8558392

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

January 06, 2025

THIS IS TO CERTIFY THAT ANNEXED IS A TRUE COPY FROM THE RECORDS OF THIS OFFICE OF THE FILE WRAPPER AND CONTENTS OF:

APPLICATION NUMBER: ***15/161,787***
FILING DATE: ***May 23, 2016***
PATENT NUMBER: ***10868908***
ISSUE DATE: ***December 15, 2020***

Certified by

Acting Under Secretary of Commerce
for Intellectual Property
and Acting Director of the United States
Patent and Trademark Office

PTO/SB/81 (01-09)
Approved for use through 11/30/2011. OMB 0651-0035
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 displays a valid OMB control number.

POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS

Application Number	
Filing Date	2016-05-23
First Named Inventor	ERIC DELANGIS
Title	DEVICES AND METHODS FOR MULTIPATH COMMUNCATION
Art Unit	
Examiner Name	
Attorney Docket Number	ED 3000

I hereby revoke all previous powers of attorney given in the above-identified application.

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

64828

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

Practitioner(s) Name	Registration Number

Please recognize or change the correspondence address for the above-identified application to:

☒ The address associated with the above-mentioned Customer Number.

OR

☐ The address associated with Customer Number:

OR

☐	Firm or Individual Name				
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the:

☒ Applicant/Inventor.

OR

☐ Assignee of record of the entire interest. *See 37 CFR 3.71.*
Statement under 37 CFR 3.73(b) (Form PTO/SB/96) submitted herewith or filed on _____

SIGNATURE of Applicant or Assignee of Record

Signature		Date	May 23, 2016
Name	ERIC DELANGIS	Telephone	970-310-3576
Title and Company	INVENTOR		

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☐ *Total of _____ forms are submitted

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. 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 1.11 and 1.14. This collection is estimated to take 3 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.

RED HAT 1008
RED HAT V. CAS

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATION
First Named Inventor/Applicant Name:	Eric M DeLangis
Filer:	Harold C. McGurk
Attorney Docket Number:	ED 3000

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility filing Fee (Electronic filing)	4011	1	70	70
Utility Search Fee	2111	1	300	300
Utility Examination Fee	2311	1	360	360
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

RED HAT 1008
RED HAT V. CAS

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**730**

Electronic Acknowledgement Receipt	
EFS ID:	25855383
Application Number:	15161787
International Application Number:	
Confirmation Number:	3396
Title of Invention:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATION
First Named Inventor/Applicant Name:	Eric M DeLangis
Customer Number:	64828
Filer:	Harold C. McGurk
Filer Authorized By:	
Attorney Docket Number:	ED 3000
Receipt Date:	23-MAY-2016
Filing Date:	
Time Stamp:	15:24:59
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$730
RAM confirmation Number	1835
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

RED HAT 1008
RED HAT V. CAS

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	ED_3000_ADS_SB14.pdf	1023560 d77197daf80f6b7aebad96d8fed16f551273fbe3	no	5
Warnings:					
Information:					
2	Specification	ED_3000_Specification_FINAL.pdf	128819 0312ab4ae61ddd8115e72a2e6a25062e16576a65	no	24
Warnings:					
Information:					
3	Drawings-only black and white line drawings	ED_3000_Drawings_1-9.PDF	2620724 5f2c2bc1b63f197728e97df396e6f7ff589f976b	no	9
Warnings:					
Information:					
4	Abstract	ED_3000_Abstract.pdf	23483 8fb9cd0256f081681ec445996bd34f67fd8328a5	no	1
Warnings:					
Information:					
5	Claims	ED_3000_Claims.pdf	16066 e7536128e6952aeeaeb8c52aec0ad903689e5ad6	no	2
Warnings:					
Information:					
6	Oath or Declaration filed	ED_3000_Declaration.pdf	3018958 7640e5c1a024574df2023875a9892e1b2f422382	no	1
Warnings:					
Information:					
7	Power of Attorney	ED_3000_Power_Attorney.pdf	3152623 ca4f26870d2933978c6a73947c8dc6c4ae2178de	no	1
Warnings:					
Information:					

8	Fee Worksheet (SB06)	fee-info.pdf	34770 58baf9a9accc5f6ee67effb04bbe24d05580e57b	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	10019003	

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 a 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.

RED HAT 1008
RED HAT V. CAS

PTO/SB/14 (11-08)
Approved for use through 01/31/2014. OMB 0651-0032
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.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	ED 3000
	Application Number	
Title of Invention	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Applicant Information:

Applicant 1				Remove
Applicant Authority	● Inventor	Legal Representative under 35 U.S.C. 117	Party of Interest under 35 U.S.C. 118	
Prefix	Given Name	Middle Name	Family Name	Suffix
	Eric	M.	Delangis	
Residence Information (Select One)	● US Residency	Non US Residency	Active US Military Service	
City	Huntsville	State/Province	AL	Country of Residence: US
Citizenship under 37 CFR 1.41(b)	US			
Mailing Address of Applicant:				
Address 1	231 Brevard Blvd			
Address 2				
City	Huntsville	State/Province	AL	
Postal Code	35811	Country	US	

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	64828		
Email Address	claymcgurk@gmail.com	Add Email	Remove Email

Application Information:

Title of the Invention	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS		
Attorney Docket Number	ED 3000	Small Entity Status Claimed	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		Sub Class (if any)	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	9	Suggested Figure for Publication (if any)	7

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	ED 3000
	Application Number	
Title of Invention	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS	

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S. C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Enter either Customer Number or complete the Representative Name section below. If both sections are completed the Customer Number will be used for the Representative Information during processing.

Please Select One:	● Customer Number	US Patent Practitioner	◯ Limited Recognition (37 CFR 11.9)
Customer Number	64828		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78(a)(2) or CFR 1.78(a)(4), and need not otherwise be made part of the specification.

Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
	Continuation of	14512414	2014-10-11	9350649	2016-05-24
Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
14512414	Continuation of	13531294	2012-06-22	8861349	2014-10-14
Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
13531294	Continuation of	12581852	2009-10-19	8228801	2012-07-24
Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
12581852	Continuation of	10686375	2003-10-14	7606156	2009-10-20
Prior Application Status	Expired				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)		
10686375	non provisional of	60418521	2002-10-15		

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	ED 3000
	Application Number	
Title of Invention	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS	

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

Foreign Priority Information:

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).

Remove

Application Number	Country[i]	Parent Filing Date (YYYY-MM-DD)	Priority Claimed
			• Yes No

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button. Add

Assignee Information:

Providing this information in the application data sheet does not substitute for compliance with any requirement of part 3 of Title 37 of the CFR to have an assignment recorded in the Office.

Assignee 1 Remove

If the Assignee is an Organization check here. ☐

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix

Mailing Address Information:

Address 1			
Address 2			
City		**State/Province**	
Country[i]		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Assignee Data may be generated within this form by selecting the **Add** button. Add

Signature:

A signature of the applicant or representative is required in accordance with 37 CFR 1.33 and 10.18. Please see 37 CFR 1.4(d) for the form of the signature.

Signature	/H C McGurk, Reg. 34964/			Date (YYYY-MM-DD)	2016-05-23
First Name	Harold	Last Name	McGurk	Registration Number	34964

PTO/SB/14 (11-08)
Approved for use through 01/31/2014. OMB 0651-0032
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.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	ED 3000
	Application Number	
Title of Invention	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS	

This collection of information is required by 37 CFR 1.76. 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 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet 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.**

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 the Freedom of Information Act requires disclosure of these records.

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 inspections 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.

DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS

RELATED APPLICATIONS

[0001] This application is a continuation of U.S. Patent Application Serial No. 14/512,414 filed October 11, 2014, now patented as U.S. Patent 9,350,649, which is a continuation of U.S. Patent Application Serial No. 13/531,294 filed June 12, 2012, now patented as U.S. Patent 8,861,349, which is a continuation of U.S. Patent Application Serial No. 12/581,852 filed October 19, 2009, now patented as U.S. Patent 8,228,801, which is a continuation of U.S. Patent Application Serial No. 10/686,375 filed October 14, 2003, now patented as U.S. Patent 7,606,156, which claims priority to U.S. Provisional Application Serial No. 60/418,521, filed October 15, 2002, all of which are incorporated by reference herein.

BACKGROUND OF INVENTION

[0002] 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.

[0003] 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

RED HAT 1008
RED HAT V. CAS

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.

[0004] 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.

[0005] 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:

[0006] 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.

[0007] 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

[0008] 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.

[0009] 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.

[0010] 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:

[0011] The following discussion refers to figure 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.

[0012] 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.

[0013] 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:

[0014] Up to three telephone lines i.e. numbers, over a single POTS line and/or wireless connection.

[0015] Ethernet, USB and IEEE 1394 computer interfaces.

[0016] Full G1, G2 and G3 FAX support.

[0017] Full support for all CLASS services.

[0018] 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.)

[0019] Automated, remote upgradability and configuration. (Requires the customer to do nothing.)

[0020] Transparent user operation. (User doesn't have to know that any new technology is being employed)

[0021] 100% compatible with existing public telephone system.

[0022] Video Telephone capabilities.

[0023] No local or long distance usage charges.

[0024] No Internet access fees.

[0025] Lower monthly communication costs.

[0026] Multiple telephone calls at the same time.

[0027] 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.

[0028] All of these features are available even while connected to the Internet.

[0029] Very low cost of entry into the market, especially as compared to broadband alternatives.

[0030] New calling features that are not currently available to home users.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031] Figure 1 shows the RCG functional block diagram with the preferred embodiment of an 802.11 wireless connection.

[0032] Figure 2 shows the network topology for native RCG to RCG communications.

[0033] Figure 3 shows the network topology for an RCG to PSTN call.

[0034] Figure 4 shows the RCG top view with associated functions.

[0035] Figure 5 shows the RCG rear view and associated connections.

[0036] Figure 6 shows a typical application with peripheral equipment connections.

[0037] Figure 7 shows an ad-hoc wireless LAN configuration with ppp multilink data distribution and wireless connectivity.

[0038] Figure 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).

[0039] Figure 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

[0040] 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

[0041] Refer to figures 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.

[0042] 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.

[0043] 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.

[0044] 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.

[0045] 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.

[0046] 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

[0047] 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:

[0048] Dialed call origination from a telephone connected to an RCG POTS port and terminating at another user's RCG POTS port:

[0049] 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.

[0050] 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.

[0051] Referring to Figure 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.

[0052] 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.

[0053] 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.

[0054] On the receiving end of the call, referring back to Figure 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.

[0055] 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.

[0056] 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.

[0057] 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:

[0058] Calls between an RCG device and a PSTN telephone:

[0059] Refer to figure 3 for the following discussion.

[0060] 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.

[0061] 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.

[0062] 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.

[0063] 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.

[0064] 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:

[0065] 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:

[0066] 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.

[0067] 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.

[0068] 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.

[0069] 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.

[0070] 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:

[0071] 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:

[0072] 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 56Kbps 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 64Kbps. Since legacy T1 transmission equipment uses robbed-bit signaling, the maximum guaranteed transmission rate for the PSTN as a whole is 56Kbps. Because of this limitation, standard POTS lines can only guarantee a maximum of 56Kbps 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 64Kbps 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.

[0073] The RCG gets around the 56Kbps 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:

[0074] Referring to figure 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.

[0075] 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 56Kbps each to transfer information. This is roughly equivalent to a transfer rate of 1.79Mpbs in the inbound

direction (towards the RCG) and approximately 1.075Mbps in the outbound direction (towards the PSTN).

[0076] 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:

[0077] Referring to figure 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 figure 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

RED HAT 1008
RED HAT V. CAS

than some arbitrary limit such as 8Kbps to 16 Kbps. This 8Kbps to 16Kbps 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 33Kbps to 56Kbps, this would leave approximately 17Kbps to 40Kbps 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.

[0078] 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

RED HAT 1008
RED HAT V. CAS

– 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.

[0079] Refer to figure 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.

[0080] 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 54Mbps (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:

[0081] Refer to figure 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 56Kbps 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.

[0082] 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:

[0083] 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.

[0084] 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:

[0085] 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.

[0086] 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:

[0087] 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

[0088] 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).

[0089] 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.

16 – CPU USB INTERFACE
12 – USB PORT
11 – ETHERNET PORT
13 – USB DRIVER
21 – DISPLAY AND KEY DRIVERS
10 – DISPLAY AND KEYPAD
15 – USB VIDEO INPUT
17 –ETHERNET DRIVER
ETHERNET DRIVER
USB DRIVER
VIDEO CAMERA
14 – VIDEO CAMERA
DISPLAY AND KEY PAD
22 – SPEAKERPHONE DRIVERS
22 – DISPLAY AND KEYPAD CABLES
18 – CPU E-NET I/F
42 – CPU TO MODEM/DAA I/F
41 – MODEM/DAA
23 – MICROPHONE CABLE
19 – MAIN CPU
V.90/V.92 MODEM/DAA
40 – INCOMING POTS PORT
20 – CPU DISPLAY & KEYPAD I/F
DISPLAY & KEY PAD I/F
MAIN SYSTEM PROCESSOR
37 – LIFELINE BYPASS ROUTING
24 – MICROPHONE
32 – DSP SPKR PHONE I/F
43 – CPU LIFELINE INT
SPEAKERPHON E I/F
LIFELINE FAIL-SAFE LOGIC
25 – SPEAKER
33 – DSP ENGINE
39 – LIFELINE FAILSAFE LOGIC
28 – POTS 3 PORT
CODECS AND SLICS
26 – SPKR CABLE
POWER CIRCUITRY
VOICE PROC-DSP AND IP PACKETIZATION
38 – POWER CONDITIONING AND MONITORING
29 – POTS 2 PORT
3 TELEPHONE INTERFACES
35 – 802.11B I/F
36 – 802.11B/G MODULE
30 – POTS 1 PORT
IRDA I/F
WIFI MODULE
37 – LIFELINE BYPASS ROUTING
27 – SLIC/CODEC INTERFACE
31 – DSP AUDIO INTERFACE
34 – CPU/DSP COMM PATH
8 – IRDA PORT
9 – 802.11B INTERFACE
10 – IRDA Interface

FIG. 1

58 – PSTN NETWORK
59 – IXC NETWORK
SOFTSWITCH, SIP PROXY SERVER AND REGISTRAR
51 – SOFTSWITCH, SIP PROXY SERVER AND REGISTRAR
52 – IP BASED NETWORK ROUTE
53 – IP BASED NETWORK ROUTE
49 – IXC B MODEM/ROUTER
46 – IXC A INTEROFFICE TRUNK
IXC A MODEM BANK/ROUTE
IXC B MODEM BANK/ROUT
54 – IXC B INTEROFFICE TRUNK
45 – USER A POTS LINE
57 – IP BASED RTP STREAM
55 – USER B POTS LINE
48 – IXC A MODEM/ROUTER
RCG
CLASS 5 OFFICE A
CLASS 5 OFFICE B
RCG
50 – CLASS 5 OFFICE B
44 – USER A RCG
47 – CLASS 5 OFFICE A
56 – USER B RCG

FIG. 2

58 – PSTN NETWORK
59 – IXC NETWORK
51 – SOFTSWITCH, SIP PROXY SERVER AND REGISTRAR
52 - IP BASED NETWORK ROUTE
SOFTSWITCH, SIP PROXY SERVER AND REGISTRAR
53 - IP BASED MEDIA GATEWAY CONTROL
46 – IXC A INTEROFFICE TRUNK
60 – IXC MEDIA GATEWAY
54 – IXC B INTEROFFICE TRUNK
45 – USER A POTS LINE
IXC A MODEM BANK/ROUTER
57 – IP BASED RTP STREAM
MEDIA GATEWAY - SIP BASED
55 – USER B POTS LINE
48 – IXC A MODEM/ROUTER
RCG
CLASS 5 OFFICE A
CLASS 5 OFFICE B
50 – CLASS 5 OFFICE B
44 – USER A RCG
47 – CLASS 5 OFFICE A
61 – USER B TELEPHONE

FIG. 3

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

FIG. 4

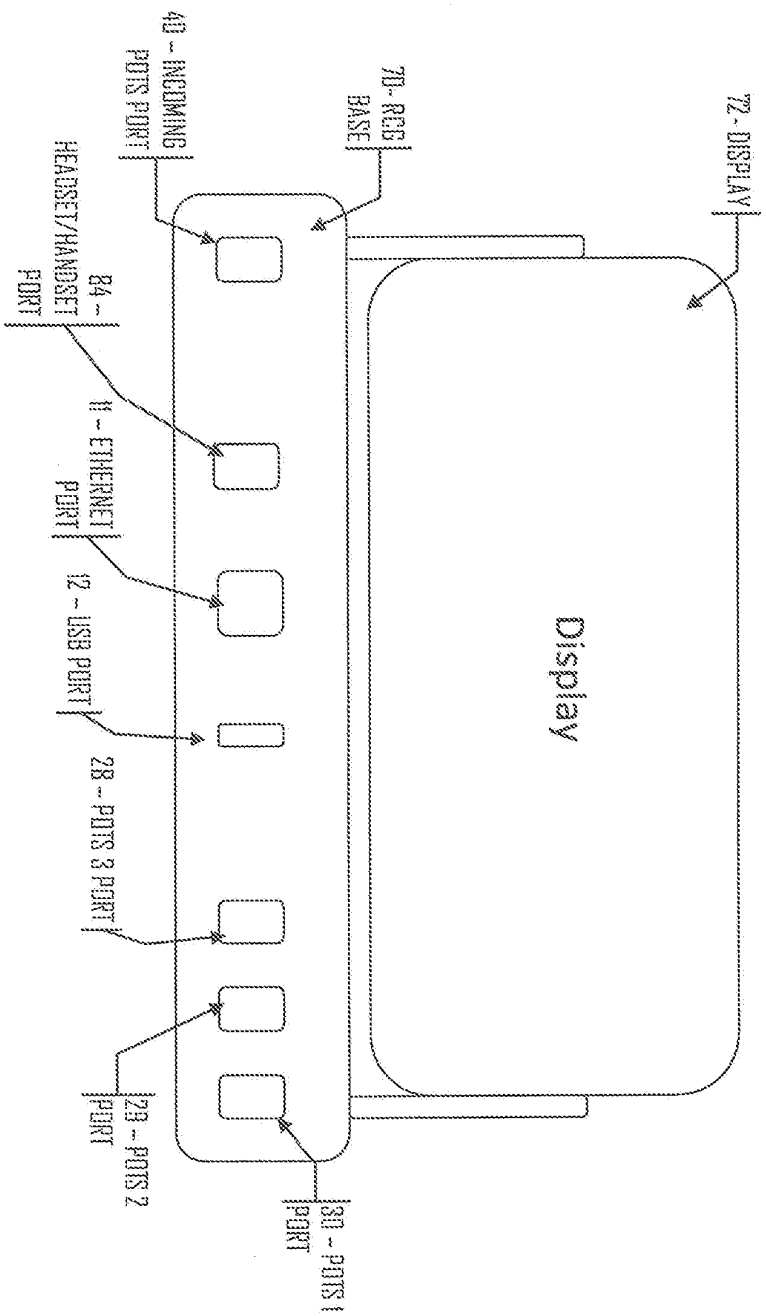


FIG. 5

RED HAT 1008
RED HAT V. CAS

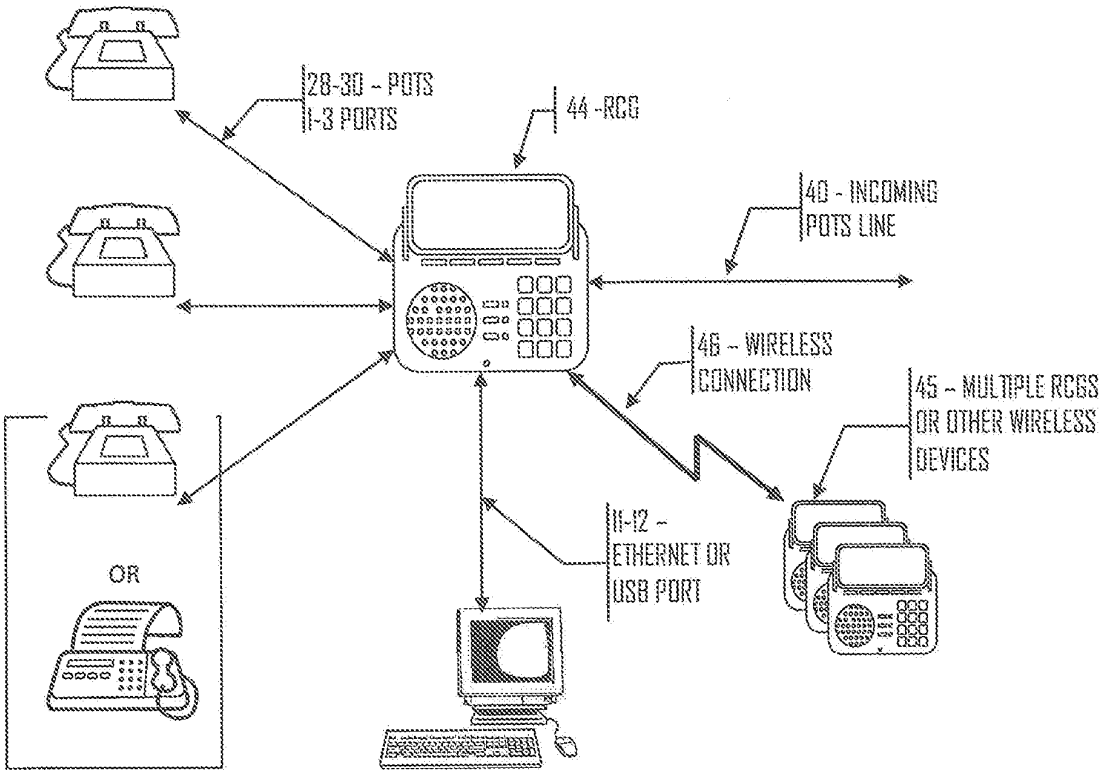


FIG. 6

RED HAT 1008
RED HAT V. CAS

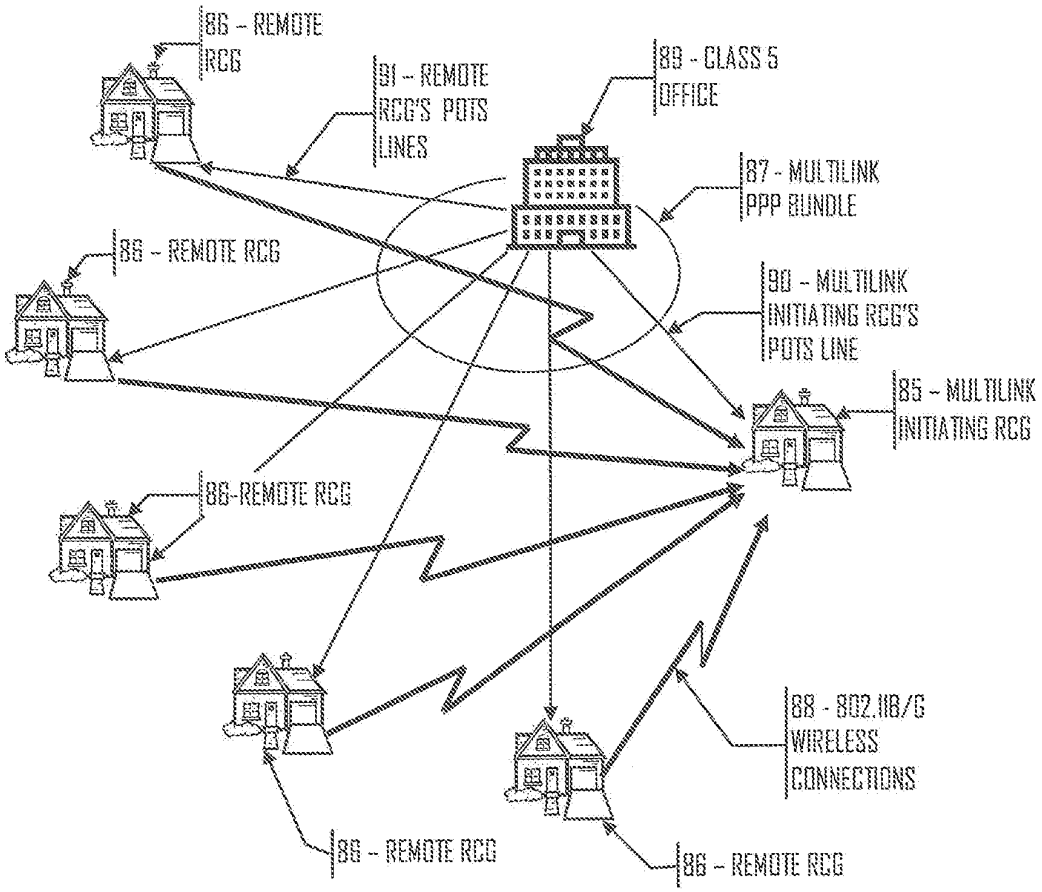


FIG. 7

RED HAT 1008
RED HAT V. CAS

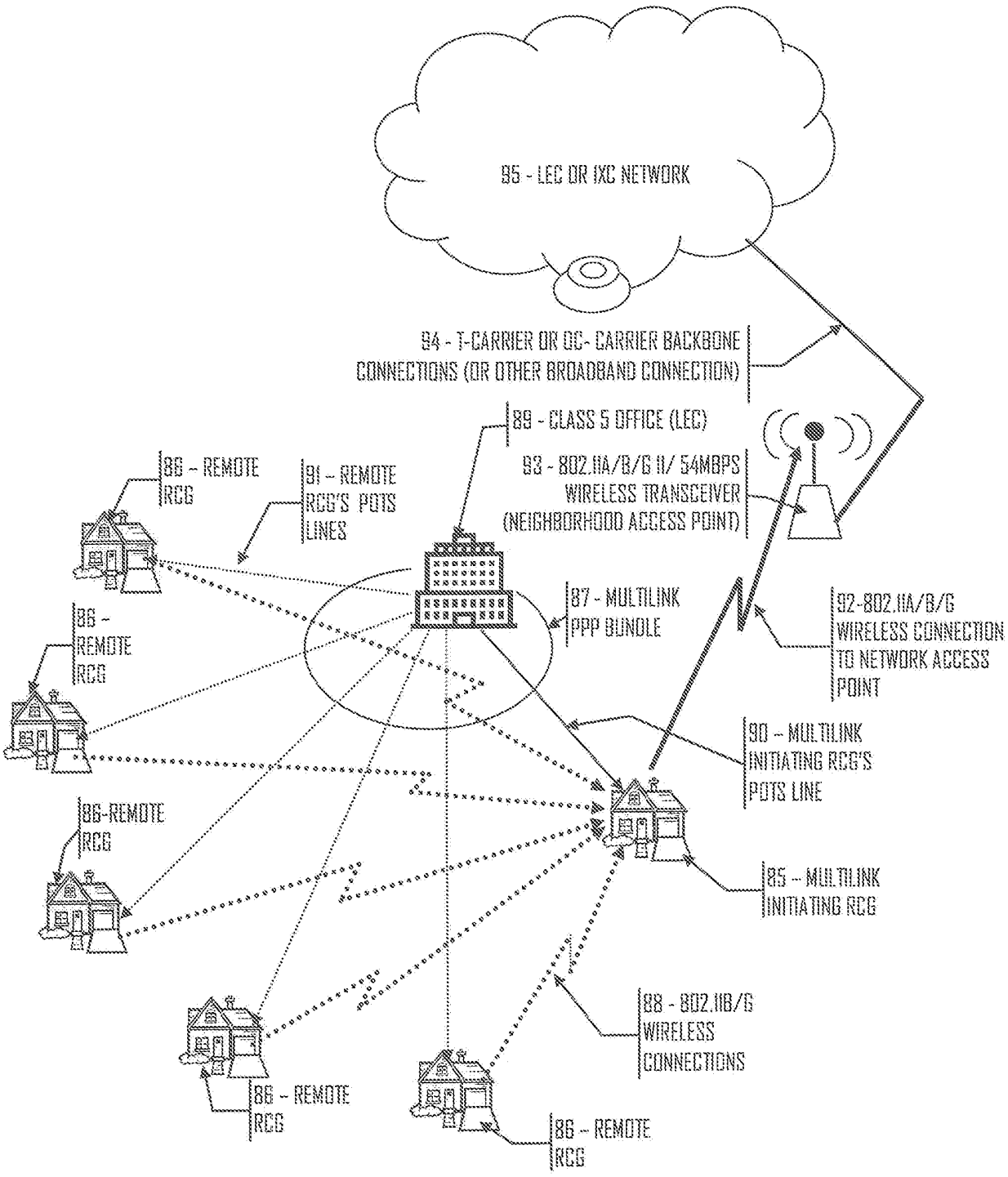


FIG. 8

RED HAT 1008
RED HAT V. CAS

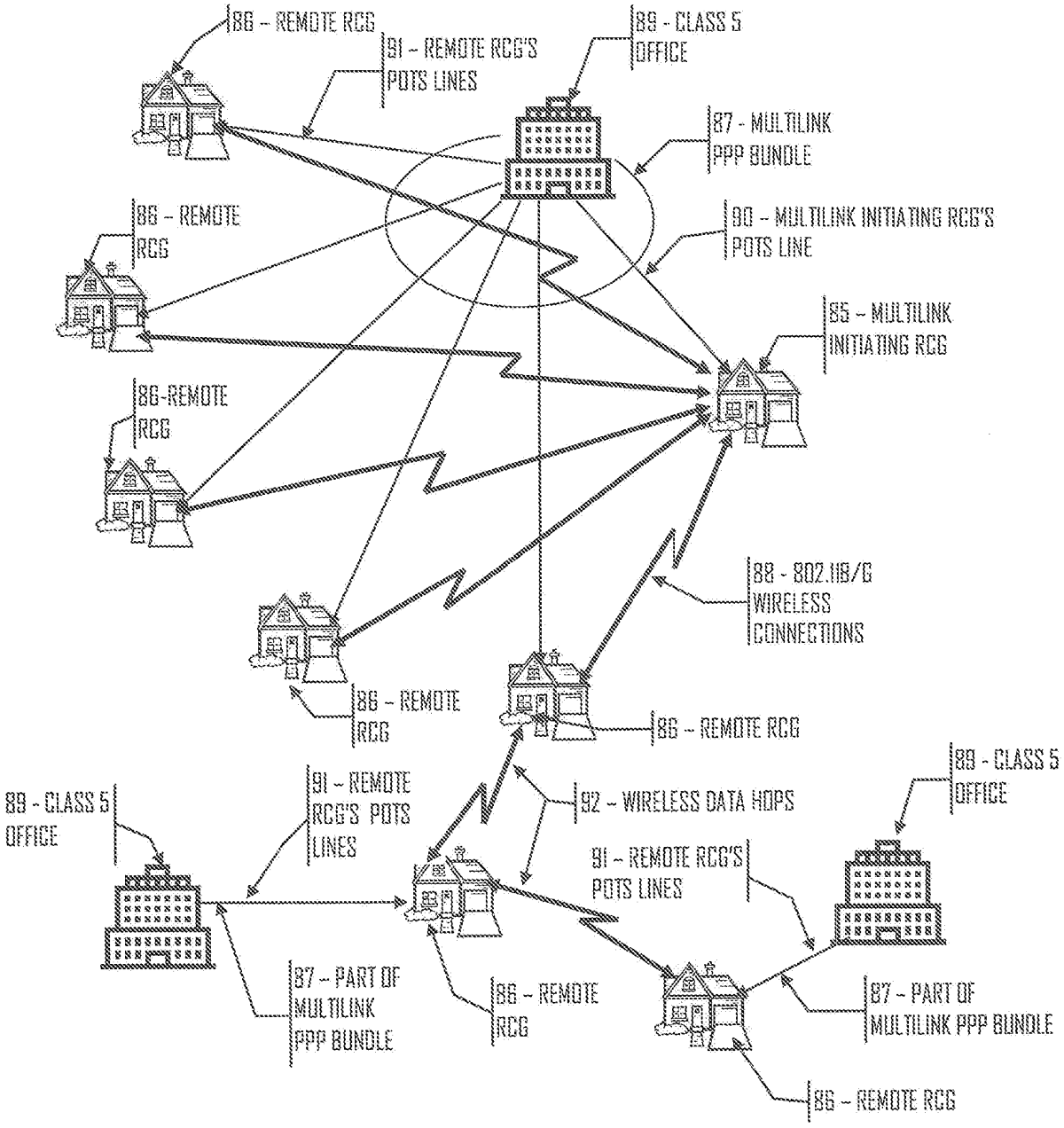

86 – REMOTE RCG
91 – REMOTE RCG'S POTS LINES
89 - CLASS 5 OFFICE
87 - MULTILINK PPP BUNDLE
86 – REMOTE RCG
90 – MULTILINK INITIATING RCG'S POTS LINE
85 – MULTILINK INITIATING RCG
86-REMOTE RCG
88 - 802.11B/G WIRELESS CONNECTIONS
86 – REMOTE RCG
86 – REMOTE RCG
89 - CLASS 5 OFFICE
91 – REMOTE RCG'S POTS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

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.

CLAIMS

What is claimed is:

1. A method for a network-edge device for participating in a multipath connection with a data-requesting device, comprising:

receiving control information from the data-requesting device to establish a connection with the data-requesting device; and

during the multipath connection:

receiving a plurality of data packets from one or more networks; and

routing the data packets to the data-requesting device when the data packets are destined for the data-requesting device.

2. The method of claim 1, wherein the control information includes a connection ID.

3. The method of claim 2, further comprising:

notifying the data-requesting device that the connection will be terminated sometime in the future; and

terminating the connection with the data-requesting device.

4. A method for a network-edge device for participating in a plurality of multipath connections with a plurality of data-requesting devices, comprising:

receiving control information from each of the data-requesting devices to establish a separate connection with each of the data-requesting devices; and

during each of the multipath connections:

receiving a plurality of data packets from one or more networks, each of the data-packets having a connection ID; and

routing the data packets to a particular data-requesting device based on the connection ID.

5. A communications device comprising:

at least one interface capable of connecting concurrently to a plurality of remote devices and a data-requesting device; and

a processor coupled to the at least one interface that

receives control information from the data-requesting device to establish a connection with the data-requesting device; and

during the multipath connection:

receives a plurality of data packets from one or more remote devices; and

routes the data packets to the data-requesting device when the data packets are destined for the data-requesting device.

RED HAT 1008
RED HAT V. CAS

PTO/AIA/01 (06-12)
Approved for use through 01/31/2014. OMB 0651-0032
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 displays a valid OMB control number.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS

As the below named inventor, I hereby declare that:

This declaration is directed to:

- [■] The attached application, or
- [ ] United States application or PCT international application number _____

filed on _____.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: ERIC DELANGIS Date (Optional): May 23, 2016

Signature: _____

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. 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 1.11 and 1.14. This collection is estimated to take 1 minute 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.

RED HAT 1008
RED HAT V. CAS

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
15/161,787	05/23/2016	2652	730	ED 3000	5	3

CONFIRMATION NO. 3396

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

FILING RECEIPT



Date Mailed: 06/08/2016

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Eric M. Delangis, Huntsville, AL;

Applicant(s)

Eric M. Delangis, Huntsville, AL;

Power of Attorney: The patent practitioners associated with Customer Number 64828

Domestic Priority data as claimed by applicant

This application 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 for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: No

Permission to Access Search Results: No

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 06/07/2016

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/161,787**

Projected Publication Date: 09/15/2016

Non-Publication Request: No

Early Publication Request: No
**** SMALL ENTITY ****
Title

DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS

Preliminary Class

379

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 15/161,787

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	70		N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	300		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	360		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	5 minus 20 =	*	x 40 =	0.00	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*	x 210 =	0.00			
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).			0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	730		TOTAL	

APPLICATION AS AMENDED - PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** 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 found in the appropriate box in column 1.

To: CLAYMCGURK@GMAIL.COM,,
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 64828

Jun 08, 2016 05:25:39 AM

Dear PAIR Customer:

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

The following USPTO patent application(s) associated with your Customer Number, 64828 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

Disclaimer:
The list of documents shown below is provided as a courtesy and is not part of the official file wrapper. The content of the images shown in PAIR is the official record.

Application	Document	Mailroom Date	Attorney Docket No.
15161787	APP.FILE.REC	06/08/2016	ED 3000

To view your correspondence online or update your email addresses, please visit us anytime at https://sportal.uspto.gov/secure/myportal/privatepair.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/161,787	05/23/2016	Eric M. Delangis	ED 3000

CONFIRMATION NO. 3396

PUBLICATION NOTICE

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

OC000000085822565

Title:DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS

Publication No.US-2016-0269547-A1
Publication Date:09/15/2016

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

To: CLAYMCGURK@GMAIL.COM,,
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 64828

Sep 16, 2016 05:44:24 AM

Dear PAIR Customer:

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

The following USPTO patent application(s) associated with your Customer Number, 64828 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

Disclaimer:
The list of documents shown below is provided as a courtesy and is not part of the official file wrapper. The content of the images shown in PAIR is the official record.

Application	Document	Mailroom Date	Attorney Docket No.
15161787	NTC.PUB	09/15/2016	ED 3000

To view your correspondence online or update your email addresses, please visit us anytime at https://sportal.uspto.gov/secure/myportal/privatepair.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/161,787	05/23/2016	Eric M. Delangis	ED 3000	3396

64828 7590 10/12/2016

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

EXAMINER	
CHO, HONG SOL	

ART UNIT	PAPER NUMBER
2467	

NOTIFICATION DATE	DELIVERY MODE
10/12/2016	ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

CLAYMCGURK@GMAIL.COM

Office Action Summary	Application No. 15/161,787	Applicant(s) DELANGIS, ERIC M.	
	Examiner HONG CHO	Art Unit 2467	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance 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.

Disposition of Claims*

5)☒ Claim(s) 1-5 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) 1-5 is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☒ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on 05/23/2016 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

1. The present application is being examined under the pre-AIA first to invent provisions.

DETAILED ACTION

Specification

2. The abstract is objected to because it lacks a concise statement of the technical disclosure of the invention.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 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 of this title, 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 negatived by the manner in which the invention was made.

4. Claims 1, 2, 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pung et al (US 20020150099, "Pung") in view of Yamada (US 20010007557, "Yamada").

Re claims 1, 4 and 5, Pung discloses receiving control information from the data-requesting device (figure 12A, element 14A; paragraph [0099]) to establish a connection with the data-requesting device; and receiving a plurality of data packets from one or

RED HAT 1008
RED HAT V. CAS

more networks (figure 12A, element 14B); and routing the data packets to the data-requesting device when the data packets are destined for the data-requesting device (paragraph [0004]), but fails to disclose a network-edge device for participating in a multipath connection. However, Yamada discloses setting multiple transfer paths between datagram transfer units (figure 19, paragraph [0315]). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of Pung with Yamada for the benefit of providing reliable multicasting service by utilizing multipath.

Re claim 2, Yamada discloses control information includes a connection ID (figure 19, multipath ID).

5. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Pung in view of Yamada and Joyce et al (US 20020106065, "Joyce").

Re claim 3, Pung discloses all of the limitations of the base claim, but fails to disclose notifying the data-requesting device that the connection will be terminated sometime in the future; and terminating the connection with the data-requesting device. However, it is well known in the art that a user would be notified before the termination of existing connection. Joyce disclose notifying a user before terminating the connection (paragraph [0114], lines 47-50). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of Yamada with the teaching of Joyce for the benefit of providing reliable multicasting service by terminating a connection that does not satisfy QoS constraints.

RED HAT 1008
RED HAT V. CAS

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hong Cho whose telephone number is 571-272-3087. The examiner can normally be reached on Mon-Fri during 7 am to 4 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hassan Phillips can be reached on 571-272-3940. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Hong Cho/

Primary Examiner, Art Unit 2467

RED HAT 1008
RED HAT V. CAS

Notice of References Cited	Application/Control No. 15/161,787	Applicant(s)/Patent Under Reexamination DELANGIS, ERIC M.	
	Examiner HONG CHO	Art Unit 2467	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-2002/0150099 A1	10-2002	Pung, Hung Keng	H04L12/1886	370/390
*	B	US-2001/0007557 A1	07-2001	Yamada, Kenshin	H04L45/00	370/389
*	C	US-2002/0106065 A1	08-2002	Joyce, Simon James	G06Q20/00	379/114.02
	D	US-				
	E	US-				
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

BIB DATA SHEET

CONFIRMATION NO. 3396

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
15/161,787	05/23/2016	379	2467	ED 3000

APPLICANTS

INVENTORS

Eric M. Delangis, Huntsville, AL;

**** CONTINUING DATA ***************************

This application 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 **** ** SMALL ENTITY **
06/07/2016

Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☑ No Verified and Acknowledged /HONG SOL CHO/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		AL	9	5	3

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		
730	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).

RED HAT 1008
RED HAT V. CAS

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15161787	DELANGIS, ERIC M.
	Examiner	Art Unit
	HONG CHO	2467

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
H04M3/007 or H04L47/821 or H04M1/6033 or H04L45/54 or H04L69/168 or H04L61/2015 or H04L45/24 or H04W88/16 or H04L12/5692 or H04M2203/60 or H04M2250/06 or H04M2203/052 or H04W80/00 or H04W40/02 or H04W28/06 or H04W84/18 or H04W84/12 or H04W72/04 or H04W8/26 (EAST text search)	10/5/2016	hc

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15161787	DELANGIS, ERIC M.
	Examiner	**Art Unit**
	HONG CHO	2467

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	10/05/2016								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L5	198259	(H04M3/007 or H04L47/821 or H04M1/6033 or H04L45/54 or H04L69/168 or H04L61/2015 or H04L45/24 or H04W88/16 or H04L12/5692 or H04M2203/60 or H04M2250/06 or H04M2203/052 or H04W80/00 or H04W40/02 or H04W28/06 or H04W84/18 or H04W84/12 or H04W72/04 or H04W8/26).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/05 07:19
L4	14	(("DELANGIS") near3 ("Eric")).INV.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/05 07:19
L8	1	l7 and @rlad<"20021015"	US-PGPUB; USPAT	OR	OFF	2016/10/05 07:20
L7	41	l5 and join$3 with multicast$3 and multi near (path or link)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/05 07:20
L11	326	(prun$3 or remov$3) with multicast$3 near tree	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/05 07:29
L13	1	15/161787	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/05 07:30
L12	32	L11 and @rlad<"20021015"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/05 07:30
L30	597	(multicast$3 or broadcast$3 or distribut$3 or rout$3) near (packet$1 or stream$1 or data or traffic) with multi	US-PGPUB; USPAT; USOCR;	OR	OFF	2016/10/05 07:41

		near (path or link)	FPRS; EPO; JPO; DERWENT; IBM_TDB			
L31	55	L30 and @rlad<"20021015"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/05 07:42
L32	4	09/752461	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/05 08:28
L33	3	09/885223	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/05 08:31
L58	17	L57 and @rlad<"20021015"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/05 10:09
L57	50	notif$7 near (user or subscriber) with (terminat$3 or tear near down$3) near connection	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/05 10:09

10/5/2016 10:57:37 AM
C:\Users\hcho\Documents\EAST\Workspaces\15161787.wsp

To: CLAYMCGURK@GMAIL.COM,,
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 64828

Oct 12, 2016 05:43:34 AM

Dear PAIR Customer:

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

The following USPTO patent application(s) associated with your Customer Number, 64828 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

Disclaimer:
The list of documents shown below is provided as a courtesy and is not part of the official file wrapper. The content of the images shown in PAIR is the official record.

Application	Document	Mailroom Date	Attorney Docket No.
15161787	CTNF	10/12/2016	ED 3000
	892	10/12/2016	ED 3000

To view your correspondence online or update your email addresses, please visit us anytime at https://sportal.uspto.gov/secure/myportal/privatepair.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

UNITED STATES PATENT AND TRADEMARK OFFICE
COMMISSIONER FOR PATENTS
P.O.BOX 1450
ALEXANDRIA VA 22313-1451

PRESORTED
FIRST-CLASS MAIL
U.S. POSTAGE PAID
POSTEDIGITAL
NNNNN

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

Courtesy Reminder for
Application Serial No: 15/161,787

Attorney Docket No: ED 3000
Customer Number: 64828
Date of Electronic Notification: 10/12/2016

This is a courtesy reminder that new correspondence is available for this application. If you have not done so already, please review the correspondence. The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

An email notification regarding the correspondence was sent to the following email address(es) associated with your customer number:
CLAYMCGURK@GMAIL.COM

To view your correspondence online or update your email addresses, please visit us anytime at **https://sportal.uspto.gov/secure/myportal/privatepair.** If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov or call 1-866-217-9197.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.:	**15/161,787**	EXAMINER:	HONG CHO
INVENTOR:	Eric M. Delangis	GROUP ART UNIT:	2467
FILED:	OCTOBER 11, 2014	CONFIRMATION NO.:	9530
TITLE:	Multipath Communication Devices and Methods		
ATTORNEY NO:	ED 3000		

Commissioner For Patents
PO Box 1450
Alexandria, VA 22313-1450

AMENDMENT

In response to the Office Action issued on October 12, 2016 ("Office Action"), please reconsider the above-identified application in light of the following amendments and accompanying remarks. A petition for extension of time for one month is being requested, thus extending the period for response to February 12, 2017 (a Sunday). Pursuant to 35 U.S.C. § 24, this Amendment can be filed on the next business date (i.e., a Monday) and will be considered to be timely filed. This Amendment and the requisite fee are being submitted on February 13, 2017.

CERTIFICATE OF ELECTRONIC (EFS-WEB) TRANSMISSION

I hereby certify that this correspondence is being transmitted via the U.S. Patent Office's electronic filing system in accordance with 37 C.F.R. § 1.8(a)(1) from the **Pacific Time Zone** of the United States on the local date shown below.

Dated: February 13, 2017 By: Clay McGurk

Clay McGurk

RED HAT 1008
RED HAT V. CAS

IN THE ABSTRACT

Please change the Abstract to the following:

The broadband network-edge router ~~Residential Communications Gateway (RCG)~~ is a broadband communications device that ~~combines all voice, data and video~~ ~~communications~~ receives broadband packetized data and then wirelessly communicates to and from a router located in 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~~ or other device. ~~The RCG does this by employing packetized data with Voice over Internet Protocol (VoIP) technologies combined with RF communications technologies.~~ 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. ~~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.~~

RED HAT 1008
RED HAT V. CAS

IN THE CLAIMS

This listing of claims will replace all prior versions and listings of the claims in the application:

1. (Currently Amended) A method for a network-edge device for participating in a multipath connection with a data-requesting device, the multipath connection comprising at least two network-edge devices capable of communicating with the data-requesting device where each of the at least two network-edge devices is capable of sending different data packets to the data-requesting device during the multipath connection, comprising:

receiving control information from the data-requesting device to establish a connection with the data-requesting device for participating in the multipath connection; and

during the multipath connection:

receiving a plurality of data packets from one or more networks; and

routing the data packets to the data-requesting device when the data packets are destined for the data-requesting device.

2. (Original) The method of claim 1, wherein the control information includes a connection ID.

3. (Original) The method of claim 2, further comprising:

notifying the data-requesting device that the connection will be terminated sometime in the future; and

terminating the connection with the data-requesting device.

RED HAT 1008
RED HAT V. CAS

4. (Currently Amended) A method for a network-edge device for participating in a plurality of multipath connections with a plurality of data-requesting devices, the multipath connection comprising at least two network-edge devices communicating with a data-requesting device where each of the at least two network-edge devices is capable of sending different data packets to the data-requesting device during the multipath connection,, comprising:

receiving control information from each of the data-requesting devices to establish a separate multipath connection with each of the data-requesting devices; and

during each of the separate multipath connections:

receiving a plurality of data packets from one or more networks, each of the data-packets having a connection ID; and

routing the data packets to a particular data-requesting device based on the connection ID.

RED HAT 1008
RED HAT V. CAS

5. (Currently Amended) A communications device for participating in one or more simultaneous multipath connections, a multipath connection comprising at least two communication devices capable of communicating with a data-requesting device where each of the at least two communication devices is capable of sending different data packets to the data-requesting device during the multipath connection, comprising:

at least ~~one~~ a first interface capable of connecting concurrently to a plurality of remote devices;

at least a second interface capable of connection to ~~and~~ a data-requesting device; and

a processor coupled to the at least ~~one~~ the first interface and the at least the second interface that:

receives control information from the data-requesting device to establish a connection with the data-requesting device during a setup of a particular multipath connection; and

during the particular multipath connection:

receives a plurality of data packets from one or more remote devices via the at least the first interface; and

routes the data packets via the at least the second interface to the data-requesting device when the data packets are destined for the data-requesting device.

RED HAT 1008
RED HAT V. CAS

REMARKS

Status of the Claims

Claims 1-5 were pending in this application before this Amendment. Claims 1, 4 and 5 have been amended to clarify the function performed by the network-edge device, which can be for example a Wi-Fi router or cell tower. No new matter has been added in this Amendment. Thus, claims 1-5 are now pending pursuant to this Amendment.

35 U.S.C. § 103 Rejections

Starting on page 2 of the Office Action, claims 1, 2, 4 and 5 were rejected under 35 U.S.C. §102(e) as being unpatentable over "Pung" (U.S. Appl. Publ. 2002-0150099) in view of "Yamada" (U.S. Appl. Publ. 2001-0007557).

Figure 7 of the present application is shown below to help to understand the "network-edge device":

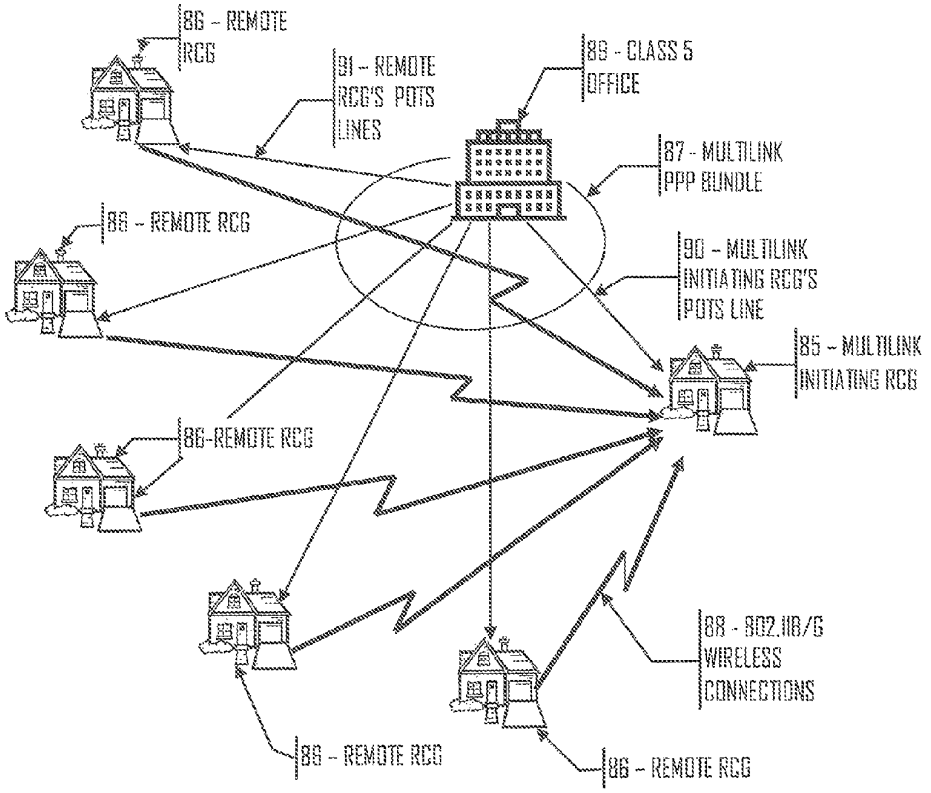


FIG. 7

RED HAT 1008
RED HAT V. CAS

In one embodiment of the present invention, amended independent claims 1, 4 and 5 are covering a method for a network-edge device (claims 1, 4) and a communication device (claim 5). These Remote RCGs 86 are network-edge devices (claims 1, 4), and the communication device (claim 5). These remote RCGs 86 participate in a multipath connection with the multilink initiating RCG 85 (e.g., the "data-requesting device") where separate data packets are capable of being communicated from the remote RCGs 86 (the network-edge devices) to the multilink initiating RCG 85 (the data-requesting device).

Pung is deficient as Pung discloses methods for establishing multicasting routing. (Pung, Abstract). Pung does not mention or show in its many figures two "network-edge devices" – or nodes 12A-E – that is capable of communicating with the data-requesting device which is node 14A. In Fig. 12A-F of Pung, node 12A is the **ONLY** node that communicates directly with data-requesting device or node 14A. No other node 12B-E communicates with node 14A. The claims require that data-requesting device or node 14A must have an additional node that communicates with node 14A other than node 12A. This is not shown in Figures 12A-F, 13A-E and 14A-F of Pung, because the purpose of Pung is to connect to a multicast stream of data, whether from nodes 12C or 12B. (Pung, ¶¶ 99-104).

Yamada does not make up for the deficiences because Yamada also does not show multiple "network-edge devices" that are capable of communicating data packets to the data-requesting device. Fig. 19 of Yamada shows one datagram transfer unit 4a that is connected to two other datagram transfer units 4c and 4d. Fig. 19 and ¶ 315 disclose multiple paths between unit 4a and unit 4c, and unit 4a and unit 4d. Again, what is shown in Fig. 5 of the present application (reproduced above) does not align with Fig. 19 of Yamada.

It is respectfully hoped that the added language to claims 1, 4 and 5 helps to clarify what is meant by a "multipath connection", since neither Pung nor Yamada disclose, mention, show or suggest such a multipath connection. If additional language is needed as to the "multipath connection", please feel free to call the attorney of record to discuss any additional language that would be needed to make these claims patentably distinguishable over Pung and Yamada.

Claim 2 is dependent on amended independent claim 1 and is allowable for the same reasons provided above for distinguishing claim 1 over Pung and Yamada. For this reasons, it is respectfully requested that the rejection of claims 1, 2, 4 and 5 under 35 U.S.C. § 103 based on Pung and Yamada be reconsidered and withdrawn.

RED HAT 1008
RED HAT V. CAS

On page 3 of the Office Action, claim 3 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Pung in view of Yamada and "Joyce" (U.S. Appl. Publ. 2002-0106065). Joyce was relied upon for teaching a user being notified before the termination of a connection. (Office Action, 3:17-18). Joyce was not relied upon for disclosing the deficiencies noted above. Therefore, since claim 3 is dependent on amended independent claim 1, it is allowable for the same reasons provided above for distinguishing claim 1 over Pung and Yamada. It is respectfully requested that the rejection of claim 3 under 35 U.S. C. § 103 based on Pung in view of Yamada and Joyce be reconsidered and withdrawn.

Conclusion

It is noted that claimed subject matter may be patentably distinguished from the cited references for additional reasons. It is also noted that any failure to comment directly upon any of the positions asserted in the Office Action does not indicate agreement or acquiescence with those asserted positions or allegations. Instead, it is believed that the foregoing sufficiently addresses the issues raised in the Office Action, and that the present claims are in condition for allowance.

All rejections in the Office Action have been properly traversed. It is respectfully requested that all outstanding rejections be reconsidered and withdrawn. It is believed that a full and complete reply has been made in response to the Office Action, and, that as such, the present patent application is in a condition for allowance.

The Examiner is always welcome to telephone the attorney of record at the telephone number provided below if such telephone discussion would help expedite the prosecution of the patent application. Prompt and favorable consideration of this Amendment is respectfully requested.

Respectfully Submitted,



Date: February 13, 2017

H C McGurk IV, Reg. No. 34,964
Attorney for Applicant

The Law Office of Clay McGurk
PO Box 1488
Orange, CA 92706
Phone: **949.395.3942**

RED HAT 1008
RED HAT V. CAS

Email: claymcgurk@gmail.com

Electronic Patent Application Fee Transmittal

Application Number:	15161787
Filing Date:	23-May-2016
Title of Invention:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
First Named Inventor/Applicant Name:	Eric M. Delangis
Filer:	Harold C. McGurk
Attorney Docket Number:	ED 3000

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

RED HAT 1008
RED HAT V. CAS

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 1 month with $0 paid	2251	1	100	100
Miscellaneous:				
		Total in USD ($)		**100**

Electronic Acknowledgement Receipt	
EFS ID:	28344554
Application Number:	15161787
International Application Number:	
Confirmation Number:	3396
Title of Invention:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
First Named Inventor/Applicant Name:	Eric M. Delangis
Customer Number:	64828
Filer:	Harold C. McGurk
Filer Authorized By:	
Attorney Docket Number:	ED 3000
Receipt Date:	13-FEB-2017
Filing Date:	23-MAY-2016
Time Stamp:	21:15:31
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$100
RAM confirmation Number	021417INTEFSW21172000
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

RED HAT 1008
RED HAT V. CAS

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment/Req. Reconsideration-After Non-Final Reject	15161787_Amendment_2-13-2017.pdf	216465 00de50a69f195acab2c1fbc274db8e27e5f31b46	no	9
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30572 06d41db400a782753082ce20cc60f1964921fd1a	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	247037		

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 a 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.

RED HAT 1008
RED HAT V. CAS

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
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 displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/161,787	Filing Date 05/23/2016	☐ To be Mailed

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) 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 $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ 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

AMENDMENT **02/13/2017**

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 5	Minus	** 20	= 0	X $40 =	0
Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $210 =	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

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ 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.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** 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.

LIE
TAMMY D. MCBETH BROWN

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.

RED HAT 1008
RED HAT V. CAS

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/161,787	05/23/2016	Eric M. Delangis	ED 3000	3396

64828 7590 04/17/2017

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

EXAMINER	
CHO, HONG SOL	

ART UNIT	PAPER NUMBER
2467	

NOTIFICATION DATE	DELIVERY MODE
04/17/2017	ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

CLAYMCGURK@GMAIL.COM

Office Action Summary	Application No. 15/161,787	Applicant(s) DELANGIS, ERIC M.	
	Examiner HONG CHO	Art Unit 2467	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02/13/2017*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance 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.

Disposition of Claims*

5)☒ Claim(s) *1-5* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-5* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

1. The present application is being examined under the pre-AIA first to invent provisions.

DETAILED ACTION

Response to Amendment

2. This office action is in response to the amendment filed on 02/13/2017. Claims 1-5 are pending in the instant application.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 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 of this title, 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 negatived by the manner in which the invention was made.

4. Claims 1, 2, 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pung et al (US 20020150099, "Pung") in view of Yamada (US 20010007557, "Yamada").

Re claims 1, 4 and 5, Pung discloses receiving control information from the data-requesting device (figure 12A, element 12C; paragraph [0099]) to establish a connection

RED HAT 1008
RED HAT V. CAS

with the data-requesting device; and receiving a plurality of data packets from one or more networks (figure 12A, elements 14B); and routing the data packets to the data-requesting device when the data packets are destined for the data-requesting device (paragraph [0004]), but fails to disclose a network-edge device for participating in a multipath connection. However, Yamada discloses setting multiple transfer paths between datagram transfer units (figure 19, paragraph [0315]). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of Pung with Yamada for the benefit of providing reliable multicasting service by utilizing multipath.

Re claim 2, Yamada discloses control information includes a connection ID (figure 19, multipath ID).

5. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Pung in view of Yamada and Joyce et al (US 20020106065, "Joyce").

Re claim 3, Pung discloses all of the limitations of the base claim, but fails to disclose notifying the data-requesting device that the connection will be terminated sometime in the future; and terminating the connection with the data-requesting device. However, it is well known in the art that a user would be notified before the termination of existing connection. Joyce disclose notifying a user before terminating the connection (paragraph [0114], lines 47-50). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of

RED HAT 1008
RED HAT V. CAS

Yamada with the teaching of Joyce for the benefit of providing reliable multicasting service by terminating a connection that does not satisfy QoS constraints.

Response to Arguments

6. Applicant's arguments filed on 02/13/2017 have been fully considered but they are not persuasive.

The applicant argues that neither Pung nor Yamada disclose at least two network-edge devices for participating in a multipath connection with a data-requesting device by stating that Pung discloses only one network edge deice for participating in a multipath connection with a data-requesting device. The examiner respectfully disagrees. As shown in the rejection above, Pung discloses at least two network-edge devices (figure 12A, elements 12D and 12E) receiving requests (Req (A,c,d) and Req (A,c,e)) for participating in a multipath connection with a data-requesting device. In addition, the examiner advises to put the preamble in the body of the claim to receive patentable weight.

Conclusion

7. **THIS ACTION IS MADE FINAL**. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within

RED HAT 1008
RED HAT V. CAS

TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no, however, event will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hong Cho whose telephone number is 571-272-3087. The examiner can normally be reached on Mon-Fri during 7 am to 4 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hassan Phillips can be reached on 571-272-3940. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Hong Cho/

Primary Examiner, Art Unit 2467

RED HAT 1008
RED HAT V. CAS

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S390	45	S389 and join$3 with multicast$3 and multi near (path or link)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/07 09:22
S389	220898	(H04M3/007 or H04L47/821 or H04M1/6033 or H04L45/54 or H04L69/168 or H04L61/2015 or H04L45/24 or H04W88/16 or H04L12/5692 or H04M2203/60 or H04M2250/06 or H04M2203/052 or H04W80/00 or H04W40/02 or H04W28/06 or H04W84/18 or H04W84/12 or H04W72/04 or H04W8/26).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/07 09:22
S395	55	S394 and @rlad<"20021015"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/07 09:25
S394	639	(multicast$3 or broadcast$3 or distribut$3 or rout$3) near (packet$1 or stream$1 or data or traffic) with multi near (path or link)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/07 09:25
S396	14	((Eric) near2 (Delangis)).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/04/07 09:30
S397	14	((request$3 or join$3) with (two or multiple or different or several) near multicast$3 near group).clm.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/04/07 10:21

4/7/2017 10:43:43 AM
C:\Users\hcho\Documents\EAST\Workspaces\15161787.wsp

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15161787	DELANGIS, ERIC M.
	Examiner	Art Unit
	HONG CHO	2467

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
H04M3/007 or H04L47/821 or H04M1/6033 or H04L45/54 or H04L69/168 or H04L61/2015 or H04L45/24 or H04W88/16 or H04L12/5692 or H04M2203/60 or H04M2250/06 or H04M2203/052 or H04W80/00 or H04W40/02 or H04W28/06 or H04W84/18 or H04W84/12 or H04W72/04 or H04W8/26 (EAST text search)	10/5/2016	hc
updated search	4/7/2017	hc

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15161787	DELANGIS, ERIC M.
	Examiner	**Art Unit**
	HONG CHO	2467

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	10/05/2016	04/07/2017							
	1	✓	✓							
	2	✓	✓							
	3	✓	✓							
	4	✓	✓							
	5	✓	✓							

To: CLAYMCGURK@GMAIL.COM,,
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 64828

Apr 17, 2017 04:02:59 AM

Dear PAIR Customer:

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

The following USPTO patent application(s) associated with your Customer Number, 64828 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

Disclaimer:
The list of documents shown below is provided as a courtesy and is not part of the official file wrapper. The content of the images shown in PAIR is the official record.

Application	Document	Mailroom Date	Attorney Docket No.
15161787	CTFR	04/17/2017	ED 3000

To view your correspondence online or update your email addresses, please visit us anytime at https://sportal.uspto.gov/secure/myportal/privatepair.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

UNITED STATES PATENT AND TRADEMARK OFFICE
COMMISSIONER FOR PATENTS
P.O.BOX 1450
ALEXANDRIA VA 22313-1451

PRESORTED
FIRST-CLASS MAIL
U.S. POSTAGE PAID
POSTEDIGITAL
NNNNN

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

Courtesy Reminder for
Application Serial No: 15/161,787

Attorney Docket No: ED 3000
Customer Number: 64828
Date of Electronic Notification: 04/17/2017

This is a courtesy reminder that new correspondence is available for this application. If you have not done so already, please review the correspondence. The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

An email notification regarding the correspondence was sent to the following email address(es) associated with your customer number:
CLAYMCGURK@GMAIL.COM

To view your correspondence online or update your email addresses, please visit us anytime at **https://sportal.uspto.gov/secure/myportal/privatepair.** If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov or call 1-866-217-9197.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.:	**15/161,787**	EXAMINER:	HONG CHO
INVENTOR:	Eric M. Delangis	GROUP ART UNIT:	2467
FILED:	OCTOBER 11, 2014	CONFIRMATION NO.:	3396
TITLE:	Multipath Communication Devices and Methods		
ATTORNEY NO:	ED 3000		

Commissioner For Patents
PO Box 1450
Alexandria, VA 22313-1450

AMENDMENT

In response to the Office Action issued on final April 17, 2017 ("Office Action"), please reconsider the above-identified application in light of the following amendments and accompanying remarks.

CERTIFICATE OF ELECTRONIC (EFS-WEB) TRANSMISSION
I hereby certify that this correspondence is being transmitted via the U.S. Patent Office's electronic filing system in accordance with 37 C.F.R. § 1.8(a)(1) from the **Pacific Time Zone** of the United States on the local date shown below.

Dated: July 17, 2017 By: Clay McGurk
Clay McGurk

MAILSTOP AF

RED HAT 1008
RED HAT V. CAS

IN THE CLAIMS

This listing of claims will replace all prior versions and listings of the claims in the application:

1. (Currently Amended) A method for a network-edge device for participating in a multipath connection with a data-requesting device, the multipath connection comprising at least two network-edge devices capable of ~~communicating~~ concurrently connecting with the data-requesting device where each of the at least two network-edge devices is capable of sending different data packets to the data-requesting device during the multipath connection, comprising:

receiving control information from the data-requesting device to establish a connection with the data-requesting device for participating in the multipath connection; and

during the multipath connection:

receiving a plurality of data packets from one or more networks; and

routing the data packets to the data-requesting device when the data packets are destined for the data-requesting device.

2. (Original) The method of claim 1, wherein the control information includes a connection ID.

3. (Original) The method of claim 2, further comprising:

notifying the data-requesting device that the connection will be terminated sometime in the future; and

terminating the connection with the data-requesting device.

RED HAT 1008
RED HAT V. CAS

4. (Currently Amended) A method for a network-edge device for participating in a plurality of multipath connections with a plurality of data-requesting devices, the multipath connection comprising at least two network-edge devices ~~communicating~~ concurrently connecting with a data-requesting device where each of the at least two network-edge devices is capable of sending different data packets to the data-requesting device during the multipath connection,, comprising:

receiving control information from each of the data-requesting devices to establish a separate multipath connection with each of the data-requesting devices; and

during each of the separate multipath connections:

receiving a plurality of data packets from one or more networks, each of the data-packets having a connection ID; and

routing the data packets to a particular data-requesting device based on the connection ID.

RED HAT 1008
RED HAT V. CAS

5. (Currently Amended) A communications device for participating in one or more simultaneous multipath connections, a multipath connection comprising at least two communication devices capable of ~~communicating~~ concurrently connecting with a data-requesting device where each of the at least two communication devices is capable of sending different data packets to the data-requesting device during the multipath connection, comprising:

at least a first interface capable of connecting concurrently to a plurality of remote devices;

at least a second interface capable of connection to a data-requesting device; and

a processor coupled to the at least the first interface and the at least the second interface that:

receives control information from the data-requesting device to establish a connection with the data-requesting device during a setup of a particular multipath connection; and

during the particular multipath connection:

receives a plurality of data packets from one or more remote devices via the at least the first interface; and

routes the data packets via the at least the second interface to the data-requesting device when the data packets are destined for the data-requesting device.

RED HAT 1008
RED HAT V. CAS

REMARKS

Status of the Claims

Claims 1-5 were pending in this application before this Amendment. Claims 1, 4 and 5 have been amended to clarify what a "multipath connection" is comprised of. No new matter has been added in this Amendment. Thus, claims 1-5 are now pending pursuant to this Amendment.

35 U.S.C. § 103 Rejections

Starting on page 2 of the Office Action, claims 1, 2, 4 and 5 were rejected under 35 U.S.C. §102(e) as being unpatentable over "Pung" (U.S. Appl. Publ. 2002-0150099) in view of "Yamada" (U.S. Appl. Publ. 2001-0007557).

In the previous amendment (before this amendment after final), the preamble contained the language "the multipath connection comprising at least two network-edge devices capable of communicating with the data-requesting device…". After seeing the Examiner's comments on page 4 of the Office Action, the word "communicating" was replaced with "concurrently connecting", meaning that a "multipath connection" occurs when at least two network-edge devices are concurrently connected to the data-requesting device. When the preamble in each of the amended independent claims 1, 4 and 5 defines a "multipath connection" to occur when at least two network-edge devices are concurrently connected to the data-requesting device, then if the body of the claim uses "multipath connection", that means that the body of claim is subject to the definition in the preamble. Therefore the steps in amended independent method claims 1 and 4 and the part of the communications device of amended independent claim 5 are dependent on what a "multipath connection" is comprised of as defined in the preamble of each claim.

It is respectfully hoped that the revised language to claims 1, 4 and 5 is enough to allow this application, since neither Pung nor Yamada disclose, mention, show or suggest such a "multipath connection". If additional language is needed as to the "multipath connection", such as the words "concurrently connected directly", please feel free to call the attorney of record to discuss any additional language that would be needed to make these claims patentably distinguishable over Pung and Yamada.

It is respectfully submitted that a combination of Pung and Yamada do not teach was is required in the amended independent claims because there is no "multipath connection" disclosed in either Pung or Yamada as required by the body of each of claims 1, 4 and 5.

RED HAT 1008
RED HAT V. CAS

Pung is deficient as Pung discloses methods for establishing multicasting routing. (Pung, Abstract). Pung does not mention or show in its many figures two "network-edge devices" – or nodes 12A-E – that is capable of communicating with the data-requesting device which is node 14A. In Fig. 12A-F of Pung, node 12A is the **ONLY** node that communicates directly with data-requesting device or node 14A. No other node 12B-E communicates with node 14A. The claims require that data-requesting device or node 14A must have an additional node that communicates with node 14A other than node 12A. This is not shown in Figures 12A-F, 13A-E and 14A-F of Pung, because the purpose of Pung is to connect to a multicast stream of data, whether from nodes 12C or 12B. (Pung, ¶¶ 99-104).

Yamada does not make up for the deficiences because Yamada also does not show multiple "network-edge devices" that are capable of communicating data packets to the data-requesting device. Fig. 19 of Yamada shows one datagram transfer unit 4a that is connected to two other datagram transfer units 4c and 4d. Fig. 19 and ¶ 315 disclose multiple paths between unit 4a and unit 4c, and unit 4a and unit 4d. Again, what is shown in Fig. 5 of the present application (reproduced above) does not align with Fig. 19 of Yamada.

Claim 2 is dependent on amended independent claim 1 and is allowable for the same reasons provided above for distinguishing claim 1 over Pung and Yamada. For this reasons, it is respectfully requested that the rejection of claims 1, 2, 4 and 5 under 35 U.S.C. § 103 based on Pung and Yamada be reconsidered and withdrawn.

On page 3 of the Office Action, claim 3 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Pung in view of Yamada and "Joyce" (U.S. Appl. Publ. 2002-0106065). Joyce was relied upon for teaching a user being notified before the termination of a connection. (Office Action, 3:17-18). Joyce was not relied upon for disclosing the deficiencies noted above. Therefore, since claim 3 is dependent on amended independent claim 1, it is allowable for the same reasons provided above for distinguishing claim 1 over Pung and Yamada. It is respectfully requested that the rejection of claim 3 under 35 U.S. C. § 103 based on Pung in view of Yamada and Joyce be reconsidered and withdrawn.

Conclusion

It is noted that claimed subject matter may be patentably distinguished from the cited references for additional reasons. It is also noted that any failure to comment directly upon any

RED HAT 1008
RED HAT V. CAS

of the positions asserted in the Office Action does not indicate agreement or acquiescence with those asserted positions or allegations. Instead, it is believed that the foregoing sufficiently addresses the issues raised in the Office Action, and that the present claims are in condition for allowance.

All rejections in the Office Action have been properly traversed. It is respectfully requested that all outstanding rejections be reconsidered and withdrawn. It is believed that a full and complete reply has been made in response to the Office Action, and, that as such, the present patent application is in a condition for allowance.

The Examiner is always welcome to telephone the attorney of record at the telephone number provided below if such telephone discussion would help expedite the prosecution of the patent application. Prompt and favorable consideration of this Amendment is respectfully requested.

Respectfully Submitted,

Date: July 17, 2017

H C McGurk IV, Reg. No. 34,964
Attorney for Applicant

The Law Office of Clay McGurk
PO Box 1488
Orange, CA 92706
Phone: **949.395.3942**
Email: claymcgurk@gmail.com

Electronic Acknowledgement Receipt

EFS ID:	29807990
Application Number:	15161787
International Application Number:	
Confirmation Number:	3396
Title of Invention:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
First Named Inventor/Applicant Name:	Eric M. Delangis
Customer Number:	64828
Filer:	Harold C. McGurk
Filer Authorized By:	
Attorney Docket Number:	ED 3000
Receipt Date:	17-JUL-2017
Filing Date:	23-MAY-2016
Time Stamp:	20:40:24
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Response After Final Action	15161787_AAF_7-17-2017.pdf	131736 ac0759d58eb2a11a9aadca54720502aedfad0c5d	no	7

Warnings:

RED HAT 1008
RED HAT V. CAS

Information:	
Total Files Size (in bytes):	131736

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 a 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.

RED HAT 1008
RED HAT V. CAS

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
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 displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/161,787	Filing Date 05/23/2016	☐ To be Mailed

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) 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 $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ 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

AMENDMENT	07/17/2017	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 5	Minus	** 20	= 0	X $40 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $210 =	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

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
	☐ 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.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** 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.

LIE
JAMES MASON

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.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/161,787	05/23/2016	Eric M. Delangis	ED 3000	3396

64828 7590 08/09/2017

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

EXAMINER	
CHO, HONG SOL	

ART UNIT	PAPER NUMBER
2467	

NOTIFICATION DATE	DELIVERY MODE
08/09/2017	ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

CLAYMCGURK@GMAIL.COM

Advisory Action Before the Filing of an Appeal Brief	**Application No.** 15/161,787	**Applicant(s)** DELANGIS, ERIC M.	
	Examiner HONG CHO	**Art Unit** 2467	**AIA (First Inventor to File) Status** No

--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

THE REPLY FILED 17 July 2017 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

NO NOTICE OF APPEAL FILED

1. ☒ The reply was filed after a final rejection. No Notice of Appeal has been filed. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114 if this is a utility or plant application. Note that RCEs are not permitted in design applications. The reply must be filed within one of the following time periods:
   a) ☒ The period for reply expires 3 months from the mailing date of the final rejection.
   b) ☐ The period for reply expires on: (1) the mailing date of this Advisory Action; or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.
   c) ☐ A prior Advisory Action was mailed more than 3 months after the mailing date of the final rejection in response to a first after-final reply filed within 2 months of the mailing date of the final rejection. The current period for reply expires months from the mailing date of *the prior Advisory Action* or SIX MONTHS from the mailing date of the final rejection, whichever is earlier.
   Examiner Note: If box 1 is checked, check either box (a), (b) or (c). ONLY CHECK BOX (b) WHEN THIS ADVISORY ACTION IS THE FIRST RESPONSE TO APPLICANT'S FIRST AFTER-FINAL REPLY WHICH WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. ONLY CHECK BOX (c) IN THE LIMITED SITUATION SET FORTH UNDER BOX (c). See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) or (c) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

NOTICE OF APPEAL

2. ☐ The Notice of Appeal was filed on _____. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37 CFR 41.37(a).

AMENDMENTS

3. ☐ The proposed amendments filed after a final rejection, but prior to the date of filing a brief, will not be entered because
   a) ☐ They raise new issues that would require further consideration and/or search (see NOTE below);
   b) ☐ They raise the issue of new matter (see NOTE below);
   c) ☐ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or
   d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.
   NOTE: _____. (See 37 CFR 1.116 and 41.33(a)).
4. ☐ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).
5. ☐ Applicant's reply has overcome the following rejection(s): _____.
6. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).
7. ☐ For purposes of appeal, the proposed amendment(s): (a) ☐ will not be entered, or (b) ☐ will be entered, and an explanation of how the new or amended claims would be rejected is provided below or appended.

AFFIDAVIT OR OTHER EVIDENCE

8. ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
9. ☐ The affidavit or other evidence filed after final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).
10. ☐ The affidavit or other evidence filed after the date of filing the Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing of good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).
11. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

12. ☒ The request for reconsideration has been considered but does NOT place the application in condition for allowance because: See Continuation Sheet.
13. ☐ Note the attached Information *Disclosure Statement*(s). (PTO/SB/08) Paper No(s). _____
14. ☐ Other: _____.

STATUS OF CLAIMS

15. The status of the claim(s) is (or will be) as follows:
    Claim(s) allowed: .
    Claim(s) objected to: .
    Claim(s) rejected: 1-5.
    Claim(s) withdrawn from consideration: .

/HONG CHO/
Primary Examiner, Art Unit 2467

Continuation of 12. does NOT place the application in condition for allowance because: the applicant's argument is not persuasive. Applicant argues that there is no "multipath connection" disclosed in either Pung or Yamada. The examiner respectfully disagrees.Yamada clealy discloses multipath connections between datagram transfer units as shown in figure 19. The applicant further argues that either Pung or Yamada does not disclose two "network-edge devices" that are capable of communicationg data packets to the data requesting device by staing that Pung discloses only one node that communicates with data requesting device. The examiner respectfully disagrees. Pung clealy discloses at least two network-edge devices (figure 12A, elements 12D and 12E) communicating with data requesting device (figure 12A, element C) by receiving requests (Req (A,c,d) and Req (A,c,e)).In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See In re Keller, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); In re Merck & Co., 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). In this case, it is the combined teaching of the two references that shows all the limitations of the claim.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.:	**15/161,787**	EXAMINER:	HONG CHO
INVENTOR:	Eric M. Delangis	GROUP ART UNIT:	2467
FILED:	OCTOBER 11, 2014	CONFIRMATION NO.:	3396
TITLE:	Multipath Communication Devices and Methods		
ATTORNEY NO:	ED 3000		

Commissioner For Patents
PO Box 1450
Alexandria, VA 22313-1450

DO NOT ENTER: /H.S.C/

AMENDMENT

In response to the Office Action issued on final April 17, 2017 ("Office Action"), please reconsider the above-identified application in light of the following amendments and accompanying remarks.

CERTIFICATE OF ELECTRONIC (EFS-WEB) TRANSMISSION

I hereby certify that this correspondence is being transmitted via the U.S. Patent Office's electronic filing system in accordance with 37 C.F.R. § 1.8(a)(1) from the **Pacific Time Zone** of the United States on the local date shown below.

Dated: July 17, 2017

By: Clay McGurk
Clay McGurk

MAILSTOP AF

RED HAT 1008
RED HAT V. CAS

To: CLAYMCGURK@GMAIL.COM,,
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 64828

Aug 09, 2017 03:58:52 AM

Dear PAIR Customer:

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

The following USPTO patent application(s) associated with your Customer Number, 64828 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

Disclaimer:
The list of documents shown below is provided as a courtesy and is not part of the official file wrapper. The content of the images shown in PAIR is the official record.

Application	Document	Mailroom Date	Attorney Docket No.
15161787	CTAV	08/09/2017	ED 3000

To view your correspondence online or update your email addresses, please visit us anytime at https://sportal.uspto.gov/secure/myportal/privatepair.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

RED HAT 1008
RED HAT V. CAS

PTO/SB/30EFS (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.

REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	15161787	Filing Date	2016-05-23	Docket Number (if applicable)	ED 3000	Art Unit	2467
First Named Inventor	ERIC DELANGIS			Examiner Name	HONG CHO		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☒ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

☐ Other _____

☐ Enclosed

☐ Amendment/Reply

☐ Information Disclosure Statement (IDS)

☐ Affidavit(s)/ Declaration(s)

☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____
(Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☒ Other Extension of time for one month

FEES

The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

☐ The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No _____

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

Applicant Signature

PTO/SB/30EFS (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.

Signature of Registered U.S. Patent Practitioner			
Signature	/H C McGurk IV, Reg No 34964/	Date (YYYY-MM-DD)	2017-08-17
Name	Harold McGurk	Registration Number	34964

This collection of information is required by 37 CFR 1.114. 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 1.11 and 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.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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 the Freedom of Information Act requires disclosure of these records.

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 inspections 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.

Electronic Patent Application Fee Transmittal

Application Number:	15161787
Filing Date:	23-May-2016
Title of Invention:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
First Named Inventor/Applicant Name:	Eric M. Delangis
Filer:	Harold C. McGurk
Attorney Docket Number:	ED 3000

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

RED HAT 1008
RED HAT V. CAS

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 1 month with $0 paid	2251	1	100	100
Miscellaneous:				
RCE- 1st Request	2801	1	600	600
		Total in USD ($)		**700**

Electronic Acknowledgement Receipt

EFS ID:	30115722
Application Number:	15161787
International Application Number:	
Confirmation Number:	3396
Title of Invention:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
First Named Inventor/Applicant Name:	Eric M. Delangis
Customer Number:	64828
Filer:	Harold C. McGurk
Filer Authorized By:	
Attorney Docket Number:	ED 3000
Receipt Date:	17-AUG-2017
Filing Date:	23-MAY-2016
Time Stamp:	23:31:33
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$700
RAM confirmation Number	081817INTEFSW23414400
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

RED HAT 1008
RED HAT V. CAS

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Continued Examination (RCE)	15161787_RCE_8-17-2017.pdf	697635 fcbd1fca212deb64d97ee0423f6b604e82db6f8c	no	3
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	32247 ce9d9028c4b0af42decb55be298511a5af2255fd	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	729882		

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 a 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.

RED HAT 1008
RED HAT V. CAS

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
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 displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/161,787	Filing Date 05/23/2016	☐ To be Mailed

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) 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 $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ 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

AMENDMENT **08/17/2017**

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 5	Minus	** 20	= 0	X $40 =	0
Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $210 =	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

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ 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.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** 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.

LIE
PEARLIE FENNELL

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.

RED HAT 1008
RED HAT V. CAS

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/161,787	05/23/2016	Eric M. Delangis	ED 3000	3396

64828 7590 10/03/2017

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

EXAMINER	
CHO, HONG SOL	

ART UNIT	PAPER NUMBER
2467	

NOTIFICATION DATE	DELIVERY MODE
10/03/2017	ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

CLAYMCGURK@GMAIL.COM

Office Action Summary	Application No. 15/161,787	Applicant(s) DELANGIS, ERIC M.	
	Examiner HONG CHO	Art Unit 2467	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08/17/2017*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance 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.

Disposition of Claims*

5)☒ Claim(s) *1-5* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-5* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

1. The present application is being examined under the pre-AIA first to invent provisions.

DETAILED ACTION

Response to Amendment

2. This office action is in response to the amendment filed on 08/17/2017. Claims 1-5 are pending in the instant application.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 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 of this title, 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 negatived by the manner in which the invention was made.

4. Claims 1, 2, 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pung et al (US 20020150099, "Pung") in view of Yamada et al (US 20010007557, "Yamada") and Goddard (US 20020055982).

RED HAT 1008
RED HAT V. CAS

Re claims 1, 4 and 5, Pung discloses receiving control information from the data-requesting device (figure 12A, element 12C; paragraph [0099]) to establish a connection with the data-requesting device; and receiving a plurality of data packets from one or more networks (figure 12A, elements 14B); and routing the data packets to the data-requesting device when the data packets are destined for the data-requesting device (paragraph [0004]), but fails to explicitly disclose network-edge devices capable of concurrently connecting with a data requesting device for participating in a multipath connection. However, Yamada discloses setting multiple transfer paths between datagram transfer units (figure 19, paragraph [0315]) and Goddard discloses establishing concurrent multipath connections between a server and clients (claim 7). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of Pung with Yamada and Goddard for the benefit of providing reliable multicasting service by utilizing multipath.

