 2 depicts a format of conventional generalized LCP packet 200. As shown, packet 200 is formed of eight-bit code field 210, eight-bit identifier field 220, sixteen-bit length field 230 and finally variable-length data field 240. This packet can be any one of several types, with the value of the code field, having values typically ranging from one to thirteen, specifying the type of any such packet. Of

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note, a value of one indicates that the packet is an LCP Configure Request packet. Such a request packet is sent by a PPP peer whenever that peer desires to change a configuration parameter, such as from a default value, associated with the link."; also see col. 8, line 60-col. 9, line 67, wherein "Each specific option has to be separately negotiated between the PPP peers and appropriately acknowledged prior to its use. Inasmuch as the only values for this type field, i.e., the only configuration options, that are relevant to understanding the invention are 17, 18 and 19, which designate a multi-link MRRU (Multi-link Maximum Receive Reconstructed unit) request, **a multi-link Short Sequence Number** header request and a "multi-link endpoint discriminator" option, respectively (which will all be discussed in detail below in conjunction with FIG. 5). ... Each such multi-link PPP packet contains a sequence number--which increases by one with each successive packet, inserted by the multi-link protocol."; also see col. 10, lines 6-53, wherein "These formats are depicted as long and short sequence number formats 510 and 550 having 24- and 12-bit sequence numbers, respectively. The specific format of the multi-link PPP packet to use in any situation can be specified by a PPP sender by transmitting an LCP Configuration Request message for a Multi-link Maximum Receive Reconstructed Unit (MRRU) format, i.e., designating long sequence number format 510, or a Multi-link Short Sequence Number Header format, i.e., designating short sequence number format 550, coupled with successful negotiations with its PPP peer therefor. Use of format 510 or 550 is requested by a type field having a value of 17 or 18, respectively, in an LCP Configure Request message, as noted above, transmitted by the PPP sender to its PPP peer."]; and

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receive the different data packets through the at least one network interface from the second device and from the third device during the multilink session [see col. 10, line 6-col. 11, line 28; also see col. 14, lines 22-57, wherein "As a result, server computer 665, by virtue of the common endpoint discriminator associated the application executing at client PC 610 and with every ISDN BRI (B channel pair) emanating from client 605, will then, through conventional multi-link protocol processing correctly view links 630 as a common bundle, i.e., a pipe, for packets generated by and destined to this application and handle packets appearing thereon as multi-link PPP packets."; also see col. 14, line 61-col. 15, line 11, wherein "First, a transmitting side device which transmits (e.g., any of devices 620 or 660) an incoming packet need not split any of these incoming packets but can alternate these packets between each of its physical links, i.e., applies these packets in a round-robin (or other predefined) fashion among its outgoing links. In this scenario, no changes need to be made to the contents of each of these incoming packets to transmit that packet through one or more levels in a hierarchy of multi-link PPP devices. A receiving side device merely passes the multi-link packets it receives to its associated DTE in increasing order of the sequence numbers of the packets its received, while ignoring beginning and ending flags in the multi-link header of each such packet."],

wherein the data transfer rate associated with the network interface to the second device and the network interface to the third device provide an increased data transfer rate for the first device [see col. 2, line 32-col. 3, line 41, wherein "Second, as more users simultaneously contend for available network bandwidth at particular times, such as when the network experiences its peak daily loading, the network becomes increasingly congested. Hence, at these times, network traffic tends to slow which also tends to

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lengthen download time, thereby frustrating the users particularly those seeking relatively large files. … Once successfully negotiated between two PPP peers, then, at a transmitting peer, multi-link PPP segments a packetized data stream (i.e., a PPP frame) into segments (or fragments), forms a stream of multi-link PPP packets each containing one such a segment, and then assigns these multi-link PPP packets on an approximately equal basis, where practical, between two B channels in the BRI connection for transmission to a receiving PPP peer; here the two B channels form a pipe. Small packets may not be segmented and to accommodate links of different speeds (which is not the case with two ISDN B channels), the segments need not be of the same size nor do the same number of segments need to be transmitted over each link."; also see col. 17, lines 20-57, wherein "Hence, through the present invention, a link in an original multi-link bundle and carrying multi-link PPP packets can itself be effectively divided (demultiplexed) into substantially any number of different paths with these paths being remotely and correctly recombined (multiplexed) so as to appear to be a link of the original multi-link bundle. … Furthermore, if all multi-link PPP links in a bundle have same data transmission rate such as two B-channels in an ISDN line, then each terminal adapter can simply send its incoming multi-link PPP packets as outgoing multi-link PPP packets on alternating B-channels without the need to encapsulate these packets with multi-multi-link protocol headers….However, if the same data transmission rate can not be guaranteed across all links in a common bundle, then packet encapsulation of incoming multi-link PPP packets with multi-multi-link headers and ordering of incoming multi-multi-link PPP packets based on their multi-multi-link headers should preferably be used."].

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With this, as discussed above, Maurya is seen to disclose that the first and second messages include a multilink request and a destination IP address. But in this regard, the reference of Maurya does not expressly disclose if the first and second messages include a multilink request and a **destination URL**, as currently recited in independent claim 13.

However, the reference of Low discloses a first device that transmits messages through a network interface, whereby the message includes a multilink request and a destination URL [see Fig. 4, with the terminal 31 transmitting a message 38 to a server 32 that includes a request and a destination URL; also see page 11, line 12-page 13, line 15, wherein "A cornerstone of the WWW is its ability to address particular information resources by means of an Uniform Resource Locator (URL) that identifies a resource by location…By way of example, a full or 'absolute' URL will comprise the following elements:…the Internet host domain or IP address…This request includes a request method, and the 'Request-URI' (which is generally just the absolute path of the resource on the server as identified by the 'abs-path' element of the URI); the request may include additional data elements."; also see page 23, line 5-page 24, line 9].

With this, it would have been obvious for one of ordinary skill in the art to have include a destination URL in messages sent from the client to the server, as recognized by Low, within the first and second messages disclosed in Maurya. Maurya and Low are combinable because they are from the same field of endeavor, both being systems that perform multilink data packet communication. At the time of the invention, it would have been obvious to one of ordinary skill

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in the art to have the client device of Maurya include the functionality that "the first and second messages include a multilink request **and a destination URL**", as recognized by Low. The suggestion/motivation for doing so would be that the client device of Maurya would conform with known protocols for communicating packets in systems utilizing point-to-point protocol (PPP), as discussed by Low in page 11, lines 21-page 12, line 28 which states "In this case, the user terminal 34 will generally communicate with the ISP 33 over the public telephone system using a modem and employing either SLIP (Serial Line Interface Protocol) or PPP (Point-to-Point Protocol). These protocols allow Internet packets to traverse ordinary telephone lines. ...A cornerstone of the WWW is its ability to address particular information resources by means of an Uniform Resource Identifier (URI) that will generally be either a Uniform Resource Locator that identifies a resource by location, or a Uniform Resource Name (URN) that can be resolved into an URL." Here, Low describes that utilizing URLs for PPP communication of packets between user terminals and Internet service providers was well known, and thus, this modification of Maurya with the functionality taught in Low would easily be implemented with these well-known teachings, as exemplified by Low, and would yield predictable results. In this regard, Maurya specifically states in col. 9, lines 42-55 that "Other classes of addresses exist. Inasmuch as the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention, I will omit any further details of the latter two aspects." Therefore, it would have been obvious to combine the teachings of Low of using a URL with the client device described in Maurya to obtain the invention specified in independent claim 13.

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Regarding ***claim 14***, Maurya and Low disclose the first device discussed above in claim 13, and Maurya further teaches wherein the first device and the second device are separate devices or separate parts of the same device [see Fig. 6A, whereby the client 605, which includes PC 610 with communication interfaces 612, is separate from the DCE 660_1, being located at the server 650].

Regarding ***claim 15***, Maurya and Low disclose the first device discussed above in claim 13, and Maurya further teaches wherein the first device is **one of** a cell phone, a tablet, a switch, a server, a network device, a router, a computer, a Wi-Fi device, a Wi-Max device, a mobile communication device, a wireless communications device, a near-field communications device, and a Bluetooth device [see Fig. 6A, whereby the client 605 includes PC 610, which is seen to be "a computer" , as well as a "network device"].

Extensions of Time

23. Extensions of time under 37 CFR 1.136(a) will not be permitted in these proceedings because the provisions of 37 CFR 1.136 apply only to "an applicant" and not to parties in a reexamination proceeding. Additionally, 35 U.S.C. 305 requires that reexamination proceedings "will be conducted with special dispatch" (37 CFR 1.550(a)). Extension of time in *ex parte* reexamination proceedings are provided for in 37 CFR 1.550(c).

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Submissions

24. In order to ensure full consideration of any amendments, affidavits or declarations, or other documents as evidence of patentability, such documents must be submitted in response to this Office action. Submissions after the next Office action, which is intended to be a final action, will be governed by the requirements of 37 CFR 1.116, after final rejection and 37 CFR 41.33 after appeal, which will be strictly enforced.

Conclusion

25. The Patent Owner is reminded of the continuing responsibility under 37 CFR 1.565(a) to apprise the Office of any litigation activity, or other prior or concurrent proceeding, involving U.S. Patent 10,868,908 throughout the course of this reexamination proceeding. See MPEP §§ 2207, 2282, and 2286.

26. **All** correspondence relating to this *ex parte* reexamination proceeding should be directed:

By Mail to: Mail Stop *Ex Parte* Reexam
Central Reexamination Unit
Commissioner for Patents
United States Patent & Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

By FAX to: (571) 273-9900
Central Reexamination Unit

By hand: Customer Service Window

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Randolph Building
401 Dulany Street
Alexandria, VA 22314

Any inquiry concerning this communication or earlier communications from the Reexamination Legal Advisor or Examiner, or as to the status of this proceeding, should be directed to the Central Reexamination Unit at telephone number (571) 272-7705.

Signed:

/JOSEPH R POKRZYWA/
Primary Examiner, Art Unit 3992
(571) 272-7410

Conferees:

/ERON J SORRELL/
Primary Examiner, Art Unit 3992
/MICHAEL FUELLING/
Supervisory Patent Examiner, Art Unit 3992

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Owner:	Competitive Access Systems, Inc.
Reexam Control No.:	90/019,265
Conf. No.:	3396
Filed:	October 4, 2023
Title:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
Art Unit:	3992
Examiner:	Joseph R. Pokrzywa
Docket No.:	COM908

Mail Stop *Ex Parte* Reexam
Central Reexamination Unit
Commissioner for Patents
United States Patent & Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE TO NON-FINAL OFFICE ACTION
IN *EX PARTE* REEXAMINATION PROCEEDING

Examiner:

Applicant provides this Response in reply to the Non-Final Office Action dated June 13, 2024. **A Listing of the Claims** begins on page 2 of this paper. **Remarks** begin on page 7 of this paper.

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Listing of Claims:

Claim 1 (original): A client device for multilink data packet communication with a server, the client device comprising:

a first network interface having a first data transfer rate associated with a first path from the server to the first network interface of the client device;

a second network interface having a second data transfer rate associated with a second path from the server to the second network interface of the client device; and

at least one processor configured to:

transmit a first message through the first network interface to the server, wherein the first message includes a multilink request a destination URL;

transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification the destination URL; and

receive data packets from the server through the first and second network interfaces of the client device during the multilink session wherein the first data transfer rate and the second data transfer rate provide an increased data transfer rate of the first path and the second path from the server to the client device.

Claim 2 (original): The client device of claim 1, wherein the at least one processor further is configured to transmit the first message and the second message to at least one server, wherein the at least one server is a device providing the data packets, or a device that manages the client device and another device that is providing data to the client device.

Claim 3 (original): The client device of claim 1, wherein a server provides the multilink session identification that is unique to the multilink session.

Claim 4 (original): The client device of claim 1, wherein the first information is comprised of at least one of an Internet address associated with the first network interface,

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and the second information is comprised of at least one of an Internet address associated with the second network interface.

Claim 5 (original): The client device of claim 1, wherein each of the first network interface and the second network interface is one or more of cellular interface, Wi-Fi interface, a wireless interface, a cable interface, a wired interface, an Ethernet interface, a Bluetooth interface, a near-field communication interface, and an optical interface.

Claim 6 (original): The client device of claim 1, wherein the processor is configured to reorder the one or more data packets that are received over the at least two or more network interfaces of the client device during the multilink session.

Claim 7 (original): The client device of claim 1, wherein the client device is one of a cell phone, a tablet, a switch, a server, a network device, a router, a computer, a Wi-Fi device, a Wi-Max device, a wireless device, a mobile communication device, a near-field communications device, and a Bluetooth device.

Claim 8 (original): A server for multilink communication with a device, the server comprising:

at least one server network interface; and

one or more processors coupled to the at least one server network interface and configured to:

receive a first multilink packet over the at least one server network interface, the first multilink packet comprised of a request for a multilink communication and first information associated with first network communication interface of the device that is capable of being used by the device to receive data packets;

sending a data packet including the multilink session identification to the first network communication interface of the device;

receive a second multilink packet over the at least one server network interface, the second multilink packet comprised of the multilink session identification and second

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information associated with a second network communication interface of the device that is capable of being used by the device to receive data packets; and

send different groups of data packets over the at least one server network interface to the first network communication interface of the device and to the second network communication interface of the device, wherein each of the different groups of data packets includes the multilink session identification.

Claim 9 (original): The server of claim 8, wherein the one or more processors is further configured to send the multilink session identification that is unique to the data packets being sent to the first network communication interface and the second network communication interface.

Claim 10 (original): The server of claim 8, wherein the one or more processors is further configured to:

receive a third multilink packet, the third multilink packet is comprised of multilink information associated with a third network communication interface of the device that is capable of being used by the device to receive data packets; and

send different groups of data packets to the first network communication interface of the device, the second network communication interface of the device and the third network communication interface of the device.

Claim 11 (original): The server of claim 8, wherein the one or more processors is further configured to receive a multilink packets comprised of multilink information associated with which one of the first network communication interface of the device, the second network communication interface of the device and the third network communication interface of the device is to be removed from the multilink session.

Claim 12 (original): The server of claim 8, wherein the one or more processors is further configured to receive different multilink packets over the at least one server network interface at different periods of time.

Claim 13 (original): A first device comprising:

a network interface; and

at least one processor configured to:

transmit a first message through the network interface to a second device, wherein the first message includes a multilink request and a destination URL, the network interface to the second device having a data transfer rate associated therewith;

transmit a second message through the network interface to a third device, wherein the second message includes a multilink session identification that is unique to the multilink session and the destination URL, the network interface to the third device having a data transfer rate associated therewith; and

receive the different data packets through the at least one network interface from the second device and from the third device during the multilink session, wherein the data transfer rate associated with the network interface to the second device and the network interface to the third device provide an increased data transfer rate for the first device.

Claim 14 (original): The first device of claim 13, wherein the first device and the second device are separate devices or separate parts of the same device.

Claim 15 (original): The first device of claim 13, wherein the first device is one of a cell phone, a tablet, a switch, a server, a network device, a router, a computer, a Wi-Fi device, a Wi-Max device, a mobile communication device, a wireless communications device, a near-field communications device, and a Bluetooth device.

Claim 16 (original): A first device for multilink communication, comprising:

at least one network interface; and

one or more processors coupled to the at least one network interface and configured to:

receiving one or more multilink packets where each multilink packet comprises information associated with one or more of a plurality of network communication interfaces of a second device that are capable of being used to receive data packets;

during a multilink session

splitting up data from a data source into different groups of data packets; and

controlling a data server where the data server sends the different groups of data packets from the data server to different network communication interfaces of the second device, wherein each of the different groups of data packets includes the multilink session identification.

Claim 17 (original): A client device for multilink communication, the client device comprising:

a first network interface having a first data transfer rate associated therewith;

a second network interface having a second data transfer rate associated therewith; and

at least one processor and configured to:

transmit a first message through the first network interface to at least one server, wherein the first message includes a multilink request and a destination URL;

transmit a second message through the second network interface to the at least one server, wherein the second message includes a multilink session identification that is unique to the multilink session and the destination URL; and

receive concurrently the different data packets from the server through the first network interface and the second network interface of the client device during the multilink session, wherein the first data transfer rate and the second data transfer rate provide an increase in the data transfer rate of the client device.

REMARKS

Applicant submits this Response in reply to the Non-Final Office Action dated June 13, 2024. The Commissioner is hereby authorized to charge Deposit Account 02-1818 for any additional fees which are due and owing. If any such charges are applied, please indicate Attorney Docket No. 3725791.00005 on the account statement.

Claims 1-3, 5, 6, and 13-15 are subject to the reexamination and stand rejected. Patent Owner respectfully traverses the rejections. No new matter has been introduced.

Patent Owner has served this Response to the third-party requester and has attached a certificate of service to this Response.

A. Introduction

Claims 1-3, 5-6, and 13-15 currently stand rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,160,808, issued to Maurya ("Maurya") in view of WO 97/22212, with the inventor of Low ("Low"). Patent Owner contends that the claimed invention is not obvious over the combination of Maurya and Low and respectfully requests the rejections to be withdrawn.

Each of the claims at issue requires a first message that includes: (i) a multilink request; and (ii) a destination URL, and a second message that includes: (iii) a multilink session identification; and the destination URL. In other words, the two messages must include three distinct claim elements:

1. a multilink request;
2. a destination URL; and
3. a multilink session identification.

No combination of Maurya and Low disclose, teach, or otherwise render obvious the claim element "**multilink session identification**." Accordingly, claims 1-3, 5-6, and 13-15 are patentable over the combination of Maurya and Low.

B. The '908 Patent

The '908 Patent is directed to devices utilizing a multipath connection to increase bandwidth available to a receiving device by splitting data that is then routed over multiple device connections before being recombined for the receiving device.

Independent Claims 1 and 13 recite similar elements, as shown below. Claim 1 is

directed to a client device that includes first and second network interfaces, each having a data transfer rate associated with a path from a server to the respective network interface. The client device also includes a processor configured to transmit first and second messages to the server through the different network interfaces, the first message including a multilink request and a destination URL and the second message including a multilink session identification and the destination URL, and to receive data packets from the server through the different network interfaces.

> Claim 1: A client device for multilink data packet communication with a server, the client device comprising:
>
> a first network interface having a first data transfer rate associated with a first path from the server to the first network interface of the client device;
>
> a second network interface having a second data transfer rate associated with a second path from the server to the second network interface of the client device; and
>
> at least one processor configured to:
>
> transmit **a first message** through the first network interface to the server, wherein the first message includes **a multilink request a destination URL**;
>
> transmit **a second message** through the second network interface to the server, wherein the second message includes **a multilink session identification the destination URL**; and
>
> receive data packets from the server through the first and second network interfaces of the client device during the multilink session wherein the first data transfer rate and the second data transfer rate provide an increased data transfer rate of the first path and the second path from the server to the client device.

Claim 13 is directed to a first device that includes a network interface and a processor. The processor is configured to transmit first and second messages to second and third

devices, respectively, through the network interface, the first message including a multilink request and a destination URL and the second message including a multilink session identification and the destination URL, and to receive different data packets from the second device and the third device through the multilink session.

Claim 13: A first device comprising:

a network interface; and

at least one processor configured to:

transmit **a first message** through the network interface to a second device, wherein the first message includes **a multilink request** and **a destination URL**, the network interface to the second device having a data transfer rate associated therewith;

transmit **a second message** through the network interface to a third device, wherein the second message includes **a multilink session identification** that is unique to the multilink session and **the destination URL**, the network interface to the third device having a data transfer rate associated therewith; and

receive the different data packets through the at least one network interface from the second device and from the third device during the multilink session, wherein the data transfer rate associated with the network interface to the second device and the network interface to the third device provide an increased data transfer rate for the first device.

As shown, each of the claims at issue requires a first message that includes: (i) a multilink request; and (ii) a destination URL, and a second message that includes: (iii) a multilink session identification; and the destination URL. In other words, the two messages must include three distinct claim elements:

1. a multilink request;
2. a destination URL; and
3. a multilink session identification.

An example detailing these three claim elements is provided with the description of FIG. 7 starting at column 12, line 2, and continuing through column 13, line 18. In this example, the claimed multilink request ("requests a multilink PPP session") and destination URL ("URL") are first described at column 12, lines 2-4:

> Referring to FIG. 7, an RCG—85 that decides to initiate a multilink PPP session with a remote computer i.e. internet URL, **requests a multilink PPP session** with that **URL** resource via Link Control Protocol (LCP) session management.

In this example, the claimed multilink session identification is first described in column 12, lines 9-14:

> As part of a successful multilink PPP session setup, the initiating RCG—85 receives **a multilink PPP session ID**, or "magic number", which is used to identify this particular multilink PPP session and is also used for adding or removing links from the multilink bundle—87.