Re claim 2, Yamada discloses control information includes a connection ID (figure 19, multipath ID).

5. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Pung in view of Yamada and Goddard and further in view of Joyce et al (US 20020106065, "Joyce").

Re claim 3, Pung discloses all of the limitations of the base claim, but fails to disclose notifying the data-requesting device that the connection will be terminated sometime in the future; and terminating the connection with the data-requesting device. However, it is well known in the art that a user would be notified before the termination

RED HAT 1008
RED HAT V. CAS

of existing connection. Joyce disclose notifying a user before terminating the connection (paragraph [0114], lines 47-50). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of Yamada with the teaching of Joyce for the benefit of providing reliable multicasting service by terminating a connection that does not satisfy QoS constraints.

Response to Arguments

6. Applicant's arguments with respect to claims have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hong Cho whose telephone number is 571-272-3087. The examiner can normally be reached on Mon-Fri during 7 am to 4 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hassan Phillips can be reached on 571-272-3940. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you

RED HAT 1008
RED HAT V. CAS

have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Hong Cho/

Primary Examiner, Art Unit 2467

RED HAT 1008
RED HAT V. CAS

Notice of References Cited	Application/Control No. 15/161,787	Applicant(s)/Patent Under Reexamination DELANGIS, ERIC M.	
	Examiner HONG CHO	Art Unit 2467	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-2002/0055982 A1	05-2002	Goddard, Steve	H04L29/06	709/217
	B	US-				
	C	US-				
	D	US-				
	E	US-				
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S401	55	S400 and @rlad<"20021015"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/09/19 07:22
S400	681	(multicast$3 or broadcast$3 or distribut$3 or rout$3) near (packet$1 or stream$1 or data or traffic) with multi near (path or link)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/09/19 07:22
S398	235227	(H04M3/007 or H04L47/821 or H04M1/6033 or H04L45/54 or H04L69/168 or H04L61/2015 or H04L45/24 or H04W88/16 or H04L12/5692 or H04M2203/60 or H04M2250/06 or H04M2203/052 or H04W80/00 or H04W40/02 or H04W28/06 or H04W84/18 or H04W84/12 or H04W72/04 or H04W8/26).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/09/19 07:22
S404	47	S398 and join$3 with multicast$3 and multi near (path or link)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/09/19 07:25
S405	14	((Eric) near2 (Delangis)).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/09/19 07:37
S406	14	((request$3 or join$3) with (two or multiple or different or several) near multicast$3 near group).clm.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/09/19 07:49
L2	28	(US-20060079274-$ or US-20030202468-$ or US-20030063591-$ or US-20040090924-$ or US-20020102987-$ or US-20090150924-$ or US-20030137959-$ or US-20020150099-$ or US-20010037472-$ or US-20010007557-$ or US-20020106065-$).did. or (US-7257106-$ or US-6307839-$ or US-7385924-$ or US-7308279-$ or US-7068623-$ or US-6249669-$ or US-6941151-$ or US-7426316-$ or US-7562110-$ or US-7889181-$ or US-7035914-$ or US-7065090-$ or US-8285802-$ or US-	US-PGPUB; USPAT	OR	OFF	2017/09/19 08:59

		7653089-$ or US-6496477-$ or US-5483522-$ or US-7315900-$).did.				
L18	25	l17 and @rlad<"20021015"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/09/19 09:41
L17	185	(devices or subscribers or computers or clients) with (establish$4 or creat$3 or set$4 adj up) near3 (connect or connection or connecting) near3 (simultaneous$2 or concurrent$2)	US-PGPUB; USPAT; USOCR	OR	OFF	2017/09/19 09:41

9/19/2017 10:25:01 AM
C:\Users\hcho\Documents\EAST\Workspaces\15161787.wsp

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15161787	DELANGIS, ERIC M.
	Examiner	Art Unit
	HONG CHO	2467

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
H04M3/007 or H04L47/821 or H04M1/6033 or H04L45/54 or H04L69/168 or H04L61/2015 or H04L45/24 or H04W88/16 or H04L12/5692 or H04M2203/60 or H04M2250/06 or H04M2203/052 or H04W80/00 or H04W40/02 or H04W28/06 or H04W84/18 or H04W84/12 or H04W72/04 or H04W8/26 (EAST text search)	10/5/2016	hc
updated search	4/7/2017	hc
updated search	9/19/2017	hc

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15161787	DELANGIS, ERIC M.
	Examiner	**Art Unit**
	HONG CHO	2467

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	10/05/2016	04/07/2017	09/19/2017						
	1	✓	✓	✓						
	2	✓	✓	✓						
	3	✓	✓	✓						
	4	✓	✓	✓						
	5	✓	✓	✓						

To: CLAYMCGURK@GMAIL.COM,,
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 64828

Oct 03, 2017 04:40:45 AM

Dear PAIR Customer:

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

The following USPTO patent application(s) associated with your Customer Number, 64828 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

Disclaimer:
The list of documents shown below is provided as a courtesy and is not part of the official file wrapper. The content of the images shown in PAIR is the official record.

Application	Document	Mailroom Date	Attorney Docket No.
15161787	CTNF	10/03/2017	ED 3000
	892	10/03/2017	ED 3000

To view your correspondence online or update your email addresses, please visit us anytime at https://sportal.uspto.gov/secure/myportal/privatepair.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

RED HAT 1008
RED HAT V. CAS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.:	**15/161,787**	EXAMINER:	HONG CHO
INVENTOR:	Eric M. Delangis	GROUP ART UNIT:	2467
FILED:	OCTOBER 11, 2014	CONFIRMATION NO.:	3396
TITLE:	Multipath Communication Devices and Methods		
ATTORNEY NO:	ED 3000		

Commissioner For Patents
PO Box 1450
Alexandria, VA 22313-1450

AMENDMENT

In response to the Office Action issued on October 12, 2017 ("Office Action"), please reconsider the above-identified application in light of the following amendments and accompanying remarks.

CERTIFICATE OF ELECTRONIC (EFS-WEB) TRANSMISSION

I hereby certify that this correspondence is being transmitted via the U.S. Patent Office's electronic filing system in accordance with 37 C.F.R. § 1.8(a)(1) from the **Pacific Time Zone** of the United States on the local date shown below.

Dated: January 9, 2018

By: Clay McGurk
Clay McGurk

RED HAT 1008
RED HAT V. CAS

IN THE CLAIMS

This listing of claims will replace all prior versions and listings of the claims in the application:

1-5. (Cancelled).

6. (NEW) A device for receiving data from a server, the data comprising first data and second data, the device comprising:

a first communication interface capable of connecting to a first device;

a second communication interface capable of connecting to a second device; and

at least one processor coupled to the first communication interface and the second communication interface, the at least one processor concurrently receiving a portion of the first data from the first device and a portion of the second data from the second device, and after receipt of the first data and the second data, aggregating together the first data and the second data.

7. (NEW) The device of claim 6, wherein the device is one of a cell phone, a tablet, a network device, a router, a computer, a Wi-Fi device, a Wi-Max device, a mobile communications device and a Bluetooth device.

8. (NEW) The device of claim 6, wherein the first communication interface is a cellular phone interface, and the second communication interface is a Wi-Fi interface.

9. (NEW) The device of claim 8, wherein the first communication interface is a cellular phone interface capable of connecting to an LTE network.

10. (NEW) The device of claim 6, wherein the first communication interface is a Ethernet interface, and the second communication interface is a cellular interface.

RED HAT 1008
RED HAT V. CAS

11. (NEW) The device of claim 10, wherein the second communication interface is a cellular phone interface capable of connecting to an LTE network.

12. (NEW) The device of claim 6, wherein the first device comprises one or more of a network device, a cellular network device, a Wi-MAX communication device, a wireless router device, a mobile communications device, a Bluetooth device, a Wi-Fi device, a network switch, a network router, a micro-cell device and a hotspot device; and

wherein the second device comprises one or more of a network device, a cellular network device, a Wi-MAX communication device, a wireless router device, a mobile communications device, a Bluetooth device, a Wi-Fi device, a network switch, a network router, a micro-cell device and a hotspot device.

13. (NEW) The device of claim 6, wherein a transmitting device of the first device and a transmitting device of the second device are located on different parts of a cellular tower.

14. (NEW) A method implemented by a device for aggregating data, the data comprising first data packets and second data packets, the method comprising:

establishing a first connection to a first network;

sending a request for the data to a server;

in response to the request, receiving the first data packets over the first connection;

detecting an availability of at least one second connection to a second network;

establishing a second connection to a second network based on the availability of the at least one second connection;

notifying the server of the second connection;

after notification to the server, receiving a portion of the second data packets over the second connection at the same time that a portion of the first data packets are received over the first connection; and

aggregating together the first data packets and the second data packets.

RED HAT 1008
RED HAT V. CAS

15. (NEW) The device of claim 14, wherein the data comprises one or more data associated with a website, an application, a music file, a video file, a data file, streaming video, streaming music and a gaming software.

16. (NEW) The device of claim 14, wherein the device is one of a cellular phone, a router, a computer, a hotspot device, a tablet and a modem.

17. (NEW) The method of claim 14, wherein the first network is at least one of a cable network, a telecommunication network, a cellular network, an optical network and a communications network; and

wherein the second network is comprised of at least one of a cable network, a telecommunication network, a cellular network, an optical network and a communications network.

RED HAT 1008
RED HAT V. CAS

18. (NEW) A device comprising:

a first interface;

a second interface; and

a processor, coupled to the first interface and the second interface, the processor:

establishing a first connection using the first interface;

sending over the first connection a request for data from a remote server;

in response to the request, receiving first data over the first interface from the remote server;

using the second interface to detect an availability of at least one second connection to a second network;

establishing a second connection using the second interface based on the availability of the at least one second connection;

notifying the remote server of the second connection;

receiving second data over the second connection, where a first portion of the data is being received over the first connection, and at the same time, a second portion of the data is being received over of the second connection; and

aggregating together the first data packets and the second data packets.

19. (NEW) The device of claim 18, wherein the device is one of a cell phone, a tablet, a network device, a router, a computer, a Wi-Fi device, a Wi-Max device, a mobile communications device and a Bluetooth device.

20. (NEW) The device of claim 18, wherein the first interface is a cellular phone interface, and the second interface is a Wi-Fi interface.

21. (NEW) The device of claim 18, wherein the first interface is a Ethernet interface, and the second interface is a cellular interface.

RED HAT 1008
RED HAT V. CAS

22. (NEW) The device of claim 18, wherein the first interface is capable of connecting to at least one network device, a cellular network device, a Wi-MAX communication device, a wireless router device, a mobile communications device, a Bluetooth device, a Wi-Fi device, a network switch, a network router, a micro-cell device and a hotspot device; and

wherein the second interface is capable of connecting to at least one network device, a cellular network device, a Wi-MAX communication device, a wireless router device, a mobile communications device, a Bluetooth device, a Wi-Fi device, a network switch, a network router, a micro-cell device and a hotspot device.

23. (NEW) The device of claim 18, wherein the processor establishes the first connection and second connection from a plurality of available connections based on at least one of quality of service of a connection, speed of the connection, and signal strength of the connection.

24. (NEW) The device of claim 18, wherein the processor further determines how many devices are located in a transmission range of the device.

25. (NEW) The device of claim 18, wherein the first interface is capable of establishing one or more connections; and

wherein the processor further receives a plurality of first data from the one or more of the connections, and aggregates the plurality of first data and the second data.

26. (NEW) The device of claim 25, wherein the first interface is capable of establishing one or more Wi-Fi connection.

RED HAT 1008
RED HAT V. CAS

REMARKS

Status of the Claims

Claims 1-5 were pending in this application before this Amendment. Claims 1-5 have been cancelled without prejudice or disclaimer. Claims 6-26 are new claims. No new matter has been added in this Amendment or in the claims. Thus, claims 6-26 are now pending pursuant to this Amendment.

Prior Rejections

The prior rejections contained in the Office Action were in regards to claim 1-5, which are now cancelled without prejudice or disclaimer, thus making all of the prior rejections moot. If the Examiner needs to change anything via an Examiner's Amendment, the Examiner is always welcome as has been done before to phone the attorney of record to discuss such changes.

Respectfully Submitted,

Date: January 9, 2018

H C McGurk IV, Reg. No. 34,964
Attorney for Applicant

The Law Office of Clay McGurk
PO Box 1488
Orange, CA 92706
Phone: **949.395.3942**
Email: claymcgurk@gmail.com

Electronic Patent Application Fee Transmittal

Application Number:	15161787
Filing Date:	23-May-2016
Title of Invention:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
First Named Inventor/Applicant Name:	Eric M. Delangis
Filer:	Harold C. McGurk
Attorney Docket Number:	ED 3000

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

RED HAT 1008
RED HAT V. CAS

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 1 month with $0 paid	2251	1	100	100
Miscellaneous:				
			Total in USD ($)	**100**

Electronic Acknowledgement Receipt

EFS ID:	31453773
Application Number:	15161787
International Application Number:	
Confirmation Number:	3396
Title of Invention:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
First Named Inventor/Applicant Name:	Eric M. Delangis
Customer Number:	64828
Filer:	Harold C. McGurk
Filer Authorized By:	
Attorney Docket Number:	ED 3000
Receipt Date:	09-JAN-2018
Filing Date:	23-MAY-2016
Time Stamp:	20:35:11
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$100
RAM confirmation Number	011018INTEFSW20392100
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

RED HAT 1008
RED HAT V. CAS

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment/Req. Reconsideration-After Non-Final Reject	15161787_Amendment_1-9-2018.pdf	135844 cbdb28b87b75c0ea9f48edecf45a4be0ab0fa242	no	7
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30563 1e22bf61e74fc6354e63049a0022fc3fad96b608	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	166407		

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 a 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.

RED HAT 1008
RED HAT V. CAS

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
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 displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/161,787	Filing Date 05/23/2016	☐ To be Mailed

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) 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 $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ 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

AMENDMENT **01/09/2018**

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 5	Minus	** 20	= 0	X $40 =	0
Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $210 =	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

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ 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.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** 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.

LIE
DEANNA RORIE

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.

RED HAT 1008
RED HAT V. CAS

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/161,787	05/23/2016	Eric M. Delangis	ED 3000	3396

64828 7590 03/20/2018

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

EXAMINER	
CHO, HONG SOL	

ART UNIT	PAPER NUMBER
2467	

NOTIFICATION DATE	DELIVERY MODE
03/20/2018	ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

CLAYMCGURK@GMAIL.COM

Office Action Summary	Application No. 15/161,787	Applicant(s) DELANGIS, ERIC M.	
	Examiner HONG CHO	Art Unit 2467	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 2 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *01/09/2018*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance 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.

Disposition of Claims*

5)☒ Claim(s) *1-26* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☐ Claim(s) _____ is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☒ Claim(s) *1-26* are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

1. The present application is being examined under the pre-AIA first to invent provisions.

DETAILED ACTION

Response to Amendment

2. This office action is in response to the amendment filed on 01/09/2018. Claims 1-5 are cancelled. Claims 6-26 are added.

Election/Restrictions

3. Restriction to one of the following inventions is required under 35U.S.C. 121:

Group I, claims 1-5 are drawn to routing packets to a destination.

Group II, claims 6-26 are drawn to aggregating data received from network devices/connections.

4. The inventions are distinct, each from the other because of the following reasons: Invention I and II are unrelated. Inventions are unrelated if it can be shown that they are not disclosed as capable of use together and they have different designs, modes of operation, and effects (MPEP § 802.01 and § 806.06). In the instant case, the different inventions are:

I: routing packets, classified in H04L 45/00.

II: aggregating data, classified in H04L 65/00.

RED HAT 1008
RED HAT V. CAS

5. Because these inventions are independent or distinct for the reasons given above and there would be a serious burden on the examiner if restriction is not required because the inventions have acquired a separate status in the art in view of their different classification, restriction for examination purposes as indicated is proper.

6. Claims added by amendment following action by the examiner, MPEP § 818.01, § 818.02(a), to an invention other than previously claimed, should be treated as indicated by 37 CFR 1.145.

7. If, after an office action on an application, the applicant presents claims directed to an invention distinct from and independent of the invention previously claimed, the applicant will be required to restrict the claims to the invention previously claimed if the amendment is entered, subject to reconsideration and review as provided in §§ 1.143 and 1.144.

Election by Original Presentation

8. Newly submitted claims directed to an invention that is independent or distinct from the invention originally claimed for the reasons stated above.

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claims **II** are withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

RED HAT 1008
RED HAT V. CAS

9. The amendment filed on **01/09/2018** canceling all claims drawn to the elected invention and presenting only claims drawn to a non-elected invention is non-responsive (MPEP § 821.03). The remaining claims are not readable on the elected invention.

10. Since the above-mentioned amendment appears to be *a bona fide* attempt to reply, applicant is given a TIME PERIOD of TWO MONTHS from the mailing date of this notice within which to supply the omission or correction in order to avoid abandonment. EXTENSIONS OF THIS TIME PERIOD UNDER 37 CFR 1.136(a) ARE AVAILABLE.

Conclusion

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hong Cho whose telephone number is 571-272-3087. The examiner can normally be reached on Mon-Fri during 7 am to 4 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hassan Phillips can be reached on 571-272-3940. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you

RED HAT 1008
RED HAT V. CAS

have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Hong Cho/

Primary Examiner, Art Unit 2467

RED HAT 1008
RED HAT V. CAS

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15161787	DELANGIS, ERIC M.
	Examiner	Art Unit
	HONG CHO	2467

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	10/05/2016	04/07/2017	09/19/2017	03/14/2018					
	1	✓	✓	✓	÷					
	2	✓	✓	✓	÷					
	3	✓	✓	✓	÷					
	4	✓	✓	✓	÷					
	5	✓	✓	✓	÷					
	6				÷					
	7				÷					
	8				÷					
	9				÷					
	10				÷					
	11				÷					
	12				÷					
	13				÷					
	14				÷					
	15				÷					
	16				÷					
	17				÷					
	18				÷					
	19				÷					
	20				÷					
	21				÷					
	22				÷					
	23				÷					
	24				÷					
	25				÷					
	26				÷					

To: CLAYMCGURK@GMAIL.COM,,
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 64828

Mar 20, 2018 04:41:04 AM

Dear PAIR Customer:

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

The following USPTO patent application(s) associated with your Customer Number, 64828 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

Disclaimer:
The list of documents shown below is provided as a courtesy and is not part of the official file wrapper. The content of the images shown in PAIR is the official record.

Application	Document	Mailroom Date	Attorney Docket No.
15161787	NTC.A.NONCPL	03/20/2018	ED 3000

To view your correspondence online or update your email addresses, please visit us anytime at https://sportal.uspto.gov/secure/myportal/privatepair.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

RED HAT 1008
RED HAT V. CAS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.:	**15/161,787**	EXAMINER:	HONG CHO
INVENTOR:	Eric M. Delangis	GROUP ART UNIT:	2467
FILED:	OCTOBER 11, 2014	CONFIRMATION NO.:	3396
TITLE:	Multipath Communication Devices and Methods		
ATTORNEY NO:	ED 3000		

Commissioner For Patents
PO Box 1450
Alexandria, VA 22313-1450

AMENDMENT

In response to the Notice issued on March 20, 2018 ("Notice") and the Office Action dated October 3, 2017 ("Office Action"), please reconsider the above-identified application in light of the following amendments and accompanying remarks. It is respectfully requested that the previous request made in the Amendment filed on January 9, 2018, to cancel claims 1-5 not be entered due to the restriction requirement as presented in the Notice. According to the Notice, claims 6-26 have been withdrawn by the examiner from consideration as being directed to a non-elected invention. If the cancellation of claims 1-5 cannot be reversed, then please call the attorney of record at the phone number listed below to discuss the examiner's preference on re-entering the consideration of claims 1-5.

Pursuant to 35 U.S.C. § 21(b), this Amendment can be filed on the next business day where the date of response falls on a Sunday, and will be considered to be timely filed. March 20th is a Sunday, and therefore this Amendment can be filed on Monday, March 21st and be considered to be timely filed.

CERTIFICATE OF ELECTRONIC (EFS-WEB) TRANSMISSION

I hereby certify that this correspondence is being transmitted via the U.S. Patent Office's electronic filing system in accordance with 37 C.F.R. § 1.8(a)(1) from the **Pacific Time Zone** of the United States on the local date shown below.

Dated: May 21, 2018

By: Clay McGurk
Clay McGurk

RED HAT 1008
RED HAT V. CAS

IN THE CLAIMS

This listing of claims will replace all prior versions and listings of the claims in the application:

1. (Currently Amended) A method executed by a first device ~~for a network edge device for participating in a multipath connection with a data-requesting device, the multipath connection comprising at least two network edge devices capable of concurrently connecting with the data-requesting device where each of the at least two network edge devices is capable of sending different data packets to the data-requesting device during the multipath connection,~~ comprising:

establishing at least two connections between the first device and at least two second devices, each of the at least two connections being separate from the other of the at least two connections ~~receiving control information from the data-requesting device to establish a connection with the data-requesting device for participating in the multipath connection~~; ~~and~~

~~during the multipath connection:~~

receiving concurrently at the first device from the at least two connections a plurality of data packets, ~~from one or more networks~~ the data packets being associated with a single session; and

routing the data packets to ~~the data-requesting~~ a particular third device ~~when the data packets are destined for the data-requesting device~~.

2. (Currently Amended) The method of claim 1, wherein the ~~control~~ information includes a connection ID.

3. (Currently Amended) The method of claim 2, further comprising:

receiving a notification from one of ~~notifying~~ the ~~data-requesting~~ second devices ~~device~~ that the connection between the first device and the one of the second devices will be terminated ~~sometime in the future~~; and

terminating the connection with the one of the second devices ~~data-requesting device~~.

RED HAT 1008
RED HAT V. CAS

4. (Currently Amended) A method ~~for a network edge~~ executed by a first device ~~for participating in a plurality of multipath connections with a plurality of data-requesting devices, the multipath connection comprising at least two network edge devices concurrently connecting with a data-requesting device where each of the at least two network edge devices is capable of sending different data packets to the data-requesting device during the multipath connection~~, comprising:

establishing at least two connections between the first device and at least two second devices, each of the at least two connections being separate from the other of the at least two connections ~~receiving control information from each of the data-requesting devices to establish a separate multipath connection with each of the data-requesting devices~~; ~~and~~

~~during each of the separate multipath connections:~~

receiving concurrently at the first device from the at least two connections a plurality of data packets ~~from one or more networks~~, each of the data-packets having a connection ID, the data packets being associated with a single session;

joining together the data packets that share the same connection ID; and

routing the joined-together data packets that have the same connection ID to a particular ~~data-requesting~~ third device ~~based on the connection ID~~.

5. (Currently Amended) A ~~communications~~ first device ~~for participating in one or more simultaneous multipath connections, a multipath connection comprising at least two communication devices capable of concurrently connecting with a data-requesting device where each of the at least two communication devices is capable of sending different data packets to the data-requesting device during the multipath connection~~, comprising:

~~at least~~ a plurality of first interfaces ~~interface~~ capable of connecting concurrently to a plurality of second ~~remote~~ devices;

~~at least~~ a plurality of second interfaces ~~interface~~ capable of connection to a ~~data-requesting device~~ third devices; and

a processor coupled to the ~~at least~~ the first ~~interface~~ interfaces and the ~~at least the~~ second ~~interface~~ interfaces that:

~~receives control information from the data-requesting device to establish a connection with the data-requesting device during a setup of a particular multipath connection; and~~

~~during the particular multipath connection:~~

receives concurrently a plurality of data packets from ~~one or more~~ at least two of the second ~~remote~~ devices via at least two of the ~~at least~~ the first ~~interface~~ interfaces, the data packets being associated with a single session;

assembles together the data packets that are destined for a particular one of the third devices; and

routes the assembled data packets via ~~the at least~~ a particular one of the second ~~interface~~ interfaces to the particular one of ~~data-requesting device~~ third devices ~~when the data packets are destined for the data-requesting device~~.

6.-26. (Withdrawn).

27. (New) The method of claim 1, further comprising, when a quality of service associated with one of the at least two connections falls below a threshold, switching to another of the at least two connections having a better quality of service.

28. (New) The method of claim 1, wherein each of the at least two connections is one or more wired connections, wireless connections and optical connections.

29. (New) The method of claim 1, wherein the single session comprises data packets associated with a data stream, a data file, streaming video, internet-related information, or electronic data.

30. (New) The method of claim 1, further comprising the step of after receiving concurrently data packets, identifying the data packets as destined for which of a plurality of third devices, and grouping the data packets together that belong to different ones of the third devices before routing the grouped data packets to the different ones of the third devices.

31. (New) The method of claim 1, wherein the data packets being received at the same time are associated with different sessions.

32. (New) The method of claim 4, further comprising, when a quality of service associated with one of the at least two connections falls below a threshold, switching to another of the at least two connections having a better quality of service.

33. (New) The method of claim 4, wherein each of the at least two connections is one or more wired connections, wireless connections and optical connections.

34. (New) The method of claim 4, wherein the single session comprises data packets associated with a data stream, a data file, streaming video, internet-related information, or electronic data.

RED HAT 1008
RED HAT V. CAS

35. (New) The method of claim 4, further comprising the step of after receiving concurrently data packets, identifying the data packets as destined for which of a plurality of third devices, and grouping the data packets together that belong to different ones of the third devices before routing the grouped data packets to the different ones of the third devices.

36. (New) The method of claim 4, wherein the data packets being received at the same time are associated with different sessions.

37. (New) The first device of claim 5, wherein the first device comprises one or more of a network device, a router, a server, and a network switch;

wherein the second device is comprised of at least one of a cable network device, a telecommunication network device, a cellular network device, an optical network device and a communications network device; and

wherein the third device comprises one or more of a network device, a computer, a tablet, a server, a cellular phone, a mobile communications device, a network switch, a router, a micro-cell device and a hotspot device.

38. (New) The method of claim 5, wherein each of the first interfaces is one or more wired connections, wireless connections and optical connections.

39. (New) The first device of claim 5, wherein the processor assembles together the data packets based on a sequence number, a connection ID or a hash number.

40. (New) The first device of claim 5, wherein the particular one of the second interfaces is a wired connection, a wireless connection or an optical connection.

RED HAT 1008
RED HAT V. CAS

REMARKS

Status of the Claims

Claims 1-5 were pending in this application before this Amendment. Claims 1-5 have been amended. Claims 6-26 were withdrawn by the examiner. Claims 27-40 are new claims. No new matter has been added in this Amendment. Thus, claims 1-5 and 27-40 are now pending pursuant to this Amendment.

35 U.S.C. § 103 Rejections

Starting on page 2 of the Office Action, claims 1, 2, 4 and 5 were rejected under 35 U.S.C. §102(e) as being unpatentable over "Pung" (U.S. Appl. Publ. 2002-0150099) in view of "Yamada" (U.S. Appl. Publ. 2001-0007557) and "Goddard" (US Appl. Publ. 2002-0055982).

Amended independent claims 1 and 4, both method claims, require: "establishing at least two connections between the first device and at least two second devices, each of the at least two connections being separate from the other of the at least two connections" and "receiving concurrently at the first device from the at least two connections a plurality of data packets… the data packets being associated with a single session".

On page 3 of the Office Action, the examiner cited Figure 12A from Pung. As shown Figures 12A-12E of Pung, once the request from 14A to 14B is setup up, data is transferred as shown in Figure 12F of Pung, where the data is sent from 14B through nodes 12E, 12C and 12A and then to 14A. Node 12A does not receive concurrently a plurality of data packets from at least two connections as required in amended independent claims 1 and 4.

Yamada does not make up for the deficiency of Pung. On page 3 of the Office Action, the examiner relies on Figure 19 of Yamada. This configuration as shown in Figure 19 of Yamada is deficient because the lack of at least two connections between a first device and at least two second devices. As shown in Figure 19 of Yamada, datagram transfer unit 4a is connected only to one data transfer unit 4b. Amended independent claims 1 and 4 require at least two data transfer units 4b that are connected to data transfer unit 4a.

Goddard also does not make up for the deficiencies of Pung and Yamada. On page 2 of the Office Action, the examiner relied on claim 7. Claim 7 of Goddard states: "establishing, in

RED HAT 1008
RED HAT V. CAS

response to some of the connection requests, a number of concurrent connections between a server and clients". There is no mention of separate connections between the clients and at least two servers as required in amended independent claims 1 and 4. Therefore, Pung, Yamada and Goddard are all deficient and thus, amended independent claims 1 and 4 are patentable over a combination of Pung, Yamada and Goddard.

Amended independent claim 5, a device claim, relies on "first interfaces" that exist concurrently and receive data concurrently via the first interfaces. For the same reasons as provided above in relation to claims 1 and 4, claim 5 is similarly patentable over a combination of Pung, Yamada and Goddard.

Claim 2 is dependent on amended independent claim 1 and is allowable for the same reasons provided above for distinguishing claim 1 over Pung, Yamada and Goddard. For these reasons, it is respectfully requested that the rejection of claims 1, 2, 4 and 5 under 35 U.S.C. § 103 based on Pung, Yamada and Goddard be reconsidered and withdrawn.

On page 3 of the Office Action, claim 3 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Pung in view of Yamada and Goddard, and further in view of "Joyce" (U.S. Appl. Publ. 2002-0106065). Joyce was relied upon for teaching a user being notified before the termination of a connection. Joyce was not relied upon for disclosing the deficiencies noted above. Therefore, since claim 3 is dependent on amended independent claim 1, it is allowable for the same reasons provided above for distinguishing claim 1 over Pung, Yamada and Goddard. It is respectfully requested that the rejection of claim 3 under 35 U.S. C. § 103 based on Pung, Yamada Goddard and Joyce be reconsidered and withdrawn.

Conclusion

It is noted that claimed subject matter may be patentably distinguished from the cited references for additional reasons. It is also noted that any failure to comment directly upon any of the positions asserted in the Office Action does not indicate agreement or acquiescence with those asserted positions or allegations. Instead, it is believed that the foregoing sufficiently addresses the issues raised in the Office Action, and that the present claims are in condition for allowance.

RED HAT 1008
RED HAT V. CAS

All rejections in the Office Action have been properly traversed. It is respectfully requested that all outstanding rejections be reconsidered and withdrawn. It is believed that a full and complete reply has been made in response to the Office Action, and, that as such, the present patent application is in a condition for allowance.

The Examiner is always welcome to telephone the attorney of record at the telephone number provided below if such telephone discussion would help expedite the prosecution of the patent application. Prompt and favorable consideration of this Amendment is respectfully requested.

Respectfully Submitted,

Date: May 21, 2018

H C McGurk IV, Reg. No. 34,964
Attorney for Applicant

THE LAW OFFICE OF CLAY MCGURK
PO Box 1488
Orange, CA 92706
Phone: **949.395.3942**
Email: claymcgurk@gmail.com

PTO/SB/08a (01-10)
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.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	15161787
Filing Date	2016-05-23
First Named Inventor	Eric DeLangis
Art Unit	2467
Examiner Name	HONG CHO
Attorney Docket Number	ED 3000

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5487069		1996-01-23	O'Sullivan et al.	
	2	6502135		2002-12-31	Munger et al.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15161787
	Filing Date	2016-05-23
	First Named Inventor	Eric DeLangis
	Art Unit	2467
	Examiner Name	HONG CHO
	Attorney Docket Number	ED 3000

Examiner Initials*	Cite No	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, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	802.3 IEEE Standard for Information Technology, Part 3, March 2002 (specifically, starting at p.232 "43. Link Aggregation")	
	2	Link Aggregation according to IEEE 802.3ad, by SysKonnect GmbH, 2002.	
	3	M-TCP: TCP for Mobile Cellular Network, Kevin Brown and Suresh Singh, University of South Carolina, 1997.	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15161787
	Filing Date	2016-05-23
	First Named Inventor	Eric DeLangis
	Art Unit	2467
	Examiner Name	HONG CHO
	Attorney Docket Number	ED 3000

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/H C McGurk IV/	Date (YYYY-MM-DD)	2018-05-21
Name/Print	H C McGurk	Registration Number	34964

This collection of information is required by 37 CFR 1.97 and 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 1 hour 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.**

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 the Freedom of Information Act requires disclosure of these record s.

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 inspections 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.

M-TCP: TCP for Mobile Cellular Networks*

Kevin Brown and Suresh Singh
Department of Computer Science
University of South Carolina
Columbia, SC 29205
{*kbrown,singh*}*@cs.sc.edu*
Tel: 803-777-2596

July 29, 1997

Abstract

Transport connections set up over wireless links are frequently plagued by problems such as – high bit error rate (BER), frequent disconnections of the mobile user, and low wireless bandwidth that may change dynamically. In this paper, we study the effects of frequent disconnections and low variable bandwidth on TCP throughput and propose a protocol that addresses this problem. We discuss the implementation (in NetBSD) of our protocol called M-TCP and compare its performance against other mobile TCP implementations. We show that M-TCP has two significant advantages over other solutions: (1) it maintains *end-to-end* TCP semantics and, (2) it delivers excellent performance for environments where the mobile encounters periods of disconnection.

1 Introduction

Mobile computing is an emerging new computing paradigm that will allow users to access electronic data and services "anywhere, anytime". Thus, users away from home will be able to transparently access their data as if they had never left. We can identify at least two types of *mobile users* based on observed patterns of user behavior – one type of user model is where the user travels away from home and accesses her data from a remote *stationary* location (say a hotel room), and the second model is one where the user accesses her data while *on the move* (e.g., while in a car). In this paper we will restrict ourselves to the latter type of mobile data access only.

A *cellular network* infrastructure is typically used to connect mobile users to the Internet. A geographical region, such as a highway or campus, is divided into *cells* each of which contains a *base station* that provides a connection end-point for roaming mobiles. The base stations are connected to the wired infrastructure to provide access to the Internet. A cell may be as small as tens of meters in diameter (in the case of in-building picocellular networks [15]) or as large as a mile in diameter (macrocellular network). Smaller cells are useful if we need to provide higher bandwidth to the users (this is possible since the number of users per cell is smaller) but results in smaller *cell latencies* (i.e., time a mobile spends in a cell) that, in turn, cause frequent *handoffs* (when the mobile roams into a new cell, the new base station takes over the management of all connections – this is called a handoff).

In order to maintain connections for mobile users, it is necessary to keep track of their *location*, ensure that the network can *route* packets to the user's current location and, depending on the type of connection, ensure some Quality of Service (e.g., best-effort UDP, reliable data transfer, etc.). Many solutions have been proposed for all of these problems. For instance, [13, 9, 20] discuss several aspects of routing in a mobile environment and compare different solutions including Mobile-IP. Other authors have addressed the problem of location management, see for instance [8]. A solution for improving the performance of UDP over wireless links was proposed by us, [11]. In this paper, however, we are only interested in studying the behavior of the TCP protocol over wireless links and we will therefore only provide a comprehensive literature review of research relevant to this problem.

Many papers have been written proposing methods for improving TCP performance over a wireless link, [3, 21, 6, 7, 12]. All these papers have, however, concentrated on only one problem associated with wireless links – a perceived high bit-error rate (BER) over the wireless link. While a high BER has significant implications for protocol performance, other limitations of the wireless environment are equally or more important than high BER. In this

*This work was supported by the NSF under grant number NCR-9410357 and by a equipment grant from NCR Corporation.

RED HAT 1008
RED HAT V. CAS

paper we study the effects of *periodic disconnections* on TCP performance and develop a protocol (M-TCP) that successfully deals with this problem. The protocol is also capable of on-the-fly data compression in the event that the wireless bandwidth available is very small. Finally, unlike many other solutions, our protocol maintains *end-to-end* TCP semantics.

1.1 The Problem with TCP

TCP is a connection-oriented transport layer protocol that provides reliable, in-order delivery of data to the TCP receiver. Since mobile hosts will expect the same services that are offered to fixed hosts, it is necessary to implement TCP for the mobile domain. If we use TCP without any modification in mobile networks, we experience a serious drop in the throughput of the connection. There are several reasons for such a drastic drop in TCP throughput and in this section we examine these reasons in some detail.

The Effect of a High Bit Error Rate (BER)

It has been suggested that the wireless link suffers from a high bit error rate. While this may be true in some cases, recent studies [14] indicate that the bit error may be no worse then 10^{-5} which can be reduced by one or two orders of magnitude by the use of appropriate FEC (Forward Error Correcting) codes and retransmission schemes at the link layer, see [2]. However, let us assume for the sake of this discussion that the wireless link *is* susceptible to inordinately high bit error rates.

Bit errors cause packets to get corrupted which result in lost TCP data segments or acknowledgements. When acknowledgements do not arrive at the TCP sender within a short amount of time, (the retransmit timeout or RTO which is a multiple of half a second), the sender retransmits the segment, exponentially backs off its retransmit timer for the next retransmission, and *closes its congestion window to one segment.* Repeated errors will ensure that the congestion window at the sender remains small resulting in low throughput (see [5]). It is important to note that FEC may be used to combat high BER, but it will waste valuable wireless bandwidth when correction is not necessary.

The Effect of Disconnections

In a mobile environment, as a user moves between cells, there is a brief blackout period (or disconnection) while the mobile performs a handoff with the new MSS. Disconnections may also be caused by physical obstacles in the environment that block radio signals, such as buildings. If a cell contains many users, some connections (of newly arriving mobiles) may not receive any bandwidth for large time periods (call blocking) – this can also be considered a disconnection event. Disconnection periods can be of the order of several seconds causing packet loss or delay in the transmission of acknowledgements of received packets. In the case of Metricom's Ricochet network [1], for instance, a disconnection may last as long as 1 minute! These disconnections result in lost data segments and lost ACKs which, in turn, result in the TCP sender timing out and closing its congestion window, thus greatly reducing the efficiency of the connection. Since these disconnections tend to be fairly lengthy, forward error correction schemes are ineffective.

The Effect of Frequent Disconnections

It is likely that in order to provide high-bandwidth wireless connections, cell sizes will have to be reduced (one example where cell sizes are small is the Ricochet network developed by Metricom, Inc. – a typical cell covers a one or two block area). Small cell sizes unfortunately result in small *cell latencies* that, in turn, cause frequent disconnections as a user roams. All the problems that result from disconnections, as we discussed above, occur more often here.

Another problem caused by small cell latencies and frequent disconnections is that of *serial* timeouts at the TCP sender. A serial timeout is a condition wherein multiple consecutive retransmissions of the same segment are transmitted to the mobile while it is disconnected. All these retransmissions are thus lost (see Figure 1). Since the retransmission timer at the sender is doubled with each unsuccessful retransmission attempt (until it reaches 64 sec), several consecutive failures can lead to inactivity lasting several *minutes.* Thus, even when the mobile is reconnected no data is successfully transmitted for as long as 1 minute! We have found that serial timeouts at the TCP sender can prove to be even more harmful to overall throughput than losses due to bit errors or small congestion windows.

RED HAT 1008
RED HAT V. CAS

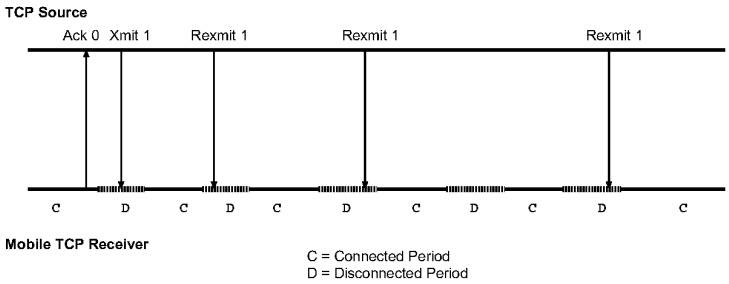


Figure 1: Serial timeouts at the TCP sender.

1.2 Overview of the Paper

Our M-TCP protocol was designed to work well in the presence of frequent disconnection events and over low bit-rate wireless links subject to dynamically changing bandwidth. In addition, it maintains end-to-end TCP semantics. In the following section we discuss the related work on this problem. In section 3 we present our network architecture in the context of which we developed M-TCP. Section 4 presents the design of our M-TCP protocol and section 5 discusses the implementation details. Performance results are presented in section 6 and section 7 concludes the paper.

2 Approaches for Improving TCP Throughput in Mobile Environments

In order to ensure that the TCP connection to a mobile is efficient, it is necessary to prevent the sender from shrinking its congestion window when packets are lost either due to bit-error or due to disconnection. Furthermore, it is important to ensure that, when the mobile is reconnected, it begins receiving data immediately (rather than having to wait for the sender to timeout and retransmit). As we saw from our earlier discussion, the sender may shrink its congestion window in response to a timeout (caused by lost packets – either due to a high BER or due to disconnections) or in response to duplicate ACKs. Most of the solutions we discuss below attempt to keep the sender's congestion window open by introducing a host in the fixed network who 'spoofs' the sender into thinking everything is fine on the wireless link. Unfortunately, however, these solutions do not work under all scenarios of mobility. Specifically, they all perform poorly when faced with frequent or lengthy disconnections. Furthermore, some solutions fail to maintain end-to-end TCP semantics.

The remainder of this section is divided into three parts. In section 2.1 we present the existing solutions to the problem. In section 2.2 we discuss the relative performance of these solutions and outline their drawbacks. Finally, other related work is presented in section 2.3.

2.1 Existing Solutions

One proposed solution for losses caused by high BER is the Berkeley Snoop Module [6]. The snoop module resides at an intermediate host near the mobile user (typically the base station). It inspects the TCP header of TCP data packets and acknowledgements which pass through and buffers copies of the data packets. Using the information from the headers, the snoop module detects lost packets (a packet is assumed to be lost when duplicate acknowledgements are received) and performs local retransmissions to the mobile. The module also implements its own retransmission timer, similar to the TCP retransmission timeout, and performs retransmissions when an acknowledgement is not received within this interval. An improved version of the snoop module [7] adds selective retransmissions from the intermediate node to the mobile.

Another solution to the problem caused by high BER is the I-TCP [3] protocol (Indirect-TCP). In the I-TCP protocol a TCP connection between a fixed host and a Mobile Host (MH) is **split** in two at the Mobile Support Station (MSS) or base station. Data sent to the MH is received and ACK'ed by the MSS before being delivered to the MH. Note that on the connection between the MSS and MH it is not necessary to use TCP, rather some protocol optimized for the wireless link could be used. The MTCP protocol of [21] is very similar to I-TCP. It also splits a TCP connection in two – one from the MH to MSS and another from the MSS to the FH (i.e., the Fixed Host or sender). The MH to MSS connection passes through MHP, a session layer protocol. Two implementations for

RED HAT 1008
RED HAT V. CAS

MHP are proposed. In the first, MHP uses TCP over the wireless link to the MSS. In the second implementation, a selective repeat protocol, SRP, is used over the wireless link. SRP lies below the socket layer but above TCP.

Both I-TCP and MTCP achieve better throughputs than standard TCP for the following reason: the node where the connection is split is, hopefully, one or two hops away from the MH's cell and can adapt more quickly to the dynamic mobile environment because the round trip time (RTT) is very small. This means that even if the MSS sender (the node where the connection is split) reduces its congestion window to one because of lost acknowledgements from the mobile, the window will quickly build up to the maximum again when new ACKs arrive from the mobile because of the short RTT. MTCP/SRP also increases throughput by using selective repeat which reduces duplicate sends.

[12] presents a solution that addresses the problem caused by short disconnections (where one or two segments only are lost). It, however, does not split the TCP connection. The solution is based on the following observation: during a handoff, since the MH cannot receive packets, unmodified TCP at the sender will think a congestion has occurred and will begin congestion control (reduce window size and retransmit) after a timeout. The timeout period is long and even though the MH may have completed the handoff it will have to wait for the full timeout period before it begins receiving packets from the sender. The fast retransmit idea presented in [12] forces the MH to retransmit, in triplicate, the last old ACK as soon as it finishes a handoff. This forces the sender to reduce the congestion window to a half and retransmit one segment immediately.

2.2 Drawbacks and Strengths of Existing Solutions

In this section we examine how each of the existing solutions discussed above fare when confronted with high BER, different types of disconnections, and their ability to maintain TCP semantics.

Let us first consider the two *split* connection protocols, I-TCP and MTCP (note that [7] discusses these and other minor variants of the split connection idea as well). It is easy to see that the sender is shielded from any knowledge of the wireless link including disconnections and high BER because the MSS ACKs all data even before it is ACK'ed by the MH. However, as [7] showed, it is necessary to implement SACK (Selective ACK) over the MSS–MH part of the connection in order to recover quickly in high bit-error environments.

If the mobile environment is subject to frequent disconnections, it is easy to see that *serial timeouts* may occur at the base station resulting in long idle periods. We have found that the standard split connection approach, which uses TCP on both halves of the connection, does, in fact, respond poorly to lengthy disconnections. In experiments using a cell latency of 5 seconds, and fade intervals ranging from 0.5 to 4.5 seconds, we have observed serial timeouts that sometimes cause periods of inactivity lasting as long as 5 minutes or more. Thus, a split connection using TCP on both sides only localizes the problem, it does not correct it.

It is also important to observe that, since the MSS ACK's segments to the sender before delivering them to the MH, it can easily run out of buffer space (imagine several users browsing the web simultaneously and downloading GIFs) – *this happens because there is no linkage between the wireless throughput and the receive buffer size at the MSS*. There is thus a need to develop smart buffer management strategies at the base station. Another problem arising from the use of large buffer space is an increased handoff latency when the MH roams from one cell into another. When the mobile moves from one cell to another, the old MSS will need to handoff all the I-TCP state. This state can be fairly large and will cause a significant handoff delay (the MH cannot receive data until the state has been handed off).

Finally, it is clear that both I-TCP and MTCP *do not* preserve end-to-end TCP semantics. The sender may believe a segment is delivered correctly to the MH since the MSS ACK'ed it even if the MH disconnected before receiving this segment. This is clearly a serious problem for many applications.

The snoop module [6, 7] was designed to combat high BER environments by providing local retransmissions of data and local filtering of ACKs to prevent the sender from invoking congestion control. The snoop module implements a round-trip timer, much like TCP and does retransmissions of unacknowledged segments based on this timer. In addition snoop maintains a persist timer that goes off once every 200 ms, when there is unacknowledged data at the snoop module, and there has been no activity from either the sender or the receiver in that time (where the retransmissions above do not count as activity).

It is easy to see that the snoop module (in particular the version that incorporates SACK [7]) performs extremely well in high BER environments because the RTO estimate between the MSS and MH is small resulting in quick retransmissions of lost data. In addition, the persist timer ensures that if there has been a bursty loss (2-6 packets, see [7]), the snoop module will retransmit some data within 200 msec (this interval is smaller than the minimum granularity of TCP timers which is 500 msec) thus ensuring that the sender does not invoke congestion control due

RED HAT 1008
RED HAT V. CAS

	Fast Retransmit	Snoop	I-TCP & MTCP	Our M-TCP
End-to-end TCP semantics	√	√		√
Handle High BER		√	√	√
Long Disconnections			May run out of buffers	√
Frequent Disconnections			High handoff cost	√

Table 1: Comparison of different mobile TCP solutions.

to such a loss. It is also noteworthy that snoop *maintains* end-to-end TCP semantics because it simply forwards ACKs generated by the MH.

Unfortunately, snoop does not perform as well either in the presence of lengthy disconnections or in environments where there are frequent disconnections. If the mobile is disconnected for a lengthy period of time, the sender will automatically invoke congestion control because it will not have received ACKs for some segments. The snoop module will generate persist packets every 200 msec but, since the mobile is disconnected, these packets will serve no purpose.

A related problem with snoop is its behavior in the presence of frequent handoffs. When a MH moves into a new cell, the new MSS starts up a copy of the snoop module on behalf of this MH. This snoop module starts out with an empty cache and slowly builds the cache up. Thus, while the snoop module is building up its cache, the MH will see poor TCP throughput since snoop cannot yet perform any useful retransmission or filtering functions. If we assume that cell sizes are small (as they will be in picocellular and microcellular environments), we see that the performance degradation can be serious. A solution proposed to this problem is to use 'soft handoffs' where the MH continues receiving data from the old MSS while the new MSS builds up its cache. A problem with this solution is the assumption that the mobile will move into a specific new cell when it moves out of its current cell. It is quite likely that the mobile may move into one of many adjacent cells. Thus, in order for the above solution to work, the MSSs in *all* adjacent cells will need to begin running the snoop module *in anticipation* of the MH wandering in. In effect, each MSS runs a snoop module for MHs located in its own cell as well as in all adjacent cells! The processing and buffering overhead is clearly too high for this solution to be practical.

The fast retransmit solution [12] was designed specifically to combat the effects of short disconnections on TCP throughput. If we assume that one or two packets were lost due to a disconnection and if the RTO at the sender is large, it is clear that this solution works very well since the sender is forced to retransmit one packet as soon as the MH finishes handoff. Unfortunately, if the MH was disconnected for a long time, the sender would already have invoked congestion control and shrunk its window to one segment. Thus when the MH sends three duplicate ACKs, the sender will only retransmit the one segment in its window. The congestion window will have to grow slowly – in effect the behavior of this protocol is no different from unmodified TCP. Similarly, if disconnections are frequent or if the wireless environment is lossy, this scheme will do little to improve throughput because the sender's congestion window will repeatedly get shrunk to half its previous size.

We summarize the performance of all these protocol in Table 1. The last column refers to the M-TCP protocol presented in this paper and we will justify its columnar entries later in the paper.

2.3 Other Solutions

Most other solutions that have been proposed to improve wireless throughput focus on the link layer. Some schemes attempt to allievate the problem of losses over the wireless link by using FEC codes or by employing ARQ (automatic repeat request) messages [17] – the MH requests retransmissions of specific messages that were corrupted. The AIRMAIL [2] protocol is one good example of an approach that uses both of these techniques. The drawback to using link layer solutions is that they *cannot account for disconnections*. Thus, even though link layer solutions succeed in reducing the observed BER, they can do little to prevent TCP from timing out when an ACK does not arrive on time (because the MH was disconnected). We believe that link layer solutions, in combination with our own M-TCP protocol, provide the best solution for improving TCP throughput – the link layer solutions reduce the loss rate due to bit-error while our protocol ensures that the sender does not react negatively to disconnections and low (or variable) wireless bandwidth.

RED HAT 1008
RED HAT V. CAS

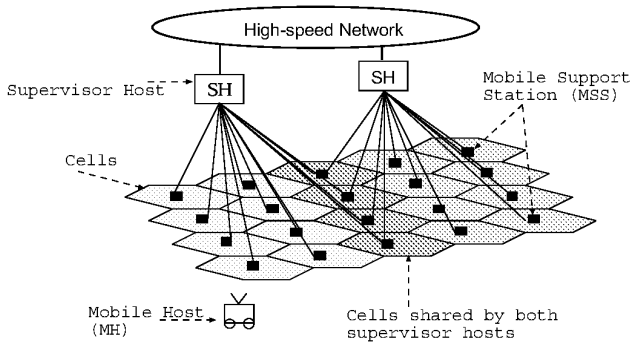


Figure 2: Proposed Architecture.

3 Underlying Architecture

The implementation of M-TCP was influenced, to some degree, by the mobile network architecture we have been developing at the University of South Carolina. The detailed architecture is presented in [10] and in this section we briefly summarize the main points. Our architecture may be viewed as a three-level hierarchy (see Figure 2). At the lowest level are the mobile hosts (MH) who communicate with MSS nodes in each cell. Several MSSs are controlled by a machine called the Supervisor Host (SH). The SH is connected to the wired network and it handles most of the routing and other protocol details for the mobile users. In addition it maintains connections for mobile users, handles flow-control and is responsible for maintaining the negotiated quality of service. These SHs thus serve the function of *gateways*. Why did we opt for a 3-layer architecture? Some of the reasons are:

1. The MSSs are simple cheap devices that only serve as connection end-points. The I-TCP, MTCP and snoop protocols, on the other hand, require a sophisticated MSS – this increases the cost of the cellular infrastructure particularly if we have small cell sizes as is the case for in-building picocellular networks.

2. When a MH roams from one cell into another, the two MSSs need not perform any state transfer if the two cells are controlled by the same SH. Observe that, if a SH controls a region containing n cells, there may only be $O(\sqrt{n})$ significant handoffs per unit time (i.e., when a mobile leaves a cell controlled by one SH and enters one controlled by another SH – the old SH will have to transfer the state of all the mobile's connections). Contrast this with the case where the MSSs manage all transport connections – here there will be $O(n)$ state handoffs per unit time (see [18]).

3. Since several MSSs are controlled by a single SH, the roaming MH remains within the domain of the same SH for long time periods[1]. This makes it easier to manage the MH's connections and ensures that any MH state maintained at the SH need only be moved infrequently.

One drawback of this architecture is the complexity of the SH. In particular, if one SH manages several cells, we need to ensure that it can handle all connections that may originate from mobiles located in these cells. In section 6 we examine this issue in some more detail.

3.1 Transport Layer Design

The design of our transport layer was influenced by the following constraints unique to the mobile environment:

- Available bandwidth within a cell may change dynamically (because it is impossible to control the number of users per cell). This leads to difficulties in guaranteeing QoS parameters such as delay bounds and bandwidth guarantees.

- Mobile hosts frequently encounter extended periods of disconnection (due to handoff or physical interference with the signal) resulting in significant loss of data causing poor TCP and UDP throughput.

[1] e.g., a MH may roam frequently between rooms in an office building but remain for many hours within the building – each room is a cell and all cells in the building are controlled by one SH.

RED HAT 1008
RED HAT V. CAS

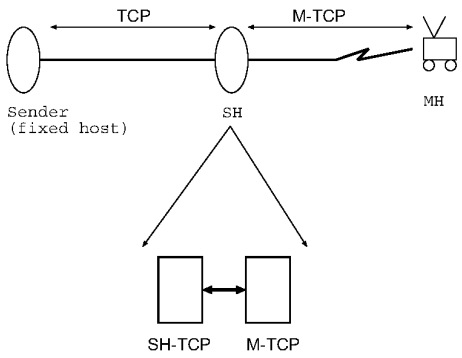


Figure 3: Setting up a TCP connection.

- Mobile devices are battery powered and hence power is a scarce resource. Protocols designed for use on mobile platforms must therefore be tailored to be power-efficient.

All of these factors point towards using transport protocols which are optimized specifically for the wireless link. It is not reasonable, however, to assume that the entire installed network base will (or should) upgrade to these mobile-friendly protocols as they may never have occasion to communicate with a mobile user. Hence, the obvious solution is to split transport connections in two. The existing protocols may continue to be used on the fixed network, and the protocols optimized for the wireless environment may be used in the mobile subnetworks. In our system, all connections set up by a MH, where the other endpoint is either another MH or is a fixed host, are split at the SH. Thus, the service-provider sets up a connection with the SH assuming the SH is the other end-point of the connection. The SH sets up another connection to the MH. This allows us to address the problems listed above as follows:

- A *bandwidth management module* at the SH (see [10]) assigns a fixed amount of bandwidth to each connection (this is recomputed periodically based on the changing needs of other MHs) and ensures that data is transmitted to all MHs at their assigned rate. This mechanism allows us to implement some limited form of QoS guarantees.
- In our architecture, the SH performs local error recovery to combat the efficiency problems resulting from loss over the wireless link.
- The SH tracks mobiles as they roam and uses this information to ensure that the number of duplicate packets transmitted to the mobile are kept small. Since every packet received by the MH has to be processed, consuming battery power, keeping the number of duplicates small reduces power consumption at the MH.

4 Design of M-TCP

Our goal in developing the M-TCP protocol was to provide a general solution to the problem of improving TCP's efficiency for mobile computing applications. Specifically, we wanted to design a protocol that had the following characteristics:

1. Improve TCP performance for mobile clients.
2. Maintain end-to-end TCP semantics.
3. Be able to deal with the problems caused by lengthy disconnections or by frequent disconnections.
4. Adapt to dynamically changing bandwidth over the already starved wireless link.
5. Ensure that handoffs (as a mobile roams) are efficient.

To this end we chose to use the *split connection* approach for implementing M-TCP because it fits in well with our general design philosophy articulated in the previous section and because it allows us to modify TCP on the mobile network to make it respond better to disconnections and low (or varying) wireless bandwidth.

RED HAT 1008
RED HAT V. CAS

Thus, every TCP connection is split in two at the SH. The TCP sender on the fixed network uses unmodified TCP to send data to the SH while the SH uses our version of TCP for delivering data to the MH. Figure 3 illustrates the manner in which a TCP connection gets split. The TCP client at the SH (called SH-TCP) receives segments transmitted by the sender and it passes these segments to the M-TCP client for delivery to the MH. ACKs received by M-TCP at the SH are forwarded to SH-TCP for delivery to the TCP sender. In the remainder of this section we discuss the behavior of SH-TCP and M-TCP in detail. Before doing so, however, we briefly discuss our assumptions regarding the mobile networking environment.

Wireless bandwidth will always be a precious resource and we therefore believe that it ought to be allocated to users based on their need. In our architecture, we use a bandwidth management module (see [10]), that resides at the SH, to perform this task. This module determines the amount of bandwidth to be allocated to each connection within each cell (unfortunately, a discussion of the implementation of this module is beyond the scope of this paper). Thus, when a mobile opens a TCP connection, it is allocated a fixed amount of bandwidth (this amount may change periodically depending on the needs of other mobiles and the current status of this mobile's connection). What implication does this have for the design of TCP? Clearly, since the bandwidth allocated to the mobile is fixed, there is little reason to implement TCP's sophisticated congestion control mechanisms between the SH and MH. A second assumption we make in our development is that the bit error rate visible at the transport layer will be small. This assumption is based on two observations: first, [14] notes that the BER over wireless channels is, in actuality, quite small (of the order of 10^{-5}) and, second, FEC and link-layer mechanisms can further reduce the observed bit error rate. Thus, we felt it necessary to design a TCP protocol that handles unremedied problems – disconnections and low-bandwidth – rather than a protocol that works well only in high BER environments.

4.1 The SH-TCP Client

When SH-TCP receives a segment from the TCP sender, it passes the segment on to the M-TCP client. However, unlike I-TCP and MTCP, it does not ACK this data until the MH does. SH-TCP is notified of MH ACKs by the M-TCP client running at the SH. It is easy to see that this behavior ensures that *end-to-end TCP semantics are maintained.* However, how do we ensure that the sender does not go into congestion control when ACKs do not arrive (because the MH was temporarily disconnected and did not receive the data, or could not send the ACKs)? Our approach is to **choke** the TCP *sender* when the MH is disconnected, and allow the sender to **transmit at full speed** when the MH reconnects by manipulating the TCP sender's window. Specifically:

- Let W denote the currently advertised receive window at SH-TCP. Say the window contains $w \leq W$ bytes. Assume that the MH has ACK'ed bytes up to $w' \leq w$. SH-TCP sends an ACK (or ACKs) for bytes up to $w' - 1$ in the normal way. As and when the MH ACKs more data, more ACKs are generated but one last byte is always left unacknowledged.

- Say the MH disconnects after having ACK'ed bytes up to w'. The M-TCP client assumes that the MH has been temporarily disconnected because it stops receiving ACKs for bytes transmitted after w'. M-TCP sends an indication of this fact to SH-TCP who then sends an ACK for the w'th byte to the sender. This ACK will also contain a TCP window size update that **sets the sender's window size to zero**. When the TCP sender receives the window update, it is forced into *persist* mode. While in this state, it will not suffer from retransmit timeouts and will not exponentially back off its retransmission timer, nor will it close its congestion window [2].

  Note that as long as the SH-TCP sends ACKs for the persist packets sent by the TCP source, the state of the sender does not change no matter how long the disconnection period lasts.

- If the MH has not disconnected but is in a cell with very little available bandwidth, SH-TCP still sends an ACK for byte w' with a window size set to 0. SH-TCP estimates the round trip time (RTT) to the TCP sender and estimates the RTO interval. It uses this information to preemptively shrink the sender's window before the sender goes into exponential backoff (to implement this scheme, we maintain a timer at the SH that is initialized to this estimated RTO value).

- When a MH regains its connection, it sends a greeting packet to the SH (see [16]). M-TCP is notified of this event and it passes on this information to SH-TCP which, in turn, sends an ACK to the sender and reopens its receive window (and hence the sender's transmit window). The window update allows the sender to leave

[2] RFC 1122 states that TCP clients go into persist mode when the window is shrunk to zero. However, in order to shrink the window to zero, the receiver must send a *new ACK*. This is why we hold on to the last byte at SH-TCP. To grow a window, however, we can retransmit an old ACK.

RED HAT 1008
RED HAT V. CAS

persist mode and begin sending data again. Since the sender never timed out, it never performed congestion control or slow-start. *Thus the sender can resume transmitting at full-speed!* The sender *will* begin sending from byte $w+1$ here though, possibly duplicating previous sends, so we don't want to shrink the window more often than necessary.

A potential problem with this protocol is the following: say the sender only sends data to the MH occasionally. Specifically, if the sender only needed to send bytes 0 to 50 to the MH, according to our protocol, SH-TCP will ACK bytes up to 49 but will not ACK byte 50. This will cause the sender to timeout and retransmit this byte repeatedly. Eventually, after 12 retransmissions, the TCP sender will give up and quit! This is clearly an undesirable situation. We handle this problem by not allowing SH-TCP to shrink the sender's window if it believes that there will be no more new ACKs from the MH that will allow it to open up the sender's window back up again. Thus, when SH-TCP thinks that the sender will timeout (and if the MH is in a cell with plenty of available bandwidth), it simply ACKs the last byte. At this point, there will be no saved byte at SH-TCP to allow it to shrink the sender's window. Observe that this is not a problem because the sender didn't really have any new segments to send to the MH. As and when the sender does transmit new data to the MH, SH-TCP reverts to its previously described behavior.

4.2 Design of the M-TCP protocol between the SH and MH

Our goal in designing SH-TCP was to keep the TCP sender's congestion window open in the face of disconnection events at the MH. On the wireless side, on the other hand, our goal is to be able to recover quickly from losses due to disconnections, and to eliminate serial timeouts.

In designing M-TCP, we use a scheme similar to SH-TCP except that we have more design freedom since we can modify the protocol at both ends of M-TCP. M-TCP at the mobile receiver is very similar to standard TCP except that it responds to notifications of wireless link connectivity. When M-TCP at the MH is notified (by the communications hardware) that the connection to its MSS has been lost, it freezes all M-TCP timers. This essentially ensures that disconnections do not cause the MH's M-TCP to invoke congestion control. Observe that neither acknowledgements nor data are lost during a disconnection. When the connection is regained, M-TCP at the MH sends a specially marked ACK to M-TCP at the SH which contains the sequence number of the highest byte received thus far. It also unfreezes M-TCP timers to allow normal operation to resume.

At the SH we need to ensure that M-TCP monitors link connectivity and takes appropriate action either when a disconnection occurs or when a reconnection occurs. How does M-TCP determine that the MH has been disconnected? In our design M-TCP monitors the flow of ACKs from the MH in response to segments transmitted on the downlink. If it does not receive an ACK for some time, it automatically assumes that the MH has been disconnected. It then informs SH-TCP of this fact and SH-TCP reacts by putting the TCP sender in persist mode. M-TCP at the SH knows when the MH reconnects because M-TCP at the MH retransmits the last ACK, and marks it as a reconnection ACK, on being reconnected. M-TCP responds by informing SH-TCP who reopens the sender's transmit window. This behavior is based on our assumption that the bandwidth management module at the SH assigns bandwidth to each connection and regulates its usage so there is no need to invoke congestion control at the SH when ACKs are not received from the MH. M-TCP at the SH works as follows:

- When a retransmit timeout occurs, rather than retransmit the segment and shrink the congestion window we force M-TCP into persist mode. We assume the absence of an ACK means that the mobile receiver has temporarily disconnected, hence retransmissions are futile until the MH notifies the SH that it has reconnected.

  At first glance our implementation may appear to have a problem when operating in high BER environments. This is because a significant proportion of packet loss in such environments will be due to the high BER and not due to disconnections. We respond to this observation by making two points:

  - We believe that in most mobile environments link layer solutions will ensure that the bit error seen at the transport layer is small.
  - Even if the mobile environment does have high BER, the M-TCP sender will come out of persist mode quickly and resume regular data transmissions. This is because, when in persist mode, M-TCP will send persist packets to the MH who will be forced to respond when it receives these packets. Currently, the persist packets are generated at increasing intervals starting at 5 seconds and doubling until the interval becomes 60 seconds. We could change the interval to be equal to the RTT between the SH and the MH to ensure earlier recovery (we have not implemented this simply because of our assumption of low BER).

RED HAT 1008
RED HAT V. CAS

- When the SH receives a specially marked reconnection ACK, it moves back out of persist mode and retransmits all packets greater than the ACK'ed byte as these must have been lost during the disconnection. If the SH misinterpreted a lengthy delay as a disconnection, the MH will eventually ACK the transmitted packets, which will also move the SH M-TCP out of persist but will not cause all packets to be retransmitted.

Since M-TCP at the SH begins sending again immediately each time it is notified that the MH has reconnected, it recovers immediately from disconnections. Since it does not rely on the retransmit timer except to eliminate duplicate sends, and never backs off the timer in any case, serial timeouts are eliminated. Finally, since M-TCP relies on the SH's regulation of bandwidth and not the congestion window, it always sends at the maximum rate possible.

4.2.1 Enhancements to M-TCP: Compressed M-TCP

Another problematic aspect of the wireless link is the low (and possibly varying) bandwidth available to the mobile. We have added an option to allow data compression in order to make more efficient use of the limited wireless bandwidth. If the option is enabled, the data portion of each downlink M-TCP packet is compressed at the SH before transmission and decompressed at the mobile receiver.

4.3 Benefits of our Approach

What are some benefits of our approach?

- Clearly, end-to-end TCP semantics are maintained.
- The efficiency of the TCP connection is not degraded due to disconnections since the sender is prevented from going into exponential backoff and slow-start (this is even true for arbitrarily long disconnections – e.g., Metricom's Ricochet network where disconnections are as long as 1 minute).
- The sender's timeout estimate is based on the round trip time to the MH (including effects of disconnections). This means that the timeout intervals at the sender will be more 'realistic' causing fewer unnecessary retransmissions over the wireline networks. This also ensures that the sender's transmission rate adapts to the available wireless bandwidth.
- If the MH moves from the domain of one SH into the domain of another SH, the old SH does not need to forward the socket buffers (as in I-TCP). When the MH temporarily disconnects while moving between the two SHs, the old SH's SH-TCP shrinks the TCP sender's window to zero. When the MH connects to the new SH, SH-TCP at the new SH grows the sender's window to its full size which causes the sender to automatically retransmit all outstanding segments to the *new SH*. Thus, only a small amount of state is transferred from the old SH to the new SH (2 tcpcbs and inpcbs and 1 mtb) – no more than 500 bytes in all. It is noteworthy that, in contrast to our protocol, transfer of large socket buffers in I-TCP [3] may take as long as 1.5 seconds (see [4]).
- Serial timeouts and the accompanying periods of inactivity are avoided by disabling exponential backoff in M-TCP.

Observe that M-TCP is more efficient than TCP because the sender is spoofed into transmitting data to the SH at the rate at which data can be delivered to the MH. In addition, the problems associated with using TCP in a mobile environment are avoided.

5 Implementation of M-TCP

In this section, we examine implementation issues and the protocol in more detail. Again, consider the TCP to SH-TCP portion of the connection first. Figure 4 shows the state diagram of SH-TCP's window shrink control functions. WS is the window state, and the wintimer is the SH's timer controlling the sending of window shrink updates to the TCP sender. In most cases, SH-TCP resides in the NOSHRINK state, and an M-TCP ack for byte x generates a TCP ack for byte $x - 1$. Normally, when the timer expires, SH-TCP sends a window shrink update to shrink the TCP sender's window to 0 forcing it into persist state. However, SH-TCP **does not** shrink the window if:

RED HAT 1008
RED HAT V. CAS

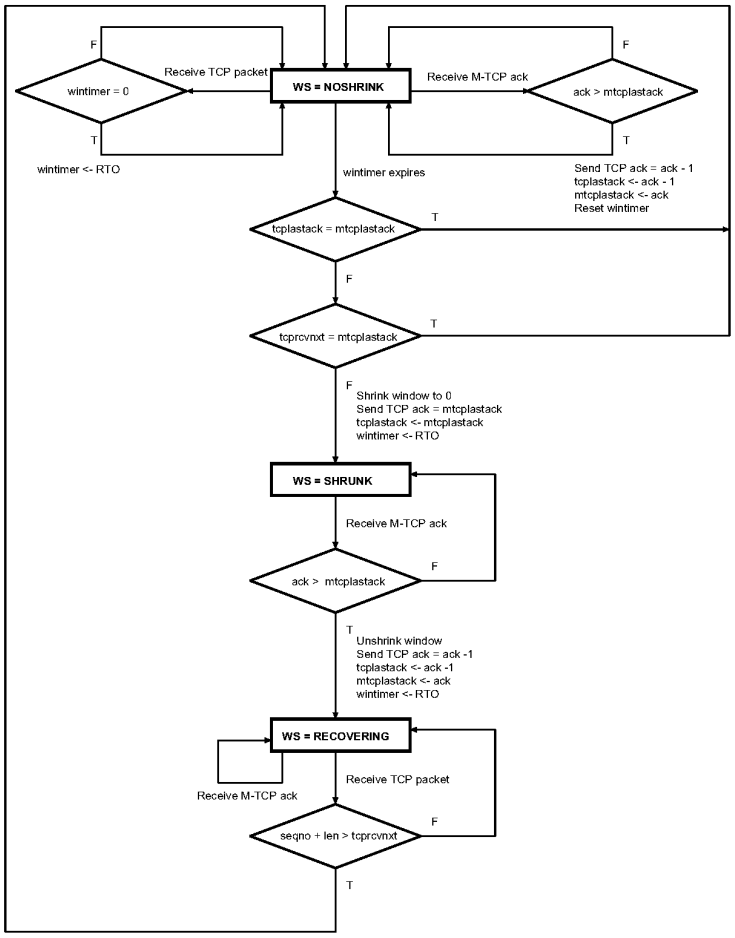


Figure 4: SH-TCP window shrinking causality.

- It has already acknowledged all the data to the TCP sender and thus has no unacknowledged bytes to use to shrink the sender's window. Note that window window shrinks are ignored unless accompanied by a **new** acknowledgement.
- Or if the saved byte will end up acknowledging all the data SH-TCP has received. In this case, SH-TCP just acknowledges the last byte without shrinking the window. This ACK will reset (or clear) the REXMT timer at the TCP sender. This scheme ensures that SH-TCP acknowledges everything in a timely manner in the event that the TCP sender has no further data to send (but does not end the connection). If it so happens that there is outstanding data, but SH-TCP has not received it, the acknowledgement at least keeps the TCP sender from invoking congestion control for another RTO.

In all other cases, expiration of the wintimer moves SH-TCP to the SHRUNK state. While in this state, SH-TCP acknowledges persist packets from the TCP sender but keeps the window size set to zero. When a new M-TCP acknowledgement is received, SH-TCP reopens the send window and moves into RECOVERING state. This state is necessary because many existing TCP implementations reset snd_max (the highest byte sent) to snd_una (the highest byte acknowledged) when they exit persist state. SH-TCP needs to ensure that it does not acknowledge a byte that is greater than the TCP sender's view of snd_max. Since SH-TCP very well may have received bytes higher than snd_una, it needs to keep track of the sequence numbers of incoming packets and only move back to the NOSHRINK state when its own view of snd_max is consistent with the TCP sender's. This state is unnecessary but benign for TCP implementations which do not reset snd_max.

RED HAT 1008
RED HAT V. CAS

5.1 M-TCP State Diagram

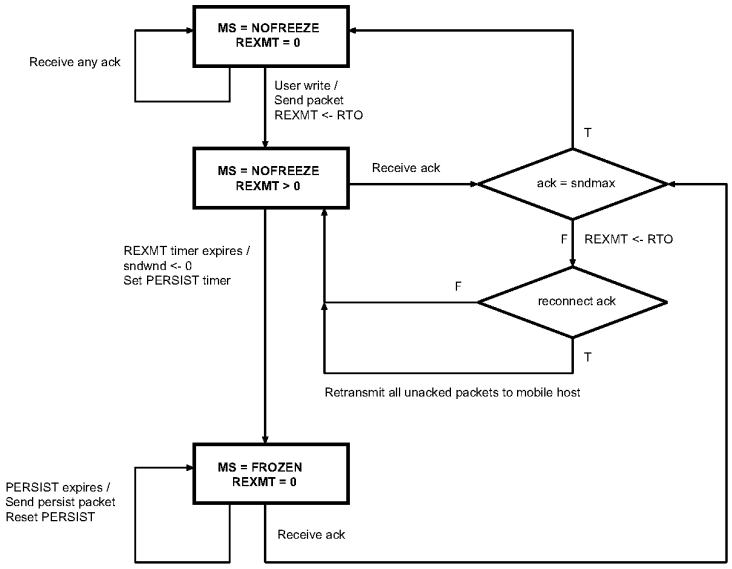


Figure 5: M-TCP timer freezing causality at the SH.

Now we consider the behavior of the M-TCP protocol (at the SH) on the wireless portion of the connection. Figure 5 shows a state diagram illustrating M-TCP's freezing functions (where freezing is equivalent to moving into persist state voluntarily). In most cases, M-TCP's state (MS) is NOFREEZE, either with a zero or non-zero REXMT timer depending on whether there is outstanding data to be acknowledged by the mobile receiver or not. When the REXMT timer goes off, rather than invoking congestion control, M-TCP voluntarily moves into persist state (MS = FROZEN). It then waits for an acknowledgement from the mobile receiver. Since, M-TCP at the SH only enters FROZEN state when there is unacknowledged data, the mobile will eventually send an acknowledgement to unfreeze it. There are two cases we need to consider:

- The MH really did temporarily disconnect, in which case it will generate a specially marked acknowledgement on reconnection. This moves M-TCP at the SH back into NOFREEZE state and causes it to retransmit all unacknowledged bytes.

  We use an unused combination of TCP flags in a standard TCP acknowledgement packet to allow the MH to signal its reconnection to the SH.

- The MH did not disconnect, in which case it will acknowledge the data the SH sent it. Again, this moves the SH back into NOFREEZE state but does not cause it to resend packets thus keeping the number of duplicates small.

Note that in either of these cases, the acknowledgement may be lost. Again, two methods for recovery are available. If the MH moves through another cycle of disconnection and reconnection, it will generate another specially marked acknowledgement. Otherwise, the MH stays connected in the same cell, allowing it to respond when M-TCP at the SH sends a persist packet. Thus, M-TCP at the SH recovers whether the MH moves or not.

5.2 Implementation Notes

M-TCP/SH-TCP Interaction

M-TCP and SH-TCP communicate through a shared data structure, the mtb (M-TCP transition block), which tracks the last acknowledged byte in each direction, the state of the connection on the fixed and wireless segments, the window shrink and freeze state, and other information pertinent to the connection. When passing application data from one protocol stack to the other, an attempt was made to make this process as efficient as possible. No extra copies were introduced at this stage. Mbufs are moved directly from the incoming socket buffer of one protocol to

RED HAT 1008
RED HAT V. CAS

the outgoing socket buffer of the analogous protocol. Note that TCP's (and hence M-TCP's) reliable delivery feature requires that a copy be done when actually *sending* a packet. Hence, in comparison to a router which would just pass the packet through, SH-TCP/M-TCP does one additional copy.

Handoff

Transfer of state is actually handled by the handoff module that is incorporated within out transport layer design (see [10]). When handoff begins, M-TCP is notified and the send window is shrunk on the TCP side. Next, some of the state regarding the connection is serialized at the old SH and passed to the new SH. At the new SH, the connection state is unserialized, and the TCP send window is re-opened. Note that the contents of the socket buffers (which can be quite large) are *not* serialized or transferred – they are discarded. The new SH reopens the send window at the TCP sender after handoff is completed. Thus, the TCP sender retransmits a full window worth of packets to the new SH. This approach makes for very fast handoffs at the expense of additional retransmissions on the fixed network. Serialization and unserialization require several functions at the SH including:

- Freezing of connection state.
- Removal of inpcbs and tcpcbs without affecting connection state.
- Spontaneous generation of inpcbs and tcpcbs in connected states.
- The ability to bind inpcbs to non-local addresses.
- Unfreezing of connection state.

5.3 Design Decisions

5.3.1 Connection Setup

When initially setting up the split connection, an order for completion must be determined. For a connection originating on the fixed network (the order for a connection originating on the mobile subnetwork is symmetric) there are two alternatives:

- Complete the TCP connection between the fixed host and the SH. Then initiate and complete the M-TCP connection between the SH and the MH.
- Complete the connections on both halves in lock-step. In other words, when the SYN packet is received from the fixed host, send a SYN packet to the MH. When the SYN/ACK is received from the MH, send a SYN/ACK to the fixed host. Continue until both segments of the connection are completed.

We chose the former option because it allowed a cleaner separation of the two protocols. If a mobile receiver moves during the connection setup phase, handoff of state to a new SH is simplified if only one segment of the connection is incomplete.

Another decision we made was to make the SH's presence transparent to the TCP sender in the fixed network from the addressing point of view. On connection setup, the SH creates sockets whose local addresses are bound to the TCP sender's address and to the MH's address. In this way, the TCP sender always sends to the MH's address, and the MH always sends to the TCP sender's address.

5.3.2 Wintimer Settings

The wintimer is used to determine when to send a window shrink update to the TCP sender. As such, it should expire at a time giving the SH the opportunity to generate a packet, and for the packet to propagate to the TCP sender before the sender times out and invokes congestion control. Assume that the TCP sender REXMT timer is set to F_{TCP}RTO, which is based on the sender's estimate of the round-trip propagation delay (RTT) between itself and the MH. Since the SH is situated between the TCP sender and the MH, it has RTT and hence RTO estimates for both segments of the connection (S_{TCP}RTO and S_{M-TCP}RTO) and can thus estimate the TCP sender's RTO. We assume that $F_{TCP}\text{RTO} \approx S_{TCP}\text{RTO} + S_{M-TCP}\text{RTO}$.

How can this information be used to set the wintimer? Let us say that the sender generated a new segment at time 0. Its retransmit timer is set to go off at time F_{TCP}RTO. We can assume that the packet takes $F_{TCP}\text{RTO}/2$

RED HAT 1008
RED HAT V. CAS

time to propagate to the SH. The SH forwards the packet to the MH and hopefully receives an ACK. The total time elapsed (counting from time 0) is thus F_{TCP}RTO/2 + S_{M-TCP}RTO. The ACK is forwarded on to the sender and arrives at time F_{TCP}RTO preempting a retransmit event. If, however, the SH did not receive an ACK within time S_{M-TCP}RTO, it needs to send a window shrink message to the sender so that it arrives before the retransmit timer goes off. Therefore we need to set wintimer to S_{M-TCP}RTO whenever a new segment arrives at the SH.

5.3.3 Selective Acknowledgements (SACK)

We have chosen not to implement SACK at this time. Although SACK has been shown to be very effective against high BER, its effect on disconnections is likely to be marginal. Note that since the mobile host acknowledges the highest byte received in the end-of-disconnection ack the only scenario where selective acks could be useful is as follows:

1) SH begins sending packets.

2) MH goes into fade and comes back out before SH transmits 1 window worth of packets.

3) MH receives some packets at the end of the window.

4) MH can use SACK so that SH need not retransmit packets at end of window.

Since fades are relatively long, this situation is unlikely to happen very frequently. Hence SACK is of limited benefit when dealing with disconnections.

5.3.4 Presence of Slow-Start Mechanism in M-TCP

We have chosen not to shrink the congestion window (on M-TCP at the SH) on timeout, since these timeouts are caused by disconnections and not congestion. As a result, slow-start behavior is limited to the beginning of a connection. It may also be beneficial to remove congestion control, and hence slow-start, at this point. Since the SH controls bandwidth allocation for each MH, the ramping-up of throughput to test bandwidth availability is unnecessary. For large data transfers, the presence or absence of congestion control will have little effect on delay, but small data transfers may benefit from the complete removal of congestion control.

6 Performance Measurement

We implemented M-TCP in the NetBSD kernel and in this section we discuss the performance of our implementation. Our goal in running the various experiments was to examine M-TCP's performance and, in addition, to determine if the gateway approach we have adopted could be a potential bottleneck in the deployment of large-scale mobile networks. Specific questions we looked at were:

1. How well does M-TCP perform in environments where the mobile is subjected to frequent disconnection events? How does it perform when the wireless bandwidth available is low? Performance was measured as the time taken to transfer large files.

2. How do losses over the wired Internet affect M-TCP's performance? If the loss over the Internet is high we expect disconnection events and high BER over the wireless link to have a much smaller impact on end-to-end TCP performance.

3. What is the performance gain if the SH compresses data? Note that if wireless bandwidth is at a premium, it may be a good idea to employ compression. However, the processing cost at the SH will increase substantially.

4. How many duplicates does the MH receive? This measures the extra amount of processing that the MH will have to perform. Since processing consumes battery power, we would like to keep the number of duplicates received to a minimum.

5. What is the processing overhead at the SH? This overhead will include the extra checksum computation by SH-TCP and M-TCP and extra data copies (if any). Based on the processing overhead, we can determine if the gateway approach is scalable to large mobile networks.

RED HAT 1008
RED HAT V. CAS

In order to evaluate the performance of our protocol, we used the experimental testbed shown in Figure 6. As illustrated, the SH and MSS code run on a single Pentium PC. The MH code runs at another Pentium PC that is connected on an isolated ethernet to the SH. We employed two different senders for the experiment. The close sender was located 5 hops away (connected via ethernets) and the distant sender was located 15 hops away. In order to emulate[3] a low-bandwidth downlink (32kbps) we modified the IP code at the SH as follows. All calls to ip_output() are intercepted and then, based on the link speed and packet size (including TCP and IP headers), a timer is set to go off each time a packet can be sent on the wireless link. At each timeout one packet is removed from a link queue and ip_output() is called normally. We emulated a low-bandwidth uplink from the MH to the SH by modifying the MH's IP code in a similar manner. In order to emulate disconnections, we modified the MH's IP code as follows. A MH may be viewed as either being connected or disconnected. We thus divide time into alternating periods of connection and disconnection. Packets transmitted to the MH during a disconnection period are discarded by IP at the MH. In addition, IP informs M-TCP at the MH of the disconnection event.

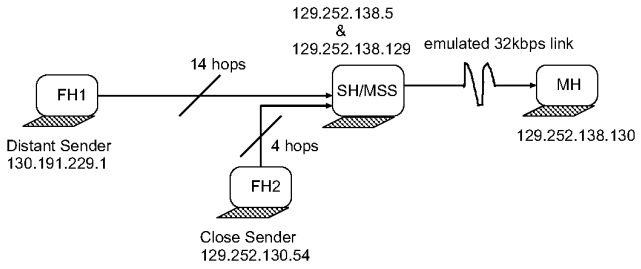


Figure 6: Experimental set up.

For our experiments we used a 32 Kbps downlink and a 8 Kbps uplink. In order to model disconnection events, for most of our experiments, we assume a cell latency mean of 5 seconds[4]. Disconnection length means varying from 0.5 to 4.5 seconds giving disconnections that range from from 10% to almost 50% of the cell latency[5]. If we transfer a 500KByte file over the 32kbps link, it takes 62.5 seconds. With a 5 second mean cell latency, the mobile will encounter approximately 12 disconnection events. Note that [3, 12] also use cell latencies and disconnection periods in the same range. For different experiments, the cell latency and disconnection lengths were chosen either from a standard normal distribution or from an exponential distribution.

In order to get a more complete picture of M-TCP's performance, we ran additional experiments using much longer cell latencies and disconnection intervals, typically of the order of minutes, to model the environment of large cells. However, while these results also show that M-TCP performs far better than TCP, we find them to be of limited interest because, if a mobile has a very long cell latency, it is likely that it will receive all of the data before encountering a disconnection event (except in the case of long data transfers). Furthermore, we expect cells to be relatively small in the future (to enable higher bandwidth wireless data access) implying much smaller cell latencies and disconnection intervals (as we discussed in the previous paragraph).

6.1 M-TCP Performance in the Wireless Environment

We tested M-TCP performance against TCP when the emulated wireless link described above was used. The time to transfer a file from a fixed host TCP sender to a mobile receiver was measured. In Figure 7 we plot file transfer time for 500K and 1MB files (respectively) against disconnection length where latency and disconnection length were normally distributed random variables and the TCP sender was 5 hops away. Here we can see that M-TCP performs much better than TCP across the range of disconnection lengths and perhaps, more importantly, is much more stable than TCP. As we can see by the 95% confidence intervals (each test was repeated 10 times), TCP transfer times varied quite widely and in fact some transfers failed to complete (the results from these tests were discarded), whereas M-TCP times were very consistent. Note also that M-TCP performance is close to optimal, where we calculate optimal times based on the assumption that the wireless link is the bottleneck, i.e., how long

[3]Emulating the wireless link in this manner gives us precise control over the available wireless bandwidth, disconnection events, etc.

[4]If a cell has a diameter of 100 meters (approximately one city block), then a car travelling at 60Kmph will have a cell latency of 6 seconds not including handoff delays, fades, etc.

[5]When a mobile moves into a new cell, it has to complete a handoff before the MSS can begin sending data. It is also possible that the new mobile may not receive any bandwidth in a crowded cell at all. Thus, it is reasonable to have disconnect period lengths of the stated range.

RED HAT 1008
RED HAT V. CAS

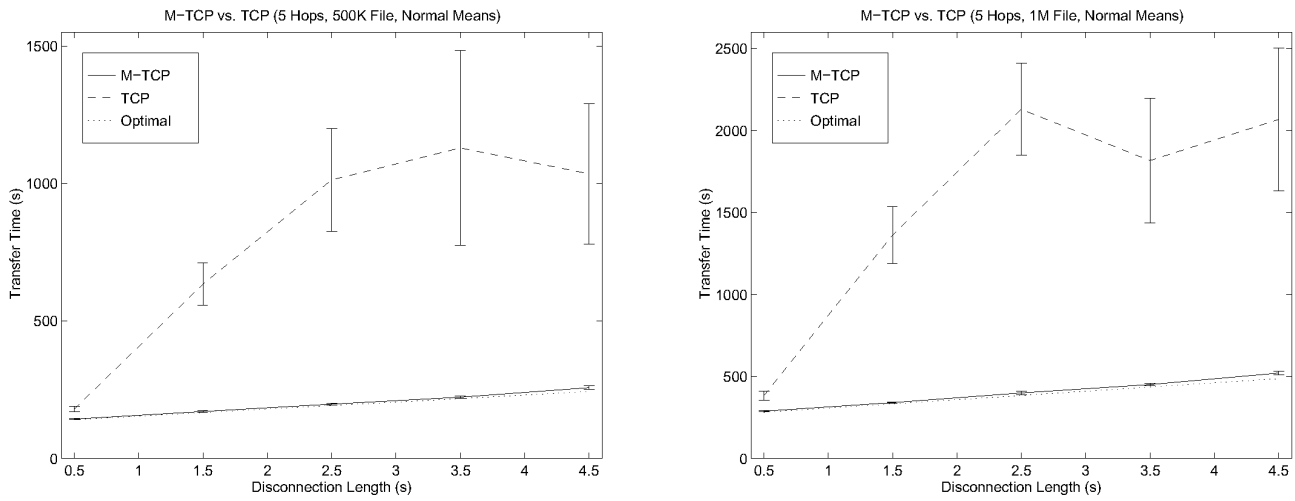


Figure 7: M-TCP vs TCP performance.

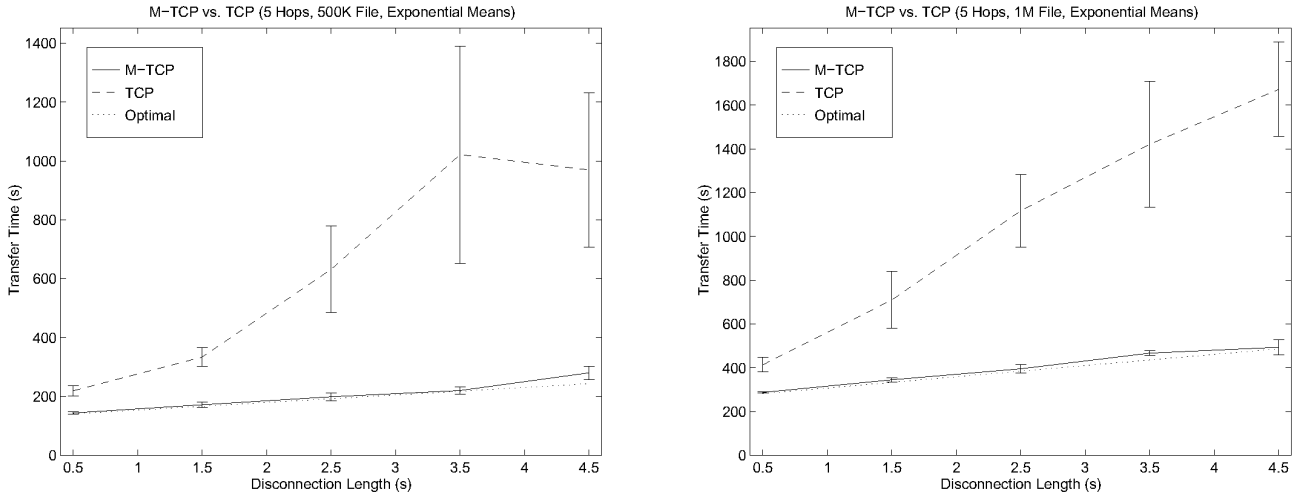


Figure 8: M-TCP vs TCP performance.

does it take to transfer a file over a 32 kbps link under disconnections of the given distribution. We obtain similar results for the exponentially distributed means, see Figure 8, although there was slightly more variation in M-TCP's performance.

In Figure 9, we plot M-TCP's transfer time against the optimal transfer time for 3 file sizes (100K, 500K and 1M) over 5 hops. The figure on the left shows the results of tests performed when the cell latency and disconnection length means were normally distributed, and the figure on the right shows results for exponential means. For both distributions, all three file sizes, and all disconnection lengths, M-TCP's performance is very close to optimal. It is interesting to observe that as the file size increases, the difference between M-TCP's transfer time and the optimal transfer time increases. This increase is due to the fact that more packets are transferred and each packet encounters additional processing delay at the SH. As we will discuss in section 6.4, processing delay is cumulative over several packets.

RED HAT 1008
RED HAT V. CAS

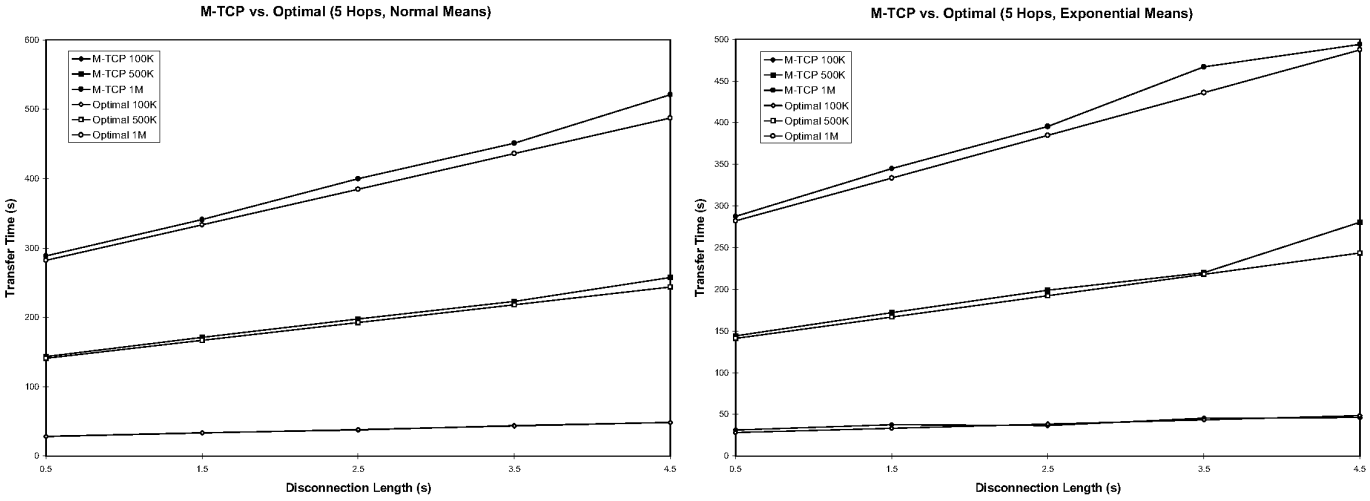


Figure 9: M-TCP vs. Optimal performance.

RED HAT 1008
RED HAT V. CAS

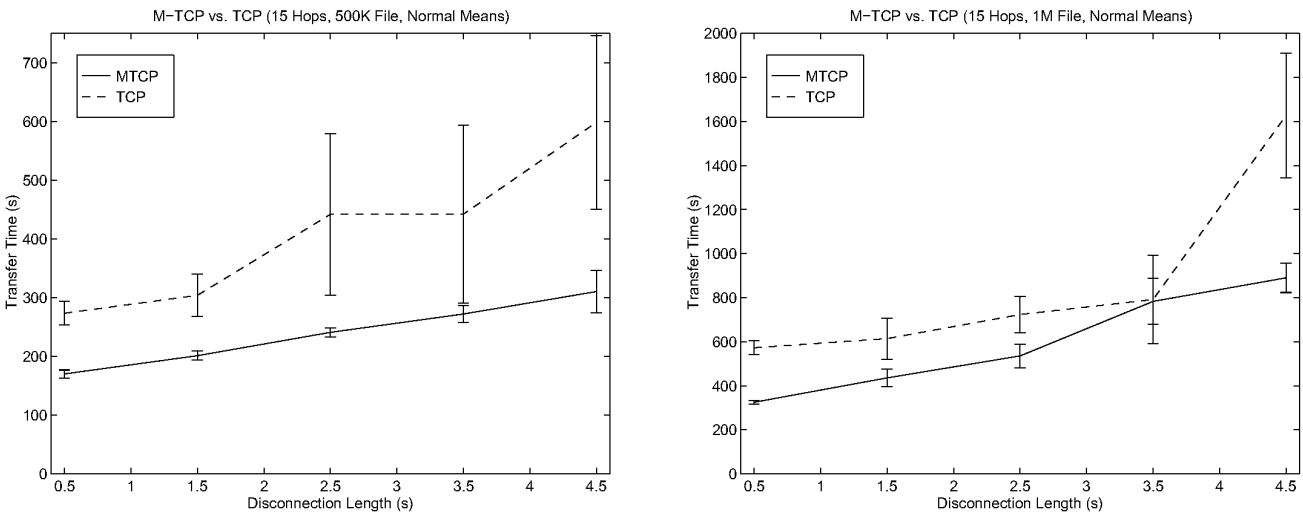


Figure 10: M-TCP vs TCP performance.

When we moved the TCP sender 15 hops away from the mobile receiver, a great deal more variation was observed in the performance of both, TCP and M-TCP. Figures 10 and 11 plot the transfer time against disconnection lengths for normal and exponential distributions respectively. In each figure, the graph on the left plots the results for a 500KB file transfer and the graph on the right plots the results for a 1MB file transfer. The variation appears to be caused by losses on the fixed network, which we had originally assumed to be fairly negligible. Upon further measurement, however, we found losses on the Internet to be substantial, even during times of light traffic. We found loss rates of 5.1% when sending independent bursts of 6 packets and loss rates of 23.8% when sending bursts of 32 packets (these results were obtained at night and the packets were sent by the FH1 in Figure 6). Loss rates during the daytime were much worse.

Losses in the fixed network require a fast retransmit or retransmit timeout at the TCP sender for recovery, both of which incur delays and which cause (at least partial) congestion control to be invoked at the sender. Due to this effect and the apparent random nature of these losses, M-TCP's relative performance gain is reduced and its variability increased. In most cases, however, M-TCP still performs much better than TCP and has much lower variability. Finally, note that for a lossy fixed network, we do not believe that the optimal transfer time can be modelled based only on the assumption that the wireless link is the bottleneck. Therefore, we have not plotted the optimal transfer time in the these graphs.

Finally, we conducted experiments to study the effect of very long cell latencies and disconnection periods on M-TCP's performance. We expected a smaller performance difference between TCP and M-TCP for these cases because, even though the TCP sender (in the case of unmodified end-to-end TCP) will shrink its congestion window to 1 due to repeated timeouts during the long disconnection period, it has plenty of time to grow the window back up to its maximum size after reconnection. Figure 12 plots the file transfer times for a 12MB file when the mean cell latency is 5 minutes and the mean disconnection length is 1 minute. As we can see M-TCP outperforms TCP for both, the close sender and the far sender cases. However the performance difference is less pronounced for the far sender case due to the higher error rate over the Internet.

6.2 Power used on the Mobile Host: number of duplicates received by the MH

Since mobile devices will be battery operated, power consumption at the mobile receiver is an important measure of protocol performance. We therefore determined the number of duplicates received per packet at the MH. Since each reception consumes power, duplicates should be kept to a minimum. Figure 13 shows the number of receives per byte for normal and exponential (respectively) distributions of cell latency and disconnection length means. While M-TCP generally sends fewer duplicates than TCP, the difference in the ratios (e.g., 1.02 vs. 1.06) is fairly negligible.

RED HAT 1008
RED HAT V. CAS

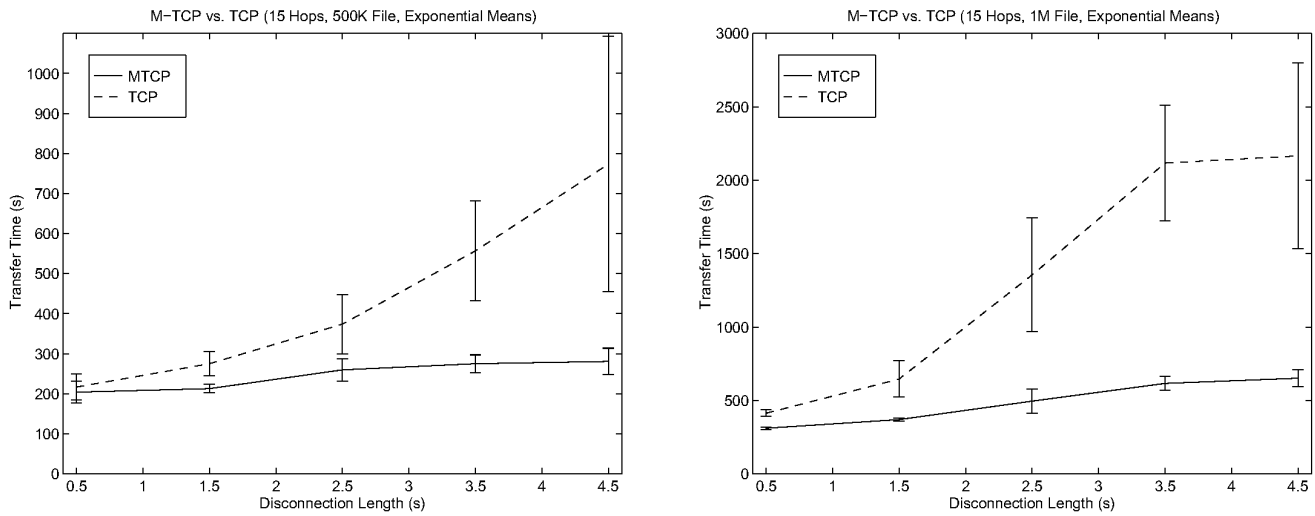


Figure 11: M-TCP vs TCP performance.

6.3 Dealing with a Slow Wireless Link : Compressed M-TCP

Another problematic aspect of the wireless link is its slow speed. This means that large file transfers take a long time, a problem which is only exacerbated by the effects of frequent disconnections. One possible scheme for reducing bandwidth usage on the wireless link is to implement M-TCP header compression, much like the TCP header compression used on SLIP links. Unfortunately, however, there may be problems with this scheme in the face of high BER and lost packets since SLIP header compression relies on incremental differences in consecutive packets. In addition, the packet size is not decreased by that much using header compression (40 bytes may be transformed to as few a 3 bytes) – 2% to 7% depending on packet size.

We believe that much higher gains can be had by compressing the data portion of the packet. We therefore have added data compression to M-TCP (as an option) to make more efficient use of the limited wireless bandwidth. The data portion of each downlink M-TCP packet is compressed before sending and decompressed at the mobile receiver. It is important to note, though, that processing costs at the SH may be prohibitive. Since the SH may maintain connections for many MHs, and compression is a cpu-intensive operation, it may not be possible to use compression on all open connections. We suggest that compression only be used on connections where the wireless bandwidth is very limited, and hence where the transfer time savings are especially large.

We implemented compression by using existing gzip code. Essentially, we pushed gzip down into the kernel, stripping off the user interface sections and reducing the encryption/decryption methods to one. We also threw out most of the gzip header (which is prepended to each packet) to save bandwidth on the wireless link.

Figure 14 shows processing times at the SH and the MH for compression and decompression (respectively) of packets ranging in size from 100 bytes to 1400 bytes. Gzip provides a compression level option which we varied from 1 to 9 (1 being the least amount of compression, 9 being the most). In fact, the compression ratio only changed by a few percent between the two extremes, probably due to the small size of the packets. The processing times do differ by a non-negligible amount, up to 500μs in some cases. Based on the tradeoff between processing time and compression ratio obtained, we decided to use a compression level of 3.

In Figure 15 we show file transfer times of a 1M file versus disconnection lengths for a TCP sender which is 5 hops away, for cell latencies and disconnection length means which are normally and exponentially distributed respectively. Original packet sizes were 1460 bytes. Compressed M-TCP outperformed M-TCP by a wide margin for both text and binary files. We can see that the binary files took longer to transfer than the text files because they did not compress as well, but both compressed types transferred much faster than uncompressed M-TCP. Figure 15 shows the results for a TCP sender which is 15 hops away. Compressed M-TCP still outperforms uncompressed M-TCP, but by a smaller margin. This is due to the fact that the packet size used in non-local connections is only 512 bytes, giving less opportunity for compression.

RED HAT 1008
RED HAT V. CAS

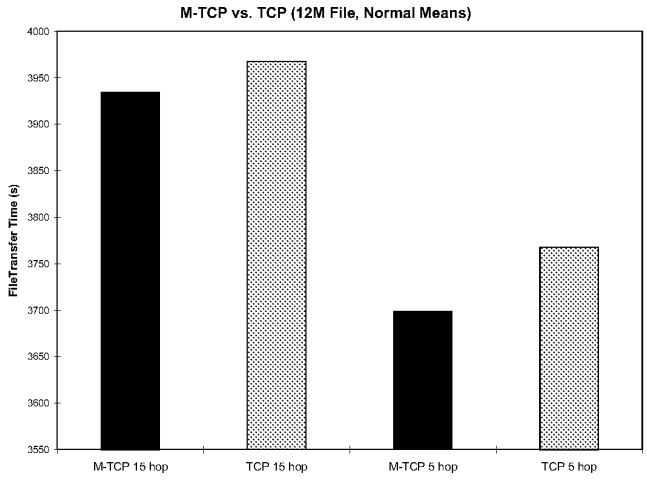


Figure 12: Relative performance of M-TCP and TCP for long cell latencies.

6.4 Justification of the Split-Connection Approach

Several criticisms, including extra processing overhead and potential delays have been aimed at approaches that use split-connections for implementing mobile transport protocols. We performed three different sets of experiments to refute these criticisms:

1. The first set of experiments measures the processing cost at the gateway nodes as a way to determine the feasibility of using the split-connection approach for deploying large-scale mobile networks.
2. M-TCP takes a small performance hit for small send buffer sizes. This is because there is a per-packet processing delay at the SH. With larger send buffer sizes, this cost is amortized over the window size. The second set of experiments illustrates this cost and justifies the 16K send buffer size we used in the previous section.
3. Finally, a macroscopic way of determining the total cost of using M-TCP is to run experiments *without wireless links and without disconnections*. If M-TCP fares better than TCP then, clearly, the delay incurred at the SH (by M-TCP) can be ignored.

A common argument against the split-connection approach is the extra processing (extra checksum computation as well as the extra data copies) required for each packet as it passes up to the transport layer and back down at the gateway, rather than just being routed through the network layer. In our implementation we eliminate any extra data copies when moving between socket buffers by passing pointers to the data. We added instrumentation to the kernel at the entry and exit points of IP and measured packet processing times for standard TCP packets, which were routed straight through, and for M-TCP packets, which passed through the transport layer. The processing times at the SH for packets of varying sizes are shown in the left-hand graph in Figure 17.

The TCP results include just IP processing and are steady around 31μs for all packet sizes. A larger packet size is necessary to see the effects of the IP checksum on processing time. M-TCP processing time grows with packet size from 91 to 112μs as expected. Subtracting the 31μs of IP processing (which is not entirely valid, since it includes ip_forward processing which does not apply to M-TCP packets), gives 60-81μs of transport-layer processing per packet. At 31μs per packet (1400 bytes each), a router could process 361 Mbps of IP forwarding traffic. At 112μs per packet, a gateway (Pentium PC) could potentially process 100 Mbps of MTCP data traffic (we are, of course, ignoring data transfer speeds within the PC itself).

We tested the file transfer time (for a 1MB file) of TCP and M-TCP using different send buffer sizes at the TCP source. These tests were conducted from the source 5 hops away, contain no disconnection events and run at full

RED HAT 1008
RED HAT V. CAS

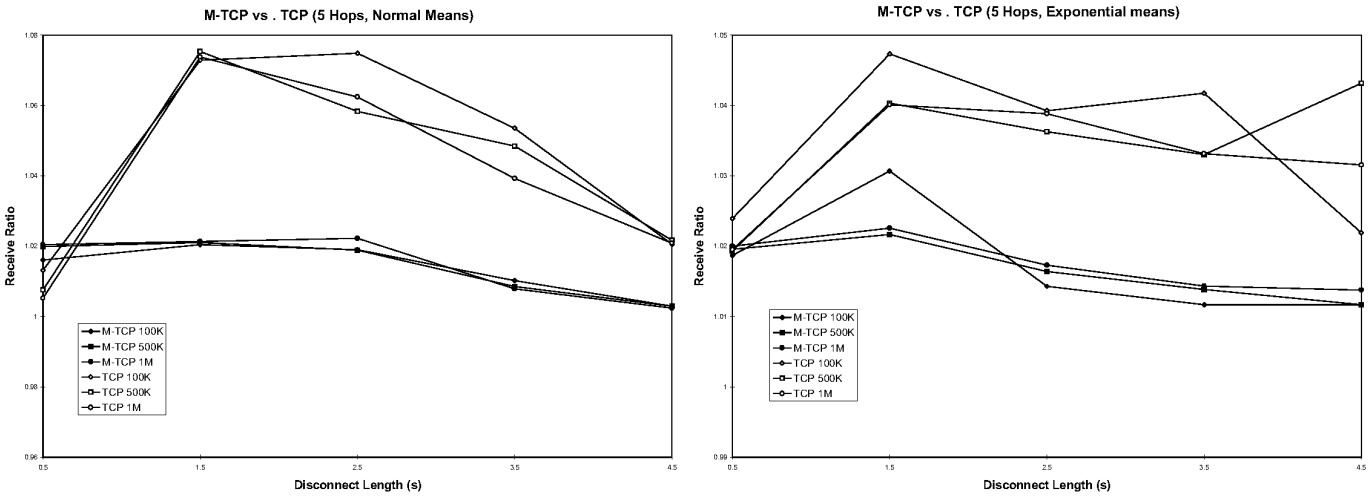


Figure 13: M-TCP and TCP receive rate performance.

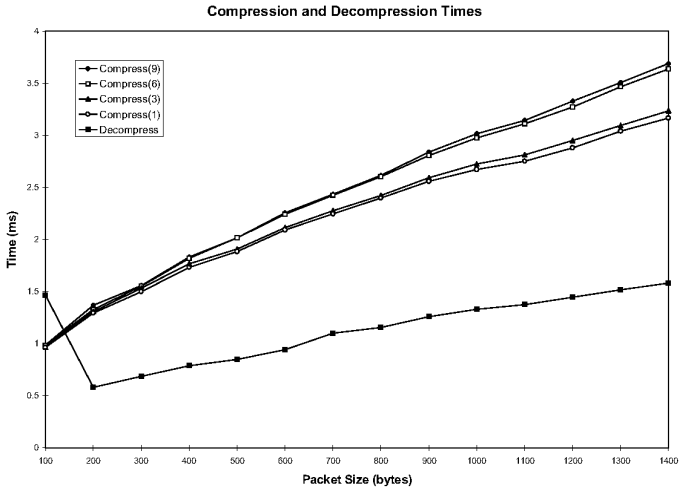


Figure 14: Compression and decompression times in M-TCP.

RED HAT 1008
RED HAT V. CAS

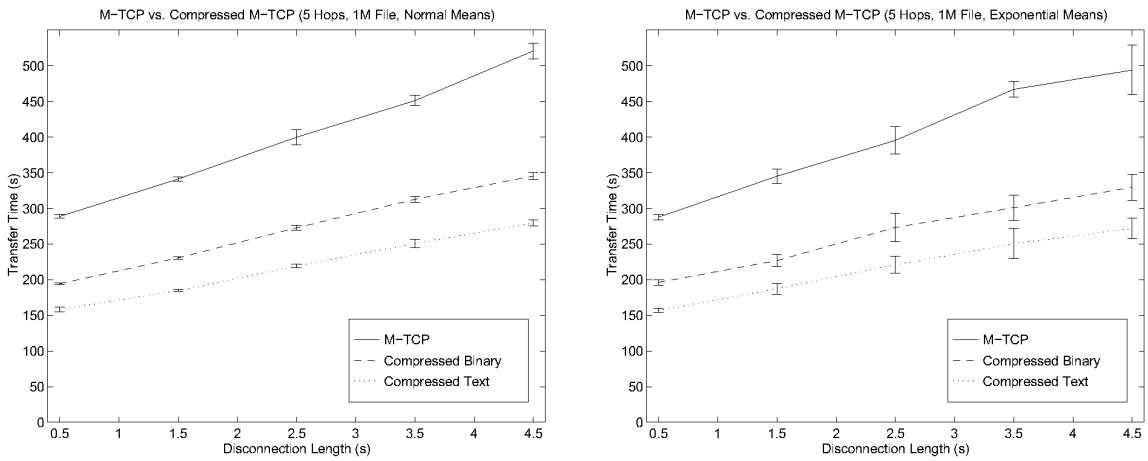


Figure 15: Compressed M-TCP performance.

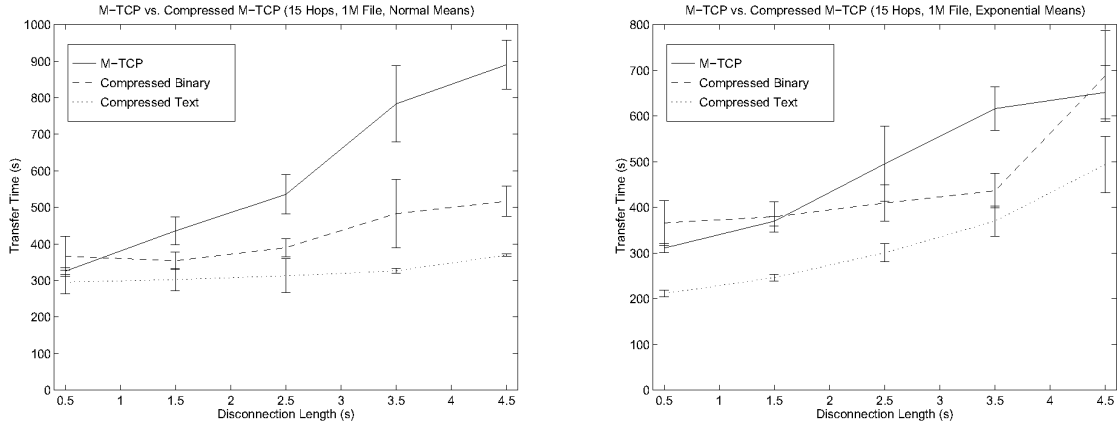


Figure 16: Compressed M-TCP performance.

speed (i.e., we do not perform any link emulation to bring down the speed to 32kbps). The TCP sender send buffer size is varied from 1/2K to 16K and 1M of data is sent for each trial with 50 repetitions per test. In Figure 17 we see that M-TCP takes a much larger penalty hit for small window sizes than TCP. This is because we do extra processing for each window, and the effect is thus cumulative – more windows implies more total delay. Using a larger window size reduces this cumulative effect to a negligible level.

Finally, we measured the delay experienced in transferring files of varying sizes using TCP and M-TCP (again without using the slow link emulation and with no disconnections). The TCP sender used a send buffer of size 16K and was located either 5 hops or 15 hops from the mobile receiver. The results are shown in Figure 18 (the 95% confidence intervals are also shown). In the 5-hop tests, M-TCP tends to be slightly slower than TCP, due to extra processing. In the 15-hop tests, note that M-TCP is statistically better for all 3 file sizes. This is due to the fact that the round-trip times are shorter on the two portions of the connection than on the entire connection, allowing both the TCP sender and M-TCP at the SH to respond more quickly to bandwidth variation and loss.

Based on these results we can conclude that the gateway approach (where we split the TCP connection) is scalable to large mobile networks and does not suffer any noticeable performance hits.

6.5 Performance Summary

Our experimental results clearly show that, in addition to maintaining end-to-end TCP semantics, M-TCP performs very well in environments where the mobile is subjected to frequent disconnections (note that M-TCP will perform

RED HAT 1008
RED HAT V. CAS

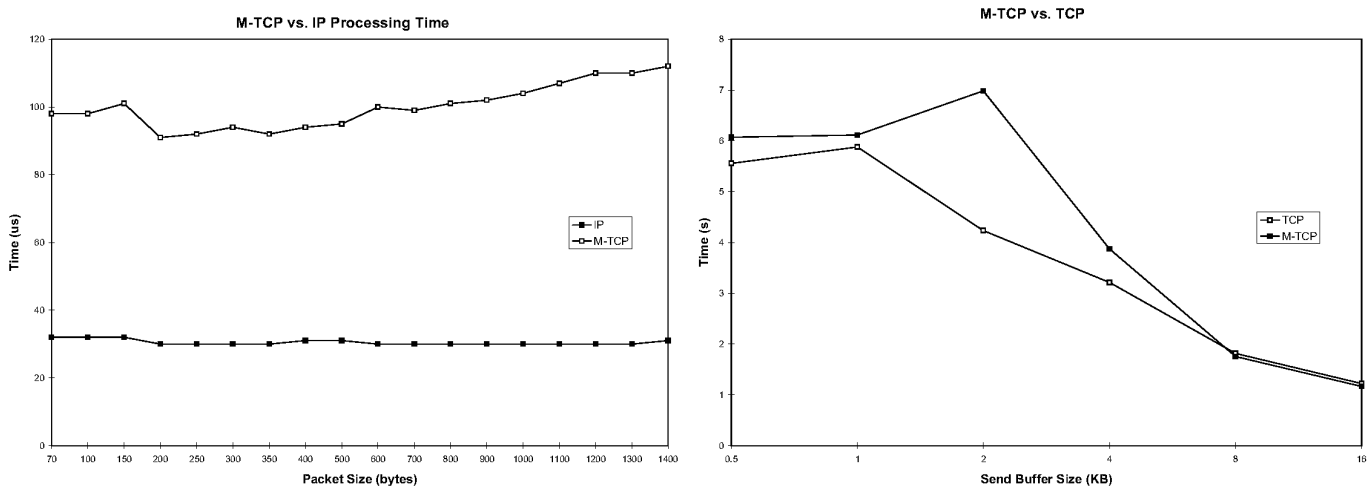


Figure 17: Processing time at the gateway and effect of send buffer sizes.

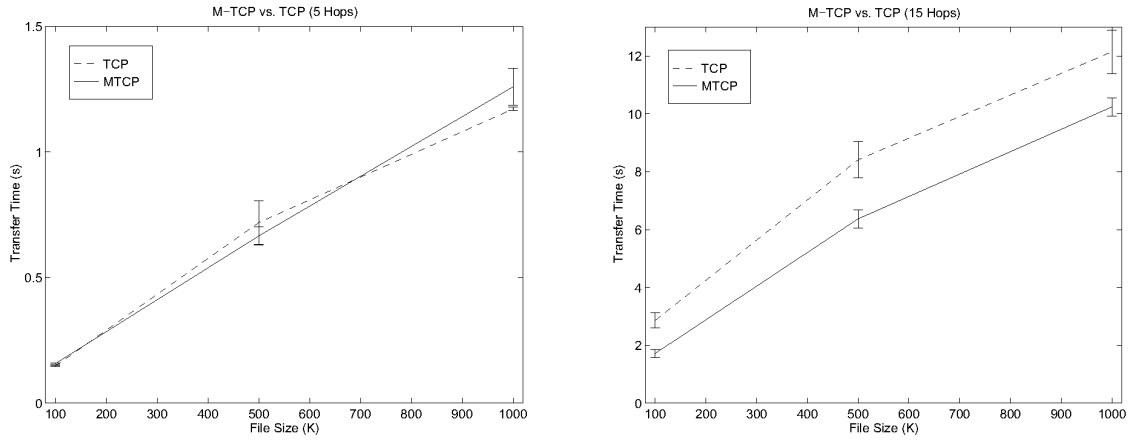


Figure 18: M-TCP vs. TCP performance without slow link emulation or disconnections.

RED HAT 1008
RED HAT V. CAS

well even in the presence of error-prone wireless channels for the same reason that I-TCP does – local retransmissions of lost segments). Specifically,

1. In the presence of disconnections, M-TCP's file transfer time is less than a third of TCP's file transfer time over 5 hops. Over 15 hops, M-TCP's performance is still much better than TCP's, however, due to a high loss rate over the Internet, the performance gap is smaller.

2. Data compression reduces M-TCP's file transfer time even more. However, the processing overhead at the SH (about 3 msec for a 1400 byte packet) is significant. Thus, compression can be used profitably only in environments where the mobile is in a severely bandwidth-starved cell.

3. The processing time at the gateway nodes is small and does not appear to be a performance bottleneck.

7 Conclusions

In this paper we develop a TCP protocol for use in mobile networks. Our design is based on the observation that, in mobile networks, users will be plagued by frequent disconnection events (caused either by signal fades, lack of bandwidth or by handoff) that must be explicitly handled by the protocol. We also examine the use of data compression for transmission over very low bandwidth links and show that there are significant performance gains to be had. Finally, we answer a frequently leveled criticism of the split connection approach – *viz.,* the gateway will be unable to handle many connections because of the additional processing it needs to do. We show that, in fact, a 100 MHz Pentium PC can adequately handle numerous simultaneous M-TCP connections with little performance degradation.

References

[1] Personal communication with Mike Cunningham. See also `www.metricom.com`.

[2] E. Ayanoglu, S. Paul, T.F. LaPorta, K.K. Sabnani and R.D. Gitlin, "AIRMAIL: A link-layer protocol for wireless networks", *J. Wireless Networks*, Vol. 1, (1995), pp. 47-60.

[3] A. Bakre and B. R. Badrinath,"I-TCP: Indirect TCP for Mobile Hosts", *Proceedings of the 15th International Conference on Distributed Computing Systems, Vancouver, Canada,* June 1995, pp. 136–143.

[4] A. Bakre and B. R. Badrinath,"Handoff and Systems Support for Indirect TCP/IP", *2nd Usenix Symposium on Mobile and Location-Independent Computing,* April 1995.

[5] A. Bakre and B. R. Badrinath,"Indirect Transport Layer Protocols for Mobile Wireless Environment", in Mobile Computing, eds. T. Imielinski and H.F. Korth, Kluwer Academic Publishers, (1996), pp. 229-252.

[6] H. Balakrishnan, S. Seshan, and Randy Katz, "Improving Reliable Transport and Handoff Performance in Cellular Wireless Networks", *Wireless Networks*, Vol. 1, No. 4, December (1995).

[7] H. Balakrishnan, V.N. Padmanabhan, S. Seshan, and Randy Katz, "A Comparison of Mechanisms for Improving TCP Performance over Wireless Links", *ACM SIGCOMM'96*, pp. 256-269, Palo Alto, CA, August (1996).

[8] B.R. Badrinath and T. Imielinski,"Location Management for Networks with Mobile Users", in Mobile Computing, eds. T. Imielinski and H.F. Korth, Kluwer Academic Publishers, (1996), pp. 129-152.

[9] P. Bhagwat, S. Tripathi and C. Perkins,"Network Layer Mobility: an Architecture and Survey", *Technical Report*, CS-TR-3570, University of Maryland (September 13, 1995).

[10] K. Brown and S. Singh, "A Network Architecture for Mobile Computing", *Proc. IEEE INFOCOMM'96*, S.F. CA, March 1996, pp. 1388-1396.

[11] K. Brown and S. Singh, "M-UDP: UDP for Mobile Networks", *ACM Computer Communication Review*, Vol. 26(5), Pct. 1996, pp. 60-78.

[12] R. Caceres and L. Iftode, "Improving the Performance of Reliable Transport Protocols in Mobile Computing Environments", *IEEE Selected Areas in Communications*, Vol. 13(5), (June 1994), pp. 850-857.

RED HAT 1008
RED HAT V. CAS

[13] S. Cheshire and M. Baker,"Internet Mobility 4×4", *Proceedings ACM SIGCOMM'96*, (Oct. 1996), pp. 318-329.

[14] D. Eckhardt and P. Steenkiste,"Measurement and Analysis of the Error Characteristics of an In-Building Wireless Network", *Proceedings ACM SIGCOMM'96*, (Oct. 1996), pp. 243-254.

[15] R. Ghai and S. Singh, "An Architecture and Communication Protocol for Picocellular Networks", *IEEE Personal Communications Magazine*, Third Quarter 1994, pp. 36-46.

[16] R. Gopalakrishnan, K. Brown and S. Singh, "Transport State Handoff in Mobile Networks", Manuscript.

[17] S. Nanda, R.P. Ejzak and B.T. Doshi,"A retransmission scheme for circuit-mode data on wireless links", *IEEE JSAC*, 1994.

[18] K. Seal and S. Singh,"Loss Profiles: A quality of service measure in mobile computing", *J. Wireless Networks*, Vol. 2 (1996), pp. 45-61.

[19] S. Singh,"Quality of Service Guarantees in Mobile Computing", *Journal Computer Communications*, Vol 19(4), pp. 359-371 (April 1996).

[20] F. Teraoka and M. Tokoro, "Host Migration Transparency in IP Networks: The VIP Approach", *SIGCOMM CCR*, Vol. 23, No. 1, Jan 1993, pp. 45-65.

[21] R. Yavatkar and N. Bhagawat,"Improving End-to-End Performance of TCP over Mobile Internetworks", *IEEE 1994 Workshop on Mobile Computing Systems and Applications, Santa Cruz, CA*, (1994).

RED HAT 1008
RED HAT V. CAS

Electronic Acknowledgement Receipt

EFS ID:	32683980
Application Number:	15161787
International Application Number:	
Confirmation Number:	3396
Title of Invention:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
First Named Inventor/Applicant Name:	Eric M. Delangis
Customer Number:	64828
Filer:	Harold C. McGurk
Filer Authorized By:	
Attorney Docket Number:	ED 3000
Receipt Date:	21-MAY-2018
Filing Date:	23-MAY-2016
Time Stamp:	20:05:22
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment/Req. Reconsideration-After Non-Final Reject	15161787_Amendment_5-21-2018.pdf	157357 0419d547afdd462890b5e8a9e8632a070577a4db	no	9
Warnings:					

RED HAT 1008
RED HAT V. CAS

Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	15161787_IDS_5-21-2018-2.pdf	612460 f02dabc96d4651897795b2dba466763d9e585a35	no	4
Warnings:					
Information:					
3	Other Reference-Patent/App/Search documents	m-tcp-singh-1997-2.pdf	890626 fcc59de366b3916ea042cb28c791d82fa48a915b	no	25
Warnings:					
Information:					
		Total Files Size (in bytes):	1660443		

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 a 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.

RED HAT 1008
RED HAT V. CAS

PTO/SB/08a (01-10)
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.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	15161787
Filing Date	2016-05-23
First Named Inventor	Eric DeLangis
Art Unit	2467
Examiner Name	HONG CHO
Attorney Docket Number	ED 3000

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	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, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15161787
	Filing Date	2016-05-23
	First Named Inventor	Eric DeLangis
	Art Unit	2467
	Examiner Name	HONG CHO
	Attorney Docket Number	ED 3000

	1	802.3 IEEE Standard for Information Technology, Part 3, March 2002, starting at p.232 "43. Link Aggregation"	
	2	Link Aggregation according to IEEE 802.3ad, by SysKonnect GmbH, 2002.	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15161787
	Filing Date	2016-05-23
	First Named Inventor	Eric DeLangis
	Art Unit	2467
	Examiner Name	HONG CHO
	Attorney Docket Number	ED 3000

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/H C McGurk IV/	Date (YYYY-MM-DD)	2018-05-23
Name/Print	H C McGurk	Registration Number	34964

This collection of information is required by 37 CFR 1.97 and 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 1 hour 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.**

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 the Freedom of Information Act requires disclosure of these record s.

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.

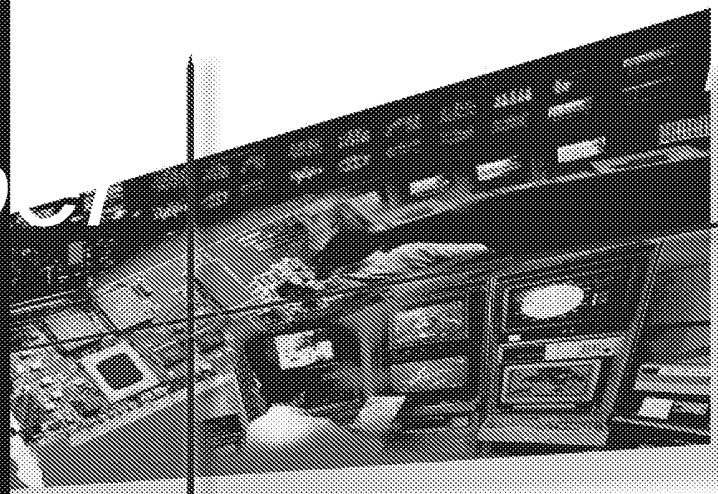
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

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 inspections 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.

Paper:



LinkAggregationaccordingto IEEEStandard802.3ad

SysKonnect

Link Aggregation according to IEEE 802.3ad

Copyright SysKonnect GmbH, 2002. All rights reserved.
All brand and product names are trademarks or registered trademarks of their respective holders. Contents are subject to change.

English

(v1.10 10-Oct-2002)

About SysKonnect and Marvell:

SysKonnect focuses on the worldwide development, manufacture, and marketing of highend adapter boards for computer and telecom networks. SysKonnect products include both high-performance fiber- and copper-based network interface cards (NICs) for GigabitEthernet systems, as well as FDDI/CDDI and FDDI concentrators for strategic networks. The Company's comprehensive line of SK-NET NICs is ideally suited to secure-server-based public- and private-sector computing environments, such as electronic commerce, finance, healthcare, imaging, and other bandwidth-intensive applications, as well as to enterprise systems developed by SAP and Baan.

SysKonnect maintains offices in Great Britain and the USA. Visit

www.syskonnect.com.

SysKonnect is a subsidiary of Marvell Technology Group Ltd. (NASDAQ: MRVL). Marvell is the leading global semiconductor provider of complete broadband communications solutions for the data communications and storage markets. The Company's diverse product portfolio includes switching, transceiver, communications controller, wireless, and storage solutions that power the entire communications infrastructure, including enterprise, metro, home, and storage networking. As used in this release, the terms "Company" and "Marvell" refer to Marvell Technology Group Ltd. and its subsidiaries, including Marvell Semiconductor, Inc. (MSI), Marvell Asia Pte Ltd (MAPL), Marvell Japan K.K., Marvell Taiwan Ltd., Marvell International Ltd. (MIL), Galileo Technology Ltd., and SysKonnect GmbH. MSI is headquartered in Sunnyvale, CA and designs, develops, and markets products on behalf of MIL and MAPL.
MSI may be contacted at 408-222-2500 or at www.marvell.com.

Table of Contents

1 Why Link Aggregation? 5

Higher Link Availability 5

Increased Link Capacity 5

Aggregating replaces Upgrading 5

2 Types of Link Aggregation 7

Switch-to-Switch Connections 7

Switch-to-Station (Server or Router) Connections 8

Station-to-Station Connections 9

3 The IEEE Standard 802.3ad11

4 Configuration 13

Physical issues in Link Aggregation 13

Addressing 13

Distribution of Frames 13

Technology Constraints 13

SysKonnect solution for Link Aggregation with Gigabit Ethernet 14

Link Aggregation Control Protocol (LACP) 14

Creation of aggregators and teams 14

Redundant Switch Failover 15

SysKonnect Network Control for Windows 2000 17

5 Conclusion 21

1 Why Link Aggregation?

Link Aggregation or trunking is a method of combining physical network links into a single logical link for increased bandwidth. With Link aggregation we are able to increase the capacity and availability of the communications channel between devices (both switches and end stations) using existing Fast Ethernet and Gigabit Ethernet technology. Two or more Gigabit Ethernet connections are combined in order to increase the bandwidth capability and to create resilient and redundant links. A set of multiple parallel physical links between two devices is grouped together to form a single logical link.

Link Aggregation also provides load balancing where the processing and communications activity is distributed across several links in a trunk so that no single link is overwhelmed.

By taking multiple LAN connections and treating them as a unified, aggregated link, we can achieve practical benefits in many applications.

Link Aggregation provides the following important benefits:

Higher link availability
Increased link capacity
Improvements are obtained using existing hardware (no upgrading to higher-capacity link technology is necessary)

Higher Link Availability

Link aggregation prevents the failure of any single component link from leading to a disruption of the communications between the interconnected devices. The loss of a link within an aggregation reduces the available capacity but the connection is maintained and the data flow is not interrupted.

Increased Link Capacity

The performance is improved because the capacity of an aggregated link is higher than each individual link alone.

RED HAT 1008
RED HAT V. CAS

Standard LAN technology provides data rates of 10 Mb/s, 100 Mb/s, and 1000 Mb/s. Link Aggregation can fill the gaps of these available data rates when an intermediate performance level is more appropriate; a factor of 10 increase may be overkill in some environments.

If a higher capacity than 1000 Mb/s is needed, the user can group several SysKonnect 1000 Mb/s adapters together to form a high speed connection and additionally benefit from the failover function the SysKonnect driver for Link Aggregation supports. This provides migration to 10 Gigabit Ethernet solutions which are not yet available.

Aggregating replaces Upgrading

If the link capacity is to be increased, there are usually two possibilities: either upgrade the native link capacity or use an aggregate of two or more lower-speed links (if provided by the card's manufacturer). Upgrades typically occur in factors of 10. In many cases, however, the device cannot take advantage of this increase. A performance improvement of 1:10 is not achieved, moreover the bottleneck is just moved from the network link to some other element within the device. Thus, the performance will always be limited by the weakest link, the end-to-end connection.

Link aggregation may be less expensive than a native speed upgrade and yet achieve a similar performance level. Both the hardware costs for a higher speed link and the equivalent number of lower speed connections have to be balanced to decide which approach is the most advantageous.

Sometimes link aggregation may even be the only means to improve performance when the highest data rate available on the market is not sufficient.

Many network administrators have experienced that upgrading the network hardware (e.g., switching from 10 Mb/s network adapters to 100 Mb/s network adapters), in the end, led to a performance improvement much less than the 10:1 ratio implied by the hardware change (or perhaps no improvement at all!).

Whether an aggregated link actually yields a performance improvement commensurate with the number of links provided depends to a great extent on network traffic patterns and the algorithm used by the devices to distribute frames among aggregated links. To the extent that traffic can be distributed uniformly across the links, the effective capacity will increase as desired. If the traffic and distribution algorithm is such that a few links carry the bulk of the traffic while others go nearly idle, the improvement will be less than anticipated.

2 Types of Link Aggregation

There are a number of situations where Link Aggregation is commonly deployed:

Switch-to-switch connections
Switch-to-station (server or router) connections
Station-to-station connections

The following figure shows the different uses.

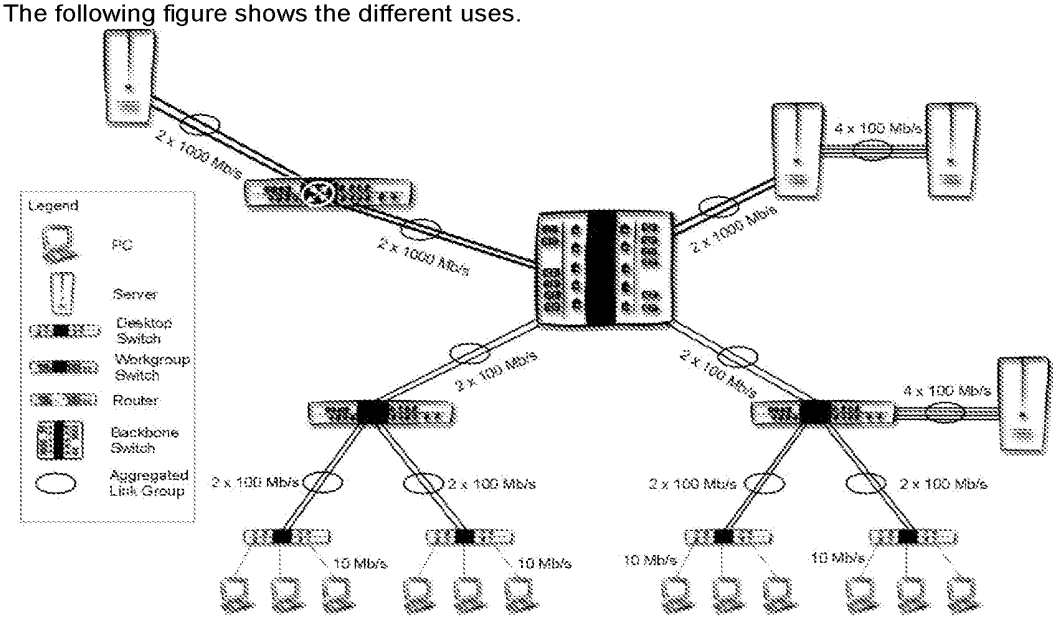


Figure 1. Aggregated links

Switch-to-Switch Connections

In this scenario, multiple workgroups are joined to form one aggregated link. By aggregating multiple links, the higher speed connections can be achieved without hardware upgrade.

Example In Figure 2, two switches are shown which are connected using four 1000 Mb/s links. If one link fails between these two switches, the other links in the link aggregation group take over the traffic and the connection is maintained.

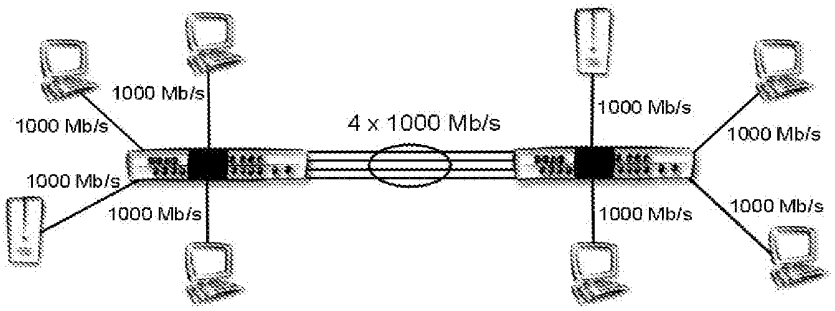


Figure 2. Switch-to-switch connection

This configuration reduces the number of ports available for connection to external devices. Aggregation thus implies a trade-off between port usage and additional capacity for a given device pair.

Switch-to-Station (Server or Router) Connections

Most server platforms can saturate a single 100 Mb/s link with many of the applications available today. Thus, link capacity becomes the limiting factor for overall system performance.

Example In Figure 3, two servers are shown, each connected to a switch using four 100 Mb/s links. In this application, link aggregation is used to improve performance for the link-constrained station. By aggregating multiple links, better performance is achieved without requiring a hardware upgrade to either the server or the switch. Aggregation on the server side can generally be achieved through software changes in the device driver for the LAN interface(s).

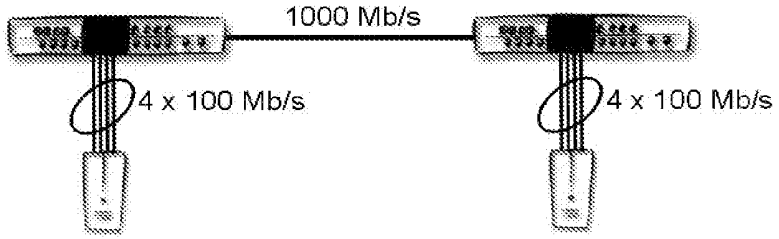


Figure 3. Switch-to-station connection

Link Aggregation trades off port usage for effective link capacity. While it is common for high port-density switches to have some number of excess ports, it is rare for a server to have unused network interface cards. In addition, traditional single-port network adapters use a server backplane slot for each interface; often a server configuration will have only a limited number of slots available for network peripherals. In response to this problem, a number of manufacturers offer multiport network adapters specifically for use in servers, e.g. SysKonnect's Dual Link Gigabit Ethernet Adapter.

Figure 1 depicts multiple 1000 Mb/s links being aggregated between the backbone switch and a high-performance enterprise backbone router. From the perspective of the switch, a network layer router is simply an end station – not much different from a server. As such, we can aggregate links between a switch and a router for the same reasons as in the switch-toserver case. One important difference arises regarding the choice of algorithm used to distribute frames among the links.

Station-to-Station Connections

In the case of aggregation directly between a pair of end stations, no switches are involved at all. As in the station-to-switch case, the higher performance channel is created without having to upgrade to higher-speed LAN hardware. In some cases, higher-speed NICs may not even be available for a particular server platform, making link aggregation the only practical choice for improved performance.

Example Figure 4 shows two servers interconnected by an aggregation of four 1000 Mb/s links.

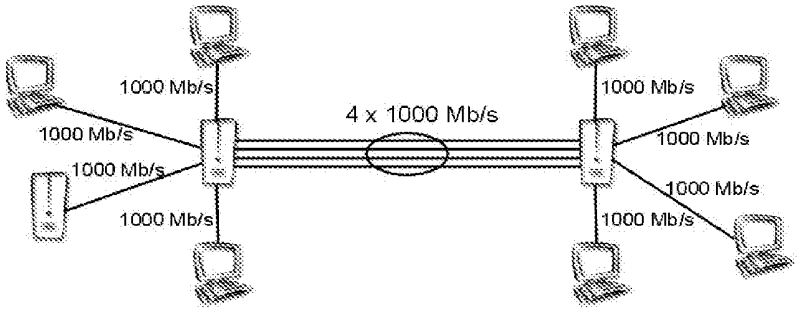


Figure 4. Station-to-station connection

This high-speed connection may be useful for multi-processing or server redundancy applications where high performance is needed to maintain real-time server coherence (this configuration is sometimes called *back-end network*).

2 Types of Link Aggregation

This page left blank to accommodate double-sided printing.

3 The IEEE Standard 802.3ad

"Link Aggregation allows one or more links to be aggregated together to form a Link Aggregation Group, such that a MAC client can treat the Link Aggregation Group as if it were a single link" (from IEEE Standard 802.3, 2000 Edition, page 1215).

The standard lists the following main goals and objectives for Link Aggregation (from IEEE Standard 802.3, 2000 Edition, page 1215):

Increased bandwidth
The capacity of multiple links is combined into one logical link.

Increased availability
The failure or replacement of a single link within a Link Aggregation Group need not cause failure from the perspective of a MAC Client.

Linearly incremental bandwidth
Bandwidth can be increased in unit multiples as opposed to the order-of-magnitude increase available through Physical Layer technology options (10 Mb/s, 100 Mb/s, 1000 Mb/s, etc.).

Load sharing
MAC Client traffic may be distributed across multiple links.

Automatic configuration
In the absence of manual overrides, an appropriate set of Link Aggregation Groups is automatically configured, and individual links are allocated to those groups.

Rapid configuration and reconfiguration
In the event of changes in physical connectivity, Link Aggregation will quickly converge to a new configuration, typically on the order of 1 second or less.

Deterministic behavior
Depending on the selection algorithm chosen, the configuration can be made to resolve deterministically; i.e. the resulting aggregation can be made independent of the order in which events occur, and be completely determined by the capabilities of the individual links and their physical connectivity.

Low risk of duplication or mis-ordering of frames
During both steady-state operation and link (re-) configuration, there is a high probability that frames are neither duplicated nor mis-ordered.

Support of existing IEEE 802.3 MAC Clients (frames transmitted are ordinary MAC frames)
No change is required to existing higher-layer protocols or application to use Link Aggregation.

Backwards compatibility with aggregation-unaware devices
Links that cannot take part in Link Aggregation - either because of their inherent capabilities, management configuration, or the capabilities of the devices to which they attach – operate as normal, individual IEEE 802.3 links.

Accommodation of differing capabilities and constraints
Devices with differing hardware and software constraints on Link Aggregation are, to the extent possible, accommodated.

No change to the IEEE 802.3 frame format
Link Aggregation neither adds to, nor changes the contents of frames exchanged between MAC Clients.

Network Management Support
The standard specifies appropriate management objects for configuration, monitoring, and control of Link Aggregation.

Link Aggregation, according to IEEE 802.3, does not support the following:

Multipoint Aggregations

The mechanisms specified in this clause do not support aggregations among more than two systems.

Dissimilar MACs

Link Aggregation is supported only on links using the IEEE 802.3 MAC (Gigabit Ethernet and FDDI are not supported in parallel but dissimilar PHYs such as copper and fiber are supported)

Half duplex operation

Link Aggregation is supported only on point-to-point links with MACs operating in full duplex mode.

Operation across multiple data rates

All links in a Link Aggregation Group operate at the same data rate (e.g. 10 Mb/s, 100 Mb/s, or 1000 Mb/s).

4 Configuration

Physical issues in Link Aggregation

Addressing

Each network interface controller is assigned a unique MAC address. Usually this address is programmed into the ROM during manufacturing. During initialization, the device driver reads the contents of the ROM and transfers the address to a register within the MAC controller. In most cases, this address is used as source and destination address during the transmission of packets. Aggregated links are to appear as a single link with a single logical network interface and therefore only have one “virtual” MAC address. The MAC address of one of the interfaces belonging to the aggregated link provides the “virtual” address of the logical link.

Frame Distribution

When applying WAN technologies, frames are sometimes broken into smaller units to accelerate transmission (such as in the bonding of B-channel ISDN lines). LAN communications channels, however, do not support sub-frame transfers. The complete frame has to be sent through the same physical link. Using aggregated links, the task is to select the link on which to transmit a given frame. Sending one long frame may take longer than sending several short ones, so the short frames may be received earlier than one long frame. The order has to be restored at the receiver side. Thus, an agreement has been made: all frames belonging to one conversation must be transmitted through the same physical link, which guarantees correct ordering at the receiving end station. For this reason no sequencing information may be added to the frames. Traffic belonging to separate conversations can be sent through various links in a random order. The algorithm for assigning frames to a conversation depends on the application environment and the kind of devices used at each end of the link.

When a conversation is to be transferred to another link because the originally mapped link is out of service (failed or configured out of the aggregation) or a new link has become available relieving the existing ones, precautions have to be taken to avoid mis-ordering of frames at the receiver. This can be realized either by means of a delay time the distributor must determine somehow or through an explicit marker protocol that searches for a marker identifying the last frame of a conversation. The distributor inserts a “marker message” behind the last frame of a conversation. After the collector receives this “marker message” it sends a response to the distributor, which then knows, that all frames of the conversation have been delivered. Now the distributor can send frames of these types of conversations via a new link without delay. If the conversation is to be transferred to a new link, because the originally mapped link failed, this method will not work. There is no path on which the message marker can be transferred, i.e. the distributor has to employ the timeout method.

Technology Constraints

In principle, the devices applied in the aggregation restrict the throughput. Using an aggregation of four 100 Mb/s links instead of one 100 Mb/s link will increase the capacity but the throughput on each link remains the same.

SysKonnect solution for Link Aggregation with Gigabit Ethernet

All SysKonnect Gigabit Ethernet adapters support link aggregation according to the IEEE standard 802.3ad. At the moment SysKonnect provides a Link Aggregation driver for Windows 2000. In the future, Link Aggregation support according to IEEE 802.3ad will be implemented in drivers for other operating systems such as Linux, Sun Solaris, HP-UX and IBM AIX. The SysKonnect Link Aggregation intermediate driver for Windows 2000, which is part of the "SysKonnect Network Driver Installation Package", supports the possibility of combining all ports in a system into port groups. A port group consists of one or more ports, which are connected to the same non-segmented network. One port can not belong to more than one port group. Every port group will behave like a single network interface to the operating system. If a port group consists of only one port, it will behave like a single link adapter. This functional aggregation of ports enables Link Aggregation.

Link Aggregation means that multiple connections between two network instances are treated like a single connection of higher bandwidth. It is implemented according to the standard 802.3ad. It will increase the bandwidth (assuming the system has enough resources to process additional data) and fault tolerance of the connection.

Link Aggregation offers an efficient and low-cost solution to increase bandwidth between server and switch. Another advantage it provides is that if a connection fails completely the remaining links can take over the traffic and thus replace the broken line.

The SysKonnect Link Aggregation driver helps to increase the network performance by distributing the network traffic among the network adapters belonging to the same group (load balancing). As soon as the server is contacted the driver assigns links to the diverse applications according to the network load. This way, bandwidth can be extended proportionally to the network adapters.

All ports that are configured for Link Aggregation (at least one) can be used to transmit and/or receive frames, depending on their configuration. If one connection fails the aggregated connection will lose bandwidth but remain stable as long as at least one connection of the group is working.

In addition, SysKonnect offers a Redundant Switch Failover mechanism (RSF). If a switch fails completely, RSF can move the link to a different switch, which then takes over the traffic.

Link Aggregation Control Protocol (LACP)

The LACP is required by the IEEE standard 802.3ad for dynamically exchanging configuration information among cooperating systems in order to automatically configure and maintain link aggregation groups. The protocol is able to automatically detect the presence and capabilities of other aggregation capable devices, i.e. with LACP it is possible to specify which links in a system can be aggregated.

Creation of aggregators and teams

The SysKonnect Link Aggregation driver uses LACP to establish link aggregation groups between two connected devices. Each device considers itself as being an "actor" and the device at the other end of the link as "partner", i.e. both devices are actors and both are partners depending on the point of view. The ports send their actor information (LACP frames) to the other device in order to find a suitable partner to form an aggregation. LACP compares the actor and partner information and then decides which ports can be trunked to establish an aggregator. Aggregators are built automatically from those ports for which partner information is available. Using the SysKonnect Network Control running on Windows 2000 (see below) the user can combine two or more ports to create a team. For drivers of other operating systems, similar tools for the configuration of Link Aggregation will be available.

Teams and aggregators have the following main features:

There is a virtual MAC address for the whole team (the MAC address of one adapter of the team).

The aggregator with the most active links is the active aggregator.

Every other aggregator is in hot standby.

The aggregators are configured automatically (see the link aggregation standard).

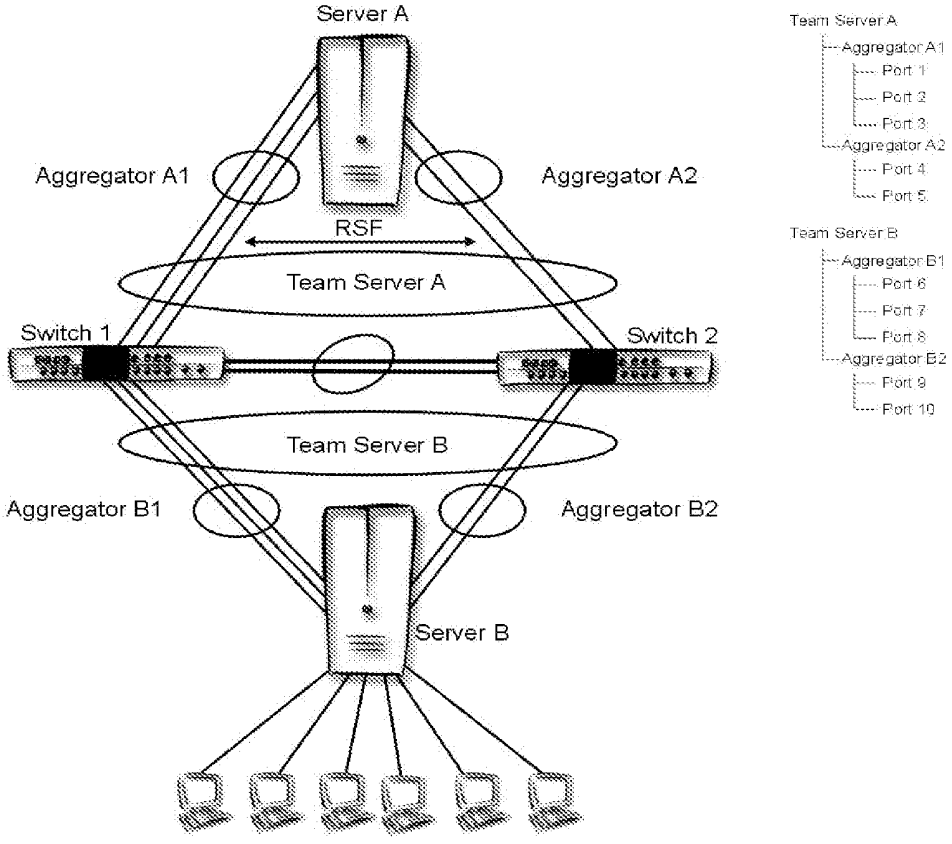
Below the team level, LACP automatically creates aggregators as described above. If all ports have the same partner information, only one aggregator is established. If there are “n” types of partner information, “n” aggregators will be created. With more than one aggregator within a team, the redundant switch failover mechanism RSF provided by SysKonnect can be employed. This unique feature is described in the next chapter “Redundant Switch Failover”.

Redundant Switch Failover

Beyond the features required for Link Aggregation in the IEEE 802.3ad standard, SysKonnect drivers support an additional failover feature, Redundant Switch Failover (RSF). At the moment this feature is only implemented in the driver for Windows 2000, but will be available for other operating systems in the future. The standard requires that all links of a link aggregation group are connected to the same partner. With SysKonnect’s Link Aggregation driver one team can comprise more than one aggregator. If a team has more than one aggregator, which are connected to separate switches, the failover feature is utilized.

The decision on which link (aggregator) data is transferred is based on the bandwidth (link speed multiplied with number of ports). The link with the largest bandwidth is used for data transmission. If the bandwidth of the aggregators is equal, the first aggregator of a team is used.

In the following figure a typical system employing Link Aggregation and SysKonnect’s RSF is depicted. Two scenarios are described in the example.



RED HAT 1008
RED HAT V. CAS

Figure 5. Link Aggregation and RSF

Example In the above system data is normally transferred from Server A to Server B via Aggregator A1, Switch 1, and Aggregator B1 and vice versa, i.e. Aggregators A1 and B1 are the active links, Aggregators A2 and B2 are in hot standby.

Scenario 1: Port failure

Assume two links of Aggregator A1 fail: RSF switches the data flow of Server A to Aggregator A2, because data is always transferred on the link with the larger bandwidth. Data from Server A to Server B is then transmitted via Aggregator A2, Switch 2, Switch 1, and Aggregator B1 (is still the aggregator with the greatest bandwidth in Team of Server B) and vice versa. In case the two links of Aggregator A1 become active again, RSF switches data transfer back to Aggregator A1 due to the larger bandwidth.

Scenario 2: Switch failure

Assume Switch 1 fails: RSF switches the data flow from Server A to Aggregator A2 and the data flow from Server B to Aggregator B2 because both Aggregator A1 and B1 do not have an active link anymore. Data from Server A to Server B is then transmitted via Aggregator A2, Switch 2, and Aggregator B2 and vice versa. When switch 1 is functional again, RSF switches data transmission back to Aggregator A1 and B1 due to the larger bandwidth.

SysKonnect Network Control for Windows 2000

The link aggregation functionality in SysKonnect drivers is configured and controlled via the SysKonnect Network Control, a utility program running on Windows 2000 systems. The SysKonnect Network Control can be reached via “Start” --> “Settings” --> “Control Panel” --> “SysKonnect Network Control”. This utility program enables the user to configure all SysKonnect SK-98xx Gigabit Ethernet adapters installed in a system. The various tabs contain tree views showing the installed adapters and their configuration. The tab “Adapter” displays the network adapters available in the system with their corresponding ports. It shows the ports which have been configured as VLANs, for RLMT (Redundant Link Management Technology) and the ones which have been combined to form a team.

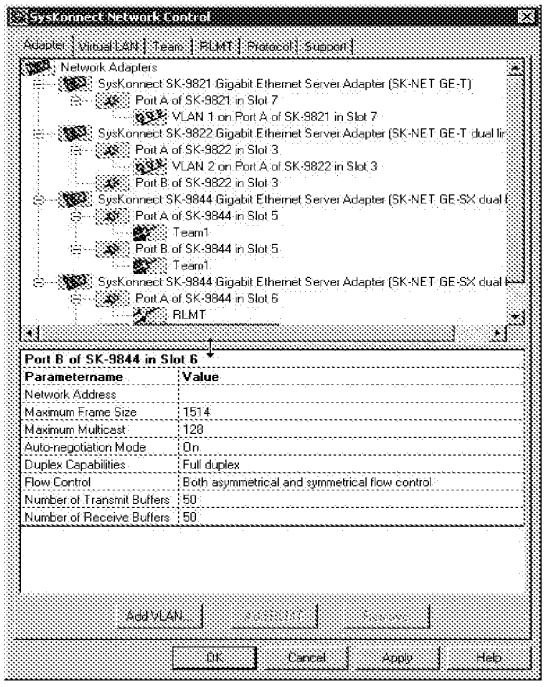


Figure 6. Adapter Overview in SysKonnect Network Control

The corresponding tab in the SysKonnect Network Control where the user is able to configure the link aggregation features is called “Team”. The “Team” tab shows all links or ports of SysKonnect Gigabit Ethernet adapters which are available for teaming or have been already grouped to form a team.

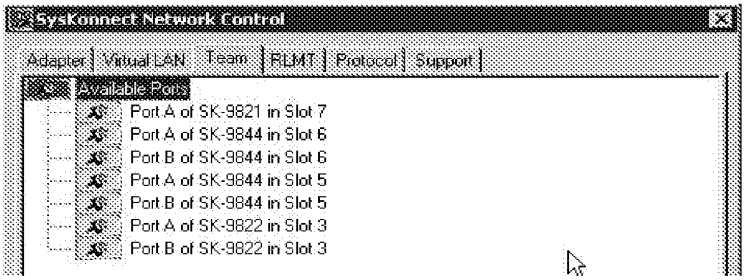


Figure 7. Available ports for teaming

In this tab the user is able to create teams, add ports to teams, remove teams, and rename teams. After a new team has been created the user can add ports to this team. If a port from this team has found a partner on the other end of the connection, which is suitable for link aggregation, a message is displayed next to the corresponding port (see Figure 8).

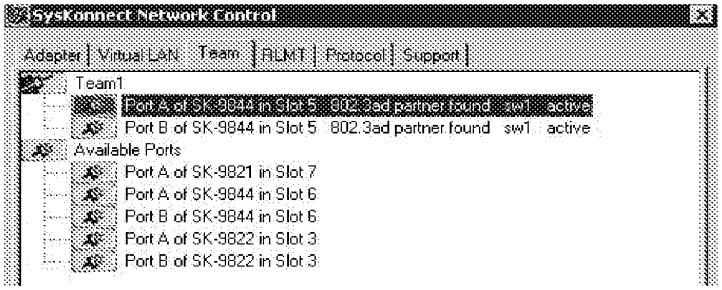


Figure 8. 802.3ad partner found

If a team is selected, the corresponding parameters are displayed below the tree view. The following parameters can be viewed:

Parameter	Values	Description
IP Address	xxx.xxx.xxx.xxx (decimal)	Unique 32-bit (4 bytes) address of an end station within a TCP/IP network. The IP address can not be defined in the SysKonnect Network Control.
Maximum Frame Size	12..9014	This parameter specifies the maximum frame size in bytes the driver will support. The performance of the network usually increases if a large packet size is used. Do not use values larger than 1514 if you are not sure whether or not your network supports jumbo frames. If VLAN is configured the actual frame size on the port is always 4 Bytes larger than the configured frame size of the VLAN because the VLAN tag is inserted into the frame. The Maximum Frame Size can be defined in the SysKonnect Network Control.
Maximum Multicast	0..10000	This option specifies the maximum number of multicast addresses the driver accepts. The Maximum Multicast can be defined in the SysKonnect Network Control.

If a port, which is part of a team, is selected, the following additional link aggregation parameters are displayed among others (see Figure 9):

Parameter	Values	Description
Link Status	Link up Link down	This parameter indicates whether the port has an active link (up) or is inactive (down). The status of this parameter is delivered by the network driver.
Link Aggregation Status	802.3ad partner found no partner found	This parameter indicates whether the port has found an 802.3ad partner with which it can form a team. The status of this parameter is delivered by the network driver.
Switch membership	e.g. sw1, sw2, sw3, ...	This parameter shows to which switch the port is connected physically. The information for this parameter is delivered by the network driver. It can only be changed, if you physically connect the port to a different switch.
Failover Status	active standby	This parameter indicates whether the port is active or in standby mode to take over in case the active link fails.

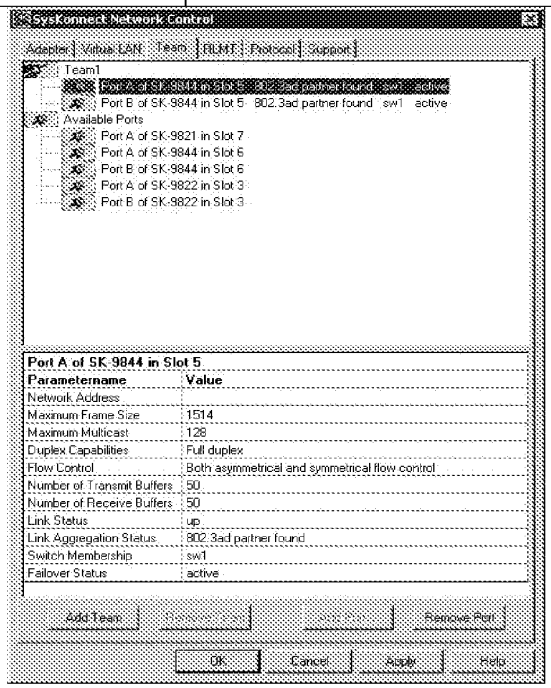


Figure 9. Port parameters of port belonging to a team

This page left blank to accommodate double-sided printing

RED HAT 1008
RED HAT V. CAS

5 Conclusion

SysKonnect' s solution for Link Aggregation offers two main features which are essential for every network administrator: it provides increased capacity and a fail safe system. By employing Link Aggregation the costs for upgrading the performance and the resiliency of a system can be kept reasonable because both benefits can be attained using existing hardware. By using the automatic configuration protocol LACP we can provide redundancy with automatic switching to the standby link in case the active link fails.

The SysKonnect driver enables load balancing not only on the basis of MAC address information but also on the basis of IP, TCP, and UDP information.

Higher throughput by aggregating multiple links is possible with existing hardware. No additional network adapters have to be purchased. The benefits of Link Aggregation can be reached with the SysKonnect Network Driver Installation Package for Windows 2000. The package contains the Miniport driver, the Virtual LAN (VLAN) intermediate driver, the Link Aggregation (LAGG) intermediate driver and the configuration utility SysKonnect Network Control and is available for free download for SysKonnect customers on our web site: www.syskonnect.com.

Demanding applications running in high-performance environments like servers in enterprises, web servers, and intranet servers gain particularly from the high-bandwidth and duplex capabilities of Link Aggregation.

The SysKonnect implementation of Link Aggregation also provides a perfect solution on the road to the migration to 10 Gigabit Ethernet which will be integrated in the future. The user can fill the capacity gap by employing for example four 1000 Mb/s adapters in a team and also gets the benefit of a failsafe system by making use of the Redundant Switch Failover mechanism the SysKonnect driver provides.

Headquarters

SysKonnectGmbH
AMarvell®Company
Siemensstrasse23
D-76275Ettlingen

Germany

Phone: +497243502100
Support: +497243502330
Fax: +497243502989

E-mail:sales@syskonnect.de

Americas,Canada,
andPacificRim

SysKonnect,Inc.
AMarvell®Company
1922 ZankerRoad
SanJose,CA95112

USA

Sales: +18007163334
+14082220809
Support: +18667822507
+14082220666
Fax: +14087529040

E-mail:info@syskonnect.com

Europe,MiddleEast,
andAfrica

SysKonnectLtd.
AMarvell®Company
55 HenleyDrive
FrimleyGreen,Camberley
Surrey,Gu166NF

UnitedKingdom

Phone: +441252836467
Fax: +441252836537

E-mail:sales-uk@syskonnect.de

Visitourwebsite
www.syskonnect.com

RED HAT 1008
RED HAT V. CAS

43. Link Aggregation

43.1 Overview

This clause defines an optional Link Aggregation sublayer for use with CSMA/CD MACs. Link Aggregation allows one or more links to be aggregated together to form a Link Aggregation Group, such that a MAC Client can treat the Link Aggregation Group as if it were a single link. To this end, it specifies the establishment of DTE to DTE logical links, consisting of N parallel instances of full duplex point-to-point links operating at the same data rate.

43.1.1 Terminology

In this clause, unless otherwise noted, the term *link* refers to an *Aggregation Link* and the term *port* refers to *Aggregation Port,* as defined in 1.4. This allows for better readability of this clause while avoiding conflicting use of these terms in other clauses of this standard. Similarly, the term *Key* when used in this clause is synonymous with *Aggregation Key,* and the term *System* is synonymous with *Aggregation System*.

43.1.2 Goals and objectives

Link Aggregation, as specified in this clause, provides the following:

a) **Increased bandwidth**—The capacity of multiple links is combined into one logical link.
b) **Linearly incremental bandwidth**—Bandwidth can be increased in unit multiples as opposed to the order-of-magnitude increase available through Physical Layer technology options (10 Mb/s, 100 Mb/s, 1000 Mb/s, etc.).
c) **Increased availability**—The failure or replacement of a single link within a Link Aggregation Group need not cause failure from the perspective of a MAC Client.
d) **Load sharing**—MAC Client traffic may be distributed across multiple links.
e) **Automatic configuration**—In the absence of manual overrides, an appropriate set of Link Aggregation Groups is automatically configured, and individual links are allocated to those groups. If a set of links can aggregate, they will aggregate.
f) **Rapid configuration and reconfiguration**—In the event of changes in physical connectivity, Link Aggregation will quickly converge to a new configuration, typically on the order of 1 second or less.
g) **Deterministic behavior**—Depending on the selection algorithm chosen, the configuration can be made to resolve deterministically; i.e., the resulting aggregation can be made independent of the order in which events occur, and be completely determined by the capabilities of the individual links and their physical connectivity.
h) **Low risk of duplication or mis-ordering**—During both steady-state operation and link (re)configuration, there is a high probability that frames are neither duplicated nor mis-ordered.
i) **Support of existing IEEE 802.3® MAC Clients**—No change is required to existing higher-layer protocols or applications to use Link Aggregation.
j) **Backwards compatibility with aggregation-unaware devices**—Links that cannot take part in Link Aggregation—either because of their inherent capabilities, management configuration, or the capabilities of the devices to which they attach—operate as normal, individual IEEE 802.3® links.
k) **Accommodation of differing capabilities and constraints**—Devices with differing hardware and software constraints on Link Aggregation are, to the extent possible, accommodated.
l) **No change to the IEEE 802.3® frame format**—Link aggregation neither adds to, nor changes the contents of frames exchanged between MAC Clients.
m) **Network management support**—The standard specifies appropriate management objects for configuration, monitoring, and control of Link Aggregation.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

Link Aggregation, as specified in this clause, does not support the following:

n) **Multipoint Aggregations**—The mechanisms specified in this clause do not support aggregations among more than two Systems.
o) **Dissimilar MACs**—Link Aggregation is supported only on links using the IEEE 802.3® MAC.
p) **Half-duplex operation**—Link Aggregation is supported only on point-to-point links with MACs operating in full duplex mode.
q) **Operation across multiple data rates**—All links in a Link Aggregation Group operate at the same data rate (e.g., 10 Mb/s, 100 Mb/s, or 1000 Mb/s).

43.1.3 Positioning of Link Aggregation within the IEEE 802.3® architecture

Link Aggregation comprises an optional sublayer between a MAC Client and the MAC (or optional MAC Control sublayer). Figure 43–1 depicts the positioning of the Link Aggregation sublayer in the CSMA/CD layer architecture, and the relationship of that architecture to the Data Link and Physical Layers of the OSI Reference Model. The figure also shows the ability of the Link Aggregation sublayer to combine a number of individual links in order to present a single MAC interface to the MAC Client.

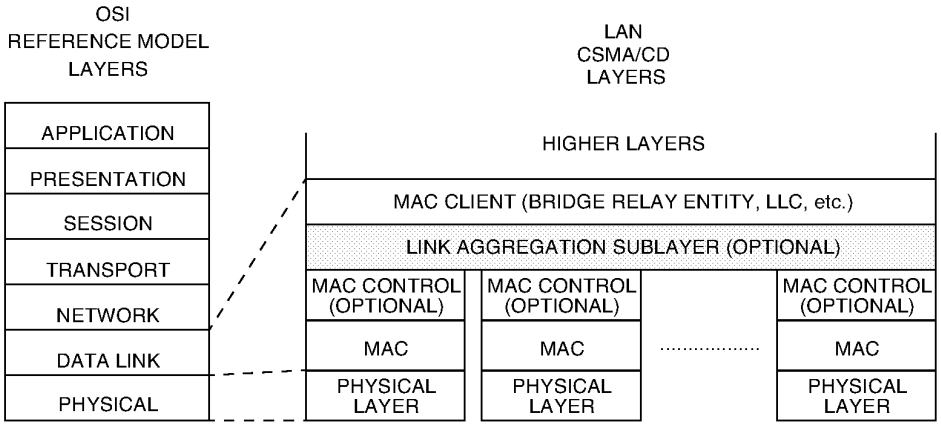


Figure 43–1—Architectural positioning of Link Aggregation sublayer

Figure 43–2 depicts the major blocks that form the Link Aggregation sublayer, and their interrelationships.