Additionally, this example describes how additional links are added to an ongoing multilink session in column 12, lines 51-66:

> The initiating RCG then selects which of the responding remote RCGs—86 it will use for the multilink PPP bundle—87 and sends them a multilink initialization packet containing **the URL of the destination** as well as **the multilink PPP session ID** (magic number) and any other pertinent information required for the remote RCG to join in the existing multilink PPP bundle—87. Each remote RCG POTS interface—91 participating in a multilink PPP bundle, represents a logical "link" in the initiating RCG's multilink PPP bundle—87. The remote RCGs—86 then send a multilink PPP packet (over their respective POTS lines—91) to the destination URL with the multilink PPP session ID and request to be added to that multilink PPP bundle—87. The destination URL accepts the request of each of the remote RCGs—86 and begins sending data packets to each over their respective POTS lines—91.

C. Maurya

Maurya teaches a technique for transmitting incoming multi-link point-to-point (PPP) packet traffic over multiple outgoing links in a multi-link bundle. Specifically, Maurya teaches multi-link communication between a client and a server. In doing so, Maurya combines multiple ISDN communication links that are each connected to a corresponding ISDN terminal adapter (ISDN TA) located on the client side of the communication and sends streams of data from the client through the multiple ISDN communication links and corresponding ISDN TAs to the server. An exemplary illustration of Maurya's teachings is

provided in FIG. 6A reproduced below:

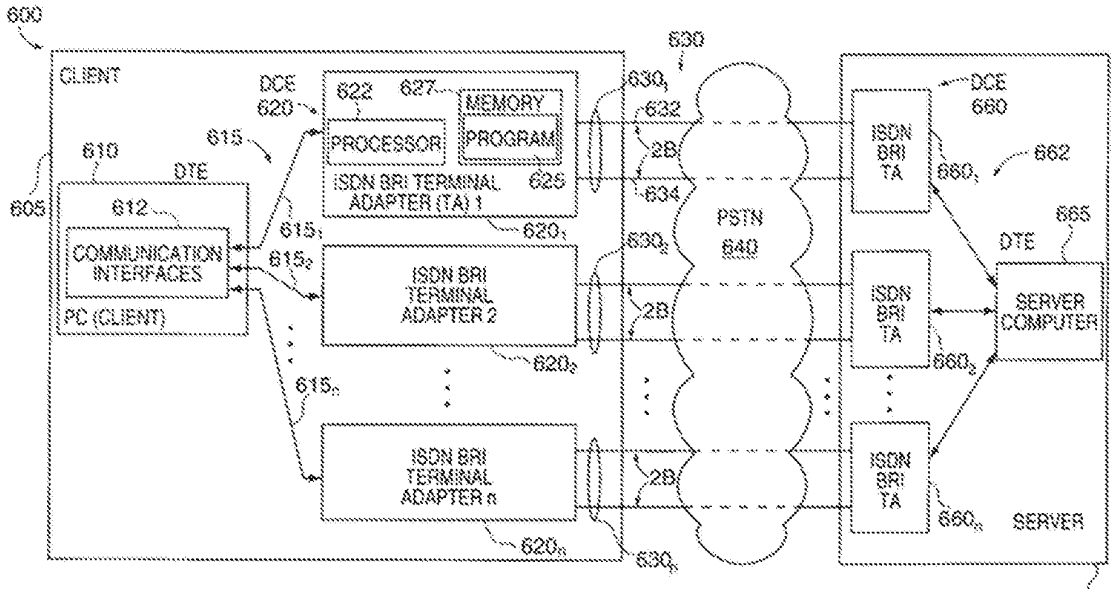


FIG. 6A

Maurya teaches the use of an endpoint discriminator value unique to the originating device that is sent to each sending terminal adapter 620_n, which in turn sets the value of its own endpoint discriminator to match that of the sending peer 610. While each sending terminal adapter 620_n negotiates with a corresponding receiving terminal adaptor 660_n, each terminal adaptor 620_n sends the same endpoint discriminator value of the sending peer 610 to its receiving terminal adapter 660_n. (Maurya, 9:35-49 and 13: 61-14:21).

As a result, in Maurya, all the links in the multilink bundle have the same physical link address (*i.e.*, endpoint discriminator). In contrast, each endpoint (*e.g.*, RCG) in the '908 Patent has its own unique link address. ('908 Patent, 12:16-23).

D. Low

Low is directed to a switched telecommunication system that uses service resource items (URLs) to set up a network. *See, e.g.*, Ex. 1005, 1:7-9 and 2:2-16. Generally, the system of Low enables a user to access setup control logic for a channel through a public switched telephone network (PSTN). Ex. 1005, 16:12-29. Fig. 13, reproduced below, demonstrates this functionality with respect to a "personal number" service in which a first user can setup a

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single, unique, unchanging personal phone number (a "Webtel" number) that can be used by others to reach the first user by phone, even when the first user changes their "real phone number" (a B-telNb). *Id.*, at 35:9-22. In this example, the system allots the first user a unique personal number that is associated with a dedicated "phone page," which associates the Webtel number with the first user's current real telephone number. *Id.*, at 35:19-22. The phone page is located at a URL, which, when accessed, returns the current real phone number. *Id.*, at 35:18-19. Accordingly, when another user calls the first user's Webtel number, the system accesses the phone page associated with the Webtel number, acquires the first user's current real phone number, and uses the current real phone number to complete the call. *Id.*, at 35:27-36:10.

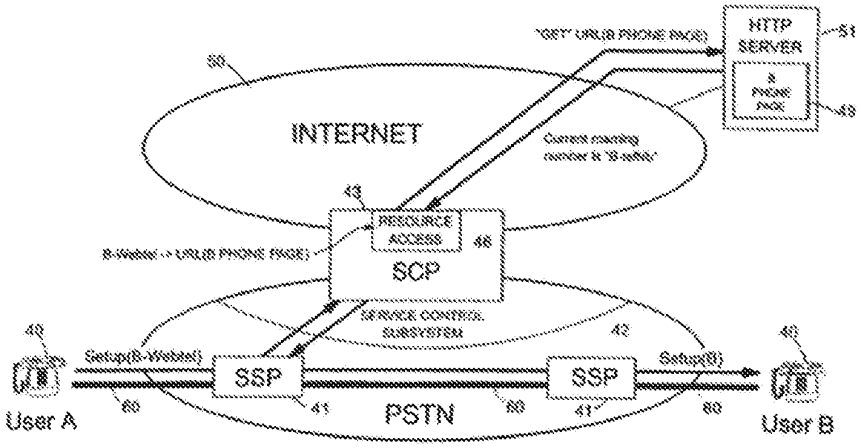


FIG. 13

Id., Fig. 13. More specifically, when a phone call is made, the service switching point (SSP) generates a service request that is conveyed to the service control point (SCP). *Id.*, at 20:29-32. The service logic program running in the SCP is a skeleton form, being instantiated on receipt of a service request and then serving to initiate service resources access and to return the results of this access to the entity that made the service request. *Id.*, at 21:20-27. The association between the unique number and the URL of the phone page is stored in an association table accessible to SCP 43. *Id.*, at 35:24-25. Therefore, the SCP receives the unique

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number from the first user and locates the URL through a table. *Id.*

E. Validity of the '908 Patent

Claims 1-3, 5-6, and 13-15 currently stand rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Maurya in view of Low. For the following reasons, Patent Owner contends that the claimed invention is not obvious over the combination of Maurya and Low and respectfully requests the rejections to be withdrawn:

1. the Examiner does not present any argument that the cited art discloses a multilink session identification;
2. the endpoint discriminator taught by Maurya is not a multilink session identification, nor does it render obvious the use of a multilink session identification claimed in the '908 Patent; and
3. Low does not disclose, teach, or render obvious a second message that includes: a multilink session identification; and the destination URL.

Accordingly, no combination of the cited art renders claims 1-3, 5-6, and 13-15 obvious.

a. The Office Action Fails To Point To Any Disclosure Of A Multilink Session Identification

As provided in MPEP 2143.03, "All words in a claim must be considered in judging the patentability of that claim against the prior art." In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). Examiners must consider all claim limitations when determining patentability of an invention over the prior art. In re Gulack, 703 F.2d 1381, 1385, 217 USPQ 401, 403-04 (Fed. Cir. 1983). However, in the Office Action dated June 13, 2024, the Examiner fails to address Patent Owners claim limitation "a multilink session identification."

On Page 16 of the Office Action, the Examiner states:

> With this, as discussed above, Maurya is seen to disclose that the first and second messages include a multilink request and a destination IP address. But in this regard, the reference of Maurya does not expressly disclose if the first and second messages include a multilink request **and a destination URL**, as currently recited in independent claim 1.

In this statement, the Examiner implies that both the first and second messages require **a multilink request** and a destination URL and fails to acknowledge the second

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message must include **a multilink session identification** and a destination URL. The Examiner's statement, in combination with the Office Action's failure to provide any evidence or argument that the cited art discloses or teaches a multilink session identification, demonstrates that the rejections in the Office Action fail to address each of the claim limitations.

Accordingly, the Patent Owner submits that the rejections in the Office Action are improper and respectfully requests the Examiner allow claims 1-3, 5-6, and 13-15.

b. A Multi-Link Short Sequence Number Header Request Is Not A Multilink Session Identification And Is Not An Endpoint Discriminator

As noted above, Patent Owner respectfully submits that the Office Action fails to identify what element in Maurya the Examiner believes renders obvious the claimed multilink session identification. However, the Examiner addresses the broader claim limitation in which the multilink session identification claim term is found starting with the second paragraph of page 13 to the first paragraph of page 14, reproduced here for the convenience of the Examiner:

> transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification ***[and] the destination IP address*** [see col. 7, line 22-39; also see col. 8, lines 20-59, wherein "FIG. 2 depicts a format of conventional generalized LCP packet 200. As shown, packet 200 is formed of eight-bit code field 210, eight-bit identifier field 220, sixteen-bit length field 230 and finally variable-length data field 240. This packet can be any one of several types, with the value of the code field, having values typically ranging from one to thirteen, specifying the type of any such packet. Of note, a value of one indicates that the packet is an LCP Configure Request packet. Such a request packet is sent by a PPP peer whenever that peer desires to change a configuration parameter, such as from a default value, associated with the link."; also see col. 8, line 60-col. 9, line 67, wherein "Each specific option has to be separately negotiated between the PPP peers and appropriately acknowledged prior to its use. Inasmuch as the only values for this type field, i.e., the only configuration options, that are relevant to understanding the invention are 17, 18 and 19, which designate a multi-link MRRU (Multi-link Maximum Receive Reconstructed unit) request, **a multi-link Short Sequence Number** header request and a "multi-link endpoint discriminator"

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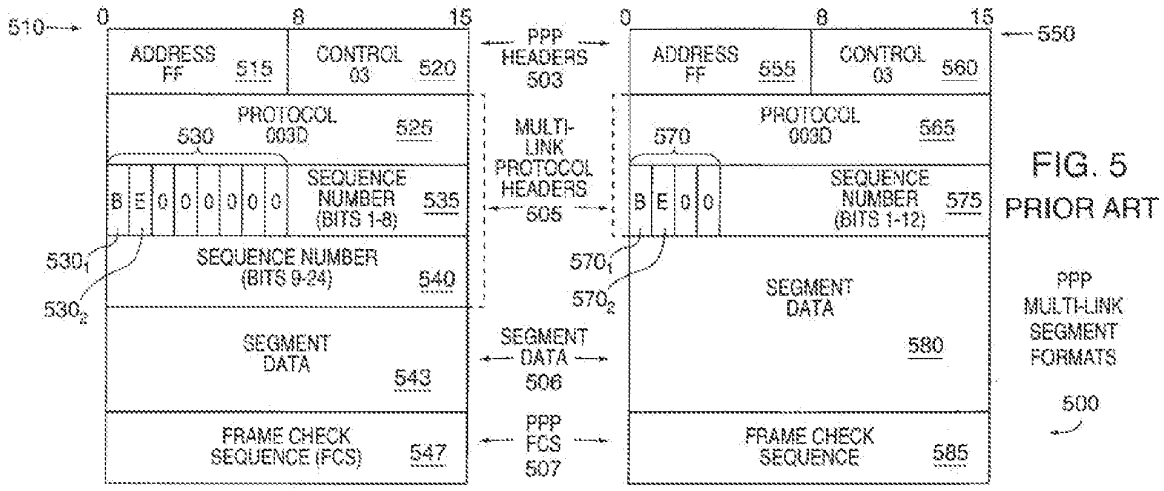
> option, respectively (which will all be discussed in detail below in conjunction with FIG. 5). . . . Each such multi-link PPP packet contains a sequence number--which increases by one with each successive packet, inserted by the multi-link protocol."; also see col. 10, lines 6-53, wherein "These formats are depicted as long and short sequence number formats 510 and 550 having 24- and 12-bit sequence numbers, respectively. The specific format of the multi-link PPP packet to use in any situation can be specified by a PPP sender by transmitting an LCP Configuration Request message for a Multi-link Maximum Receive Reconstructed Unit (MRRU) format, i.e., designating long sequence number format 510, or a Multi-link Short Sequence Number Header format, i.e., designating short sequence number format 550, coupled with successful negotiations with its PPP peer therefor. Use of format 510 or 550 is requested by a type field having a value of 17 or 18, respectively, in an LCP Configure Request message, as noted above, transmitted by the PPP sender to its PPP peer."]; and

For claim 13, the "multilink session identification" is similarly addressed on pages 24 and 25.

Based on the excerpt provided above, it is unclear whether the Office intends to equate the claimed multilink session identification to Maurya's multi-link Short Sequence Number header request or to Maurya's endpoint discriminator. The multilink session identification is neither.

i. Maurya's Multi-Link Short Sequence Number Header Request Is Not A Multilink Session Identification

Maurya describes that each multi-link PPP packet contains a "sequence number – which increases by one with each successive packet." (Maurya, 9:53-67). The purpose of the sequence numbers is to order the packets sent. (Maurya, 4:7-12; "[t]o ensure proper ordering ... it receives and then reorder its received packets based on their sequence numbers..."). The sequence number can either be in a short sequence number format or in a long sequence number format. Both are shown in Fig. 5 (reproduced below) and are described in Maurya starting on col. 10, line 6 to the end of col. 10:



As shown in Fig. 5, a multi-link Short Sequence Number (575) is part of a packet having a short sequence number format (550). This multi-link Short Sequence Number (575) is used for ordering the packets after receipt on the receiving side.

The '908 patent does not use the "multilink session identification" for anything associated with re-ordering packets or as referred to as "reassembly" of packets in the '908 patent. (*See,* '908, 12:9-14; "As part of a successful multilink PPP session setup, the initiating RCG—85 receives a multilink PPP session ID, or "magic number", which is used to identify this particular multilink PPP session and is also used for adding or removing links from the multilink bundle—87.")

As shown, Maurya's multi-link Short Sequence Number is for ordering messages within a session and the '908 Patent's multilink session identification is for distinguishing between sessions. Accordingly, Maurya's multi-link Short Sequence Number is distinctly different in purpose and function from the claimed multilink session identification.

ii. Maurya's Endpoint Discriminator Is Not A Multilink Session Identification

Although the Office Action does not make any argument that Maurya teaches the multilink session identification claim element in claims 1-3, 5-6, and 13-15, Patent Owner hereby addresses the argument presented in the Request for *Ex Parte* Reexamination of U.S. Patent 10,868,908 filed by Unified Patents, LLC on October 4, 2023, (the "Unified Patents

Request") that Maurya's endpoint discriminator value acts as a multilink session identification.

1. Unified Patents' Argument

The Unified Patents Request incorrectly argues that Maurya's endpoint discriminator (or endpoint identifier) is equivalent to the claimed multilink session identification. Starting on page 26, the Unified Patents Request argues that Maurya's "client PC requires **each peer** to send the client's unique endpoint discriminator, or endpoint identifier (i.e., *multilink session identification*) when initiating a link." The Unified Patents Request further argues that the "endpoint discriminator option allows different peers, such as the terminal adapters, to join a link by specifying an endpoint discriminator of an endpoint system." The Unified Patents Request then provides the following:

> Maurya explains that one drawback to conventional PPP systems is that multiple outgoing links connected to the same endpoint system, such as a client, still may have different endpoint discriminators; this results in the endpoint system at the opposite end of the pipe, such as a server, as viewing each network device as separate instead of as part of a common bundle of links terminating at one system, resulting in packets not being properly reassembled at the client PC.

(Maurya, 13:23-46).

As noted in the Unified Patents Request, "Maurya purports to solve this problem by creating a 'multi-multi' link protocol in which a client directs each peer at the end of one pipe to 'share a common endpoint discriminator value.'"

Citing its expert's declaration, on Page 28, the Unified Patents Request argues:

> A POSA would have recognized that Maurya's endpoint discriminator, also called an endpoint identifier (id., 9:39-40, 10:22-25, 13:19-21), is a *multilink session identification* because it identifies the session using LCP configuration packets, which were used to add and remove devices from a link.

As shown below, the Unified Patents Request argument is incorrect and Maurya does not teach the claimed multilink session identification. Accordingly, no combination of Maurya and Low renders obvious claims 1-3, 5-6, and 13-15.

2. Why The Unified Patents' Argument Is Wrong

Maurya's endpoint discriminator and the '908 Patent's multilink session identification are different in both form and operation. In fact, the '908 Patent's multilink

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session identification solves problems that cannot be solved by Maurya's endpoint discriminator. Accordingly, Maurya's endpoint discriminator is not equivalent to and cannot render obvious the '908 Patent's claimed multilink session identification.

In the seven-layer OSI Model, Maurya's endpoint discriminator is a Layer 2 PPP LCP identifier used to associate multiple communication link equipment ports with a physical multilink bundle. In other words, Maurya endpoint discriminator helps its system to initially construct a multilink data link layer (*i.e.*, Layer 2 in the OSI Model) prior to any data being transmitted over the multilink connection. This is demonstrated, in part, in Maurya's description in column 1, lines 52-64:

> Before any data is transmitted over a PPP link, each PPP peer connected to one end of the link will send LCP configuration packets to the other end to establish and test the link; thus, ensuring the link is fully operational. Once the LCP protocol has successfully completed its negotiations, the PPP peers then negotiate the necessary NCPs to properly configure the link for the different network layer protocols that are to be used; with a different NCP being negotiated for each different network layer protocol. Once the NCP(s), for the various network layer protocols, have been successfully negotiated and configured at both PPP peers, then PPP packet traffic containing encapsulated data, using the network layer protocols, can commence over that link.

Maurya's endpoint discriminator is used in this LCP configuration process prior to data being sent over the multilink connection. For example, as described in column 9, lines 35-42:

> As depicted in FIG. 4, an LCP Configure Request packet specifies a multi-link endpoint discriminator option whenever the type field of the LCP Configure Request packet is set to value nineteen, as is field 410. Identification of the endpoint system (commonly referred to as either an "endpoint discriminator" or "endpoint identifier") is accomplished through class field 430 and address field 440, which collectively contain data carried by this packet.

Further description of Maurya's LCP negotiation is presented with reference to FIG. 7, in which Maurya teaches, "[o]nce these [LCP] negotiations are successfully concluded, then process 700 progresses to step 760 at which the links between the near and far-end terminal adapters all enter network (data transmission) state 140 (see FIG. 1) during which communicate packetized data can be transported between the client PC and the server computer." (Maurya, 16:47-53).

As shown, Maurya requires all links to be provisioned and configured to operate the

same before any data transfers can commence. Maurya does not provide any disclosure or teaching of how such an endpoint discriminator could be used to dynamically add or remove links to an existing multilink communication session.

In contrast, the '908 Patent's claimed multilink request, multilink session identification, and destination URL are solutions for managing multilink communication over an existing link layer. Accordingly, the multilink session identification can be used to dynamically add and remove links in an existing multilink communication session, as described in column 12, lines 51-66, of the '908 Patent:

> The initiating RCG then selects which of the responding remote RCGs—86 it will use for the multilink PPP bundle—87 and sends them a multilink initialization packet containing **the URL of the destination** as well as **the multilink PPP session ID** (magic number) and any other pertinent information required for the remote RCG to join in the existing multilink PPP bundle—87. Each remote RCG POTS interface—91 participating in a multilink PPP bundle, represents a logical "link" in the initiating RCG's multilink PPP bundle—87. The remote RCGs—86 then send a multilink PPP packet (over their respective POTS lines—91) to the destination URL with the multilink PPP session ID and request to be added to that multilink PPP bundle—87. The destination URL accepts the request of each of the remote RCGs—86 and begins sending data packets to each over their respective POTS lines—91.

Column 13, line 13, through column 14, line 9, further describes the dynamic nature of the '908 system detailing how remote RCGs can be added and removed from existing sessions, including column 13, lines 54-59:

> Once a remote RCG—86 has been removed from participating in a multilink bundle—87, the initiating RCG—85 will then look up another remote RCG in its router tables that can be used to participate in the multilink PPP bundle—87, and request that the new remote RCG—86 to join the existing multilink bundle—87.

This is quite an improvement from the "fixed pairs of systems" type networks taught by Maurya and a direct benefit of the multilink session identification operating above the Layer 2 endpoint discriminator used in Maurya.