It is possible to implement the optional Link Aggregation sublayer for some ports within a System while not implementing it for other ports; i.e., it is not necessary for all ports in a System to be subject to Link Aggregation. A conformant implementation is not required to be able to apply the Link Aggregation sublayer to every port.

43.1.4 State diagram conventions

Many of the functions specified in this clause are presented in state diagram notation. All state diagrams contained in this clause use the notation and conventions defined in 21.5. In the event of a discrepancy between the text description and the state diagram formalization of a function, the state diagrams take precedence.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

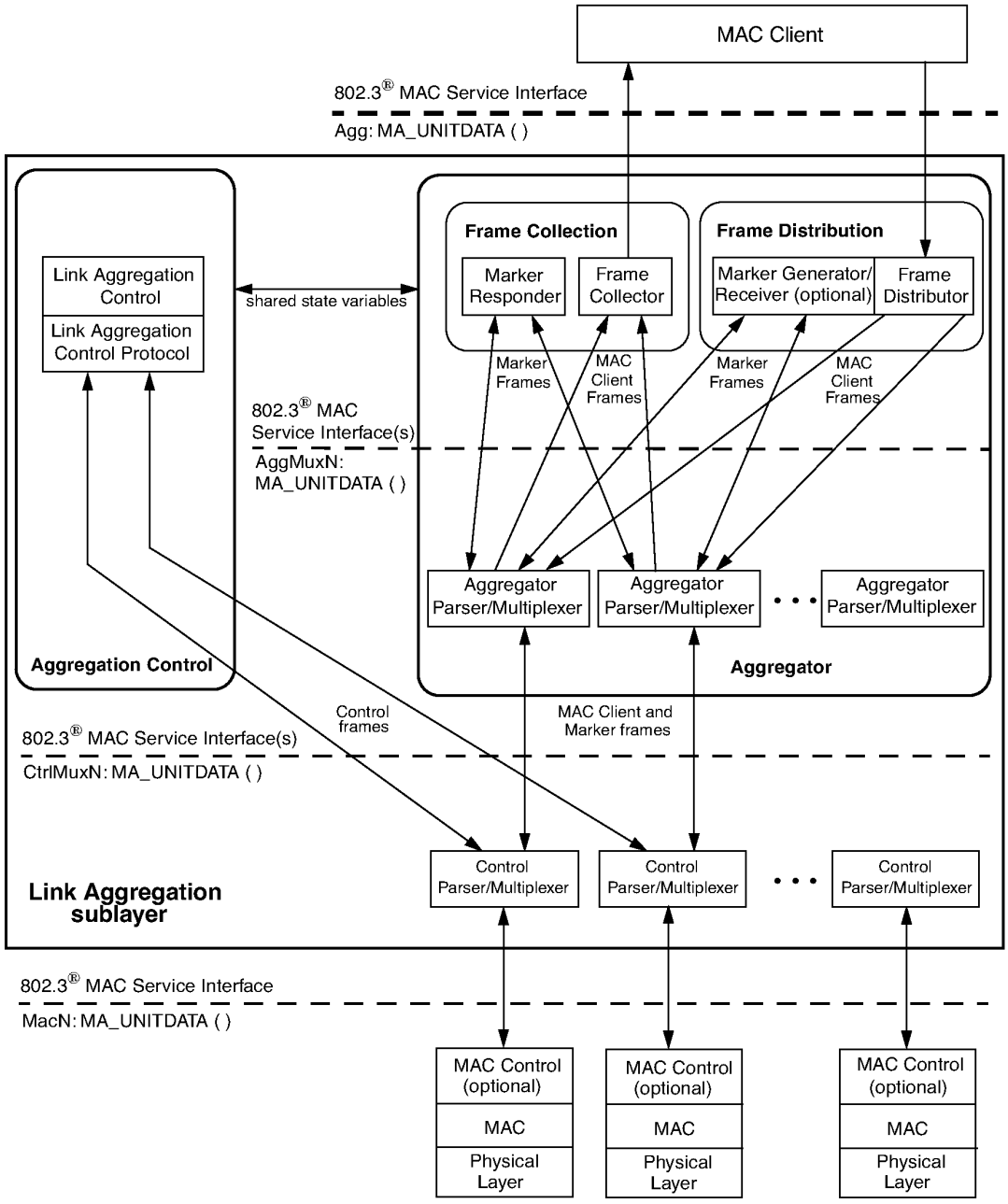


Figure 43–2—Link Aggregation sublayer block diagram

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

43.2 Link Aggregation operation

As depicted in Figure 43–2, the Link Aggregation sublayer comprises the following functions:

a) *Frame Distribution*. This block is responsible for taking frames submitted by the MAC Client and submitting them for transmission on the appropriate port, based on a frame distribution algorithm employed by the Frame Distributor. Frame Distribution also includes an optional *Marker Generator/Receiver* used for the Marker protocol. (See 43.2.4, 43.2.5, and 43.5.)

b) *Frame Collection*. This block is responsible for passing frames received from the various ports to the MAC Client. Frame Collection also includes a *Marker Responder,* used for the Marker protocol. (See 43.2.3 and 43.5.)

c) *Aggregator Parser/Multiplexers*. On transmit, these blocks simply pass frame transmission requests from the Distributor, Marker Generator, and/or Marker Responder to the appropriate port. On receive, these blocks distinguish among Marker Request, Marker Response, and MAC Client PDUs, and pass each to the appropriate entity (Marker Responder, Marker Receiver, and Collector, respectively).

d) *Aggregator*. The combination of Frame Distribution and Collection, along with the Aggregator Parser/Multiplexers, is referred to as the Aggregator.

e) *Aggregation Control*. This block is responsible for the configuration and control of Link Aggregation. It incorporates a *Link Aggregation Control Protocol* (LACP) that can be used for automatic communication of aggregation capabilities between Systems and automatic configuration of Link Aggregation.

f) *Control Parser/Multiplexers*. On transmit, these blocks simply pass frame transmission requests from the Aggregator and Control entities to the appropriate port. On receive, these blocks distinguish Link Aggregation Control PDUs from other frames, passing the LACPDUs to the appropriate sublayer entity, and all other frames to the Aggregator.

43.2.1 Principles of Link Aggregation

Link Aggregation allows a MAC Client to treat a set of one or more ports as if it were a single port. In doing so, it employs the following principles and concepts:

a) A MAC Client communicates with a set of ports through an Aggregator, which presents a standard IEEE 802.3® service interface to the MAC Client. The Aggregator binds to one or more ports within a System.

b) It is the responsibility of the Aggregator to distribute frame transmissions from the MAC Client to the various ports, and to collect received frames from the ports and pass them to the MAC Client transparently.

c) A System may contain multiple Aggregators, serving multiple MAC Clients. A given port will bind to (at most) a single Aggregator at any time. A MAC Client is served by a single Aggregator at a time.

d) The binding of ports to Aggregators within a System is managed by the Link Aggregation Control function for that System, which is responsible for determining which links may be aggregated, aggregating them, binding the ports within the System to an appropriate Aggregator, and monitoring conditions to determine when a change in aggregation is needed.

e) Such determination and binding may be under manual control through direct manipulation of the state variables of Link Aggregation (e.g., Keys) by a network manager. In addition, automatic determination, configuration, binding, and monitoring may occur through the use of a Link Aggregation Control Protocol (LACP). The LACP uses peer exchanges across the links to determine, on an ongoing basis, the aggregation capability of the various links, and continuously provides the maximum level of aggregation capability achievable between a given pair of Systems.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

f) Frame ordering must be maintained for certain sequences of frame exchanges between MAC Clients (known as conversations, see 1.4). The Distributor ensures that all frames of a given conversation are passed to a single port. For any given port, the Collector is required to pass frames to the MAC Client in the order that they are received from that port. The Collector is otherwise free to select frames received from the aggregated ports in any order. Since there are no means for frames to be misordered on a single link, this guarantees that frame ordering is maintained for any conversation.

g) Conversations may be moved among ports within an aggregation, both for load balancing and to maintain availability in the event of link failures.

h) This standard does not impose any particular distribution algorithm on the Distributor. Whatever algorithm is used should be appropriate for the MAC Client being supported.

i) Each port is assigned a unique, globally administered MAC address. This MAC address is used as the source address for frame exchanges that are initiated by entities within the Link Aggregation sublayer itself (i.e., LACP and Marker protocol exchanges).

NOTE—The LACP and Marker protocols use a multicast destination address for all exchanges, and do not impose any requirement for a port to recognize more than one unicast address on received frames.

j) Each Aggregator is assigned a unique, globally administered MAC address; this address is used as the MAC address of the aggregation from the perspective of the MAC Client, both as a source address for transmitted frames and as the destination address for received frames. The MAC address of the Aggregator may be one of the MAC addresses of a port in the associated Link Aggregation Group (see 43.2.10).

43.2.2 Service interfaces

The MAC Client communicates with the Aggregator using the standard service interface specified in Clause 2. Similarly, Link Aggregation communicates internally (between Frame Collection/Distribution, the Aggregator Parser/Multiplexers, the Control Parser/Multiplexers, and Link Aggregation Control) and with its bound ports using the same, standard service interface. No new interlayer service interfaces are defined for Link Aggregation.

Since Link Aggregation uses four instances of the MAC Service Interface, it is necessary to introduce a notation convention so that the reader can be clear as to which interface is being referred to at any given time. A prefix is therefore assigned to each service primitive, indicating which of the four interfaces is being invoked, as depicted in Figure 43–2. The prefixes are as follows:

a) *Agg:*, for primitives issued on the interface between the MAC Client and the Link Aggregation sublayer.

b) *AggMuxN:*, for primitives issued on the interface between Aggregator Parser/Multiplexer N and its internal clients (where N is the port number associated with the Aggregator Parser/Multiplexer).

c) *CtrlMuxN:*, for primitives issued on the interface between Control Parser/Multiplexer N and its internal clients (where N is the port number associated with the Control Parser/Multiplexer).

d) *MacN:*, for primitives issued on the interface between underlying MAC N and its Control Parser/Multiplexer (where N is the port number associated with the underlying MAC).

MAC Clients may generate Agg:MA_DATA.request primitives for transmission on an aggregated link. These are passed by the Frame Distributor to a port selected by the distribution algorithm. MacN:MA_DATA.indication primitives signifying received frames are passed unchanged from a port to the MAC Client by the Frame Collector.

MAC Clients that generate MA_CONTROL.request primitives (and which expect MA_CONTROL.indication primitives in response) cannot communicate through a Link Aggregation sublayer. They must communicate directly with the MAC Control entity through which these control primitives are to be sent and received.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

The multiplexing of such MAC Control clients with a Link Aggregation sublayer for simultaneous use of a single port is outside the scope of this standard.

The multiplexing of MAC Clients with a Link Aggregation sublayer for simultaneous use of an individual MAC that is also part of a Link Aggregation Group is outside the scope of this standard.

43.2.3 Frame Collector

A Frame Collector is responsible for receiving incoming frames (i.e., AggMuxN:MA_DATA.indications) from the set of individual links that form the Link Aggregation Group (through each link's associated Aggregator Parser/Multiplexer) and delivering them to the MAC Client. Frames received from a given port are delivered to the MAC Client in the order that they are received by the Frame Collector. Since the Frame Distributor is responsible for maintaining any frame ordering constraints, there is no requirement for the Frame Collector to perform any reordering of frames received from multiple links.

The Frame Collector shall implement the function specified in the state diagram shown in Figure 43–3 and the associated definitions contained in 43.2.3.1.

43.2.3.1 Frame Collector state diagram

43.2.3.1.1 Constants

CollectorMaxDelay
: In tens of microseconds, the maximum time that the Frame Collector may delay the delivery of a frame received from an Aggregator Parser to its MAC Client. Value is assigned by management or administration policy.
Value: Integer

43.2.3.1.2 Variables

DA
SA
m_sdu
status
: The parameters of the MA_DATA.indication primitive, as defined in Clause 2.

BEGIN
: A Boolean variable that is set to TRUE when the System is initialized or reinitialized, and is set to FALSE when (re-)initialization has completed.
Value: Boolean

43.2.3.1.3 Messages

Agg:MA_DATA.indication
AggMuxN:MA_DATA.indication
: The service primitives used to pass a received frame to a client with the specified parameters.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

43.2.3.1.4 State diagram

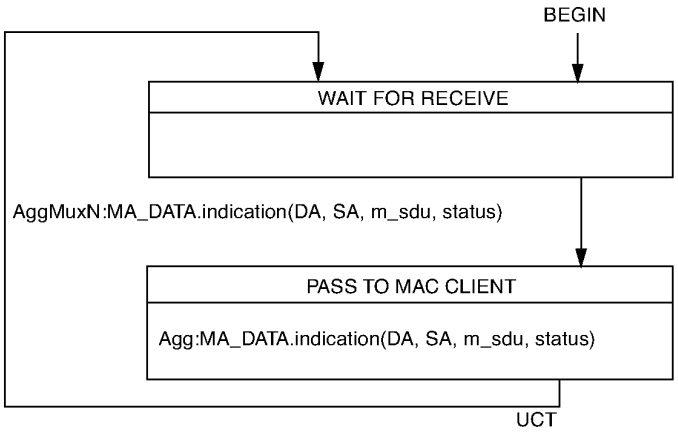


Figure 43–3—Frame Collector state diagram

The architectural models of the IEEE 802.3® MAC and Link Aggregation do not make any provision for queueing of frames between the link and the MAC Client. Furthermore, the state machine conventions used in this standard assume that actions within a state occur instantaneously (see 21.5). However, practical implementations of Link Aggregation will typically incur both queueing and delay in the Frame Collector. In order to ensure that frame delivery is not delayed indefinitely (which could cause a frame ordering problem when moving conversations from one link to another), the Frame Collector shall, upon receiving a frame from an Aggregator Parser, either deliver the frame to its MAC Client, or discard the frame within a CollectorMaxDelay time. The Frame Distributor (within the Partner System at the other end of the link) can assume that all frames transmitted on a given link have been either received by its Partner's MAC Client or discarded after a CollectorMaxDelay plus the propagation delay of the link. The use of CollectorMaxDelay is further discussed in 43A.3.

43.2.4 Frame Distributor

The Frame Distributor is responsible for taking outgoing frames from the MAC Client and transmitting them through the set of links that form the Link Aggregation Group. The Frame Distributor implements a distribution function (algorithm) responsible for choosing the link to be used for the transmission of any given frame or set of frames.

This standard does not mandate any particular distribution algorithm(s); however, any distribution algorithm shall ensure that, when frames are received by a Frame Collector as specified in 43.2.3, the algorithm shall not cause

a) Mis-ordering of frames that are part of any given conversation, or
b) Duplication of frames.

The above requirement to maintain frame ordering is met by ensuring that all frames that compose a given conversation are transmitted on a single link in the order that they are generated by the MAC Client; hence, this requirement does not involve the addition (or modification) of any information to the MAC frame, nor any buffering or processing on the part of the corresponding Frame Collector in order to re-order frames. This approach to the operation of the distribution function permits a wide variety of distribution and load balancing algorithms to be used, while also ensuring interoperability between devices that adopt differing algorithms.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

NOTE—The subject of distribution algorithms and maintenance of frame ordering is discussed in Annex 43A.

The Frame Distributor shall implement the function specified in the state diagram shown in Figure 43–4 and the associated definitions contained in 43.2.4.1.

43.2.4.1 Frame Distributor state diagram

43.2.4.1.1 Variables

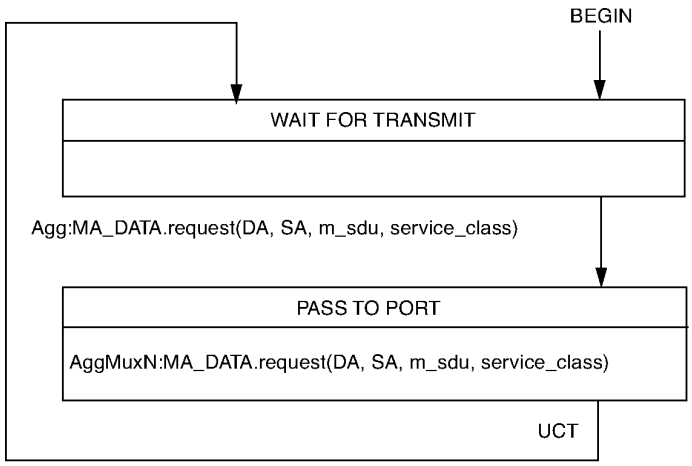
DA
SA
m_sdu
service_class
: The parameters of the MA_DATA.request primitive, as defined in Clause 2.

BEGIN
: A Boolean variable that is set to TRUE when the System is initialized or reinitialized, and is set to FALSE when (re-)initialization has completed.
Value: Boolean

43.2.4.1.2 Messages

Agg:MA_DATA.request
AggMuxN:MA_DATA.request
: The service primitives used to transmit a frame with the specified parameters.

43.2.4.1.3 State diagram



If a client issues an Agg:MA_DATA.request primitive that contains no SA parameter, the AggMuxN:MA_DATA.request primitive generated shall use the Aggregator's MAC address for the SA.

NOTE—The algorithm that the Frame Distributor uses to select the value of N in AggMuxN:MA_DATA.request for a given frame is unspecified.

Figure 43–4—Frame Distributor state diagram

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

43.2.5 Marker Generator/Receiver (optional)

The optional Marker Generator is used by the Marker protocol, as specified in 43.5. When implemented and so requested by the Distribution algorithm, the Marker Generator shall issue an AggMuxN:MA_DATA.request primitive, with an m_sdu containing a Marker PDU as defined in 43.5.3, to the port associated with the conversation being marked, subject to the timing restrictions for Slow Protocols specified in Annex 43B.

The optional Marker Receiver is used by the Marker protocol, as specified in 43.5. It receives Marker Response PDUs from the Aggregator Parser.

43.2.6 Marker Responder

The Marker Responder is used by the Marker protocol, as specified in 43.5. The Marker Responder receives Marker PDUs (generated by a Partner System's Marker Generator), and transmits a Marker Response PDU through the same port from which the Marker PDU was received. While implementation of the Marker Generator/Receiver is optional, the ability to respond to a Marker PDU (the Marker Responder) is mandatory. An implementation conformant to this clause shall implement the Marker Responder as specified in 43.5.4.2, thus ensuring that implementations that need to make use of the protocol can do so.

43.2.7 Aggregator Parser/Multiplexer

On transmission, the Aggregator Multiplexer shall provide transparent pass-through of frames submitted by the Marker Responder and optional Marker Generator to the port specified in the transmission request. The Aggregator Multiplexer shall provide transparent pass-through of frames submitted by the Frame Distributor to the port specified in the transmission request only when the port state is Distributing (see 43.4.15); otherwise, such frames shall be discarded.

On receipt, the Aggregator Parser decodes frames received from the Control Parser, passes those frames destined for the Marker Responder or Marker Receiver to the selected entity, and discards frames with invalid Slow Protocol subtype values (see Table 43B–2). The Aggregator Parser shall pass all other frames to the Frame Collector for passage to the MAC Client only when the port state is Collecting (see 43.4.15); otherwise, such frames shall be discarded. The Aggregator Parser shall implement the function specified in the state diagram shown in Figure 43–5 and the associated definitions contained in 43.2.7.1.

43.2.7.1 Aggregator Parser state diagram

43.2.7.1.1 Constants

Slow_Protocols_Multicast
: The value of the Slow Protocols Multicast address. (See Table 43B–1.)

Slow_Protocols_Type
: The value of the Slow Protocols Length/Type field. (See Annex 43B.)

Marker_subtype
: The value of the Subtype field for the Marker protocol. (See 43.5.3.)
Value: Integer
2

Marker_Information
: The encoding of the Marker Information TLV_type field. (See 43.5.3.)
Value: Integer
1

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

Marker_Response_Information
The encoding of the Marker Response Information TLV_type field. (See 43.5.3.)
Value: Integer
2

43.2.7.1.2 Variables

DA
SA
m_sdu
status
The parameters of the MA_DATA.indication primitive as defined in Clause 2.

Length/Type
The value of the Length/Type field in a received frame.
Value: Integer

Subtype
The value of the octet following the Length/Type field in a Slow Protocol frame.
(See Annex 43B.)
Value: Integer

TLV_type
The value contained in the octet following the Version Number in a received Marker or Marker Response frame. This identifies the "type" for the Type/Length/Value (TLV) tuple. (See 43.5.3.)
Value: Integer

BEGIN
A Boolean variable that is set to TRUE when the System is initialized or reinitialized, and is set to FALSE when (re-)initialization has completed.
Value: Boolean

43.2.7.1.3 Messages

CtrlMuxN:MA_DATA.indication
AggMuxN:MA_DATA.indication
The service primitives used to pass a received frame to a client with the specified parameters.

43.2.8 Aggregator

An *Aggregator* comprises an instance of a Frame Collection function, an instance of a Frame Distribution function and one or more instances of the Aggregator Parser/Multiplexer function for a Link Aggregation Group. A single Aggregator is associated with each Link Aggregation Group. An Aggregator offers a standard IEEE 802.3® MAC service interface to its associated MAC Client; access to the MAC service by a MAC Client is always achieved via an Aggregator. An Aggregator can therefore be considered to be a *logical MAC*, bound to one or more ports, through which the MAC client is provided access to the MAC service.

A single, individual MAC address is associated with each Aggregator (see 43.2.10).

An Aggregator is available for use by the MAC Client if the following are all true:

a) It has one or more attached ports.
b) The Aggregator has not been set to a disabled state by administrative action (see 30.7.1.1.13).

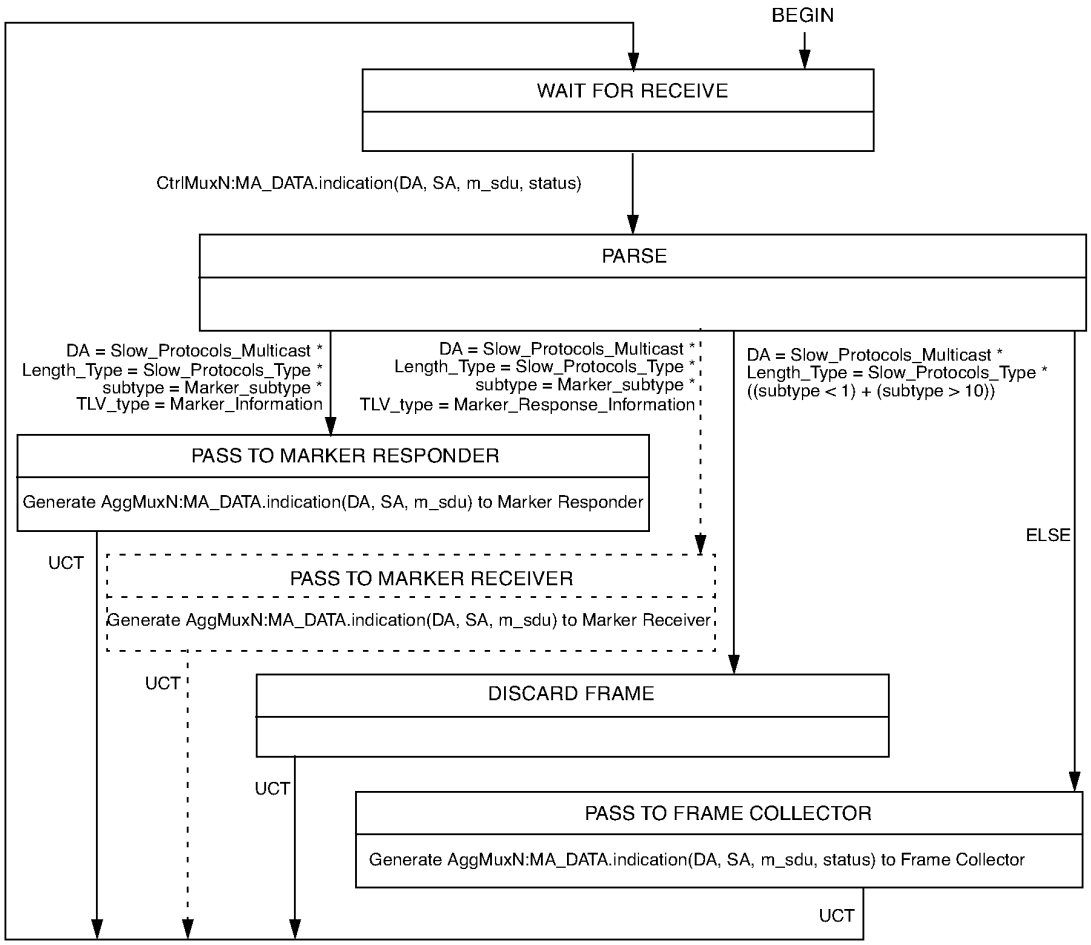
Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

c) The collection and/or distribution function associated with one or more of the attached ports is enabled (see 30.7.1.1.14).

NOTE—To simplify the modeling and description of the operation of Link Aggregation, it is assumed that there are as many Aggregators as there are ports in a given System; however, this is not a requirement of this standard. Aggregation of two or more ports consists of changing the bindings between ports and Aggregators such that more than one port is bound to a single Aggregator. The creation of any aggregations of two or more links will therefore result in one or more Aggregators that are bound to more than one port, and one or more Aggregators that are not bound to any port. An Aggregator that is not bound to any port appears to a MAC Client as a MAC interface to an inactive port. During times when the bindings between ports and Aggregators are changing, or as a consequence of particular configuration choices, there may be occasions when one or more ports are not bound to any Aggregator.

43.2.8.1 State diagram



If the optional Marker Receiver is not implemented, Marker Responses shall be passed to the Frame Collector. If the port state is not Collecting, all frames that would have been passed to the MAC Client through the Collector will be discarded.

Figure 43–5—Aggregator Parser state diagram

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

43.2.9 Control Parser/Multiplexer

On transmission, the Control Multiplexer shall provide transparent pass-through of frames submitted by the Aggregator and Link Aggregation Control Protocol to the port specified in the transmission request.

On receipt, the Control Parser decodes frames received from the various ports in the Link Aggregation Group, passes those frames destined for the Link Aggregation Control Protocol to the appropriate entity, and passes all other frames to the Aggregator Parser. The Control Parser shall implement the function specified by the state diagram shown in Figure 43–6 and the associated definitions contained in 43.2.9.1.

43.2.9.1 Control Parser state diagram

43.2.9.1.1 Constants

Slow_Protocols_Multicast
: The value of the Slow Protocols Multicast address. (See Table 43B–1.)

Slow_Protocols_Type
: The value of the Slow Protocols Length/Type field. (See Table 43B–2.)

LACP_subtype
: The value of the Subtype field for the Link Aggregation Control Protocol. (See Table 43B–3.)
Value: Integer
1

43.2.9.1.2 Variables

DA
SA
m_sdu
status
: The parameters of the MA_DATA.indication primitive, as defined in Clause 2.

Length/Type
: The value of the Length/Type field in a received frame.
Value: Integer

Subtype
: The value of the octet following the Length/Type field in a Slow Protocol frame.
(See Annex 43B.)
Value: Integer

BEGIN
: A Boolean variable that is set to TRUE when the System is initialized or reinitialized, and is set to FALSE when (re-)initialization has completed.
Value: Boolean

43.2.9.1.3 Messages

MacN:MA_DATA.indication
CtrlMuxN:MA_DATA.indication
: The service primitives used to pass a received frame to a client with the specified parameters.

Copyright © 2002 IEEE. All rights reserved.

43.2.9.1.4 State diagram

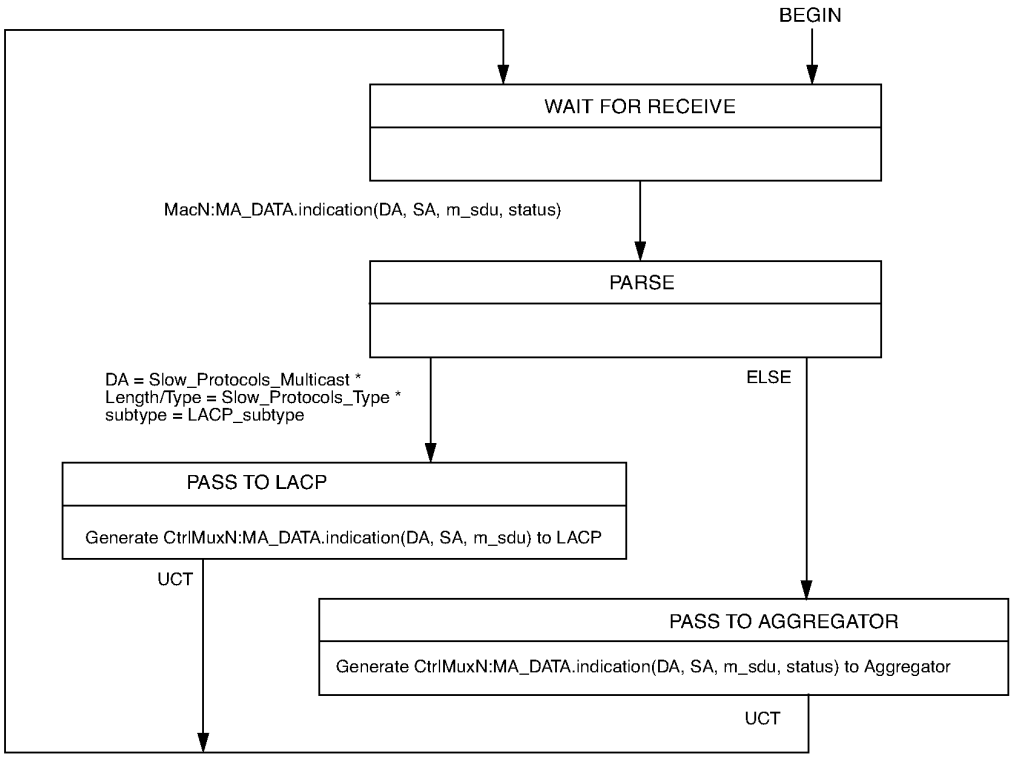


Figure 43–6—Control Parser state diagram

43.2.10 Addressing

Each IEEE 802.3® MAC has an associated globally-unique individual MAC address, whether that MAC is used for Link Aggregation or not (see Clause 4).

Each Aggregator to which one or more ports are attached has an associated globally-unique individual MAC address (see 43.3.3). The MAC address of the Aggregator may be the globally-unique individual MAC addresses of one of the MACs in the associated Link Aggregation Group, or it may be a distinct MAC address. The manner in which such addresses are chosen is not otherwise constrained by this standard.

Protocol entities sourcing frames from within the Link Aggregation sublayer (e.g., LACP and the Marker protocol) use the MAC address of the MAC within an underlying port as the source address in frames transmitted through that port. The MAC Client sees only the Aggregator and not the underlying MACs, and therefore uses the Aggregator's MAC address as the source address in transmitted frames. If a MAC Client submits a frame to the Aggregator for transmission without specifying a source address, the Aggregator inserts its own MAC address as the source address for transmitted frames.

NOTE—This behavior causes the Aggregator to behave the same way as a standard MAC with regard to frames submitted by its client.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

43.3 Link Aggregation Control

Link Aggregation Control configures and controls the Link Aggregation sublayer using static information local to the control function and dynamic information exchanged by means of the Link Aggregation Control Protocol.

For each aggregatable port in the System, Link Aggregation Control

a) Maintains configuration information (reflecting the inherent properties of the individual links as well as those established by management) to control aggregation.

b) Exchanges configuration information with other Systems to allocate the link to a Link Aggregation Group.

NOTE—A given link is allocated to, at most, one Link Aggregation Group at a time. The allocation mechanism attempts to maximize aggregation, subject to management controls.

c) Attaches the port to the Aggregator used by the Link Aggregation Group, and detaches the port from the Aggregator when it is no longer used by the Group.

d) Uses information from the Partner System's Link Aggregation Control entity to enable or disable the Aggregator's Collector and Distributor.

The operation of Link Aggregation Control involves the following activities, which are described in detail in the subclauses that follow:

e) Checking that candidate links can actually be aggregated.

f) Controlling the addition of a link to a Link Aggregation Group, and the creation of the group if necessary.

g) Monitoring the status of aggregated links to ensure that the aggregation is still valid.

h) Removing a link from a Link Aggregation Group if its membership is no longer valid, and removing the group if it no longer has any member links.

In order to allow Link Aggregation Control to determine whether a set of links connect to the same System, and to determine whether those links are compatible from the point of view of aggregation, it is necessary to be able to establish

i) A globally unique identifier for each System that participates in Link Aggregation (see 43.3.2).

j) A means of identifying the set of capabilities associated with each port and with each Aggregator, as understood by a given System.

k) A means of identifying a Link Aggregation Group and its associated Aggregator.

System identification allows the detection of links that are connected in a loopback configuration (i.e., both ends of the same link are connected to the same System).

43.3.1 Characteristics of Link Aggregation Control

Link Aggregation Control provides a configuration capability that is

a) **Automatic.** In the absence of manual override controls, an appropriate set of Link Aggregation Groups is automatically configured, and individual links are allocated to those groups. If a set of links can aggregate, they do aggregate.

b) **Continuous.** Manual intervention or initialization events are not a requirement for correct operation. The configuration mechanism continuously monitors for changes in state that require reconfiguration. The configuration functions detect and correct misconfigurations by performing reconfiguration and/or by taking misconfigured links out of service.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

c) **Deterministic.** The configuration can resolve deterministically; i.e., the configuration achieved can be made independent of the order in which events occur, and be completely determined by the combination of the capabilities of the individual links and their physical connectivity.
d) **Controllable.** The configuration capabilities accommodate devices with differing hardware and software constraints on Link Aggregation.
e) **Compatible.** Links that cannot take part in Link Aggregation, either because of their inherent capabilities or of the capabilities of the devices to which they attach, operate as normal IEEE 802.3® links. The introduction of Link Aggregation capability at one or both ends of a link should not result in a degradation of the perceived performance of the link.
f) **Rapid.** The configuration resolves rapidly to a stable configuration. Convergence can be achieved by the exchange of three LACPDUs, without dependence on timer values.

with

g) **Low risk of misdelivery.** The operation of the (re-)configuration functions minimizes the risk of frames being delivered to the wrong Aggregator.
h) **Low risk of duplication or mis-ordering.** The operation of the (re-)configuration functions minimizes the risk of frame duplication and frame mis-ordering.
i) **Low protocol overhead.** The overhead involved in external communication of configuration information between devices is small.

43.3.2 System identification

The globally unique identifier used to identify a System shall be the concatenation of a globally administered individual MAC address and the System Priority. The MAC address chosen may be the individual MAC address associated with one of the ports of the System.

Where it is necessary to perform numerical comparisons between System Identifiers, each System Identifier is considered to be an eight octet unsigned binary number, constructed as follows:

a) The two most significant octets of the System Identifier comprise the System Priority. The System Priority value is taken to be an unsigned binary number; the most significant octet of the System Priority forms the most significant octet of the System Identifier.
b) The third most significant octet of the System Identifier is derived from the initial octet of the MAC address; the least significant bit of the octet is assigned the value of the first bit of the MAC address, the next most significant bit of the octet is assigned the value of the next bit of the MAC address, and so on. The fourth through eighth octets are similarly assigned the second through sixth octets of the MAC address.

43.3.3 Aggregator identification

Each Aggregator to which one or more ports are attached shall be assigned a unique, globally administered individual MAC address. The MAC address assigned to the Aggregator may be the same as the MAC address assigned to one of its bound ports. No Aggregator shall be assigned a MAC address that is the same as that of a port bound to a different Aggregator within the System. When receiving frames, a port is never required to recognize more than one unicast address, i.e., the Aggregator's MAC address.

NOTE—This ensures that Aggregators can be uniquely addressed, and allows (but does not require) the unique address to be allocated from the same set of addresses as are assigned to the ports. It also acknowledges the fact that locally administered addresses may be used in particular implementations or environments. The stated restriction on the allocation of MAC addresses to Aggregators may have implications with regard to the choice of selection algorithm.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

An aggregator also shall be assigned an integer identifier that is used by Link Aggregation Control to uniquely identify the aggregator within the System. This value will typically be the same as the interface identifier (ifIndex) used for management purposes.

43.3.4 Port identification

Link Aggregation Control uses a Port Identifier, comprising the concatenation of a Port Priority and a Port Number, to identify the port. Port Numbers (and hence, Port Identifiers) shall be uniquely assigned within a System. Port Number 0 shall not be assigned to any port.

When it is necessary to perform numerical comparisons between Port Identifiers, each Port Identifier is considered to be a four octet unsigned binary number constructed as follows:

a) The most significant and second most significant octets are the first and second most significant octets of the Port Priority, respectively.
b) The third and fourth most significant octets are the first and second most significant octets of the Port Number, respectively.

43.3.5 Capability identification

The ability of one port to aggregate with another is summarized by a simple integer parameter, known as a Key. This facilitates communication and comparison of aggregation capabilities, which may be determined by a number of factors, including

a) The port's physical characteristics, such as data rate, duplexity, point-to-point or shared medium.
b) Configuration constraints established by the network administrator.
c) Use of the port by higher layer protocols (e.g. assignment of Network Layer addresses).
d) Characteristics or limitations of the port implementation itself.

Two Keys shall be associated with each port: an operational Key and an administrative Key. The operational Key is the Key that is currently in active use for the purposes of forming aggregations. The administrative Key allows manipulation of Key values by management. The administrative and operational Keys assigned to a port may differ

e) If the operation of the implementation is such that an administrative change to a Key value cannot be immediately reflected in the operational state of the port.
f) If the System supports the dynamic manipulation of Keys, as discussed in 43.6.2, either to accurately reflect changes in operational capabilities of the port (for example, as a result of Auto-Negotiation), or to provide a means of handling constraints on aggregation capability.

A given Key value is meaningful only in the context of the System that allocates it; there is no global significance to Key values. Similarly, the relationship between administrative and operational Key values is meaningful only in the context of the System that allocates it. When a System assigns an administrative Key value to a set of ports, it signifies that the set of ports have the potential to aggregate together, subject to the considerations discussed in 43.6.2. When a System assigns an operational Key value to a set of ports, it signifies that, in the absence of other constraints, the current operational state of the set of ports allows any subset of that set of ports (including the entire set) to be aggregated together from the perspective of the System making the assignment. The set of such ports that will actually be aggregated will be those that terminate at a common Partner System, and for which that Partner System has assigned a common operational Key value, local to that Partner. The set of ports in a given System that share the same operational Key value are said to be members of the same Key Group.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

A System may determine that a given link is not able to be aggregated with other links. Such links are referred to as Individual links (as opposed to Aggregatable links). A System may declare a link to be Individual if the inherent properties of the link allow its use as part of an aggregation, but the system is aware of no other links that are capable of aggregating with this link (e.g., the System has allocated a unique operational Key value to the link).

The capability information communicated between Systems, therefore, includes this local knowledge of the aggregation capability of the link in addition to the operational Key value; i.e., whether the System considers the link to be Aggregatable or Individual.

An administrative Key value and an operational Key value shall also be associated with each Aggregator. The operational Key is the Key that is currently in active use for the purposes of forming aggregations. The administrative Key allows manipulation of Key values by management. The values of administrative and operational Key for an Aggregator may differ in the same manner as that of port Keys, per item e) and item f), in this subclause. Ports that are members of a given Key Group can only be bound to Aggregators that share the same operational Key value.

All Keys are 16-bit identifiers. All values except the null value (all zeroes) are available for local use.

NOTE—This model allows for two convenient initial configurations. The first is achieved by assigning each port an initial administrative and operational Key value identical to its port number, and assigning the same port numbers as Keys to the corresponding Aggregators for each port. A device with this initial configuration will bring up all links as individual, non-aggregated links. The second is achieved by assigning the same administrative and operational Key values to all ports with a common set of capabilities, and also to all Aggregators. A device with this initial configuration will attempt to aggregate together any set of links that have the same Partner System ID and operational Key, and for which both Systems are prepared to allow aggregation.

43.3.6 Link Aggregation Group identification

A Link Aggregation Group consists of either

a) One or more Aggregatable links that terminate in the same pair of Systems and whose ports belong to the same Key Group in each System, or
b) An Individual link.

43.3.6.1 Construction of the Link Aggregation Group Identifier

A unique Link Aggregation Group Identifier (LAG ID) is constructed from the following parameters for each of the communicating Systems:

a) The System Identifier
b) The operational Key assigned to the ports in the LAG
c) The Port Identifier, if the link is identified as an Individual link

The local System's values for these parameters shall be non-zero. In cases where the local System is unable to determine the remote System's values for these parameters by exchange of protocol information, administrative values are used in the construction of the LAG ID. The value of these administrative parameters for the remote System may be configured as zero, provided that the port(s) concerned are also configured to be Individual.

A compound identifier formed from the System Identifiers and Key values alone is sufficient to identify a LAG comprising Aggregatable links. However, such an identifier is not sufficient for a LAG comprising a single Individual link where the Partner System Identifier and operational Key may be zero. Even if these are non-zero there may be multiple Individual Links with the same System Identifier and operational Key combinations, and it becomes necessary to include Port Identifiers to provide unique LAG IDs.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

Given

d) S and T are System Identifiers,
e) K and L are the operational Keys assigned to a LAG by S and T respectively, and
f) P and Q are the Port Identifiers of the ports being attached if the LAG comprises a single Individual Link and zero if the LAG comprises one or more Aggregatable links,

then the general form of the unique LAG ID is [(SKP), (TLQ)].

To simplify comparison of LAG IDs it is conventional to order these such that S is the numerically smaller of S and T.

43.3.6.2 Representation of the Link Aggregation Group Identifier

In order to allow for convenient transcription and interpretation by human network personnel, this standard provides a convention for representing compound LAG IDs. Using this format

a) All fields are written as hexadecimal numbers, 2 digits per octet, in canonical format.
b) Octets are presented in order, from left to right. Within fields carrying numerical significance (e.g., priority values), the most significant octet is presented first, and the least significant octet last.
c) Within fields that carry MAC addresses, successive octets are separated by dashes (-), in accordance with the hexadecimal representation for MAC addresses defined in IEEE Std 802-1990™ .
d) Parameters of the LAG ID are separated by commas.

For example, consider the parameters for the two Partners in a Link Aggregation Group shown in Table 43–1.

Table 43–1—Example Partner Parameters

	Partner SKP	Partner TLQ
System Parameters (S, T)	System Priority = 0x8000 (see 43.4.2.2) System Identifier = AC-DE-48-03-67-80	System Priority = 0x8000 (see 43.4.2.2) System Identifier = AC-DE-48-03-FF-FF
Key Parameter (K, L)	Key = 0x0001	Key = 0x00AA
Port Parameters (P, Q)	Port Priority = 0x80 (see 43.4.2.2) Port Number = 0x0002	Port Priority = 0x80 (see 43.4.2.2) Port Number = 0x0002

The complete LAG ID derived from this information is represented as follows, for an Individual link:

[(SKP), (TLQ)] = [(8000,AC-DE-48-03-67-80,0001,80,0002), (8000,AC-DE-48-03-FF-FF,00AA,80,0002)]

The corresponding LAG ID for a set of Aggregatable links is represented as follows:

[(SKP), (TLQ)] = [(8000,AC-DE-48-03-67-80,0001,00,0000), (8000,AC-DE-48-03-FF-FF,00AA,00,0000)]

NOTE—The difference between the two representations is that, for an Aggregatable link, the port identifier components are zero.

It is recommended that this format be used whenever displaying LAG ID information for use by network personnel.

Copyright © 2002 IEEE. All rights reserved.

43.3.7 Selecting a Link Aggregation Group

Each port is selected for membership in the Link Aggregation Group uniquely identified by the LAG ID (composed of operational information, both derived from local administrative parameters and received through the Link Aggregation Control Protocol). Initial determination of the LAG ID is delayed to allow receipt of such information from a peer Link Aggregation Control entity; in the event such information is not received, locally configured administrative defaults are assumed for the remote port's operational parameters.

Where a particular link is known to be Individual, the complete LAG ID is not required to select the Link Aggregation Group since the link will not be aggregated with any other.

43.3.8 Agreeing on a Link Aggregation Group

Before frames are distributed and collected from a link, both the local Link Aggregation Control entity and its remote peer (if present) need to agree on the Link Aggregation Group. The Link Aggregation Control Protocol allows each of the communicating entities to check their peer's current understanding of the LAG ID, and facilitates rapid exchange of operational parameters while that understanding differs from their own. The protocol entities monitor their operation and, if agreement is not reached (perhaps due to an implementation failure), management is alerted.

The ability of LACP to signal that a particular link is Individual can accelerate the use of the link since, if both Link Aggregation Control entities know that the link is Individual, full agreement on the LAG ID is not necessary.

43.3.9 Attaching a link to an Aggregator

Once a link has selected a Link Aggregation Group, Link Aggregation Control can attach that link to a compatible Aggregator. An Aggregator is compatible if

a) The Aggregator's operational Key matches the port's operational Key, and
b) All other links currently attached to the Aggregator have selected the same Link Aggregation Group.

If several compatible Aggregators exist, Link Aggregation Control may employ a locally determined algorithm, either to ensure deterministic behavior (i.e., independence from the order in which Aggregators become available) or to maximize availability of the aggregation to a MAC Client. If no compatible Aggregator exists, then it is not possible to enable the link until such a time as a compatible Aggregator becomes available.

NOTE—In a properly configured System, there should always be a suitable Aggregator available with the proper Key assigned to serve a newly created Link Aggregation Group, so the unavailability of a compatible Aggregator is normally a temporary state encountered while links are moved between Aggregators. However, given the flexibility of the Key scheme, and given that in some implementations there may not be enough Aggregators to service a given configuration of links, it is possible to create configurations in which there is no Aggregator available to serve a newly identified LAG, in which case the links that are members of that LAG cannot become active until such a time as the configuration is changed to free up an appropriate Aggregator.

Links that are not successful candidates for aggregation (e.g., links that are attached to other devices that cannot perform aggregation or links that have been manually configured to be non-aggregatable) are enabled to operate as individual IEEE 802.3® links. For consistency of modeling, such a link is regarded as being attached to a compatible Aggregator that can only be associated with a single link. That is, from the perspective of Link Aggregation, non-aggregated links are not a special case; they compose an aggregation with a maximum membership of one link.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

More than one link can select the same Link Aggregation Group within a short period of time and, as these links detach from their prior Aggregators, additional compatible Aggregators can become available. In order to avoid such events causing repeated configuration changes, Link Aggregation Control applies hysteresis to the attachment process and allows multiple links to be attached to an Aggregator at the same time.

43.3.10 Signaling readiness to transfer user data

Once a link has been attached to an Aggregator (43.3.9) compatible with the agreed-upon Link Aggregation Group (43.3.8), each Link Aggregation Control entity signals to its peer its readiness to transfer user data to and from the Aggregator's MAC Client. In addition to allowing time for the organization of local Aggregator resources, including the possibility that a compatible Aggregator may not exist, explicit signaling of readiness to transfer user data can be delayed to ensure preservation of frame ordering and prevention of frame duplication. Link Aggregation Control will not signal readiness until it is certain that there are no frames in transit on the link that were transmitted while the link was a member of a previous Link Aggregation Group. This may involve the use of an explicit Marker protocol that ensures that no frames remain to be received at either end of the link before reconfiguration takes place. The operation of the Marker protocol is described in 43.5. The decision as to when, or if, the Marker protocol is used is entirely dependent upon the nature of the distribution algorithm that is employed.

43.3.11 Enabling Collection and Distribution

Every Aggregator can enable or disable Collection and Distribution of frames for each port that is attached to the Aggregator. Initially, both Collection and Distribution are disabled. Once the Link Aggregation Control entity is ready to transfer user data using the link and its peer entity has also signaled readiness, the process of enabling the link can proceed. The Collector is enabled (thus preparing it to receive frames sent over the link by the remote Aggregator's Distributor) and that fact is communicated to the Partner. Once the received information indicates that the remote Aggregator's Collector is enabled, the Distributor is also enabled.

NOTE—This description assumes that the implementation is capable of controlling the state of the transmit and receive functions of the MAC independently. In an implementation where this is not possible, the transmit and receive functions are enabled or disabled together. The manner in which this is achieved is detailed in the description of the Mux machine (see 43.4.15).

If at least one port's Mux in the Link Aggregation Group is Collecting, then the Receive state of the corresponding Aggregator will be Enabled. If at least one port's Mux in the Link Aggregation Group is Distributing, then the Transmit state of the corresponding Aggregator will be Enabled.

43.3.12 Monitoring the membership of a Link Aggregation Group

Each link is monitored in order to confirm that the Link Aggregation Control functions at each end of the link still agree on the configuration information for that link. If the monitoring process detects a change in configuration that materially affects the link's membership in its current LAG, then it may be necessary to remove the link from its current LAG and to move it to a new LAG.

43.3.13 Detaching a link from an Aggregator

A port may be detached from the Aggregator used by its Link Aggregation Group as a result of protocol (e.g., Key) changes, or because of System constraints (e.g., exceeding a maximum allowable number of aggregated links, or device failures) at either end of the link. Both classes of events will cause the LAG ID information for the link to change, and it will be necessary for Link Aggregation Control to detach the link from its current Aggregator and move it to a new LAG (if possible). At the point where the change is detected, the Collecting and Distributing states for the port are set to FALSE. The Frame Distribution function is informed that the link is no longer part of the group, the changed configuration information is

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

communicated to the corresponding Link Aggregation Partner, then the Frame Collection function is informed that the link is no longer part of the group.

Once a link has been removed from its Aggregator, the link can select its new Link Aggregation Group and then attach to a compatible Aggregator, as described in 43.3.7 and 43.3.9.

Any conversation that is reallocated to a different link as a result of detaching a link from an Aggregator shall have its frame ordering preserved. This may involve the use of the Marker protocol to ensure that no frames that form part of that conversation remain to be received at either end of the old link before the conversation can proceed on the new link.

43.3.14 Configuration and administrative control of Link Aggregation

Administrative configuration facilities allow a degree of control to be exerted over the way that links may be aggregated. In particular, administrative configuration allows

a) The Key values associated with a port to be identified or modified.
b) The Key values associated with an Aggregator to be identified or modified.
c) Links to be identified as being incapable of aggregation.
d) Link Aggregation Control Protocol parameters to be identified or modified.

43.3.15 Link Aggregation Control state information

The Link Aggregation Control function maintains the following information with respect to each link:

a) The identifier of the Link Aggregation Group to which it currently belongs.
b) The identifier of the Aggregator associated with that Link Aggregation Group.
c) The status of interaction between the Frame Collection function of the Aggregator and the link (Collecting TRUE or Collecting FALSE). Collecting TRUE indicates that the receive function of this link is enabled with respect to its participation in an aggregation; i.e., received frames will be passed up to the Aggregator for collection.
d) The status of interaction between the Frame Distribution function of the Aggregator and the link (Distributing TRUE or Distributing FALSE). Distributing TRUE indicates that the transmit function of this link is enabled with respect to its participation in an aggregation; i.e., frames may be passed down from the Aggregator's distribution function for transmission.

This state information is communicated directly between Link Aggregation Control and the Aggregator through shared state variables without the use of a formal service interface.

The Link Aggregation Control function maintains the following information with respect to each Aggregator:

e) The status of the Frame Collection function (Receive Enabled or Receive Disabled).
f) The status of the Frame Distribution function (Transmit Enabled or Transmit Disabled).

These status values are exactly the logical OR of the Collection and Distribution status of the individual links associated with that Aggregator; i.e., if one or more links in the Link Aggregation Group are Collecting, then the Aggregator is Receive Enabled, and if one or more links are Distributing, then the Aggregator is Transmit Enabled.

The Transmit and Receive status of the Aggregator effectively govern the point at which the Aggregator becomes available for use by the MAC Client, or conversely, the point at which it ceases to be available.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

43.4 Link Aggregation Control Protocol (LACP)

The Link Aggregation Control Protocol (LACP) provides a standardized means for exchanging information between Partner Systems on a link to allow their Link Aggregation Control instances to reach agreement on the identity of the Link Aggregation Group to which the link belongs, move the link to that Link Aggregation Group, and enable its transmission and reception functions in an orderly manner.

43.4.1 LACP design elements

The following considerations were taken into account during the development of the protocol described in this subclause:

a) The protocol depends upon the transmission of information and state, rather than the transmission of commands. LACPDUs sent by the first party (the Actor) convey to the second party (the Actor's protocol Partner) what the Actor knows, both about its own state and that of the Partner.
b) The information conveyed in the protocol is sufficient to allow the Partner to determine what action to take next.
c) Active or passive participation in LACP is controlled by LACP_Activity, an administrative control associated with each port, that can take the value Active LACP or Passive LACP. Passive LACP indicates the port's preference for not transmitting LACPDUs unless its Partner's control value is Active LACP (i.e., a preference not to speak unless spoken to). Active LACP indicates the port's preference to participate in the protocol regardless of the Partner's control value (i.e., a preference to speak regardless).
d) Periodic transmission of LACPDUs occurs if the LACP_Activity control of either the Actor or the Partner is Active LACP. These periodic transmissions will occur at either a slow or fast transmission rate depending upon the expressed LACP_Timeout preference (Long Timeout or Short Timeout) of the Partner System.
e) In addition to periodic LACPDU transmissions, the protocol transmits LACPDUs when there is a Need To Transmit (NTT) something to the Partner; i.e., when the Actor's state changes or when it is apparent from the Partner's LACPDUs that the Partner does not know the Actor's current state.
f) The protocol assumes that the rate of LACPDU loss is very low.

There is no explicit frame loss detection/retry mechanism employed by the LACP; however, if information is received from the Partner indicating that it does not have up-to-date information on the Actor's state, or if the next periodic transmission is due, then the Actor will transmit a LACPDU that will correctly update the Partner.

43.4.2 LACPDU structure and encoding

43.4.2.1 Transmission and representation of octets

All LACPDUs comprise an integral number of octets. The bits in each octet are numbered from 0 to 7, where 0 is the low-order bit. When consecutive octets are used to represent a numerical value, the most significant octet is transmitted first, followed by successively less significant octets.

When the encoding of (an element of) a LACPDU is depicted in a diagram

a) Octets are transmitted from top to bottom.
b) Within an octet, bits are shown with bit 0 to the left and bit 7 to the right, and are transmitted from left to right.
c) When consecutive octets are used to represent a binary number, the octet transmitted first has the more significant value.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

d) When consecutive octets are used to represent a MAC address, the least significant bit of the first octet is assigned the value of the first bit of the MAC address, the next most significant bit the value of the second bit of the MAC address, and so on through the eighth bit. Similarly the least significant through most significant bits of the second octet are assigned the value of the ninth through seventeenth bits of the MAC address, and so on for all the octets of the MAC address.

43.4.2.2 LACPDU structure

LACPDUs are basic IEEE 802.3® frames; they shall not be tagged (See Clause 3). The LACPDU structure shall be as shown in Figure 43–7 and as further described in the following field definitions:

a) *Destination Address (DA)*. The DA in LACPDUs is the Slow_Protocols_Multicast address. Its use and encoding are specified in Annex 43B.

b) *Source Address (SA)*. The SA in LACPDUs carries the individual MAC address associated with the port through which the LACPDU is transmitted.

c) *Length/Type*. LACPDUs are always Type encoded, and carry the Slow_Protocols_Type field value. The use and encoding of this type is specified in Annex 43B.

d) *Subtype*. The Subtype field identifies the specific Slow Protocol being encapsulated. LACPDUs carry the Subtype value 0x01.

e) *Version Number*. This identifies the LACP version; implementations conformant to this version of the standard carry the value 0x01.

f) *TLV_type = Actor Information*. This field indicates the nature of the information carried in this TLV-tuple. Actor information is identified by the value 0x01.

g) *Actor_Information_Length*. This field indicates the length (in octets) of this TLV-tuple, Actor information uses a length value of 20 (0x14).

h) *Actor_System_Priority*. The priority assigned to this System (by management or administration policy), encoded as an unsigned integer.

i) *Actor_System*. The Actor's System ID, encoded as a MAC address.

j) *Actor_Key*. The operational Key value assigned to the port by the Actor, encoded as an unsigned integer.

k) *Actor_Port_Priority*. The priority assigned to this port by the Actor (the System sending the PDU; assigned by management or administration policy), encoded as an unsigned integer.

l) *Actor_Port*. The port number assigned to the port by the Actor (the System sending the PDU), encoded as an unsigned integer.

m) *Actor_State*. The Actor's state variables for the port, encoded as individual bits within a single octet, as follows and as illustrated in Figure 43–8:

   1) *LACP_Activity* is encoded in bit 0. This flag indicates the Activity control value with regard to this link. Active LACP is encoded as a 1; Passive LACP is encoded as a 0.
   2) *LACP_Timeout* is encoded in bit 1. This flag indicates the Timeout control value with regard to this link. Short Timeout is encoded as a 1; Long Timeout is encoded as a 0.
   3) *Aggregation* is encoded in bit 2. If TRUE (encoded as a 1), this flag indicates that the System considers this link to be *Aggregatable*; i.e., a potential candidate for aggregation. If FALSE (encoded as a 0), the link is considered to be *Individual*; i.e., this link can be operated only as an individual link.
   4) *Synchronization* is encoded in bit 3. If TRUE (encoded as a 1), the System considers this link to be *IN_SYNC*; i.e., it has been allocated to the correct Link Aggregation Group, the group has been associated with a compatible Aggregator, and the identity of the Link Aggregation Group is consistent with the System ID and operational Key information transmitted. If FALSE (encoded as a 0), then this link is currently *OUT_OF_SYNC;* i.e., it is not in the right Aggregation.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

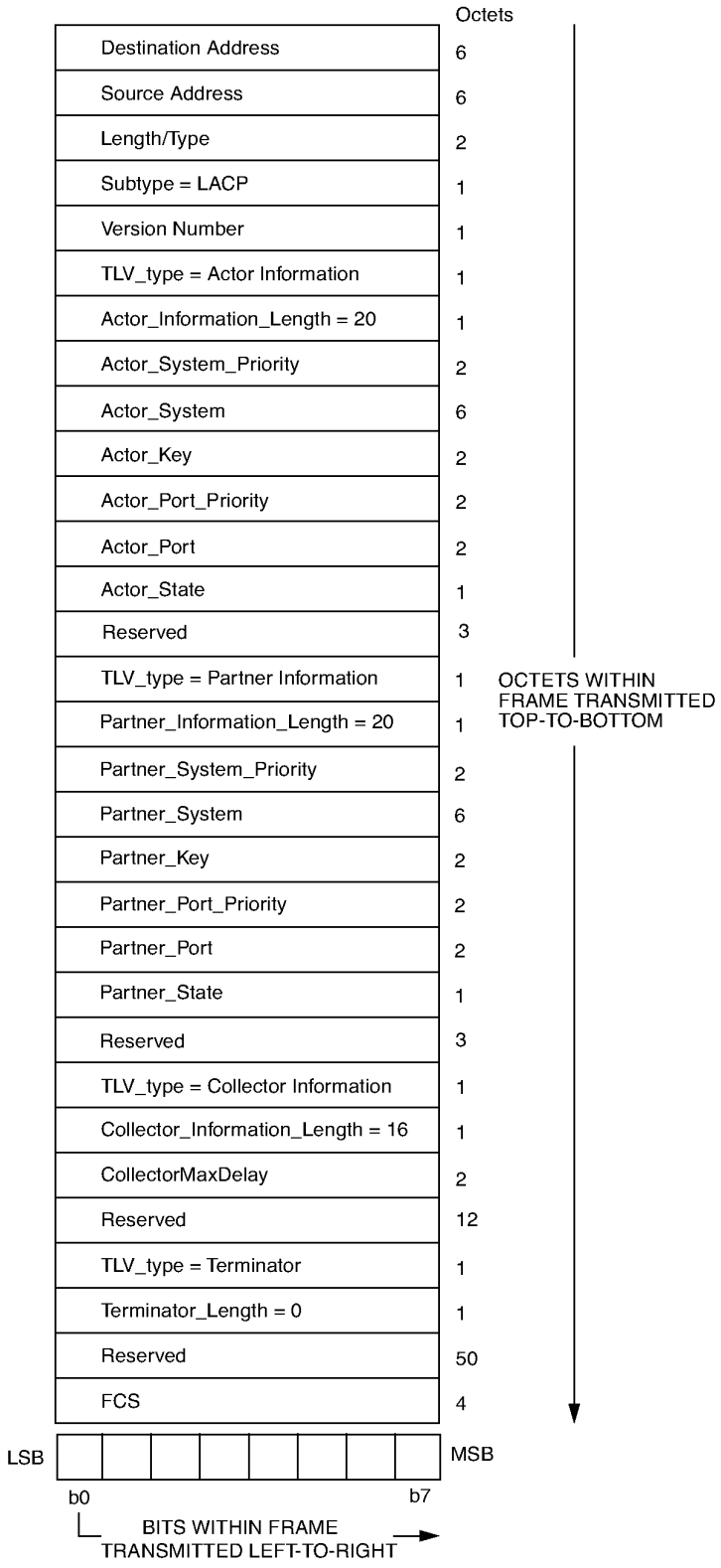


Figure 43–7—LACPDU structure

Copyright © 2002 IEEE. All rights reserved.

5) *Collecting* is encoded in bit 4. TRUE (encoded as a 1) means collection of incoming frames on this link is definitely enabled; i.e., collection is currently enabled and is not expected to be disabled in the absence of administrative changes or changes in received protocol information. Its value is otherwise FALSE (encoded as a 0);
6) *Distributing* is encoded in bit 5. FALSE (encoded as a 0) means distribution of outgoing frames on this link is definitely disabled; i.e., distribution is currently disabled and is not expected to be enabled in the absence of administrative changes or changes in received protocol information. Its value is otherwise TRUE (encoded as a 1);
7) *Defaulted* is encoded in bit 6. If TRUE (encoded as a 1), this flag indicates that the Actor's Receive machine is using Defaulted operational Partner information, administratively configured for the Partner. If FALSE (encoded as a 0), the operational Partner information in use has been received in a LACPDU;
8) *Expired* is encoded in bit 7. If TRUE (encoded as a 1), this flag indicates that the Actor's Receive machine is in the EXPIRED state; if FALSE (encoded as a 0), this flag indicates that the Actor's Receive machine is not in the EXPIRED state.

NOTE—The received values of Defaulted and Expired state are not used by LACP; however, knowing their values can be useful when diagnosing protocol problems.

BIT 0	1	2	3	4	5	6	7
LACP_Activity	LACP_Timeout	Aggregation	Synchronization	Collecting	Distributing	Defaulted	Expired

NOTE—Bit ordering within this field is as specified in 43.4.2.1.

Figure 43–8—Bit encoding of the Actor_State and Partner_State fields

n) *Reserved*. These 3 octets are reserved for use in future extensions to the protocol. They shall be ignored on receipt and shall be transmitted as zeroes to claim compliance with Version 1 of this protocol.
o) *TLV_type = Partner Information*. This field indicates the nature of the information carried in this TLV-tuple. Partner information is identified by the integer value 0x02.
p) *Partner_Information_Length*. This field indicates the length (in octets) of this TLV-tuple, Partner information uses a length value of 20 (0x14).
q) *Partner_System_Priority*. The priority assigned to the Partner System (by management or administration policy), encoded as an unsigned integer.
r) *Partner_System*. The Partner's System ID, encoded as a MAC address.
s) *Partner_Key*. The operational Key value assigned to the port associated with this link by the Partner, encoded as an unsigned integer.
t) *Partner_Port_Priority*. The priority assigned to this port by the Partner (by management or administration policy), encoded as an unsigned integer.
u) *Partner_Port*. The port number associated with this link assigned to the port by the Partner, encoded as an unsigned integer.
v) *Partner_State*. The Actor's view of the Partner's state variables, depicted in Figure 43–8 and encoded as individual bits within a single octet, as defined for Actor_State.
w) *Reserved*. These 3 octets are reserved for use in future extensions to the protocol. They shall be ignored on receipt and shall be transmitted as zeroes to claim compliance with Version 1 of this protocol.
x) *TLV_type = Collector Information*. This field indicates the nature of the information carried in this TLV-tuple. Collector information is identified by the integer value 0x03.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

y) *Collector_Information_Length*. This field indicates the length (in octets) of this TLV-tuple. Collector information uses a length value of 16 (0x10).

z) *CollectorMaxDelay*. This field contains the value of CollectorMaxDelay (43.2.3.1.1) of the station transmitting the LACPDU, encoded as an unsigned integer number of tens of microseconds. The range of values for this parameter is 0 to 65 535 tens of microseconds (0.65535 seconds).

aa) *Reserved*. These 12 octets are reserved for use in future extensions to the protocol. They shall be ignored on receipt and shall be transmitted as zeroes to claim compliance with Version 1 of this protocol.

ab) *TLV_type = Terminator*. This field indicates the nature of the information carried in this TLV-tuple. Terminator (end of message) information is identified by the integer value 0x00.

ac) *Terminator_Length*. This field indicates the length (in octets) of this TLV-tuple. Terminator information uses a length value of 0 (0x00).

NOTE—The use of a Terminator_Length of 0 is intentional. In TLV encoding schemes it is common practice for the terminator encoding to be 0 both for the type and the length.

ad) *Reserved*. These 50 octets are reserved for use in future extensions to the protocol. They are ignored on receipt and are transmitted as zeroes to claim compliance with Version 1 of this protocol.

NOTE—The Reserved octets are included in all valid LACPDUs in order to force the TLV lengths to multiples of 4 octets, and to force a fixed PDU size of 128 octets, regardless of the version of the protocol. Hence, a Version 1 implementation is guaranteed to be able to receive version N PDUs successfully, although version N PDUs may contain additional information that cannot be interpreted (and will be ignored) by the Version 1 implementation. A crucial factor in ensuring backwards compatibility is that any future version of the protocol is required not to re-define the structure or semantics of information defined for the previous version; it may only add new information elements to the previous set. Hence, in a version N PDU, a Version 1 implementation can expect to find the Version 1 information in exactly the same places as in a Version 1 PDU, and can expect to interpret that information as defined for Version 1. Future versions of this protocol expect to have the Reserved octets available for their use.

ae) *FCS*. This field is the Frame Check Sequence, typically generated by the underlying MAC.

43.4.3 LACP state machine overview

The operation of the protocol is controlled by a number of state machines, each of which performs a distinct function. These state machines are for the most part described on a per-port basis; any deviations from per-port description are highlighted in the text. Events (such as expiration of a timer or received LACPDUs) may cause state transitions and also cause actions to be taken; those actions may include the need for transmission of a LACPDU containing repeated or new information. Periodic and event-driven transmissions are controlled by the state of a Need-To-Transmit (NTT) variable (see 43.4.7), generated by the state machines as necessary.

The state machines are as follows:

a) *Receive machine (RX—43.4.12)*. This state machine receives LACPDUs from the Partner, records the information contained, and times it out using either Short Timeouts or Long Timeouts, according to the setting of LACP_Timeout. It evaluates the incoming information from the Partner to determine whether the Actor and Partner have both agreed upon the protocol information exchanged to the extent that the port can now be safely used, either in an aggregation with other ports or as an individual port; if not, it asserts NTT in order to transmit fresh protocol information to the Partner. If the protocol information from the Partner times out, the Receive machine installs default parameter values for use by the other state machines.

b) *Periodic Transmission machine (43.4.13)*. This state machine determines whether the Actor and its Partner will exchange LACPDUs periodically in order to maintain an aggregation (periodic LACPDU exchanges occur if either or both are configured for Active LACP).

c) *Selection Logic (43.4.14)*. The Selection Logic is responsible for selecting the Aggregator to be associated with this port.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

d) *Mux machine (MUX—43.4.15)*. This state machine is responsible for attaching the port to a selected Aggregator, detaching the port from a de-selected Aggregator, and for turning collecting and distributing at the port on or off as required by the current protocol information.

e) *Transmit machine (TX—43.4.16)*. This state machine handles the transmission of LACPDUs, both on demand from the other state machines, and on a periodic basis.

Figure 43–9 illustrates the relationships among these state machines and the flow of information between them. The set of arrows labelled Partner State Information represents new Partner information, contained in an incoming LACPDU or supplied by administrative default values, being fed to each state machine by the Receive machine. The set of arrows labelled Actor State Information represents the flow of updated Actor state information between the state machines. Transmission of LACPDUs occurs either as a result of the Periodic machine determining the need to transmit a periodic LACPDU, or as a result of changes to the Actor's state information that need to be communicated to the Partner. The need to transmit a LACPDU is signalled to the Transmit machine by asserting NTT. The remaining arrows represent shared variables in the state machine description that allow a state machine to cause events to occur in another state machine.

NOTE—The arrows marked Ready_N show that information derived from the operation of another port or ports can affect the operation of a port's state machine. See the definition of the Ready and Ready_N variables in 43.4.8.

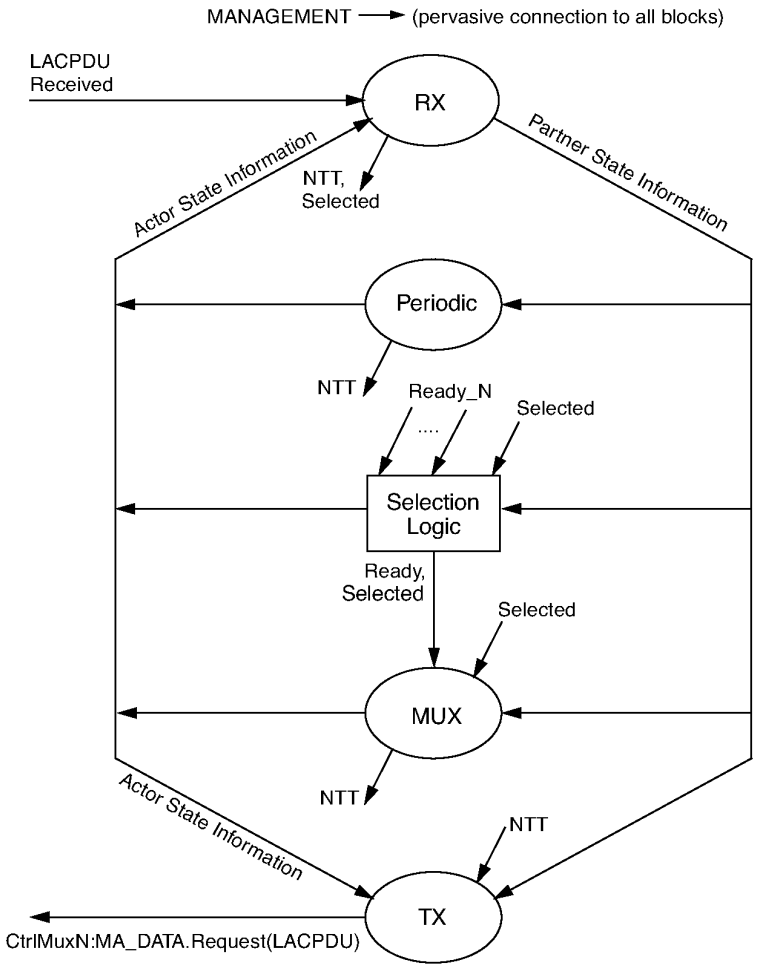


Figure 43–9—Interrelationships among state machines

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

Two further state machines are defined for diagnostic purposes. They are as follows:

f) *Actor and Partner Churn Detection machines (43.4.17)*. These state machines make use of the IN_SYNC and OUT_OF_SYNC states generated by the Actor and Partner Mux machines in order to detect the situation where the state machines are unable to resolve the state of a given link; e.g., because the Partner System repeatedly sends conflicting information in its LACPDUs. As this situation can occur in a normally functioning link, particularly where either or both participating Systems have constrained aggregation capability (see 43.6), these state machines simply detect the presence of such a condition and signal its existence to management.

43.4.4 Constants

All timers specified in this subclause have an implementation tolerance of ± 250 ms.

Fast_Periodic_Time
The number of seconds between periodic transmissions using Short Timeouts.
Value: Integer
1

Slow_Periodic_Time
The number of seconds between periodic transmissions using Long Timeouts.
Value: Integer
30

Short_Timeout_Time
The number of seconds before invalidating received LACPDU information when using Short Timeouts (3 x Fast_Periodic_Time).
Value: Integer
3

Long_Timeout_Time
The number of seconds before invalidating received LACPDU information when using Long Timeouts (3 x Slow_Periodic_Time).
Value: Integer
90

Churn_Detection_Time
The number of seconds that the Actor and Partner Churn state machines wait for the Actor or Partner Sync state to stabilize.
Value: Integer
60

Aggregate_Wait_Time
The number of seconds to delay aggregation, to allow multiple links to aggregate simultaneously.
Value: Integer
2

43.4.5 Variables associated with the System

Actor_System
The MAC address component of the System Identifier of the System.
Value: 48 bits
Assigned by administrator or System policy.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

Actor_System_Priority
The System Priority of the System.
Value: Integer
Assigned by administrator or System policy.

43.4.6 Variables associated with each Aggregator

Aggregator_MAC_address
The MAC address assigned to the Aggregator.
Value: 48 bits
Assigned by administrator or System policy.

Aggregator_Identifier
Used to uniquely identify an Aggregator within a System.
Value: Integer
Assigned by administrator or System policy.

Individual_Aggregator
The aggregation capability of the Aggregator.
Value: Boolean
TRUE if the port attached to this Aggregator is not capable of aggregation with any other port.
FALSE if the port(s) attached to this Aggregator are capable of aggregation with other ports.

Actor_Admin_Aggregator_Key
The administrative Key value associated with the Aggregator.
Value: Integer
Assigned by administrator or System policy.

Actor_Oper_Aggregator_Key
The operational Key value associated with the Aggregator.
Value: Integer
Assigned by the Actor.

Partner_System
The MAC address component of the System Identifier of the remote System to which the Aggregator is connected. If the Aggregator has no attached ports, this variable is set to 0x00-00-00-00-00-00.
Value: 48 bits

Partner_System_Priority
The System Priority of the remote System to which the Aggregator is connected. If the Aggregator has no attached ports, this variable is set to zero.
Value: Integer

Partner_Oper_Aggregator_Key
The operational Key assigned to an aggregation by the remote System to which this Aggregator is connected. If the Aggregator has no attached ports, this variable is set to zero.
Value: Integer

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

Receive_State
The Receive_State of the Aggregator will be Enabled if one or more ports attached to the Aggregator are Collecting (i.e., Actor_Oper_Port_State.Collecting is TRUE for any port). Otherwise, Receive_State is Disabled.
Values: Enabled or Disabled

Transmit_State
The Transmit_State of the Aggregator will be Enabled if one or more ports attached to the Aggregator are Distributing (i.e., Actor_Oper_Port_State.Distributing is TRUE for any port). Otherwise, Transmit_State is Disabled.
Values: Enabled or Disabled

LAG_Ports
The set of ports that belong to the Link Aggregation Group.
Value: Integer Array

43.4.7 Variables associated with each port

Actor_Port_Number
The port number assigned to the port.
Value: Integer
Assigned by administrator or System policy.

Actor_Port_Priority
The priority value assigned to the port, used to converge dynamic Key changes.
Value: Integer
Assigned by administrator or System policy.

Actor_Port_Aggregator_Identifier
The identifier of the Aggregator that this port is attached to.
Value: Integer

NTT
Need To Transmit flag.
Value: Boolean
TRUE indicates that there is new protocol information that should be transmitted on the link, or that the Partner needs to be reminded of the old information.
FALSE otherwise.

Actor_Admin_Port_Key
The administrative value of Key assigned to this port by administrator or System policy.
Value: Integer

Actor_Oper_Port_Key
The operational value of Key assigned to this port by the Actor.
Value: Integer

Actor_Admin_Port_State
The administrative values of the Actor's state parameters. This consists of the following set of variables, as described in 43.4.2.2:
LACP_Activity
LACP_Timeout
Aggregation
Synchronization

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

Collecting
Distributing
Defaulted
Expired
Value: 8 bits

Actor_Oper_Port_State
The operational values of the Actor's state parameters. This consists of the following set of variables, as described in 43.4.2.2:
LACP_Activity
LACP_Timeout
Aggregation
Synchronization
Collecting
Distributing
Defaulted
Expired
Value: 8 bits

Partner_Admin_System
Default value for the MAC address component of the System Identifier of the Partner, assigned by administrator or System policy for use when the Partner's information is unknown or expired.
Value: 48 bits

Partner_Oper_System
The operational value of the MAC address component of the System Identifier of the Partner. The Actor sets this variable either to the value received from the Partner in an LACPDU, or to the value of Partner_Admin_System.
Value: 48 bits

Partner_Admin_System_Priority
Default value for the System Priority component of the System Identifier of the Partner, assigned by administrator or System policy for use when the Partner's information is unknown or expired.
Value: Integer

Partner_Oper_System_Priority
The operational value of the System Priority of the Partner. The Actor sets this variable either to the value received from the Partner in an LACPDU, or to the value of Partner_Admin_System_Priority.
Value: Integer

Partner_Admin_Key
Default value for the Partner's Key, assigned by administrator or System policy for use when the Partner's information is unknown or expired.
Value: Integer

Partner_Oper_Key
The operational value of the Key value assigned to this link by the Partner. The Actor sets this variable either to the value received from the Partner in an LACPDU, or to the value of Partner_Admin_Key.
Value: Integer

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

Partner_Admin_Port_Number
Default value for the Port Number component of the Partner's Port Identifier, assigned by administrator or System policy for use when the Partner's information is unknown or expired.
Value: Integer

Partner_Oper_Port_Number
The operational value of the port number assigned to this link by the Partner. The Actor sets this variable either to the value received from the Partner in an LACPDU, or to the value of Partner_Admin_Port_Number.
Value: Integer

Partner_Admin_Port_Priority
Default value for the Port Priority component of the Partner's Port Identifier, assigned by administrator or System policy for use when the Partner's information is unknown or expired.
Value: Integer

Partner_Oper_Port_Priority
The operational value of the priority value assigned to this link by the Partner, used to converge dynamic Key changes. The Actor sets this variable either to the value received from the Partner in an LACPDU, or to the value of Partner_Admin_Port_Priority.
Value: Integer

Partner_Admin_Port_State
Default value for the Partner's state parameters, assigned by administrator or System policy for use when the Partner's information is unknown or expired. The value consists of the following set of variables, as described in 43.4.2.2:
LACP_Activity
LACP_Timeout
Aggregation
Synchronization
Collecting
Distributing
Defaulted
Expired
The value of Collecting shall be set the same as the value of Synchronization.
Value: 8 bits

Partner_Oper_Port_State
The operational value of the Actor's view of the current values of the Partner's state parameters. The Actor sets this variable either to the value received from the Partner in an LACPDU, or to the value of Partner_Admin_Port_State. The value consists of the following set of variables, as described in 43.4.2.2:
LACP_Activity
LACP_Timeout
Aggregation
Synchronization
Collecting
Distributing
Defaulted
Expired
Value: 8 bits

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

port_enabled
A variable indicating that the physical layer has indicated that the link has been established and the port is operable.
Value: Boolean
TRUE if the physical layer has indicated that the port is operable.
FALSE otherwise.

NOTE—The means by which the value of the port_enabled variable is generated by the underlying MAC and/or PHY is implementation-dependent.

43.4.8 Variables used for managing the operation of the state machines

BEGIN
This variable indicates the initialization (or reinitialization) of the LACP protocol entity. It is set to TRUE when the System is initialized or reinitialized, and is set to FALSE when (re-)initialization has completed.
Value: Boolean

LACP_Enabled
This variable indicates that the port is operating the LACP. If the port is operating in half duplex, the value of LACP_Enabled shall be FALSE. Otherwise, the value of LACP_Enabled shall be TRUE.
Value: Boolean

actor_churn
This variable indicates that the Actor Churn Detection machine has detected that a local port configuration has failed to converge within a specified time, and that management intervention is required.
Value: Boolean

partner_churn
This variable indicates that the Partner Churn Detection machine has detected that a remote port configuration has failed to converge within a specified time, and that management intervention is required.
Value: Boolean

Ready_N
The port asserts Ready_N TRUE to indicate to the Selection Logic that the wait_while_timer has expired and it is waiting (i.e., the port is in the WAITING state) to attach to an Aggregator. Otherwise, its value is FALSE. There is one Ready_N value for each port.
Value: Boolean

Ready
The Selection Logic asserts Ready TRUE when the values of Ready_N for all ports that are waiting to attach to a given Aggregator are TRUE. If any of the values of Ready_N for the ports that are waiting to attach to that Aggregator are FALSE, or if there are no ports waiting to attach to that Aggregator, then the value of Ready is FALSE.
Value: Boolean

Selected
A value of SELECTED indicates that the Selection Logic has selected an appropriate Aggregator. A value of UNSELECTED indicates that no aggregator is currently selected. A value of STANDBY indicates that although the Selection Logic has selected an appropriate Aggregator, aggregation restrictions currently prevent the port from being enabled as part of the aggrega-

Copyright © 2002 IEEE. All rights reserved.

tion, and so the port is being held in a standby condition. This variable can only be set to SELECTED or STANDBY by the operation of the port's Selection Logic. It can be set to UNSELECTED by the operation of the port's Receive machine, or by the operation of the Selection Logic associated with another port.

NOTE—Setting Selected UNSELECTED in the Selection Logic associated with another port occurs if the Selection Logic determines that the other port has a stronger claim to attach to this port's current Aggregator.

Value: SELECTED, UNSELECTED, or STANDBY

port_moved

This variable is set to TRUE if the Receive machine for a port is in the PORT_DISABLED state, and the combination of Partner_Oper_System and Partner_Oper_Port_Number in use by that port has been received in an incoming LACPDU on a different port. This variable is set to FALSE once the INITIALIZE state of the Receive machine has set the Partner information for the port to administrative default values.
Value: Boolean

43.4.9 Functions

recordPDU

This function records the parameter values for the Actor carried in a received LACPDU (Actor_Port, Actor_Port_Priority, Actor_System, Actor_System_Priority, Actor_Key, and Actor_State variables) as the current Partner operational parameter values (Partner_Oper_Port_Number, Partner_Oper_Port_Priority, Partner_Oper_System, Partner_Oper_System_Priority, Partner_Oper_Key, and Partner_Oper_Port_State variables with the exception of Synchronization) and sets Actor_Oper_Port_State.Defaulted to FALSE.

This function also updates the value of the Partner_Oper_Port_State.Synchronization using the parameter values carried in received LACPDUs. Parameter values for the Partner carried in the received PDU (Partner_Port, Partner_Port_Priority, Partner_System, Partner_System_Priority, Partner_Key, and Partner_State.Aggregation) are compared to the corresponding operational parameter values for the Actor (Actor_Port_Number, Actor_Port_Priority, Actor_System, Actor_System_Priority, Actor_Oper_Port_Key, and Actor_Oper_Port_State.Aggregation). Partner_Oper_Port_State.Synchronization is set to TRUE if all of these parameters match, Actor_State.Synchronization in the received PDU is set to TRUE, and LACP will actively maintain the link in the aggregation.

Partner_Oper_Port_State.Synchronization is also set to TRUE if the value of Actor_State.Aggregation in the received PDU is set to FALSE (i.e., indicates an Individual link), Actor_State.Synchronization in the received PDU is set to TRUE, and LACP will actively maintain the link.

Otherwise, Partner_Oper_Port_State.Synchronization is set to FALSE.