The invention claimed in the '908 Patent is a solution to additional limitations in Maurya's system. For example, the endpoint discriminator value of Maurya cannot be used to differentiate between various multilink sessions occurring between Maurya's PC client and server—any data sent between the PC client and server is treated as part of a single

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session. As a result, the Maurya system does not support multiple concurrent sessions between the PC client and the server. However, incorporating the '908 Patent's multilink session identification into the Maurya system would enable multiple concurrent multilink sessions between Maurya's client PC and server where each distinct session would be identified and distinguished by the multilink session identification. Hypothetically, if one were to implement the '908 Patent's multilink session identification on top of the Maurya OSI Layer 2 link layer, Maurya's sending device could send data through different, identifiable multilink sessions (even over an identical set of ISDN communication links and ISDN TAs on the client side) and Maurya's receiving device could associate received data with individually identifiable multilink sessions. The fact that Maurya cannot run concurrent sessions using only its endpoint discriminator and the fact that the inclusion of the '908 Patent's claimed multilink session identification would provide expanded functionality for the Maurya system demonstrates that Maurya's endpoint discriminator is not equivalent to the claimed multilink session identification.

As shown, not only is Maurya's endpoint discriminator not equivalent to the claimed multipath session identification, incorporation of the claimed multipath session identification into Maurya would result in an improvement to the functionality of the Maurya system. Accordingly, the Patent Owner submits that the combination of Maurya and Low fails to render obvious claims 1-3, 5-6, and 13-15 and respectfully requests the Examiner allow the claims over the cited art.

c. Low Does Not Teach a Multilink Session Identification

In the Office Action, claims 1-3, 5-6, and 13-15 are rejected based on a combination of Maurya and Low. As shown above, Maurya does not teach a second message that includes a multilink session identification. Patent Owner respectfully submits that the Examiner does not present any evidence or argument that Low teaches a second message that includes a multilink session identification. Therefore, Low does not remedy Maurya's failure to render the claims obvious.

As noted above, Low is directed to call setup in telephone systems. Low does not include any teachings related to multilink communications. As a result, Low does not teach any mechanism for identifying or distinguishing between different multilink sessions in a

multilink communication system. Accordingly, Low does not teach the multilink session identification element missing from Maurya.

Accordingly, without waiving any additional arguments related to patentability, the Patent Owner submits that, for at least the reasons above, the combination of Maurya and Low fails to render obvious claims 1-3, 5-6, and 13-15 and respectfully requests the Examiner allow the claims over the cited art.

F. Conclusion

Patent Owner respectfully submits that no combination of Maurya and Low discloses, teaches, or otherwise renders obvious claims 1-3, 5-6, and 13-15 and the pre-AIA 35 U.S.C. 103(a) rejection of these claims has been overcome. Accordingly, Patent Owner requests the Examiner allow claims 1-3, 5-6, and 13-15.

Conclusion

An earnest endeavor has been made to place this application in condition for formal allowance, and allowance is courteously solicited. If the Examiner has any questions regarding this Response, Patent Owner respectfully requests that the Examiner contact the undersigned.

Respectfully submitted,

K&L Gates LLP

By: /M. Clare Frederick/
M. Clare Frederick
Reg. No. 66,608
Telephone No. (312) 807-4335
Customer No. 29156

Dated: August 13, 2024

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UNITED STATES
PATENT AND TRADEMARK OFFICE

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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
90/019,265	**12/02/2024 05:18:09 PM Z ET**	**COM908**

Title of Invention

DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS

Application Information

APPLICATION TYPE	Utility / ex parte reexam	PATENT #	10868908
CONFIRMATION #	3396	FILED BY	Joshua Brooks
PATENT CENTER #	68185640	FILING DATE	10/04/2023
CUSTOMER #	29156	FIRST NAMED INVENTOR	- 10868908
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Clare Frederick

Documents

TOTAL DOCUMENTS: 1

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
3725791.00005_NoticeAppeal.pdf	2	Notice of Appeal Filed	290 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
3725791.00005_NoticeAppeal.pdf	7DC8BABDF6DDD574CCC60B93441AB8A7329E63CE0D2BB840D7EB560B97D88103C255CBF2731BB5558702B40D3EF3DA4A921413F970EB91B1E3B3281D4FE71815

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New Applications Under 35 U.S.C. 111

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National Stage of an International Application under 35 U.S.C. 371

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New International Application Filed with the USPTO as a Receiving Office

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APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
90/019,265	**12/02/2024 05:18:09 PM Z ET**	**COM908**

Title of Invention

DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS

Application Information

APPLICATION TYPE	Utility / ex parte reexam	PATENT #	10868908
CONFIRMATION #	3396	FILED BY	Joshua Brooks
PATENT CENTER #	68185640	AUTHORIZED BY	Clare Frederick
CUSTOMER #	29156	FILING DATE	10/04/2023
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	- 10868908

Payment Information

PAYMENT METHOD	PAYMENT TRANSACTION ID	PAYMENT AUTHORIZED BY
DA / 021818	**E2024B2H18587521**	**US Patent Mail**

PRE-AUTHORIZED ACCOUNT	PRE-AUTHORIZED CATEGORY
021818	**37 CFR 1.16 (National application filing, search, and examination fees); 37 CFR 1.17 (Patent application and reexamination processing fees)**

FEE CODE	DESCRIPTION	ITEM PRICE($)	QUANTITY	ITEM TOTAL($)
1401	NOTICE OF APPEAL	840.00	1	840.00
			TOTAL AMOUNT:	**$840.00**

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New Applications Under 35 U.S.C. 111

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Docket Number (Optional): 3725791.00005

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Signature: /M. Clare Frederick/

Typed or printed name: M. Clare Frederick

First Named Inventor: Eric M. Delangis	
Application Number: 90/019,265	Filed: 2023-10-04
For: DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS	
Art Unit: 3992	Examiner: JOSEPH R. POKRZYWA

Applicant hereby **appeals** to the Patent Trial and Appeal Board from the last decision of the examiner.

The fee for this Notice of Appeal is (37 CFR 41.20(b)(1)) $ 840

☐ Applicant asserts small entity status. See 37 CFR 1.27. Therefore, the fee shown above is reduced by 60%, and the resulting fee is: $ _____

☐ Applicant certifies micro entity status. See 37 CFR 1.29. Therefore, the fee shown above is reduced by 80%, and the resulting fee is: $ _____
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I am the

☐ applicant ☑ attorney or agent of record Registration number 66608 ☐ attorney or agent acting under 37 CFR 1.34 Registration number _____

Signature: /M. Clare Frederick/

Typed or printed name: M. Clare Frederick

Telephone Number: 312-807-4276

Date: 2024-12-02

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9) the Office of Personnel Management (OPM) for personnel research purposes; and

10) the Office of Management and Budget (OMB) for legislative coordination and clearance.

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Reexam Control No.:	90/019,265
U.S. Patent No.:	10,868,908
Patent Owner:	Competitive Access Systems, Inc.
Conf. No.:	3396
Filed:	October 4, 2023
Title:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
Art Unit:	3992
Examiner:	Joseph R. Pokrzywa
Docket No.:	COM908

Mail Stop *Ex Parte* Reexam
Attn: Central Reexamination Unit
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Certificate of Service

Commissioner:

The undersigned, on behalf of Patent Owner, hereby certifies that copies of the following documents are being served on the Third Party Requester listed below by first class mail, postage prepaid, on the 3rd day of February, 2025:

- Petition to Withdraw Finality of Office Action and Exhibits 1-3 filed October 31, 2024;
- Request to Expedite Petition Pursuant to 37 C.F.R. § 1.182 filed October 31, 2024; and
- Notice of Appeal from the Examiner to the Patent Trial and Appeal Board filed December 2, 2024.

The name and party being served is as follows:

Attn: Michelle Aspen
Unified Patents, LLC
4445 Willard Ave., Suite 600
Chevy Chase, MD 20815

Respectfully submitted,

K&L Gates LLP

By: /M. Clare Frederick/
M. Clare Frederick
Reg. No. 66,608
Telephone No. (312) 807-4335
Customer No. 29156

Dated: February 3, 2025

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APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
90/019,265	**02/03/2025 05:28:00 PM Z ET**	**COM908**

Title of Invention

DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS

Application Information

APPLICATION TYPE	Utility / ex parte reexam	PATENT #	10868908
CONFIRMATION #	3396	FILED BY	Joshua Brooks
PATENT CENTER #	69030600	FILING DATE	10/04/2023
CUSTOMER #	29156	FIRST NAMED INVENTOR	- 10868908
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Clare Frederick

Documents

TOTAL DOCUMENTS: 2

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
3725791.00005_Certificate of Service.pdf	1	Reexam Certificate of Service	122 KB
3725791.00005_FinalAppeal Brief.pdf	32	Appeal Brief-Owner	1426 KB

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DOCUMENT	MESSAGE DIGEST(SHA-512)
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3725791.00005_FinalAppealBrief.pdf	7D6B2FF65783C2C1CAD12B220B99D6DD615A4AA0A4D7D6E FD85E92C4AEE78D5DD9A148BEA58A81503BF1E156D945E66

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New International Application Filed with the USPTO as a Receiving Office

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THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT TRIAL AND APPEAL BOARD

Reexam Control No.:	90/019,265
U.S. Patent No.:	10,868,908
Patent Owner:	Competitive Access Systems, Inc.
Conf. No.:	3396
Filed:	October 4, 2023
Title:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
Art Unit:	3992
Examiner:	Joseph R. Pokrzywa
Docket No.:	3725791.00005

Commissioner for Patents
P.O. Box 1450
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APPELLANT'S APPEAL BRIEF

Commissioner:

Appellant submits this Appeal Brief in support of the Notice of Appeal filed on December 2, 2024. This Appeal is taken from the Final Office Action dated October 2, 2024 ("Office Action").

I. REAL PARTY IN INTEREST

The real party in interest for the above-identified patent application on appeal is Competitive Access Systems, Inc. ("CAS") because of an assignment executed on May 13, 2021, which was recorded on May 13, 2021, at reel 056236, frame 0492 in the United States Patent and Trademark Office.

II. RELATED APPEALS, INTERFERENCES, AND TRIALS

Appellant submitted a Petition to the USPTO to withdraw the finality of the pending Office Action on October 31, 2024. The Office of Petitions has not yet issued a decision.

U.S. Patent No. 10,868,908 (the "'908 Patent") is currently involved in *Red Hat, Inc. v. Competitive Access Systems, Inc.*, EDNC-5-24-cv-00505-D-BM.

Further, the '908 Patent was previously involved in the following proceedings:

- *Red Hat, Inc. v. Competitive Access Systems, Inc.*, EDNC-4-24-cv-00130, transferred;
- *Competitive Access Systems, Inc. v. Oracle Corp. et al.*, WDTX-1-23-cv-00286, terminated;
- *Competitive Access Systems, Inc. v. Oracle Corp. et al.*, EDTX-2-22-cv-00287, transferred; and
- IPR2023-00584, *Unified Patents, LLC v. Competitive Access Systems, Inc.*, filed October 2, 2024, terminated prior to institution decision.

III. SUMMARY OF CLAIMED SUBJECT MATTER

The following summary correlates claim elements to specific embodiments in the application specification as originally filed but does not in any manner limit claim interpretation. Although specification citations are given in accordance with 37 C.F.R. §41.37, these citations are merely examples of support in the specification for the terms used in this section of the Brief. There is no intention to suggest in any way that the terms of the claims are limited to the examples in the specification. Rather, the following summary is provided only to facilitate the Patent Trial and Appeal Board's (PTAB's) understanding of the subject matter of this appeal.

Independent claim 1 recites a client device (e.g., RCG—85; column 4, line 42-column 6, line 29; column 12, line 2-column 13, line 12; FIGS. 1 and 7-9) for multilink data packet

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communication with a server (e.g., column 5, lines 2-21; column 12, line 2-26; and FIGS. 7-9), the client device comprising:

a first network interface having a first data transfer rate associated with a first path from the server to the first network interface of the client device (e.g., interface—90, interface—88; column 10, line 58-column 11, line 23; column 12, line 14-26; and FIGS. 7-9);

a second network interface having a second data transfer rate associated with a second path from the server to the second network interface of the client device (e.g., interface—90, interface—88; column 10, line 58-column 11, line 23; column 12, line 14-26; and FIGS. 7-9); and

at least one processor configured to:

transmit a first message through the first network interface to the server, wherein the first message includes a multilink request [and] a destination URL (e.g., column 12, lines 2-26 and FIGS. 7-9);

transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification [and] the destination URL (e.g., column 12, lines 9-14 and 56-57 and FIGS. 7-9); and

receive data packets from the server through the first and second network interfaces of the client device during the multilink session wherein the first data transfer rate and the second data transfer rate provide an increased data transfer rate of the first path and the second path from the server to the client device (e.g., column 10, line 56-column 11, line 67; column 12, line 14-column 13, line 3; and FIGS. 7-9).

Independent claim 13 recites a first device (e.g., RCG—85; column 4, line 42-column 6, line 29; column 4, line 42-column 6, line 29; column 12, line 2-column 13, line 12; FIGS. 1 and 7-9) comprising:

a network interface (e.g., interface—90, interface—88; column 10, line 58-column 11, line 23; column 12, line 14-26; and FIGS. 7-9); and

at least one processor (e.g., column 12, line 56-column 13, line 3 and FIGS. 7-9) configured to:

transmit a first message through the network interface to a second device (e.g., column 10, line 58-column 11, line 23; column 12, line 14-26; and FIGS. 7-9), wherein the first message includes a multilink request and a destination URL (e.g., column 10, line 58-

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column 11, line 23; column 12, line 14-26; and FIGS. 7-9), the network interface to the second device having a data transfer rate associated therewith (e.g., column 12, line 56-column 13, line 3 and FIGS. 7-9);

transmit a second message through the network interface to a third device (e.g., column 12, line 56-column 13, line 3 and FIGS. 7-9), wherein the second message includes a multilink session identification that is unique to the multilink session and the destination URL (e.g., column 12, lines 9-14 and 56-57 and FIGS. 7-9), the network interface to the third device having a data transfer rate associated therewith (e.g., column 12, line 56-column 13, line 3 and FIGS. 7-9); and

receive the different data packets through the at least one network interface from the second device and from the third device during the multilink session (e.g., column 12, line 56-column 13, line 3 and FIGS. 7-9), wherein the data transfer rate associated with the network interface to the second device and the network interface to the third device provide an increased data transfer rate for the first device (e.g., column 12, line 56-column 13, line 3 and FIGS. 7-9).

IV. ARGUMENT

1. LEGAL STANDARD

The Federal Circuit held that the legal determination of an obviousness rejection under 35 U.S.C. §103 is:

> whether the claimed invention as a whole would have been obvious to a person of ordinary skill in the art at the time the invention was made…The foundational facts for the *prima facie* case of obviousness are: (1) the scope and content of the prior art; (2) the difference between the prior art and the claimed invention; and (3) the level of ordinary skill in the art…Moreover, objective indicia such as commercial success and long felt need are relevant to the determination of obviousness…Thus, each obviousness determination rests on its own facts.[1]

In making this determination, the Examiner has the initial burden of proving a *prima facie* case of obviousness.[2] This burden may only be overcome "by showing some objective

[1] *In re Mayne*, 41 U.S.P.Q. 2d 1451, 1453 (Fed. Cir. 1997); *see also In re Youngblood*, 215 F.3d 1342, *3 (Fed. Cir. 1999).
[2] *In re Gianelli*, 739 F.3d 1375, 1379 (Fed. Cir. 2014); *In re Rijckaert*, 28 U.S.P.Q. 2d 1955, 1956 (Fed. Cir. 1993).

teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings."[3] "If the examination at the initial stage does not produce a *prima facie* case of unpatentability, then without more the applicant is entitled to grant of the patent."[4]

Moreover, the Examiner must provide explicit reasons why the claimed invention is obvious in view of the prior art. The Supreme Court has emphasized that when formulating a rejection under 35 U.S.C. §103(a) based upon a combination of prior art elements it remains necessary to identify the reason why a person of ordinary skill in the art would have combined the prior art elements in the manner claimed.[5]

Moreover, as the Federal Circuit explained, "the mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification."[6] Furthermore, "[o]ne cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art" to recreate the claimed invention.[7]

Of course, references must be considered as a whole and those portions teaching against or away from the claimed invention must be considered. "A prior art reference may be considered to teach away when a person of ordinary skill, upon reading the reference would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the Applicant."[8]

2. OVERVIEW OF THE CLAIMED INVENTION

U.S. Patent 10,868,908 ("'908 Patent") teaches and claims a network communication technology that uses IP address routing to communicate data packets between two end points across a **multilink communication pathway spanning multiple heterogeneous**

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[3] *Tec Air, Inc. v. Denso Mfg. Michigan Inc.*, 192 F.3d 1353, 1359-60 (Fed. Cir. 1999); *In re Fine*, 5 U.S.P.Q. 2d 1596, 1598 (Fed. Cir. 1988).
[4] *In re Oetiker*, 24 U.S.P.Q. 2d 1443, 1444 (Fed. Cir. 1992).
[5] *KSR v. Teleflex*, 127 S. Ct. 1727 (2007).
[6] *In re Fritch*, 972 F.2d 1260, 1266 (Fed. Cir. 1992).
[7] *In re Fine*, 837 F.2d 1071, 1075 (Fed. Cir. 1988); *see also In re GPAC Inc.*, 57 F. 3d 1573, 1582 (Fed. Cir. 1995).
[8] *Monarch Knitting Machinery Corp. v. Fukuhara Industrial Trading Co., Ltd.*, 139 F.3d 877, 885 (Fed. Cir. 1998) (quotation omitted).

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networks. As described in greater detail below in Section 4.2, the '908 Patent invention operates on Layers 3 and above (i.e., the network layer, the transport layer, the session layer, the presentation layer, and the application layer) of the Open Systems Interconnection ("OSI") model.

More specifically, the '908 Patent claims a receiving device that sets up a multipath connection utilizing **separate networks** to increase bandwidth available to the receiving device. This groundbreaking and innovative technology was invented by inventor Eric Delangis. Living in rural Colorado in the early 2000's, Mr. Delangis did not have access to high-speed internet. As a work-around, he came up with the idea of pooling multiple lower-speed internet connections from neighboring networks to collectively achieve higher speeds of data transfer. But Mr. Delangis could not find a commercial solution to implement this idea. To respond to this need, Mr. Delangis invented technology that determines how data is to be routed over several network connections using multiple devices and combines the received data for the intended receiving device through a multipath connection. Instead of creating and managing new systems of physical links between connected network devices (Layers 1 and 2 of the OSI model), which would have been impossible for him at the time, he instead developed protocols using Layers 3-7 of the OSI model **to logically join multiple physical networks** for form a multilink PPP bundle capable of transmitting and receiving data.

By utilizing multiple communication channels, i.e. paths or links, across separate networks that can be added and removed within a given communication session, Mr. Delangis' invention leverages aggregation to increase both speeds and reliability, as data is no longer reliant upon a single statically, pre-defined communication path or channel. For example, data can be transmitted even when some of the communication channels from the separate networks are suffering reduced performance or are unavailable and data from a single session or multiple sessions can be dynamically rerouted among the separate network paths to provide roaming capabilities.

Referring to the claimed network communication technology, independent Claims 1 and 13 recite similar elements. Claim 1 is directed to a client device that includes first and second network interfaces, each having a data transfer rate associated with a path from a server to the respective network interface. The client device also includes a processor

configured to transmit first and second messages to the server through the different network interfaces, the first message including a multilink request and a destination URL and the second message including a multilink session identification and the destination URL, and to receive data packets from the server through the different heterogeneous network interfaces.

Claim 13 is directed to a first device that includes a network interface and a processor. The processor is configured to transmit first and second messages to second and third devices, respectively, through the network interface, the first message including a multilink request and a destination URL and the second message including a multilink session identification and the destination URL, and to receive different data packets from the second device and the third device through the multilink session.

Each independent claim at issue requires a first message that includes: (i) a multilink request; and (ii) a destination URL, and a second message that includes: (iii) a multilink session identification; and the destination URL. In other words, the two messages must include three distinct claim elements:

1. a multilink request;
2. a destination URL; and
3. a multilink session identification.

An example detailing these three claim elements is provided with the description of FIG. 7 of the '908 Patent, starting at column 12, line 2, and continuing through column 13, line 18. In this example, the claimed multilink request ("requests a multilink PPP session") and destination URL ("URL") are described at column 12, lines 2-19:

> Referring to FIG. 7, an RCG—85 that decides to initiate a multilink PPP session with a remote computer i.e. internet URL, requests a multilink PPP session with that URL resource via Link Control Protocol (LCP) session management. The initiating RCG—**85** and the remote server computer (not shown) will negotiate the pertinent multilink parameters such as compression, packet size, sync/async, link quality monitoring, bit stuffing etc. As part of a successful multilink PPP session setup, the initiating RCG—**85** receives a multilink PPP session ID, or "magic number", which is used to identify this particular multilink PPP session and is also used for adding or removing links from the multilink bundle—**87**. Once the multilink bundle is setup, the initiating RCG—**85** begins data transfer across its POTS interface—**90** with the far end computer system. The initiating RCG—**85** then looks up the addresses of up to 31 (in this embodiment) other RCGs in its router tables to use for the multilink

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PPP transfer.