LACP is considered to be actively maintaining the link if either the PDU's Actor_State.LACP_Activity variable is TRUE or both the Actor's Actor_Oper_Port_State.LACP_Activity and the PDU's Partner_State.LACP_Activity variables are TRUE.

recordDefault

This function records the default parameter values for the Partner carried in the Partner Admin parameters (Partner_Admin_Port_Number, Partner_Admin_Port_Priority, Partner_Admin_System, Partner_Admin_System_Priority, Partner_Admin_Key, and

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

Partner_Admin_Port_State) as the current Partner operational parameter values (Partner_Oper_Port_Number, Partner_Oper_Port_Priority, Partner_Oper_System, Partner_Oper_System_Priority, Partner_Oper_Key, and Partner_Oper_Port_State) and sets Actor_Oper_Port_State.Defaulted to TRUE.

update_Selected

This function updates the value of the Selected variable, using parameter values from a newly received LACPDU. The parameter values for the Actor carried in the received PDU (Actor_Port, Actor_Port_Priority, Actor_System, Actor_System_Priority, Actor_Key, and Actor_State.Aggregation) are compared with the corresponding operational parameter values for the port's Partner (Partner_Oper_Port_Number, Partner_Oper_Port_Priority, Partner_Oper_System, Partner_Oper_System_Priority, Partner_Oper_Key, and Partner_Oper_Port_State.Aggregation). If one or more of the comparisons show that the value(s) received in the PDU differ from the current operational values, then Selected is set to UNSELECTED. Otherwise, Selected remains unchanged.

update_Default_Selected

This function updates the value of the Selected variable, using the Partner administrative parameter values. The administrative values (Partner_Admin_Port_Number, Partner_Admin_Port_Priority, Partner_Admin_System, Partner_Admin_System_Priority, Partner_Admin_Key, and Partner_Admin_Port_State.Aggregation) are compared with the corresponding operational parameter values for the Partner (Partner_Oper_Port_Number, Partner_Oper_Port_Priority, Partner_Oper_System, Partner_Oper_System_Priority, Partner_Oper_Key, and Partner_Oper_Port_State.Aggregation). If one or more of the comparisons shows that the administrative value(s) differ from the current operational values, then Selected is set to UNSELECTED. Otherwise, Selected remains unchanged.

update_NTT

This function updates the value of the NTT variable, using parameter values from a newly received LACPDU. The parameter values for the Partner carried in the received PDU (Partner_Port, Partner_Port_Priority, Partner_System, Partner_System_Priority, Partner_Key, Partner_State.LACP_Activity, Partner_State.LACP_Timeout, Partner_State.Synchronization, and Partner_State.Aggregation) are compared with the corresponding operational parameter values for the Actor (Actor_Port_Number, Actor_Port_Priority, Actor_System, Actor_System_Priority, Actor_Oper_Port_Key, Actor_Oper_Port_State.LACP_Activity, Actor_Oper_Port_State.LACP_Timeout, Actor_Oper_Port_State.Synchronization, and Actor_Oper_Port_State.Aggregation). If one or more of the comparisons show that the value(s) received in the PDU differ from the current operational values, then NTT is set to TRUE. Otherwise, NTT remains unchanged.

Attach_Mux_To_Aggregator

This function causes the port's Control Parser/Multiplexer to be attached to the Aggregator Parser/Multiplexer of the selected Aggregator, in preparation for collecting and distributing frames.

Detach_Mux_From_Aggregator

This function causes the port's Control Parser/Multiplexer to be detached from the Aggregator Parser/Multiplexer of the Aggregator to which the port is currently attached.

Enable_Collecting

This function causes the Aggregator Parser of the Aggregator to which the port is attached to start collecting frames from the port.

Copyright © 2002 IEEE. All rights reserved.

Disable_Collecting
This function causes the Aggregator Parser of the Aggregator to which the port is attached to stop collecting frames from the port.

Enable_Distributing
This function causes the Aggregator Multiplexer of the Aggregator to which the port is attached to start distributing frames to the port.

Disable_Distributing
This function causes the Aggregator Multiplexer of the Aggregator to which the port is attached to stop distributing frames to the port.

Enable_Collecting_Distributing
This function causes the Aggregator Parser of the Aggregator to which the port is attached to start collecting frames from the port, and the Aggregator Multiplexer to start distributing frames to the port.

Disable_Collecting_Distributing
This function causes the Aggregator Parser of the Aggregator to which the port is attached to stop collecting frames from the port, and the Aggregator Multiplexer to stop distributing frames to the port.

43.4.10 Timers

current_while_timer
This timer is used to detect whether received protocol information has expired. If Actor_Oper_State.LACP_Timeout is set to Short Timeout, the timer is started with the value Short_Timeout_Time. Otherwise, it is started with the value Long_Timeout_Time (see 43.4.4).

actor_churn_timer
This timer is used to detect Actor churn states. It is started using the value Churn_Detection_Time (see 43.4.4).

periodic_timer (time_value)
This timer is used to generate periodic transmissions. It is started using the value Slow_Periodic_Time or Fast_Periodic_Time (see 43.4.4), as specified in the Periodic Transmission state machine.

partner_churn_timer
This timer is used to detect Partner churn states. It is started using the value Churn_Detection_Time (see 43.4.4).

wait_while_timer
This timer provides hysteresis before performing an aggregation change, to allow all links that will join this Aggregation to do so. It is started using the value Aggregate_Wait_Time (see 43.4.4).

43.4.11 Messages

CtrlMuxN:MA_DATA.indicate(LACPDU)
This message is generated by the Control Parser as a result of the reception of a LACPDU, formatted as defined in 43.4.2.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

43.4.12 Receive machine

The Receive machine shall implement the function specified in Figure 43–10 with its associated parameters (43.4.4 through 43.4.11).

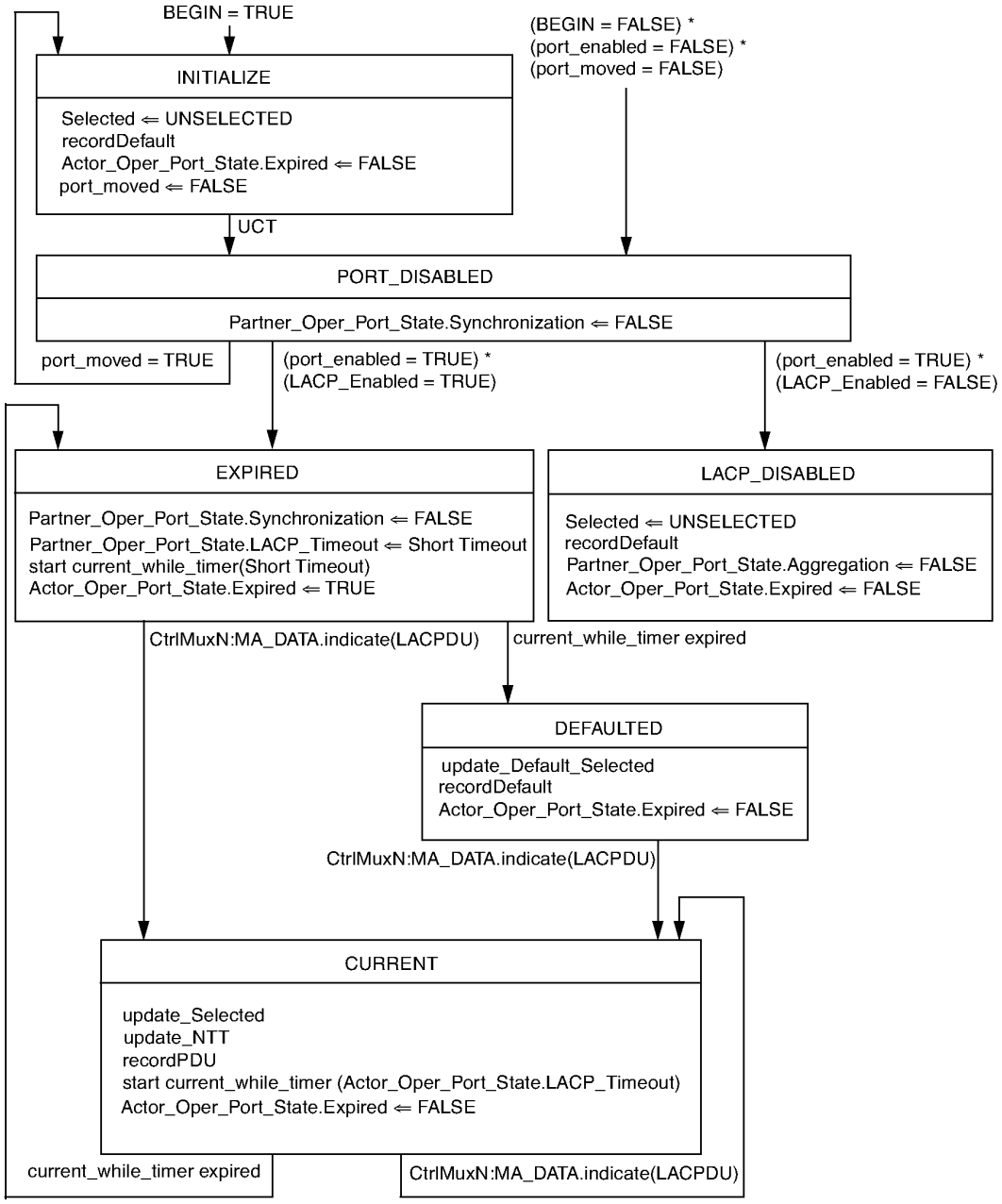


Figure 43–10—Receive machine state diagram

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

On receipt of a LACPDU, the state machine enters the CURRENT state. The update_Selected function sets the Selected variable UNSELECTED if the Link Aggregation Group identified by the combination of the protocol Partner's own information and the Actor's own information has changed. The Selected variable is used by the Mux machine (43.4.15).

NOTE—The Receive machine may set the Selected variable to UNSELECTED; however, setting this variable to SELECTED or STANDBY is the responsibility of the Selection Logic.

The update_NTT function is used to determine whether further protocol transmissions are required; NTT is set to TRUE if the Partner's view of the Actor's operational parameters is not up to date. The recordPDU function records the information contained in the LACPDU in the Partner operational variables, and the current_while timer is started. The value used to start the timer is either Short_Timeout_Time or Long_Timeout_Time, depending upon the Actor's operational value of LACP_Timeout.

In the process of executing the recordPDU function, a Receive machine compliant to this standard shall not validate the Version Number, TLV_type, or Reserved fields in received LACPDUs. The same actions are taken regardless of the values received in these fields. A Receive machine may validate the Actor_Information_Length, Partner_Information_Length, Collector_Information_Length, or Terminator_Length fields. These behaviors, together with the constraint on future protocol enhancements, are discussed in 43.4.2.2.

NOTE—The rules expressed above allow Version 1 devices to be compatible with future revisions of the protocol.

If no LACPDU is received before the current_while timer expires, the state machine transits to the EXPIRED state. The Partner_Oper_Port_State.Synchronization variable is set to FALSE, the current operational value of the Partner's LACP_Timeout variable is set to Short Timeout, and the current_while timer is started with a value of Short_Timeout_Time. This is a transient state; the LACP_Timeout settings allow the Actor to transmit LACPDUs rapidly in an attempt to re-establish communication with the Partner.

If no LACPDU is received before the current_while timer expires again, the state machine transits to the DEFAULTED state. The recordDefault function overwrites the current operational parameters for the Partner with administratively configured values. This allows configuration of aggregations and individual links when no protocol Partner is present, while still permitting an active Partner to override default settings. The update_Default_Selected function sets the Selected variable UNSELECTED if the Link Aggregation Group has changed. Since all operational parameters are now set to locally administered values, there can be no disagreement as to the Link Aggregation Group, so the Partner_Oper_Port_State.Synchronization variable is set to TRUE.

If the port becomes inoperable and a BEGIN event has not occurred, the state machine enters the PORT_DISABLED state. Partner_Oper_Port_State.Synchronization is set to FALSE. This state allows the current Selection state to remain undisturbed, so that, in the event that the port is still connected to the same Partner and Partner port when it becomes operable again, there will be no disturbance caused to higher layers by unneccessary re-configuration. If the same Actor System ID and Port are seen in a LACPDU received on a different Port (port_moved is set to TRUE), this indicates that the physical connectivity has changed, and causes the state machine to enter the INITIALIZE state. This state is also entered if a BEGIN event occurs.

The INITIALIZE state causes the administrative values of the Partner parameters to be used as the current operational values, and sets Selected to UNSELECTED. These actions force the Mux machine to detach the port from its current Aggregator. The variable port_moved is set to FALSE; if the entry to INITIALIZE occurred as a result of port_moved being set to TRUE, then the state machine will immediately transition back to the PORT_DISABLED state.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

If the port is operating in half duplex, the operation of LACP is disabled on the port (LACP_Enabled is FALSE) and the LACP_DISABLED state is entered. This state is entered following a BEGIN or Port Enabled event. This state is similar to the DEFAULTED state, except that the port is forced to operate as an Individual port, as the value of Partner_Oper_Port_State.Aggregation is forced to Individual. Exit from this state occurs on a BEGIN or Port Disabled event.

43.4.13 Periodic Transmission machine

The Periodic Transmission machine shall implement the function specified in Figure 43–11 with its associated parameters (43.4.4 through 43.4.11).

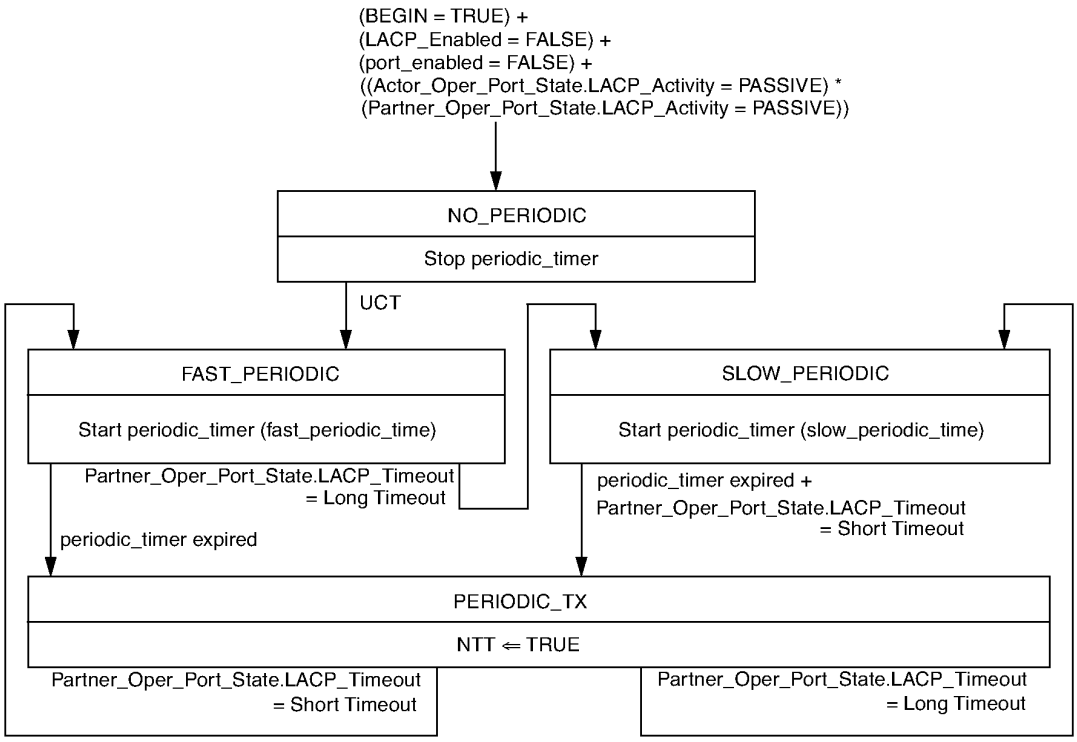


Figure 43–11—Periodic Transmission machine state diagram

The Periodic Transmission machine establishes the desire of the Actor and Partner to exchange periodic LACPDUs on the link in order to maintain an aggregation, and establishes how often those periodic transmissions should occur. Periodic transmissions will take place if either participant so wishes. Transmissions occur at a rate determined by the Partner; this rate is linked to the speed at which the Partner will time out received information.

The state machine has four states. They are as follows:

a) *NO_PERIODIC*. While in this state, periodic transmissions are disabled.
b) *FAST_PERIODIC*. While in this state, periodic transmissions are enabled at a fast transmission rate.
c) *SLOW_PERIODIC*. While in this state, periodic transmissions are enabled at a slow transmission rate.
d) *PERIODIC_TX*. This is a transitory state entered on periodic_timer expiry, that asserts NTT and then exits to FAST_PERIODIC or SLOW_PERIODIC depending upon the Partner's LACP_Timeout setting.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

The values of Partner_Oper_Port_State.LACP_Activity and Actor_Oper_Port_State.LACP_Activity determine whether periodic transmissions take place. If either or both parameters are set to Active LACP, then periodic transmissions occur; if both are set to Passive LACP, then periodic transmissions do not occur. Similarly, if either of the LACP_Enabled or port_enabled variables is set to FALSE, indicating that LACP has been disabled on the port or that the port is non-operational, then no periodic transmissions take place.

If periodic transmissions are enabled, the rate at which they take place is determined by the value of the Partner_Oper_Port_State.LACP_Timeout variable. If this variable is set to Short Timeout, then the value fast_periodic_time is used to determine the time interval between periodic transmissions. Otherwise, slow_periodic_time is used to determine the time interval.

43.4.14 Selection Logic

The Selection Logic selects a compatible Aggregator for a port, using the port's LAG ID. The Selection Logic may determine that the link should be operated as a standby link if there are constraints on the simultaneous attachment of ports that have selected the same Aggregator.

NOTE—There will never be more than one Aggregator with the same LAG ID, but there may be none. Normally, the latter will be a temporary state, caused by the fact that it takes a finite time for ports to be moved to the correct aggregators during reconfiguration.

The Mux machine controls the process of attaching the port to a selected Aggregator, after first detaching the port from any prior Aggregator if the port's LAG ID has changed.

NOTE—A port is always detached from its prior Aggregator when the LAG ID changes, even if the same Aggregator is selected later; to do otherwise would be to risk misdelivery of frames. Selection of a new Aggregator cannot take place until the port is detached from any prior Aggregator; other Aggregators may become free while the port is detaching, and other ports may attach to some of the available Aggregators during this time interval.

The operation of the Selection Logic is separated into the following two subclauses:

a) The requirements for the correct operation of the Selection Logic are defined in 43.4.14.1.
b) The recommended default operation of the Selection Logic is described in 43.4.14.2.

This separation reflects the fact that a wide choice of selection rules is possible within the proper operation of the protocol. An implementation that claims conformance to this standard may support selection rules other than the recommended default; however, any such rules shall meet the requirements stated in 43.4.14.1.

43.4.14.1 Selection Logic—Requirements

Aggregation is represented by a port selecting an appropriate Aggregator, and then attaching to that Aggregator. The following are required for correct operation of the selection and attachment logic:

a) The implementation shall support at least one Aggregator per System.
b) Each port shall be assigned an operational Key (43.3.5). Ports that can aggregate together are assigned the same operational Key as the other ports with which they can aggregate; ports that cannot aggregate with any other port are allocated unique operational Keys.
c) Each Aggregator shall be assigned an operational Key.
d) Each Aggregator shall be assigned an identifier that distinguishes it among the set of Aggregators in the System.
e) A port shall only select an Aggregator that has the same operational Key assignment as its own operational Key.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

f) Subject to the exception stated in item g), ports that are members of the same Link Aggregation Group (i.e., two or more ports that have the same Actor System ID, Actor Key, Partner System ID, and Partner Key, and that are not required to be Individual) shall select the same Aggregator.

g) Any pair of ports that are members of the same Link Aggregation Group, but are connected together by the same link, shall not select the same Aggregator (i.e., if a loopback condition exists between two ports, they shall not be aggregated together. For both ports, the Actor System ID is the same as the Partner System ID; also, for port A, the Partner's port identifier is port B, and for port B, the Partner's port identifier is port A).

NOTE—This exception condition prevents the formation of an aggregated link, comprising two ends of the same physical link aggregated together, in which all frames transmitted through an Aggregator are immediately received through the same Aggregator. However, it permits the aggregation of multiple links that are in loopback; for example, if port A is looped back to port C and port B is looped back to port D, then it is permissible for A and B (or A and D) to aggregate together, and for C and D (or B and C) to aggregate together.

h) Any port that is required to be Individual (i.e., the operational state for the Actor or the Partner indicates that the port is Individual) shall not select the same Aggregator as any other port.

i) Any port that is Aggregatable shall not select an Aggregator to which an Individual port is already attached.

j) If the above conditions result in a given port being unable to select an Aggregator, then that port shall not be attached to any Aggregator.

k) If there are further constraints on the attachment of ports that have selected an Aggregator, those ports may be selected as standby in accordance with the rules specified in 43.6.1. Selection or deselection of that Aggregator can cause the Selection Logic to re-evaluate the ports to be selected as standby.

l) The Selection Logic operates upon the operational information recorded by the Receive state machine, along with knowledge of the Actor's own operational configuration and state. The Selection Logic uses the LAG ID for the port, determined from these operational parameters, to locate the correct Aggregator to attach the port to.

m) The Selection Logic is invoked whenever a port is not attached to and has not selected an Aggregator, and executes continuously until it has determined the correct Aggregator for the port.

NOTE—The Selection Logic may take a significant time to complete its determination of the correct Aggregator, as a suitable Aggregator may not be immediately available, due to configuration restrictions or the time taken to re-allocate ports to other Aggregators.

n) Once the correct Aggregator has been determined, the variable Selected shall be set to SELECTED or to STANDBY (43.4.8, 43.6.1).

NOTE—If Selected is SELECTED, the Mux machine will start the process of attaching the port to the selected Aggregator. If Selected is STANDBY, the Mux machine holds the port in the WAITING state, ready to be attached to its Aggregator once its Selected state changes to SELECTED.

o) The Selection Logic is responsible for computing the value of the Ready variable from the values of the Ready_N variable(s) associated with the set of ports that are waiting to attach to the same Aggregator (see 43.4.8).

p) Where the selection of a new Aggregator by a port, as a result of changes to the selection parameters, results in other ports in the System being required to re-select their Aggregators in turn, this is achieved by setting Selected to UNSELECTED for those other ports that are required to re-select their Aggregators.

NOTE—The value of Selected is set to UNSELECTED by the Receive machine for the port when a change of LAG ID is detected.

q) A port shall not be enabled for use by the MAC Client until it has both selected and attached to an Aggregator.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

43.4.14.2 Selection Logic—Recommended default operation

The recommended default behavior provides an element of determinism (i.e., history independence) in the assignment of ports to Aggregators. It also has the characteristic that no additional MAC addresses are needed, over and above those already assigned to the set of underlying MACs.

NOTE—This standard does not specify any alternative selection rules beyond the recommended set. A wide variety of selection rules are possible within the scope of the requirements stated in 43.4.14.1. In particular, it is possible within these requirements to support implementations that provide fewer Aggregators than ports, as well as implementations designed to minimize configuration changes at the expense of less deterministic behavior.

Each port has an Aggregator associated with it, (i.e., the number of Aggregators in the System equals the number of ports supported). Each port/Aggregator pair is assigned the same operational Key and port number. When there are multiple ports in an aggregation, the Aggregator that the set of ports selects is the Aggregator with the same port number as the lowest-numbered port in the aggregation. Note that this lowest numbered port may not be in a state that allows data transfer across the link; however, it has selected the Aggregator in question. This is illustrated in Figure 43–12.

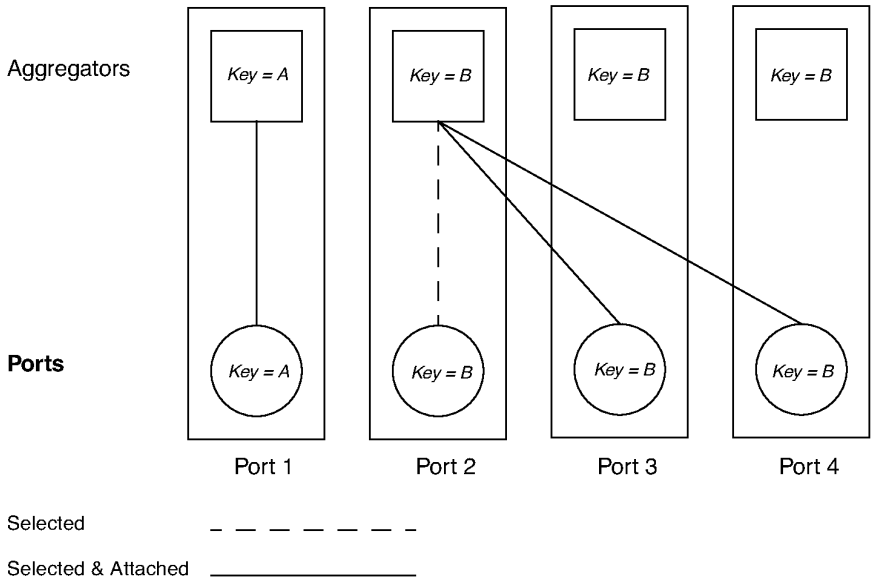


Figure 43–12—Selection of Aggregators

If the port is Individual, then the Aggregator selected is always the port's own Aggregator. Otherwise, an Aggregator is selected from the set of Aggregators corresponding to the set of ports that will form the aggregation. The Aggregator selected is the lowest numbered Aggregator with the same selection parameters as those of the port. These selection parameters are

a) The Actor's System ID
b) The Actor's operational Key
c) The Partner's System ID
d) The Partner's operational Key
e) The Individual_Aggregator state (which must be FALSE)

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

43.4.15 Mux machine

The Mux machine shall implement the function specified in either of the Mux machine state diagrams, Figure 43–13 and Figure 43–14, with their associated parameters (43.4.4 through 43.4.11).

The state machine conventions in 21.5 assert that all in-state actions are instantaneous, are performed in sequence, and are performed prior to evaluating any exit conditions. While the Mux machine will operate correctly if all actions can be performed instantaneously, this will not be realistic in many implementations. Correct operation is maintained even if actions are not completed instantaneously, as long as each action completes prior to initiating the next sequential action, and all actions complete prior to evaluating any exit conditions.

The independent control state diagram (Figure 43–13) is suitable for use implementations in which it is possible to control enabling and disabling of frame collection from a port, and frame distribution to a port, independently. The coupled control state diagram (Figure 43–14) is suitable for use implementations where collecting and distributing cannot be controlled independently with respect to a port. It is recommended that the independent control state diagram be implemented in preference to the coupled control state diagram.

The value of the Selected variable may be changed by the following:

a) *The Receive machine*. The Receive machine can set Selected to UNSELECTED at any time if any of the following change: The Partner System ID, the Partner Priority, the Partner Key, the Partner_State.Aggregation, the Actor System ID, the Actor Priority, the Actor Key, or the Actor_State.Aggregation.
b) *The Selection Logic, in the process of selecting an Aggregator.* The Selection Logic will select an Aggregator when the Mux machine is in the DETACHED state and the value of the Selected variable is UNSELECTED.
c) *The Selection Logic, in the process of selecting or de-selecting standby links*. If the value of the Selected variable is SELECTED or STANDBY, the Selection Logic can change the value to STANDBY or SELECTED.

The Mux machine enters the WAITING state from the DETACHED state if the Selection Logic determines that Selected is either SELECTED or STANDBY. The WAITING state provides a holding state for the following two purposes:

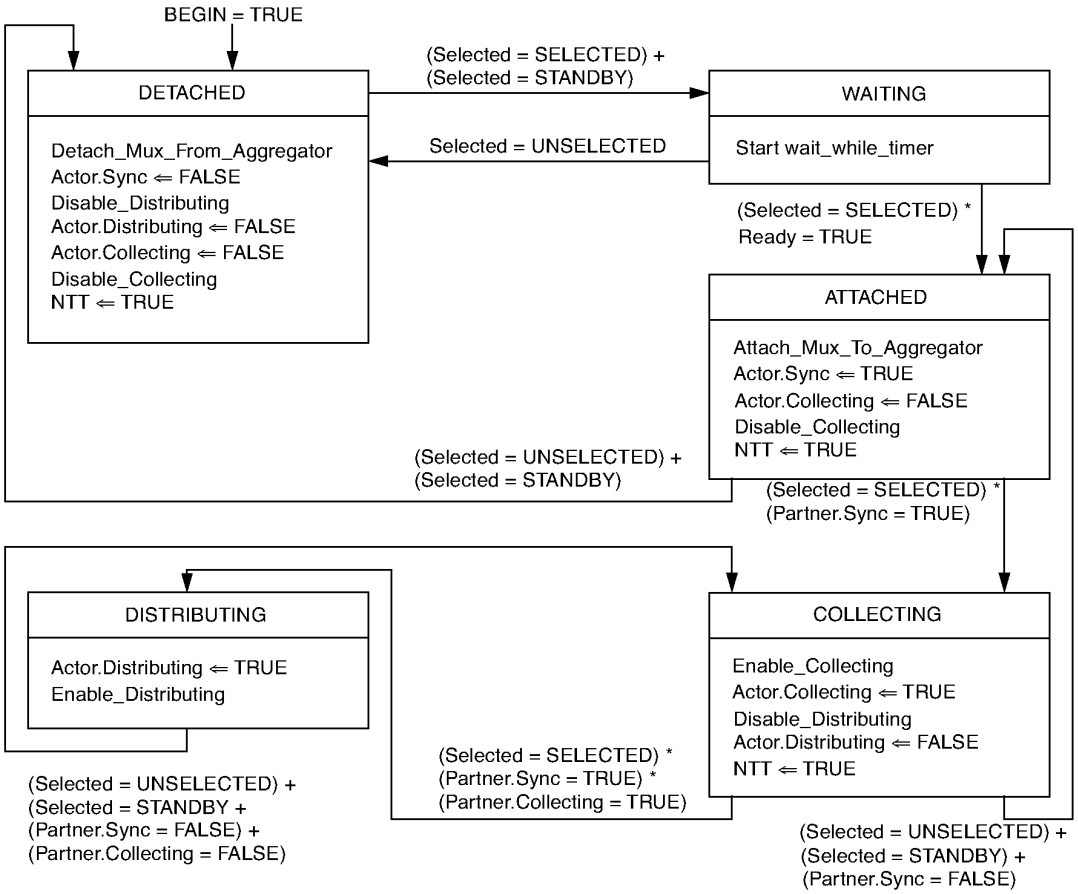
d) If Selected is SELECTED, the wait_while_timer forces a delay to allow for the possibility that other ports may be reconfiguring at the same time. Once the wait_while_timer expires, and once the wait_while_timers of all other ports that are ready to attach to the same Aggregator have expired, the process of attaching the port to the Aggregator can proceed, and the state machine enters the ATTACHED state. During the waiting time, changes in selection parameters can occur that will result in a re-evaluation of Selected. If Selected becomes UNSELECTED, then the state machine re-enters the DETACHED state. If Selected becomes STANDBY, the operation is as described in item e).

   NOTE—This waiting period reduces the disturbance that will be visible to higher layers; for example, on start-up events. However, the selection need not wait for the entire waiting period in cases where it is known that no other ports will attach; for example, where all other ports with the same operational Key are already attached to the Aggregator.

e) If Selected is STANDBY, the port is held in the WAITING state until such a time as the selection parameters change, resulting in a re-evaluation of the Selected variable. If Selected becomes UNSELECTED, the state machine re-enters the DETACHED state. If SELECTED becomes SELECTED, then the operation is as described in item d). The latter case allows a port to be brought into operation from STANDBY with minimum delay once Selected becomes SELECTED.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS



The following abbreviations are used in this diagram:
Actor.Sync: Actor_Oper_Port_State.Synchronization
Actor.Collecting: Actor_Oper_Port_State.Collecting
Actor.Distributing: Actor_Oper_Port_State.Distributing
Partner.Sync: Partner_Oper_Port_State.Synchronization
Partner.Collecting: Partner_Oper_Port_State.Collecting

Figure 43–13—Mux machine state diagram (independent control)

On entry to the ATTACHED state, the Mux machine initiates the process of attaching the port to the selected Aggregator. Once the attachment process has completed, the value of Actor_Oper_Port_State.Synchronization is set to TRUE indicating that the Actor considers the port to be IN_SYNC, and Actor_Oper_Port_State.Collecting is set to FALSE. Collection of frames from the port is disabled. In the coupled control state machine, Distribution of frames to the port is also disabled, and Actor_Oper_Port_State.Distributing is set to FALSE.

A change in the Selected variable to UNSELECTED or to STANDBY causes the state machine to enter the DETACHED state. The process of detaching the port from the Aggregator is started. Once the detachment process is completed, Actor_Oper_Port_State.Synchronization is set to FALSE indicating that the Actor considers the port to be OUT_OF_SYNC, distribution of frames to the port is disabled, Actor_Oper_Port_State.Distributing and Actor_Oper_Port_State.Collecting are set to FALSE, and collection of frames from the port is disabled. The state machine remains in the DISABLED state until such time as the Selection logic is able to select an appropriate Aggregator.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

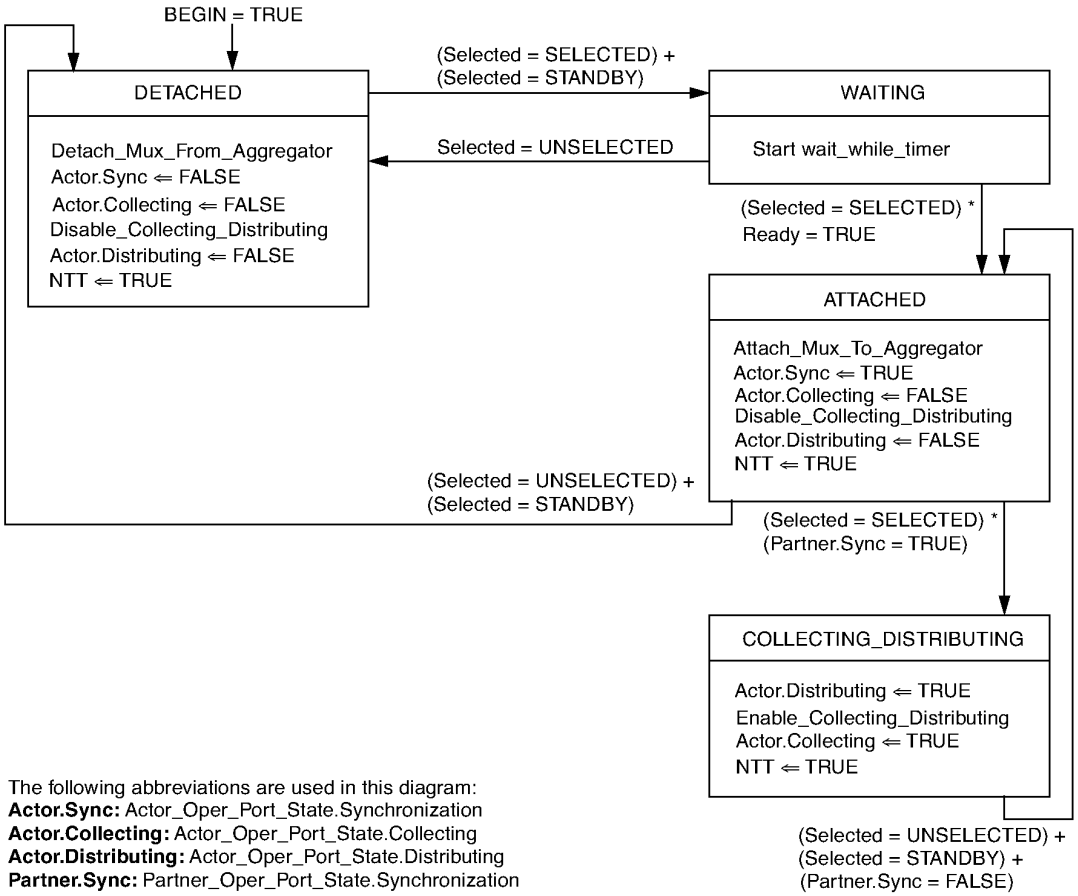


Figure 43–14—Mux machine state diagram (coupled control)

While in the ATTACHED state, a TRUE value for Partner_Oper_Port_State.Synchronization causes the state machine to transition to the COLLECTING state (independent control) or the COLLECTING_DISTRIBUTING state (coupled control).

In the COLLECTING state, collection of frames from the port is enabled, then Actor_Oper_Port_State.Collecting is set to TRUE, then distribution of frames to the port is disabled and Actor_Port_Oper_State.Distributing is set to FALSE. The state machine will return to the ATTACHED state if Selected changes to UNSELECTED or STANDBY, or if the Partner's synchronization state becomes FALSE. Once the Partner has signalled that collecting has been enabled (Partner_Oper_Port_State.Collecting is TRUE), the state machine transitions to the DISTRIBUTING state. The value of Actor_Oper_Port_State.Distributing is set to TRUE, and then distribution of frames to the port is enabled. From DISTRIBUTING, a return to the COLLECTING state occurs if the value of Selected becomes UNSELECTED or STANDBY, if the Partner's synchronization state becomes FALSE, or if the Partner signals that collection has been disabled (Partner_Oper_Port_State.Collecting is FALSE).

In the COLLECTING_DISTRIBUTING state, the value of Actor_Oper_Port_State.Distributing is set to TRUE, distribution of frames to the port and collection of frames from the port are both enabled, and then Actor_Oper_Port_State.Collecting is set to TRUE. The state machine will return to the ATTACHED state if Selected changes to UNSELECTED or STANDBY, or if the Partner's synchronization state becomes FALSE.

Copyright © 2002 IEEE. All rights reserved.

The sequence of operations and transitions defined for the COLLECTING and DISTRIBUTING states in the independent control version of this state machine ensures that frames are not distributed to a port until the Partner has enabled collection, and that distribution is stopped as soon as the Partner's state indicates that collection has been disabled. This sequence minimizes the possibility that frames will be misdelivered during the process of bringing the port into operation or taking the port out of operation. In the coupled control version of the state machine, the COLLECTING and DISTRIBUTING states merge together to form the combined state, COLLECTING_DISTRIBUTING. As independent control is not possible, the coupled control state machine does not wait for the Partner to signal that collection has started before enabling both collection and distribution.

The NTT variable is set to TRUE in the DETACHED, ATTACHED, COLLECTING, and COLLECTING_DISTRIBUTING states in order to ensure that the Partner is made aware of the changes in the Actor's state variables that are caused by the operations performed in those states.

43.4.16 Transmit machine

When the Transmit machine creates a LACPDU for transmission, it shall fill in the following fields with the corresponding operational values for this port:

a) Actor_Port and Actor_Port_Priority
b) Actor_System and Actor_System_Priority
c) Actor_Key
d) Actor_State
e) Partner_Port and Partner_Port_Priority
f) Partner_System and Partner_System_Priority
g) Partner_Key
h) Partner_State
i) CollectorMaxDelay

When the Periodic machine is in the NO_PERIODIC state, the Transmit machine shall

— Not transmit any LACPDUs, and
— Set the value of NTT to FALSE.

When the LACP_Enabled variable is TRUE and the NTT (43.4.7) variable is TRUE, the Transmit machine shall ensure that a properly formatted LACPDU (43.4.2) is transmitted (i.e., issue a Ctrl-MuxN:MA_DATA.Request(LACPDU) service primitive), subject to the restriction that no more than three LACPDUs may be transmitted in any Fast_Periodic_Time interval. If NTT is set to TRUE when this limit is in force, the transmission shall be delayed until such a time as the restriction is no longer in force. The NTT variable shall be set to FALSE when the Transmit machine has transmitted a LACPDU.

If the transmission of a LACPDU is delayed due to the above restriction, the information sent in the LACPDU corresponds to the operational values for the port at the time of transmission, not at the time when NTT was first set to TRUE. In other words, the LACPDU transmission model is based upon the transmission of state information that is current at the time an opportunity to transmit occurs, as opposed to queuing messages for transmission.

When the LACP_Enabled variable is FALSE, the Transmit machine shall not transmit any LACPDUs and shall set the value of NTT to FALSE.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

43.4.17 Churn Detection machines

If implemented, the Churn Detection machines shall implement the functions specified in Figure 43–15 and Figure 43–16 with their associated parameters (43.4.4 through 43.4.11). Implementation of the Churn Detection machines is mandatory if the associated management functionality (the Aggregation Port Debug Information package) is implemented; otherwise, implementation of the Churn Detection machines is optional.

The Churn Detection machines detect the situation where a port is operable, but the Actor and Partner have not attached the link to an Aggregator and brought the link into operation within a bounded time period. Under normal operation of the LACP, agreement between Actor and Partner should be reached very rapidly. Continued failure to reach agreement can be symptomatic of device failure, of the presence of non-standard devices, or of misconfiguration; it can also be the result of normal operation in cases where either or both Systems are restricted in their ability to aggregate. Detection of this condition is signalled by the Churn Detection machines to management in order to prompt administrative action to further diagnose and correct the fault.

NOTE—One of the classes of problems that will be detected by this machine is the one where the implementation has been designed to support a limited number of Aggregators (fewer than the number of ports—see 43.6.4.2) and the physical topology is such that one or more ports end up with no Aggregator to attach to. This may be the result of a wiring error or an error in the allocation of operational Key values to the ports and Aggregators. Alternatively, failure of a link to aggregate may be the result of a link being placed in standby mode by a System that has hardware limitations placed on its aggregation ability, leading it to make use of the techniques described in 43.6 to find the ideal configuration. Given that the time taken by an aggregation-constrained System to stabilize its configuration may be relatively large, the churn detection timers allow 60 seconds to elapse before a Churn condition is signalled.

The symptoms that the Actor Churn Detection state machine detects is that the Actor's Mux has determined that it is OUT_OF_SYNC, and that condition has not resolved itself within a period of time equal to Short_Timeout_Time (43.4.4). Under normal conditions, this is ample time for convergence to take place. Similarly, the Partner Churn Detection state machine detects a failure of the Partner's Mux to synchronize.

The Actor Churn Detection state machine is depicted in Figure 43–15. The Partner Churn Detection state machine is depicted in Figure 43–16.

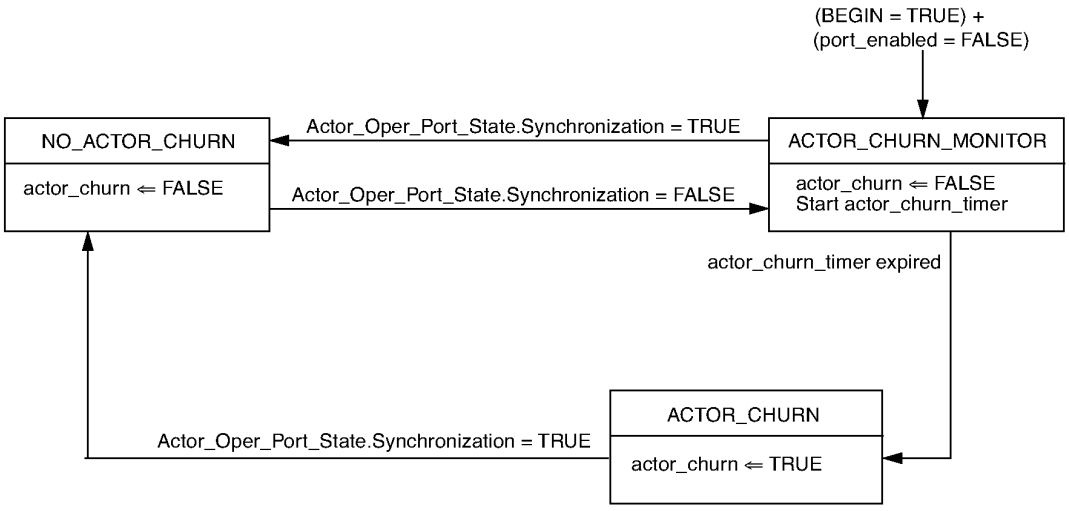


Figure 43–15—Actor Churn Detection machine state diagram

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

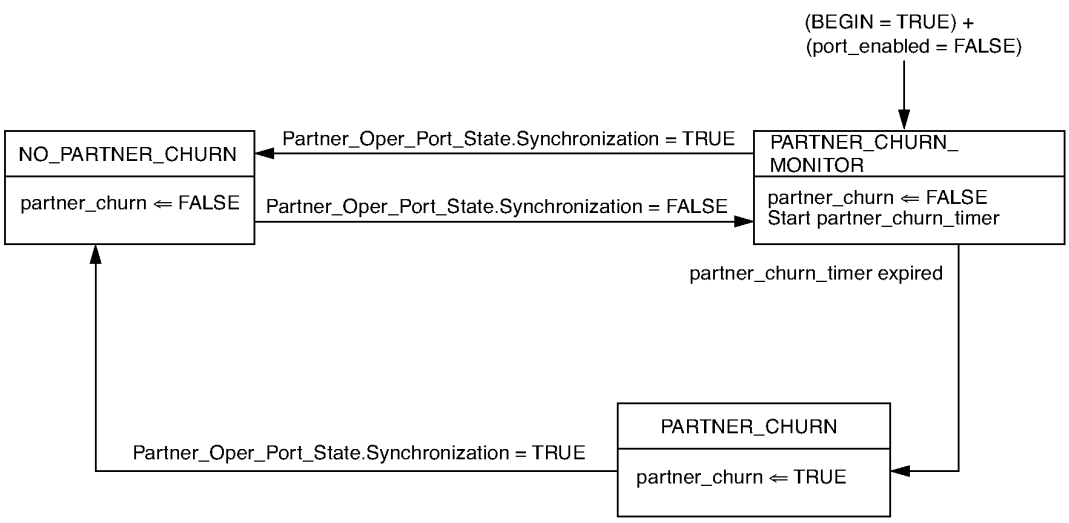


Figure 43–16—Partner Churn Detection machine state diagram

43.5 Marker protocol

43.5.1 Introduction

The Marker protocol allows the distribution function of an Actor's Link Aggregation sublayer to request the transmission of a Marker PDU on a given link. The Marker PDU is received by the Partner's collection function and a Marker Response PDU is returned on the same link to the initiating Actor's distribution function. Marker and Marker Response PDUs are treated by the underlying MACs at each end of the link as normal MAC Client PDUs; i.e., there is no prioritization or special treatment of Marker or Marker Response PDUs relative to other frames. Marker/Marker Response PDUs are subject to the operation of flow control, where supported on the link. Hence, if the distribution function requests transmission of a Marker PDU on a given link and does not transmit any further MAC Client PDUs that relate to a given set of conversations until the corresponding Marker Response PDU is received from that link, then it can be certain that there are no MAC Client PDUs related to those conversations still to be received by the Partner's collection function. The use of the Marker protocol can therefore allow the Distribution function a means of determining the point at which a given set of conversations can safely be reallocated from one link to another without the danger of causing frames in those conversations to be mis-ordered at the collector.

NOTE—The use of the Marker protocol is further discussed in Annex 43A.

The operation of the Marker protocol is unaffected by any changes in the Collecting and Distributing states associated with the port. Therefore, Marker and Marker Response PDUs can be sent on a port whose distribution function is disabled; similarly, such PDUs can be received and passed to the relevant Aggregator's collection or distribution function on a port whose collection function is disabled.

The use of the Marker protocol is optional; however, the ability to respond to Marker PDUs, as defined for the operation of the Marker Responder (see 43.5.4.1 and 43.5.4.2), is mandatory. Some distribution algorithms may not require the use of a marker; other mechanisms (such as timeouts) may be used as an alternative. As the specification of distribution algorithms is outside the scope of this standard, no attempt is made to specify how, when, or if the Marker protocol is used. (See Annex 43A for an informative discussion of distribution algorithms.).

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

The Marker protocol does not provide a guarantee of a response from the Partner; no provision is made for the consequences of frame loss or for the failure of the Partner System to respond correctly. Implementations that make use of this protocol must therefore make their own provision for handling such cases.

43.5.2 Sequence of operations

Figure 43–17 illustrates the sequence of marker operations between an initiating and responding System. Time is assumed to flow from the top of the diagram to the bottom.

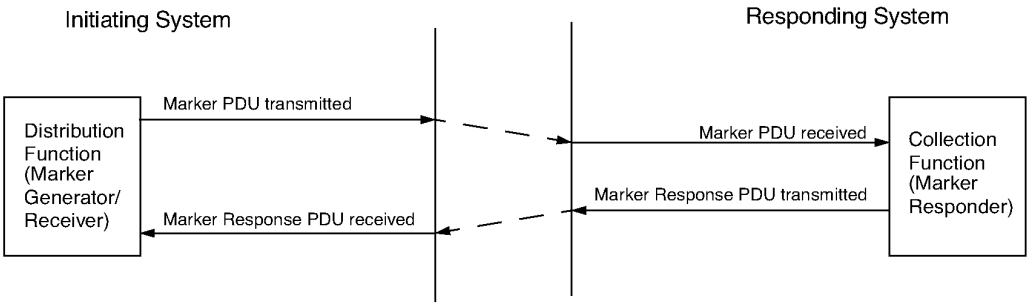


Figure 43–17—Marker protocol time sequence diagram

43.5.3 Marker and Marker Response PDU structure and encoding

43.5.3.1 Transmission and representation of octets

All Marker and Marker Response PDUs comprise an integral number of octets. The bits in each octet are numbered from 0 to 7, where 0 is the low-order bit. When consecutive octets are used to represent a numerical value, the most significant octet is transmitted first, followed by successively less significant octets.

When the encoding of (an element of) a Marker or Marker Response PDU is depicted in a diagram, then

a) Octets are transmitted from top to bottom.
b) Within an octet, bits are shown with bit 0 to the left and bit 7 to the right, and are transmitted from left to right.
c) Numerical values are encoded as binary numbers.

43.5.3.2 Marker and Marker Response PDU structure

Marker PDUs and Marker Response PDUs are basic IEEE 802.3® frames; they shall not be tagged (see Clause 3). The Marker PDU and Marker Response PDU structure shall be as shown in Figure 43–18 and as further described in the following field definitions:

a) *Destination Address*. The DA in all Marker and Marker Response PDUs is the Slow_Protocols_Multicast address. Its use and encoding are specified in Annex 43B.
b) *Source Address*. The SA in Marker and Marker Response PDUs is the individual MAC address associated with the port from which the PDU is transmitted.
c) *Length/Type*. Marker and Marker Response PDUs are always Type encoded, and carry the Slow Protocol type field. The use and encoding of this type field is specified in Annex 43B.
d) *Subtype*. The Subtype field identifies the specific Slow Protocol being encapsulated. Both Marker and Marker Response PDUs carry the Marker_subtype value 0x02.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

e) *Version number*. This identifies the Marker protocol version; implementations conformant to this version of the standard carry the value 0x01.

f) *TLV_type = Marker Information/Marker Response Information*. This indicates the nature of the information carried in this TLV-tuple. Marker Information is encoded as the integer value 0x01; Marker Response Information is encoded as the integer value 0x02.

g) *Marker_Information_Length/Marker_Response_Information_Length*. This field indicates the length (in octets) of this TLV-tuple. Both Marker and Marker Response information use a length value of 16 (0x10).

h) *Requester_Port*. The port number assigned to the port by the Requester (the System sending the initial Marker PDU), encoded as an unsigned integer.

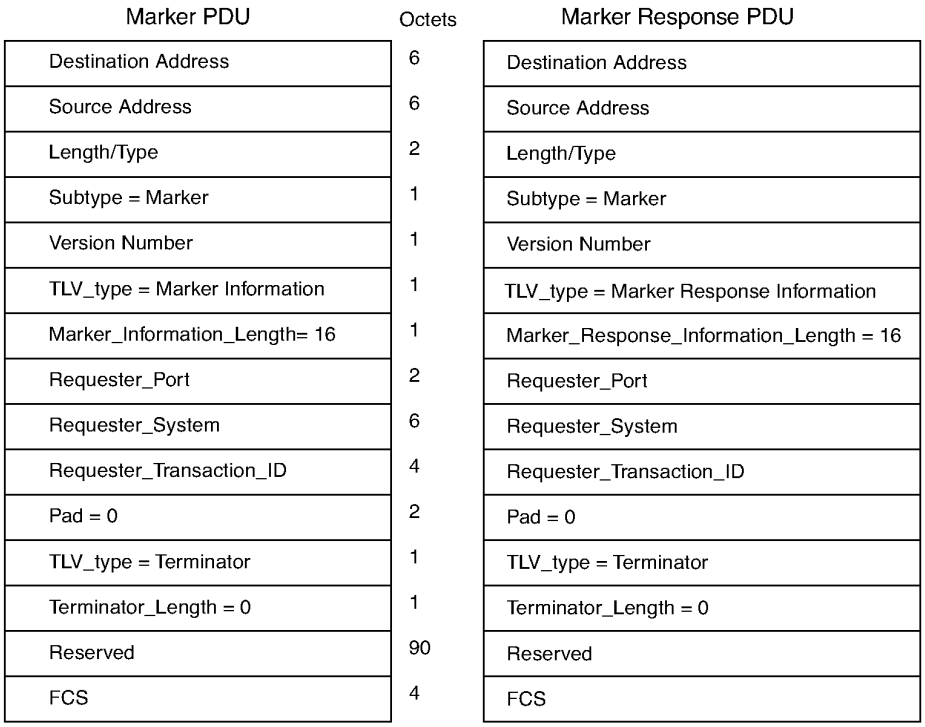


Figure 43–18—Marker PDU and Marker Response PDU structure

i) *Requester_System*. The Requester's System ID, encoded as a MAC address.

j) *Requester_Transaction_ID*. The transaction ID allocated to this request by the requester, encoded as an integer.

k) *Pad*. This field is used to align TLV-tuples on 16-byte memory boundaries. It is transmitted as zeroes in Marker PDUs; in Marker Response PDUs, this field may be transmitted as zeroes, or with the contents of this field from the Marker PDU triggering the response. The field is ignored on receipt in all cases.

NOTE—The difference in handling of the Pad field in Marker Response PDUs allows an implementation to reflect the contents of the received Marker PDU in its response, without enforcing the requirement to transmit the field as zeroes.

l) *TLV_type = Terminator*. This field indicates the nature of the information carried in this TLV-tuple. Terminator (end of message) information carries the integer value 0x00.

m) *Terminator_Length*. This field indicates the length (in octets) of this TLV-tuple. Terminator information uses a length value of 0 (0x00).

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

n) *Reserved*. These 90 octets are reserved for use in future extensions to the protocol. It is transmitted as zeroes in Marker PDUs; in Marker Response PDUs, this field may be either transmitted as zeroes, or with the contents of this field from the Marker PDU triggering the response. The field is ignored on receipt in all cases.

NOTE—These trailing reserved octets are included in all Marker and Marker Response PDUs in order to force a fixed PDU size, regardless of the version of the protocol. Hence, a Version 1 implementation is guaranteed to be able to receive version N PDUs successfully, although version N PDUs may contain additional information that cannot be interpreted (and will be ignored) by the Version 1 implementation. A crucial factor in ensuring backwards compatibility is that any future version of the protocol is required not to re-define the structure or semantics of information defined for the previous version; it may only add new information elements to the previous set. Hence, in a version N PDU, a Version 1 implementation can expect to find the Version 1 information in exactly the same places as in a Version 1 PDU, and can expect to interpret that information as defined for Version 1.

o) *FCS*. This field is the Frame Check Sequence, typically generated by the underlying MAC.

43.5.4 Protocol definition

43.5.4.1 Operation of the marker protocol

Marker PDUs may be generated by the Frame Distribution function to provide a sequence marker in the stream of frames constituting a conversation or set of conversations. Received Marker PDUs are delivered to the Marker Responder within the Frame Collection function of the Partner System.

On receipt of a valid Marker PDU, the Frame Collection function issues a Marker Response PDU, in the format specified in Figure 43–18, to the same port from which the Marker PDU was received. The **Requester_Port, Requester_System,** and **Requester_Transaction_ID** parameter in the Marker Response PDU carry the same values as those received in the corresponding Marker PDU.

Received Marker Response PDUs are passed to the Marker Receiver within the Frame Distribution function. Implementation of the Marker Generator and Receiver is optional.

The Marker Generator, if implemented, shall comply with the frame rate limitation constraint for Slow Protocols, as specified in Annex 43B.3. A Marker Responder may (but is not required to) control its Marker Response transmissions to conform to this Slow Protocols timing constraint when faced with Marker messages not in compliance with this constraint (i.e., to send fewer Marker Response PDUs than Marker PDUs received). If the Marker Responder is controlling its responses in this manner, Marker Response PDUs corresponding to Marker PDUs received in excess of the Slow Protocols timing constraint shall not be sent.

NOTE—It is important that Marker Response PDUs not be queued indefinitely, and sent long after the corresponding Marker PDU that triggered the response.

Frames generated by the Marker Responder do not count towards the rate limitation constraint for Slow Protocols, as specified in Annex 43B.3.

43.5.4.2 Marker Responder state diagram

The Marker Responder shall implement the function specified in Figure 43–19, with its associated parameters (43.5.4.2.1 through 43.5.4.2.3).

43.5.4.2.1 Constants

Slow_Protocols_Multicast
The value of the Slow Protocols reserved multicast address. (See Table 43B–1.)

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

43.5.4.2.2 Variables

DA
SA
m_sdu
service_class
status
The parameters of the MA_DATA.request and MA_DATA.indication primitives, as defined in Clause 2.

43.5.4.2.3 Messages

AggMuxN:MA_DATA.request
The service primitive used to transmit a frame with the specified parameters.

AggMuxN:MA_DATA.indication
The service primitive used to pass a received frame to a client with the specified parameters.

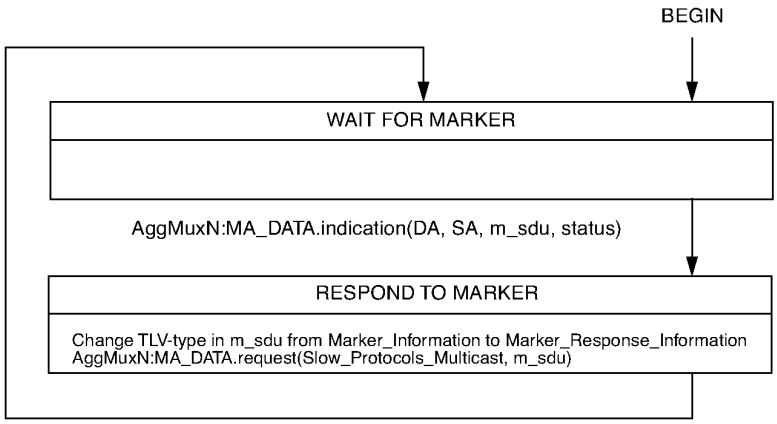


Figure 43–19—Marker Responder state diagram

Upon receipt of an AggMuxN:MA_DATA.indication primitive, the Marker Responder shall not validate the Version Number, Pad, or Reserved fields in the contained Marker Request PDU. The same actions are taken regardless of the values received in these fields. A Marker Responder may validate the Marker_Information_Length field. These behaviors, together with the constraint on future protocol enhancements discussed in the Note in 43.5.3.2, allow Version 1 devices to be compatible with future revisions of the protocol.

43.6 Configuration capabilities and restrictions

43.6.1 Use of system and port priorities

The formulation chosen for the Link Aggregation Group identifier (43.3.6) has the consequence that it is not possible to represent two or more Link Aggregation Groups, comprising aggregatable links, that share the same combination of {SK, TL}. Hence, placing configuration restrictions on the size of an aggregation (e.g.,

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

for a Key Group containing 6 members, restricting the size of any aggregation to 4 members or fewer) is only possible if it is also acceptable that only one Link Aggregation Group can be constructed from that Key Group for a given {SK, TL}. In practice, this restriction can be somewhat alleviated by subdividing Key Groups and allocating different operational Keys to each subdivision; however, this is, in general, only useful if the form of the size restriction is closely bound to physical subdivisions in the implementation (e.g., it might be possible to aggregate only those links that are on the same interface card).

In Systems that have limited aggregation capability of this form, the following algorithm shall be used to determine the subset of ports that will be aggregated together:

a) The System Aggregation Priority of each System is an eight octet binary number, formed by using the Actor_System_Priority as the two most significant octets and the Actor's System ID as the least significant six octets. For a given Actor and Partner, the System with the numerically lower value of System Aggregation Priority has the higher priority.

b) The Port Aggregation Priority of each port is a four octet binary number, formed by using the Actor_Port_Priority as the two most significant octets and the port number as the two least significant octets. For any given set of ports, the port with the numerically lower value of Port Aggregation Priority has the higher priority.

c) Ports shall be selected for aggregation by each System based upon the Port Aggregation Priority assigned by the System with the higher System Aggregation Priority, starting with the highest priority port of the System with the higher priority, and working downward through the ordered list of Port Aggregation Priority values for the N ports, applying the particular constraints imposed on the System concerned.

d) For each link that a given System cannot include in the aggregation, the Selection Logic identifies the Selection state of the corresponding port as STANDBY, preventing the link from becoming active. The synchronization state signalled in transmitted LACPDUs for such links will be OUT_OF_SYNC.

e) The selection algorithm is reapplied upon changes in the membership of the Link Aggregation Group (for example, if a link fails, or if a new link joins the group) and any consequent changes to the set of active links are made accordingly.

A port that is selected as standby as a result of limitations on aggregation capability can be viewed as providing a "hot standby" facility, as it will be able to take part in the aggregation upon failure of one of the active links in the aggregation. The ability to hold links in a standby mode in this way provides the possibility of using LACP even where the System is incapable of supporting distribution and collection with more than one port. Parallel links could be automatically configured as standby links, and deployed to mask link failures without any disruption to higher layer protocols.

43.6.2 Dynamic allocation of operational Keys

In some circumstances, the use of System and port priorities may prove to be insufficient to generate the optimum aggregation among the set of links connecting a pair of Systems. A System may have a limited aggregation capability that cannot be simply expressed as a limit on the total number of links in the aggregation. The full description of its restrictions may be that it can only aggregate together particular subsets of links, and the sizes of the subsets need not all be the same.

NOTE—An example would be an implementation organized such that, for a set of four links A through D, it would be possible to operate with {A+B+C+D} as a single aggregation, or operate with {A+B} and {C+D} as two separate aggregations, or operate as four individual links; however, all other aggregation possibilities (such as {A+C} and {B+D}) would not be achievable by the implementation.

In such circumstances, it is permissible for the System with the higher System Aggregation Priority (i.e., the numerically lower value) to dynamically modify the operational Key value associated with one or more of

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

the ports; the System with the lower priority shall not attempt to modify operational Key values for this purpose. Operational Key changes made by the higher priority System should be consistent with maintaining its highest priority port in the aggregate as an active link (i.e., in the IN_SYNC state). Successive operational Key changes, if they occur, should progressively reduce the number of ports in the aggregation. The original operational Key value should be maintained for the highest priority port thought to be aggregatable.

NOTE—Restricting operational Key changes in the manner described prevents the case where both Partner Systems involved have limited capability and both attempt to make operational Key changes; this could be a non-converging process, as a change by one participant can cause the other participant to make a change, which in turn causes the first participant to make a change—and so on, ad infinitum.

This approach effectively gives the higher priority System permission to search the set of possible configurations, in order to find the best combination of links given its own and its Partner's configuration constraints. The reaction of the Partner System to these changes can be determined by observing the changes in the synchronization state of each link. A System performing operational Key changes should allow at least 4 seconds for the Partner System to change an OUT_OF_SYNC state to an IN_SYNC state.

In the course of normal operation a port can dynamically change its operating characteristics (e.g., data rate, full or half duplex operation). It is permissible (and appropriate) for the operational Key value associated with such a port to change with the corresponding changes in the operating characteristics of the link, so that the operational Key value always correctly reflects the aggregation capability of the link. Operational Key changes that reflect such dynamic changes in the operating characteristics of a link may be made by either System without restriction.

43.6.3 Link Aggregation on shared-medium links

The Link Aggregation Control Protocol cannot detect the presence of multiple Aggregation-aware devices on the same link. Hence, shared-medium links shall be treated as Individual, with transmission/reception of LACPDUs disabled on such ports.

43.6.4 Selection Logic variants

Two variants of the Selection Logic rules are described as follows:

a) The first accommodates implementations that may wish to operate in a manner that minimizes disturbance of existing aggregates, at the expense of the deterministic characteristics of the logic described in 43.4.14.2.
b) The second accommodates implementations that may wish to limit the number of Aggregators that are available for use to fewer than the number of ports supported.

43.6.4.1 Reduced reconfiguration

By removing the constraint that the Aggregator chosen is always the lowest numbered Aggregator associated with the set of ports in an aggregation, an implementation can minimize the degree to which changes in the membership of a given aggregation result in changes of connectivity at higher layers. As there would still be the same number of Aggregators and ports with a given operational Key value, any port will still always be able to find an appropriate Aggregator to attach to, however the configuration achieved over time (i.e., after a series of link disconnections, reconnections, or reconfigurations) with this relaxed set of rules would not necessarily be the same as the configuration achieved if all Systems involved were reset, given the rules stated in 43.4.15.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

43.6.4.2 Limited Aggregator availability

By removing the constraint that there are always as many Aggregators as ports, an implementation can limit the number of MAC Client interfaces available to higher layers while maintaining the ability for each Aggregator to serve multiple ports. This has the same effect as removing the assumption that Aggregators and their associated ports have the same operational Key value; Aggregators can be effectively disabled (and therefore ignored) by configuring their Keys to be different from any operational Key value allocated to any of the ports.

In this scenario, any port(s) that cannot find a suitable Aggregator to attach to will simply wait in the DETACHED state until an Aggregator becomes available, with a synchronization state of OUT_OF_SYNC.

43.7 Protocol Implementation Conformance Statement (PICS) proforma for Clause 43, Aggregation of Multiple Link Segments[13]

43.7.1 Introduction

The supplier of an implementation that is claimed to conform to Clause 43, Link Aggregation, shall complete the following Protocol Implementation Conformance Statement (PICS) proforma.

A detailed description of the symbols used in the PICS proforma, along with instructions for completing the PICS proforma, can be found in Clause 21.

43.7.2 Identification

43.7.2.1 Implementation identification

Supplier (Note 1)	
Contact point for queries about the PICS (Note 1)	
Implementation Name(s) and Version(s) (Notes 1 and 3)	
Other information necessary for full identification—e.g., name(s) and version(s) of machines and/or operating system names (Note 2)	
NOTES 1—Required for all implementations. 2—May be completed as appropriate in meeting the requirements for the identification. 3—The terms Name and Version should be interpreted appropriately to correspond with a supplier's terminology (e.g., Type, Series, Model).	

[13] *Copyright release for PICS proformas:* Users of this standard may freely reproduce the PICS proforma in this annex so that it can be used for its intended purpose and may further publish the completed PICS.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

43.7.2.2 Protocol summary

Identification of protocol specification	IEEE Std 802.3-2002®, Clause 43, Link Aggregation.
Identification of amendments and corrigenda to the PICS proforma which have been completed as part of the PICS	
Have any Exception items been required? No [ ] Yes [ ] (See Clause 21: the answer Yes means that the implementation does not conform to IEEE Std 802.3-2002®, Clause 43, Link Aggregation.)	

Date of Statement	

43.7.3 Major capabilities/options

Item	Feature	Subclause	Value/Comment	Status	Support
*MG	Marker Generator/Receiver	43.2.5		O	Yes [ ] No [ ]
*AM	Aggregation Port Debug Information package support	30.7		O	Yes [ ] No [ ]
*CM	Churn Detection machine	43.4.17	Required if Aggregation Port Debug Information package supported	AM: M !AM: O	N/A [ ] M:Yes [ ] Yes [ ] No [ ]

43.7.4 Frame Collector

Item	Feature	Subclause	Value/Comment	Status	Support
FC1	Frame Collector function	43.2.3	As specified in the state diagram shown in Figure 43–3 and associated definitions in 43.2.3.1	M	Yes [ ]
FC2	Frame Collector function—CollectorMaxDelay	43.2.3.1.4	Deliver or discard frames within CollectorMaxDelay	M	Yes [ ]

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

43.7.5 Frame Distributor

Item	Feature	Subclause	Value/Comment	Status	Support
	Distribution algorithm ensures the following, when frames received by Frame Collector:	43.2.4			
FD1	Frame mis-ordering		None	M	Yes [ ]
FD2	Frame duplication		None	M	Yes [ ]
FD3	Frame Distributor function	43.2.4	Function as specified in the state diagram shown in Figure 43–4 and associated definitions in 43.2.4.1	M	Yes [ ]

43.7.6 Marker protocol

Item	Feature	Subclause	Value/Comment	Status	Support
MGR1	Marker Generator/Receiver	43.2.5		MG:M	N/A [ ] M:Yes [ ]
MGR2	Marker Responder	43.2.6	Function specified in 43.5.4.2	M	Yes [ ]

43.7.7 Aggregator Parser/Multiplexer

Item	Feature	Subclause	Value/Comment	Status	Support
APM1	Aggregator Multiplexer	43.2.7	Transparent pass-through of frames	M	Yes [ ]
APM2	Aggregator Multiplexer	43.2.7	Discard of TX frames when port not Distributing	M	Yes [ ]
APM3	Aggregator Parser	43.2.7	Function specified by state diagram shown in Figure 43–5 and associated definitions in 43.2.7.1.	M	Yes [ ]
APM4	Aggregator Parser	43.2.7	Discard of RX frames when port not Collecting	M	Yes [ ]

Copyright © 2002 IEEE. All rights reserved.

43.7.8 Control Parser/Multiplexer

Item	Feature	Subclause	Value/Comment	Status	Support
CPM1	Control Multiplexer	43.2.9	Transparent pass-through of frames	M	Yes [ ]
CPM2	Control Parser	43.2.9	Function specified by state diagram shown in Figure 43–6 and associated definitions in 43.2.9.1.	M	Yes [ ]

43.7.9 System identification

Item	Feature	Subclause	Value/Comment	Status	Support
SID1	Globally unique identifier	43.3.2	Globally administered individual MAC address plus System Priority	M	Yes [ ]
SID2	MAC address chosen	43.3.2	MAC address associated with one of the ports	O	Yes [ ] No [ ]

43.7.10 Aggregator identification

Item	Feature	Subclause	Value/Comment	Status	Support
AID1	Globally unique identifier	43.3.3	Globally administered individual MAC address	M	Yes [ ]
AID2	Integer identifier	43.3.3	Uniquely identifies the Aggregator within the System	M	Yes [ ]
*AID3	Unique identifier allocated	43.3.3	Unique identifier assigned to one of its bound ports	O	Yes [ ] No [ ]
AID4			Unique identifier not assigned to any other Aggregator	!AID3 :M	N/A [ ] M:Yes [ ]

43.7.11 Port identification

Item	Feature	Subclause	Value/Comment	Status	Support
PID1	Port identifiers	43.3.4	Unique within a System; port number 0 not used for any port	M	Yes [ ]

Copyright © 2002 IEEE. All rights reserved.

43.7.12 Capability identification

Item	Feature	Subclause	Value/Comment	Status	Support
CID1	Administrative and operational Key values associated with each port	43.3.5		M	Yes [ ]
CID2	Administrative and operational Key values associated with each Aggregator	43.3.5		M	Yes [ ]

43.7.13 Link Aggregation Group identification

Item	Feature	Subclause	Value/Comment	Status	Support
LAG1	LAG ID component values	43.3.6.1	Actor's values non-zero. Partner's admin values only zero for Individual ports	M	Yes [ ]

43.7.14 Detaching a link from an Aggregator

Item	Feature	Subclause	Value/Comment	Status	Support
DLA1	Effect on conversation reallocated to a different link	43.3.13	Frame ordering preserved	M	Yes [ ]

43.7.15 LACPDU structure

Item	Feature	Subclause	Value/Comment	Status	Support
LPS1	LACPDU Frame format	43.4.2.2	Not Tagged	M	Yes [ ]
LPS2	LACPDU structure	43.4.2.2	As shown in Figure 43–7 and as described	M	Yes [ ]
LPS3	LACPDU structure	43.4.2	All Reserved octets ignored on receipt and transmitted as zero	M	Yes [ ]

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

43.7.16 State machine variables

Item	Feature	Subclause	Value/Comment	Status	Support
SMV1	Partner_Admin_Port_State	43.4.7	Collecting set to the same value as Synchronization	M	Yes [ ]
SMV2	LACP_Enabled	43.4.8	FALSE for half duplex ports, otherwise TRUE	M	Yes [ ]

43.7.17 Receive machine

Item	Feature	Subclause	Value/Comment	Status	Support
RM1	Receive machine	43.4.12	As defined in Figure 43–10 and associated parameters	M	Yes [ ]
RM2	Validation of LACPDUs		No validation of Version Number, TLV_type, or Reserved fields	M	Yes [ ]

43.7.18 Periodic Transmission machine

Item	Feature	Subclause	Value/Comment	Status	Support
PM1	Periodic Transmission machine	43.4.13	As defined in Figure 43–11 and associated parameters	M	Yes [ ]

Copyright © 2002 IEEE. All rights reserved.

43.7.19 Selection Logic

Item	Feature	Subclause	Value/Comment	Status	Support
	Selection logic requirements	43.4.14.1			
SLM1	Aggregator support		At least one Aggregator per System	M	Yes [ ]
SLM2	Port Keys		Each port assigned an operational Key	M	Yes [ ]
SLM3	Aggregator Keys		Each Aggregator assigned an operational Key	M	Yes [ ]
SLM4	Aggregator Identifiers		Each Aggregator assigned an identifier	M	Yes [ ]
SLM5	Aggregator selection		If same Key assignment as port	M	Yes [ ]
SLM6	Ports that are members of the same Link Aggregation Group		Ports select same Aggregator	M	Yes [ ]
SLM7	Pair of ports connected in loopback		Not select same Aggregator as each other	M	Yes [ ]
SLM8	Port required to be Individual		Not select same Aggregator as any other port	M	Yes [ ]
SLM9	Port is Aggregatable		Not select same Aggregator as any Individual port	M	Yes [ ]
SLM10	Port unable to select an Aggregator		Port not attached to any Aggregator	M	Yes [ ]
SLM11	Further aggregation constraints		Ports may be selected as standby	O	Yes [ ] No [ ]
SLM12	Selected variable		Set to SELECTED or STANDBY once Aggregator is determined	M	Yes [ ]
SLM13	Port enabled		Only when selected and attached to an Aggregator	M	Yes [ ]
SLM14	Recommended default operation of Selection Logic	43.4.14.2	Meets requirements of 43.4.14.2	O	Yes [ ] No [ ]

43.7.20 Mux machine

Item	Feature	Subclause	Value/Comment	Status	Support
XM1	Mux machine	43.4.15	As defined in Figure 43–13 or Figure 43–14, and associated parameters	M	Yes [ ]

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

43.7.21 Transmit machine

Item	Feature	Subclause	Value/Comment	Status	Support
	Transmitted in outgoing LACPDUs	43.4.16			
TM1	Actor_Port and Actor_Port_Priority			M	Yes [ ]
TM2	Actor_System and Actor_System_Priority			M	Yes [ ]
TM3	Actor_Key			M	Yes [ ]
TM4	Actor_State			M	Yes [ ]
TM5	Partner_Port and Partner_Port_Priority			M	Yes [ ]
TM6	Partner_System and Partner_System_Priority			M	Yes [ ]
TM7	Partner_Key			M	Yes [ ]
TM8	Partner_State			M	Yes [ ]
TM9	CollectorMaxDelay			M	Yes [ ]
TM10	Action when Periodic machine is in the NO_PERIODIC state	43.4.16	Set NTT to FALSE, do not transmit	M	Yes [ ]
TM11	Action when LACP_Enabled is TRUE, NTT is TRUE, and not rate limited	43.4.16	Properly formatted LACPDU transmitted	M	Yes [ ]
TM12	Action when LACP_Enabled is TRUE and NTT is TRUE, when rate limit is in force	43.4.16	Transmission delayed until limit is no longer in force	M	Yes [ ]
TM13	Action when LACPDU has been transmitted	43.4.16	Set NTT to FALSE	M	Yes [ ]
TM14	Action when LACP_Enabled is FALSE	43.4.16	Set NTT to FALSE, do not transmit	M	Yes [ ]

43.7.22 Churn Detection machines

Item	Feature	Subclause	Value/Comment	Status	Support
CM1	Churn Detection machines	43.4.17	As defined in Figure 43–15 and Figure 43–16	CM:M	N/A [ ] Yes [ ]

Copyright © 2002 IEEE. All rights reserved.

43.7.23 Marker protocol

Item	Feature	Subclause	Value/Comment	Status	Support
FP1	Respond to all received Marker PDUs	43.5.1	As specified by 43.5.4	M	Yes [ ]
FP2	Use of the Marker protocol	43.5.1	As specified by 43.5.4	O	Yes [ ] No [ ]
FP3	MARKER.request service primitives request rate	43.5.4.1	Maximum of five during any one-second period	MG:M	N/A [ ] Yes [ ]
FP4	Marker PDU Frame format	43.5.3.2	Not Tagged	MG:M	N/A [ ] Yes [ ]
FP5	Marker Response PDU Frame format	43.5.3.2	Not Tagged	M	Yes [ ]
FP6	Marker PDU structure	43.5.3.2	As shown in Figure 43–18 and as described	MG:M	N/A [ ] Yes [ ]
FP7	Marker Response PDU structure	43.5.3.2	As shown in Figure 43–18 and as described	M	Yes [ ]
FP8	Marker Responder State Diagram	43.5.4.2	As specified in Figure 43–19 and 43.5.4.2.1 through 43.5.4.2.3	M	Yes [ ]
FP9	Validation of Marker Request PDUs	43.5.4.2.3	Marker Responder shall not validate the Version Number, Pad, or Reserved fields	M	Yes [ ]

43.7.24 Configuration capabilities and restrictions

Item	Feature	Subclause	Value/Comment	Status	Support
CCR1	Algorithm used to determine subset of ports that will be aggregated in Systems that have limited aggregation capability	43.6.1	As specified in items a) to e) of 43.6.1	M	Yes[ ]
CCR2	Key value modification to generate optimum aggregation	43.6.2		O	Yes [ ] No [ ]
CCR3	Key value modification when System has higher System Aggregation Priority			CCR2:M	N/A [ ] M:Yes [ ]
CCR4	Key value modification when System has lower System Aggregation Priority			CCR2:X	N/A [ ] X:Yes [ ]

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

43.7.25 Link Aggregation on shared-medium links

Item	Feature	Subclause	Value/Comment	Status	Support
LSM1	Shared-medium links—Configuration	43.6.3	Configured as Individual links	M	Yes [ ]
LSM2	Shared-medium links—Operation of LACP	43.6.3	LACP is disabled	M	Yes [ ]

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

Annex 36A

(informative)

Jitter test patterns

This annex defines test patterns that allow 1000BASE-X PMDs to be tested for compliance while in a system environment. The patterns may be implemented at a bit, code-group, or frame level and may be used for transmitter testing. The receiver may not have the capability to accept these diagnostic sequences; however, system debug can be improved if a receiver is able to test for one or more of these patterns and report bit errors (e.g. 8B/10B decoder errors) back to the user.

36A.1 High-frequency test pattern

The intent of this test pattern is to test random jitter (RJ) at a BER of 10^{-12}, and also to test the asymmetry of transition times. This high-frequency test pattern generates a one, or light on, for a duration of 1 bit time, followed by a zero, or light off, for a duration of 1 bit time. This pattern repeats continuously for the duration of the test. For example: 10101010101010101010101010101010101010...

NOTE—This pattern can be generated by the repeated transmission of the D21.5 code-group. Disparity rules are followed.

36A.2 Low-frequency test pattern

The intent of this test pattern is to test low-frequency RJ and also to test PLL tracking error. This low frequency test pattern generates a one, or light on, for a duration of 5 bit times, followed by a zero, or light off, for a duration of 5 bit times. This pattern repeats continuously for the duration of the test. For example: 11111000001111100000111110000011111100000...

NOTE—This pattern can be generated by the repeated transmission of the K28.7 code-group. Disparity rules are followed.

36A.3 Mixed frequency test pattern

The intent of this test pattern is to test the combination of RJ and deterministic jitter (DJ). This mixed frequency test pattern generates a one, or light on, for a duration of 5 bit times, followed by a zero, or light off, for a duration of 1 bit times, followed by a one for 1 bit time followed by a zero for 1 bit time followed by a one for 2 bit times followed by a zero for 5 bit times followed by a one for 1 bit time followed by a zero for 1 bit time followed by a one for 1 bit time followed by a zero for 2 bit times. This pattern repeats continuously for the duration of the test. For example: 11111010110000010100111110101100000010100...

NOTE—This pattern can be generated by the repeated transmission of the K28.5 code-group. Disparity rules are followed.

36A.4 Long continuous random test pattern

The long continuous random test pattern is a random test pattern intended to provide broad spectral content and minimal peaking that can be used for the measurement of jitter at either a component or system level.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

NOTE—The derivation of this pattern may be found in *Fibre Channel Jitter Working Group Technical Report* [B36]. This technical report modified the original RPAT as defined by Fibre Channel so that it would maintain its intended qualities but fit into a Fibre Channel frame. This annex uses similar modifications to fit the same RPAT into an 802.3® frame.

The long continuous random test pattern consists of a continuous stream of identical packets, separated by a minimum IPG. Each packet is encapsulated within SPD and EPD delimiters as specified in Clause 36 in the ordinary way. The contents of each packet is composed of the following octet sequences, as observed at the GMII, before 8B/10B coding.

Each packet in the long continuous random test pattern consists of 8 octets of PREAMBLE/SFD, followed by 1512 data octets (126 repetitions of the 12-octet modified RPAT sequence), plus 4 CRC octets, followed by a minimum IPG of 12 octets of IDLE.

PREAMBLE/SFD:

55 55 55 55 55 55 55 D5

MODIFIED RPAT SEQUENCE (LOOP 126 TIMES)

BE D7 23 47 6B 8F B3 14 5E FB 35 59

CRC

94 D2 54 AC

IPG (TX_EN and TX_ER low)

00 00 00 00 00 00 00 00 00 00 00 00

END

36A.5 Short continuous random test pattern

The short continuous random test pattern is a random test pattern intended to provide broad spectral content and minimal peaking that can be used for the measurement of jitter at either a component or system level.

NOTE—The derivation of this pattern may be found in *Fibre Channel Jitter Working Group Technical Report* [B36]. This technical report modified the original RPAT as defined by Fibre Channel so that it would maintain its intended qualities but fit into a Fibre Channel frame. This annex uses similar modifications to fit the same RPAT into an 802.3® frame.

The short continuous random test pattern consists of a continuous stream of identical packets, separated by a minimum IPG. Each packet is encapsulated within SPD and EPD delimiters as specified in Clause 36 in the ordinary way. The contents of each packet is composed of the following octet sequences, as observed at the GMII, before 8B/10B coding.

Each packet in the short continuous random test pattern consists of 8 octets of PREAMBLE/SFD, followed by 348 data octets (29 repetitions of the 12-octet modified RPAT sequence), plus 4 CRC octets, followed by a minimum IPG of 12 octets of IDLE.

The format of this packet is such that the PCS will generate the following ordered sets for the IPG: /T/ /R/ /I1/ /I2/ /I2/ /I2/ /I2/

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

PREAMBLE/SFD:

55 55 55 55 55 55 55 D5

MODIFIED RPAT SEQUENCE (LOOP 29 TIMES)

BE D7 23 47 6B 8F B3 14 5E FB 35 59

CRC

2F E0 AA EF

IPG (TX_EN and TX_ER low)

00 00 00 00 00 00 00 00 00 00 00 00

END

Copyright © 2002 IEEE. All rights reserved.