In this example, the claimed "multilink session identification" is described in column 12, lines 9-14 of the '908 Patent:

> As part of a successful multilink PPP session setup, the initiating RCG—85 receives **a multilink PPP session ID**, or "magic number", which is used to identify this particular multilink PPP session and is also used for adding or removing links from the multilink bundle—87.

Additionally, this example describes how additional links are added to an ongoing multilink session in column 12, lines 51-66:

> The initiating RCG then selects which of the responding remote RCGs—86 it will use for the multilink PPP bundle—87 and sends them a multilink initialization packet containing **the URL of the destination** as well as **the multilink PPP session ID** (magic number) and any other pertinent information required for the remote RCG to join in the existing multilink PPP bundle—87. Each remote RCG POTS interface—91 participating in a multilink PPP bundle, represents a logical "link" in the initiating RCG's multilink PPP bundle—87. The remote RCGs—86 then send a multilink PPP packet (over their respective POTS lines—91) to the destination URL with the multilink PPP session ID and request to be added to that multilink PPP bundle—87. The destination URL accepts the request of each of the remote RCGs—86 and begins sending data packets to each over their respective POTS lines—91.

No combination of Maurya and Low discloses, teaches, or otherwise renders obvious the claimed multilink data packet communication/session or the claim element "multilink session identification." Accordingly, claims 1-3, 5-6, and 13-15 are patentable over the combination of Maurya and Low.

3. THE OBVIOUSNESS REJECTION OF CLAIMS 1-3, 5-6, AND 13-15 OVER *MAURYA* AND *LOW* SHOULD BE REVERSED.

3.1. Brief Overview of the Examiner's Rejections

Claims 1-3, 5-6, and 13-15 currently stand rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,160,808 issued to Maurya in view of International Publication No. WO 97/22212 to Low. The Examiner makes at least three primary errors in making these rejections. A summary of each of the three primary errors follows.

3.1.1. The Examiner Erred in Arguing Maurya's Endpoint Discriminator Value is the Same as the Claimed Multilink Session Identification

Citing Maurya's Abstract, the Examiner argues the endpoint discriminator value "appears to be used to identify the particular multilink PPP session."

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> "Specifically, during LCP negotiations, a multi-link PPP originator assigns itself a unique endpoint discriminator value and informs all its immediate PPP peers by sending the latter, via a first bundle of outgoing links, an LCP Endpoint Discriminator packet containing this value. Each of these immediate PPP peers assumes, as its endpoint discriminator, the value that has been provided to it in the LCP Endpoint Discriminator packet it receives from the originator and then sends an LCP Endpoint Discriminator packet containing this same endpoint discriminator value, via a second bundle of outgoing links, to all of its immediate PPP peers."

As described in Maurya, and further explained in detail below, the network interfaces on the client side of Maurya's multi-link client-server communication apparatus share a first common endpoint discriminator value (i.e., spoofing each other to appear to be a single network device) and the network interfaces on the server side of Maurya's multi-link client-server communication apparatus share a second common endpoint discriminator value (i.e., spoofing each other to appear to be a single network device). As a result, each of the network interfaces on a given side of the network present themselves to the other side as having a single, common MAC address.

The Examiner further cites to Maurya in col. 9, lines 14-55, in support of this argument, including the following statement.

> The endpoint discriminator packet identifies, by specifying an address, of an end system (an "endpoint"), then situated on an end of a link, that is transmitting this particular packet.[9]

Maurya's description makes it clear that the endpoint discriminator value is the address of the endpoint in the system, it is not an identification of a communication session.

Notably, Maurya does not provide any mechanism for distinguishing amongst different sessions that may then occur between the client and server. Instead, as described next, Maurya simply uses a multi-link Short Sequence Number to order the packets received ("[t]o ensure proper ordering … it receives and then reorder its received packets based on their sequence numbers…").[10]

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[9] Maurya, column, lines 18-21.
[10] *Id.*, at column 4, lines 7-12.

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3.1.2. The Examiner Erred in Arguing Maurya's Multi-Link Short Sequence Number is the Same as the Claimed Multilink Session Identification

The Examiner also argues "the multi-link Short Sequence Number can be interpreted as a "multi-link session identification", as each packet in the multi-link contains this sequence number, which "identifies" the multilink session, as described in the specification of the '908 Patent." FOA p 29-30 para 21 and p 31-32, para 25.

The Examiner cites to Maurya, col. 8, line 65-col. 9, line 13 (emphasis in original):

> "Each specific option has to be separately negotiated between the PPP peers and appropriately acknowledged prior to its use. Inasmuch as the only values for this type field, i.e., the only configuration options, that are relevant to understanding the invention are 17, 18 and 19, which designate a multi-link MRRU (Multi-link Maximum Receive Reconstructed unit) request, a multi-link Short Sequence Number header request and a "multi-link endpoint discriminator" option, respectively (which will all be discussed in detail below in conjunction with FIG. 5) .... **Each such multi-link PPP packet contains a sequence number--which increases by one with each successive packet**, inserted by the multi-link protocol."

However, the Examiner has bolded the language that demonstrates the multi-link Short Sequence Number cannot be the claimed multi-link session identification. The claimed multi-link session identification is a single "magic number" that is common to every packet in a given multilink PPP session. In contrast, Maurya's sequence number increases by one with each successive packet sent. Maurya's sequence number doesn't identify the session; it identifies the order of the packets within the session. These are entirely different and non-analogous functions.

3.1.3. The Examiner Erred in Arguing It Would Have Been Obvious to Combine Maurya and Low Such That the First and Second Messages include a Multilink Request and a Destination URL.

The Examiner admits that Maurya fails to disclose "the first and second messages include a multilink request **and a destination URL**." However, the Examiner argues, "at the time of the invention, it would have been obvious to one of ordinary skill in the art to have the client device of Maurya a include the functionality that "the first and second messages include a multilink request and a destination URL", as recognized by Low. However, as detailed below, there is no motivation to combine Maurya and Low, and, even if they were combined, the combination would fail to provide the invention claimed in the '908 Patent.

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3.2. Maurya Fails to Teach or Suggest Logically Connecting Devices from Different Networks as Required By the Claims

Before moving on to the Examiner's specific rejections, it is important to discuss significant differences between the claimed inventions of the '908 Patent and the system of Maurya. The '908 Patent teaches and claims a network communication technology that uses IP address routing to communicate data packets between two end points across a multilink communication pathway spanning multiple **heterogeneous** networks. In contrast, Maurya teaches network communication technology that uses MAC addressing to provide local multilink connectivity between directly connected devices in a single **homogeneous** network. In terms of the Open Systems Interconnection ("OSI") model, Maurya's invention operates on Layer 2 (i.e., the data link layer) and the '908 Patent invention operates on Layers 3 and above (i.e., the network layer, the transport layer, the session layer, the presentation layer, and the application layer).

The distinction between IP-based routing ('908 Patent) and MAC-based addressing (Maurya) is material to understanding why the claims in the '908 Patent are not obvious over the combination of Maurya and Low. The '908 Patent uses IP addressing to provide innovative, scalable, cross-network communications that cannot be provided using Maurya's Layer 2 MAC addressing.

FIGS. 7-9 of the '908 Patent teach at least three different embodiments in which separate networks are joined together via IP based routing using the subject matter taught and claimed in the '908 Patent. The '908 Patent teaches systems and methods for ***logically connecting*** communication devices across ***separate networks*** to provide a multilink PPP bundle having increased data transfer rates as compared to any one of the individual networks. In contrast, Maurya teaches systems and methods for ***physically connecting*** data links within a ***single network*** to provide greater bandwidth within that single network.

One skilled in the art would recognize that the innovative communication protocol taught and claimed in the '908 Patent operates in Layers 3 through 7 of the OSI model and that the systems and methods described in Maurya operate in Layer 2 of the OSI model. In other words, the '908 Patent teaches systems and methods for using IP addresses to route data (Layers 3-7) over multiple separate physical networks (Layer 2). For example, any one

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or more of the separate networks utilized by the '908 Patent may be a singular multilink, point-to-point (PPP) network such as that taught in Maurya.

FIGS. 7 and 8 of the '908 Patent show two embodiments in which the '908 Patent's new communication protocol operates. Referring FIG. 7 shown below, a multilink initiating residential communication gateway (RCG), RCG 85, of the first embodiment uses the claimed communication protocol to communicate with one or more of the five neighboring remote RCGs 86. The hardware of the initiating RCG 85 and neighboring RCGs 86 is shown in FIG. 1 of the '908 Patent. The Layer 2 data links used by each of these neighboring RCGs 86 to communicate with the multilink initiating RCG 85 may be distinct and separate networks, i.e. heterogeneous networks, from each other and, in fact, may even be provided by separate service providers.

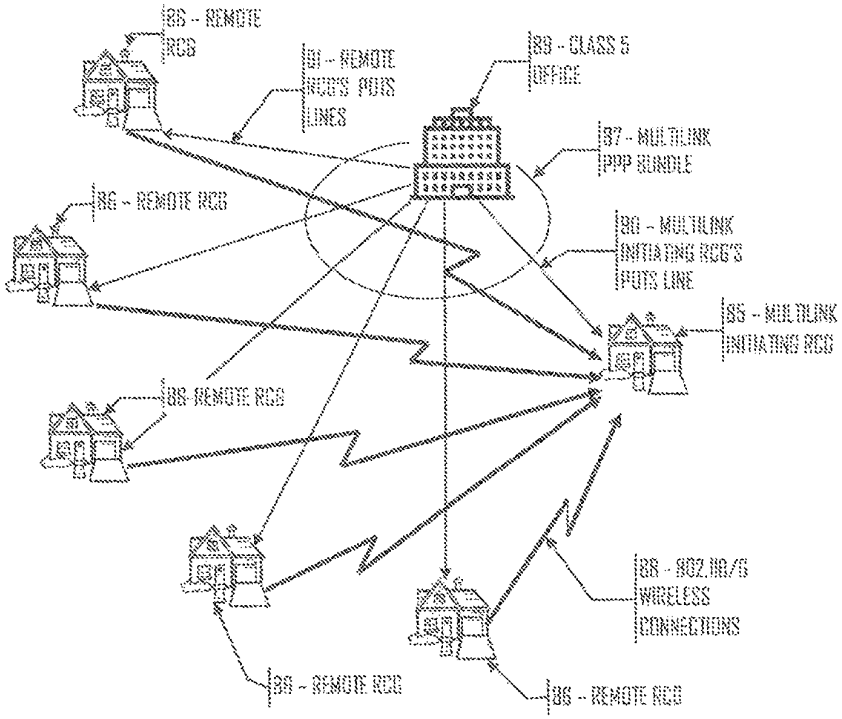


FIG. 7 of the '908 Patent

FIG. 8 provided below illustrates the second embodiment of the claimed communication protocol of the '908 Patent in which a multilink initiating RCG 85 communicate with five neighboring remote RCGs 86 and a neighboring access point 93. Again, the hardware of the initiating RCG 85 and neighboring RCGs 86 is shown in FIG. 1 of

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the '908 Patent. FIG. 9 illustrates a further example of RCGs bouncing or relaying data traffic between each other to reach other RCGs located farther than the RCG's wireless transmission area.

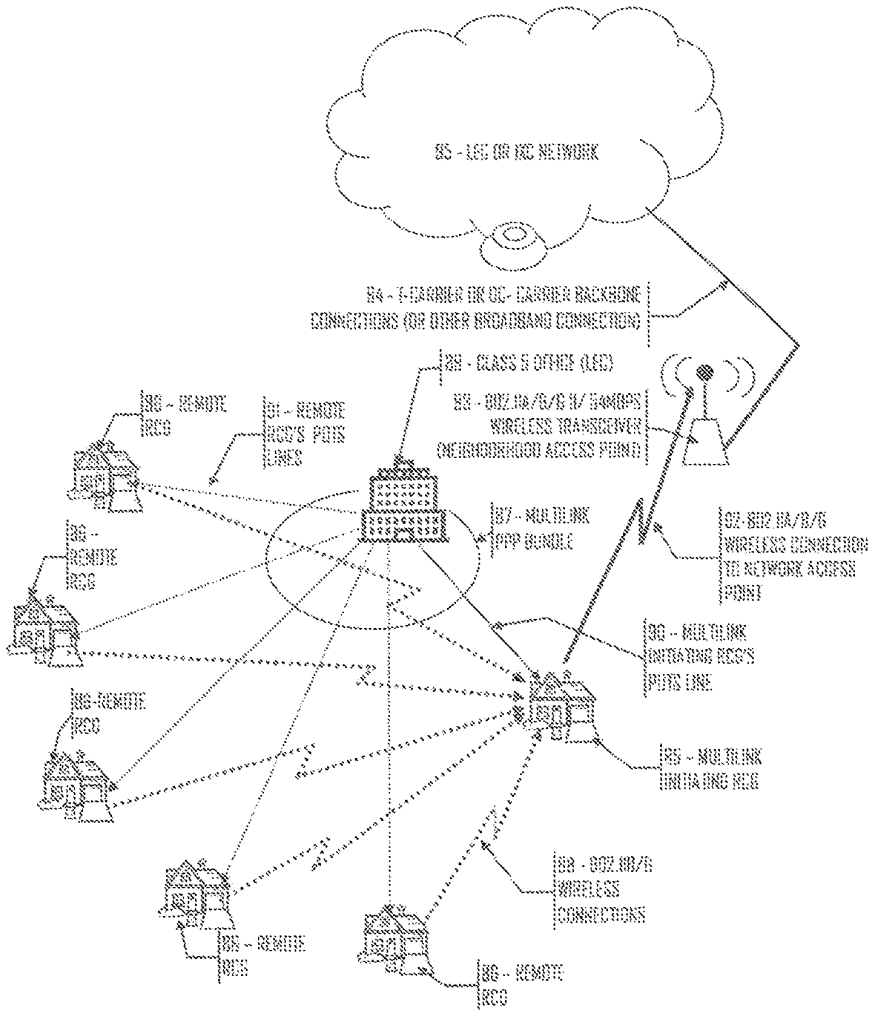


FIG. 8 of the '908 Patent

Maurya's topology is shown in FIG. 6A reproduced below. Maurya describes a ***single homogeneous network*** that combines multiple ISDN (Integrated Services Digital Network) communication links 630 connected to a plethora of ISDN terminal adapters 620. Terminal adapters 620 are physically placed at the client's location 605. In FIG. 6A of Maurya, box 605 is described as the "client." This "client" 605 includes the different devices that comprise the

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physical network for the client 605. These devices include PC 610 and ISDN termination adapters 620 which are physically connected to each other and are part of the same physical network, i.e., the same local network domain.

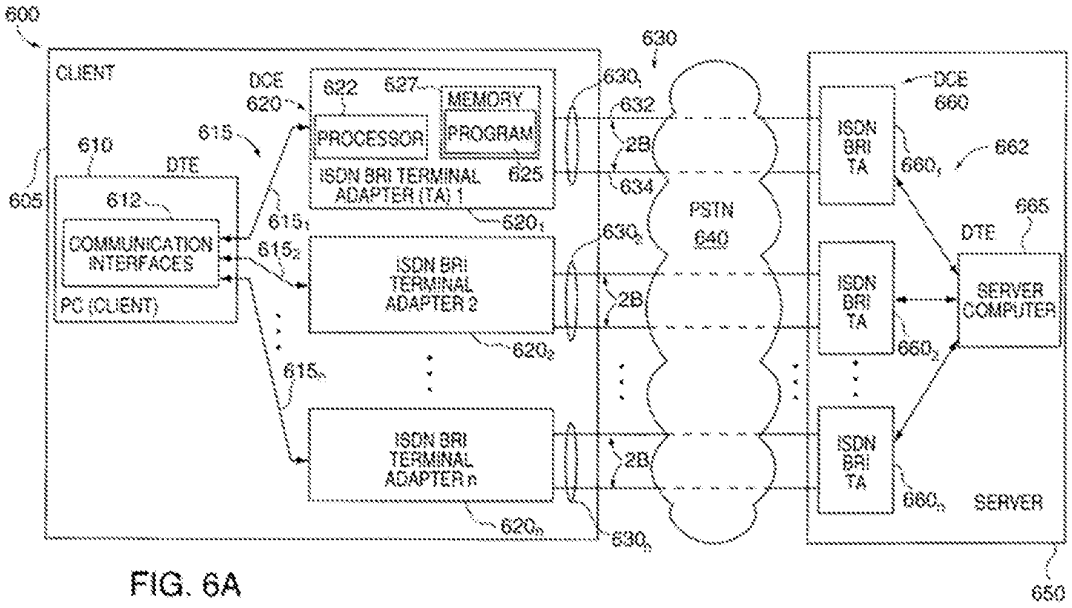


FIG. 6A

FIG. 6A of Maurya

One skilled in the art understands that Maurya's topology does not overlay or match the topologies shown in FIGS. 7 and 8 of the '908 Patent. Maurya uses ***a single homogeneous network*** comprised of multiple identical terminal adapters for transferring data. In contrast, the invention of the '908 Patent joins together **multiple disparate heterogeneous networks** to form a multilink PPP bundle. Maurya essentially teaches how to create a multilink data link connection between any one of the '908 Patent's remote RCGs 86 and the initiating RCG 85, but does not teach how to bundle the connections between the various remote RCGs 86 and the initiating RCG 85 **into a multilink PPP bundle**. This multilink PPP bundle is not limited to a single network, but may span a plurality of global networks.

Specifically, the use of the destination URL in the first and second messages sent by the processor in each of independent Claims 1 and 13 to create the multilink data packet

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communication/session requires use of Layers 3-7 of the OSI model, and Maurya's simply teaches how to configure a Layer 2 data link.

Importantly, Maurya suffers from the very problem that the '908 Patent solves. Maurya requires ***physically connecting*** devices operating within a ***single network***. The '908 Patent teaches systems and methods for ***logically connecting*** devices operating across ***different networks***.

3.3. Neither the Endpoint Discriminator Value Nor the Multi-Link Short Sequence Number Header Request of Maurya Corresponds to the Claimed Multilink Session Identification

In the Office Action, the Examiner alleges that the claimed "multilink session identification" recited in the claims is equivalent to Maurya's "endpoint discriminator value" and to Maurya's "multi-link Short Sequence Number."[11] The multilink session identification is neither.

3.3.1. Maurya's "Endpoint Discriminator Value" Is Not Equivalent to a "Multilink Session Identification"

The Examiner also asserts Maurya's endpoint discriminator value acts as a multilink session identification.[12] There are at least three major distinctions in the systems taught in Maurya and the '908 Patent that illustrate why Maurya's endpoint discriminator value does not teach the '908 Patent's multilink session identification.

First, Maurya's endpoint discriminator is the physical link address for the sending and receiving devices, as well as each related terminal adapter, whereas the '908 Patent's multilink session identification is not.

Second, because Maurya's endpoint discriminator value is the physical link address for the network devices, it cannot be used to differentiate between various multilink sessions occurring between Maurya's PC client and server—any data sent between the PC client and server is treated as part of a single session.

Third, Maurya's endpoint discriminator is only used in the LCP configuration process prior to data being sent over the multilink connection, whereas the '908 Patent's multilink

[11] Office Action, pages 27-37.
[12] *Id.*, at pages 28-29.

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session identification is used during the communication session to add and remove links to the multilink PPP bundle.

3.3.1.1. Maurya's endpoint discriminator is a physical link address and the '908 Patent's multilink session identification is not

In reference to Maurya's FIG. 6A, Maurya teaches the use of an endpoint discriminator value unique to the originating (i.e., sending) device, peer 610, that is sent to each sending terminal adapter 620_n, which in turn sets the value of its own endpoint discriminator to match that of the peer 610. While each sending terminal adapter 620_n negotiates with a corresponding receiving terminal adapter 660_n, each terminal adapter 620_n sends the same endpoint discriminator value as the sending peer 610 to its receiving terminal adapter 660_n.[13] As a result, in Maurya, all the links 630_n in the multilink bundle are negotiated such that each of the each terminal adapters 620_n has the ***same physical link address*** (i.e., endpoint discriminator value or Layer 2 MAC address), which then, through conventional multi-link protocol processing, enables the links 630_n to be viewed as a common bundle.[14]

What Maurya describes in its Layer 2 LCP configuration is now commonly referred to as "MAC spoofing." MAC spoofing is a practice (usually done for nefarious purposes) in which a first network device's MAC address is changed to match a second network device's MAC address in order for the first network device to connect to a network and receive traffic that is intended for the second network device. While Maurya's teachings are obviously not for that nefarious purpose, an understanding of the general principle may help make Maurya's invention more easily understood.