Annex 36B

(informative)

8B/10B transmission code running disparity calculation examples

Detection of a invalid code-group in the 8B/10B transmission code does not necessarily indicate that the code-group in which the error was detected was the one in which the error occurred. Invalid code-groups may result from a prior error that altered the running disparity of the bit stream but that did not result in a detectable error at the code-group in which the error occurred. The examples shown in Tables 36B–1 and 36B–2 exhibit this behavior. The example shown in Table 36B–3 exhibits the case where a bit error in a received code-group is detected in that code-group, affects the next code group, and error propagation is halted upon detection of the running disparity error.

Table 36B–1—RD error detected two code-groups following error

Stream	Code-group			Code-group			Code-group		
	RD	RD	RD	RD	RD	RD	RD	RD	RD
Transmitted code-group	–	D21.1	–	D10.2	–	D23.5	+		
Transmitted bit stream	–	101010 - 1001	–	010101 – 0101	–	111010 + 1010	+		
Received bit stream	–	101010 - 1011[a]	+	010101 + 0101	+	111010 +[b] 1010	+		
Received code-group	–	D21.0	+	D10.2	+	invalid code-group[b]	+		

[a]Bit error introduced (1001 ⇒ 1011)
[b]Nonzero disparity blocks must alternate in polarity (+ ⇒ –). In this case, RD does not alternate (+ ⇒ +), the received code group is not found in the Current RD+ column in either Table 36–1a or Table 36–2, and an invalid code-group is recognized.
[c]Running disparity is calculated on the received code-group regardless of the validity of the received code-group. Nonzero disparity blocks prevent the propagation of errors and normalize running disparity to the transmitted bit stream (i.e., equivalent to the received bit stream had an error not occurred).

Table 36B–2—RD error detected in next code-group following error

Stream	Code-group			Code-group			Code-group		
	RD	RD	RD	RD	RD	RD	RD	RD	RD
Transmitted code-group	–	D21.1	–	D23.4	–	D23.5	+		
Transmitted bit stream	–	101010 – 1001	–	111010 + 0010	–	111010 + 1010	+		
Received bit stream	–	101010 – 1011[a]	+	111010 +[b] 0010	–	111010 + 1010	+		
Received code-group	–	D21.0	+	invalid code-group[b]	–	D23.5	+		

[a]Bit error introduced (1001 ⇒ 1011)
[b]Nonzero disparity blocks must alternate in polarity (+ ⇒ –).

Copyright © 2002 IEEE. All rights reserved.

Table 36B–3—A single bit error affects two received code-groups

Stream	Code-group			Code-group			Code-group		
	RD	RD	RD	RD	RD	RD	RD	RD	RD
Transmitted code-group	–	D3.6 (FCS3)	–	K29.7 (/T/)		–	K23.7 (/R/)		–
Transmitted bit stream	–	110001 - 0110	–	101110 + 1000		–	111010 + 1000		–
Received bit stream	–	110001 - 0111[a] +[b]		101110 +[c] 1000		–	111010 + 1000		–
Received code-group	–	invalid code-group[d] + invalid code-group[e]				–	K23.7 (/R/)		–

[a]Bit error introduced (0110 ⇒ 0111).
[b]Nonzero disparity blocks must alternate in polarity (– ⇒ +). Received RD differs from transmitted RD.
[c]Nonzero disparity blocks must alternate in polarity (+ ⇒ –). Invalid code-group due to RD error since RD remains at +.
[d]Received code-group is not found in either Table 36–1a or Table 36–2.
[e]Nonzero disparity blocks prevent the propagation of errors and normalize running disparity to the transmitted bit stream (i.e. equivalent to the received bit stream had an error not occurred). All code-groups contained in PCS End_of_Packet delimiters (/T/R/R or /T/R/K28.5/) include nonzero disparity blocks.

Copyright © 2002 IEEE. All rights reserved.

Annex 38A

(informative)

Fiber launch conditions

38A.1 Overfilled Launch

Overfilled Launch (OFL), as described in IEC 60793-1-4 [B24], is the standard launch used to define optical fiber bandwidth. This launch uniformly overfills the fiber both angularly and spatially. It excites both radial and azimuthal modes of the fiber equally, thus providing a reproducible bandwidth which is insensitive to small misalignments of the input fiber. It is also relatively insensitive to microbending and macrobending when they are not sufficient to affect power distribution carried by the fiber. A restricted launch gives a less reproducible bandwidth number and is dependent on an exact definition of the launch. Overfilled launch is commonly used to measure the bandwidth of LED-based links.

38A.2 Radial Overfilled Launch (ROFL)

A Radial Overfilled Launch is created when a multimode optical fiber is illuminated by the coherent optical output of a source operating in its lowest order transverse mode in a manner that excites predominantly the radial modes of the multimode fiber. This contrasts with the OFL, which is intended to excite both radial and azimuthal modes of the fiber equally. In practice an ROFL is obtained when

a) A spot of laser light is projected onto the core of the multimode fiber,
b) The laser spot is approximately symmetrical about the optical center of the multimode fiber,
c) The optical axis of both the fiber and the laser beam are approximately aligned,
d) The angle of divergence of the laser beam is less than the numerical aperture of the multimode fiber,
e) The laser spot is larger than the core of the multimode fiber.

An ROFL cannot be created using a multi-transverse mode laser or by simply projecting a speckle pattern through an aperture.

Copyright © 2002 IEEE. All rights reserved.

Annex 40A

(informative)

Additional cabling design guidelines

This annex provides additional cabling guidelines when installing a new Category 5 balanced cabling system or using an existing Category 5 balanced cabling system. These guidelines are intended to supplement those in Clause 40. 1000BASE-T is designed to operate over 4-pair unshielded twisted-pair cabling systems that meet both the Category 5 requirements described in ANSI/TIA/EIA-568A (1995) and ISO/IEC 11801:1995, and the additional transmission parameters of return loss, ELFEXT loss, and MDELFEXT loss specified in 40.7. There are additional steps that may be taken by network designers that provide additional operating margins and ensure the objective BER of 10^{-10} is achieved. Cabling systems that meet or exceed the specifications in 40.7 for a worst case 4-connector topology are recommended for new installations. Whether installing a new Category 5 balanced cabling system or reusing one that is already installed, it is *highly recommended* that the cabling system be measured/certified before connecting 1000BASE-T equipment following the guidelines in (proposed) ANSI/TIA/EIA TSB95.

40A.1 Alien crosstalk

40A.1.1 Multipair cabling (i.e., greater than 4-pair)

Multiple Gigabit Ethernet links [(n*4-Pair) with n greater than 1] should not share a common sheath as in a 25-pair binder group in a multipair cable. When the multipair cable is terminated into compliant connecting hardware (TIA does not specify 25 position connecting hardware), the NEXT loss contributions between the adjacent 4-pair gigabit ethernet link, from connecting hardware and the cable combined, cannot be completely cancelled.

40A.1.2 Bundled or hybrid cable configurations

Another source of alien crosstalk can occur in a bundled or hybrid cable configuration where two or more 4-pair cables are assembled together.

In order to limit the noise coupled between adjacent 1000BASE-T link segments in a bundled or hybrid cable configuration, the PSNEXT loss between a 1000BASE-T duplex channel in a link segment and all duplex channels in adjacent 1000BASE-T link segments should be greater than 35 – 15*log(*f*/100) (dB) at all frequencies from 1 MHz to 100 MHz.

40A.2 Cabling configurations

The primary application for the Clause 40 specification is expected to be between a workstation and the local telecommunications closet. In commercial buildings this application is generally referred to as the horizontal cabling subsystem. As specified in ANSI/TIA/EIA-568-A and ISO/IEC 11801: 1995 the maximum length of a horizontal subsystem building wiring channel is 100 m. The channel consists of cords, cables, and connecting hardware. The maximum configuration for this channel is shown in Figure 40A–1.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

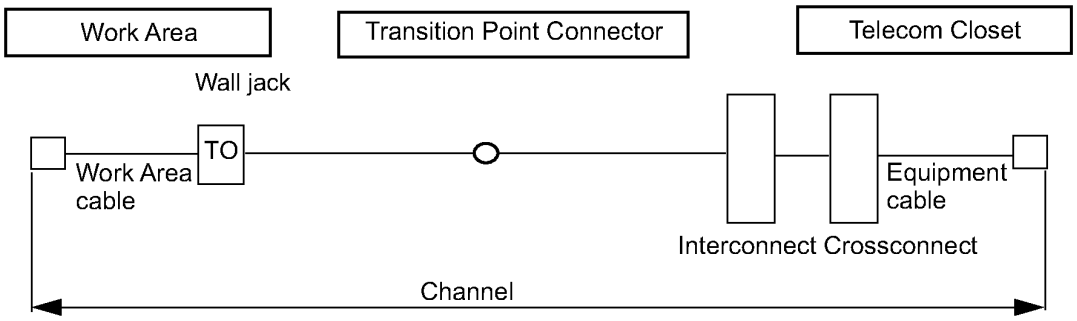


Figure 40A–1—Maximum horizontal subsystem configuration

On the other hand, a minimum configuration can be achieved by removing the patch cord and transition point, which is shown in Figure 40A–2.

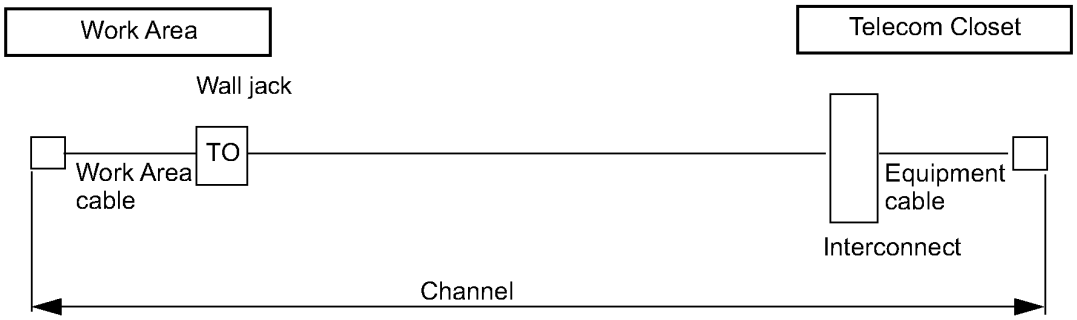


Figure 40A–2—Minimum horizontal subsystem configuration

1000BASE-T is designed to operate over a channel that meets the specifications of 40.7 and the channel configuration shown in Figure 40A–1. However, if the channel specifications of 40.8 cannot be met when using the channel configuration shown in Figure 40A–1, the configuration shown in Figure 40A–2 is recommended. This optimized channel for a 1000BASE-T link segment deletes the transition point and runs an equipment patch cord directly between the LAN equipment and the connector termination of the permanent link. This reduces the number of connectors and their associated crosstalk in the link. The minimum link configuration:

a) Minimizes crosstalk, both near-end and far-end, which maximizes the BER margin; and
b) Minimizes link insertion loss.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

Annex 40B

(informative)

Description of cable clamp

This annex describes the cable clamp used in the common-mode noise rejection test of 40.6.1.3.3, which is used to determine the sensitivity of the 1000BASE-T receiver to common-mode noise from the link segment. As shown in Figure 40B–1, the clamp is 300 mm long, 58 mm wide, 54 mm high with a center opening of 6.35 mm (0.25 in). The clamp consists of two halves that permit the insertion of a cable into the clamp.

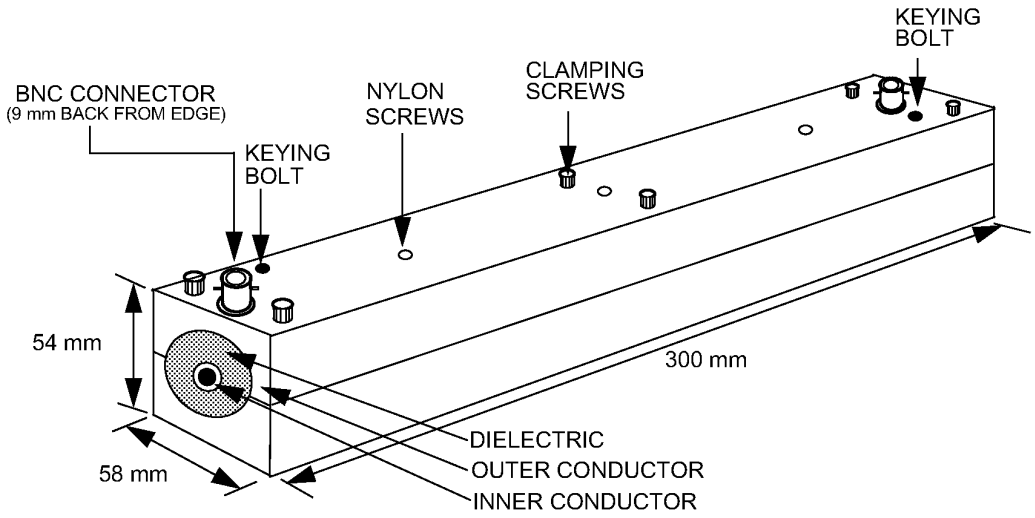


Figure 40B–1—Cable clamp

The clamp has a copper center conductor and an aluminum outer conductor with a high density polyethylene dielectric. The following is a review of the construction and materials of the clamp:

a) *Inner conductor*—Copper tubing with an inner diameter of 6.35 mm (0.25 in) and an outer diameter of 9.4 mm (0.37 in).
b) *Outer conductor*—Aluminum bar that is 300 mm long and approximately 54 mm by 58 mm. The bar is milled to accept the outer diameter of the dielectric material.
c) *Dielectric*—High Density Polyethylene (Residual, TypeF) with dielectric constant of 2.32. An outside diameter of 33.5 mm and an inner diameter that accepts the outside diameter of the copper inner conductor.
d) *Connectors*—BNC connectors are located 9 mm (0.39 in) from each end of the clamp and are recessed into the outer conductor. The center conductor of the connector is connected to the inter conductor as shown in Figure 40B–2.
e) *Clamping screws*—Six screws are used to connect the two halves of the clamp together after the cable has been inserted. Although clamping screws are shown in Figure 40B–1, any clamping method may be used that ensures the two halves are connected electrically and permits quick assembly and disassembly.
f) *Nylon screws*—Used to align and secure the inner conductor and dielectric to the outer conductor. The use and location of the screws is left to the manufacturer.
g) *Keying bolts*—Two studs used to align the two halves of the clamp.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

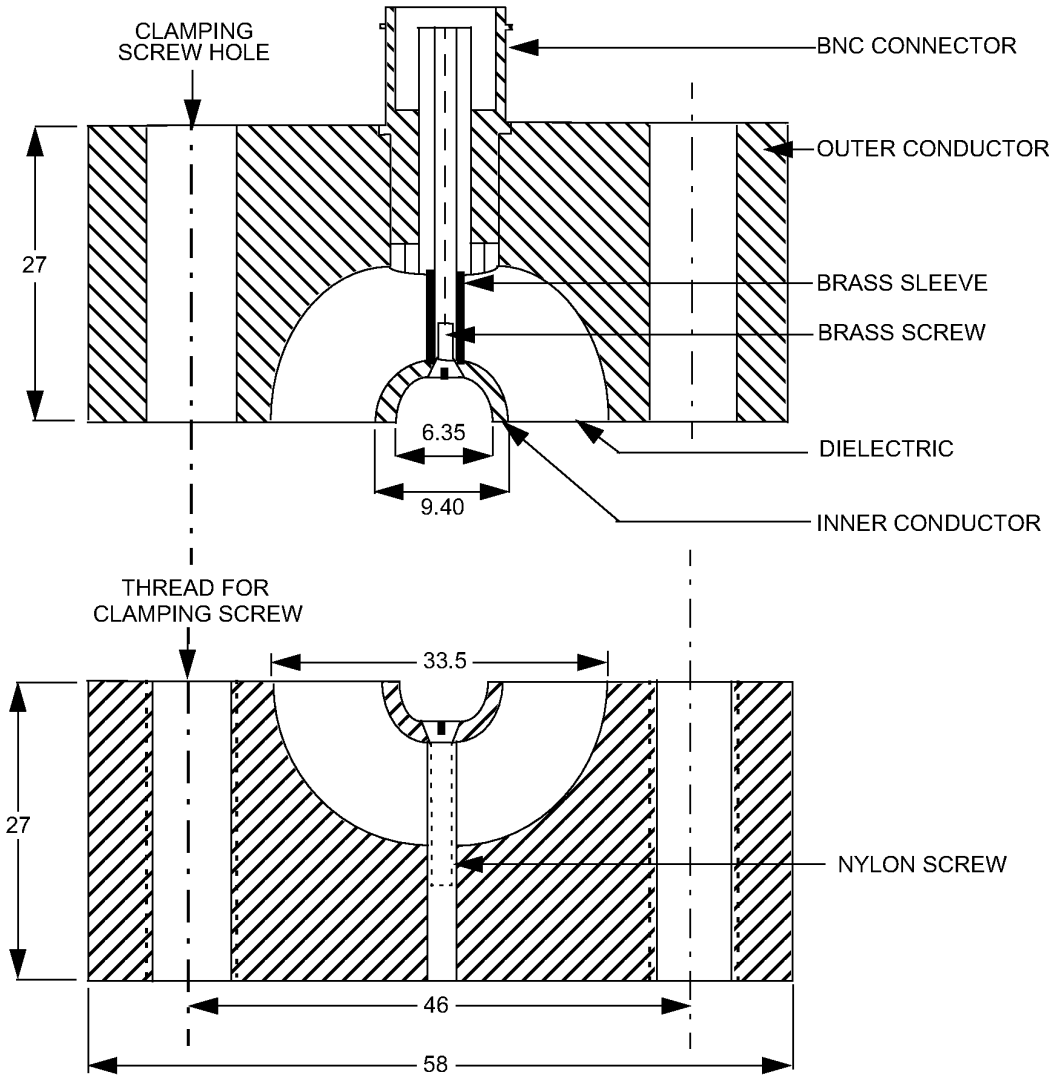


Figure 40B–2—Cross-section of cable clamp

As shown in Figure 40B–2 the inner conductor on the bottom half of the clamp extends slightly (~ 0.1mm) above the dielectric to ensure there is good electrical connection with the inner conductor of the top half of the clamp along the full length of the conductor when the two halves are clamped together.

The electrical parameters of the clamp between 1MHz and 250 MHz are as follows:

a) Insertion loss: < 0.2 dB
b) Return loss: > 20.0 dB

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

40B.1 Cable clamp validation

In order to ensure the cable clamp described above is operating correctly, the following test procedure is provided. Prior to conducting the following test shown in Figure 40B–3, the clamp should be tested to ensure the insertion loss and return loss are as specified above. The cable clamp validation test procedure uses a well-balanced 4-pair Category 5 unshielded test cable or better that meets the specifications of 40.7. The test hardware consists of the following:

a) *Resistor network*—Network consists of three 50 ±0.1% Ω resistors; two resistors are connected in series as a differential termination for cable pairs and the other resistor is connected between the two and the ground plane as a common-mode termination.

b) *Balun*—3 ports, laboratory quality with a 100 Ω differential input, 50 Ω differential output, and a 50 Ω common-mode output:

Insertion Loss (100 Ω balanced <->50 Ω unbalanced): <1.2 dB (1-350MHz)

Return Loss: >20 dB (1-350 MHz)

Longitudinal Balance: >50 dB (1-350 MHz)

c) *Test cable*—4-pair 100 Ω UTP category 5 balanced cable at least 30 m long.

d) *Chokes (2)*—Wideband Ferrite Material:

Inter-diameter: 6.35 to 6.86 mm

Impedance: 250 Ω @ 100 MHz

e) *Ground plane*—Copper sheet or equivalent.

f) *Signal generator*

g) *Oscilloscope*

h) *Receiver*

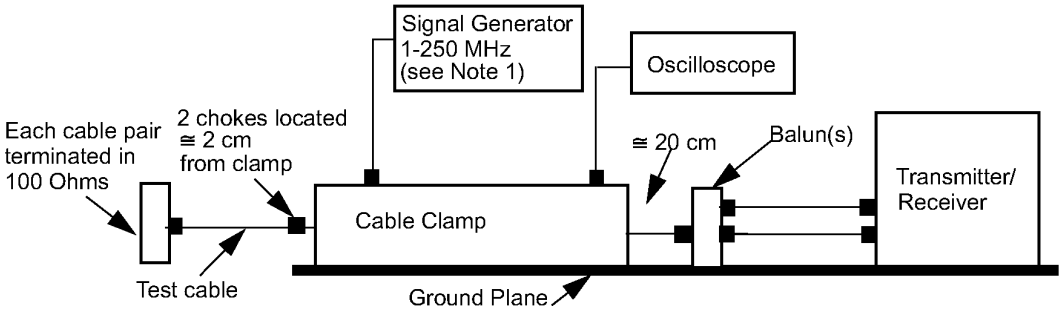


Figure 40B–3—Cable clamp validation test configuration

With the test cable inserted in the cable clamp, a signal generator with a 50 Ω output impedance is connected to one end of the cable clamp and an oscilloscope with a 50 Ω input impedance is connected to the other end. The signal generator shall be capable of providing a sine wave signal of 1 MHz to 250 MHz. The output of the signal generator is adjusted for a voltage of 1.0 Vrms (2.83 Vpp) at 20 MHz on the oscilloscope. The remainder of the test is conducted without changing the signal generator voltage. The cable pairs not connected to the balun are terminated in a resistor network, although when possible it is recommended that each cable pair be terminated in a balun. It very important that the cable clamp, balun, receiver, and resistor networks have good contact with the ground plane. The two chokes, which are located next to each other, are located approximately 2.0 cm from the clamp. The cable between the clamp and the balun should be straight and not in contact with the ground plane.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

The differential-mode and common-mode voltage outputs of the balun should meet the limits shown in Table 40B–1 over the frequency range 1 MHz to 250 MHz for each cable pair. The differential mode voltage at the output of the balun must be increased by 3 dB to take into account the 100-to-50 impedance matching loss of the balun.

Table 40B–1—Common- and differential-mode output voltages

Frequency (*f*)	Common-mode voltage	Differential-mode voltage
1-30 MHz	<0.1+0.97(f/30) Vpp	<2.4 + 19.68 (f/30) mVpp
30-80 MHz	<1.07 Vpp	<22 mVpp
80-250 MHz	<1.07 – 0.6 (f-80)/170 Vpp	<22 mVpp

NOTE—Prior to conducting the validation test the cable clamp should be tested without the cable inserted to determine the variation of the signal generator voltage with frequency at the output of the clamp. The signal generator voltage should be adjusted to 1 Vrms (2.83 Vpp) at 20 MHz on the oscilloscope. When the frequency is varied from 20 MHz to 250 MHz, the voltage on the oscilloscope should not vary more than ±7.5%. If the voltage varies more than ±7.5%, then a correction factor must be applied at each measurement frequency.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

Annex 40C

(informative)

Add-on interface for additional Next Pages

This annex describes a technique for implementing Auto-Negotiation for 1000BASE-T when the implementor wishes to send additional Next Pages (other than those required to configure for 1000BASE-T operation). To accomplish this mode of Auto-Negotiation, the implementor must ensure that the three Next Pages required for 1000BASE-T configuration are sent first.

The add-on interface described in this annex shows one technique for supporting the transmission of additional Next Pages. This mechanism utilizes the existing Clause 28 Auto-Negotiation mechanism and variables defined in Clause 28. Its purpose is merely to provide optional NEXT PAGE WAIT responses to the Auto-Negotiation Arbitration state diagram (see Figure 28–16).

The add-on interface for Auto-Negotiation is intended to interface directly between the defined registers and the Auto-Negotiation mechanism defined in Clause 28. The mechanism described includes five main blocks (see Figure 40C–1).

The first three blocks are used by the MASTER-SLAVE resolution function. They are used to generate and store random seeds and to resolve the status of the MASTER-SLAVE relationship. Their operation is described later in this annex. The final two blocks, the transmit state machine for the 1000BASE-T Next Page exchange and the receive state machine for the 1000BASE-T Next Page exchange, are described in this annex.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

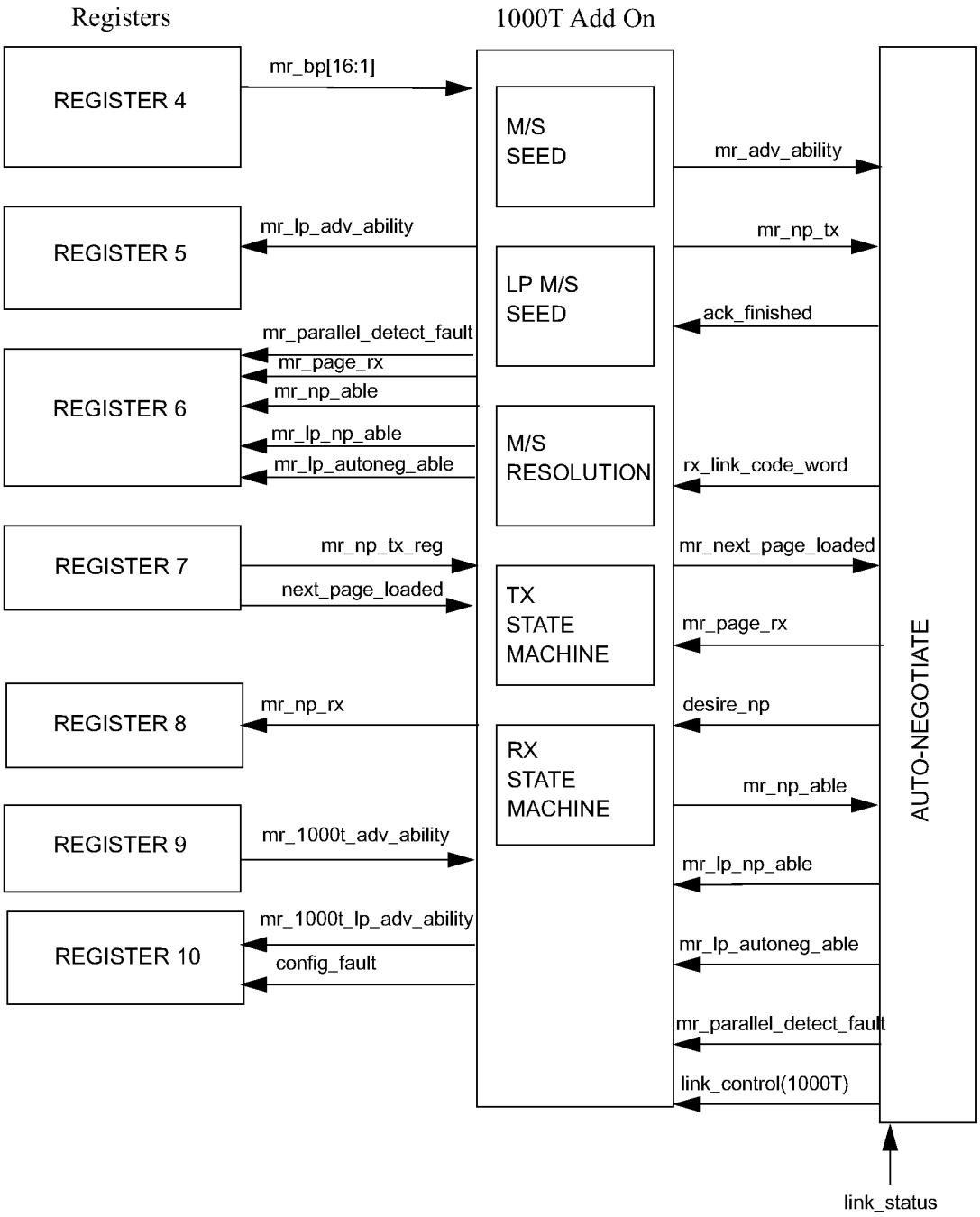


Figure 40C–1—Auto-negotiate add-on diagram for 1000BASE-T

NOTE—When the exchange of Next Pages is complete, the MASTER-SLAVE relationship can be determined using Table 40–5 with the 1000BASE-T Technology Ability Next Page bit values specified in Table 40–4 and information received from the link partner. This process is conducted at the entrance to the FLP LINK GOOD CHECK state shown in the Auto-Negotiation Arbitration State Diagram (Figure 28–16).

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

40C.1 State variables

mr_bp
: This variable is used as an intermediate signal from register 4. Normally register 4 would directly source the mr_adv_ability information. This information is now sourced from the transmit state machine.

mr_1000t_adv_ability
: A 16-bit array used to store and indicate the contents of register 9.

mr_1000t_lp_adv_ability
: A 16-bit array used to write information to register 10.

mr_np_tx_reg
: This variable is an intermediate signal from register 7. Normally register 7 would directly source the information to the Auto-Negotiation function via mr_np_tx. This information is now sourced from the transmit state machine.

mr_np_rx
: A 16-bit array used to write information to register 8.
Values: Zeros; data bit is logical zero.
One; data bit is logical one.

config_fault
: This variable indicates the result of the MASTER-SLAVE resolution function.

next_page_loaded
: This variable is an intermediate signal from register 7. Normally register 7 would directly source the information to the Auto-Negotiation function via mr_next_page_loaded. This information is now sourced from the transmit state machine.

reg_random
: An 11-bit array used to store the received random seed from the link partner. It is used by the MASTER-SLAVE resolution function.

1000T_capable
: This variable is used merely to show the local device is 1000Base-T capable. It is shown to illustrate the path that a non-1000Base-T device would take within the auto negotiation mechanism.

ATMP_CNT
: This variable is used to count the number of failed MASTER-SLAVE resolutions. It has a maximum value of 7.

All other signals are defined in Clause 28.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

40C.2 State diagrams

40C.2.1 Auto-Negotiation Transmit state machine add-on for 1000BASE-T

The Auto-Negotiation transmit state machine add-on (see Figure 40C–2) is responsible for sending the Base Page, 1000BASE-T Next Pages, as well as additional Next Pages as specified by the management interface. 1000BASE-T Next Pages will automatically be sent by the PHY whenever there are no additional Next Pages to be sent. If the user desires to send additional Next Pages, then the user must first send three pages of any format. Management will automatically replace these three pages with the appropriate 1000BASE-T Message Page and the two following unformatted pages and then will send the additional Next Pages as specified by the user. All other steps are performed by the management interface. The management interface is now required to complete the Next Page exchange by sourcing its own NULL page. This is shown in Figure 40C–2 for illustration only.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

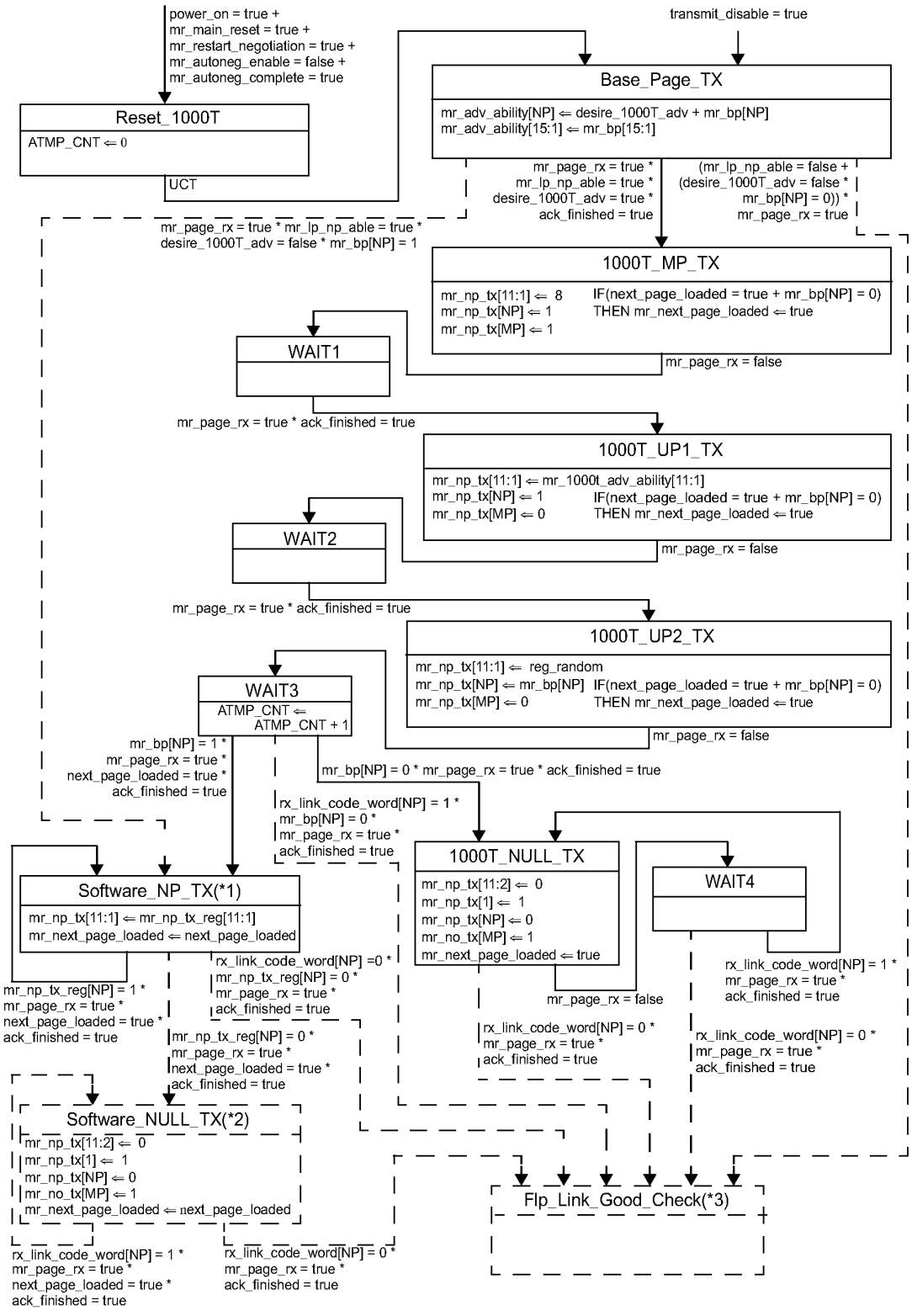


Figure 40C–2—Auto-Negotiation Transmit state diagram add-on for 1000BASE-T

Copyright © 2002 IEEE. All rights reserved.

NOTES for Figure 40C–2

1—(Software_NP_TX) If the user desires to send additional Next Pages, then the contents of the first three Next Pages will be overwritten by the three 1000BASE-T Next Pages. In this case, the user is responsible for stepping through the Next Page sequence (by creating the initial three Next Pages to be overwritten by the three 1000BASE-T Next Pages); otherwise the process is automatic. (next_page_loaded signals clear operation as per Clause 28.)

2—(Software_NULL_TX) This is shown for illustration only. This is done in software and is required.

3—(Flp_Link_Good_Check) This is shown for illustration only. This state is from the Auto-Negotiation arbitration state diagram and indicates the conclusion of pages being sent. (The transition 1000T_capable = false is to show sequence for non 1000BASE-T implementations.)

40C.2.2 Auto-Negotiation receive state diagram add-on for 1000BASE-T

The Auto-Negotiation receive state machine add-on for 1000BASE-T Next Pages (see Figure 40C–3) is responsible for receiving the Base Page, 1000BASE-T Next Pages, and any additional Next Pages received. 1000BASE-T Next Pages will automatically be received whenever the user does not wish to participate in Next Page exchanges. In this case, the appropriate 1000BASE-T message page and its two unformatted pages will automatically be received and stored in their appropriate registers. Any additional Next Pages received will still be placed in register 8, but will be overwritten automatically when a new page is received. The net result is that the management interface does not need to poll registers 6 and 8. The information in register 8 will be meaningless in this case. If the user desires to participate in additional Next Page exchanges via setting the appropriate bit in register 4, the user now becomes responsible (as was previously the case) for defining how this will be accomplished. In this situation, the first three Next Pages received may be 1000BASE-T and should be discarded. This information will automatically be stored internally in the appropriate register 10 and reg_random. The management interface/user can ignore the information received for the 1000BASE-T Next Pages.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

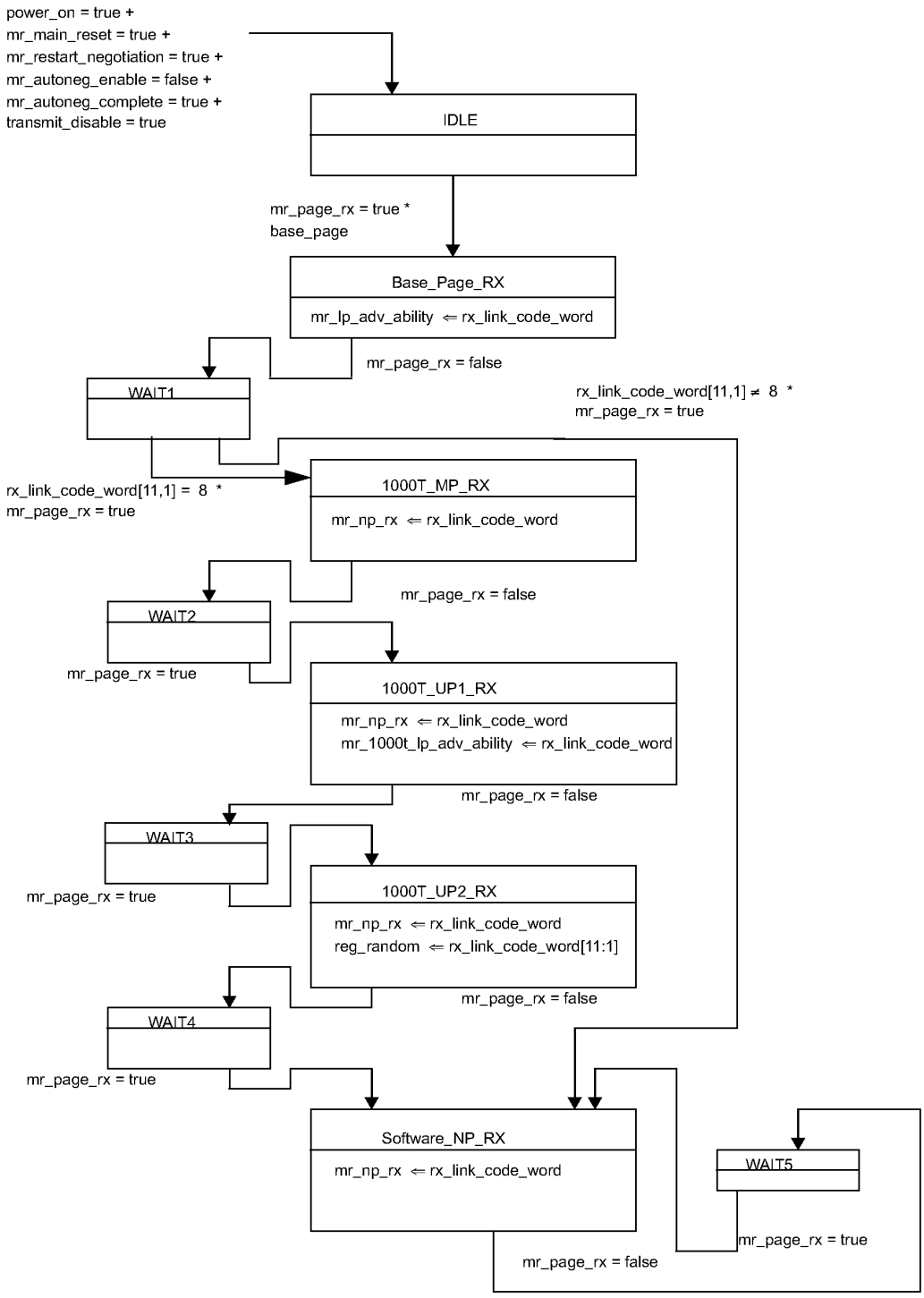


Figure 40C–3—Auto-Negotiation Receive state diagram add-on for 1000BASE-T

Copyright © 2002 IEEE. All rights reserved.

Annex 43A

(informative)

Collection and Distribution functions

43A.1 Introduction

The specification of the Collection and Distribution functions was defined with the following considerations in mind:

a) Frame duplication is not permitted.
b) Frame ordering must be preserved in aggregated links. Strictly, the MAC service specification (ISO/IEC 15802-1) states that order must be preserved for frames with a given SA, DA, and priority; however, this is a tighter constraint than is absolutely necessary. There may be multiple, logically independent conversations in progress between a given SA-DA pair at a given priority; the real requirement is to maintain ordering within a conversation, though not necessarily between conversations.
c) A single algorithm can be defined for the collection function that is independent of the distribution function(s) employed by the Partner System.
d) In the interests of simplicity and scalability, the collection function should not perform re-assembly functions, re-order received frames, or modify received frames. Distribution functions, therefore, do not make use of segmentation techniques, do not label or otherwise modify transmitted frames in any way, and must operate in a manner that will inherently ensure proper ordering of received frames with the specified collector.
e) The distribution and collection functions need to be capable of handling dynamic changes in aggregation membership.
f) There are expected to be many different topologies and many different types of devices in which Link Aggregation will be employed. It is therefore unlikely that a single distribution function will be applicable in all cases.

A simple collection function has been specified. The Collector preserves the order of frames received on a given link, but does not preserve frame ordering amongst links. The distribution function maintains frame ordering by

— Transmitting frames of a given conversation on a single link at any time.
— Before changing the link on which frames of a given conversation are transmitted, ensuring that all previously transmitted frames of that conversation have been received to a point such that any subsequently transmitted frames received on a different links will be delivered to the MAC Client at a later time.

Given the wide variety of potential distribution algorithms, the normative text in Clause 43 specifies only the requirements that such algorithms must meet, and not the details of the algorithms themselves. To clarify the intent, this informative annex gives examples of distribution algorithms, when they might be used, and the role of the Marker protocol (43.5) in their operation. The examples are not intended to be either exhaustive or prescriptive; implementors may make use of any distribution algorithms as long as the requirements of Clause 43 are met.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

43A.2 Port selection

A distribution algorithm selects the port used to transmit a given frame, such that the same port will be chosen for subsequent frames that form part of the same conversation. The algorithm may make use of information carried in the frame in order to make its decision, in combination with other information associated with the frame, such as its reception port in the case of a MAC Bridge.

The algorithm may assign one or more conversations to the same port, however, it must not allocate some of the frames of a given conversation to one port and the remainder to different ports. The information used to assign conversations to ports could include the following:

a) Source MAC address
b) Destination MAC address
c) The reception port
d) The type of destination address (individual or group MAC address)
e) Ethernet Length/Type value (i.e., protocol identification)
f) Higher layer protocol information (e.g., addressing and protocol identification information from the LLC sublayer or above)
g) Combinations of the above

One simple approach applies a hash function to the selected information to generate a port number. This produces a deterministic (i.e., history independent) port selection across a given number of ports in an aggregation. However, as it is difficult to select a hash function that will generate a uniform distribution of load across the set of ports for all traffic models, it might be appropriate to weight the port selection in favor of ports that are carrying lower traffic levels. In more sophisticated approaches, load balancing is dynamic; i.e., the port selected for a given set of conversations changes over time, independent of any changes that take place in the membership of the aggregation.

43A.3 Dynamic reallocation of conversations to different ports

It may be necessary for a given conversation or set of conversations to be moved from one port to one or more others, as a result of

a) An existing port being removed from the aggregation,
b) A new port being added to the aggregation, or
c) A decision on the part of the Distributor to re-distribute the traffic across the set of ports.

Before moving conversation(s) to a new port, it is necessary to ensure that all frames already transmitted that are part of those conversations have been successfully received. The following procedure shows how the Marker protocol (43.5) can be used to ensure that no mis-ordering of frames occurs:

1) Stop transmitting frames for the set of conversations affected. If the MAC Client requests transmission of further frames that are part of this set of conversations, these frames are discarded.
2) Start a timer, choosing the timeout period such that, if the timer expires, the destination System can be assumed either to have received or discarded all frames transmitted prior to starting the timer.
3) Use the Marker protocol to send a Marker PDU on the port previously used for this set of conversations.
4) Wait until either the corresponding Marker Response PDU is received or the timer expires.
5) Restart frame transmission for the set of conversations on the newly selected port.

The appropriate timeout value depends on the connected devices. For example, the recommended maximum Bridge Transit Delay is 1 second; if the receiving device is a MAC Bridge, it may be expected to have

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

forwarded or discarded all frames received more than 1 second ago. The appropriate timeout value for other circumstances could be smaller or larger than this by several orders of magnitude. For example, if the two Systems concerned are high-performance end stations connected via Gigabit Ethernet links, then timeout periods measured in milliseconds might be more appropriate. In order to allow an appropriate timeout value to be determined, the Frame Collector parameter CollectorMaxDelay (see 43.2.3) defines the maximum delay that the collector can introduce between receiving a frame from a port and either delivering it to the MAC Client or discarding it. This value will be dependent upon the particular implementation choices that have been made in a System. As far as the operation of the Collector state machine is concerned, CollectorMaxDelay is a constant; however, a management attribute, aAggCollectorMaxDelay (30.7.1.1.32), is provided that allows interrogation and administative control of its value. Hence, if a System knows the value of CollectorMaxDelay that is in use by a Partner System, it can set the value of timeout used when flushing a link to be equal to that value of CollectorMaxDelay, plus sufficient additional time to allow for the propagation delay experienced by frames between the two Systems. A value of zero for the CollectorMaxDelay parameter indicates that the delay imposed by the Collector is less than the resolution of the parameter (10 microseconds). In this case, the delay that must be considered is the physical propagation delay of the channel. Allowing management manipulation of CollectorMaxDelay permits fine-tuning of the value used in those cases where it may be difficult for the equipment to pre-configure a piece of equipment with a realistic value for the physical propagation delay of the channel.

The Marker protocol provides an optimization that can result in faster reallocation of conversations than would otherwise be possible—without the use of markers, the full timeout period would always have to be used in order to be sure that no frames remained in transit between the local Distributor and the remote Collector. The timeout described recovers from loss of Marker or Marker Response PDUs that can occur.

43A.4 Topology considerations in the choice of distribution algorithm

Figure 43A–1 gives some examples of different aggregated link scenarios. In some cases, it is possible to use distribution algorithms that use MAC frame information to allocate conversations to links; in others, it is necessary to make use of higher-layer information.

In example A, there is a many-to-many relationship between end stations communicating over the aggregated link. It would be possible for each switch to allocate conversations to links simply on the basis of source or destination MAC addresses.

In examples B and C, a number of end stations communicate with a single server via the aggregated link. In these cases, the distribution algorithm employed in the server or in Switch 2 can allocate traffic from the server on the basis of destination MAC address; however, as one end of all conversations constitutes a single server with a single MAC address, traffic from the end stations to the server would have to be allocated on the basis of source MAC address. These examples illustrate the fact that different distribution algorithms can be used in different devices, as appropriate to the circumstances. The collection function is independent of the distribution function(s) that are employed.

In examples D and E, assuming that the servers are using a single MAC address for all of their traffic, the only appropriate option is for the distribution algorithm used in the servers and switches to make use of higher-layer information (e.g., Transport Layer socket identifiers) in order to allocate conversations to links. Alternatively, in example E, if the servers were able to make use of multiple MAC addresses and allocate conversations to them, then the switches could revert to MAC Address-based allocation.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

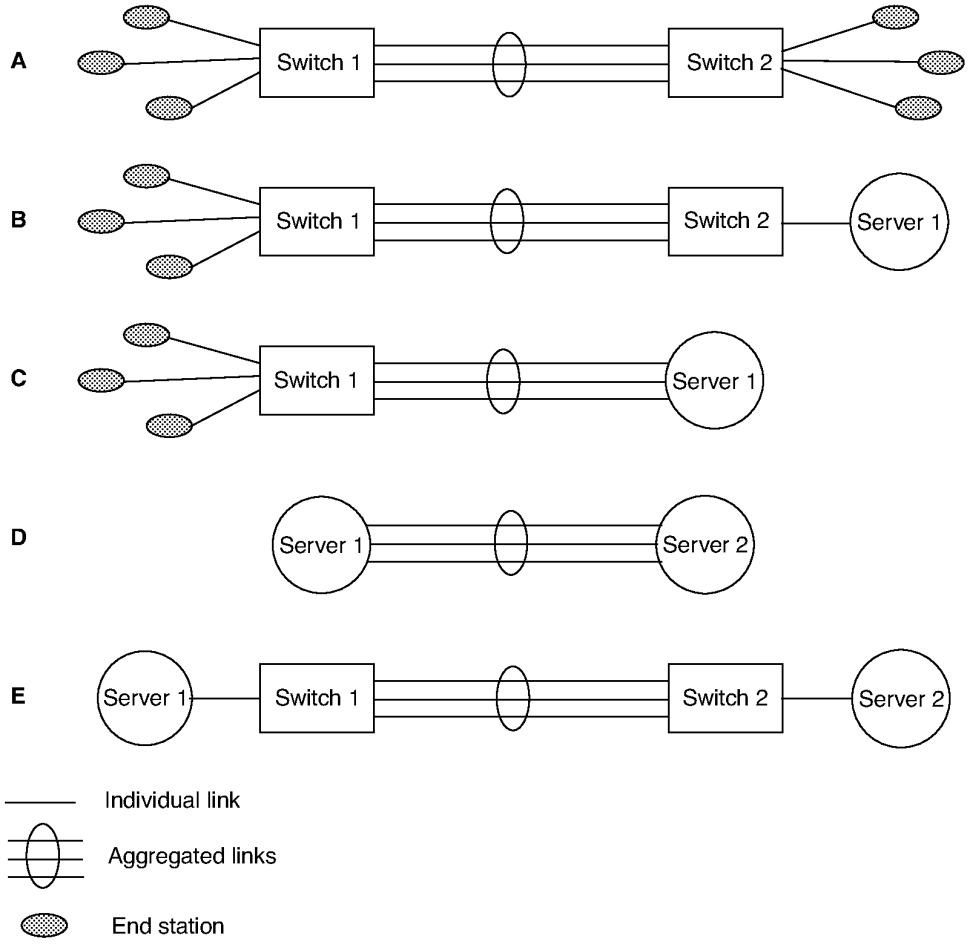


Figure 43A–1—Link aggregation topology examples

Copyright © 2002 IEEE. All rights reserved.

Annex 43B

(normative)

Requirements for support of Slow Protocols

43B.1 Introduction and rationale

There are two distinct classes of protocols used to control various aspects of the operation of IEEE 802.3® devices. They are as follows:

a) Protocols such as the MAC Control PAUSE operation (Annex 31B) that need to process and respond to PDUs rapidly in order to avoid performance degradation. These are likely to be implemented as embedded hardware functions, making it relatively unlikely that existing equipment could be easily upgraded to support additional such protocols.

   NOTE—This consideration was one of the contributing factors in the decision to use a separate group MAC address to support LACP and the Marker protocol, rather than re-using the group MAC address currently used for PAUSE frames.

b) Protocols such as LACP, with less stringent frequency and latency requirements. These may be implemented in software, with a reasonable expectation that existing equipment be upgradeable to support additional such protocols, depending upon the approach taken in the original implementation.

In order to place some realistic bounds upon the demands that might be placed upon such a protocol implementation, this annex defines the characteristics of this class of protocols and identifies some of the behaviors that an extensible implementation needs to exhibit.

43B.2 Slow Protocol transmission characteristics

Protocols that make use of the addressing and protocol identification mechanisms identified in this annex are subject to the following constraints:

a) No more than 5 frames shall be transmitted in any one-second period.
b) The maximum number of Slow Protocols is 10.

   NOTE—This is the maximum number of Slow Protocols that use the specified protocol type defined here. That is, there may be more than 10 slow protocols in the universe, but no more than 10 may map to the same Ethernet Length/Type field.

c) The MAC Client data generated by any of these protocols shall be in the normal length range for an IEEE 802.3® MAC frame, as specified in 4.4.2. It is recommended that the maximum length for a Slow Protocol frame be limited to 128 octets.

   NOTE—The Slow Protocols specified in Clause 43 (i.e., LACP and Marker) conform to this recommended maximum.

d) PDUs generated by these protocols shall use the Basic and not the Tagged frame format (see Clause 3).

The effect of these restrictions is to restrict the bandwidth consumed and performance demanded by this set of protocols; the absolute maximum traffic loading that would result is 50 maximum length frames per second per link.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

43B.3 Addressing

The Slow_Protocols_Multicast address has been allocated exclusively for use by Slow Protocols PDUs; its value is identified in Table 43B–1.

Table 43B–1—Slow_Protocols_Multicast address

Name	Value
Slow_Protocols_Multicast address	01-80-C2-00-00-02

NOTES

1—This address is within the range reserved by ISO/IEC 15802-3 (MAC Bridges) for link-constrained protocols. As such, frames sent to this address will not be forwarded by conformant MAC Bridges; its use is restricted to a single link.

2—Although the two currently existing Slow Protocols (i.e., LACP and the Marker protocol) always use this MAC address as the destination address in transmitted PDUs, this may not be true for all Slow Protocols. In some yet-to-be-defined protocol, unicast addressing may be appropriate and necessary. Rather, the requirement is that this address not be used by any protocols that are not Slow Protocols.

43B.4 Protocol identification

All Slow Protocols use Type-field encoding of the Length/Type field, and use the Slow_Protocols_Type value as the primary means of protocol identification; its value is shown in Table 43B–2.

Table 43B–2—Slow_Protocols_Type field

Name	Value
Slow_Protocols_Type field	88-09

The first octet of the MAC Client data following the Length/Type field is a protocol subtype identifier that distinguishes between different Slow Protocols. Table 43B–3 identifies the semantics of this subtype.

NOTE—Although this mechanism is defined as part of an IEEE 802.3® standard, it is the intent that the reserved code points in this table will be made available to protocols defined by other working groups within IEEE 802®, should this mechanism be appropriate for their use.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

Table 43B–3—Slow Protocols subtypes

Protocol Subtype value	Protocol name
0	Unused—Illegal value
1	Link Aggregation Control Protocol (LACP)
2	Link Aggregation—Marker Protocol
3	Reserved for future use
4	Reserved for future use
5	Reserved for future use
6	Reserved for future use
7	Reserved for future use
8	Reserved for future use
9	Reserved for future use
10	Reserved for future use
11–255	Unused—Illegal values

43B.5 Handling of Slow Protocol frames

Any received MAC frame that carries the Slow_Protocols_Type field value is assumed to be a Slow Protocol frame. An implementation that claims conformance to this standard shall handle all Slow Protocol frames as follows:

a) Discard any Slow Protocol frame that carries an illegal value of Protocol Subtype (see Table 43B–3). Such frames shall not be passed to the MAC Client.

b) Pass any Slow Protocol frames that carry Protocol Subtype values that identify supported Slow Protocols to the protocol entity for the identified Slow Protocol.

c) Pass any Slow Protocol frames that carry Protocol Subtype values that identify unsupported Slow Protocols to the MAC Client.

NOTE—The intent of these rules is twofold. First, they rigidly enforce the maximum number of Slow Protocols, ensuring that early implementations of this mechanism do not become invalidated as a result of "scope creep." Second, they make it clear that the appropriate thing to do in any embedded frame parsing mechanism is to pass frames destined for unsupported protocols up to the MAC Client rather than discarding them, thus allowing for the possibility that, in soft configurable systems, the MAC Client might be enhanced in the future in order to support protocols that were not implemented in the hardware.

Copyright © 2002 IEEE. All rights reserved.

43B.6 Protocol Implementation Conformance Statement (PICS) proforma for Annex 43B, Requirements for support of Slow Protocols[14]

43B.6.1 Introduction

The supplier of an implementation that is claimed to conform to Annex 43B shall complete the following Protocol Implementation Conformance Statement (PICS) proforma.

A detailed description of the symbols used in the PICS proforma, along with instructions for completing the PICS proforma, can be found in Clause 21.

43B.6.2 Identification

43B.6.2.1 Implementation identification

Supplier (Note 1)	
Contact point for queries about the PICS (Note 1)	
Implementation Name(s) and Version(s) (Notes 1 and 3)	
Other information necessary for full identification—e.g., name(s) and version(s) of machines and/or operating system names (Note 2)	
NOTES 1—Required for all implementations. 2—May be completed as appropriate in meeting the requirements for the identification. 3—The terms Name and Version should be interpreted appropriately to correspond with a supplier's terminology (e.g., Type, Series, Model).	

43B.6.2.2 Protocol summary

Identification of protocol specification	IEEE Std 802.3-2002®, Annex 43B, Requirements for support of Slow Protocols.
Identification of amendments and corrigenda to the PICS proforma which have been completed as part of the PICS	
Have any Exception items been required? No [ ] Yes [ ] (See Clause 21: the answer Yes means that the implementation does not conform to IEEE Std 802.3-2002®, Annex 43B, Requirements for support of Slow Protocols.)	

Date of Statement	

[14]*Copyright release for PICS proformas:* Users of this standard may freely reproduce the PICS proforma in this annex so that it can be used for its intended purpose and may further publish the completed PICS.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

43B.6.2.3 Transmission characteristics

Item	Feature	Subclause	Value/Comment	Status	Support
SP1	Transmission rate	43B.2	Max 5 frames in any one-second period	M	Yes [ ]
SP2	Frame size	43B.2	Normal IEEE 802.3® frame size range (see 4.4.2)	M	Yes [ ]
SP3	Frame format	43B.2	Basic (not Tagged) frame format	M	Yes [ ]

43B.6.2.4 Frame handling

Item	Feature	Subclause	Value/Comment	Status	Support
FH1	Handling of Slow Protocol frames	43B.5	As specified in 43B.5	M	Yes [ ]

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

Annex 43C

(informative)

LACP standby link selection and dynamic Key management

43C.1 Introduction

While any two ports on a given system that have been assigned the same administrative Key may be capable of aggregation, it is not necessarily the case that an arbitrary selection of such ports can be aggregated. (Keys may have been deliberately assigned to allow one link to be operated specifically as a hot standby for another). A system may reasonably limit the number of ports attached to a single Aggregator, or the particular way more than two ports can be combined.

In cases where both communicating systems have constraints on aggregation, it is necessary for them both to agree to some extent on the links to be selected for aggregation and on which not to use. Otherwise it might be possible for the two systems to make different selections, possibly resulting in no communication at all.

When one or more links have to be selected as standby, it is possible that they could be used as part of a different Link Aggregation Group. For this to happen, one or another of the communicating systems has to change the operational Key values used for the ports attached to those links.

If the operational Key values were to be changed independently by each system, the resulting set of aggregations could be unpredictable. It is possible that numerous aggregations, each containing a single link, may result. Worse, with no constraint on changes, the process of both systems independently searching for the best combination of operational Key values may never end.

This annex describes protocol rules for standby link selection and dynamic Key management. It provides examples of a dynamic Key management algorithm applied to connections between systems with various aggregation constraints.

43C.2 Goals

The protocol rules presented

a) Enable coordinated, predictable, and reproducible standby link selections.
b) Permit predictable and reproducible partitioning of links into aggregations by dynamic Key management.

They do not require

c) A LACP system to understand all the constraints on aggregations of multiple ports that might be imposed by other systems.
d) Correct configuration of parameters, i.e., they retain the plug and play attributes of LACP.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

43C.3 Standby link selection

Every link between systems operating LACP is assigned a unique priority. This priority comprises (in priority order) the System Priority, System ID, Port Priority, and Port Number of the higher-priority system. In priority comparisons, numerically lower values have higher priority.

Ports are considered for active use in an aggregation in link priority order, starting with the port attached to the highest priority link. Each port is selected for active use if preceding higher priority selections can also be maintained, otherwise the port is selected as standby.

43C.4 Dynamic Key management

Dynamic Key management changes the Key values used for links that either system has selected as a standby to allow use of more links. Whether this is desirable depends on their use. For example, if a single spanning tree is being used throughout the network, separating standby links into a separate aggregation serves little purpose. In contrast, if equal cost load sharing is being provided by routing, making additional bandwidth available in a separate Link Aggregation Group may be preferable to holding links in standby to provide link resilience.

The communicating system with the higher priority (as determined by System Priority and unique System ID) controls dynamic Key changes. Dynamic Key changes may only be made by this controlling system.

NOTE—The controlling system can observe the port priorities assigned by the Partner system, if it wishes to take these into account.

This rule prevents the confusion that could arise if both systems change Keys simultaneously. In principle the controlling system might search all possible Key combinations for the best way to partition the links into groups. In practice the number of times that Keys may have to be changed to yield acceptable results is small.

After each Key change, the controlling system assesses which links are being held in standby by its Partner. Although there is no direct indication of this decision, standby links will be held OUT_OF_SYNC. After matched information is received from the protocol Partner, and before acting on this information, a "settling time" allows for the Partner's aggregate wait delay, and for the selected links to be aggregated. Twice the Aggregate Wait Time (the expiry period for the wait_while_timer), i.e., 4 seconds, should be ample. If matched Partner information indicates that all the links that the Actor can make active have been brought IN_SYNC, it can proceed to change Keys on other links without further delay.

43C.5 A dynamic Key management algorithm

The following algorithm is simple but effective.

After the "settling time" (see 43C.4) has elapsed, the controlling system scans its ports in the Link Aggregation Group (i.e., all those ports with a specific operational Key value that have the same Partner System Priority, System ID, and Key) in descending priority order.

For each port, it may wish to know

a) Is the port (i.e., the Actor) *capable* of being aggregated with the ports already selected for aggregation with the current Key? Alternatively is the Actor *not capable* of this aggregation?
b) Is the port's Partner IN_SYNC or is the Partner OUT_OF_SYNC?

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

And as it inspects each port it may

c) *Select* the port to be part of the aggregation with the current Key.
d) *Retain* the current Key for a further iteration of the algorithm, without selecting the port to be part of the current aggregation.
e) *Change* the operational Key to a new value. Once a new value is chosen, all the ports in the current Link Aggregation Group that have their Keys changed will be changed to this new value.

As the ports are scanned for the first time

1) The highest priority port is always selected.

   If it is capable and IN_SYNC, move to step 2).

   Otherwise, **change** the operational Key of all other ports (if any) in this Link Aggregation Group, and apply this dynamic Key algorithm to those ports, beginning with step 1), after the settling time.

2) Move to the next port.

   IF there is a next port, continue at step 3).

   Otherwise, dynamic Key changes for ports with this operational Key are complete.

   Note that ports that were once in the same aggregation may have had their operational Keys changed to (further) new values. If so, apply the dynamic Key management algorithms to those ports, beginning with step 1), after the settling time.

3) If this port is capable and IN_SYNC:

      select it, and repeat from step 2).

   If this port is OUT_OF_SYNC:

      change the operational Key, and repeat from step 2).

   If this port is not capable but IN_SYNC:

      change the operational Key, move to step 4).

4) Move to the next port.

   If there is a next port, continue at step 5).

   Otherwise If there are still ports in the current Link Aggregation Group (which will have the current operational Key), wait for the settling time and appy the dynamic Key management algorithm, beginning with the first such port, at step 3).

   Otherwise, dynamic Key changes for ports with this operational Key are complete.

5) **If** this port is capable:

      retain the current Key and repeat from step 2).

   Otherwise, **change** the operational Key and repeat from step 2).

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

This procedure is repeated until no OUT_OF_SYNC links remain, or a limit on the number of steps has been reached.

If the Partner's System ID changes on any link at any time, the Actor's operational Key for that link should revert to the administrative Key value, and the dynamic Key procedure should be rerun. This may involve changing the operational Key values for all the links that were assigned Key values subsequent to the change in Key for the link with the new Partner.

43C.6 Example 1

Two systems, A and B, are connected by four parallel links. Each system can support a maximum of two links in an aggregation. They are connected as shown in Figure 43C–1. System A is the higher priority system.

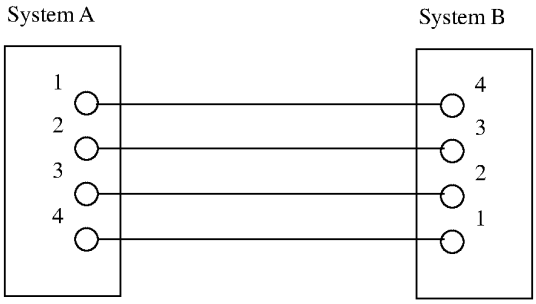


Figure 43C–1—Example 1

The administrative Key for all of System A and System B's ports is 1. Neither system knows before the configuration is chosen that all its ports would attach to links of the same Partner system. Equally, if the links were attached to two different systems, it is not known which pair of links (e.g., 1 and 2, or 1 and 4) would be attached to the same Partner. So choosing the administrative Keys values to be identical for four ports, even though only two could be actively aggregated, is very reasonable.

If there was no rule for selecting standby links, System A and System B might have both selected their own ports 1 and 2 as the active links, and there would be no communication. With the rule, the links A1-B4 and A2-B3 will become active, while A3-B2 and A4-B1 will be standby.

Since System A is the higher-priority system, System B's operational Key values will remain 1 while System A may dynamically change Keys, though it may choose to retain the standby links. Following the Key management algorithm suggested, System A would be able to change the Keys for A3 and A4 in a little over 2 seconds (depending on how fast System B completes the process of attaching its ports to the selected Aggregator) after the connections were first made, and both aggregations could be operating within 5 seconds.

If System A's aggregations were to be constrained to a maximum of three links, rather than two, while System B's are still constrained to two, the suggested algorithm would delay for 4 seconds before changing Keys. Both aggregations could be operating within 7 seconds.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

43C.7 Example 2

A system has the odd design constraint that each of its four ports may be aggregated with one other as follows:

a) Port 1 with port 2, or port 4.
b) Port 2 with port 3, or port 1.
c) Port 3 with port 4, or port 2.
d) Port 4 with port 1, or port 3.

This is equivalent to each port being able to aggregate with either neighbor, understanding the ports to be arranged in a circle.

Two such systems are connected with four parallel links as shown in Figure 43C–2.

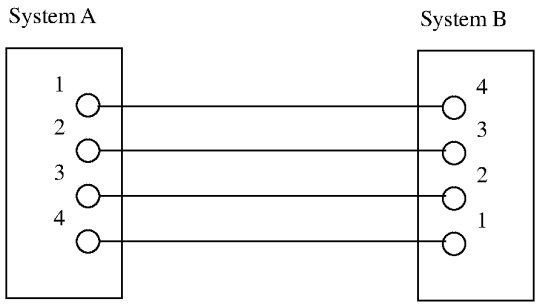


Figure 43C–2—Example 2a

Just as for Example 1, links A1-B4 and A2-B3 become active without changing the operational Key from its original administrative value. The Key for A3 and A4 is changed as soon as they become active, and a few seconds later A3-B2 and A4-B1 become active in a separate aggregation.

If the two systems had been connected as shown in Figure 43C–3:

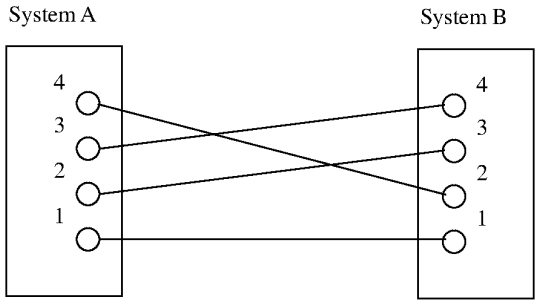


Figure 43C–3—Example 2b

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

the following would occur, assuming that System A operates the simple algorithm already described.

Initially System A advertises an operational Key equal to the administrative Key value of 1 on all ports. System B first selects B1 as active; since the link connects to A1 it has the highest priority. The next highest priority link is B3-A2, but System B cannot aggregate B3 with B1, so System B makes this port standby. System B can aggregate B4-A3, so the port is made active. Finally if B4 is aggregated with B1, B2 cannot be aggregated, so B2 is made standby.

System A, observing the resulting synchronization status from System B, assigns a Key value of 2 to ports 2 and 3, retaining the initial Key of 1 for ports 1 and 4. System B will remove B4 from the aggregation with B1, and substitute B2. B3 and B4 will be aggregated. In the final configuration A1-B1 and A4-B2 are aggregated, as are A2-B3 and A3-B4.

Copyright © 2002 IEEE. All rights reserved.

RED HAT 1008
RED HAT V. CAS

Electronic Acknowledgement Receipt

EFS ID:	32709216
Application Number:	15161787
International Application Number:	
Confirmation Number:	3396
Title of Invention:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
First Named Inventor/Applicant Name:	Eric M. Delangis
Customer Number:	64828
Filer:	Harold C. McGurk
Filer Authorized By:	
Attorney Docket Number:	ED 3000
Receipt Date:	23-MAY-2018
Filing Date:	23-MAY-2016
Time Stamp:	18:15:31
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	15161787_IDS_5-23-2018.pdf	612233 2405d27a22a83faec9eed044569131 9a7290c3fc	no	4

Warnings:

RED HAT 1008
RED HAT V. CAS

Information:					
A U.S. Patent Number Citation or a U.S. Publication Number Citation is required in the Information Disclosure Statement (IDS) form for autoloading of data into USPTO systems. You may remove the form to add the required data in order to correct the Informational Message if you are citing U.S. References. If you chose not to include U.S. References, the image of the form will be processed and be made available within the Image File Wrapper (IFW) system. However, no data will be extracted from this form. Any additional data such as Foreign Patent Documents or Non Patent Literature will be manually reviewed and keyed into USPTO systems.					
2	Other Reference-Patent/App/Search documents	linkage_aggregation_10-10-2002-1.pdf	1146862 67d8b45ef89a250cec700d89b0b0e37143ae4971	no	20
Warnings:					
Information:					
3	Other Reference-Patent/App/Search documents	1465_8023_IEEE-28023_IEEE.pdf	415467 b747aabe47901656a7840a9c74b1cc4b122d2dc0	no	98
Warnings:					
Information:					
		Total Files Size (in bytes):	2174562		

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 a 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.

RED HAT 1008
RED HAT V. CAS

PTO/SB/08a (01-10)
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.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	15161787
Filing Date	2016-05-23
First Named Inventor	Eric DeLangis
Art Unit	2467
Examiner Name	HONG CHO
Attorney Docket Number	ED 3000

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6775235		2004-08-10	Datta et al.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	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, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15161787
	Filing Date	2016-05-23
	First Named Inventor	Eric DeLangis
	Art Unit	2467
	Examiner Name	HONG CHO
	Attorney Docket Number	ED 3000

	1	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15161787
	Filing Date	2016-05-23
	First Named Inventor	Eric DeLangis
	Art Unit	2467
	Examiner Name	HONG CHO
	Attorney Docket Number	ED 3000

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/H C McGurk IV/	Date (YYYY-MM-DD)	2018-05-30
Name/Print	H C McGurk	Registration Number	34964

This collection of information is required by 37 CFR 1.97 and 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 1 hour 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.**

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 the Freedom of Information Act requires disclosure of these record s.

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 inspections 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.

Electronic Acknowledgement Receipt

EFS ID:	32761295
Application Number:	15161787
International Application Number:	
Confirmation Number:	3396
Title of Invention:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
First Named Inventor/Applicant Name:	Eric M. Delangis
Customer Number:	64828
Filer:	Harold C. McGurk
Filer Authorized By:	
Attorney Docket Number:	ED 3000
Receipt Date:	30-MAY-2018
Filing Date:	23-MAY-2016
Time Stamp:	16:55:25
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	15161787_IDS_5-30-2018.pdf	612121 596f43ec3c7fc6fb6183cb7978c5faedb46ab9f7	no	4

Warnings:

RED HAT 1008
RED HAT V. CAS

Information:	
Total Files Size (in bytes):	612121

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 a 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.

RED HAT 1008
RED HAT V. CAS

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
U.S. Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

64828 e 2018-06-18

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

Paper No.

Application No.:	**15/161,787**	**Date Mailed:**	**2018-06-18** **ELECTRONIC**
First Named Inventor:	Eric M. Delangis	Examiner:	CHO, HONG SOL
Attorney Docket No.:	ED 3000	Art Unit:	2467
Confirmation No.:	3396	Filing Date:	05/23/2016

Please find attached an Office communication concerning this application or proceeding.

Commissioner for Patents

PTO-90c (Rev.08-06)

RED HAT 1008
RED HAT V. CAS

Notice of Non-Compliant Amendment (37 CFR 1.121)	Application No. 15/161,787	Applicant(s) DELANGIS, ERIC M.

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

The amendment document filed on *21 May, 2018* is considered non-compliant because it has failed to meet the requirements of 37 CFR 1.121 or 1.4. In order for the amendment document to be compliant, correction of the following item(s) is required.

THE FOLLOWING MARKED (X) ITEM(S) CAUSE THE AMENDMENT DOCUMENT TO BE NON-COMPLIANT:

- ☐ 1. Amendments to the specification:
  - ☐ A. Amended paragraph(s) do not include markings.
  - ☐ B. New paragraph(s) should not be underlined.
  - ☐ C. Other _____.
- ☐ 2. Abstract:
  - ☐ A. Not presented on a separate sheet. 37 CFR 1.72.
  - ☐ B. Other _____.
- ☐ 3. Amendments to the drawings:
  - ☐ A. The drawings are not properly identified in the top margin as "Replacement Sheet," "New Sheet," or "Annotated Sheet" as required by 37 CFR 1.121(d).
  - ☐ B. The practice of submitting proposed drawing correction has been eliminated. Replacement drawings showing amended figures, without markings, in compliance with 37 CFR 1.84 are required.
  - ☐ C. Other _____.
- ☒ 4. Amendments to the claims:
  - ☐ A. A complete listing of all of the claims is not present.
  - ☒ B. The listing of claims does not include the text of all pending claims (including withdrawn claims)
  - ☐ C. Each claim has not been provided with the proper status identifier, and as such, the individual status of each claim cannot be identified. Note: the status of every claim must be indicated after its claim number by using one of the following status identifiers: (Original), (Currently amended), (Canceled), (Previously presented), (New), (Not entered), (Withdrawn) and (Withdrawn-currently amended).
  - ☐ D. The claims of this amendment paper have not been presented in ascending numerical order.
  - ☐ E. Other: _____.
- ☐ 5. Other (e.g., the amendment is unsigned or not signed in accordance with 37 CFR 1.4): For further explanation of the amendment format required by 37 CFR 1.121, see MPEP § 714.

TIME PERIODS FOR FILING A REPLY TO THIS NOTICE:

1. Applicant is given **no new time period if the non-compliant amendment is an** after-final amendment or an amendment filed after allowance, or a drawing submission (only) If applicant wishes to resubmit the non-compliant after-final amendment with corrections, the **entire corrected amendment** must be resubmitted.

2. Applicant is given **two months** from the mail date of this notice to supply the correction, if the non-compliant amendment is one of the following: a preliminary amendment, a non-final amendment (including a submission for a request for continued examination (RCE) under 37 CFR 1.114), a supplemental amendment filed within a suspension period under 37 CFR 1.103(a) or (c), and an amendment filed in response to a Quayle action. If any of above boxes 1 to 4 are checked, the correction required is only the corrected section of the non-compliant amendment in compliance with 37 CFR 1.121.

Extensions of time are available under 37 CFR 1.136(a) only if the non-compliant amendment is a non-final amendment or an amendment filed in response to a *Quayle* action.

Failure to timely respond to this notice will result in:

Abandonment of the application if the non-compliant amendment is a non-final amendment or an amendment filed in response to a *Quayle* action; or

Non-entry of the amendment if the non-compliant amendment is a preliminary amendment or supplemental amendment.

Legal Instruments Examiner (LIE), if applicable KIM WATSON Telephone No: (571)272-3616

To: CLAYMCGURK@GMAIL.COM,,
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 64828

Jun 18, 2018 03:22:33 AM

Dear PAIR Customer:

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

The following USPTO patent application(s) associated with your Customer Number, 64828 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

Disclaimer:
The list of documents shown below is provided as a courtesy and is not part of the official file wrapper. The content of the images shown in PAIR is the official record.

Application	Document	Mailroom Date	Attorney Docket No.
15161787	NTC.A.NONCPL	06/18/2018	ED 3000

To view your correspondence online or update your email addresses, please visit us anytime at https://sportal.uspto.gov/secure/myportal/privatepair.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

RED HAT 1008
RED HAT V. CAS

PTO/SB/08a (01-10)
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.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	15161787
Filing Date	2016-05-23
First Named Inventor	Eric DeLangis
Art Unit	2467
Examiner Name	HONG CHO
Attorney Docket Number	ED 3000

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6628617		2003-09-30	KAROL et al.	
	2	7406048		2008-07-29	DATTA et al.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15161787
	Filing Date	2016-05-23
	First Named Inventor	Eric DeLangis
	Art Unit	2467
	Examiner Name	HONG CHO
	Attorney Docket Number	ED 3000

Examiner Initials*	Cite No	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, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1		

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15161787
	Filing Date	2016-05-23
	First Named Inventor	Eric DeLangis
	Art Unit	2467
	Examiner Name	HONG CHO
	Attorney Docket Number	ED 3000

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/H C McGurk IV/	Date (YYYY-MM-DD)	2018-08-14
Name/Print	H C McGurk	Registration Number	34964

This collection of information is required by 37 CFR 1.97 and 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 1 hour 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.**

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 the Freedom of Information Act requires disclosure of these record s.

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 inspections 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.

Electronic Acknowledgement Receipt

EFS ID:	33463521
Application Number:	15161787
International Application Number:	
Confirmation Number:	3396
Title of Invention:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
First Named Inventor/Applicant Name:	Eric M. Delangis
Customer Number:	64828
Filer:	Harold C. McGurk
Filer Authorized By:	
Attorney Docket Number:	ED 3000
Receipt Date:	14-AUG-2018
Filing Date:	23-MAY-2016
Time Stamp:	15:01:18
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment/Req. Reconsideration-After Non-Final Reject	15161787_Amendment_8-14-2018.pdf	171086 988dbed6334acbebd1d3be743d9cbec49a7f455c	no	14

Warnings:

RED HAT 1008
RED HAT V. CAS

Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	15161787_IDS_8-14-2018.pdf	612158 6c5f44c544c9b40f270e55a0d21f041a9c5b957f	no	4
Warnings:					
Information:					
			Total Files Size (in bytes):	783244	

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 a 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.

RED HAT 1008
RED HAT V. CAS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.:	**15/161,787**	EXAMINER:	HONG CHO
INVENTOR:	Eric M. Delangis	GROUP ART UNIT:	2467
FILED:	OCTOBER 11, 2014	CONFIRMATION NO.:	3396
TITLE:	Multipath Communication Devices and Methods		
ATTORNEY NO:	ED 3000		

Commissioner For Patents
PO Box 1450
Alexandria, VA 22313-1450

AMENDMENT

In response to the Notice issued on June 18, 2018 ("Notice"), please reconsider the above-identified application in light of the following amendments and accompanying remarks. The Notice required the claim language be provided for the withdrawn claims.

CERTIFICATE OF ELECTRONIC (EFS-WEB) TRANSMISSION

I hereby certify that this correspondence is being transmitted via the U.S. Patent Office's electronic filing system in accordance with 37 C.F.R. § 1.8(a)(1) from the **Pacific Time Zone** of the United States on the local date shown below.

Dated: August 14, 2018

By: Clay McGurk
Clay McGurk

RED HAT 1008
RED HAT V. CAS

IN THE CLAIMS

This listing of claims will replace all prior versions and listings of the claims in the application:

1. (Currently Amended) A method executed by a first device ~~for a network edge device for participating in a multipath connection with a data-requesting device, the multipath connection comprising at least two network edge devices capable of concurrently connecting with the data-requesting device where each of the at least two network edge devices is capable of sending different data packets to the data-requesting device during the multipath connection,~~ comprising:

detecting which connections are available between the first device and a plurality of second devices, each of the connections being physically separate from the other of the connections, each of the connections being associated with a network or another network different from the network ~~receiving control information from the data-requesting device to establish a connection with the data-requesting device for participating in the multipath connection~~; ~~and~~

~~during the multipath connection:~~

communicating the available connections to a sending device;

receiving concurrently at the first device over at least two of the connections a plurality of data packets from the sending device, ~~from one or more networks~~ the data packets being associated with a session; and

routing the data packets to ~~the data-requesting~~ a particular third device ~~when the data packets are destined for the data-requesting device~~.

2. (Currently Amended) The method of claim 1, wherein the ~~control~~ information includes a connection ID.

3. (Currently Amended) The method of claim 2, further comprising:

RED HAT 1008
RED HAT V. CAS

receiving a notification from one of ~~notifying~~ the ~~data-requesting~~ second devices ~~device~~ that the connection between the first device and the one of the second devices will be terminated ~~sometime in the future~~; and

terminating the connection with the one of the second devices ~~data-requesting device~~.

4. (Currently Amended) A method ~~for a network edge~~ executed by a first device ~~for participating in a plurality of multipath connections with a plurality of data-requesting devices, the multipath connection comprising at least two network edge devices concurrently connecting with a data-requesting device where each of the at least two network edge devices is capable of sending different data packets to the data-requesting device during the multipath connection~~, comprising:

detecting which connections are available between the first device and a plurality of second devices, each of the connections being physically separate from the other of the connections, each of the connections being associated with a network or another network different from the network ~~receiving control information from each of the data-requesting devices to establish a separate multipath connection with each of the data-requesting devices~~; ~~and~~

~~during each of the separate multipath connections:~~

notifying a device of the available connections;

receiving concurrently at the first device from the source device over the at least two connections a plurality of data packets ~~from one or more networks~~, each of tvhe data-packets having a connection ID, the data packets being associated with a session;

joining together the data packets that share the same connection ID; and

routing the joined-together data packets that have the same connection ID to a particular ~~data-requesting~~ third device ~~based on the connection ID~~.

5. (Currently Amended) A ~~communications~~ first device ~~for participating in one or more simultaneous multipath connections, a multipath connection comprising at least two communication devices capable of concurrently connecting with a data-requesting device where each of the at least two communication devices is capable of sending different data packets to the data-requesting device during the multipath connection~~, comprising:

~~at least~~ a plurality of first interfaces ~~interface~~ capable of connecting concurrently to a plurality of second ~~remote~~ devices;

~~at least~~ a plurality of second interfaces ~~interface~~ capable of connection to a ~~data-requesting device~~ third devices; and

a processor coupled to the ~~at least~~ the first ~~interface~~ interfaces and the ~~at least the~~ second ~~interface~~ interfaces that:

~~receives control information from the data-requesting device to establish a connection with the data-requesting device during a setup of a particular multipath connection; and~~

~~during the particular multipath connection:~~

receives concurrently a plurality of data packets from ~~one or more~~ at least two of the second ~~remote~~ devices via at least two of the ~~at least~~ the first ~~interface~~ interfaces, the data packets being associated with a session;

assembles together the data packets that are destined for a particular one of the third devices; and

routes the assembled data packets via ~~the at least~~ a particular one of the second ~~interface~~ interfaces to the particular one of ~~data-requesting device~~ third devices ~~when the data packets are destined for the data-requesting device~~.

6. (Withdrawn) A device for receiving data from a server, the data comprising first data and second data, the device comprising:

a first communication interface capable of connecting to a first device;

a second communication interface capable of connecting to a second device; and

RED HAT 1008
RED HAT V. CAS

at least one processor coupled to the first communication interface and the second communication interface, the at least one processor concurrently receiving a portion of the first data from the first device and a portion of the second data from the second device, and after receipt of the first data and the second data, aggregating together the first data and the second data.

7. (Withdrawn) The device of claim 6, wherein the device is one of a cell phone, a tablet, a network device, a router, a computer, a Wi-Fi device, a Wi-Max device, a mobile communications device and a Bluetooth device.

8. (Withdrawn) The device of claim 6, wherein the first communication interface is a cellular phone interface, and the second communication interface is a Wi-Fi interface.

9. (Withdrawn) The device of claim 8, wherein the first communication interface is a cellular phone interface capable of connecting to an LTE network.