In contrast, the '908 Patent's multilink session identification (i.e., multilink PPP session ID or "magic number") is used to identify a particular multilink session and is also used for adding or removing links from the multilink bundle.[15] This distinction between the '908 Patent's multilink session identification and Maurya's endpoint discriminator value is made clear by the description immediately following the introduction of the multilink session identification, in which the '908 Patent describes "[t]he initiating RCG—85 then looks up the addresses of up to 31 (in this embodiment) other RCGs in its router tables to use for

[13] Maurya, column 14, lines 22-37 and FIG. 6A.
[14] *Id.*, at column 14, lines 37-60 and FIG. 6A.
[15] The '908 Patent, column 12, lines 9-14.

the multilink PPP transfer."[16] The RCG addresses stored in the router tables are Layer 3 IP addresses, which are used for communicating across different networks, and are unique to each device. Clearly, the '908 Patent's multilink session identification does not function as the address of the network devices used in the multilink bundle.

Accordingly, Maurya's endpoint discriminator value and the '908 Patent's multilink session identification are different in both form and operation, with Maurya's endpoint discriminator value being a Layer 2 data link address of a network device (Maurya, column 9, lines 18-21) and the '908 Patent's multilink session identification operating in Layers 3 and above to identify a unique communication session. As such, the '908 Patent's multilink session identification solves problems that cannot be solved by Maurya's endpoint discriminator. Therefore, Maurya's endpoint discriminator is not equivalent to and cannot render obvious the '908 Patent's claimed multilink session identification.

3.3.1.2. Maurya's endpoint discriminator value cannot be used to differentiate between multilink sessions occurring between Maurya's PC client and server

As a second point of distinction, Maurya's endpoint discriminator is only used in the LCP configuration process prior to data being sent over the multilink connection. As described in Maurya, column 9, lines 35-42, the endpoint discriminator is specifically carried by the LCP Configure Request packet:

> As depicted in FIG. 4, an LCP Configure Request packet specifies a multi-link endpoint discriminator option whenever the type field of the LCP Configure Request packet is set to value nineteen, as is field 410. Identification of the endpoint system (commonly referred to as either an "endpoint discriminator" or "endpoint identifier") is accomplished through class field 430 and address field 440, which collectively contain data carried by this packet.

As shown, and with reference to the seven-layer OSI Model, Maurya's endpoint discriminator is used solely in constructing the Layer 2 "data link" structure. In other words, Maurya endpoint discriminator helps its system to initially construct a multilink data link layer (*i.e.*, Layer 2 in the OSI Model) prior to any data being transmitted over the multilink connection. This is further demonstrated, in part, in Maurya's description in column 1, lines 52-64:

[16] *Id.*, at column 12, lines 16-19.

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> **Before any data is transmitted** over a PPP link, **each PPP peer connected to one end of the link will send LCP configuration packets to the other end to establish and test the link**; thus, ensuring the link is fully operational. Once the LCP protocol has successfully completed its negotiations, the PPP peers then negotiate the necessary NCPs to properly configure the link for the different network layer protocols that are to be used; with a different NCP being negotiated for each different network layer protocol. Once the NCP(s), for the various network layer protocols, have been successfully negotiated and configured at both PPP peers, **then PPP packet traffic containing encapsulated data, using the network layer protocols, can commence over that link**.

A person skilled in the art knows that this Layer 2 process can only be performed on a single homogeneous network domain where "endpoint discriminators" are known. Endpoint discriminators are not known, used, or applicable outside of the network to which their equipment is physically connected via Layer 1 and 2 protocols.

Further description of Maurya's LCP negotiation is presented with reference to FIG. 7, in which Maurya teaches, "[o]nce these [LCP] negotiations are successfully concluded, then process 700 progresses to step 760 at which the links between the near and far-end terminal adapters all enter network (data transmission) state 140 (see FIG. 1) during which communicate packetized data can be transported between the client PC and the server computer."[17]

As shown, Maurya requires all links to be provisioned and configured to operate the same before any data transfers can commence—Maurya's endpoint discriminator is used solely in the construction of the Layer 2 data link layer. Maurya does not describe, teach, or suggest how an endpoint discriminator value could be used to dynamically add or remove links during an active multilink communication session, as Maurya cannot remove links during an active multilink communication session. Thus, Maurya teaches away from what is taught and claimed in the '908 Patent.

In contrast, the '908 Patent's claimed multilink request, multilink session identification, and destination URL are solutions for managing multilink communication above an existing link layer. As such, the multilink session identification can be used to dynamically add and remove links in an existing multilink communication session, as

[17] Maurya, column 16, lines 47-53.

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described in column 12, lines 51-66, of the '908 Patent:

> The initiating RCG then selects which of the responding remote RCGs—86 it will use for the multilink PPP bundle—87 and sends them a multilink initialization packet containing **the URL of the destination** as well as **the multilink PPP session ID** (magic number) and any other pertinent information required for the remote RCG to join in the existing multilink PPP bundle—87. Each remote RCG POTS interface—91 participating in a multilink PPP bundle, represents a logical "link" in the initiating RCG's multilink PPP bundle—87. The remote RCGs—86 then send a multilink PPP packet (over their respective POTS lines—91) to the destination URL with the multilink PPP session ID and request to be added to that multilink PPP bundle—87. The destination URL accepts the request of each of the remote RCGs—86 and begins sending data packets to each over their respective POTS lines—91.

Column 13, line 13, through column 14, line 9, further describes the dynamic nature of the '908 system detailing how remote RCGs can be added and removed from existing sessions, including, specifically, column 13, lines 54-59:

> Once a remote RCG—86 has been removed from participating in a multilink bundle—87, the initiating RCG—85 will then look up another remote RCG in its router tables that can be used to participate in the multilink PPP bundle—87, and request that the new remote RCG—86 to join the existing multilink bundle—87.

This is a significant improvement from the "fixed pairs of systems" type networks taught by Maurya and a direct benefit of the multilink session identification operating above the Layer 2 endpoint discriminator used in Maurya. As such, the '908 Patent's multilink session identification solves problems, that cannot be solved by Maurya's endpoint discriminator, such as adding and dropping links during a communications session and logically connecting global networks to participate in said multilink bundle. Therefore, Maurya's endpoint discriminator is not equivalent to and cannot render obvious the '908 Patent's claimed multilink session identification.

3.3.1.3. Maurya's endpoint discriminator is not used during the communication session to add and remove links to the multilink PPP bundle

As a third point of distinction, Maurya's endpoint discriminator value cannot be used to differentiate between various multilink sessions occurring between Maurya's PC client and server—any data sent between the PC client and server is treated as part of a single session. As a result, the Maurya system does not support multiple concurrent sessions

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between the PC client and the server. However, incorporating the '908 Patent's multilink session identification into the Maurya system and enabling Maurya's ISDN terminal adapters to handle **routing functions** of Layer 3 and above (which they are incapable of doing) would enable multiple concurrent multilink sessions between Maurya's client PC and server where each distinct session would be identified and distinguished by the multilink session identification. Hypothetically, if one were to implement the '908 Patent's multilink session identification on top of the Maurya's OSI Layer 2 link layer, Maurya's sending device could send data through different, identifiable multilink sessions (even over an identical set of ISDN communication links and ISDN TAs on the client side) and Maurya's receiving device could associate received data with individually identifiable multilink sessions. The fact that Maurya cannot run concurrent sessions using only its endpoint discriminator value and the fact that the inclusion of the '908 Patent's claimed multilink session identification would provide expanded functionality for the Maurya system demonstrates that Maurya's endpoint discriminator value is not equivalent to the claimed multilink session identification and cannot render obvious the '908 Patent's claimed multilink session identification.

For at least the three reasons above, not only is Maurya's endpoint discriminator not equivalent to the claimed multipath session identification, incorporation of the claimed multipath session identification into Maurya would result in an improvement to the functionality of the Maurya system. Accordingly, Appellant submits that the combination of Maurya and Low fails to render obvious claims 1-3, 5-6, and 13-15 and respectfully requests the Examiner allow the claims over the cited art.

3.3.2. Maurya's "Multi-Link Short Sequence Number" Is Not Equivalent to a "Multilink Session Identification"

As noted above, Maurya discloses a technique for transmitting incoming multi-link PPP packet traffic over multiple outgoing links in a multi-link bundle that exists on a single network domain. Specifically, Maurya teaches multi-link communication between a client and a server. In doing so, Maurya combines multiple ISDN communication links located in a single physical network (i.e., client 605) that are each physically connected via Layer 1 and employ Layer 2 protocols to a corresponding ISDN terminal adapter 620 located on the client side of the communication and sends streams of data from the client through the multiple ISDN communication links and corresponding ISDN TAs to the server. The setup performed

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in Maurya occurs at Layer 2 of the OSI model as Maurya's techniques are used to manage the physical links between the PC (Client) 610 and the Server Computer 665. FIG. 6A of Maurya is reproduced again below:

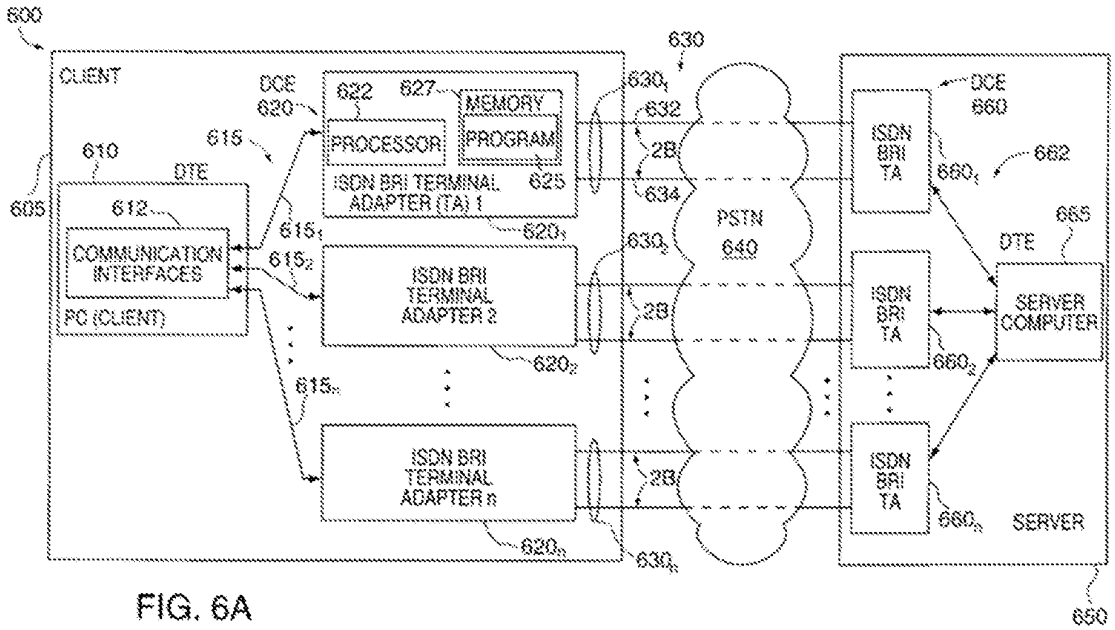


FIG. 6A

FIG. 6A of Maurya

Maurya describes that each multi-link PPP packet contains a "sequence number – which increases by one with each successive packet."[18] The purpose of the sequence numbers is to order the packets sent.[19] The sequence number can either be in a short sequence number format or in a long sequence number format. Both are shown in FIG. 5 of Maurya (reproduced below) and are described in Maurya starting on col. 10, line 6 to the end of col. 10:

[18] *Id.*, at column 9, lines 53-67.

[19] *Id.*, at column 4, lines 7-12 ("[t]o ensure proper ordering … it receives and then reorder its received packets based on their sequence numbers…").

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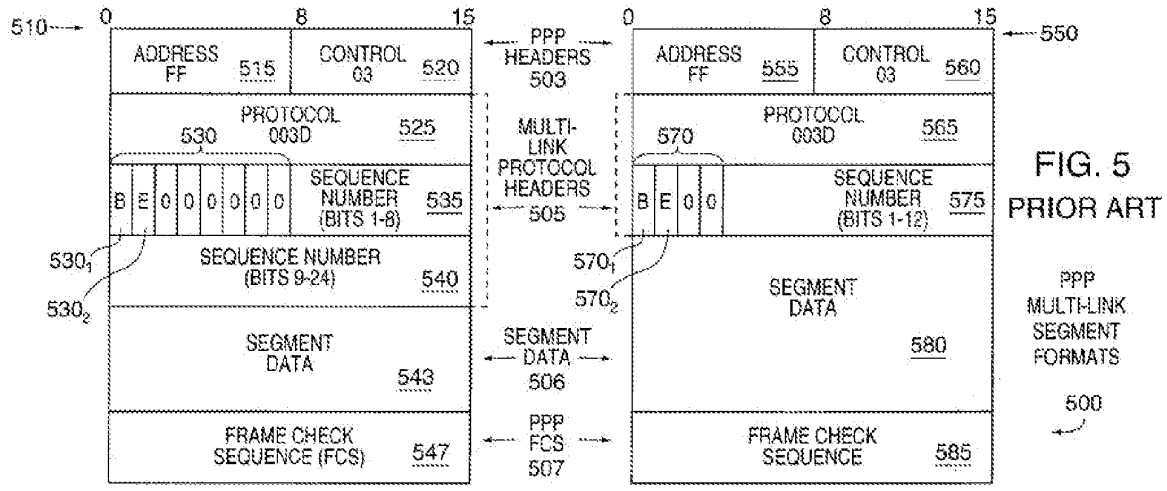


FIG. 5
PRIOR ART

As shown in FIG. 5, a multi-link Short Sequence Number 575 is part of a packet having a short sequence number format 550. This multi-link Short Sequence Number 575 is used for ***ordering the packets*** after receipt on the receiving side.

The '908 Patent does not describe, teach, or suggest using the "multilink session identification" for anything associated with re-ordering packets (referred to as "reassembly" of packets in the '908 Patent). The '908 specification notes that "[a]s part of a successful multilink PPP session setup, the initiating RCG—85 receives a multilink PPP session ID, or "magic number", which is used to identify **this particular multilink PPP session** and is also used for adding or removing links from the multilink bundle—87."[20]

Because Maurya's multi-link Short Sequence Number is used for ordering the received messages within a single multilink communication session, Maurya necessarily uses a plurality of Short Sequence Numbers in each multilink communication session. Because each individual message within a given session has its own Short Sequence Number, there is no single unique session number or identification that corresponds to the session itself, as required by the '908 Patent. In fact, none is needed.

As described above, the Maurya system does not support multiple concurrent sessions between the PC client and the server—any data sent between the PC client and server is treated as part of a single session over a single network domain, and therefore, there is no purpose for identifying a given session with a multilink session identification.

[20] The '908 Patent, column 12, lines 9-14.

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Accordingly, Maurya's multi-link Short Sequence Number is distinctly different in purpose and function from the claimed multilink session identification.

3.3.3. Low Does Not Teach a Multilink Session Identification

As shown above, Maurya does not teach a second message that includes a multilink session identification. Appellant respectfully submits Low also fails to teach a second message that includes a multilink session identification. Indeed, the Office Action provides, "the Examiner notes that the reference of Low is not being relied on to teach the claimed "multilink session identification"."[21] Therefore, Low does not remedy Maurya's failure to render the claims obvious.

3.4. The Examiner Erred in Arguing a Motivation to Combine Maurya and Low

In the Office Actions, the Examiner concedes that Maurya fails to disclose or suggest a destination URL included in the first and second messages, and points to Low for the disclosure thereof. However, the skilled artisan would not have modified the message of Maurya to include the phone page URL of Low for the reasons below.

3.4.1. Overview of Low

Low is directed to call setup in telephone systems that uses service resource items (URLs) to set up a network.[22] Generally, the system of Low enables a user to access setup control logic for a channel through a public switched telephone network (PSTN).[23] Fig. 13, reproduced below, demonstrates this functionality with respect to a "personal number" service in which a first user can setup a single, unique, unchanging personal phone number (a "Webtel" number) that can be used by others to reach the first user by phone, even when the first user changes their "real phone number" (a B-telNb).[24] In this example, the system allots the first user a unique personal number that is associated with a dedicated "phone page," which associates the Webtel number with the first user's current real telephone number.[25] The phone page is located at a URL, which, when accessed, returns the current real

[21] Office Action, page 37, paragraph 36 (emphasis in original).
[22] *See, e.g.*, Low, column 1, lines 7-9 and column 2, lines 2-16.
[23] *Id.*, at column 16, lines 12-29.
[24] *Id.*, at column 35, lines 9-22.
[25] *Id.*, at column 35, lines 19-22.

phone number.[26] Accordingly, when another user calls the first user's Webtel number, the system accesses the phone page associated with the Webtel number, acquires the first user's current real phone number, and uses the current real phone number to complete the call.[27]

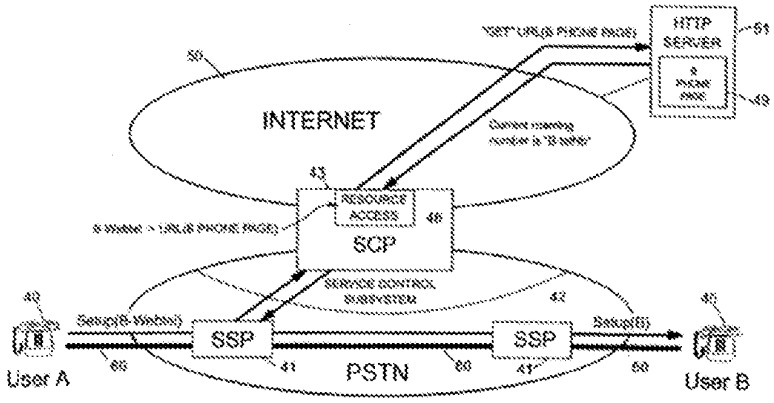


FIG. 13

More specifically, when a phone call is made, the service switching point (SSP) generates a service request that is conveyed to the service control point (SCP).[28] The service logic program running in the SCP is a skeleton form, being instantiated on receipt of a service request and then serving to initiate service resources access and to return the results of this access to the entity that made the service request.[29] The association between the unique number and the URL of the phone page is stored in an association table accessible to SCP 43.[30] Therefore, the SCP receives the unique number from the first user and locates the URL through a table.[31]

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[26] *Id.*, at column 35, lines 18-19.
[27] *Id.*, at column 35, line 27-column 36, line 10.
[28] *Id.*, at column 20, lines 29-32.
[29] *Id.*, at column 21, lines 20-27.
[30] *Id.*, at column 35, lines 24-25.
[31] *Id.*

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Essentially, Low provides an automated call forwarding service in which the number to which a call should be forwarded is stored at a URL. It is this URL that the Examiner improperly argues is equivalent to the '908 Patent's destination URL.

More importantly, the reference to Low's URL requires that Layer 3-4 (TCP-IP) routing protocols are used by the SCP in Low to access the HTTP Layer 7 server. Maurya does not teach or suggest the use of any Layer 3-7 routing functionality nor even alludes to how other routing protocols would be needed to connect to a specific URL. This omission further demonstrates that the skilled artisan would not be motivated to modify the packets of Maurya to include the web page URL of Low.

3.4.2. There is No Motivation to Combine Maurya and Low and, even if Combined, the Combination Would Not Render the '908 Patent Claims Obvious

The Examiner argues Low discloses a client device that transmits messages through a network interface, whereby one message includes a destination URL.[32] The Examiner then notes that Low teaches that a URL identifies a resource by its location on the internet and that a full or "absolute" URL includes the IP address.[33] The Examiner then concludes that it would have been obvious for one of ordinary skill in the art to have included a destination URL, as recognized by Low, within the second message disclosed by Maurya, claiming the suggestion/motivation for doing so would be that the client device of Maurya a would conform with known protocols for communicating packets in systems utilizing point-to-point protocol.[34] The Examiner further concludes Low describes that utilizing URLs for PPP communication of packets between user terminals and Internet service providers was well known, and thus, this modification of Maurya with the functionality taught in Low would easily be implemented with these well-known teachings, as exemplified by Low, and would yield predictable results.[35]

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[32] Office Action, pages 10-11 and page 38, paragraph 38.
[33] *Id*.
[34] *Id*., at pages 11-12 and page 38, paragraphs 39-40.
[35] *Id*.

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As shown below, there is no motivation to combine Maurya and Low, and, even if they were combined, the combination would fail to provide the invention claimed in the '908 Patent.

3.4.2.1. There is No Motivation to Combine Maurya and Low

As described above, Maurya teaches a multi-link protocol that enables data transfer through multiple-link transmission channels between peers to improve data transfer speed and Low is a switched telecommunication system for a telephone network. Although Maurya and Low are each concerned, in their own ways, with communication systems, this is not sufficient to establish that a person of ordinary skill in the art would have an objective reason to combine the references or that the resultant combination would have been obvious. Rejection of a claim based on obviousness cannot be sustained by mere conclusory statements; there must be some articulated reasoning with some rational underpinning to support the conclusion of obviousness.[36]

As described above, Low teaches a system in which a Webtel number is used to access a URL that includes the real phone number currently associated with the Webtel number to automatically forward telephone calls from the Webtel number to the current real phone number. Because Low relates to transferring phone calls over telephone channels and does not relate in any manner to Maurya's goal of increasing the bandwidth available for transferring data through its networks, the skilled artisan would not have been motivated to apply any of the disclosure of Low to the multi-link connection of Maurya and vice-versa.

Further, Maurya discloses the LCP configuration packets that include *all information necessary* to create the multi-link connection described therein.[37] Maurya continues to describe the contents of packets that are used in the multi-link protocol.[38] A person of ordinary skill in the art would have no reason to look to Low to fill gaps that do not exist in Maurya. There is no need in Maurya for a URL to access a phone page as taught by Low or to access any other details of the multi-link connection.

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[36] *KSR v. Teleflex Inc.*, 550 U.S. 398, 418 (2007) (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)).
[37] Maurya, column 1, lines 39-45; column 8, lines 24-44; and column 8, line 60-column 9, line 55.
[38] *Id.*, at column 15, lines 22-31.

Additionally, as Maurya does not disclose or teach anything about network routing—only Layer 2 physical addressing, there would be no motivation for a person of ordinary skill in the art to use Maurya as the basis for a service that requires Layers 3-7 routing functions such as those disclosed in Low.

Finally, the URL in the system of Low is merely a phone page that is translated by a service logic program into a currently available number to connect a phone call over a telephone line. There is no information in the packet of Maurya that could be substituted with the phone page URL as taught by Low. The POSITA would have no reason whatsoever to include a phone page as disclosed in Low in the packet of Maurya because Maurya has no need to access a phone page.

3.4.2.2. The Combination of Maurya and Low Would Not Render the '908 Patent Claims Obvious

The '908 Patent's destination URL is the URL at which remote RCGs are added to the multilink PPP bundle and from which data packets are sent to the remote RCGs that have been added to the multilink PPP bundle.[39] Low's alleged "destination URL" HTTP server cannot be used to add remote RCGs to a multilink PPP bundle. Low's alleged "destination URL" HTTP server cannot be used to send data packets to the remote RCGs that have been added to the multilink PPP bundle. Low's alleged "destination URL" HTTP server is literally just the URL location of a real phone number database that is associated with a code that acts as a proxy for that phone number. Accordingly, even if combined, the combination of Maurya and Low would not render the '908 Patent claims obvious.

The Examiner's arguments fail to consider the purpose and content of the URL used in Low. Further, the Examiners allegations are conclusory and do not establish motivation for the skilled artisan to modify the packets of Maurya to include Low's URL. It is well known that the teachings of a cited reference must be taken as whole, rather than by mere identification of individual out-of-context elements of a claim:

> It is impermissible within the framework of section 103 to pick and choose from any one reference only so much of it as will support a given position, to

[39] The '908 Patent, column 12, lines 51-61.

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> the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art.[40]

As such, there is no motivation to combine Maurya and Low, and even if they were combined, the combination would fail to provide the invention claimed in the '908 Patent. Therefore, the Examiner erred in arguing that a person of ordinary skill in the art would incorporate the phone page URL of Low into the packets of Maurya to create a system in which a destination URL is included in both a first message and a second message sent between devices of a multipath connection to transfer data.

Accordingly, without waiving any additional arguments related to patentability, the Appellant submits that, for at least the reasons above, the combination of Maurya and Low fails to render obvious claims 1-3, 5-6, and 13-15 and respectfully requests the Board allow the claims over the cited art.

IV. CONCLUSION

Appellant respectfully submits that no combination of Maurya and Low discloses, teaches, or otherwise renders obvious Claims 1-3, 5-6, and 13-15 and that the pre-AIA 35 U.S.C. 103(a) rejection of these claims has been overcome. Accordingly, Appellant requests the Board allow Claims 1-3, 5-6, and 13-15.

Appellant respectfully submits that the obviousness rejections are erroneous in law and in fact and should, therefore, be reversed by this Board.

[40] *Application of Hermann Wesslau*, 353 F.2d. 238, 241 (CCPA 1965).

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The Director is authorized to charge any fee for the Appeal Brief that may be due and any additional fee that may be required or to credit any overpayment to Deposit Account No. 02-1818. If such a withdrawal is made, please indicate the Attorney Docket No. 3712036-03392 on the account statement.

Respectfully submitted,

K&L GATES LLP

BY / M. Clare Frederick /
M. Clare Frederick
Reg. No. 66,608
Customer No.: 29156
Phone No. 312-807-4276

Dated: February 3, 2025

CLAIMS APPENDIX

PENDING CLAIMS ON APPEAL OF U.S. PATENT APPLICATION SERIAL NO. 14/768,609

Claim 1: A client device for multilink data packet communication with a server, the client device comprising:

a first network interface having a first data transfer rate associated with a first path from the server to the first network interface of the client device;

a second network interface having a second data transfer rate associated with a second path from the server to the second network interface of the client device; and

at least one processor configured to:

transmit a first message through the first network interface to the server, wherein the first message includes a multilink request a destination URL;

transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification the destination URL; and

receive data packets from the server through the first and second network interfaces of the client device during the multilink session wherein the first data transfer rate and the second data transfer rate provide an increased data transfer rate of the first path and the second path from the server to the client device.

Claim 2: The client device of claim 1, wherein the at least one processor further is configured to transmit the first message and the second message to at least one server, wherein the at least one server is a device providing the data packets, or a device that manages the client device and another device that is providing data to the client device.

Claim 3: The client device of claim 1, wherein a server provides the multilink session identification that is unique to the multilink session.

Claim 5: The client device of claim 1, wherein each of the first network interface and the second network interface is one or more of cellular interface, Wi-Fi interface, a wireless

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interface, a cable interface, a wired interface, an Ethernet interface, a Bluetooth interface, a near-field communication interface, and an optical interface.

Claim 6: The client device of claim 1, wherein the processor is configured to reorder the one or more data packets that are received over the at least two or more network interfaces of the client device during the multilink session.

Claim 13: A first device comprising:

a network interface; and

at least one processor configured to:

transmit a first message through the network interface to a second device, wherein the first message includes a multilink request and a destination URL, the network interface to the second device having a data transfer rate associated therewith;

transmit a second message through the network interface to a third device, wherein the second message includes a multilink session identification that is unique to the multilink session and the destination URL, the network interface to the third device having a data transfer rate associated therewith; and

receive the different data packets through the at least one network interface from the second device and from the third device during the multilink session, wherein the data transfer rate associated with the network interface to the second device and the network interface to the third device provide an increased data transfer rate for the first device.

Claim 14: The first device of claim 13, wherein the first device and the second device are separate devices or separate parts of the same device.

Claim 15: The first device of claim 13, wherein the first device is one of a cell phone, a tablet, a switch, a server, a network device, a router, a computer, a Wi-Fi device, a Wi-Max device, a mobile communication device, a wireless communications device, a near-field communications device, and a Bluetooth device.

Certificate of Service

I HEREBY CERTIFY that on the 3rd day of February, 2025, a copy of the foregoing Appeal Brief has been served on the Third Party Requester listed below by first class mail, postage prepaid:

Attn: Michelle Aspen
Unified Patents, LLC
4445 Willard Ave., Suite 600
Chevy Chase, MD 20815

Respectfully submitted,

K&L Gates LLP

By: /M. Clare Frederick/
M. Clare Frederick
Reg. No. 66,608
Telephone No. (312) 807-4335
Customer No. 29156

Dated: February 3, 2025

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Reexamination	Application/Control No.	Applicant(s)/Patent Under Reexamination
	90/019,265	10868908
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Requester Correspondence Address: ☐ Patent Owner ☑ Third Party
Unified Patents, LLC 4445 Willard Ave. Suite 600 Chevy Chase, MD 20815

LITIGATION REVIEW ☑	JRP (examiner initials)	16 November 2023 (date)
Case Name		Director Initials
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COPENDING OFFICE PROCEEDINGS	
TYPE OF PROCEEDING	**NUMBER**
Inter Partes Review (terminated 10/2/2023)	IPR2023-00584

/JOSEPH R POKRZYWA/ Primary Examiner, Art Unit 3992	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	90/019,265	10868908
	Examiner	Art Unit
	JOSEPH R POKRZYWA	3992

CPC - Searched*		
Symbol	**Date**	**Examiner**
H04M 3/007	11/13/2023	JRP
H04L 12/5692	11/13/2023	JRP
H04L 45/54	11/13/2023	JRP

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	**Date**	**Examiner**
reviewed underlying patent file wrapper for U.S. Pat. 10,868,908	11/13/2023	JRP
reviewed Patent Data Portal (PDP) for continuity data	11/13/2023	JRP
reviewed P-TACTS for AIA proceedings (found IPR2023-00584)	11/13/2023	JRP
reviewed IPR2023-00584 (termination on 10/2/2023)	11/13/2023	JRP
review prosecution history	06/03/2024	JRP
review prosecution history	09/20/2024	JRP
review prosecution history	03/17/2025	JRP

/JOSEPH R POKRZYWA/ Primary Examiner, Art Unit 3992	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	90/019,265	10868908
	Examiner	Art Unit
	JOSEPH R POKRZYWA	3992

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/JOSEPH R POKRZYWA/ Primary Examiner, Art Unit 3992	

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K&L Gates LLP-ADMINRPL
P.O. Box 1135
CHICAGO, IL 60690

EXAMINER	
POKRZYWA, JOSEPH R	

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ART UNIT *3992* .

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PTOL-465 (Rev.07-04)

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

Application Number: 90/019,265
Filing Date: 4 Oct 2023
Appellant(s): 10,868,908

_____
M. Clare Frederick
K&L GATES LLP
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed February 3, 2025.

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(1) Grounds of Rejection to be Reviewed on Appeal

Every ground of rejection set forth in the Office action dated October 2, 2024 from which the appeal is taken is being maintained by the examiner except for the grounds of rejection (if any) listed under the subheading "WITHDRAWN REJECTIONS." New grounds of rejection (if any) are provided under the subheading "NEW GROUNDS OF REJECTION."

The following ground(s) of rejection are applicable to the appealed claims.

Claims 1-3, 5-6, and 13-15 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,160,808, issued to MAURYA, Sanjiv Kumar (noted herein as "Maurya"), in view of International Patent Application Publication WO 97/22212, with the inventor of LOW, Colin *et al.*, being published on June 19, 1997 (noted herein as "Low").

(2) Response to Argument

Initially, it is noted that claims 1-3, 5-6, and 13-15 of the '908 Patent are currently subject to reexamination, whereby claims 4, 7-12, and 16-17 of the '908 Patent are not subject to reexamination. With this, claims 1-3, 5-6, and 13-15 of the '908 Patent each stand rejected under 35 U.S.C. 103(a) as being unpatentable over Maurya in view of Low. No amendments to the claims have been made, and the claims remain in their original form.

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Further, the Examiner notes that because the '908 Patent was filed as multiple continuations of applications, dating back to October 14, 2003, the '908 Patent would now appear to be expired. With this, MPEP 2240 states, in part:

> ... In making the determination of whether to order reexamination, the Office will determine the proper meaning of the patent claims by giving the claims their broadest reasonable interpretation consistent with the specification (see *In re Yamamoto,* 740 F.2d 1569 (Fed. Cir. 1984)), **except in the case of an expired patent (in a reexamination involving claims of an expired patent, claim construction is pursuant to the principle set forth by the court in *Phillips v. AWH Corp.,* 415 F.3d 1303, 1316, 75 USPQ2d 1321, 1329 (Fed. Cir. 2005) (words of a claim "are generally given their ordinary and customary meaning" as understood by a person of ordinary skill in the art in question at the time of the invention**, see *Ex parte Papst-Motoren,* 1 USPQ2d 1655 (Bd. Pat. App. & Inter. 1986)). If reexamination is ordered, the patent owner statement, if applicable, and any accompanying information submitted pursuant to 37 CFR 1.501(a)(2) will be considered during the examination stage to the fullest extent possible when determining the scope of any claims of the patent which are subject to reexamination. [Emphasis added].

Thus, since the '908 Patent would appear to be expired, the claim construction will be pursuant to the principle set forth by the court in *Phillips*, whereby the "words of a claim 'are generally given their ordinary and customary meaning' as understood by a person of ordinary skill in the art in question at the time of the invention."

Further, of the claims subject to reexamination in this proceeding, claims 1 and 13 are independent, whereby the arguments presented in the instant Appeal Brief revolve around the rejections of independent claims 1 and 13, which share similar elements. Thus, the instant appeal of each of the claims subject to reexamination would appear to stand or fall with respect to the rejection of independent claims 1 and 13.

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In this regard, with respect to the rejections of claims 1 and 13, the arguments in the Appeal Brief appear to revolve around the limitations that recite the features of the "first message" and the "second message", and more particularly, the claimed "multilink session identification" that is required to be included in the "second message".

Particularly, regarding independent claim 1 of the '908 Patent, the arguments in the instant Appeal Brief appear to revolve around the limitations:

> "1. A client device for multilink data packet communication with a server, the client device comprising:
>
> … at least one processor configured to:
>
> …
>
> transmit a first message through the first network interface to the server, wherein the first message includes a multilink request a destination URL *(sic)*;
>
> transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification the destination URL (*sic*); …"

Similarly, regarding independent claim 13 of the '908 Patent, the arguments in the instant Appeal Brief appear to revolve around the limitations:

> "13. A first device comprising:
>
> … at least one processor configured to:
>
> …
>
> transmit a first message through the network interface to a second device, wherein the first message includes a multilink request and a destination URL, … ;
>
> transmit a second message through the network interface to a third device, wherein the second message includes a multilink session identification that is unique to the multilink session and the destination URL, …"

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In this regard, independent claim 1 includes two notable errors in the above limitations, most likely leaving out the word "and" in both the transmitting steps for the first and second messages, so as to specifically require the first message to include "a multilink request and a destination URL", as recited in independent claim 13, and the second message to include "a multilink session identification and the destination URL", as similarly recited in claim 13. Here, in the instant proceeding, claim 1 is assumed to have the word "and" included in the limitations of independent claim 1.

With this, beginning on pages 8 and 9 of the Appeal Brief filed February 3, 2025 (hereafter "the Brief"), the Appellant first argues that the Examiner erred in arguing that Maurya's endpoint discriminator value is the same as the claimed multilink session identification. In this regard, the Appellant argues on page 9 of the Brief that "Maurya's description makes it clear that the endpoint discriminator value is the address of the endpoint in the system, it is not an identification of a communication session . ... Maurya does not provide any mechanism for distinguishing amongst different sessions that may then occur between the client and the server."

But in response, the current claim language does not expressly require "distinguishing amongst different sessions that may then occur between the client and the server", as argued. Here, in reviewing claim 1, as a whole, the multilink session identification is seen to have the plain and ordinary meaning of the term "identification", such that the multilink session identification identifies a multilink session, with this multilink session subsequently being used to receive data packets. Further, the Examiner notes that dependent claim 3 further defines the

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"multilink session identification", requiring "a server provides the multilink session identification that is unique to the multilink session." This feature is specifically recited in independent claim 13, as noted above. With this, claims 3 and 13 require that the multilink session identification is unique, so as to identify the particular multilink session.

Looking further into the specification of the '908 Patent, in col. 12, line 1-col. 13, line 12, the '908 Patent is seen to describe the above noted claimed second message. Along this vein, in col. 12, lines 9-14, the '908 Patent states that "As part of a successful multilink PPP session setup, the initiating RCG - 85 receives a multilink PPP session ID, or "magic number", which is used to identify this particular multilink PPP session and is also used for adding or removing links from the multilink bundle - 87." Additionally, in col.. 12, lines 51-60, the '908 Patent states "The initiating RCG then selects which of the responding remote RCGs - 86 it will use for the multilink PPP bundle - 87 and sends them a multilink initialization packet containing the URL of the destination as well as the multilink PPP session ID (magic number) and any other pertinent information required for the remote RCG to join in the existing multilink PPP bundle - 87." Thus, with this, the claimed "multilink session identification" within the second message appears to be defined in the specification of the '908 Patent as a "magic number" that is described as being used "to identify this particular multilink PPP session and is also used for adding or removing links from the multilink bundle".

With this, the combination of Maurya and Low is still seen to teach the limitation regarding the claimed "multilink session identification", such that Maurya teaches of the claimed

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"second message", which "includes a multilink session identification" and the combination of Maurya and Low teach that the second message includes the destination URL.

Particularly, with respect to Maurya, the reference states in the Abstract that "Specifically, during LCP negotiations, a multi-link PPP originator assigns itself **a unique endpoint discriminator value and informs all its immediate PPP peers by sending the latter, via a first bundle of outgoing links, an LCP Endpoint Discriminator packet containing this value.** Each of these immediate PPP peers assumes, as its endpoint discriminator, the value that has been provided to it in the LCP Endpoint Discriminator packet it receives from the originator and then sends an LCP Endpoint Discriminator packet containing **this same endpoint discriminator value**, via a second bundle of outgoing links, to all of its immediate PPP peers." Here, this "unique endpoint discriminator value", as described in the Abstract, appears to be used to identify the particular multilink PPP session, being required by the plain meaning of the claim term, and consistent with the "multilink session identification" described in the specification of the '908 Patent.

Further, as discussed in col. 9, lines 14-55, Maurya states "The endpoint discriminator packet identifies, by specifying an address, of an end system (an "endpoint"), then situated on an end of a link, that is transmitting this particular packet. This peer can be an existing system, i.e., one whose address has already been specified through prior LCP negotiations to its communicating peer, though using another, i.e., existing, link to that peer, or a different system altogether. If the data contained in this packet identifies the end system as an existing system (i.e., previously so identified), then, through the PPP protocol, **the link will be joined to an**

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existing bundle of links, so as to form a "pipe" among which multi-link PPP packets will be distributed for transport between the end system peer and its peer. Alternatively, if the data contained in packet 400 **differs from that of any existing system**, then the PPP protocol **assumes a new bundle of links exists and assigns the link to this new bundle**. … **Identification** of the endpoint system (commonly referred to as either an **"endpoint discriminator" or "endpoint identifier"**) is accomplished through class field 430 and address field 440, which collectively contain data carried by this packet. … For example, a class field having a value of illustratively zero, one or two specifies that the following address is a null class (i.e., the address is zero octets long), a locally assigned address, such as a serial number (having a length up to twenty octets), or an Internet Protocol (IP) address (having a length of four octets)."

Thus, the "endpoint discriminator" value (also described as the "endpoint identifier") described in Maurya is clearly seen to identify a particular multilink PPP session and is also used for adding or removing links from the multilink bundle, being the defining function of the "multilink session identification", as discussed in the specification of the '908 Patent.

Continuing, on page 10 of the Brief, the Appellant argues that the Examiner erred in arguing multilink short sequence number is the same as the claimed multilink session identification. Here, the Appellant argues that "[t]he claimed multi-link session identification is a single 'magic number' that is common to every packet in a given multilink PPP session. In contrast, Maurya's sequence number increases by one with each successive packet sent.

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Maurya's sequence number doesn't identify the session: it identifies the order of the packets within the session."

In this regard, in an additional interpretation, the Examiner also noted that the multi-link Short Sequence Number can also be interpreted as the claimed "multi-link session identification". Particularly, in col. 8, line 65-col. 9, line 13, Maurya also discloses that "Each specific option has to be separately negotiated between the PPP peers and appropriately acknowledged prior to its use. Inasmuch as the only values for this type field, i.e., the only configuration options, that are relevant to understanding the invention are 17, 18 and 19, which designate a multi-link MRRU (Multi-link Maximum Receive Reconstructed unit) request, a multi-link Short Sequence Number header request and a "multi-link endpoint discriminator" option, respectively (which will all be discussed in detail below in conjunction with FIG. 5). … **Each such multi-link PPP packet contains a sequence number--which increases by one with each successive packet**, inserted by the multi-link protocol." Thus, with these teachings, the multi-link Short Sequence Number can also be interpreted as a "multi-link session identification", as each packet in the multi-link contains this sequence number, which "identifies" the multilink session, as described in the specification of the '908 Patent.

Further, on page 10 of the Brief, the Appellant argues that the Examiner erred in arguing that it would have been obvious to combine Maurya and Low such that the first and second messages include a multilink request and a destination URL. First, as noted above, the first message and the second message in claims 1 and 13 require different elements. Particularly, the first message of claims 1 and 13 is required to include "a multilink request and a destination

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URL", while the second message is required to include "a multilink session identification the destination URL".

With this, with these sections discussed above, Maurya is seen to disclose at least one processor configured to "transmit a second message through the second network interface to the server, wherein the second message includes a multilink session identification [*sic*] *[and]* the destination IP address". In addition, in col. 9, lines 35-55, Maurya also states that "Other classes of addresses exist. Inasmuch as the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention, I will omit any further details of the latter two aspects."