10. (Withdrawn) The device of claim 6, wherein the first communication interface is a Ethernet interface, and the second communication interface is a cellular interface.

11. (Withdrawn) The device of claim 10, wherein the second communication interface is a cellular phone interface capable of connecting to an LTE network.

12. (Withdrawn) The device of claim 6, wherein the first device comprises one or more of a network device, a cellular network device, a Wi-MAX communication device, a wireless router device, a mobile communications device, a Bluetooth device, a Wi-Fi device, a network switch, a network router, a micro-cell device and a hotspot device; and

wherein the second device comprises one or more of a network device, a cellular network device, a Wi-MAX communication device, a wireless router device, a mobile

RED HAT 1008
RED HAT V. CAS

communications device, a Bluetooth device, a Wi-Fi device, a network switch, a network router, a micro-cell device and a hotspot device.

13. (Withdrawn) The device of claim 6, wherein a transmitting device of the first device and a transmitting device of the second device are located on different parts of a cellular tower.

14. (Withdrawn) A method implemented by a device for aggregating data, the data comprising first data packets and second data packets, the method comprising:

establishing a first connection to a first network;

sending a request for the data to a server;

in response to the request, receiving the first data packets over the first connection;

detecting an availability of at least one second connection to a second network;

establishing a second connection to a second network based on the availability of the at least one second connection;

notifying the server of the second connection;

after notification to the server, receiving a portion of the second data packets over the second connection at the same time that a portion of the first data packets are received over the first connection; and

aggregating together the first data packets and the second data packets.

15. (Withdrawn) The device of claim 14, wherein the data comprises one or more data associated with a website, an application, a music file, a video file, a data file, streaming video, streaming music and a gaming software.

16. (Withdrawn) The device of claim 14, wherein the device is one of a cellular phone, a router, a computer, a hotspot device, a tablet and a modem.

17. (Withdrawn) The method of claim 14, wherein the first network is at least one of a cable network, a telecommunication network, a cellular network, an optical network and a communications network; and

wherein the second network is comprised of at least one of a cable network, a telecommunication network, a cellular network, an optical network and a communications network.

RED HAT 1008
RED HAT V. CAS

18. (Withdrawn) A device comprising:

a first interface;

a second interface; and

a processor, coupled to the first interface and the second interface, the processor:

establishing a first connection using the first interface;

sending over the first connection a request for data from a remote server;

in response to the request, receiving first data over the first interface from the remote server;

using the second interface to detect an availability of at least one second connection to a second network;

establishing a second connection using the second interface based on the availability of the at least one second connection;

notifying the remote server of the second connection;

receiving second data over the second connection, where a first portion of the data is being received over the first connection, and at the same time, a second portion of the data is being received over of the second connection; and

aggregating together the first data packets and the second data packets.

19. (Withdrawn) The device of claim 18, wherein the device is one of a cell phone, a tablet, a network device, a router, a computer, a Wi-Fi device, a Wi-Max device, a mobile communications device and a Bluetooth device.

20. (Withdrawn) The device of claim 18, wherein the first interface is a cellular phone interface, and the second interface is a Wi-Fi interface.

21. (Withdrawn) The device of claim 18, wherein the first interface is a Ethernet interface, and the second interface is a cellular interface.

22. (Withdrawn) The device of claim 18, wherein the first interface is capable of connecting to at least one network device, a cellular network device, a Wi-MAX communication device, a wireless router device, a mobile communications device, a Bluetooth device, a Wi-Fi device, a network switch, a network router, a micro-cell device and a hotspot device; and

wherein the second interface is capable of connecting to at least one network device, a cellular network device, a Wi-MAX communication device, a wireless router device, a mobile communications device, a Bluetooth device, a Wi-Fi device, a network switch, a network router, a micro-cell device and a hotspot device.

23. (Withdrawn) The device of claim 18, wherein the processor establishes the first connection and second connection from a plurality of available connections based on at least one of quality of service of a connection, speed of the connection, and signal strength of the connection.

24. (Withdrawn) The device of claim 18, wherein the processor further determines how many devices are located in a transmission range of the device.

25. (Withdrawn) The device of claim 18, wherein the first interface is capable of establishing one or more connections; and

wherein the processor further receives a plurality of first data from the one or more of the connections, and aggregates the plurality of first data and the second data.

26. (Withdrawn) The device of claim 25, wherein the first interface is capable of establishing one or more Wi-Fi connection.

RED HAT 1008
RED HAT V. CAS

27. (New) The method of claim 1, further comprising, when a quality of service associated with one of the at least two connections falls below a threshold, switching to another of the at least two connections having a better quality of service.

28. (New) The method of claim 1, wherein each of the at least two connections is one or more wired connections, wireless connections and optical connections.

29. (New) The method of claim 1, wherein the single session comprises data packets associated with a data stream, a data file, streaming video, internet-related information, or electronic data.

30. (New) The method of claim 1, further comprising the step of after receiving concurrently data packets, identifying the data packets as destined for which of a plurality of third devices, and grouping the data packets together that belong to different ones of the third devices before routing the grouped data packets to the different ones of the third devices.

31. (New) The method of claim 1, wherein the data packets being received at the same time are associated with different sessions.

32. (New) The method of claim 4, further comprising, when a quality of service associated with one of the at least two connections falls below a threshold, switching to another of the at least two connections having a better quality of service.

33. (New) The method of claim 4, wherein each of the at least two connections is one or more wired connections, wireless connections and optical connections.

34. (New) The method of claim 4, wherein the single session comprises data packets associated with a data stream, a data file, streaming video, internet-related information, or electronic data.

RED HAT 1008
RED HAT V. CAS

35. (New) The method of claim 4, further comprising the step of after receiving concurrently data packets, identifying the data packets as destined for which of a plurality of third devices, and grouping the data packets together that belong to different ones of the third devices before routing the grouped data packets to the different ones of the third devices.

36. (New) The method of claim 4, wherein the data packets being received at the same time are associated with different sessions.

37. (New) The first device of claim 5, wherein the first device comprises one or more of a network device, a router, a server, and a network switch;

wherein the second device is comprised of at least one of a cable network device, a telecommunication network device, a cellular network device, an optical network device and a communications network device; and

wherein the third device comprises one or more of a network device, a computer, a tablet, a server, a cellular phone, a mobile communications device, a network switch, a router, a micro-cell device and a hotspot device.

38. (New) The method of claim 5, wherein each of the first interfaces is one or more wired connections, wireless connections and optical connections.

39. (New) The first device of claim 5, wherein the processor assembles together the data packets based on a sequence number, a connection ID or a hash number.

40. (New) The first device of claim 5, wherein the particular one of the second interfaces is a wired connection, a wireless connection or an optical connection.

RED HAT 1008
RED HAT V. CAS

REMARKS

Status of the Claims

Claims 1-5 were pending in this application before this Amendment. Claims 1-5 have been amended. Claims 6-26 were withdrawn by the examiner. Claims 27-40 are new claims. No new matter has been added in this Amendment. Thus, claims 1-5 and 27-40 are now pending pursuant to this Amendment.

35 U.S.C. § 103 Rejections

Starting on page 2 of the Office Action, claims 1, 2, 4 and 5 were rejected under 35 U.S.C. §102(e) as being unpatentable over "Pung" (U.S. Appl. Publ. 2002-0150099) in view of "Yamada" (U.S. Appl. Publ. 2001-0007557) and "Goddard" (US Appl. Publ. 2002-0055982).

Amended independent claims 1 and 4, both method claims, require: "establishing at least two connections between the first device and at least two second devices, each of the at least two connections being separate from the other of the at least two connections" and "receiving concurrently at the first device from the at least two connections a plurality of data packets… the data packets being associated with a single session".

On page 3 of the Office Action, the examiner cited Figure 12A from Pung. As shown Figures 12A-12E of Pung, once the request from 14A to 14B is setup up, data is transferred as shown in Figure 12F of Pung, where the data is sent from 14B through nodes 12E, 12C and 12A and then to 14A. Node 12A does not receive concurrently a plurality of data packets from at least two connections as required in amended independent claims 1 and 4.

Yamada does not make up for the deficiency of Pung. On page 3 of the Office Action, the examiner relies on Figure 19 of Yamada. This configuration as shown in Figure 19 of Yamada is deficient because the lack of at least two connections between a first device and at least two second devices. As shown in Figure 19 of Yamada, datagram transfer unit 4a is connected only to one data transfer unit 4b. Amended independent claims 1 and 4 require at least two data transfer units 4b that are connected to data transfer unit 4a.

Goddard also does not make up for the deficiencies of Pung and Yamada. On page 2 of the Office Action, the examiner relied on claim 7. Claim 7 of Goddard states: "establishing, in

RED HAT 1008
RED HAT V. CAS

response to some of the connection requests, a number of concurrent connections between a server and clients". There is no mention of separate connections between the clients and at least two servers as required in amended independent claims 1 and 4. Therefore, Pung, Yamada and Goddard are all deficient and thus, amended independent claims 1 and 4 are patentable over a combination of Pung, Yamada and Goddard.

Amended independent claim 5, a device claim, relies on "first interfaces" that exist concurrently and receive data concurrently via the first interfaces. For the same reasons as provided above in relation to claims 1 and 4, claim 5 is similarly patentable over a combination of Pung, Yamada and Goddard.

Claim 2 is dependent on amended independent claim 1 and is allowable for the same reasons provided above for distinguishing claim 1 over Pung, Yamada and Goddard. For these reasons, it is respectfully requested that the rejection of claims 1, 2, 4 and 5 under 35 U.S.C. § 103 based on Pung, Yamada and Goddard be reconsidered and withdrawn.

On page 3 of the Office Action, claim 3 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Pung in view of Yamada and Goddard, and further in view of "Joyce" (U.S. Appl. Publ. 2002-0106065). Joyce was relied upon for teaching a user being notified before the termination of a connection. Joyce was not relied upon for disclosing the deficiencies noted above. Therefore, since claim 3 is dependent on amended independent claim 1, it is allowable for the same reasons provided above for distinguishing claim 1 over Pung, Yamada and Goddard. It is respectfully requested that the rejection of claim 3 under 35 U.S. C. § 103 based on Pung, Yamada Goddard and Joyce be reconsidered and withdrawn.

Conclusion

It is noted that claimed subject matter may be patentably distinguished from the cited references for additional reasons. It is also noted that any failure to comment directly upon any of the positions asserted in the Office Action does not indicate agreement or acquiescence with those asserted positions or allegations. Instead, it is believed that the foregoing sufficiently addresses the issues raised in the Office Action, and that the present claims are in condition for allowance.

RED HAT 1008
RED HAT V. CAS

All rejections in the Office Action have been properly traversed. It is respectfully requested that all outstanding rejections be reconsidered and withdrawn. It is believed that a full and complete reply has been made in response to the Office Action, and, that as such, the present patent application is in a condition for allowance.

The Examiner is always welcome to telephone the attorney of record at the telephone number provided below if such telephone discussion would help expedite the prosecution of the patent application. Prompt and favorable consideration of this Amendment is respectfully requested.

Respectfully Submitted,

Date: August 14, 2018

H C McGurk IV, Reg. No. 34,964
Attorney for Applicant

THE LAW OFFICE OF CLAY MCGURK
PO Box 1488
Orange, CA 92706
Phone: **949.395.3942**
Email: claymcgurk@gmail.com

RED HAT 1008
RED HAT V. CAS

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
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 displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/161,787	Filing Date 05/23/2016	☐ To be Mailed

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) 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 $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ 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

AMENDMENT **08/14/2018**

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 17	Minus	** 20	= 0	X $50 =	0
Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $230 =	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

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ 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.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** 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.

SLIE
DEIDRE C. KING-WOODWARD

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.

RED HAT 1008
RED HAT V. CAS

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/161,787	05/23/2016	Eric M. Delangis	ED 3000	3396

64828 7590 10/09/2018

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

EXAMINER	
CHO, HONG SOL	

ART UNIT	PAPER NUMBER
2467	

NOTIFICATION DATE	DELIVERY MODE
10/09/2018	ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

CLAYMCGURK@GMAIL.COM

PTOL-90A (Rev. 04/07)

RED HAT 1008
RED HAT V. CAS

Office Action Summary	Application No. 15/161,787	Applicant(s) Delangis, Eric M.	
	Examiner HONG S CHO	Art Unit 2467	AIA Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 08/14/2018.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☑ This action is **FINAL.** 2b) ☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance 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.

Disposition of Claims*

5) ☑ Claim(s) 1-5 and 27-40 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1-5 and 27-40 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☑ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

DETAILED ACTION

Response to Amendment

2. This office action is in response to the amendment filed on 08/14/2018. Claims 1-5 and 27-40 are pending in the instant application.

Claim Rejections - 35 USC § 112, First paragraph

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 1-5 and 27-40 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Re claim 1, it recites "detecting which connections are available between the first device and a plurality of second devices, each of the connections being physically separate from the other of the connections, each of the connections being associated with

RED HAT 1008
RED HAT V. CAS

a network or another network different from the network", "communicating the available connections to a sending device; receiving concurrently at the first device over at least two of the connections a plurality of data packets from the sending device, the data packets being associated with a session; and The original specification fails to describe the above claim limitations.

Re claim 3, it recites "receiving a notification from one of second devices that the connection between the first device and the one of the second devices will be terminated" and terminating the connection with the one of the second devices".

Re claim 4, it recites "detecting which connections are available between the first device and a plurality of second devices, each of the connections being physically separate from the other of the connections, each of the connections being associated with a network or another network different from the network", "notifying a device of the available connections; receiving concurrently at the first device from the source device over the at least two connections a plurality of data packets, the data packets being associated with a session; joining together the data packets that share the same connection ID; and routing the joined-together data packets that have the same connection ID to a particular third device". The original specification fails to describe the above claim limitations.

Re claim 5, it recites "receives concurrently a plurality of data packets from at least two of the second devices via at least two of the first interfaces, the data packets being associated with a session; assembles together the data packets that are destined for a particular one of the third devices; and routes the assembled data packets via a

RED HAT 1008
RED HAT V. CAS

particular one of the second interfaces to the particular one of third devices". The original specification fails to describe the above claim limitations.

Re claims 27-40, the original specification fails to describe claim limitations recited in each claim.

Claim 2 depend on claim 1 is therefore similarly rejected.

Claim Rejections - 35 USC § 112, Second paragraph

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claim 2 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Re claim 2, it recites the limitation "the information...". There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 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 of this title, 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 negatived by the manner in which the invention was made.

RED HAT 1008
RED HAT V. CAS

8. Claims 1 and 28-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over MeLampy et al (US 20030016664, "MeLampy") in view of Eidenschink et al (US 20010036161, "Eidenschink").

Re claim 1, MeLampy discloses a first device detecting which connections are available between the first device (figure 4, element 212) and a plurality of second devices (figure 4, elements 214 and 216), each of the connections being physically separate from the other of the connections, each of the connections being associated with a network or another network different from the network; receiving concurrently at the first device over at least two of the connections a plurality of data packets from the sending device (figure 4, element 202 or element 222), the data packets being associated with a session; and routing the data packets to a particular third device (figure 4, element 222 or 202, paragraph [0072] discloses two-way communication between source and destination), but fails to disclose communicating the available connections to a sending device. However, Eidenschink discloses notifying a subscriber terminal with available routes (claim 6). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of MeLampy with Eidenschink for the benefit of providing reliable data communication by utilizing available routes.

Re claim 28, MeLampy discloses each of the at least two connections is one or more wired connections, wireless connections and optical connections (figure 4, connection between routers and source/destination).

RED HAT 1008
RED HAT V. CAS

Re claim 29, MeLampy discloses the single session comprises data packets associated with a data stream, a data file, streaming video, internet-related information, or electronic data (paragraph [0051], lines 8-10).

Re claim 30, the modified system of MeLampy discloses identifying the data packets as destined for which of a plurality of third devices after receiving concurrently data packets, and grouping the data packets together that belong to different ones of the third devices before routing the grouped data packets to the different ones of the third devices (paragraph [0069], lines 1-3).

Re claim 31, MeLampy discloses the data packets being received at the same time are associated with different sessions (paragraph [0068], lines 1-3).

9. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over MeLampy et al in view of Eidenschink and further in view of Kejriwal et al (US 6704794, "Kejriwal").

Re claim 2, MeLampy discloses all of the limitations of the base claim, but fails to disclose including a connection ID. However, Kejriwal discloses aggregating packets with connection ID (column 6, lines 60-63). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of MeLampy with Kejriwal for the benefit of providing efficient utilization of network resources by combining packets with same connection ID.

10. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over MeLampy and Eidenschink in view of Kejriwal and further in view of Joyce et al (US 20020106065, "Joyce").

RED HAT 1008
RED HAT V. CAS

Re claim 3, MeLampy discloses all of the limitations of the base claim, but fails to disclose notifying a first device that the connection will be terminated and terminating the connection with the second device. However, it is well known in the art that a user would be notified before the termination of existing connection. Joyce disclose notifying a user before terminating the connection (paragraph [0114], lines 47-50). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of MeLampy with the teaching of Joyce for the benefit of providing reliable multicasting service by terminating a connection that does not satisfy QoS constraints.

11. Claims 4 and 33-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over MeLampy et al in view of Eidenschink and further in view of Kejriwal.

Re claim 4, MeLampy discloses a first device detecting which connections are available between the first device (figure 4, element 212) and a plurality of second devices (figure 4, elements 214 and 216), each of the connections being physically separate from the other of the connections, each of the connections being associated with a network or another network different from the network; receiving concurrently at the first device over at least two of the connections a plurality of data packets from the sending device (figure 4, element 202 or element 222), the data packets being associated with a session; and routing the data packets to a particular third device (figure 4, element 222 or 202), but fails to disclose notifying a device of the available connections and joining together data packets that share the same connection ID. However, Eidenschink discloses notifying a subscriber terminal with available routes (claim 6) and Kejriwal

RED HAT 1008
RED HAT V. CAS

discloses aggregating packets with same connection ID (column 6, lines 60-63). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of MeLampy with Eidenschink and Kejriwal for the benefit of providing reliable data communication and efficient utilization of network resources by utilizing available routes and combining packets with connection ID.

Re claim 33, MeLampy discloses each of the at least two connections is one or more wired connections, wireless connections and optical connections (figure 4, connection between routers and source/destination).

Re claim 34, MeLampy discloses the single session comprises data packets associated with a data stream, a data file, streaming video, internet-related information, or electronic data (paragraph [0051], lines 8-10).

Re claim 35, the modified system of MeLampy discloses identifying the data packets as destined for which of a plurality of third devices after receiving concurrently data packets, and grouping the data packets together that belong to different ones of the third devices before routing the grouped data packets to the different ones of the third devices (paragraph [0069], lines 1-3).

Re claim 36, MeLampy discloses the data packets being received at the same time are associated with different sessions (paragraph [0068], lines 1-3).

12. Claims 5 and 37-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over MeLampy et al in view of Kejriwal.

RED HAT 1008
RED HAT V. CAS

Re claim 5, MeLampy discloses a first device (figure 4, element 212) with a plurality of first interfaces capable of connecting concurrently to a plurality of second devices (figure 4, element 214 and 216); a plurality of second interfaces interface capable of connection to a third devices (figure 4, element 202); receives concurrently a plurality of data packets from at least two of the second devices via at least two of the first interfaces, the data packets being associated with a session; assembles together the data packets that are destined for a particular one of the third devices; and routes the assembled data packets via the a particular one of the second interfaces to the particular one third devices, but fails to disclose assembling data packets that are destined for a particular device. However, Kejriwal discloses aggregating packets with same connection ID (column 6, lines 60-63). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of MeLampy with Kejriwal for the benefit of providing efficient utilization of network resources by combining packets with same connection ID.

Re claim 37, MeLampy discloses the first device comprises one or more of a network device, a router, a server, and a network switch; wherein the second device is comprised of at least one of a cable network device, a telecommunication network device, a cellular network device, an optical network device and a communications network device; and wherein the third device comprises one or more of a network device, a computer, a tablet, a server, a cellular phone, a mobile communications device, a network switch, a router, a micro-cell device and a hotspot device (figure 4, paragraph [0032]).

RED HAT 1008
RED HAT V. CAS

Re claim 38, MeLampy discloses each of the first interfaces is one or more wired connections, wireless connections and optical connections (figure 4, connection between routers and source/destination).

Re claim 39, Kejriwal discloses assembling together the data packets based on a sequence number, a connection ID or a hash number (column 6, lines 60-63).

Re claim 40, MeLampy discloses the second interface is a wired connection, wireless connection or an optical connection (figure 4, connection between routers and source/destination).

13. Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over MeLampy et al in view of Eidenschink and further in view of Cain et al (US 20030202468, "Cain").

Re claim 27, MeLampy discloses all of the limitations of the base claim, but fails to disclose switching to another of the at least two connections having a better quality of service when a quality of service associated with one of the at least two connections falls below a threshold. However, Cain discloses switching to standby route having a better quality of service when a quality of service associated with one of connections falls below a threshold (figure 5, steps 118, 120 and 124)). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of MeLampy with Cain for the benefit of providing reliable data communication by utilizing a path with better quality.

14. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over MeLampy, Eidenschink and in view of Kejriwal and further in view of Cain.

RED HAT 1008
RED HAT V. CAS

Re claim 32, MeLampy discloses all of the limitations of the base claim, but fails to disclose switching to another of the at least two connections having a better quality of service when a quality of service associated with one of the at least two connections falls below a threshold. However, Cain discloses switching to standby route having a better quality of service when a quality of service associated with one of connections falls below a threshold (figure 5, steps 118, 120 and 124)). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of MeLampy with Cain for the benefit of providing reliable data communication by utilizing a path with better quality.

Response to Arguments

15. Applicant's arguments with respect to claims have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

16. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a). A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

RED HAT 1008
RED HAT V. CAS

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

/HONG S CHO/
Primary Examiner, Art Unit 2467

RED HAT 1008
RED HAT V. CAS

Notice of References Cited	Application/Control No. 15/161,787	Applicant(s)/Patent Under Reexamination Delangis, Eric M.	
	Examiner HONG S CHO	Art Unit 2467	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20030016664-A1	01-2003	MeLampy, Patrick J.	H04L29/06027	370/389
*	B	US-20010036161-A1	11-2001	Eidenschink, Thomas	H04B7/18584	370/316
*	C	US-6704794-B1	03-2004	Kejriwal; Prabhas	H04L29/06	370/392
*	D	US-20020106065-A1	08-2002	Joyce, Simon James	G06Q20/00	379/114.02
*	E	US-20030202468-A1	10-2003	Cain, Joseph Bibb	H04L45/00	370/229
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/161,787	Delangis, Eric M.
	Examiner	**Art Unit**
	HONG S CHO	2467

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	10/05/2016	04/07/2017	09/19/2017	03/14/2018	10/01/2018				
	1	✓	✓	✓	÷	✓				
	2	✓	✓	✓	÷	✓				
	3	✓	✓	✓	÷	✓				
	4	✓	✓	✓	÷	✓				
	5	✓	✓	✓	÷	✓				
	6				÷	N				
	7				÷	N				
	8				÷	N				
	9				÷	N				
	10				÷	N				
	11				÷	N				
	12				÷	N				
	13				÷	N				
	14				÷	N				
	15				÷	N				
	16				÷	N				
	17				÷	N				
	18				÷	N				
	19				÷	N				
	20				÷	N				
	21				÷	N				
	22				÷	N				
	23				÷	N				
	24				÷	N				
	25				÷	N				
	26				÷	N				
	27					✓				
	28					✓				
	29					✓				
	30					✓				
	31					✓				
	32					✓				
	33					✓				
	34					✓				
	35					✓				
	36					✓				
	37					✓				
	38					✓				
	39					✓				
	40					✓				

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/161,787	Delangis, Eric M.
	Examiner	Art Unit
	HONG S CHO	2467

CPC - Searched*		
Symbol	Date	Examiner

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
H04M3/007 or H04L47/821 or H04M1/6033 or H04L45/54 or H04L69/168 or H04L61/2015 or H04L45/24 or H04W88/16 or H04L12/5692 or H04M2203/60 or H04M2250/06 or H04M2203/052 or H04W80/00 or H04W40/02 or H04W28/06 or H04W84/18 or H04W84/12 or H04W72/04 or H04W8/26 (EAST text search)	10/5/2016	hc
updated search	4/7/2017	hc
updated search	9/19/2017	hc
updated search	10/01/2018	hc

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
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.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	15161787
Filing Date	2016-05-23
First Named Inventor	Eric DeLangis
Art Unit	2467
Examiner Name	HONG CHO
Attorney Docket Number	ED 3000

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	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, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

EFS Web 2.1.17

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.S.C/

RED HAT 1008
RED HAT V. CAS

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15161787
	Filing Date	2016-05-23
	First Named Inventor	Eric DeLangis
	Art Unit	2467
	Examiner Name	HONG CHO
	Attorney Docket Number	ED 3000

	1	802.3 IEEE Standard for Information Technology, Part 3, March 2002, starting at p.232 "43. Link Aggregation"	
	2	Link Aggregation according to IEEE 802.3ad, by SysKonnect GmbH, 2002.	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/HONG S CHO/	Date Considered	08/28/2018

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.S.C/

RED HAT 1008
RED HAT V. CAS

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15161787
	Filing Date	2016-05-23
	First Named Inventor	Eric DeLangis
	Art Unit	2467
	Examiner Name	HONG CHO
	Attorney Docket Number	ED 3000

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/H C McGurk IV/	Date (YYYY-MM-DD)	2018-05-23
Name/Print	H C McGurk	Registration Number	34964

This collection of information is required by 37 CFR 1.97 and 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 1 hour 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.**

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.S.C/

RED HAT 1008
RED HAT V. CAS

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 the Freedom of Information Act requires disclosure of these record s.

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 inspections 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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.S.C/

RED HAT 1008
RED HAT V. CAS

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
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.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	15161787
Filing Date	2016-05-23
First Named Inventor	Eric DeLangis
Art Unit	2467
Examiner Name	HONG CHO
Attorney Docket Number	ED 3000

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5487069		1996-01-23	O'Sullivan et al.	
	2	6502135		2002-12-31	Munger et al.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

EFS Web 2.1.17

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.S.C/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15161787
	Filing Date	2016-05-23
	First Named Inventor	Eric DeLangis
	Art Unit	2467
	Examiner Name	HONG CHO
	Attorney Docket Number	ED 3000

Examiner Initials*	Cite No	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, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	802.3 IEEE Standard for Information Technology, Part 3, March 2002 (specifically, starting at p.232 "43. Link Aggregation")	
	2	Link Aggregation according to IEEE 802.3ad, by SysKonnect GmbH, 2002.	
	3	M-TCP: TCP for Mobile Cellular Network, Kevin Brown and Suresh Singh, University of South Carolina, 1997.	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/HONG S CHO/	Date Considered	08/28/2018

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.S.C/

RED HAT 1008
RED HAT V. CAS

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15161787
	Filing Date	2016-05-23
	First Named Inventor	Eric DeLangis
	Art Unit	2467
	Examiner Name	HONG CHO
	Attorney Docket Number	ED 3000

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/H C McGurk IV/	Date (YYYY-MM-DD)	2018-05-21
Name/Print	H C McGurk	Registration Number	34964

This collection of information is required by 37 CFR 1.97 and 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 1 hour 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.**

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.S.C/

RED HAT 1008
RED HAT V. CAS

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 the Freedom of Information Act requires disclosure of these record s.

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 inspections 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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.S.C/

RED HAT 1008
RED HAT V. CAS

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
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.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	15161787
Filing Date	2016-05-23
First Named Inventor	Eric DeLangis
Art Unit	2467
Examiner Name	HONG CHO
Attorney Docket Number	ED 3000

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6628617		2003-09-30	KAROL et al.	
	2	7406048		2008-07-29	DATTA et al.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

EFS Web 2.1.17

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.S.C/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15161787
	Filing Date	2016-05-23
	First Named Inventor	Eric DeLangis
	Art Unit	2467
	Examiner Name	HONG CHO
	Attorney Docket Number	ED 3000

Examiner Initials*	Cite No	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, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1		

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/HONG S CHO/	Date Considered	09/11/2018

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.S.C/

RED HAT 1008
RED HAT V. CAS

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15161787
	Filing Date	2016-05-23
	First Named Inventor	Eric DeLangis
	Art Unit	2467
	Examiner Name	HONG CHO
	Attorney Docket Number	ED 3000

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/H C McGurk IV/	Date (YYYY-MM-DD)	2018-08-14
Name/Print	H C McGurk	Registration Number	34964

This collection of information is required by 37 CFR 1.97 and 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 1 hour 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.**

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.S.C/

RED HAT 1008
RED HAT V. CAS

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 the Freedom of Information Act requires disclosure of these record s.

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 inspections 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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.S.C/

RED HAT 1008
RED HAT V. CAS

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
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.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	15161787
Filing Date	2016-05-23
First Named Inventor	Eric DeLangis
Art Unit	2467
Examiner Name	HONG CHO
Attorney Docket Number	ED 3000

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6628617		2003-09-30	KAROL et al.	
	2	7406048		2008-07-29	DATTA et al.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

EFS Web 2.1.17

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.S.C/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15161787
	Filing Date	2016-05-23
	First Named Inventor	Eric DeLangis
	Art Unit	2467
	Examiner Name	HONG CHO
	Attorney Docket Number	ED 3000

Examiner Initials*	Cite No	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, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1		

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/HONG S CHO/	Date Considered	08/28/2018

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

EFS Web 2.1.17

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.S.C/

RED HAT 1008
RED HAT V. CAS

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15161787
	Filing Date	2016-05-23
	First Named Inventor	Eric DeLangis
	Art Unit	2467
	Examiner Name	HONG CHO
	Attorney Docket Number	ED 3000

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/H C McGurk IV/	Date (YYYY-MM-DD)	2018-08-14
Name/Print	H C McGurk	Registration Number	34964

This collection of information is required by 37 CFR 1.97 and 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 1 hour 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.**

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.S.C/

RED HAT 1008
RED HAT V. CAS

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 the Freedom of Information Act requires disclosure of these record s.

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 inspections 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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.S.C/

RED HAT 1008
RED HAT V. CAS

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S428	68	server same aggregat$3 with received near (packet$1 or data) with (portion or part)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/01 09:26
S430	16	((Eric) near2 (Delangis)).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2018/10/01 09:27
S431	273073	(H04M3/007 or H04L47/821 or H04M1/6033 or H04L45/54 or H04L69/168 or H04L61/2015 or H04L45/24 or H04W88/16 or H04L12/5692 or H04M2203/60 or H04M2250/06 or H04M2203/052 or H04W80/00 or H04W40/02 or H04W28/06 or H04W84/18 or H04W84/12 or H04W72/04 or H04W8/26).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/01 09:30
S433	16	S431 and multi near (path or link) with rout$3 with concurrent$2	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/01 09:31
S434	37	multi near (path or link) with rout$3 with concurrent$2	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/01 09:32
S435	31	(US-20060079274-$ or US-20030202468-$ or US-20030063591-$ or US-20040090924-$ or US-20020102987-$ or US-20090150924-$ or US-20030137959-$ or US-20020150099-$ or US-20010037472-$ or US-20010007557-$ or US-20020106065-$ or US-20020193115-$ or US-20030191848-$ or US-20020055982-$).did. or (US-7257106-$ or US-6307839-$ or US-7385924-$ or US-7308279-$ or US-7068623-$ or US-6249669-$ or US-6941151-$ or US-7426316-$ or US-7562110-$ or US-7889181-$ or US-7035914-$ or US-7065090-$ or US-8285802-$ or US-7653089-$ or US-6496477-$ or US-	US-PGPUB; USPAT	OR	OFF	2018/10/01 09:35

		5483522-$ or US-7315900-$).did.				
S438	4	S435 and multi near (path or link)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/01 09:38
L1	228	(router or gateway) with (forward$3 or advertiz$5 or updat$3) with (route or link or path) same multi near (path or link)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/01 10:00
L2	11	l1 and @rlad<"20021015"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/01 10:01
L3	848	(router or gateway) with (forward$3 or advertiz$5) with (new or latest or updated) with (route or link or path)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/01 10:16
L5	8	l4 and multi near (path or link)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/01 10:39
L4	78	l3 and @rlad<"20021015"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/01 10:39
L6	13	09/911304	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/01 10:41
L7	4	l6 and (router or gateway) with (forward$3 or advertiz$5) with (new or latest or updated) with (route or link or path)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/01 10:46
L31	4	09/576468	US-PGPUB; USPAT; USOCR; FPRS;	OR	OFF	2018/10/01 11:40

			EPO; JPO; DERWENT; IBM_TDB			
L38	58	l37 and @rlad<"20021015"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/01 11:49
L37	587	(notif$7 or inform$3) with (user or sender or router) with (available or updated) near (connection$1 or route$1 or path$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/01 11:49
L39	1	09/311256	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/01 12:04
L40	17	(join$3 or combin$3 or aggregat$3) near (packet$1 or frame$1 or cell$1) with (session or connection) near (id or identifier)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/01 12:06
L41	34	(US-20060079274-$ or US-20030202468-$ or US-20030063591-$ or US-20040090924-$ or US-20020102987-$ or US-20090150924-$ or US-20030137959-$ or US-20020150099-$ or US-20010037472-$ or US-20010007557-$ or US-20020106065-$ or US-20020193115-$ or US-20030191848-$ or US-20020055982-$ or US-20030016664-$ or US-20010036161-$).did. or (US-7257106-$ or US-6307839-$ or US-7385924-$ or US-7308279-$ or US-7068623-$ or US-6249669-$ or US-6941151-$ or US-7426316-$ or US-7562110-$ or US-7889181-$ or US-7035914-$ or US-7065090-$ or US-8285802-$ or US-7653089-$ or US-6496477-$ or US-5483522-$ or US-7315900-$ or US-6704794-$).did.	US-PGPUB; USPAT	OR	OFF	2018/10/01 13:06
L47	1	l41 and (alternate or better) near (link or path or route) same qos	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/10/01 13:11

10/ 1/ 2018 2:13:23 PM
C:\ Users\ hcho\ Documents\ EAST\ Workspaces\ 15161787.wsp

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
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.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	15161787
Filing Date	2016-05-23
First Named Inventor	Eric DeLangis
Art Unit	2467
Examiner Name	HONG CHO
Attorney Docket Number	ED 3000

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6775235		2004-08-10	Datta et al.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	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, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

EFS Web 2.1.17

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.S.C/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15161787
	Filing Date	2016-05-23
	First Named Inventor	Eric DeLangis
	Art Unit	2467
	Examiner Name	HONG CHO
	Attorney Docket Number	ED 3000

	1		

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/HONG S CHO/	Date Considered	08/28/2018

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.S.C/

RED HAT 1008
RED HAT V. CAS

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15161787
	Filing Date	2016-05-23
	First Named Inventor	Eric DeLangis
	Art Unit	2467
	Examiner Name	HONG CHO
	Attorney Docket Number	ED 3000

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/H C McGurk IV/	Date (YYYY-MM-DD)	2018-05-30
Name/Print	H C McGurk	Registration Number	34964

This collection of information is required by 37 CFR 1.97 and 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 1 hour 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.**

EFS Web 2.1.17

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.S.C/

RED HAT 1008
RED HAT V. CAS

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 the Freedom of Information Act requires disclosure of these record s.

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 inspections 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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.S.C/

RED HAT 1008
RED HAT V. CAS

To: CLAYMCGURK@GMAIL.COM,,
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 64828

Oct 09, 2018 03:40:38 AM

Dear PAIR Customer:

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

The following USPTO patent application(s) associated with your Customer Number, 64828 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

Disclaimer:
The list of documents shown below is provided as a courtesy and is not part of the official file wrapper. The content of the images shown in PAIR is the official record.

Application	Document	Mailroom Date	Attorney Docket No.
15161787	CTFR	10/09/2018	ED 3000
	892	10/09/2018	ED 3000
	1449	10/09/2018	ED 3000
	1449	10/09/2018	ED 3000
	1449	10/09/2018	ED 3000
	1449	10/09/2018	ED 3000
	1449	10/09/2018	ED 3000

To view your correspondence online or update your email addresses, please visit us anytime at https://sportal.uspto.gov/secure/myportal/privatepair.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

RED HAT 1008
RED HAT V. CAS

PTO/SB/30EFS (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.

REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	15161787	Filing Date	2016-05-23	Docket Number (if applicable)	ED 3000	Art Unit	2467
First Named Inventor	ERIC DELANGIS			Examiner Name	HONG CHO		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

- ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
- ☐ Other _____

☒ Enclosed

- ☒ Amendment/Reply
- ☐ Information Disclosure Statement (IDS)
- ☐ Affidavit(s)/ Declaration(s)
- ☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____ (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

☐ **The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**
The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No _____

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

Applicant Signature

PTO/SB/30EFS (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.

Signature of Registered U.S. Patent Practitioner			
Signature	/H C McGurk IV, Reg No 34964/	Date (YYYY-MM-DD)	2019-02-11
Name	Harold McGurk	Registration Number	34964

This collection of information is required by 37 CFR 1.114. 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 1.11 and 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.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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 the Freedom of Information Act requires disclosure of these records.

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 inspections 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.

Electronic Patent Application Fee Transmittal

Application Number:	15161787
Filing Date:	23-May-2016
Title of Invention:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
First Named Inventor/Applicant Name:	Eric M. Delangis
Filer:	Harold C. McGurk
Attorney Docket Number:	ED 3000

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
INDEPENDENT CLAIMS IN EXCESS OF 3	2201	4	230	920
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

RED HAT 1008
RED HAT V. CAS

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Extension - 1 month with $0 paid	2251	1	100	100
Miscellaneous:				
RCE- 2ND AND SUBSEQUENT REQUEST	2820	1	950	950
		Total in USD ($)		**1970**

Electronic Acknowledgement Receipt

EFS ID:	35113695
Application Number:	15161787
International Application Number:	
Confirmation Number:	3396
Title of Invention:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
First Named Inventor/Applicant Name:	Eric M. Delangis
Customer Number:	64828
Filer:	Harold C. McGurk
Filer Authorized By:	
Attorney Docket Number:	ED 3000
Receipt Date:	11-FEB-2019
Filing Date:	23-MAY-2016
Time Stamp:	14:48:50
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1970
RAM confirmation Number	021219INTEFSW14535400
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

RED HAT 1008
RED HAT V. CAS

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment Submitted/Entered with Filing of CPA/RCE	15161787_Amendment_2-11-2019.pdf	252027 e96020845567ba0a5e65113e5e310ef62de304d4	no	11
Warnings:					
Information:					
2	Request for Continued Examination (RCE)	15161787_RCE_30e_fill.pdf	697858 f028aac8f9d127d2f6cfca779ab4ef7e22434422	no	3
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	34299 dad99351cc6c5739b1c357f33883b1c3f5922680	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	984184		

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 a 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.

RED HAT 1008
RED HAT V. CAS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.:	**15/161,787**	EXAMINER:	HONG CHO
INVENTOR:	Eric M. Delangis	GROUP ART UNIT:	2467
FILED:	OCTOBER 11, 2014	CONFIRMATION NO.:	3396
TITLE:	Multipath Communication Devices and Methods		
ATTORNEY NO:	ED 3000		

Commissioner For Patents
PO Box 1450
Alexandria, VA 22313-1450

AMENDMENT

In response to the final Office Action issued on October 9, 2018 ("Office Action"), please reconsider the above-identified application due to the following amendments and accompanying remarks. A request for an extension of time for one month is requested, thus extending the period for response to Saturday, February 9, 2019. Pursuant to 35 U.S.C. §21, this amendment can be filed on the next succeeding business day and be considered timely filed, that day being Monday, February 11, 2019. Filed concurrently with this Amendment is a Request for Continued Examination.

CERTIFICATE OF ELECTRONIC (EFS-WEB) TRANSMISSION

I hereby certify that this correspondence is being transmitted via the U.S. Patent Office's electronic filing system in accordance with 37 C.F.R. § 1.8(a)(1) from the **Pacific Time Zone** of the United States on the local date shown below.

Dated: February 11, 2019

By: Clay McGurk
Clay McGurk

RED HAT 1008
RED HAT V. CAS

IN THE CLAIMS

This listing of claims will replace all prior versions and listings of the claims in the application:

1-40. (Cancelled).

41. (New) A client device for multilink data packet reception, the client device comprising:

at least two or more network interfaces; and

at least one processor coupled to the at least two or more network interfaces and configured to:

transmit a first message through one of the at least two or more network interfaces, wherein the first message includes an identifier that is unique to a multilink session and first information that identifies at least the one of the at least two or more network interfaces of the client device that is capable of receiving one or more data packets during the multilink session;

transmit a second message through a different one of the at least two or more network interfaces, wherein the second message includes the identifier that is unique to the multilink session and second information that identifies the different one of the at least two or more network interfaces of the client device that is capable of receiving one or more data packets during the multilink session; and

receive the one or more data packets through any combination of the at least two or more network interfaces of the client device during the multilink session.

42. (New) The client device of claim 41, 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.

43. (New) The client device of claim 41, wherein a server provides the identifier that is unique to the multilink session.

44. (New) The client device of claim 41, wherein the first information is comprised of an Internet address associated with the one of the at least two or more network interfaces, and the second information is comprised of an Internet address associated with the different one of the at least two or more network interfaces.

45. (New) The client device of claim 41, wherein each of the at least two or more network interfaces is one or more of cellular interface, Wi-Fi interface, a wireless interface, a cable interface, an Ethernet interface, a Bluetooth interface, a near-field communication interface, and an optical interface.

46. (New) The client device of claim 41, wherein the processor is configured to reorder and aggregate 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.

47. (New) The client device of claim 41, 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 mobile communication device, a near-field communications device, and a Bluetooth device.

48. (New) A server for multilink data packet transmission, 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 multilink data over the at least one server network interface, the multilink data associated with a plurality of network communication interfaces that are capable of being used by a device to receive data packets; and

control at least one of (i) sending different groups of data packets over the at least one server network interface to the at least two of the network communication interfaces; (ii) sending different streams of data over the at least one server network interface to the at least two of the network communication interfaces; and (iii) sending combinations of different streams and different groups of data packets over the at least one server network interface to the at least two of the network communication interfaces.

49. (New) The server of claim 48, wherein the one or more processors is further configured to send a connection ID that is unique to the data packets being sent to the at least two of the network communication interfaces.

50. (New) The server of claim 48, wherein the one or more processors is further configured to:

receive multipath information so that data packets can be sent over an additional one of the network communication interfaces, and

control at least one of (i) sending different groups of data packets over the at least one server network interface to the at least three of the network communication interfaces; (ii) sending different streams of data over the at least one server network interface to the at least three of the network communication interfaces; and (iii) sending combinations of different streams and different groups of data packets over the at least one server network interface to the at least three of the network communication interfaces.

51. (New) The server of claim 48, wherein the one or more processors is further configured to receive multipath information about which one of the network communication interfaces is to be removed from the multilink session.

52. (New) The server of claim 48, wherein the one or more processors is further configured to receive different multilink data over the at least one server network interface at different periods of time.

53. (New) A first device comprising:

a network interface; and

at least one processor coupled to the network interface and configured to:

transmit a first message through the network interface to a second device, wherein the first message includes an identifier that is unique to a multilink session and first information that identifies the network interface of the first device that is capable of receiving one or more data packets from the second device during the multilink session;

transmit a second message through the network interface to a third device, wherein the second message includes the identifier that is unique to the multilink session and second information that identifies the network interface of the first device that is capable of receiving one or more data packets from the third device during the multilink session; and

receive the one or more data packets through the at least one network interface from the second device and from the third device during the multilink session.

54. (New) The first device of claim 53, wherein the first device and the second device are separate devices or separate parts of the same device.

55. (New) The first device of claim 53, 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.

56. (New) A first device for multilink data packet transmission, comprising:

at least one network interface; and

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

receiving information about a plurality of network communication interfaces of a second device that are capable of being used to receive data packets; and

control a data server where the data server: (i) send different groups of data packets from the data server to the network communication interfaces of the second device; (ii) send different streams of data from the data server to the network communication interfaces of the second device; and (iii) send combinations of different streams and different groups of data packets from the data server to the network communication interfaces of the second device.

RED HAT 1008
RED HAT V. CAS

57. (New) A client device for multilink data packet reception, the client device comprising:

at least two or more network interfaces; and

at least one processor coupled to the at least two or more network interfaces and configured to:

transmit a first message through one of the at least two or more network interfaces to at least one server, wherein the first message includes an identifier that is unique to a multilink session and first information that identifies at least the one of the at least two or more network interfaces of the client device that is capable of receiving one or more data packets during the multilink session, the first information being comprised of an Internet address associated with the one of the at least two or more network interfaces;

transmit a second message through a different one of the at least two or more network interfaces to the at least one server, wherein the second message includes the identifier that is unique to the multilink session and second information that identifies the different one of the at least two or more network interfaces of the client device that is capable of receiving one or more data packets during the multilink session, the second information being comprised of an Internet address associated with the different one of the at least two or more network interfaces; and

receive the one or more data packets through any combination of the at least two or more network interfaces of the client device during the multilink session.

RED HAT 1008
RED HAT V. CAS

58. (New) A device comprising:

at least one interface which is capable of connecting to a first network;

at least one wireless interface which is capable of wirelessly connecting to at least one network; and

at least one processor that:

monitors a current status of availability, operability and throughput capability of the first network and the second network to determine whether the first network and the second network are capable of participating in a multilink communication;

selects the at least one interface and the at least one wireless interface based on the current status;

receives data packets via the selected at least one interface and the selected at least one wireless interface during the multilink communication.

59. (New) The device of claim 58, wherein the at least one interface is at least one of a cellular interface, a WiFi interface, a wired interface, a wireless interface, an Ethernet interface, and a fiber optics interface; and

wherein the at least one wireless interface is at least one of a cellular interface, a WiFi interface, a Bluetooth interface, a wireless interface, and an interface involving one or more of a micro-cell, a macro-cell, a pico-cell, a fempto-cell and a nano-cell.

60. (New) A method for sharing and dynamically allocating bandwidth from a plurality of wired and wireless networks, the method comprising the steps of:

developing and updating a network table that comprises a list of remote gateways, bandwidth capabilities and quality of service of each of the remote gateways;

selecting one or more of the remote gateways to support a multilink communication transfer for the requesting gateway based upon information in the network table;

concurrently receiving data packets during the multilink communication transfer at the requesting gateway data packets from the selected remote gateways; and

after receipt of the data packets, reassembling the data packets when the data packets are out of order.

RED HAT 1008
RED HAT V. CAS

REMARKS

Status of the Claims

Claims 1-40 are now canceled in this Amendment. Claims 41-60 are new claims. No new matter has been added in this Amendment. Thus, claims 41-60 are now pending pursuant to this Amendment.

35 U.S.C. § 112 Rejections

Although the §112 rejections are moot in light of the cancellation of the previous set of claims, a courtesy explanation is provided in response to those rejections. For example, in one embodiment, the "first device" referred to in the previous set of claims would have been the "initiating RCG" 44 of Figure 6, or the "multilink initiating RCG" 85 of Figures 7 and 8. The "plurality of second devices" as referred to in the previous set of claims would have been in one embodiment the "remote RCGs 86" as shown in Figure 7, or the "remote RCGs" 86 and the "neighborhood access point" 93 as shown in Figure 8. The "sending device" as referred to in the previous set of claims would have been in one embodiment the "remote server computer" or the "far end computer system" as described in paragraph 77 in the corresponding specification. Hopefully, it will become clear for these examples that the language used in the previous set of claims (which are now cancelled) were supported in this specification and thus, would have been adequate to overcome the §112 rejections. The language used in the new claims in this Amendment are similarly supported by the specification.

35 U.S.C. § 103 Rejections

The §103 rejections are moot due to the new claims and cancellation of the previous claims. Nonetheless, the current claims are distinguishable over "MeLampy" (US 20030016664) because MeLampy does not describe "first message" and "second message" including an "identifier" as recited in the new claims that are transmitted by the second media router 214 (Fig. 4) or the destination nodes 222, 224, 226 to the data source 202, 204, 206, 208. As described in MeLampy in paragraphs 68-72, the data flow is completely different. "Eidenschink" (US 20010036161) does not make up for the deficiency of MeLampy because what is disclosed in

RED HAT 1008
RED HAT V. CAS

claim 6 of Eidenschink (as cited in the Office Action) fails to describe the "first message" and "second message" including an "identifier" as recited in the new claims. "Kejriwal" (US 6704794) also fails to describe the "first message" and the "second message" as recited in the new claims because the purpose of Kejriwal involves "cell assembly" (see e.g., the Abstract of Kejriwal). For these reasons, it is respectfully submitted that the MeLampy, Eisenschink and Kejriwal, individually or in combination, are patentably distinct from the new claims.

Conclusion

It is noted that new claimed subject matter may be patentably distinguished from the cited references for additional reasons. It is also noted that any failure to comment directly upon any of the positions asserted in the Office Action does not indicate agreement or acquiescence with those asserted positions or allegations. Instead, it is believed that the foregoing sufficiently addresses the issues raised in the Office Action, and that the present claims are in condition for allowance.

All rejections in the Office Action have been properly traversed. It is respectfully requested that all outstanding rejections be reconsidered and withdrawn. It is believed that a full and complete reply has been made in response to the Office Action, and, that as such, the present patent application is in a condition for allowance.

The Examiner can always telephone the attorney of record at the telephone number provided below if such telephone discussion would help expedite the prosecution of the patent application. Prompt and favorable consideration of this Amendment is respectfully requested.

Respectfully Submitted,

Date: February 11, 2019

H C McGurk IV, Reg. No. 34,964
Attorney for Applicant

THE LAW OFFICE OF CLAY MCGURK
PO Box 1488
Orange, CA 92706
Phone: **949.395.3942**
Email: claymcgurk@gmail.com

RED HAT 1008
RED HAT V. CAS

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
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 displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/161,787	Filing Date 05/23/2016	☐ To be Mailed

ENTITY: ☐ LARGE ☑ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) 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 $40 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $210 =	
☐ 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	02/11/2019	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0		x $50 =	0
	Independent (37 CFR 1.16(h))	* 7	Minus	*** 3	= 4		x $230 =	920
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	920

		(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".	/NICOLE L NICHOLSON/
*** 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.

RED HAT 1008
RED HAT V. CAS

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/161,787	05/23/2016	Eric M. Delangis	ED 3000	3396

64828 7590 03/01/2019

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

EXAMINER	
CHO, HONG SOL	

ART UNIT	PAPER NUMBER
2467	

NOTIFICATION DATE	DELIVERY MODE
03/01/2019	ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

CLAYMCGURK@GMAIL.COM

PTOL-90A (Rev. 04/07)

RED HAT 1008
RED HAT V. CAS

Office Action Summary	Application No. 15/161,787	Applicant(s) Delangis, Eric M.	
	Examiner HONG S CHO	Art Unit 2467	AIA Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 2 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 02/11/2019.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance 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.

Disposition of Claims*

5) ☑ Claim(s) 41-60 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☐ Claim(s) _____ is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☑ Claim(s) 41-60 are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

DETAILED ACTION

Response to Amendment

2. This office action is in response to the RCE filed on 02/11/2019. Claims 1-40 are cancelled. Claims 41-60 are added.

Election/Restrictions

3. Restriction to one of the following inventions is required under 35U.S.C. 121:

Group I, claims 41-57 are drawn to receiving multilink data packets.

Group II, claims 58 and 59 are drawn to monitoring network status.

Group III, claim 60 is drawn to allocating network bandwidth.

4. The inventions are distinct, each from the other because of the following reasons:

Invention I, II and III are unrelated. Inventions are unrelated if it can be shown that they are not disclosed as capable of use together and they have different designs, modes of operation, and effects (MPEP § 802.01 and § 806.06). In the instant case, the different inventions are:

I: receiving packets, classified in H04L 12/26.

II: monitoring network status, classified in H04L 45/70.

III: allocating network bandwidth, classified in H04W 4/00.

RED HAT 1008
RED HAT V. CAS

5. Because these inventions are independent or distinct for the reasons given above and there would be a serious burden on the examiner if restriction is not required because the inventions have acquired a separate status in the art in view of their different classification, restriction for examination purposes as indicated is proper.

6. Claims added by amendment following action by the examiner, MPEP § 818.01, § 818.02(a), to an invention other than previously claimed, should be treated as indicated by 37 CFR 1.145.

7. If, after an office action on an application, the applicant presents claims directed to an invention distinct from and independent of the invention previously claimed, the applicant will be required to restrict the claims to the invention previously claimed if the amendment is entered, subject to reconsideration and review as provided in §§ 1.143 and 1.144.

8. Since the above-mentioned amendment appears to be *a bona fide* attempt to reply, applicant is given a TIME PERIOD of TWO MONTHS from the mailing date of this notice within which to supply the omission or correction in order to avoid abandonment. EXTENSIONS OF THIS TIME PERIOD UNDER 37 CFR 1.136(a) ARE AVAILABLE.

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hong Cho whose telephone number is 571-272-3087. The examiner can normally be reached on Mon-Fri during 7 am to 4 pm.

RED HAT 1008
RED HAT V. CAS

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hassan Phillips can be reached on 571-272-3940. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/HONG S CHO/
Primary Examiner, Art Unit 2467

RED HAT 1008
RED HAT V. CAS

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/161,787	Delangis, Eric M.
	Examiner	**Art Unit**
	HONG S CHO	2467

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	02/25/2019								
	1	-								
	2	-								
	3	-								
	4	-								
	5	-								
	6	-								
	7	-								
	8	-								
	9	-								
	10	-								
	11	-								
	12	-								
	13	-								
	14	-								
	15	-								
	16	-								
	17	-								
	18	-								
	19	-								
	20	-								
	21	-								
	22	-								
	23	-								
	24	-								
	25	-								
	26	-								
	27	-								
	28	-								
	29	-								
	30	-								
	31	-								
	32	-								
	33	-								
	34	-								
	35	-								
	36	-								
	37	-								
	38	-								
	39	-								
	40	-								
	41	÷								
	42	÷								

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/161,787	Delangis, Eric M.
	Examiner	**Art Unit**
	HONG S CHO	2467

CLAIM		DATE								
Final	Original	02/25/2019								
	43	÷								
	44	÷								
	45	÷								
	46	÷								
	47	÷								
	48	÷								
	49	÷								
	50	÷								
	51	÷								
	52	÷								
	53	÷								
	54	÷								
	55	÷								
	56	÷								
	57	÷								
	58	÷								
	59	÷								
	60	÷								

To: CLAYMCGURK@GMAIL.COM,,
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 64828

Mar 01, 2019 04:36:28 AM

Dear PAIR Customer:

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

The following USPTO patent application(s) associated with your Customer Number, 64828 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

Disclaimer:
The list of documents shown below is provided as a courtesy and is not part of the official file wrapper. The content of the images shown in PAIR is the official record.

Application	Document	Mailroom Date	Attorney Docket No.
15161787	CTRS	03/01/2019	ED 3000

To view your correspondence online or update your email addresses, please visit us anytime at https://sportal.uspto.gov/secure/myportal/privatepair.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

RED HAT 1008
RED HAT V. CAS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.:	**15/161,787**	EXAMINER:	HONG CHO
INVENTOR:	Eric M. Delangis	GROUP ART UNIT:	2467
FILED:	OCTOBER 11, 2014	CONFIRMATION NO.:	3396
TITLE:	Multipath Communication Devices and Methods		
ATTORNEY NO:	ED 3000		

Commissioner For Patents
PO Box 1450
Alexandria, VA 22313-1450

RESPONSE TO RESTRICTION

In the Office Action issued on March 1, 2019 ("Office Action"), a restriction was required under 35 U.S.C. § 121 for the following three groups:

Group I, claims 41-57;

Group II, claims 58, 59; or

Group III, claim 60.

Therefore, the election of Group I, claims 41-57 is hereby selected.

Conclusion

The Examiner can always telephone the attorney of record at the telephone number provided below if such telephone discussion would help expedite the prosecution of the patent application. Prompt and favorable consideration of this Response is respectfully requested.

CERTIFICATE OF ELECTRONIC (EFS-WEB) TRANSMISSION

I hereby certify that this correspondence is being transmitted via the U.S. Patent Office's electronic filing system in accordance with 37 C.F.R. § 1.8(a)(1) from the **Pacific Time Zone** of the United States on the local date shown below.

Dated: March 7, 2019

By: Clay McGurk
Clay McGurk

RED HAT 1008
RED HAT V. CAS

Respectfully Submitted,

Date: March 7, 2019

H C McGurk IV, Reg. No. 34,964
Attorney for Applicant

THE LAW OFFICE OF CLAY MCGURK
PO Box 1488
Orange, CA 92706
Phone: **949.395.3942**
Email: claymcgurk@gmail.com

Electronic Acknowledgement Receipt

EFS ID:	35359735
Application Number:	15161787
International Application Number:	
Confirmation Number:	3396
Title of Invention:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
First Named Inventor/Applicant Name:	Eric M. Delangis
Customer Number:	64828
Filer:	Harold C. McGurk
Filer Authorized By:	
Attorney Docket Number:	ED 3000
Receipt Date:	07-MAR-2019
Filing Date:	23-MAY-2016
Time Stamp:	19:30:48
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Response to Election / Restriction Filed	15161787_Response_3-7-2019.pdf	206807 7d7e1d741357a47fdfc0853fe43a741d1c323eeb	no	2
Warnings:					

RED HAT 1008
RED HAT V. CAS

Information:	
Total Files Size (in bytes):	206807

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 a 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.

RED HAT 1008
RED HAT V. CAS

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/161,787	05/23/2016	Eric M. Delangis	ED 3000	3396

64828 7590 03/29/2019

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

EXAMINER	
CHO, HONG SOL	

ART UNIT	PAPER NUMBER
2467	

NOTIFICATION DATE	DELIVERY MODE
03/29/2019	ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

CLAYMCGURK@GMAIL.COM

Office Action Summary	Application No. 15/161,787	Applicant(s) Delangis, Eric M.	
	Examiner HONG S CHO	Art Unit 2467	AIA (FITF) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☑ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance 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.

Disposition of Claims*

5) ☑ Claim(s) 41-57 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 41-57 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

DETAILED ACTION

Response to Amendment

2. This office action is in response to election/restriction filed on 03/07/2019. Claims 41-57 were selected. Claims 41-57 are pending in the instant application.

Claim Rejections - 35 USC § 112, First paragraph

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 41-57 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Re claims 41, 53 and 57, the original specification fails to describe transmitting a message including identifier that is unique to a multilink session and information that identifies at least the one of the at least two or more network interfaces of the device and

RED HAT 1008
RED HAT V. CAS

receiving the one or more data packets through any combination of the at least two or more network interfaces of the client device during the multilink session.

Re claim 46, the original specification fails to describe reorder and aggregate 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.

Re claim 48, the original specification fails to describe receiving multilink data over the at least one server network interface, the multilink data associated with a plurality of network communication interfaces that are capable of being used by a device to receive data packets and controlling at least one of (i) sending different groups of data packets over the at least one server network interface to the at least two of the network communication interfaces; (ii) sending different streams of data over the at least one server network interface to the at least two of the network communication interfaces; and (iii) sending combinations of different streams and different groups of data packets over the at least one server network interface to the at least two of the network communication interfaces.

Re claim 49, the original specification fails to describe sending a connection ID that is unique to the data packets being sent to the at least two of the network communication interfaces.

Re claim 50, the original specification fails to describe receiving multipath information so that data packets can be sent over an additional one of the network communication interfaces.

RED HAT 1008
RED HAT V. CAS

Re claim 51, the original specification fails to describe receiving multipath information about which one of the network communication interfaces is to be removed from the multilink session.

Re claim 52, the original specification fails to describe receiving different multilink data over the at least one server network interface at different periods of time.

Re claim 56, the original specification fails to describe receiving information about a plurality of network communication interfaces of a second device that are capable of being used to receive data packets; and controlling a data server where the data server: (i) send different groups of data packets from the data server to the network communication interfaces of the second device; (ii) send different streams of data from the data server to the network communication interfaces of the second device; and (iii) send combinations of different streams and different groups of data packets from the data server to the network communication interfaces of the second device.

Claims 42-47, 49-52, 54 and 55 depend on claims 41, 48 and 53 are similarly rejected.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102(e) that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

RED HAT 1008
RED HAT V. CAS

6. Claims 48-52 and 56 are rejected under 35 U.S.C. 102(e) as being anticipated by Pung et al (US 20020150099, "Pung").

Re claims 48 and 49, Pung discloses receiving multilink data over the at least one server network interface, the multilink data associated with a plurality of network communication interfaces that are capable of being used by a device to receive data packets (figure 12a, element 12d); and controlling at least one of (i) sending different groups of data packets over the at least one server network interface to the at least two of the network communication interfaces; (ii) sending different streams of data over the at least one server network interface to the at least two of the network communication interfaces; and (iii) sending combinations of different streams and different groups of data packets over the at least one server network interface to the at least two of the network communication interfaces (figure 12b, Req (A, c, d), (A, d, c)).

Re claim 50, Pung discloses receiving multipath information so that data packets can be sent over an additional one of the network communication interfaces (figure 12b, Req (A,d,e)).

Re claim 51, Pung discloses receiving multipath information about which one of the network communication interfaces is to be removed from the multilink session (paragraph [0079], figure 8a).

Re claim 52, Pung discloses receiving different multilink data over the at least one server network interface at different periods of time (figure 12b).

RED HAT 1008
RED HAT V. CAS

Re claim 56, Pung discloses receiving information about a plurality of network communication interfaces of a second device that are capable of being used to receive data packets (figure 12a, element 12d); and controlling a data server where the data server: (i) send different groups of data packets from the data server to the network communication interfaces of the second device; (ii) send different streams of data from the data server to the network communication interfaces of the second device; and (iii) send combinations of different streams and different groups of data packets from the data server to the network communication interfaces of the second device (figure 12b, Req (A,d,e), (A, c, d), (A, d, e)).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 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 of this title, 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 negatived by the manner in which the invention was made.

8. Claims 41-47, 49, 53-55 and 57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pung in view of Banga et al (US 20030135578, "Banga").

Re claims 41, 49, 53 and 57, Pung discloses transmitting a first message through one of the at least two or more network interfaces to at least one server (figure 12b, Req (A,c,e)), wherein the first message includes an identifier that is unique to a multilink session (figure 4a, Request_ID or MT_ID); transmitting a second message through a

RED HAT 1008
RED HAT V. CAS

different one of the at least two or more network interfaces to the at least one server (figure 12b, Req (A,c,d)) and receiving the one or more data packets through any combination of the at least two or more network interfaces of the client device during the multilink session (figure 12b, Cf (A, B, e), but fails to disclose internet address information that identifies at least the one of the at least two or more network interfaces of the client device. However, Banga discloses providing IP address (connection ID in claim 49) of network interface (paragraph [0015]). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of Pung with the teaching of Banga for the benefit of providing reliable data communication by utilizing IP address of network interfaces.

Re claim 42, Pung discloses transmitting 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 (figure 12b, element 14b).

Re claim 43, Pung discloses a server provides the identifier that is unique to the multilink session (paragraph [0099]).

Re claim 44, Banga discloses the first information is comprised of an Internet address associated with the one of the at least two or more network interfaces, and the second information is comprised of an Internet address associated with the different one of the at least two or more network interfaces (paragraph [0015]).

Re claims 45 and 55, Banga discloses each of the at least two or more network interfaces is one or more of cellular interface, Wi-Fi interface, a wireless interface,

RED HAT 1008
RED HAT V. CAS

a cable interface, an Ethernet interface, a Bluetooth interface, a near-field communication interface, and an optical interface (paragraph [0029]).

Re claim 47, Pung discloses 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 mobile communication device, a near-field communications device, and a Bluetooth device (paragraph [0039]).

Re claim 54, Pung discloses the first device and the second device are separate devices or separate parts of the same device (figure 12b).

9. Claim 46 is rejected under 35 U.S.C. 103(a) as being unpatentable over Pung in view of Banga and further in view of Baldwin et al (US 20140122656, "Baldwin").

Re claim 46, Pung discloses all of the limitations of the base claim, but fails to disclose reordering and aggregating 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. Baldwin discloses aggregating packets after reordering them (paragraph [0038]). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of Pung with Baldwin for the benefit of providing efficient utilization of network resources and reliable data communications by aggregating packets after reordering them.

Conclusion

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hong Cho whose telephone number is 571-272-3087. The examiner can normally be reached on Mon-Fri during 7 am to 4 pm.

RED HAT 1008
RED HAT V. CAS

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hassan Phillips can be reached on 571-272-3940. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/HONG S CHO/
Primary Examiner, Art Unit 2467

RED HAT 1008
RED HAT V. CAS

Notice of References Cited	Application/Control No. 15/161,787	Applicant(s)/Patent Under Reexamination Delangis, Eric M.	
	Examiner HONG S CHO	Art Unit 2467	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20030135578-A1	07-2003	Banga, Gaurav	H04L29/06	709/215
*	B	US-20020150099-A1	10-2002	Pung, Hung Keng	H04L12/1886	370/390
*	C	US-20140122656-A1	05-2014	Baldwin; Christopher	H04L65/4084	709/219
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/161,787	Delangis, Eric M.
	Examiner	**Art Unit**
	HONG S CHO	2467

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	02/25/2019	03/26/2019							
	1	-	-							
	2	-	-							
	3	-	-							
	4	-	-							
	5	-	-							
	6	-	-							
	7	-	-							
	8	-	-							
	9	-	-							
	10	-	-							
	11	-	-							
	12	-	-							
	13	-	-							
	14	-	-							
	15	-	-							
	16	-	-							
	17	-	-							
	18	-	-							
	19	-	-							
	20	-	-							
	21	-	-							
	22	-	-							
	23	-	-							
	24	-	-							
	25	-	-							
	26	-	-							
	27	-	-							
	28	-	-							
	29	-	-							
	30	-	-							
	31	-	-							
	32	-	-							
	33	-	-							
	34	-	-							
	35	-	-							
	36	-	-							
	37	-	-							
	38	-	-							
	39	-	-							
	40	-	-							
	41	÷	✓							
	42	÷	✓							

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/161,787	Delangis, Eric M.
	Examiner	**Art Unit**
	HONG S CHO	2467

CLAIM		DATE								
Final	Original	02/25/2019	03/26/2019							
	43	÷	✓							
	44	÷	✓							
	45	÷	✓							
	46	÷	✓							
	47	÷	✓							
	48	÷	✓							
	49	÷	✓							
	50	÷	✓							
	51	÷	✓							
	52	÷	✓							
	53	÷	✓							
	54	÷	✓							
	55	÷	✓							
	56	÷	✓							
	57	÷	✓							
	58	÷	N							
	59	÷	N							
	60	÷	N							

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/161,787	Delangis, Eric M.
	Examiner	Art Unit
	HONG S CHO	2467

CPC - Searched*		
Symbol	Date	Examiner

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
H04M3/007 or H04L47/821 or H04M1/6033 or H04L45/54 or H04L69/168 or H04L61/2015 or H04L45/24 or H04W88/16 or H04L12/5692 or H04M2203/60 or H04M2250/06 or H04M2203/052 or H04W80/00 or H04W40/02 or H04W28/06 or H04W84/18 or H04W84/12 or H04W72/04 or H04W8/26 (EAST text search)	10/5/2016	hc
updated search	4/7/2017	hc
updated search	9/19/2017	hc
updated search	10/01/2018	hc
updated search	03/26/2019	hc
inventor search	03/26/2019	hc

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/161,787	Delangis, Eric M.
	Examiner	Art Unit
	HONG S CHO	2467

RED HAT 1008
RED HAT V. CAS

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S490	16	S489 and multi near (path or link) with rout$3 with concurrent$2	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/02/23 09:29
S489	287002	(H04M3/007 or H04L47/821 or H04M1/6033 or H04L45/54 or H04L69/168 or H04L61/2015 or H04L45/24 or H04W88/16 or H04L12/5692 or H04M2203/60 or H04M2250/06 or H04M2203/052 or H04W80/00 or H04W40/02 or H04W28/06 or H04W84/18 or H04W84/12 or H04W72/04 or H04W8/26).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/02/23 09:29
S493	17	(join$3 or combin$3 or aggregat$3) near (packet$1 or frame$1 or cell$1) with (session or connection) near (id or identifier)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/02/23 09:30
S492	72	server same aggregat$3 with received near (packet$1 or data) with (portion or part)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/02/23 09:30
S491	16	((Eric) near2 (Delangis)).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2019/02/23 09:30
S496	87	network near monitor$1 and multilink	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/02/25 09:50
S500	12	send$3 near packets same multilink	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/02/25 10:01
S501	29	allocat$3 near bandwidth same multilink	US-PGPUB; USPAT;	OR	OFF	2019/02/25 10:02

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S502	2773	(send$3 or transmit$4 or includ$3) with ip adj address with network adj interface$1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/03/25 14:19
S503	75	(send$3 or transmit$4 or includ$3) with ip adj address with (correspond$3 or associat$3) near3 network adj interface$1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/03/25 14:20
S505	34	(US-20060079274-$ or US-20030202468-$ or US-20030063591-$ or US-20040090924-$ or US-20020102987-$ or US-20090150924-$ or US-20030137959-$ or US-20020150099-$ or US-20010037472-$ or US-20010007557-$ or US-20020106065-$ or US-20020193115-$ or US-20030191848-$ or US-20020055982-$ or US-20030016664-$ or US-20010036161-$).did. or (US-7257106-$ or US-6307839-$ or US-7385924-$ or US-7308279-$ or US-7068623-$ or US-6249669-$ or US-6941151-$ or US-7426316-$ or US-7562110-$ or US-7889181-$ or US-7035914-$ or US-7065090-$ or US-8285802-$ or US-7653089-$ or US-6496477-$ or US-5483522-$ or US-7315900-$ or US-6704794-$).did.	US-PGPUB; USPAT	OR	OFF	2019/03/25 14:21
S504	10	S503 and (@pd or @ptad or @prad or @ad or @rlad)<"20021015"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/03/25 14:21
S509	34	(US-20060079274-$ or US-20030202468-$ or US-20030063591-$ or US-20040090924-$ or US-20020102987-$ or US-20090150924-$ or US-20030137959-$ or US-20020150099-$ or US-20010037472-$ or US-20010007557-$ or US-20020106065-$ or US-20020193115-$ or US-20030191848-$ or US-20020055982-$ or US-20030016664-$ or US-20010036161-$).did. or (US-7257106-$ or US-6307839-$ or US-7385924-$ or US-7308279-$ or US-7068623-$ or US-6249669-$ or US-6941151-$ or US-7426316-$ or US-7562110-$ or US-7889181-$ or US-	US-PGPUB; USPAT	OR	OFF	2019/03/26 12:25

		7035914-$ or US-7065090-$ or US-8285802-$ or US-7653089-$ or US-6496477-$ or US-5483522-$ or US-7315900-$ or US-6704794-$).did.				
S516	9	10/686375	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/03/26 12:40
S521	0	S520 and (@pd or @ptad or @prad or @ad or @rlad)<"20021015"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/03/26 12:45
S520	28	reorder$3 with aggregat$3 with received near (packet$1 or cell$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/03/26 12:45
S522	11	aggregat$3 with reordered near (packet$1 or cell$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/03/26 12:49
S523	25	(multiplex$3 or combin$3 or aggregat$3) with reordered near (packet$1 or cell$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/03/26 12:50

3/26/2019 2:21:32 PM
C:\Users\hcho\Documents\EAST\Workspaces\15161787.wsp

To: CLAYMCGURK@GMAIL.COM,,
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 64828

Mar 29, 2019 04:12:46 AM

Dear PAIR Customer:

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

The following USPTO patent application(s) associated with your Customer Number, 64828 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

Disclaimer:
The list of documents shown below is provided as a courtesy and is not part of the official file wrapper. The content of the images shown in PAIR is the official record.

Application	Document	Mailroom Date	Attorney Docket No.
15161787	CTNF	03/29/2019	ED 3000
	892	03/29/2019	ED 3000

To view your correspondence online or update your email addresses, please visit us anytime at https://sportal.uspto.gov/secure/myportal/privatepair.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

RED HAT 1008
RED HAT V. CAS

Electronic Acknowledgement Receipt

EFS ID:	36379825
Application Number:	15161787
International Application Number:	
Confirmation Number:	3396
Title of Invention:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
First Named Inventor/Applicant Name:	Eric M. Delangis
Customer Number:	64828
Filer:	Harold C. McGurk
Filer Authorized By:	
Attorney Docket Number:	ED 3000
Receipt Date:	21-JUN-2019
Filing Date:	23-MAY-2016
Time Stamp:	18:23:05
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment/Req. Reconsideration-After Non-Final Reject	15161787_Amendment_6-21-19.pdf	299699 dc4b32cb984a5921078c236356027d4e03a8a9cf	no	17

Warnings:

RED HAT 1008
RED HAT V. CAS

Information:	
Total Files Size (in bytes):	299699

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 a 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.

RED HAT 1008
RED HAT V. CAS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.:	**15/161,787**	EXAMINER:	HONG CHO
INVENTOR:	Eric M. Delangis	GROUP ART UNIT:	2467
FILED:	OCTOBER 11, 2014	CONFIRMATION NO.:	3396
TITLE:	Multipath Communication Devices and Methods		
ATTORNEY NO:	ED 3000		

AMENDMENT

In response to the final Office Action issued on March 29, 2019 ("Office Action"), please reconsider the above-identified application due to the following amendments and accompanying remarks.

CERTIFICATE OF ELECTRONIC (EFS-WEB) TRANSMISSION

I hereby certify that this correspondence is being transmitted via the U.S. Patent Office's electronic filing system in accordance with 37 C.F.R. § 1.8(a)(1) from the **Pacific Time Zone** of the United States on the local date shown below.

Dated: June 21, 2019

By: Clay McGurk

Clay McGurk

RED HAT 1008
RED HAT V. CAS

IN THE CLAIMS

This listing of claims will replace all prior versions and listings of the claims in the application:

1-40. (Cancelled).

41. (Currently Amended) A client device for multilink data packet ~~reception~~ communication, the client device comprising:

at least two or more network interfaces; and

at least one processor coupled to the at least two or more network interfaces and configured to:

transmit a first message through one of the at least two or more network interfaces, wherein the first message includes an identifier that is unique to a multilink session and first information that identifies at least the one of the at least two or more network interfaces of the client device that is capable of receiving one or more data packets during the multilink session;

transmit a second message through a different one of the at least two or more network interfaces, wherein the second message includes the identifier that is unique to the multilink session and second information that identifies the different one of the at least two or more network interfaces of the client device that is capable of receiving one or more data packets during the multilink session; and

receive the one or more data packets through any combination of the at least two or more network interfaces of the client device during the multilink session.

42. (Previously Pending) The client device of claim 41, 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.

RED HAT 1008
RED HAT V. CAS

43. (Previously Pending) The client device of claim 41, wherein a server provides the identifier that is unique to the multilink session.

44. (Currently Amended) The client device of claim 41, wherein the first information is comprised of at least one of an Internet address associated with the at least one of the at least two or more network interfaces, and the second information is comprised of at least one of an Internet address associated with the different one of the at least two or more network interfaces.

45. (Currently Amended) The client device of claim 41, wherein each of the at least two or more network interfaces 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.

46. (Previously Pending) The client device of claim 41, wherein the processor is configured to reorder and aggregate 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.

47. (Currently Amended) The client device of claim 41, 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.

48. (Currently Amended) A server for multilink ~~data packet transmission~~ communication, 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 multilink ~~data~~ packets over the at least one server network interface, each of the multilink ~~data~~ packets associated with one or more of a plurality of network communication interfaces that ~~are~~ is capable of being used by a device to receive data packets; and

control at least one of (i) sending different groups of data packets over the at least one server network interface to ~~the~~ at least two of the network communication interfaces; (ii) sending different streams of data over the at least one server network interface to the at least two of the network communication interfaces; and (iii) sending combinations of different streams and different groups of data packets over the at least one server network interface to the at least two of the network communication interfaces.

49. (Previously Pending) The server of claim 48, wherein the one or more processors is further configured to send a connection ID that is unique to the data packets being sent to the at least two of the network communication interfaces.

50. (Currently Amended) The server of claim 48, wherein the one or more processors is further configured to:

receive one or more ~~multipath information~~ multilink packets, each of the one or more multilink packets is comprised of multilink information so that data packets can be sent over an additional one of the network communication interfaces, and

control at least one of (i) sending different groups of data packets over the at least one server network interface to the at least three of the network communication interfaces; (ii) sending different streams of data over the at least one server network interface to the at least

three of the network communication interfaces; and (iii) sending combinations of different streams and different groups of data packets over the at least one server network interface to the at least three of the network communication interfaces.

51. (Currently Amended) The server of claim 48, wherein the one or more processors is further configured to receive ~~multipath~~ multilink packets comprised of multilink information ~~about~~ associated with which one of the network communication interfaces is to be removed from the multilink session.

52. (Currently Amended) The server of claim 48, wherein the one or more processors is further configured to receive different multilink ~~data~~ packets over the at least one server network interface at different periods of time.

53. (Previously Pending) A first device comprising:

a network interface; and

at least one processor coupled to the network interface and configured to:

transmit a first message through the network interface to a second device, wherein the first message includes an identifier that is unique to a multilink session and first information that identifies the network interface of the first device that is capable of receiving one or more data packets from the second device during the multilink session;

transmit a second message through the network interface to a third device, wherein the second message includes the identifier that is unique to the multilink session and second information that identifies the network interface of the first device that is capable of receiving one or more data packets from the third device during the multilink session; and

receive the one or more data packets through the at least one network interface from the second device and from the third device during the multilink session.

54. (Previously Pending) The client device of claim 53, wherein the first device and the second device are separate devices or separate parts of the same device.

55. (Previously Pending) The client device of claim 53, 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.

56. (Previously Pending) A first device for multilink ~~data packet transmission~~ communication, comprising:

at least one network interface; and

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

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

control a data server where the data server: (i) send different groups of data packets from the data server to the network communication interfaces of the second device; (ii) send different streams of data from the data server to the network communication interfaces of the second device; and (iii) send combinations of different streams and different groups of data packets from the data server to the network communication interfaces of the second device.

57. (Currently Amended) A client device for multilink ~~data packet reception~~ communication, the client device comprising:

at least two or more network interfaces; and

at least one processor coupled to the at least two or more network interfaces and configured to:

transmit a first message through one of the at least two or more network interfaces to at least one server, wherein the first message includes an identifier that is unique to a multilink session and first information that identifies at least the one of the at least two or more network interfaces of the client device that is capable of receiving one or more data packets during the multilink session, the first information being comprised an Internet address associated with the one of the at least two or more network interfaces;

transmit a second message through a different one of the at least two or more network interfaces to the at least one server, wherein the second message includes the identifier that is unique to the multilink session and second information that identifies the different one of the at least two or more network interfaces of the client device that is capable of receiving one or more data packets during the multilink session, the second information being comprised of an Internet address associated with the different one of the at least two or more network interfaces; and

receive the one or more data packets through any combination of the at least two or more network interfaces of the client device during the multilink session.

58. (Withdrawn) A device comprising:

at least one interface which is capable of connecting to a first network;

at least one wireless interface which is capable of wirelessly connecting to at least one network; and

at least one processor that:

monitors a current status of availability, operability and throughput capability of the first network and the second network to determine whether the first network and the second network are capable of participating in a multilink communication;

selects the at least one interface and the at least one wireless interface based on the current status;

receives data packets via the selected at least one interface and the selected at least one wireless interface during the multilink communication.

59. (Withdrawn) The device of claim 58, wherein the at least one interface is at least one of a cellular interface, a WiFi interface an ethernet interface, and fiber optics interface; and

wherein the at least one wireless interface is at least one of a cellular interface, a WiFi interface, a Bluetooth interface, and a micro-cell interface.

60. (Withdrawn) A method for sharing and dynamically allocating bandwidth from a plurality of wired and wireless networks, the method comprising the steps of:

developing and updating a network table that comprises information about a list of remote gateways, bandwidth capabilities and quality of service of each of the remote gateways;

selecting one or more of the remote gateways to support a multilink communication transfer for the requesting gateway based upon the information in the network table;

concurrently receiving data packets during the multilink communication transfer at the requesting gateway data packets from the selected remote gateways; and

after receipt of the data packets, reassembling the data packets when the data packets are out of order.

REMARKS

Status of the Claims

Claims 41-57 were pending and are still currently pending in this Amendment. Claims 1-40 were previously canceled. Claims 57-60 were previously withdrawn. Claims 41, 44, 45, 47, 48, 50-52 and 56-57 have been amended. No new matter has been entered herein.

35 U.S.C. § 112 Rejections

Starting on page 2 of the Office Action, claims 41-57 were rejected under 35 U.S.C. 112, first paragraph. It is respectfully submitted that the language used in claims 41-57 are supported by the specification. Reference will be to the corresponding published application 2016-0269547 ('547) and the paragraph numbers used therein. Each of the rejections are addressed below.

Regarding the § 112 rejection involving claims 41, 53 and 57, the specification describes and supports "transmitting a message including [an] identifier that is unique . . . during the multilink session" at least in paragraph 77 of '547 among others:

> 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.**
>
> ... 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**.

Regarding the § 112 rejection involving claim 46, the specification in paragraph 77 of '547 describes and supports the language of claim 46 where data packets are reordered and aggregated, by stating:

> ... 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...
> Further support can be found in the '547 specification in paragraph 74:
>
> 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." As shown in Fig. 7, each of the thirty-two 802.11 connections may be participating in the multilink bundle, where data is being sent concurrently over the participating 802.11 connections. Packet "reassembly" requires the aggregation and possible reordering of the data packets, otherwise the data transfer would be out-of-order and corrupted.

Regarding the § 112 rejection involving claim 48, the specification supports and describes "receiving multilink data over the at least one server network interface . . . to the at least two of the network communication interfaces" in at least paragraph 77 of '547 by stating:

> 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 illustrated in Fig. 7, the remote server computer is capable of sending data over at multiple links or paths at the same time to provide aggregation of bandwidth.

Regarding the § 112 rejection involving claim 49, the specification describes and supports the language used in claim 49 by stating in paragraph 77 of '547:

> 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.**
>
> ... 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**.

RED HAT 1008
RED HAT V. CAS

Regarding the § 112 rejection involving claim 50, the specification describes and supports the language used in claim 50 by stating in paragraph 77 of '547:

> ... 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**.

Regarding the § 112 rejection involving claim 51, the specification describes and supports the language used in claim 51 by stating in paragraphs 77 and 78 of '547:

> (¶77) ... 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**.
>
> (¶78) ... 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.

Regarding the § 112 rejection involving claim 52, the specification describes and supports the language used in claim 52 by stating in paragraph 77 of '547:

RED HAT 1008
RED HAT V. CAS

> … 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**.

Regarding the § 112 rejection involving claim 56, the specification describes and supports the language used in claim 56 by stating in paragraph 77 of '547:

> … 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.
>
> … Once the multilink bundle is setup, the initiating RCG—**85** begins data transfer across its POTS interface—**90** with the far end computer system. …
>
> … 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.

The § 112 rejection of claims 42-47, 49-52, 54 and 55 was based on their dependence on their corresponding independent claim 41, 48 and 53. Claim 42-47, 49-52, 54 and 55 have ample support as noted above for claims 41, 48 and 53, and therefore it is respectfully requested that the rejection of claims 41-57 under 35 U.S.C. § 112 be reconsidered and withdrawn.

35 U.S.C. § 102 Rejections

Starting on page 2 of the Office Action, claims 48-52 and 56 were rejected under 35 U.S.C. §102(e) as being unpatentable over "Pung" (U.S. Appl. Publ. 2002-0150099). Pung is deficient because Pung fails to describe or mention in claim 48 - "receive multilink packets over the at least one server network interface, each of the multilink packets associated with one or more of a plurality of network communication interfaces that is capable of being used by a device to receive data packets", and in claim 56 - "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".