But in this regard, the reference of Maurya does not expressly disclose if the first and second messages include a multilink request or a multilink session identification ***and*** a **destination URL**, as currently recited in independent claim 1, and similarly in claim 13, as Maurya is seen to only describe a destination IP address. However, the secondary reference of Low discloses a client device that transmits messages through a network interface, whereby one message includes a destination URL, as seen in Fig. 4, with the terminal 31 transmitting a message 38 to a server 32 that includes a destination URL. In addition, as read on page 11, line 12-page 13, line 15, Low states "A cornerstone of the WWW is its ability to address particular information resources by means of an Uniform Resource Locator (URL) that identifies a resource by location…By way of example, a full or 'absolute' URL will comprise the following elements:…the Internet host domain or IP address…This request includes a request method, and the 'Request-URI' (which is generally just the absolute path of the resource on the server as

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identified by the 'abs-path' element of the URI); the request may include additional data elements."

Thus, it would have been obvious for one of ordinary skill in the art to have include a destination URL, as recognized by Low, within the second message disclosed by Maurya. The suggestion/motivation for doing so would be that the client device of Maurya would conform with known protocols for communicating packets in systems utilizing point-to-point protocol (PPP), as discussed by Low in page 11, lines 21-page 12, line 28. Here, Low describes that utilizing URLs for PPP communication of packets between user terminals and Internet service providers was well known, and thus, this modification of Maurya with the functionality taught in Low would easily be implemented with these well-known teachings, as exemplified by Low, and would yield predictable results.

Continuing, on pages 11-15 of the Brief, the Appellant argues that Maurya fails to teach of suggest logically connecting devices from different networks as required by the claims. In this regard, on page 11 of the Brief, the Appellant begins arguing that the '908 Patent describes a network communication technology that routs packets across a multilink communication pathway spanning multiple **heterogeneous** networks, while Maurya teaches a network communication technology that provides multilink connectivity over a single **homogeneous** network. Further, on page 15, the Appellant argues that Maurya suffers from the very problem that the '908 Patent solves. Maurya requires physically connecting devices operating within a single network. The '908 Patent teaches systems and methods for logically connecting devices operating across different networks."

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In response, the Examiner notes that this alleged distinction is not clear in the current claim language. Rather claim 1 of the '908 Patent expressly recites "A client device for multilink data packet communication with a server", with the client device comprising a first network interface that transmits a first message **to the server**, and a second network interface that transmits a second message **to the server**. The reference of Maurya is seen to expressly disclose this claimed structure, as shown in Fig. 6A of Maurya, as illustrated in the Brief on page 14. Here, the current claim language does not require multiple networks, and there is not any required claimed pathway spanning multiple heterogeneous networks, as argued by the Appellant.

However, despite this, upon review of Maurya, the reference of Maurya actually does appear to describe that the user would able to connect to multiple networks, which would span multiple heterogeneous networks, as argued. Here, in Maurya, the server device is seen to connect to various networks for data communication.

Specifically, in col. 12, lines 17-31, Maurya states "Currently, client PC 610 can utilize any one of various existing operating systems that, if appropriately configured, is able to segment a PPP frame into multi-link PPP packets and distribute those packets among multiple links in a bundle (i.e., a pipe)." Further, in col. 1, line 65-col. 5, line 4, the reference describes in the Background of the Disclosure, that a multi-linked connection allows different packetized data from various different sources to be transmitted to a device so as to attain an increased bandwidth. Here, in col. 3, lines 1-13, Maurya states "In essence, multi-link operation involves

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real-time allocation (and deallocation) of any number of these links in the bundle to a common communication channel, i.e., the pipe, in order to dynamically provide sufficient transmission bandwidth for the underlying communication that is then to be carried by the channel.".

Continuing, on pages 15 and 16 of the Brief, the Appellant argues that the "endpoint discriminator value" in Maurya is not equivalent to a "multilink session identification". Here, in this section, the Appellant points to three alleged differences, arguing that Maurya's endpoint discriminator "is the physical link address for the sending and receiving devices, as well as each related terminal adapter, whereas the '908 Patent's multilink session identification is not", that "because Maurya's endpoint discriminator value is the physical link address for the network devices, it cannot be used to differentiate between various multilink sessions occurring between Maurya's PC client and server", and that Maurya's endpoint discriminator is the LCP configuration process prior to data being sent over the multilink connection, whereas the '908 Patent's multilink session identification is used during the communication session to add and remove links to the multilink bundle."

But in response, while Maurya's endpoint discriminator may have some different functionality than "a multilink PPP session ID" that is described in the specification of the '908 Patent, the reference of Maurya is still seen to teach that the endpoint discriminator identifies a multilink session, with the claim 1 reciting "the second message includes a multilink session identification…". Again, the claimed "multilink session identification" in claim 1 of the '908 Patent is seen to have the plain and ordinary meaning of the term "identification", such that the multilink session identification identifies a multilink session, with this multilink session

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subsequently being used to receive data packets. Further, independent claim 13 additionally defines the "multilink session identification that is unique to the multilink session."

Here, once again, looking into the specification of the '908 Patent, in col. 12, lines 9-14, the '908 Patent states that "As part of a successful multilink PPP session setup, the initiating RCG - 85 receives **a multilink PPP session ID, or "magic number", which is used to identify this particular multilink PPP session and is also used for adding or removing links from the multilink bundle** - 87." Further, in col. 12, lines 51-60, the '908 Patent additionally states "The initiating RCG then selects which of the responding remote RCGs - 86 it will use for the multilink PPP bundle - 87 and sends them a multilink initialization packet **containing the URL of the destination as well as the multilink PPP session ID (magic number)** and any other pertinent information required for the remote RCG to join in the existing multilink PPP bundle - 87." Thus, with this, the claimed "multilink session identification" within the second message appears to be defined in the specification of the '908 Patent as a number used "to identify this particular multilink PPP session and is also used for adding or removing links from the multilink bundle".

With this, as discussed above, Maurya states in the Abstract that "Specifically, during LCP negotiations, a multi-link PPP originator assigns itself **a unique endpoint discriminator value and informs all its immediate PPP peers by sending the latter, via a first bundle of outgoing links, an LCP Endpoint Discriminator packet containing this value.** Each of these immediate PPP peers assumes, as its endpoint discriminator, the value that has been provided to it in the LCP Endpoint Discriminator packet it receives from the originator and then sends an

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LCP Endpoint Discriminator packet containing **this same endpoint discriminator value**, via a second bundle of outgoing links, to all of its immediate PPP peers." Here, this "unique endpoint discriminator value", as described in the Abstract, appears to be used to identify the particular multilink PPP session, being required by the plain meaning of the claim term, and consistent with the "multilink session identification" described in the specification of the '908 Patent.

In addition, as discussed in col. 9, lines 14-55, Maurya states "The endpoint discriminator packet identifies, by specifying an address, of an end system (an "endpoint"), then situated on an end of a link, that is transmitting this particular packet. This peer can be an existing system, i.e., one whose address has already been specified through prior LCP negotiations to its communicating peer, though using another, i.e., existing, link to that peer, or a different system altogether. If the data contained in this packet identifies the end system as an existing system (i.e., previously so identified), then, through the PPP protocol, **the link will be joined to an existing bundle of links, so as to form a "pipe" among which multi-link PPP packets** will be distributed for transport between the end system peer and its peer. Alternatively, if the data contained in packet 400 **differs from that of any existing system**, then the PPP protocol **assumes a new bundle of links exists and assigns the link to this new bundle**. … **Identification** of the endpoint system (commonly referred to as either an **"endpoint discriminator" or "endpoint identifier"**) is accomplished through class field 430 and address field 440, which collectively contain data carried by this packet. … For example, a class field having a value of illustratively zero, one or two specifies that the following address is a null class (i.e., the address is zero octets long), a locally assigned address, such as a serial number (having

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a length up to twenty octets), or an Internet Protocol (IP) address (having a length of four octets)."

Thus, the "endpoint discriminator" value (also described as the "endpoint identifier") described in Maurya is clearly seen to identify a particular multilink PPP session and is also used for adding or removing links from the multilink bundle, being the defining function of the "multilink session identification", as discussed in the specification of the '908 Patent.

Continuing, on pages 16 and 17 of the Brief, the Appellant specifically argues that Maurya's endpoint discriminator is a physical link address and the '908 Patent's multilink session identification is not. Here, the Appellant initially argues on page 16 of the Brief that "the '908 Patent's multilink session dentification …is used to identify a particular multilink session and is also used for adding or removing links from the multilink bundle." But again, as discussed above, the "endpoint discriminator" value (also described as the "endpoint identifier") described in Maurya is seen to identify a particular multilink PPP session and is also used for adding … links from the multilink bundle, being the defining function of the "multilink session identification", as discussed in the specification of the '908 Patent.

Additionally, the Appellant further argues differences of Maurya and the invention of the '908 Patent, stating on page 17 of the Brief that "Maurya's endpoint discriminator value being a Layer 2 data link address of a network device …and the '908 Patent's multilink session identification operating in Layers 3 and above to identify a unique communication session." But with this, the current claim language is not seen to require operating in Layers 3 and above, as

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argued. In this regard, it is improper to import limitations from the specification into the claim language.

Particularly, MPEP 2111.01(II) states, in part:

> "**Though understanding the claim language may be aided by explanations contained in the written description, it is important not to import into a claim limitations that are not part of the claim**. For example, **a particular embodiment appearing in the written description may not be read into a claim when the claim language is broader than the embodiment**." *Superguide Corp. v. DirecTV Enterprises, Inc.*, 358 F.3d 870, 875, 69 USPQ2d 1865, 1868 (Fed. Cir. 2004). See also *Liebel-Flarsheim Co. v. Medrad Inc.*, 358 F.3d 898, 906, 69 USPQ2d 1801, 1807 (Fed. Cir. 2004) (discussing recent cases wherein the court expressly rejected the contention that if a patent describes only a single embodiment, the claims of the patent must be construed as being limited to that embodiment); *E-Pass Techs., Inc. v. 3Com Corp.*, 343 F.3d 1364, 1369, 67 USPQ2d 1947, 1950 (Fed. Cir. 2003) ("Interpretation of descriptive statements in a patent's written description is a difficult task, as an inherent tension exists as to whether a statement is a clear lexicographic definition or a description of a preferred embodiment. The problem is to **interpret claims 'in view of the specification' without unnecessarily importing limitations from the specification into the claims**.");...

With this, independent claim 1 currently recites "wherein the second message includes a multilink session identification [*sic*] the destination URL". Here, there is no current requirement in the claim language as to the specific layer that the multilink session identification operates in, as argued. Thus, the reference of Maurya can still be interpreted as teaching a "multilink session identification".

Continuing, on pages 17-19 of the Brief, the Appellant argues that Maurya's endpoint discriminator value cannot be used to differentiate between multilink sessions occurring between Maurya's PC client and server.

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Here, on page 18 of the Brief, the Appellant argues a difference in Maurya and the '908 Patent, stating that "In contrast, the '908 Patent's claimed multilink request, multilink session identification, and destination URL are solutions for managing multilink communication above an existing link layer." In addition, on page 19 of the Brief, the Appellant further argues "This is a significant improvement from the 'fixed pairs of systems' type networks taught by Maurya and a direct benefit of the multilink session identification operating above the Layer 2 endpoint discriminator used in Maurya." But with this, once again. the current claim language is not seen to require operating in any layers, let alone in a Layer above Layer 2, as argued. Once again, it is improper to import limitations from the specification into the claim language.

Continuing, on pages 19 and 20 of Appellant argues that Maurya's endpoint discriminator is not used during the communication session to add and remove link to the multilink PPP bundle. But in response, the current claim language does not require adding or removing a link to the multilink bundle during the communication session, as argued. Once again, it is improper to import limitations from the specification into the claim language.

But in this regard, the reference of Maurya is seen to describe that the endpoint discriminator is utilized to add links to the multilink bundle. Particularly, as discussed in col. 9, lines 14-55, Maurya states "The endpoint discriminator packet identifies, by specifying an address, of an end system (an "endpoint"), then situated on an end of a link, that is transmitting this particular packet. This peer can be an existing system, i.e., one whose address has already been specified through prior LCP negotiations to its communicating peer, though using another, i.e., existing, link to that peer, or a different system altogether. **If the data contained in this**

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packet identifies the end system as an existing system (i.e., previously so identified), then, through the PPP protocol, the link will be joined to an existing bundle of links, so as to form a "pipe" among which multi-link PPP packets will be distributed for transport between the end system peer and its peer. Alternatively, if the data contained in packet 400 **differs from that of any existing system**, then the PPP protocol **assumes a new bundle of links exists and assigns the link to this new bundle**. … **Identification** of the endpoint system (commonly referred to as either an **"endpoint discriminator" or "endpoint identifier"**) is accomplished through class field 430 and address field 440, which collectively contain data carried by this packet. … For example, a class field having a value of illustratively zero, one or two specifies that the following address is a null class (i.e., the address is zero octets long), a locally assigned address, such as a serial number (having a length up to twenty octets), or an Internet Protocol (IP) address (having a length of four octets)."

Thus, the "endpoint discriminator" value (also described as the "endpoint identifier") described in Maurya is seen to be used to identify a particular multilink PPP session and is also used for adding links from the multilink bundle, being the defining function of the "multilink session identification", as discussed in the specification of the '908 Patent.

Continuing, on pages 20-23 of the Brief, the Appellant argues that Maurya's "multi-link short sequence number" is not equivalent to a "multilink session identification". In this regard, once again, in an additional interpretation, the Examiner also noted that the multi-link Short Sequence Number can also be interpreted as the claimed "multi-link session identification". Particularly, in col. 8, line 65-col. 9, line 13, Maurya also discloses that "Each specific option has

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to be separately negotiated between the PPP peers and appropriately acknowledged prior to its use. Inasmuch as the only values for this type field, i.e., the only configuration options, that are relevant to understanding the invention are 17, 18 and 19, which designate a multi-link MRRU (Multi-link Maximum Receive Reconstructed unit) request, a multi-link Short Sequence Number header request and a "multi-link endpoint discriminator" option, respectively (which will all be discussed in detail below in conjunction with FIG. 5). … **Each such multi-link PPP packet contains a sequence number--which increases by one with each successive packet**, inserted by the multi-link protocol." Thus, with these teachings, the multi-link Short Sequence Number can also be interpreted as a "multi-link session identification", as each packet in the multi-link contains this sequence number, which "identifies" the multilink session, as described in the specification of the '908 Patent.

With this, on page 22 of the Brief, the Appellant argues that "Maurya does not support multiple concurrent sessions …and therefore, there is no purpose for identifying a given session with a multilink session identification." But here, the current claim language does not require having multiple concurrent sessions, as argued. Once again, it is improper to import limitations from the specification into the claim language.

Continuing, on page 23, the Appellant argues that Low does not teach a multilink session identification. With this however, Low is not utilized to teach a multilink session identification. Rather the reference of Low is utilized in the rejection to teach that using a URL for an endpoint address was well-known, as the primary reference of Maurya describes using an IP address of the

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endpoint, and that it would have been obvious to a person of ordinary skill in the art to utilize the addressing system of a URL in the system of Maurya, rather than just an IP address.

Further, on pages 23-25 of the Brief, the Appellant argues that the Examiner erred in arguing a motivation to combine Maurya and Low. Here, on page 25 of the Brief, the Appellant argues that "Low's URL requires that Layer 3-4 (TCP-IP) routing protocols are used…to access the HTTP Layer 7 server. Maurya does not teach or suggest the use of any Layer 3-7 routing functionality nor even alludes to how other routing protocols would be needed to connect to a specific URL. This omission further demonstrates that the skilled artisan would not be motivated to modify the packets of Maurya to include the web page URL of Low." But in response, the reference of Maurya recognized in col. 9, lines 14-55 that different "classes of addresses exist", such that "the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention".

With this, the reference of Maurya discloses on page 1, lines 19-27 that "To facilitate carriage of datagrams of different network layer protocols, such as IP (Internet Protocol), IPX, DECnet, AppleTalk and others, over a single point-to-point link, a protocol, collectively referred to as the "PPP" protocol, has recently been developed. The PPP protocol has self-contained mechanisms for specifying a specific network layer protocol to be carried in a PPP packet, testing the link itself and negotiating a variety of options for facilitating efficient communication over that link." Further, Maurya disclose on page 1, line 65-col. 2, line 25 that "During the past five years, Internet usage, particularly that of the world wide web, has exploded and continues to do so. Substantial increases still occur, on a monthly basis, not only in the size of the user

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community but also in the number of operational web sites. Moreover, as potential and existing site proprietors realize the potential of the Internet to very inexpensively reach an ever-increasing and diverse pool of widely dispersed potential users, these proprietors continue to post vastly increasing amounts of data, specifically, e.g., **files for increasingly sophisticated web pages that include both textual and graphical information, to their web sites for user selection and downloading**. Each time a user stationed at, e.g., a personal computer (PC) and using a web browser, "clicks" on a hypertext link or otherwise selects a web page, a file containing, e.g., HTML (hypertext mark-up language) source code for that page is transmitted by a remote web server through an Internet connection to the personal computer for rendering thereat. In addition, the Internet is also increasingly being used as a cost-effective method to deliver software to end users; an item of software being transmitted, again as a file(s), though oftentimes in compressed form, from a remote "ftp" (file transfer protocol) server to a personal computer then being operated by that user."

Looking at the reference of Low, on page 11, line 12-page 13, line 15, Low states "A cornerstone of the WWW is its ability to address particular information resources by means of an Uniform Resource Locator (URL) that identifies a resource by location…By way of example, a full or 'absolute' **URL will comprise the following elements**:…**the Internet host domain or IP address**…This request includes a request method, and the 'Request-URI' (which is generally just the absolute path of the resource on the server as identified by the 'abs-path' element of the URI); the request may include additional data elements."

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Thus, it would have been obvious for one of ordinary skill in the art to have include a destination URL, as recognized by Low, within the first and second messages disclosed by Maurya. The suggestion/motivation for doing so would be that the client device of Maurya would conform with known protocols for communicating packets in systems utilizing point-to-point protocol (PPP), as discussed by Low in page 11, lines 21-page 12, line 28. Here, Low describes that utilizing URLs for PPP communication of packets between user terminals and Internet service providers was well known, and thus, this modification of Maurya with the functionality taught in Low would easily be implemented with these well-known teachings, as exemplified by Low, and would yield predictable results. In additional, Maurya expressly states that the communicated data can be various web pages on the Internet [see col. 1, line 65-col. 2, line 25], and Maurya expressly recognized that different "classes of addresses exist", such that "the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention". [see col. 9, lines 14-55]. With this, the rejection of claims 1 and 13 as being unpatentable over the combination of Maurya in view of Low, is still deemed to be proper, and the rejection should be sustained.

Additionally, on pages 25-28 of the Brief, the Appellant argues that there is no motivation to combine Maurya and Low, and even if combined, the combination would not render the '908 Patent claims obvious. In response to Appellant's argument that there is no motivation to combine the references, the examiner recognizes that obviousness may be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the

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references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988), *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992), and *KSR International Co. v. Teleflex, Inc.*, 550 U.S. 398, 82 USPQ2d 1385 (2007).

In this case, the primary reference of Maurya expressly discloses in col. 9, lines 14-55 that different "classes of addresses exist", such that "the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention".

Further, the reference of Low describes using URLs, and states on page 7, line 29-page 8, line 6 that "For an entity to have a presence on the Internet, it needs both access to a network connected to the Internet and an IP address." Further, Low additionally states on page 11, line 12-page 13, line 15, that "A cornerstone of the WWW is its ability to address particular information resources by means of an Uniform Resource Locator (URL) that identifies a resource by location…By way of example, a full or 'absolute' **URL will comprise the following elements**:…**the Internet host domain or IP address**…This request includes a request method, and the 'Request-URI' (which is generally just the absolute path of the resource on the server as identified by the 'abs-path' element of the URI); the request may include additional data elements."

With this, motivation to utilize URL's in the system described in Maurya would be that the client device of Maurya would conform with known protocols for Internet communication of

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packets in systems utilizing point-to-point protocol (PPP), as discussed by Low in page 11, lines 21-page 12, line 28. Here, Maurya described using IP addresses in the messages, and Low describes that utilizing URLs for PPP communication of packets would include IP addresses, such that utilizing URLs between user terminals and Internet service providers was well known, and thus, this modification of Maurya with the functionality taught in Low would easily be implemented with these well-known teachings, as exemplified by Low, and would yield predictable results.

Continuing, on page 27 of the Brief, the Appellant argues that the Examiner's arguments fail to consider the purpose and content of the URL used in Low. Further, the Examiner's allegations are conclusory and do not establish motivation for the skilled artisan to modify the packets of Maurya to include Low's URL."

But here, the reference of Low is being utilized to show that it would have been obvious to one of ordinary skill in the art to use the addressing scheme of a URL in a system that sends packets in accordance with Internet protocol.

Here, the reference of Maurya discloses on page 1, lines 19-27 that "To facilitate carriage of datagrams of different network layer protocols, such as IP (Internet Protocol), IPX, DECnet, AppleTalk and others, over a single point-to-point link, a protocol, collectively referred to as the "PPP" protocol, has recently been developed. The PPP protocol has self-contained mechanisms for specifying a specific network layer protocol to be carried in a PPP packet, testing the link itself and negotiating a variety of options for facilitating efficient communication over that link."

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Further, Maurya disclose on page 1, line 65-col. 2, line 25 that "During the past five years, Internet usage, particularly that of the world wide web, has exploded and continues to do so. Substantial increases still occur, on a monthly basis, not only in the size of the user community but also in the number of operational web sites. Moreover, as potential and existing site proprietors realize the potential of the Internet to very inexpensively reach an ever-increasing and diverse pool of widely dispersed potential users, these proprietors continue to post vastly increasing amounts of data, specifically, e.g., **files for increasingly sophisticated web pages that include both textual and graphical information, to their web sites for user selection and downloading**. Each time a user stationed at, e.g., a personal computer (PC) and using a web browser, "clicks" on a hypertext link or otherwise selects a web page, a file containing, e.g., HTML (hypertext mark-up language) source code for that page is transmitted by a remote web server through an Internet connection to the personal computer for rendering thereat. In addition, the Internet is also increasingly being used as a cost-effective method to deliver software to end users; an item of software being transmitted, again as a file(s), though oftentimes in compressed form, from a remote "ftp" (file transfer protocol) server to a personal computer then being operated by that user."

With this, looking at the reference of Low, on page 11, line 12-page 13, line 15, Low states "A cornerstone of the WWW is its ability to address particular information resources by means of an Uniform Resource Locator (URL) that identifies a resource by location…By way of example, a full or 'absolute' **URL will comprise the following elements**:…**the Internet host domain or IP address**…This request includes a request method, and the 'Request-URI' (which

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is generally just the absolute path of the resource on the server as identified by the 'abs-path' element of the URI); the request may include additional data elements."

Thus, it would have been obvious for one of ordinary skill in the art to have include a destination URL, as recognized by Low, within the first and second messages disclosed by Maurya. The suggestion/motivation for doing so would be that the client device of Maurya would conform with known protocols for communicating packets in systems utilizing point-to-point protocol (PPP), as discussed by Low in page 11, lines 21-page 12, line 28. Here, Low describes that utilizing URLs for PPP communication of packets between user terminals and Internet service providers was well known, and thus, this modification of Maurya with the functionality taught in Low would easily be implemented with these well-known teachings, as exemplified by Low, and would yield predictable results. In additional, Maurya expressly states that the communicated data can be various web pages on the Internet [see col. 1, line 65-col. 2, line 25], and Maurya expressly recognized that different "classes of addresses exist", such that "the invention functions equally well with any such address and the manner through which an address is assigned and its respective class are irrelevant to the present invention". [see col. 9, lines 14-55]. With this, the rejection of claims 1 and 13 as being unpatentable over the combination of Maurya in view of Low, is still deemed to be proper, and the rejection should be sustained.

For the above reasons, it is believed that the rejections should be sustained.

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Respectfully submitted,

/JOSEPH R POKRZYWA/
Primary Examiner, Art Unit 3992

Conferees:

/ERON J SORRELL/
Primary Examiner, Art Unit 3992

/MICHAEL FUELLING/
Supervisory Patent Examiner, Art Unit 3992

Requirement to pay appeal forwarding fee. In order to avoid dismissal of the instant appeal in any application or *ex parte* reexamination proceeding, 37 CFR 41.45 requires payment of an appeal forwarding fee within the time permitted by 37 CFR 41.45(a), unless appellant had timely paid the fee for filing a brief required by 37 CFR 41.20(b) in effect on March 18, 2013.

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PATENT AND TRADEMARK OFFICE

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ELECTRONIC PAYMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
90/019,265	**05/27/2025 06:37:11 PM Z ET**	**COM908**

Title of Invention

DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS

Application Information

APPLICATION TYPE	Utility / ex parte reexam	PATENT #	10868908
CONFIRMATION #	3396	FILED BY	US Patent Mail
PATENT CENTER #	70600882	AUTHORIZED BY	Clare Frederick
CUSTOMER #	29156	FILING DATE	10/04/2023
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	- 10868908

Payment Information

PAYMENT METHOD	PAYMENT TRANSACTION ID	PAYMENT AUTHORIZED BY
DA / 021818	**E20255QI37488022**	**US Patent Mail**

PRE-AUTHORIZED ACCOUNT	PRE-AUTHORIZED CATEGORY
021818	**37 CFR 1.16 (National application filing, search, and examination fees); 37 CFR 1.17 (Patent application and reexamination processing fees)**

FEE CODE	DESCRIPTION	ITEM PRICE($)	QUANTITY	ITEM TOTAL($)
1403	REQUEST FOR ORAL HEARING	1460.00	1	1460.00
1413	FORWARDING AN APPEAL IN AN APPLICATION OR EX PARTE REEXAMINATION PROCEEDING TO THE BOARD	2535.00	1	2535.00
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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
90/019,265	**05/27/2025 06:37:11 PM Z ET**	**COM908**

Title of Invention

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Documents

TOTAL DOCUMENTS: 3

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
3725791.00005_ForwardingFee.pdf	2	Certification and Transmittal of Appeal Forwarding Fee	241 KB
3725791.00005_OralArguments.pdf	2	Oral Hearing Request-Owner	350 KB
3725791.00005_ReplyBrief.pdf	9	Reply Brief Filed	200 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
3725791.00005_ForwardingFee.pdf	46D1B48E4D30F1AE6C2F07FD69D4CCB3C23A21E659FD028152FB62A9D2F65062421B547FB3D564BCECB677B9479F2E6DC17BB22BFB516B82B178B23B2ABD72CC

3725791.00005_OralArguments.pdf	3B286CF7BAC9D6A202AEBEC7E27C1935BC562BC90E149952FEAD495812A9CD326A65CB4242FBBB5D047F1764D7230399E0AEE72666D83535F3A4502EC33DA2F3
3725791.00005_ReplyBrief.pdf	54DB72EC4DCD274ABA7727943092AE39B0F42069712A2E7F17D1EBBAEB85CE7BBDDB4E6252038B2E821C7771796350D89EF8AEC891E4D6C4F8436B71F7C37074

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Doc Code: WFEE.APPEAL
Doc Description: Certification and Transmittal of Appeal Forwarding Fee

PTO/AIA/34 (11-23)

CERTIFICATION AND TRANSMITTAL OF APPEAL FORWARDING FEE	Docket Number (Optional) 3725791.00005

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on May 27, 2025.
Signature /M. Clare Frederick/
Typed or printed name M. Clare Frederick

First Named Inventor	
COMPETITIVE ACCESS SYSTEMS INC	
Application Number: 90/019,265	Filed: 2023-10-04
For: DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS	
Art Unit: 3992	Examiner: JOSEPH R POKRZYWA

37 CFR 41.45 specifies that, in order to avoid dismissal of the appeal, appellant must pay the fee set in 37 CFR 41.20(b)(4) within two months of the later of the date of either the examiner's answer, or a decision refusing to grant a petition under 37 CFR 1.181 to designate a new ground of rejection in an examiner's answer.

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I am the

☐ appellant

☒ attorney or agent of record
Registration number 66608

☐ attorney or agent acting under 37 CFR 1.34
Registration number _____

Signature /M. Clare Frederick/
Typed or printed name M. Clare Frederick
Telephone Number 312-807-4276
Date 2025-05-27

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REQUEST FOR ORAL HEARING BEFORE THE PATENT TRIAL AND APPEAL BOARD

Docket Number (Optional): 3725791.00005

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Signature /M. Clare Frederick/

Typed or printed name M. Clare Frederick

First Named Inventor: COMPETITIVE ACCESS SYSTEMS INC	
Application Number: 90/019,265	Filed: 2023-10-04
For: DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS	
Art Unit: 3396	Examiner: JOSEPH R POKRZYWA

Applicant hereby **requests an oral hearing** before the Patent Trial and Appeal Board in the appeal of the above-identified application.

The fee for this Request for Oral Hearing is (37 CFR 41.20(b)(3)) $ 1,460

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☐ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☑ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. 02-1818.

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☐ A petition for an extension of time under 37 CFR 1.136(b) (PTO/SB/23 or equivalent) is enclosed.
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I am the

☐ applicant

☑ attorney or agent of record
Registration number 66608

☐ attorney or agent acting under 37 CFR 1.34
Registration number _____

Signature /M. Clare Frederick/

Typed or printed name M. Clare Frederick

Telephone Number 312-807-4276

Date 2025-05-27

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THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT TRIAL AND APPEAL BOARD

Reexam Control No.:	90/019,265
U.S. Patent No.:	10,868,908
Patent Owner:	Competitive Access Systems, Inc.
Conf. No.:	3396
Filed:	October 4, 2023
Title:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
Art Unit:	3992
Examiner:	Joseph R. Pokrzywa
Docket No.:	3725791.00005

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPELLANT'S REPLY BRIEF

I. INTRODUCTION

Appellant submits this Reply Brief pursuant to 37 C.F.R. §41.41 in response to the Examiner's Answer dated March 25, 2025 (the "Examiner's Answer"). Appellant's Appeal Brief (the "Brief") filed on February 3, 2025, details the deficiencies of the Office Action dated October 2, 2024. For at least the reasons set forth herein, the Examiner's Answer fails to remedy these deficiencies.

II. ARGUMENT

1. OVERVIEW OF THE CLAIMED INVENTION

U.S. Patent 10,868,908 ("'908 Patent") teaches and claims a network communication technology that enables IP address routing to communicate data packets between two end points across a **multilink communication pathway spanning multiple heterogeneous networks.** As described in detail in Section 4.2 of the Brief, the '908 Patent invention operates on Layers 3 and above (i.e., the network layer, the transport layer, the session layer, the presentation layer, and the application layer) of the Open Systems Interconnection ("OSI") model.

More specifically, the '908 Patent claims a receiving device that sets up a multipath connection utilizing **separate networks** to increase bandwidth available to the receiving device. Instead of creating and managing new systems of physical links between connected network devices (Layers 1 and 2 of the OSI model), the claimed network communication technology uses Layers 3-7 of the OSI model **to logically join multiple physical networks** for form a multilink PPP bundle capable of transmitting and receiving data.

Each of independent Claims 1 and 13 requires a first message that includes: (i) a multilink request; and (ii) a destination URL, and a second message that includes: (iii) a multilink session identification; and the destination URL. The two messages must include three distinct claim elements:

1. a multilink request;
2. a destination URL; and
3. a multilink session identification.

No combination of Maurya and Low discloses, teaches, or otherwise renders obvious the claimed multilink data packet communication/session or the claim element "multilink session identification." Accordingly, claims 1-3, 5-6, and 13-15 are patentable over the combination of Maurya and Low.

2. THE EXAMINER'S ANSWER DOES NOT SUPPORT THE REJECTIONS OF CLAIMS 1-3, 5-6, AND 13-15 OF THE '908 PATENT.

As presented in the Brief and explained in more detail below:

- Maurya does not teach a multilink session identification.
    - Maurya's endpoint discriminator value only identifies the physical address of the bundle of network devices functioning as an endpoint on one side of a multilink session.
    - Maurya's multi-link short sequence number is a dynamically incrementing number used to order and reassemble the IP packets in the correct sequence.
- The Examiner acknowledges Low doesn't teach a multilink session identification.

Accordingly, the '908 Patent claims are patentable because the prior art doesn't teach the claimed multilink session identification, and the Board should reverse the Examiner's rejections.

2.1. Maurya Fails to Teach or Suggest the Claimed Multilink Session Identification

As noted by the Examiner, the Appellant argues the Examiner erred in arguing Maurya's endpoint discriminator value is the same as the claimed multilink session identification. Specifically, on page 9 of the Brief, the Appellant argues, "Maurya's description makes it clear that the endpoint discriminator value is the address of the endpoint in the system, it is not an identification of the communication session.... Maurya does not provide any mechanism for distinguishing amongst different sessions that may then occur between the client and the server."

In response to the Appellant's argument, the Examiner argues on page 6 of the Examiner's Answer, "the current claim language does not expressly require "distinguishing amongst different **sessions** that may then occur between the client and the server." The examiner makes two main arguments in support of this point.

2.1.1. The Examiner's "Claim Differentiation" Argument

The claim language in question from independent claims 1 and 13 is "the second message includes a **multilink *session* identification**." The ordinary and customary meaning as understood by a person of ordinary skill in the art in questions at the time of the invention would be that a "multilink session identification" identifies a specific session within a multilink system. One need not look further than the claim language itself to understand a "multilink session identification" literally **identifies** a specific **session** in a **multilink** system—it is in the claim language itself.

Continuing a related argument, on page 7 of the Examiner's Answer, the Examiner attempts to distinguish independent claim 1 from independent claim 13. The Examiner starts by acknowledging independent claim 13 requires "the second message includes a multilink session identification ***that is unique to the multilink session***," which is claim language that does not appear in claim 1. It is true that claim 13 is explicit in specifying that the multilink session identification is unique to the multilink session. However, it does not logically follow

that the claimed multilink session identification in claim 1 fails to identify a unique multilink session.

To support this argument, the Examiner implicitly uses the principle of claim differentiation to say that the limitations presented in dependent claim 3 require the multilink session identification in claim 1 to be broader than one that is unique to the multilink session. However, claim 3 requires, "**a server** provides the multilink session identification that is unique to the multilink session." Claim 3 specifically requires it is **a server** that provides the multilink session identification that is unique to the multilink session, instead of the "at least one processor" required by claim 1. The additional language "that is unique to the multilink session" is simply clarifying, not an additional limitation, since the entire purpose of the multilink session identification is to identify the specific multilink session.

2.1.2. The Examiner's "Magic Number" Argument

Next, starting on page 7 of the Examiner's Answer, the Examiner argues Maurya teaches the claim limitations because, "the claimed 'multilink session identification' within the second message appears to be defined in the specification of the '908 Patent as a 'magic number' that is described as being used to '**identify this particular multilink PPP session** and is also used for adding or removing links from the multilink bundle."

First, the quote from the '908 Patent demonstrates that one of the functions of the multilink session identification is to identify the particular multilink PPP **session**. This directly undercuts the Examiner's previous argument that the multilink session identification in claim 1 does not identify a specific session.

Second, the Examiner then goes through great detail arguing that Maurya's endpoint discriminator value is the same as the claimed multilink session identification. Although Appellant makes several arguments against this point, a key argument is provided in Section 3.3.1.1 of the Brief. In this argument, and specifically with reference to Maurya's FIG. 6A, Appellant demonstrates Maurya's endpoint discriminator value doesn't identify a session, it identifies each bundle of terminal adapters that share a physical address such that they function as a single endpoint in the session. As described in Section 3.3.1.1 of the Brief and shown in Maurya's FIG. 6A, because a first bundle of terminal adapters on one side of the

network (e.g., 620n) shares a first common endpoint discriminator value, and a second bundle of terminal adapters on a second side of the network (e.g., 660n) share a second common endpoint discriminator value, the endpoint discriminator value associated with terminal adapters 620n is different than the endpoint discriminator value associated with terminal adapters 660n. Thus, in a communication between terminal adapters 620n, which share endpoint discriminator value 1, and 660n, which share endpoint discriminator value 2, neither of the endpoint discriminator values functions as a multilink **session** identification. They truly are just endpoint identifiers.

The Examiner revisits versions of these arguments throughout the Examiner's Answer, but without any additional details or context that addresses these distinctions made by Appellant in the Brief. Accordingly, neither Maurya, nor Low, nor any combination thereof, teach the claimed multilink session identification. Thus, the Examiner's obviousness rejection fails, and the Board should reverse the Examiner's rejections.

2.2. Maurya's Multi-Link Short Sequence Number is Not a Multilink Session Identification

On pages 9-10 and then again on pages 20-21 of the Examiner's Answer, the Examiner argues that Maurya's multi-link Short Sequence Number can be interpreted as the claimed multilink session identification. In making the argument, the Examiner describes how Maurya's multi-link Short Sequence Number is a sequencing number that increases by one with each successive packet. The Examiner then claims this incrementing series of numbers is the same as the claimed identification number. This argument fails on its face.

The claimed multilink session identification specifically functions as a single static number that identifies the multilink session (see, e.g., '908 Patent, col. 12, ln. 2 to col. 13, ln. 12). Maurya's multi-link Short Sequence Number is not analogous. It is not a single number. It is not static for a session. It does not identify the multilink session, it identifies the order of the packets within a session. It is just nothing like the claimed multilink session identification.

Accordingly, neither Maurya, nor Low, nor any combination thereof, teach the claimed multilink session identification. Thus, the Examiner's obviousness rejection fails, and the Board should reverse the Examiner's rejections.

2.3. The Combination of Maurya and Low Fails to Teach or Suggest the Claim Limitations of Claims 1-3, 5-6, and 13-15 of the '908 Patent

Throughout the Examiner's Answer, the Examiner reiterates his rejections of the claims at issue, particularly directed towards independent claims 1 and 13. However, none of the Examiner's arguments provide anything that hasn't been addressed in Appellant's Brief. For example, on page 10 of the Examiner's Answer, the Examiner reiterates their argument that the combination of Maurya and Low teach the first and second message include a multilink request or multilink session identification and a destination URL. Nothing is added by the Examiner's argument that isn't address in Appellant's Brief in Sections 3.1.3 and 3.4.2. Similarly, on pages 22-28, the Examiner reiterates all the arguments previously made in support of the Maurya and Low combination rejections. Again, each of these points is adequately addressed in Appellant's Brief. Accordingly, no combination of Maurya and Low teaches or otherwise renders obvious claims 1-3, 5-6, and 13-15 of the '908 Patent and the Examiner's rejections should be reversed.

2.4. The Examiner Fails to Appreciate the Context of the '908 Patent and Cited Art Matters in Making Obviousness Rejections.

Throughout the Examiner's Answer, the Examiner points out where the Appellant's arguments are not based entirely on the claim language. The Examiner is typically not wrong in this observation, but also fails to appreciate the purpose for which the arguments are being presented. The context of the ''908 Patent and the cited art are relevant to the cited art's viability in an obviousness rejection. Two illustrative examples are provided below.

First, in the Examiner's arguments in pages 14-20 of the Examiner's Answer, with respect to Appellant's OSI model-related explanations, the Examiner makes a point to explain that it is improper to import limitations from the specification into the claim language. Appellant agrees this is axiomatically true and points out that the OSI model-related explanations are merely the Appellant using technically appropriate language that would have been understood by one skilled in the art at the time of the invention to explain why the Examiner's arguments and analogies with respect to the prior art fail. The claim language itself provides the patentable distinctions from the prior art. But context matters in an obviousness rejection, and the Examiner's failure to acknowledge the significant contextual

differences between the '908 Patent and the cited art has inappropriately led to unsupported rejections of the '908 Patent claims.

Similarly, on page 21, the Examiner notes the '908 Patent claim language doesn't require having multiple concurrent sessions. This is clearly true. However, again, this contextually relevant observation about the different contexts in which the claimed invention and the cited art operate demonstrates how poorly-suited the prior art references are for an obviousness rejection.

As above, no combination of Maurya and Low teaches or otherwise renders obvious claims 1-3, 5-6, and 13-15 of the '908 Patent and the Examiner's rejections should be reversed.

III. CONCLUSION

Appellant respectfully submits that no combination of Maurya and Low discloses, teaches, or otherwise renders obvious Claims 1-3, 5-6, and 13-15 and that the pre-AIA 35 U.S.C. 103(a) rejection of these claims has been overcome. Accordingly, Appellant requests the Board allow Claims 1-3, 5-6, and 13-15.

Appellant respectfully submits that the obviousness rejections are erroneous in law and in fact and should, therefore, be reversed by this Board.

The Director is authorized to charge any fee for the Reply Brief that may be due and any additional fee that may be required or to credit any overpayment to Deposit Account No. 02-1818. If such a withdrawal is made, please indicate the Attorney Docket No. 3725791.00005 on the account statement.

Respectfully submitted,

K&L GATES LLP

BY /M. Clare Frederick/
M. Clare Frederick
Reg. No. 66,608
Customer No.: 29156
Phone No. 312-807-4276

Dated: May 27, 2025

Certificate of Service

I HEREBY CERTIFY that on the 27th day of May, 2025, a copy of the foregoing Reply Brief has been served on the Third Party Requester listed below by first class mail, postage prepaid:

Attn: Michelle Aspen
Unified Patents, LLC
4445 Willard Ave., Suite 600
Chevy Chase, MD 20815

Respectfully submitted,

K&L Gates LLP

By: /M. Clare Frederick/
M. Clare Frederick
Reg. No. 66,608
Telephone No. (312) 807-4335
Customer No. 29156

Dated: May 27, 2025