The Office Action cited to Figure 12A, element 12D, where element 12D is receiving a "multicast QoS connection" request. However, there are at least three patentable differences between Pung and what is required by claims 48 and 56. First, the "multicast QoS connection" request received by element 12D of Pung is a single request made by node 14A and does not involve "one or more multilink packets" as required in claims 48 and 56. The "multicast QoS connection" request as described in paragraphs 100 of Pung is for setting up a multicast call which only involves one path between node 14B and node 14A, that path being shown in Fig. 12F. No additional paths are setup in Pung as a result of the "multicast QoS connection" request. As shown in Fig. 12F of Pung, there is only one network communication link between node 14A and element 12A. Figures 12A-F of Pung fails to show multiple connections between node 14A and element 12A, thus making it impossible that element 12D of Pung could receive "multilink packets" where each multilink packet is associated with one or more of a plurality of network communication interfaces as required in claims 48 and 56.

Second, the purpose in Pung is solely concerned with **multicasting** which involves broadcasting the same information to many receivers at the same time. Multicasting is completely different from "multilink communication" as described and claimed in the present application. In Pung, it states in paragraphs 3, 4, 16 and 17:

[3] Multicasting, as used herein, refers to the transmission of the same information packets by a source to a multiplicity of receivers in a packet switched communications network.

[4] There are two major steps in multicasting: multicast routing for establishing the desirable connection, and data forwarding for switching of packets at each intermediate switching nodes along the path. Multicast routing establishes a delivery route through which information packets can be exchanged efficiently among participants (senders and receivers).

[16] Conveniently, methods exemplary of the present invention allow establishment of a multicast tree between a source (or root) and a group of receivers over a network with a plurality of connected nodes." In contrast, the purpose of multilink communications is to send and receive data, information or data packets over multiple links to a single device.

[17] A receiver may join a multicast service independently and dynamically, so long as a multicast service has been identified. A receiver wishing to join a multicast may generate a request packet to the network through its receiver-node. Nodes on the network duplicate the request packet to search possible routes in parallel and select **a confirmed qualified route** within a short set-up time.

Thus, multicasting is not the same as "multilink communication" as required by claims 48 and 56. In the present invention and as shown in Figs. 7 and 8 of the pending application and paragraphs 73-78, a "multilink communication" involves in one embodiment, the creation of an ad-hoc multilink network between the multilink initiating RCG 85 and a server so that the multilink initiating RCG 85 is capable of receiving data packets over different links or paths. Thus, the purpose of multilink communication is different from the purpose of multicasting as described in Pung. The multicasting described in Pung is deficient and fails to describe or suggest what is required in claims 48 and 56.

Third, a "multicast QoS connection" request is fundamentally different from "multilink packets" as used in claims 48 and 56 because the multicast request is associated with setting up and joining a multicast broadcast, while the "multilink packet" is associated with setting up and creating a multilink communication. A multicast request is associated with a multicast broadcast, which as explained above, results in a single route from the source device to the receiving device. In contrast, a "multilink packet" is used to set up multiple connections from a server or proxy

RED HAT 1008
RED HAT V. CAS

server to a receiving device. Thus, a multicast request is fundamentally different and patentably distinct from a "multilink packet" as recited in claims 48 and 56.

In summary, there are patentable distinctions between Pung and the embodiments claimed in claims 48 and 56 because (i) Pung identifies and selects a single path between nodes 14B and 14A versus multiple links or paths as required by claims 48 and 56; (ii) the purpose of multicasting as described in Pung is different from the "multilink communication" described in the present application and as claimed in claims 48 and 56; and (iii) a multicast request and multicast functionality are fundamentally different from a multilink communication setup via multilink packet or packets as required by claims 48 and 56.

Claim 49-52 are dependent on allowable independent claim 48, and thus are allowable for the same reasons provided above for claim 48. For these reasons, it is respectfully requested that the rejection of claims 48-52 and 56 under 35 U.S.C. § 102(e) based on Pung be reconsidered and withdrawn.

35 U.S.C. § 103 Rejections

Starting on page 6 of the Office Action, claims 41-47, 49, 53-55 and 57 were rejected under 35 U.S.C. §103(a) as being unpatentable over Pung in view of "Banga" (U.S. Appl. Publ. 20030135578). On page 8 of the Office Action, claim 46 was rejected under 35 U.S.C. §103(a) as being unpatentable over Pung and Banga and further in view of "Baldwin" (U.S. Appl. Publ. 20140122656).

In the Office Action, Banga was relied upon for allegedly disclosing "providing IP address (connection ID in claim 49) of network interface (paragraph [0015])", while Baldwin was relied upon for allegedly disclosing "aggregating packets after reordering them (paragraph [0038])". Neither Banga nor Baldwin were relied upon for disclosing the deficiencies noted above as to Pung. Therefore, claims 41-47, 49, 53-55 and 57 are also allowable for the same reasons provided above for distinguishing claims 48 and 56 over Pung. Therefore, it is respectfully requested that the rejection of claims 41-47, 49, 53-55 and 57 under 35 U.S. C. §103 based on Pung and Banga, and claim 46 based on Pung, Banga and Baldwin be reconsidered and withdrawn.

Conclusion

All rejections in the Office Action have been properly traversed. It is respectfully requested that all outstanding rejections be reconsidered and withdrawn. It is believed that a full and complete reply has been made in response to the Office Action, and, that as such, the present patent application is in a condition for allowance.

It is noted that new claimed subject matter may be patentably distinguished from the cited references for additional reasons. It is also noted that any failure to comment directly upon any of the positions asserted in the Office Action does not indicate agreement or acquiescence with those asserted positions or allegations. Instead, it is believed that the foregoing sufficiently addresses the issues raised in the Office Action, and that the present claims are in condition for allowance.

The Examiner can always telephone the attorney of record at the telephone number provided below if such telephone discussion would help expedite the prosecution of the patent application. Prompt and favorable consideration of this Amendment is respectfully requested.

Respectfully Submitted,

Date: June 21, 2019

H C McGurk IV, Reg. No. 34,964
Attorney for Applicant

THE LAW OFFICE OF CLAY MCGURK
PO Box 1488
Orange, CA 92706
Phone: **949.395.3942**
Email: claymcgurk@gmail.com

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
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 displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/161,787	Filing Date 05/23/2016	☐ To be Mailed

ENTITY: ☐ LARGE ☑ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) 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 $40 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $210 =	
☐ 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	06/21/2019	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0		x $50 =	0
	Independent (37 CFR 1.16(h))	* 7	Minus	*** 7	= 0		x $230 =	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".	/VANESSA D HODGES/
*** 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.

RED HAT 1008
RED HAT V. CAS

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/161,787	05/23/2016	Eric M. Delangis	ED 3000	3396

64828 7590 08/16/2019

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

EXAMINER	
CHO, HONG SOL	

ART UNIT	PAPER NUMBER
2467	

NOTIFICATION DATE	DELIVERY MODE
08/16/2019	ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

CLAYMCGURK@GMAIL.COM

PTOL-90A (Rev. 04/07)

RED HAT 1008
RED HAT V. CAS

Office Action Summary	Application No. 15/161,787	Applicant(s) Delangis, Eric M.	
	Examiner HONG S CHO	Art Unit 2467	AIA (FITF) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 06/21/2019.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☑ This action is **FINAL.** 2b) ☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance 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.

Disposition of Claims*

5) ☑ Claim(s) 41-57 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 41-57 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

DETAILED ACTION

Response to Amendment

2. This office action is in response to the amendment filed on 06/21/2019. Claims 41-57 are pending in the instant application.

Claim Rejections - 35 USC § 112, First paragraph

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 41-57 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Re claims 41, 53 and 57, the original specification fails to describe transmitting a message including identifier that is unique to a multilink session and information that identifies at least the one of the at least two or more network interfaces of the device and

RED HAT 1008
RED HAT V. CAS

receiving the one or more data packets through any combination of the at least two or more network interfaces of the client device during the multilink session.

Re claim 46, the original specification fails to describe reorder and aggregate 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.

Re claim 48, the original specification fails to describe receiving multilink data over the at least one server network interface, the multilink data associated with a plurality of network communication interfaces that are capable of being used by a device to receive data packets and controlling at least one of (i) sending different groups of data packets over the at least one server network interface to the at least two of the network communication interfaces; (ii) sending different streams of data over the at least one server network interface to the at least two of the network communication interfaces; and (iii) sending combinations of different streams and different groups of data packets over the at least one server network interface to the at least two of the network communication interfaces.

Re claim 49, the original specification fails to describe sending a connection ID that is unique to the data packets being sent to the at least two of the network communication interfaces.

Re claim 50, the original specification fails to describe receiving multipath information so that data packets can be sent over an additional one of the network communication interfaces.

Re claim 52, the original specification fails to describe receiving different multilink data over the at least one server network interface at different periods of time.

RED HAT 1008
RED HAT V. CAS

Re claim 56, the original specification fails to describe receiving information about a plurality of network communication interfaces of a second device that are capable of being used to receive data packets; and controlling a data server where the data server: (i) send different groups of data packets from the data server to the network communication interfaces of the second device; (ii) send different streams of data from the data server to the network communication interfaces of the second device; and (iii) send combinations of different streams and different groups of data packets from the data server to the network communication interfaces of the second device.

Claims 42-47, 49-52, 54 and 55 depend on claims 41, 48 and 53 are similarly rejected.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102(e) that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 48-52 and 56 are rejected under 35 U.S.C. 102(e) as being anticipated by Pung et al (US 20020150099, "Pung").

RED HAT 1008
RED HAT V. CAS

Re claims 48 and 49, Pung discloses receiving multilink data over the at least one server network interface, the multilink data associated with a plurality of network communication interfaces that are capable of being used by a device to receive data packets (figure 12a, element 12d); and controlling at least one of (i) sending different groups of data packets over the at least one server network interface to the at least two of the network communication interfaces; (ii) sending different streams of data over the at least one server network interface to the at least two of the network communication interfaces; and (iii) sending combinations of different streams and different groups of data packets over the at least one server network interface to the at least two of the network communication interfaces (figure 12b, Req (A, c, d), (A, d, c)).

Re claim 50, Pung discloses receiving multipath information so that data packets can be sent over an additional one of the network communication interfaces (figure 12b, Req (A,d,e)).

Re claim 51, Pung discloses receiving multipath information about which one of the network communication interfaces is to be removed from the multilink session (paragraph [0079], figure 8a).

Re claim 52, Pung discloses receiving different multilink data over the at least one server network interface at different periods of time (figure 12b).

Re claim 56, Pung discloses receiving information about a plurality of network communication interfaces of a second device that are capable of being used to receive data packets (figure 12a, element 12d); and controlling a data server where the data server: (i) send different groups of data packets from the data server to the network communication interfaces of the second device; (ii) send different streams of data from

RED HAT 1008
RED HAT V. CAS

the data server to the network communication interfaces of the second device; and (iii) send combinations of different streams and different groups of data packets from the data server to the network communication interfaces of the second device (figure 12b, Req (A,d,e), (A, c, d), (A, d, c)).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 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 of this title, 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 negatived by the manner in which the invention was made.

8. Claims 41-47, 49, 53-55 and 57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pung in view of Banga et al (US 20030135578, "Banga").

Re claims 41, 49, 53 and 57, Pung discloses transmitting a first message through one of the at least two or more network interfaces to at least one server (figure 12b, Req (A,c,e)), wherein the first message includes an identifier that is unique to a multilink session (figure 4a, Request_ID or MT_ID); transmitting a second message through a different one of the at least two or more network interfaces to the at least one server (figure 12b, Req (A,c,d)) and receiving the one or more data packets through any combination of the at least two or more network interfaces of the client device during the multilink session (figure 12b, Cf (A, B, e), but fails to disclose internet address information that identifies at least the one of the at least two or more network interfaces

RED HAT 1008
RED HAT V. CAS

of the client device. However, Banga discloses providing IP address (connection ID in claim 49) of network interface (paragraph [0015]). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of Pung with the teaching of Banga for the benefit of providing reliable data communication by utilizing IP address of network interfaces.

Re claim 42, Pung discloses transmitting 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 (figure 12b, element 14b).

Re claim 43, Pung discloses a server provides the identifier that is unique to the multilink session (paragraph [0099]).

Re claim 44, Banga discloses the first information is comprised of an Internet address associated with the one of the at least two or more network interfaces, and the second information is comprised of an Internet address associated with the different one of the at least two or more network interfaces (paragraph [0015]).

Re claims 45 and 55, Banga discloses each of the at least two or more network interfaces is one or more of cellular interface, Wi-Fi interface, a wireless interface, a cable interface, an Ethernet interface, a Bluetooth interface, a near-field communication interface, and an optical interface (paragraph [0029]).

Re claim 47, Pung discloses 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

RED HAT 1008
RED HAT V. CAS

device, a mobile communication device, a near-field communications device, and a Bluetooth device (paragraph [0039]).

Re claim 54, Pung discloses the first device and the second device are separate devices or separate parts of the same device (figure 12b).

9. Claim 46 is rejected under 35 U.S.C. 103(a) as being unpatentable over Pung in view of Banga and further in view of Baldwin et al (US 20140122656, "Baldwin").

Re claim 46, Pung discloses all of the limitations of the base claim, but fails to disclose reordering and aggregating 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. Baldwin discloses aggregating packets after reordering them (paragraph [0038]). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of Pung with Baldwin for the benefit of providing efficient utilization of network resources and reliable data communications by aggregating packets after reordering them.

Response to Arguments

10. Applicant's arguments filed on 06/21/2019 have been fully considered but they are not persuasive.

35 U.S.C. 112 rejections

Re claims 41, 53 and 57, the applicant argues that the specification describes and supports "transmitting a message including [an] identifier that is unique . . . during

RED HAT 1008
RED HAT V. CAS

the multilink session" at least in paragraph 77 of '547 among others: The examiner respectfully disagrees. The specification describes transmitting a message including identifier that is unique to a multilink session, but fails to describe transmitting a message including information that identifies at least the one of the at least two or more network interfaces of the device and receiving the one or more data packets through any combination of the at least two or more network interfaces of the client device during the multilink session.

Re claim 46, the applicant argues that the specification in paragraphs 74 and 77 of '547 describes and supports the language of claim 46 where data packets are reordered and aggregated, by stating packet "reassembly" requires the aggregation and possible reordering of the data packets, otherwise the data transfer would be out-of-order and corrupted. The examiner respectfully disagrees. Packet reassembly does not require the aggregation and reordering of data packets received over network interfaces since the specification does not even describe packet segmentation and packets received out-of-order.

Re claim 48, the applicant argues that the specification in paragraph 77 of '547 describes and supports the "receiving multilink data over the at least one server network interface ... to the at least two of the network communication interfaces" by stating that the remote server computer is capable of sending data over at multiple links or paths at the same time to provide aggregation of bandwidth. The examiner respectfully disagrees. The paragraph describes that 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, but is silent on sending different

RED HAT 1008
RED HAT V. CAS

groups of data packets over the at least one server network interface to the at least two of the network communication interfaces; (ii) sending different streams of data over the at least one server network interface to the at least two of the network communication interfaces; and (iii) sending combinations of different streams and different groups of data packets over the at least one server network interface to the at least two of the network communication interfaces.

Re claim 49, the applicant argues that the specification in paragraph 77 of '547 describes and supports the language used in claim 49. The examiner respectfully disagrees. The cited paragraph does not describe sending a connection ID that is unique to the data packets being sent to the at least two of the network communication interfaces.

Re claim 50, the applicant argues that the specification in paragraph 77 of '547 describes and supports the language used in claim 50. The examiner respectfully disagrees. The cited paragraph does not describe receiving multipath information so that data packets can be sent over an additional one of the network communication interfaces.

Re claim 52, the applicant argues that the specification in paragraph 77 of '547 describes and supports the language used in claim 52. The examiner respectfully disagrees. The cited paragraph does not describe receiving different multilink data over the at least one server network interface at different periods of time.

Re claim 56, the applicant argues that the specification in paragraph 77 of '547 describes and supports the language used in claim 56. The examiner respectfully disagrees. The cited paragraph does not describe receiving information about a plurality of network communication interfaces of a second device that are capable of being used to receive data packets; and controlling a data server where the data server: (i) send different

RED HAT 1008
RED HAT V. CAS

groups of data packets from the data server to the network communication interfaces of the second device; (ii) send different streams of data from the data server to the network communication interfaces of the second device; and (iii) send combinations of different streams and different groups of data packets from the data server to the network communication interfaces of the second device.

35 U.S.C. 102 rejections

Re claims 48 and 56, the applicant argues that Pung fails to show multiple connections between node 14A and element 12A, thus making it impossible that element 12D of Pung could receive "multilink packets" where each multilink packet is associated with one or more of a plurality of network communication interfaces as required in claims 48 and 56. The examiner respectfully disagrees. First, figures 12A-12F; 13A-13E; and 14A-14F of Pung clearly show multiple connections/links between nodes 12A and 12D. Second, the applicant argues that Pung fails to show sending and receiving data packets over multiple links. The examiner respectfully disagrees. It is right that Pung describes multicast routing method satisfying quality of service constraints. However, the examiner did not rely on Pung's teaching on multicasting but on transporting data packets between interconnected nodes (elements/nodes 12a-e in figure 12a). Third, the applicant argues that Pung's multicast request and multicast functionality are different from a multilink communication setup via multilink packet or packets as required by claims 48 and 56. The examiner respectfully disagrees. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., establishing multilink communication via

RED HAT 1008
RED HAT V. CAS

multilink packet or packets) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Applicant's arguments fail to comply with 37 CFR 1.111(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references.

Therefore, the Examiner concludes that the rejection of claims stands.

Conclusion

11. **THIS ACTION IS MADE FINAL**. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no, however, event will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hong Cho whose telephone number is 571-272-3087. The examiner can normally be reached on Mon-Fri during 7 am to 4 pm.

RED HAT 1008
RED HAT V. CAS

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hassan Phillips can be reached on 571-272-3940. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/HONG S CHO/
Primary Examiner, Art Unit 2467

RED HAT 1008
RED HAT V. CAS

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/161,787	Delangis, Eric M.
	Examiner	Art Unit
	HONG S CHO	2467

CPC - Searched*		
Symbol	Date	Examiner

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
H04M3/007 or H04L47/821 or H04M1/6033 or H04L45/54 or H04L69/168 or H04L61/2015 or H04L45/24 or H04W88/16 or H04L12/5692 or H04M2203/60 or H04M2250/06 or H04M2203/052 or H04W80/00 or H04W40/02 or H04W28/06 or H04W84/18 or H04W84/12 or H04W72/04 or H04W8/26 (EAST text search)	10/5/2016	hc
updated search	4/7/2017	hc
updated search	9/19/2017	hc
updated search	10/01/2018	hc
updated search	03/26/2019	hc
inventor search	03/26/2019	hc
updated search	08/13/2019	hc

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/161,787	Delangis, Eric M.
	Examiner	Art Unit
	HONG S CHO	2467

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/161,787	Delangis, Eric M.
	Examiner	**Art Unit**
	HONG S CHO	2467

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	02/25/2019	03/26/2019	08/13/2019						
	1	-	-	-						
	2	-	-	-						
	3	-	-	-						
	4	-	-	-						
	5	-	-	-						
	6	-	-	-						
	7	-	-	-						
	8	-	-	-						
	9	-	-	-						
	10	-	-	-						
	11	-	-	-						
	12	-	-	-						
	13	-	-	-						
	14	-	-	-						
	15	-	-	-						
	16	-	-	-						
	17	-	-	-						
	18	-	-	-						
	19	-	-	-						
	20	-	-	-						
	21	-	-	-						
	22	-	-	-						
	23	-	-	-						
	24	-	-	-						
	25	-	-	-						
	26	-	-	-						
	27	-	-	-						
	28	-	-	-						
	29	-	-	-						
	30	-	-	-						
	31	-	-	-						
	32	-	-	-						
	33	-	-	-						
	34	-	-	-						
	35	-	-	-						
	36	-	-	-						
	37	-	-	-						
	38	-	-	-						
	39	-	-	-						
	40	-	-	-						
	41	÷	✓	✓						
	42	÷	✓	✓						

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/161,787	Delangis, Eric M.
	Examiner	**Art Unit**
	HONG S CHO	2467

CLAIM		DATE								
Final	Original	02/25/2019	03/26/2019	08/13/2019						
	43	÷	✓	✓						
	44	÷	✓	✓						
	45	÷	✓	✓						
	46	÷	✓	✓						
	47	÷	✓	✓						
	48	÷	✓	✓						
	49	÷	✓	✓						
	50	÷	✓	✓						
	51	÷	✓	✓						
	52	÷	✓	✓						
	53	÷	✓	✓						
	54	÷	✓	✓						
	55	÷	✓	✓						
	56	÷	✓	✓						
	57	÷	✓	✓						
	58	÷	N	N						
	59	÷	N	N						
	60	÷	N	N						

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S531	17	((Eric) near2 (Delangis)).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2019/08/13 08:45
S530	16	S529 and multi near (path or link) with rout$3 with concurrent$2	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/13 08:45
S529	306009	(H04M3/007 or H04L47/821 or H04M1/6033 or H04L45/54 or H04L69/168 or H04L61/2015 or H04L45/24 or H04W88/16 or H04L12/5692 or H04M2203/60 or H04M2250/06 or H04M2203/052 or H04W80/00 or H04W40/02 or H04W28/06 or H04W84/18 or H04W84/12 or H04W72/04 or H04W8/26).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/13 08:45
S533	10	S532 and (@pd or @ptad or @prad or @ad or @rlad)<"20021015"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/13 08:48
S532	77	(send$3 or transmit$4 or includ$3) with ip adj address with (correspond$3 or associat$3) near3 network adj interface$1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/13 08:48
S535	0	S534 and (@pd or @ptad or @prad or @ad or @rlad)<"20021015"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/13 09:25
S534	79	server same aggregat$3 with received near (packet$1 or data) with (portion or part)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/13 09:25
S536	2	"20160269547"	US-PGPUB; USPAT;	OR	OFF	2019/08/13 09:40

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S538	273	segment$3 with packet near reassembl$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/08/13 09:54

8/13/2019 11:37:39 AM
C:\Users\hcho\Documents\EAST\Workspaces\15161787.wsp

To: CLAYMCGURK@GMAIL.COM,,
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 64828

Aug 16, 2019 03:31:02 AM

Dear PAIR Customer:

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

The following USPTO patent application(s) associated with your Customer Number, 64828 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

Disclaimer:
The list of documents shown below is provided as a courtesy and is not part of the official file wrapper. The content of the images shown in PAIR is the official record.

Application	Document	Mailroom Date	Attorney Docket No.
15161787	CTFR	08/16/2019	ED 3000

To view your correspondence online or update your email addresses, please visit us anytime at https://sportal.uspto.gov/secure/myportal/privatepair.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

RED HAT 1008
RED HAT V. CAS

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/161,787	05/23/2016	Eric M. Delangis	ED 3000	3396

64828 7590 09/04/2019

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

EXAMINER	
CHO, HONG SOL	

ART UNIT	PAPER NUMBER
2467	

NOTIFICATION DATE	DELIVERY MODE
09/04/2019	ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

CLAYMCGURK@GMAIL.COM

PTOL-90A (Rev. 04/07)

RED HAT 1008
RED HAT V. CAS

Applicant-Initiated Interview Summary	**Application No.** 15/161,787	**Applicant(s)** Delangis, Eric M.	
	Examiner HONG S CHO	**Art Unit** 2467	**AIA (FITF) Status** No

All participants (applicant, applicants representative, PTO personnel):

(1) HONG SOL. CHO.

(2) Eric Delangis.

(3) Harold McGurk.

(4) _____.

Date of Interview: 29 August 2019.

Type: ☑ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☑ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☑112 ☐102 ☐103 ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: 46.

Identification of prior art discussed: N/A.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

The applicant discussed 112 rejection on claim 46 and the examiner will consider in future response.

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/HONG S CHO/ Primary Examiner, Art Unit 2467	

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) 1.133 Interviews
Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiners responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicants correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:
1) A brief description of the nature of any exhibit shown or any demonstration conducted,-
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
(The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicants record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiners version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, Interview Record OK on the paper recording the substance of the interview along with the date and the examiners initials.

RED HAT 1008
RED HAT V. CAS

To: CLAYMCGURK@GMAIL.COM,,
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 64828

Sep 04, 2019 03:44:01 AM

Dear PAIR Customer:

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

The following USPTO patent application(s) associated with your Customer Number, 64828 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

Disclaimer:
The list of documents shown below is provided as a courtesy and is not part of the official file wrapper. The content of the images shown in PAIR is the official record.

Application	Document	Mailroom Date	Attorney Docket No.
15161787	INTV.SUM.APP	09/04/2019	ED 3000

To view your correspondence online or update your email addresses, please visit us anytime at https://sportal.uspto.gov/secure/myportal/privatepair.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

RED HAT 1008
RED HAT V. CAS

PTO/SB/30EFS (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.

REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	15161787	Filing Date	2016-05-23	Docket Number (if applicable)	ED 3000	Art Unit	2467
First Named Inventor	ERIC DELANGIS			Examiner Name	HONG CHO		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

- ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
- ☐ Other _____

☒ Enclosed

- ☒ Amendment/Reply
- ☐ Information Disclosure Statement (IDS)
- ☐ Affidavit(s)/ Declaration(s)
- ☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____ (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

☐ **The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**
The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No _____

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

Applicant Signature

PTO/SB/30EFS (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.

Signature of Registered U.S. Patent Practitioner			
Signature	/H C McGurk IV, Reg No 34964/	Date (YYYY-MM-DD)	2020-02-14
Name	Harold McGurk	Registration Number	34964

This collection of information is required by 37 CFR 1.114. 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 1.11 and 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.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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 the Freedom of Information Act requires disclosure of these records.

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 inspections 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.

Electronic Patent Application Fee Transmittal

Application Number:	15161787
Filing Date:	23-May-2016
Title of Invention:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
First Named Inventor/Applicant Name:	Eric M. Delangis
Filer:	Harold C. McGurk
Attorney Docket Number:	ED 3000

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

RED HAT 1008
RED HAT V. CAS

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 3 months with $0 paid	2253	1	700	700
Miscellaneous:				
RCE- 2ND AND SUBSEQUENT REQUEST	2820	1	950	950
		Total in USD ($)		**1650**

RED HAT 1008
RED HAT V. CAS

Electronic Acknowledgement Receipt

EFS ID:	38598889
Application Number:	15161787
International Application Number:	
Confirmation Number:	3396
Title of Invention:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
First Named Inventor/Applicant Name:	Eric M. Delangis
Customer Number:	64828
Filer:	Harold C. McGurk
Filer Authorized By:	
Attorney Docket Number:	ED 3000
Receipt Date:	14-FEB-2020
Filing Date:	23-MAY-2016
Time Stamp:	19:26:44
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1650
RAM confirmation Number	E20202DJ28449007
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

RED HAT 1008
RED HAT V. CAS

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Continued Examination (RCE)	15161787_RCE_30e_fill.pdf	697864 a3dd32b73615d300855ecff35e15f62962349770	no	3
Warnings:					
Information:					
2	Amendment Submitted/Entered with Filing of CPA/RCE	15161787_Amendment_2-14-2020.pdf	398439 95a0a27e81a932af0ba6f8d3cc7212141ec85fdc	no	13
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	32570 11c89436c862c2e7bc83753415a1170f0864ebb3	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1128873		

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 a 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.

RED HAT 1008
RED HAT V. CAS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.:	**15/161,787**	EXAMINER:	HONG CHO
INVENTOR:	Eric M. Delangis	GROUP ART UNIT:	2467
FILED:	OCTOBER 11, 2014	CONFIRMATION NO.:	3396
TITLE:	Multipath Communication Devices and Methods		
ATTORNEY NO:	ED 3000		

AMENDMENT

In response to the final Office Action issued on August 16, 2019 ("Office Action"), please reconsider the above-identified application due to the following amendments and accompanying remarks. An extension for three months to respond to the final Office Action is respectfully requested. A Request for Continued Examination (RCE) is concurrently filed herewith.

Applicant and the attorney of record greatly appreciate the time spent by the examiner in the telephone conference to discuss outstanding issues from the Office Action.

CERTIFICATE OF ELECTRONIC (EFS-WEB) TRANSMISSION

I hereby certify that this correspondence is being transmitted via the U.S. Patent Office's electronic filing system in accordance with 37 C.F.R. § 1.8(a)(1) from the **Pacific Time Zone** of the United States on the local date shown below.

Dated: February 14, 2020

By: Clay McGurk

Clay McGurk

RED HAT 1008
RED HAT V. CAS

IN THE CLAIMS

This listing of claims will replace all prior versions and listings of the claims in the application:

1-40. (Cancelled).

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 ~~coupled to the at least two or more network interfaces and~~ configured to:

transmit a first message through ~~one of~~ the first ~~at least two or more~~ network ~~interfaces~~ interface to the server, wherein the first message includes a multilink request ~~an identifier that is unique to a multilink session~~ and ~~first information that identifies at least the one of the at least two or more network interfaces of the client device that is capable of receiving one or more data packets during the multilink session~~ a destination URL;

transmit a second message through ~~a different one of~~ the ~~at least two or more~~ second network ~~interfaces~~ interface to the server, wherein the second message includes ~~the~~ a multilink session identification ~~identifier that is unique to the multilink session~~ and ~~second information that identifies the different one of the at least two or more network interfaces of the client device that is capable of receiving one or more data packets during the multilink session~~ the destination URL; and

receive ~~the one or more~~ data packets from the server through ~~any combination of~~ the ~~at least two or more~~ 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.

RED HAT 1008
RED HAT V. CAS

42. (Previously Pending) The client device of claim 41, 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.

43. (Currently Amended) The client device of claim 41, wherein a server provides the ~~identifier~~ multilink session identification that is unique to the multilink session.

44. (Currently Amended) The client device of claim 41, wherein the first information is comprised of at least one of an Internet address associated with the first ~~at least one of the at least two or more~~ network ~~interfaces~~ interface, and the second information is comprised of at least one of an Internet address associated with the second ~~different one of the at least two or more~~ network ~~interfaces~~ interface.

45. (Currently Amended) The client device of claim 41, wherein each of the first network interface and the second network interface ~~at least two or more network interfaces~~ 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.

46. (Currently Amended) The client device of claim 41, wherein the processor is configured to reorder ~~and aggregate~~ 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.

47. (Previously Pending) The client device of claim 41, 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.

48. (Currently Amended) 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 multilink packets over the at least one server network interface, each of the multilink packets associated with one or more of a plurality of network communication interfaces of the device that is capable of being used by ~~a~~ the device to receive data packets, each of the network communication interfaces of the device having a data transfer rate associated with a separate path from the server to the device; and

~~control at least one of (i)~~ sending different groups of data packets over the at least one server network interface to at least two of the network communication interfaces of the device wherein the data transfer rate associated with the at least two of the network communication interfaces of the device provide an increased data transfer rate for the device which is receiving the data packets from the data server~~; (ii) sending different streams of data over the at least one server network interface to the at least two of the network communication interfaces; and (iii) sending combinations of different streams and different groups of data packets over the at least one server network interface to the at least two of the network communication interfaces~~.

49. (Currently Amended) The server of claim 48, wherein the one or more processors is further configured to send a ~~connection ID~~ multilink session identification that is unique to the data packets being sent to the at least two of the network communication interfaces.

RED HAT 1008
RED HAT V. CAS

50. (Currently Amended) The server of claim 48, wherein the one or more processors is further configured to:

receive one or more multilink packets, each of the one or more multilink packets is comprised of multilink information so that data packets can be sent over an additional one of the network communication interfaces, the additional one of the network communication interfaces of the device having a data transfer rate associated with a separate path from the server to the device, and

~~control at least one of (i)~~ sending different groups of data packets over the at least one server network interface to the at least three of the network communication interfaces~~; (ii) sending different streams of data over the at least one server network interface to the at least three of the network communication interfaces; and (iii) sending combinations of different streams and different groups of data packets over the at least one server network interface to the at least three of the network communication interfaces~~ wherein the data transfer rate associated with the at least three of the network communication interfaces of the device provide an increased data transfer rate for the device which is receiving the data packets from the server.

51. (Previously Pending) The server of claim 48, wherein the one or more processors is further configured to receive multilink packets comprised of multilink information associated with which one of the network communication interfaces is to be removed from the multilink session.

52. (Previously Pending) The server of claim 48, 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.

53. (Currently Amended) A first device comprising:

a network interface; and

at least one processor ~~coupled to the network interface and~~ configured to:

transmit a first message through the network interface to a second device, wherein the first message includes ~~an identifier~~ a multilink request ~~that is unique to a multilink session~~ and a destination URL, ~~first information that identifies the network interface of the first device that is capable of receiving one or more data packets from the second device during the multilink session~~ 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 ~~the~~ a multilink session identification ~~identifier~~ that is unique to the multilink session and the destination URL, ~~second information that identifies the network interface of the first device that is capable of receiving one or more data packets from the third device during the multilink session~~ the network interface to the third device having a data transfer rate associated therewith; and

receive the ~~one or more~~ 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.

54. (Currently Amended) The ~~client~~ first device of claim 53, wherein the first device and the second device are separate devices or separate parts of the same device.

55. (Currently Amended) The ~~client~~ first device of claim 53, 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.

RED HAT 1008
RED HAT V. CAS

56. (Currently Amended) 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, each of the network communication interfaces of the second device having a data transfer rate associated therewith; and

controlling ~~control~~ a data server where the data server~~: (i) send~~ sends different groups of data packets from the data server to the network communication interfaces of the second device wherein the data transfer rate associated with the network communication interfaces of the second device provide an increased data transfer rate at which the second device is receiving the data packets from the data server~~; (ii) send different streams of data from the data server to the network communication interfaces of the second device; and (iii) send combinations of different streams and different groups of data packets from the data server to the network communication interfaces of the second device~~.

57. (Currently Amended) 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 two or more network interfaces; and~~

at least one processor ~~coupled to the at least two or more network interfaces~~ and configured to:

transmit a first message through the first network interface ~~one of the at least two or more network interfaces~~ to at least one server, wherein the first message includes a multilink request ~~an identifier that is unique to a multilink session~~ and ~~first information that identifies at least the one of the at least two or more network interfaces of the client device that is capable of receiving one or more data packets during the multilink session, the first information being comprised an Internet address associated with the one of the at least two or more network interfaces~~ a destination URL;

transmit a second message through the second network interface ~~a different one of the at least two or more network interfaces~~ to the at least one server, wherein the second message includes ~~the~~ a multilink session identification ~~identifier~~ that is unique to the multilink session and ~~second information that identifies the different one of the at least two or more network interfaces of the client device that is capable of receiving one or more data packets during the multilink session, the second information being comprised of an Internet address associated with the different one of the at least two or more network interfaces~~ the destination URL; and

receive concurrently the ~~one or more~~ different data packets from the server through the first network interface and the second network interface ~~any combination of the at least two or more network interfaces~~ 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 rateof the client device.

RED HAT 1008
RED HAT V. CAS

58. (Withdrawn) A device comprising:

at least one interface which is capable of connecting to a first network;

at least one wireless interface which is capable of wirelessly connecting to at least one network; and

at least one processor that:

monitors a current status of availability, operability and throughput capability of the first network and the second network to determine whether the first network and the second network are capable of participating in a multilink communication;

selects the at least one interface and the at least one wireless interface based on the current status;

receives data packets via the selected at least one interface and the selected at least one wireless interface during the multilink communication.

59. (Withdrawn) The device of claim 58, wherein the at least one interface is at least one of a cellular interface, a WiFi interface an ethernet interface, and fiber optics interface; and

wherein the at least one wireless interface is at least one of a cellular interface, a WiFi interface, a Bluetooth interface, and a micro-cell interface.

60. (Withdrawn) A method for sharing and dynamically allocating data transfer rate from a plurality of wired and wireless networks, the method comprising the steps of:

developing and updating a network table that comprises information about a list of remote gateways, data transfer rate capabilities and quality of service of each of the remote gateways;

selecting one or more of the remote gateways to support a multilink communication transfer for the requesting gateway based upon the information in the network table;

concurrently receiving data packets during the multilink communication transfer at the requesting gateway data packets from the selected remote gateways; and

after receipt of the data packets, reassembling the data packets when the data packets are out of order.

REMARKS

Status of the Claims

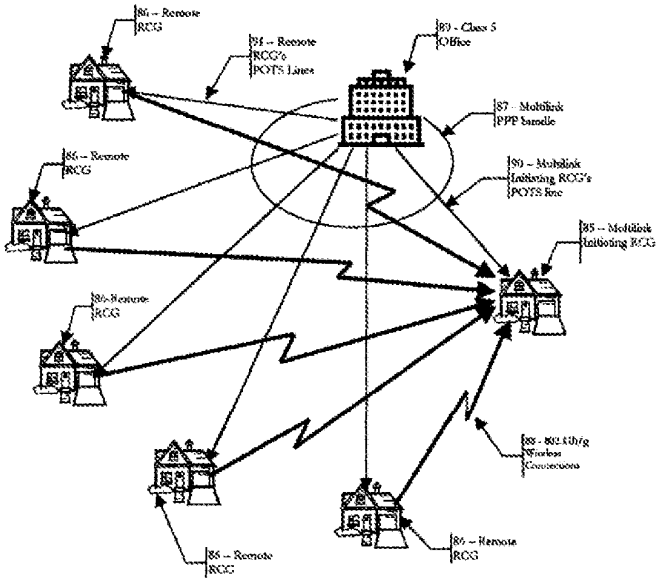
Claims 41-57 were pending and are still currently pending in this Amendment. Claims 1-40 were previously canceled. Claims 57-60 were previously withdrawn. Claims 41, 43-46, 48-50, and 53-57 have been amended. No new matter has been entered herein. All terms used in the amended claims are supported by the specification of the application.

35 U.S.C. § 112 Rejections

Starting on page 2 of the Office Action, claims 41-57 were rejected under 35 U.S.C. 112, first paragraph. In the interest of moving the prosecution forward without addressing the alleged merits of the §112 rejection, the claims have been amended to exactly match or closely match the language used in the specification. The applicant believes there is ample support in the specification for what was previously claimed and specifically reserves the right to use such deleted language in the future.

Figure 7 shows one embodiment of the present application which is applicable to claims 41-57. Figure 7 is reproduced below:

FIG.7



RED HAT 1008
RED HAT V. CAS

The multilink initiating RCG 85 is receiving first data over POTS line 90. The five RCG's shown in Fig. 7 are each receiving their data from the network via each of their own POTS line 91. Multilink initiating RCG 85 receives first data over POTS line 90 and concurrently receives data from remote RCGs 86 via wireless connections 88. In one embodiment of the present invention, this is referred to as a "Multilink PPP Connection" which is explained in detail in paragraphs 72-80 of the specification of the pending application, among other places. It is inherent in a "multilink PPP connection" that the multilink initiating RCG 85 receives data over multiple links (or paths) thereby fulfilling one of the main purposes of the invention which is to increase data transfer rate for a particular device. Fig. 7 undoubtedly shows a device that is able to establish multiple connections and can receive data over the multiple connections at the same time or separately.

It is respectfully requested that the rejection of claims 41-57 under 35 U.S.C. §112, first paragraph, be reconsidered and withdrawn.

35 U.S.C. § 102 Rejections

Starting on page 4 of the Office Action, claims 48-52 and 56 were rejected under 35 U.S.C. §102(e) as being anticipated by "Pung" (U.S. Appl. Publ. 2002-0150099). Amended independent claims 48 and 56 concern multilink communication such as shown in Figure 7 (above), which is never described or shown in the figures of Pung. Pung is deficient because Pung fails to describe or mention in claim 48 - "sending different groups of data packets over the at least one server network interface to at least two of the network communication interfaces of the device wherein the data transfer rate associated with the at least two of the network communication interfaces of the device provide an increased data transfer rate for the device which is receiving the data packets from the data server"; and in claim 56 - "controlling a data server where the data server sends different groups of data packets from the data server to the network communication interfaces of the second device wherein the data transfer rate associated with the network communication interfaces of the second device provide an increased data transfer rate at which the second device is receiving the data packets from the data server".

The Office Action cited to Figures 12A and 12B, element 12D, where element 12D is receiving a "multicast QoS connection" requests. There is nothing shown in Figures 12A and 12B of Pung or described in Pung that shows or describes "an increased data transfer rate" as cited in claims 48 and 56. Figures 12A-F of Pung illustrate the routing processes of the first receiver to join a multicast service offered by a multicast source. Multicasting is completely different from "multilink communication" as described and claimed in the present application, as shown in Figs. 7 and 8 and paragraphs 73-78 of the present invention. The purpose in Pung is solely concerned with multicasting which involves broadcasting the same information to many receivers at the same time. (See Pung, paragraphs 3, 4, 16 and 17). Thus, the purpose of multilink communication is different from the purpose of multicasting as described in Pung. The multicasting described in Pung is deficient and fails to describe or suggest what is required in amended independent claims 48 and 56.

Claim 49-52 are dependent on allowable independent claim 48, and thus are allowable for the same reasons provided above for claim 48. For these reasons, it is respectfully requested that the rejection of claims 48-52 and 56 under 35 U.S.C. § 102(e) based on Pung be reconsidered and withdrawn.

35 U.S.C. § 103 Rejections

Starting on page 6 of the Office Action, claims 41-47, 49, 53-55 and 57 were rejected under 35 U.S.C. §103(a) as being unpatentable over Pung in view of "Banga" (U.S. Appl. Publ. 20030135578). On page 8 of the Office Action, claim 46 was rejected under 35 U.S.C. §103(a) as being unpatentable over Pung and Banga and further in view of "Baldwin" (U.S. Appl. Publ. 20140122656).

In the Office Action, Banga was relied upon for allegedly disclosing "providing IP address (connection ID in claim 49) of network interface (paragraph [0015])", while Baldwin was relied upon for allegedly disclosing "aggregating packets after reordering them (paragraph [0038])". Neither Banga nor Baldwin were relied upon for disclosing the deficiencies noted above as to Pung. Therefore, claims 41-47, 49, 53-55 and 57 are also allowable for the same reasons provided above for distinguishing claims 48 and 56 over Pung. Therefore, it is respectfully requested that

the rejection of claims 41-47, 49, 53-55 and 57 under 35 U.S. C. §103 based on Pung and Banga, and claim 46 based on Pung, Banga and Baldwin be reconsidered and withdrawn.

Conclusion

All rejections in the Office Action have been properly traversed. It is respectfully requested that all outstanding rejections be reconsidered and withdrawn. It is believed that a full and complete reply has been made in response to the Office Action, and, that as such, the present patent application is in a condition for allowance.

It is noted that new claimed subject matter may be patentably distinguished from the cited references *for additional reasons*. It is also noted that any failure to comment directly upon any of the positions asserted in the Office Action does not indicate agreement or acquiescence with those asserted positions or allegations. Instead, it is believed that the foregoing sufficiently addresses the issues raised in the Office Action, and that the present claims are in condition for allowance.

The Examiner can always telephone the attorney of record at the telephone number provided below if such telephone discussion would help expedite the prosecution of the patent application. Prompt and favorable consideration of this Amendment is respectfully requested.

Respectfully Submitted,

Date: February 14, 2020

H C McGurk IV, Reg. No. 34,964
Attorney for Applicant

THE LAW OFFICE OF CLAY MCGURK
PO Box 1488
Orange, CA 92706
Phone: **949.395.3942**
Email: claymcgurk@gmail.com

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
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 displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/161,787	Filing Date 05/23/2016	☐ To be Mailed

ENTITY: ☐ LARGE ☑ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) 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 $40 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $210 =	
☐ 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	02/14/2020	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0		x $50 =	0
	Independent (37 CFR 1.16(h))	* 7	Minus	*** 7	= 0		x $230 =	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".	/JAMES E MASON/
*** 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.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/161,787	05/23/2016	Eric M. Delangis	ED 3000	3396

64828 7590 03/10/2020

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

EXAMINER	
CHO, HONG SOL	

ART UNIT	PAPER NUMBER
2467	

NOTIFICATION DATE	DELIVERY MODE
03/10/2020	ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

CLAYMCGURK@GMAIL.COM

PTOL-90A (Rev. 04/07)

RED HAT 1008
RED HAT V. CAS

Office Action Summary	**Application No.** 15/161,787	**Applicant(s)** Delangis, Eric M.	
	Examiner Hong S Cho	**Art Unit** 2467	**AIA (FITF) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 02/14/20.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☑ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance 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.

Disposition of Claims*

5) ☑ Claim(s) 41-57 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☑ Claim(s) 41-47,53-55 and 57 is/are allowed.

7) ☑ Claim(s) 48-52 and 56 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

DETAILED ACTION

Response to Amendment

2. This office action is in response to RCE filed on 02/14/2020. Claims 41-57 are pending in the instant application.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 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 of this title, 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 negatived by the manner in which the invention was made.

4. Claims 48-52 and 56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vilhuber (US 6470453) in view of Yamada et al (US 20010007557, "Yamada")

Re claims 48, 50 and 56, Vilhuber discloses receiving multilink packets over the at least one server network interface, each of the multilink packets associated with one or more of a plurality of network communication interfaces of a device that is capable of

RED HAT 1008
RED HAT V. CAS

being used to receive data packets, each of the network communication interfaces of the device having a data transfer rate associated with a separate path from the server to the device (figure 2, connections 204 and 206; column 7, lines 60-63; column 8, lines 60-65), but fails to explicitly disclose sending different groups of data packets over the at least one server network interface to at least two of the network communication interfaces of the device. However, Yamada discloses sending different groups of data packets over the at least one server network interface to at least two of the network communication interfaces of the device (figure 19). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of Vilhuber with Yamada for the benefit of accommodating a large data transfer by utilizing multiple network interfaces.

Re claim 49, Yamada discloses sending multilink session identification that is unique to the data packets being sent to the at least two of the network communication interfaces (figure 19, multi-path ID).

Re claim 50, Vilhuber discloses receiving one or more multilink packets, each of the one or more multilink packets is comprised of multilink information so that data packets can be sent over an additional one of the network communication interfaces (column 7, lines 60-63; column 8, lines 60-65), the additional one of the network communication interfaces of the device having a data transfer rate associated with a separate path from the server to the device and sending different groups of data packets over the at least one server network interface to the at least three of the network communication interfaces, wherein the data transfer rate associated with the at least three of the network communication interfaces of the device provide an increased data transfer

RED HAT 1008
RED HAT V. CAS

rate for the device which is receiving the data packets from the server (figure 4, third connection 406).

Re claim 51, Vilhuber discloses receiving multilink packets comprised of multilink information associated with which one of the network communication interfaces is to be removed from the multilink session (figure 3a, step 306, terminating a given connection).

Re claim 52, the modified system of Vilhuber discloses receiving different multilink packets over the at least one server network interface at different periods of time (sending packets after establishing additional connections implies receiving packets at different periods of time).

Allowable Subject Matter

5. Claims 41-47, 53-55 and 57 are allowed.

Response to Arguments

6. Applicant's arguments with respect to claims have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

RED HAT 1008
RED HAT V. CAS

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hong Cho whose telephone number is 571-272-3087. The examiner can normally be reached on Mon-Fri during 7 am to 4 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hassan Phillips can be reached on 571-272-3940. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/HONG S CHO/
Primary Examiner, Art Unit 2467

RED HAT 1008
RED HAT V. CAS

Notice of References Cited	Application/Control No. 15/161,787	Applicant(s)/Patent Under Reexamination Delangis, Eric M.	
	Examiner Hong S Cho	Art Unit 2467	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-6470453-B1	10-2002	Vilhuber; Jan	G06F21/577	709/225
	B					
	C					
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/161,787	Delangis, Eric M.
	Examiner	Art Unit
	Hong S Cho	2467

CPC - Searched*		
Symbol	Date	Examiner

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
H04M3/007 or H04L47/821 or H04M1/6033 or H04L45/54 or H04L69/168 or H04L61/2015 or H04L45/24 or H04W88/16 or H04L12/5692 or H04M2203/60 or H04M2250/06 or H04M2203/052 or H04W80/00 or H04W40/02 or H04W28/06 or H04W84/18 or H04W84/12 or H04W72/04 or H04W8/26 (EAST text search)	10/5/2016	hc
updated search	4/7/2017	hc
updated search	9/19/2017	hc
updated search	10/01/2018	hc
updated search	03/26/2019	hc
inventor search	03/26/2019	hc
updated search	08/13/2019	hc
updated search	03/05/2020	hc

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/161,787	Delangis, Eric M.
	Examiner	Art Unit
	Hong S Cho	2467

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/161,787	Delangis, Eric M.
	Examiner	**Art Unit**
	Hong S Cho	2467

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	02/25/2019	03/26/2019	08/13/2019	03/05/2020					
	1	-	-	-	-					
	2	-	-	-	-					
	3	-	-	-	-					
	4	-	-	-	-					
	5	-	-	-	-					
	6	-	-	-	-					
	7	-	-	-	-					
	8	-	-	-	-					
	9	-	-	-	-					
	10	-	-	-	-					
	11	-	-	-	-					
	12	-	-	-	-					
	13	-	-	-	-					
	14	-	-	-	-					
	15	-	-	-	-					
	16	-	-	-	-					
	17	-	-	-	-					
	18	-	-	-	-					
	19	-	-	-	-					
	20	-	-	-	-					
	21	-	-	-	-					
	22	-	-	-	-					
	23	-	-	-	-					
	24	-	-	-	-					
	25	-	-	-	-					
	26	-	-	-	-					
	27	-	-	-	-					
	28	-	-	-	-					
	29	-	-	-	-					
	30	-	-	-	-					
	31	-	-	-	-					
	32	-	-	-	-					
	33	-	-	-	-					
	34	-	-	-	-					
	35	-	-	-	-					
	36	-	-	-	-					
	37	-	-	-	-					
	38	-	-	-	-					
	39	-	-	-	-					
	40	-	-	-	-					
	41	÷	✓	✓	=					
	42	÷	✓	✓	=					

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/161,787	Delangis, Eric M.
	Examiner	**Art Unit**
	Hong S Cho	2467

CLAIM		DATE								
Final	Original	02/25/2019	03/26/2019	08/13/2019	03/05/2020					
	43	÷	✓	✓	=					
	44	÷	✓	✓	=					
	45	÷	✓	✓	=					
	46	÷	✓	✓	=					
	47	÷	✓	✓	=					
	48	÷	✓	✓	✓					
	49	÷	✓	✓	✓					
	50	÷	✓	✓	✓					
	51	÷	✓	✓	✓					
	52	÷	✓	✓	✓					
	53	÷	✓	✓	=					
	54	÷	✓	✓	=					
	55	÷	✓	✓	=					
	56	÷	✓	✓	✓					
	57	÷	✓	✓	=					
	58	÷	N	N	N					
	59	÷	N	N	N					
	60	÷	N	N	N					

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L2	27	L1 and request$3 with multi near (path or link) with connection	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/03/05 09:50
L1	330759	(H04M3/007 or H04L47/821 or H04M1/6033 or H04L45/54 or H04L69/168 or H04L61/2015 or H04L45/24 or H04W88/16 or H04L12/5692 or H04M2203/60 or H04M2250/06 or H04M2203/052 or H04W80/00 or H04W40/02 or H04W28/06 or H04W84/18 or H04W84/12 or H04W72/04 or H04W8/26).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/03/05 09:50
L5	0	L3 and request$3 with multi near (path or link)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/03/05 09:51
L3	17	((Eric) near2 (Delangis)).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/03/05 09:51
L6	7	l2 and (@pd or @ptad or @prad or @ad or @rlad)<"20021015"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/03/05 09:52
L10	12	network near interface$1 with different with data near transfer near rate$1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/03/05 10:15
L11	9	l10 and (@pd or @ptad or @prad or @ad or @rlad)<"20021015"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/03/05 10:16
L13	71	server and request$3 with multi near (path or link) with connection	US-PGPUB; USPAT;	OR	OFF	2020/03/05 10:52

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
L14	16	l13 and (@pd or @ptad or @prad or @ad or @rlad)<"20021015"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/03/05 10:53
L15	35	(US-20060079274-$ or US-20030202468-$ or US-20030063591-$ or US-20040090924-$ or US-20020102987-$ or US-20090150924-$ or US-20030137959-$ or US-20020150099-$ or US-20010037472-$ or US-20010007557-$ or US-20020106065-$ or US-20020193115-$ or US-20030191848-$ or US-20020055982-$ or US-20030016664-$ or US-20010036161-$ or US-20140122656-$).did. or (US-7257106-$ or US-6307839-$ or US-7385924-$ or US-7308279-$ or US-7068623-$ or US-6249669-$ or US-6941151-$ or US-7426316-$ or US-7562110-$ or US-7889181-$ or US-7035914-$ or US-7065090-$ or US-8285802-$ or US-7653089-$ or US-6496477-$ or US-5483522-$ or US-7315900-$ or US-6704794-$).did.	US-PGPUB; USPAT	OR	OFF	2020/03/05 11:01
L18	5	l15 and multi near (path or link)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/03/05 11:04
L20	207	client same server with multi near (path or link)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/03/05 11:10
L23	4	l22 and (@pd or @ptad or @prad or @ad or @rlad)<"20021015"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/03/05 11:11
L22	35	l20 and interface$1 with different	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/03/05 11:11
L24	12	l15 and client with server	US-PGPUB; USPAT; USOCR;	OR	OFF	2020/03/05 11:14

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
L26	5	l25 and (@pd or @ptad or @prad or @ad or @rlad)<"20021015"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/03/05 11:19
L25	19	client with request$3 with multi near (path or link) with connection$1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/03/05 11:19
L29	23	l28 and (@pd or @ptad or @prad or @ad or @rlad)<"20021015"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/03/05 11:23
L28	72	establish$4 with multi near (path or link) near connection$1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/03/05 11:23
L30	32	l15 and (@pd or @ptad or @prad or @ad or @rlad)<"20021015"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/03/05 11:29
L36	31	l35 and (@pd or @ptad or @prad or @ad or @rlad)<"20021015"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/03/05 11:39
L35	110	client with request$3 with multiple near connection$1 with server	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/03/05 11:39
L38	13	l37 and (@pd or @ptad or @prad or @ad or @rlad)<"20021015"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/03/05 11:53
L37	23	ppp near multilink near connection	US-PGPUB;	OR	OFF	2020/03/05

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			11:53
L39	10	ppp near multilink near connection and url	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/03/05 12:17
L41	7	l40 and distribut$3 with packet$1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/03/05 13:07
L40	37	(US-20060079274-$ or US-20030202468-$ or US-20030063591-$ or US-20040090924-$ or US-20020102987-$ or US-20090150924-$ or US-20030137959-$ or US-20020150099-$ or US-20010037472-$ or US-20010007557-$ or US-20020106065-$ or US-20020193115-$ or US-20030191848-$ or US-20020055982-$ or US-20030016664-$ or US-20010036161-$ or US-20140122656-$).did. or (US-7257106-$ or US-6307839-$ or US-7385924-$ or US-7308279-$ or US-7068623-$ or US-6249669-$ or US-6941151-$ or US-7426316-$ or US-7562110-$ or US-7889181-$ or US-7035914-$ or US-7065090-$ or US-8285802-$ or US-7653089-$ or US-6496477-$ or US-5483522-$ or US-7315900-$ or US-6704794-$ or US-6577644-$ or US-6470453-$).did.	US-PGPUB; USPAT	OR	OFF	2020/03/05 13:07

3/5/2020 2:03:43 PM
C:\Users\hcho\Documents\EAST\Workspaces\15161787.wsp

To: CLAYMCGURK@GMAIL.COM,,
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 64828

Mar 10, 2020 03:43:19 AM

Dear PAIR Customer:

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

The following USPTO patent application(s) associated with your Customer Number, 64828 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

Disclaimer:
The list of documents shown below is provided as a courtesy and is not part of the official file wrapper. The content of the images shown in PAIR is the official record.

Application	Document	Mailroom Date	Attorney Docket No.
15161787	CTNF	03/10/2020	ED 3000
	892	03/10/2020	ED 3000

To view your correspondence online or update your email addresses, please visit us anytime at https://sportal.uspto.gov/secure/myportal/privatepair.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

Electronic Acknowledgement Receipt

EFS ID:	39686376
Application Number:	15161787
International Application Number:	
Confirmation Number:	3396
Title of Invention:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
First Named Inventor/Applicant Name:	Eric M. Delangis
Customer Number:	64828
Filer:	Harold C. McGurk
Filer Authorized By:	
Attorney Docket Number:	ED 3000
Receipt Date:	10-JUN-2020
Filing Date:	23-MAY-2016
Time Stamp:	20:37:37
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment/Req. Reconsideration-After Non-Final Reject	15161787_Amendment_6-10-2020.pdf	279306 6b3bfc77b0faef05da4d154400f8607e67e9a45b	no	12

Warnings:

RED HAT 1008
RED HAT V. CAS

Information:	
Total Files Size (in bytes):	279306

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 a 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.

RED HAT 1008
RED HAT V. CAS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.:	**15/161,787**	EXAMINER:	HONG CHO
INVENTOR:	Eric M. Delangis	GROUP ART UNIT:	2467
FILED:	OCTOBER 11, 2014	CONFIRMATION NO.:	3396
TITLE:	Multipath Communication Devices and Methods		
ATTORNEY NO:	ED 3000		

AMENDMENT

In response to the final Office Action issued on March 10, 2020 ("Office Action"), please reconsider the above-identified application due to the following amendments and accompanying remarks.

CERTIFICATE OF ELECTRONIC (EFS-WEB) TRANSMISSION

I hereby certify that this correspondence is being transmitted via the U.S. Patent Office's electronic filing system in accordance with 37 C.F.R. § 1.8(a)(1) from the **Pacific Time Zone** of the United States on the local date shown below.

Dated: June 10, 2020

By: Clay McGurk

Clay McGurk

RED HAT 1008
RED HAT V. CAS

IN THE CLAIMS

This listing of claims will replace all prior versions and listings of the claims in the application:

1-40. (Cancelled).

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 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.

42. (Previously Presented) The client device of claim 41, 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.

43. (Previously Presented) The client device of claim 41, wherein a server provides the multilink session identification that is unique to the multilink session.

44. (Previously Presented) The client device of claim 41, 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.

45. (Previously Presented) The client device of claim 41, 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.

46. (Previously Presented) The client device of claim 41, 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.

47. (Previously Presented) The client device of claim 41, 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.

48. (Currently Amended) 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 ~~packets~~ over the at least one server network interface, ~~each of~~ the first multilink packet comprised of a request for a multilink communication and first information ~~packets~~ associated with ~~one or more of~~ a ~~plurality of~~ first network communication ~~interfaces~~ interface of the device that is capable of being used by the device to receive data packets~~, each of the network communication interfaces of the device having a data transfer rate associated with a separate path from the server to the device~~;

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 ~~sending~~ 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 ~~to at least two of the network communication interfaces of the device wherein the data transfer rate associated with the at least two of the network communication interfaces of the device provide an increased data transfer rate for the device which is receiving the data packets from the data server~~.

49. (Currently Amended) The server of claim 48, wherein the one or more processors is further configured to send ~~a~~ the multilink session identification that is unique to the data packets being sent to the ~~at least two of the~~ first network communication ~~interfaces~~ interface and the second network communication interface.

50. (Currently Amended) The server of claim 48, wherein the one or more processors is further configured to:

receive ~~one or more~~ a third multilink ~~packets~~ packet, ~~each of~~ the ~~one or more~~ third multilink ~~packets~~ 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 ~~so that data packets can be sent over an additional one of the network communication interfaces, the additional one of the network communication interfaces of the device having a data transfer rate associated with a separate path from the server to the device~~; and

send ~~sending~~ different groups of data packets ~~over the at least one server network interface to the at least three of the network communication interfaces, wherein the data transfer rate associated with the at least three of the network communication interfaces of the device provide an increased data transfer rate for the device which is receiving the data packets from the server~~ 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.

51. (Currently Amended) The server of claim 48, 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 ~~the network communication interfaces~~ is to be removed from the multilink session.

52. (Previously Presented) The server of claim 48, 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.

53. (Previously Presented) 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.

54. (Previously Presented) The first device of claim 53, wherein the first device and the second device are separate devices or separate parts of the same device.

55. (Previously Presented) The first device of claim 53, 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.

56. (Currently Amended) 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, ~~each of the network communication interfaces of the second device having a data transfer rate associated therewith~~;

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 ~~the~~ network communication interfaces of the second device, wherein ~~the~~ each of the different groups of data packets includes the multilink session identification ~~data transfer rate associated with the network communication interfaces of the second device provide an increased data transfer rate at which the second device is receiving the data packets from the data server~~.

57. (Previously Presented) 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.

RED HAT 1008
RED HAT V. CAS

58. (Withdrawn) A device comprising:

at least one interface which is capable of connecting to a first network;

at least one wireless interface which is capable of wirelessly connecting to at least one network; and

at least one processor that:

monitors a current status of availability, operability and throughput capability of the first network and the second network to determine whether the first network and the second network are capable of participating in a multilink communication;

selects the at least one interface and the at least one wireless interface based on the current status;

receives data packets via the selected at least one interface and the selected at least one wireless interface during the multilink communication.

59. (Withdrawn) The device of claim 58, wherein the at least one interface is at least one of a cellular interface, a WiFi interface an ethernet interface, and fiber optics interface; and

wherein the at least one wireless interface is at least one of a cellular interface, a WiFi interface, a Bluetooth interface, and a micro-cell interface.

60. (Withdrawn) A method for sharing and dynamically allocating data transfer rate from a plurality of wired and wireless networks, the method comprising the steps of:

developing and updating a network table that comprises information about a list of remote gateways, data transfer rate capabilities and quality of service of each of the remote gateways;

selecting one or more of the remote gateways to support a multilink communication transfer for the requesting gateway based upon the information in the network table;

concurrently receiving data packets during the multilink communication transfer at the requesting gateway data packets from the selected remote gateways; and

after receipt of the data packets, reassembling the data packets when the data packets are out of order.

REMARKS

Status of the Claims

Claims 41-57 were pending and are still currently pending in this Amendment. Claims 1-40 had been previously canceled. Claims 57-60 had been previously withdrawn. Claims 41-47 53-55 and 57 have been indicated as allowed in the Office Action. Claims 48-52 and 56 have been amended. No new matter has been entered herein. All terms used in the amended claims are supported by the specification of the application.

35 U.S.C. § 103 Rejections

Starting on page 2 of the Office Action, claims 48-52 and 56 were rejected under 35 U.S.C. §103(a) as being unpatentable over "Vilhuber" (USP 6470453) in view of "Yamada" (U.S. Appl. Publ. 20010007557). For Vilhuber, the examiner relied Fig. 2 (connections 204, 206); 7/60-63; and, 8/60-65. The examiner admitted that Vilhuber "fails to explicitly disclose sending different groups of data over the at least one server network interface to at least two of the network communication interfaces of the device." (Office Action, page 3, first paragraph). For Yamada, the examiner relied on Fig. 19 to make up for the deficiencies of Vilhuber.

Vilhuber not only fails to disclose what the examiner admitted in the Office Action, but also fails to describe a "multilink session identification" as recited in amended independent claims 48 and 56. Vilhuber describes a process for authenticating multiple connections between a server and a computer so that the user does not have to re-authenticate when a new connection is used. (See Vilhuber, Abstract). There is no mention of a "multilink session identification" in Vilhuber.

Yamada fails to make up for the deficiencies of Vilhuber. In Yamada, a "multi-path identifier" is described to be where the "routing determining section determines a **multi-path identifier** to uniquely identify a transfer path serving or a plurality of transfer destination routes as the transfer destination route, based on the destination address data. (Yamada, ¶ 47, p. 4, first column, last sentence). In Yamada, the multi-path identifier is not equivalent to the "multilink session identification" because Yamada uses it for the identification of a transfer path,

RED HAT 1008
RED HAT V. CAS

rather than to identify the "session" for which data will be/is to be transferred. As stated in the specification for the current application, page 17, ¶ 77, "[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.**" Thus, the "multilink session identification" is not comparable to the "multi-path identifier" of Yamada.

Moreover, Yamada is a simple datagram apparatus where if one path becomes unusable, the datagram apparatus selects another path. (Yamada, Abstract; ¶ 35). This is not a "multilink connection" as recited in amended independent claims 48 and 56, and as shown in Figs. 7-9 and the related description.

Claims 49-52 are dependent on allowable amended independent claim 48 and are allowable for the same reasons discussed above. Therefore, it is respectfully requested that the rejection of claims 48-52 and 56 under 35 U.S. C. §103 based on Vilhuber and Yamada be reconsidered and withdrawn.

Conclusion

All rejections in the Office Action have been properly traversed. It is respectfully requested that all outstanding rejections be reconsidered and withdrawn. It is believed that a full and complete reply has been made in response to the Office Action, and, that as such, the present patent application is in a condition for allowance.

It is noted that new claimed subject matter may be patentably distinguished from the cited references for additional reasons not discussed above. It is also noted that any failure to comment directly upon any of the positions asserted in the Office Action does not indicate agreement or acquiescence with those asserted positions or allegations. Instead, it is believed that the foregoing sufficiently addresses the issues raised in the Office Action, and that the present claims are in condition for allowance.

The Examiner can always telephone the attorney of record at the telephone number provided below if such telephone discussion would help expedite the prosecution of the patent application. Prompt and favorable consideration of this Amendment is respectfully requested.

RED HAT 1008
RED HAT V. CAS

Respectfully Submitted,

Date: June 10, 2020

H C McGurk IV, Reg. No. 34,964
Attorney for Applicant

THE LAW OFFICE OF CLAY MCGURK
PO Box 1488
Orange, CA 92706
Phone: **949.395.3942**
Email: claymcgurk@gmail.com

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

64828 7590 08/12/2020

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

EXAMINER
CHO, HONG SOL

ART UNIT	PAPER NUMBER
2467	

DATE MAILED: 08/12/2020

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/161,787	05/23/2016	Eric M. Delangis	ED 3000	3396

TITLE OF INVENTION: DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$500	$0.00	$0.00	$500	11/12/2020

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

64828 7590 08/12/2020

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

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/161,787	05/23/2016	Eric M. Delangis	ED 3000	3396

TITLE OF INVENTION: DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$500	$0.00	$0.00	$500	11/12/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
CHO, HONG SOL	2467	370-235000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1_____
2_____
3_____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑Issue Fee ❑Publication Fee (if required) ❑Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/161,787	05/23/2016	Eric M. Delangis	ED 3000	3396

64828 7590 08/12/2020

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

EXAMINER	
CHO, HONG SOL	

ART UNIT	PAPER NUMBER
2467	

DATE MAILED: 08/12/2020

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

PTOL-85 (Rev. 02/11)

RED HAT 1008
RED HAT V. CAS

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. 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 30 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, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

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.

RED HAT 1008
RED HAT V. CAS

Notice of Allowability	Application No. 15/161,787	Applicant(s) Delangis, Eric M.	
	Examiner Hong S Cho	Art Unit 2467	AIA (FITF) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to 06/10/2020.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 41-57 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐All b) ☐ Some *c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☐ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/HONG S CHO/
Primary Examiner, Art Unit 2467

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/161,787	Delangis, Eric M.
	Examiner	Art Unit
	Hong S Cho	2467

CPC - Searched*		
Symbol	Date	Examiner

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
H04M3/007 or H04L47/821 or H04M1/6033 or H04L45/54 or H04L69/168 or H04L61/2015 or H04L45/24 or H04W88/16 or H04L12/5692 or H04M2203/60 or H04M2250/06 or H04M2203/052 or H04W80/00 or H04W40/02 or H04W28/06 or H04W84/18 or H04W84/12 or H04W72/04 or H04W8/26 (EAST text search)	10/5/2016	hc
updated search	4/7/2017	hc
updated search	9/19/2017	hc
updated search	10/01/2018	hc
updated search	03/26/2019	hc
inventor search	03/26/2019	hc
updated search	08/13/2019	hc
updated search	03/05/2020	hc
updated search	08/04/2020	hc

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/161,787	Delangis, Eric M.
	Examiner	Art Unit
	Hong S Cho	2467

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
	see search history printout	08/04/2020	hc

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/161,787	Delangis, Eric M.
	Examiner	**Art Unit**
	Hong S Cho	2467

CPC							
Symbol						**Type**	**Version**
H04M	/	3	/	007		F	2013-01-01
H04L	/	12	/	5692		I	2013-01-01
H04W	/	88	/	16		I	2013-01-01
H04L	/	45	/	24		I	2013-01-01
H04L	/	45	/	54		I	2013-01-01
H04L	/	47	/	821		I	2013-01-01
H04L	/	61	/	2015		I	2013-01-01
H04L	/	69	/	168		I	2013-01-01
H04M	/	1	/	6033		I	2013-01-01
H04W	/	8	/	26		A	2013-01-01
H04W	/	28	/	06		A	2013-01-01
H04W	/	40	/	02		A	2013-01-01
H04W	/	72	/	04		A	2013-01-01
H04W	/	80	/	00		A	2013-01-01
H04W	/	84	/	12		A	2013-01-01
H04W	/	84	/	18		A	2013-01-01
Y02D	/	30	/	70		A	2020-08-01
H04M	/	2203	/	052		A	2013-01-01
H04M	/	2203	/	60		A	2013-01-01
H04M	/	2250	/	06		A	2013-01-01

CPC Combination Sets									
Symbol						**Type**	**Set**	**Ranking**	**Version**
	/		/						

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 17	
/HONG S CHO/ Primary Examiner, Art Unit 2467 (Primary Examiner)	04 August 2020 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 7

U.S. Patent and Trademark Office — Part of Paper No.: 20200804

RED HAT 1008
RED HAT V. CAS

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/161,787	Delangis, Eric M.
	Examiner	**Art Unit**
	Hong S Cho	2467

INTERNATIONAL CLASSIFICATION				
CLAIMED				
H04M	/	3	/	00
H04L	/	12	/	707
H04L	/	12	/	54
H04W	/	40	/	02
H04L	/	12	/	911
	/		/	

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	17	
/HONG S CHO/ Primary Examiner, Art Unit 2467	04 August 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	7

U.S. Patent and Trademark Office — Part of Paper No.: 20200804

RED HAT 1008
RED HAT V. CAS

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/161,787	Delangis, Eric M.
	Examiner	**Art Unit**
	Hong S Cho	2467

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	41	10	50												
2	42	11	51												
3	43	12	52												
4	44	13	53												
5	45	14	54												
6	46	15	55												
7	47	16	56												
8	48	17	57												
9	49														

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 17	
/HONG S CHO/ Primary Examiner, Art Unit 2467 (Primary Examiner)	04 August 2020 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 7

U.S. Patent and Trademark Office — Part of Paper No.: 20200804

RED HAT 1008
RED HAT V. CAS

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	17	((Eric) near2 (Delangis)).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/08/04 10:08
L2	1	L1 and multi near (path or link)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/08/04 10:08
L3	350,067	(H04M3/007 or H04L47/821 or H04M1/6033 or H04L45/54 or H04L69/168 or H04L61/2015 or H04L45/24 or H04W88/16 or H04L12/5692 or H04M2203/60 or H04M2250/06 or H04M2203/052 or H04W80/00 or H04W40/02 or H04W28/06 or H04W84/18 or H04W84/12 or H04W72/04 or H04W8/26).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/08/04 10:09
L4	293	L3 and multi near (path or link) with connection	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/08/04 10:09
L5	36	l4 and (@pd or @ptad or @prad or @ad or @rlad)<"20021015"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/08/04 10:10
L13	5	multi near (path or link) near session with (id or identifier or identification)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/08/04 11:08
L14	10	(multi near (path or link) and url).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/08/04 11:09

L15	6	(packet$1 with multi near (path or link) near (id or identifier or identification)).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/08/04 11:14

8/4/2020 11:14:56 AM
C:\Users\hcho\Documents\EAST\Workspaces\15161787.wsp

RED HAT 1008
RED HAT V. CAS

Bibliographic Data

Application No: 15/161,787

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☑ Met After Allowance

Verified and Acknowledged: /HONG S CHO/ (Examiner's Signature) H.S.C (Initials)

Title: DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
05/23/2016	370	2467	ED 3000
RULE			

APPLICANTS

INVENTORS

Eric M. Delangis, Huntsville, AL, UNITED STATES

CONTINUING DATA

This application is a CON of 14512414 10/11/2014 PAT 9350649

14512414 is a CON of 13531294 06/22/2012 PAT 8861349

13531294 is a CON of 12581852 10/19/2009 PAT 8228801

12581852 is a CON of 10686375 10/14/2003 PAT 7606156

10686375 has PRO of 60418521 10/15/2002

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

06/07/2016

**** SMALL ENTITY ****

STATE OR COUNTRY

UNITED STATES

ADDRESS

Harold McGurk

The Law Office of Clay McGurk

P.O. BOX 1488

Orange, CA 92856

UNITED STATES

FILING FEE RECEIVED

$730

RED HAT 1008
RED HAT V. CAS

To: CLAYMCGURK@GMAIL.COM,,
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 64828

Aug 12, 2020 03:46:53 AM

Dear PAIR Customer:

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

The following USPTO patent application(s) associated with your Customer Number, 64828 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

Disclaimer:
The list of documents shown below is provided as a courtesy and is not part of the official file wrapper. The content of the images shown in PAIR is the official record.

Application	Document	Mailroom Date	Attorney Docket No.
15161787	NOA	08/12/2020	ED 3000

To view your correspondence online or update your email addresses, please visit us anytime at https://sportal.uspto.gov/secure/myportal/privatepair.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

RED HAT 1008
RED HAT V. CAS

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

64828 7590 08/12/2020

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

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/161,787	05/23/2016	Eric M. Delangis	ED 3000	3396

TITLE OF INVENTION: DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$500	$0.00	$0.00	$500	11/12/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
CHO, HONG SOL	2467	370-235000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Clay McGurk
2 The Law Office of Clay McGurk
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ☒ Issue Fee ❑ Publication Fee (if required) ❑ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

☒ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date November 10, 2020

Typed or printed name H C McGurk IV Registration No. 34,964

RED HAT 1008
RED HAT V. CAS

Electronic Patent Application Fee Transmittal

Application Number:	15161787
Filing Date:	23-May-2016
Title of Invention:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
First Named Inventor/Applicant Name:	Eric M. Delangis
Filer:	Harold C. McGurk
Attorney Docket Number:	ED 3000

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	2501	1	500	500

RED HAT 1008
RED HAT V. CAS

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**500**

RED HAT 1008
RED HAT V. CAS

Electronic Acknowledgement Receipt

EFS ID:	41089425
Application Number:	15161787
International Application Number:	
Confirmation Number:	3396
Title of Invention:	DEVICES AND METHODS FOR MULTIPATH COMMUNICATIONS
First Named Inventor/Applicant Name:	Eric M. Delangis
Customer Number:	64828
Filer:	Harold C. McGurk
Filer Authorized By:	
Attorney Docket Number:	ED 3000
Receipt Date:	10-NOV-2020
Filing Date:	23-MAY-2016
Time Stamp:	19:10:55
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$500
RAM confirmation Number	E2020A0J13329112
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

RED HAT 1008
RED HAT V. CAS

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	15161787_PartB_11-10-2020.pdf	2827858 ed5c8644d52e917bf2eea6a12ab7fe20b2d3aa17	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30097 dc634f983c5894ba58c074ff46c5591da145e03a	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	2857955		

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 a 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.

RED HAT 1008
RED HAT V. CAS

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/161,787	12/15/2020	10868908	ED 3000	3396

64828 7590 11/24/2020

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

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Eric M. Delangis, Huntsville, AL;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

To: CLAYMCGURK@GMAIL.COM,,
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 64828

Nov 25, 2020 04:22:31 AM

Dear PAIR Customer:

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

The following USPTO patent application(s) associated with your Customer Number, 64828 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

Disclaimer:
The list of documents shown below is provided as a courtesy and is not part of the official file wrapper. The content of the images shown in PAIR is the official record.

Application	Document	Mailroom Date	Attorney Docket No.
15161787	ISSUE.NTF	11/24/2020	ED 3000

To view your correspondence online or update your email addresses, please visit us anytime at https://sportal.uspto.gov/secure/myportal/privatepair.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

RED HAT 1008
RED HAT V. CAS

AO 120 (Rev. 08/10)

TO:	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Eastern District of Texas on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
2:22-cv-287	7/27/2022	Eastern District of Texas

PLAINTIFF	DEFENDANT
Competitive Access Systems, Inc.	Oracle Corporation and Oracle America, Inc.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	8,228,801	7/24/2012	Competitive Access Systems, Inc.
2	9,350,649	5/24/2016	Competitive Access Systems, Inc.
3	10,868,908	12/15/2020	Competitive Access Systems, Inc.
4			
5			

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

Copy 1—Upon initiation of action, mail this copy to Director **Copy 3—Upon termination of action, mail this copy to Director**
Copy 2—Upon filing document adding patent(s), mail this copy to Director **Copy 4—Case file copy**

RED HAT 1008
RED HAT V. CAS

AO 120 (Rev. 08/10)

TO:	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
Mail Stop 8 **Director of the U.S. Patent and Trademark Office** **P.O. Box 1450** **Alexandria, VA 22313-1450**	

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Western Districtof Texas on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
1:23-cv-286	3/16/2022	Western District of Texas

PLAINTIFF	DEFENDANT
Competitive Access Systems, Inc.	Oracle Corporation and Oracle America, Inc.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	8,228,801	7/24/2012	Competitive Access Systems, Inc.
2	9,350,649	5/24/2016	Competitive Access Systems, Inc.
3	10,868,908	12/15/2020	Competitive Access Systems, Inc.
4			
5			

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE
PHILIP J. DEVLIN		03/20/2023

Copy 1—Upon initiation of action, mail this copy to Director **Copy 3—Upon termination of action, mail this copy to Director**
Copy 2—Upon filing document adding patent(s), mail this copy to Director **Copy 4—Case file copy**

RED HAT 1008
RED HAT V. CAS

AO 120 (Rev. 08/10)

TO:	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
Mail Stop 8 **Director of the U.S. Patent and Trademark Office** **P.O. Box 1450** **Alexandria, VA 22313-1450**	

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court for the District of Arizona on the following

☑ Trademarks or ☐ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
2:23-cv-00368-DWL	3/1/2023	for the District of Arizona

PLAINTIFF	DEFENDANT
Christian Copyright Licensing International, LLC	Multitracks.com LLC

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	U.S. Reg. No. 4,872,	12/15/2015	Multitracks.com LLC
2			
3			
4			
5			

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE
DEBRA LUCAS		3/10/23

Copy 1—Upon initiation of action, mail this copy to Director **Copy 3—Upon termination of action, mail this copy to Director**
Copy 2—Upon filing document adding patent(s), mail this copy to Director **Copy 4—Case file copy**

RED HAT 1008
RED HAT V. CAS

Patent Trial and Appeal Board

A petition has been filed in Patent Number 10,868,908 B2, Application Number 15/161,787 on March 1, 2023.

The AIA Review Number is IPR2023-00584.

To view the documents filed in this petition, go to https://ptab.uspto.gov and Search for the AIA Review Number.

- Enter your search criteria on the “Search PTAB” page
- Type in the AIA Review Number or Patent Number
- You will need to answer the CAPTCHA to prove that you are not a robot.
- Click on the “Search” button
- The search results will appear identifying the AIA Review Number
- Click on the “View Documents” button
- A pop up window will appear with a list of documents
- Click on the “Download” button to download the document.

Questions regarding this notice should be directed to the Patent Trial and Appeal Board at 571-272-7822.

RED HAT 1008
RED HAT V. CAS

Trials@uspto.gov
571-272-7822

Paper 11
Date: October 2, 2023

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

UNIFIED PATENTS, LLC,
Petitioner,

v.

COMPETITIVE ACCESS SYSTEMS, INC.,
Patent Owner.

IPR2023-00584
Patent 10,868,908 B2

Before BARBARA A. PARVIS, STEVEN M. AMUNDSON, and JASON M. REPKO, *Administrative Patent Judges.*

PARVIS, *Administrative Patent Judge.*

DECISION
Dismissal Prior to Institution of Trial
35 U.S.C. § 314

RED HAT 1008
RED HAT V. CAS

I. INTRODUCTION

On March 1, 2023, Unified Patents, LLC ("Petitioner") filed a Petition (Paper 1 ("Pet.")[1]) requesting an *inter partes* review of claims 1–3, 5, 6, and 13–15 ("challenged claims") of U.S. Patent No. 10,868,908 B2 (Ex. 1001, "the '908 patent"). On July 14, 2023, Competitive Access Systems, Inc. ("Patent Owner") filed a Preliminary Response. Paper 6 ("Prelim. Resp."). On September 28, 2023, with the Board's authorization,[2] Petitioner filed a Joint Motion to Terminate This Proceeding. Paper 10 ("Mot." or "Motion").

Petitioner contends that it "has recently sought to reallocate its resources in light of budget constraints and does not wish to expend further resources on this matter." Mot. 2; *see also id.* at 2–3 (contending that Petitioner "seeks to reallocate its budgets and resources," Petitioner "does not wish to spend additional resources on this proceeding," and "Patent Owner would not be prejudiced by dismissal and the Board's subsequent termination of this matter"). Petitioner represents "the parties have no other dispute" and "the termination of this proceeding will not affect any other proceedings before the Board." *Id.* at 2–3. Petitioner asserts that IPR2023-00880 "relates to a different patent (9,350,649)," which Petitioner refers to as the '649 Patent. *Id.* at 3. Petitioner represents that "[b]oth the '908 Patent and the '649 Patent are currently asserted in litigation against Oracle Corporation et al., and that case is in the claim construction phase." *Id.* Petitioner argues the "preservation of resources would be real and substantial for the Board and the parties." *Id.* at 2.

---

[1] Petitioner filed, with the Board's authorization, a Corrected Petition (Paper 7) to correct annotations to certain figures. *See* Ex. 1020.
[2] On September 21, 2023, we granted authorization for the parties to file a motion to dismiss and terminate the proceeding. *See* Ex. 3001.

Petitioner represents that the "parties conferred on September 20, 2023, and agreed to this motion" and "Petitioner and Patent Owner submit this motion to terminate IPR2023-00584 under 37 C.F.R. § 42.71(a)." Mot. 2. In its Motion, Petitioner represents that "beyond conferring with Patent Owner regarding its position on this motion, there are no agreements between the parties, written or otherwise." Mot. 3. Accordingly, Petitioner has nothing to submit under 35 U.S.C. 317(b) or 37 C.F.R. § 42.74(b). Mot. 3.

Having considered Petitioner's Motion, we determine that it is appropriate to dismiss the Petition and terminate the proceeding as to both Petitioner and Patent Owner without rendering either a decision to institute or a final written decision. *See* 37 C.F.R. §§ 42.5(a), 42.71(a) ("The Board . . . may grant, deny, or dismiss any petition or motion."). This case is in the preliminary proceeding stage. *See id.* § 42.2 (preliminary proceeding begins with the filing of a petition for instituting a trial and ends with a written decision as to whether trial will be instituted). No decision whether to institute a trial has been made. Under the circumstances, we find that dismissal of the Petition and termination of the proceeding at this stage will promote efficiency and avoid incurring unnecessary costs.

Accordingly, we grant the Joint Motion to Terminate This Proceeding and dismiss all further proceedings in IPR2023-00584.

This Order does not constitute a final written decision under 35 U.S.C. § 318(a).

II. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that the Joint Motion to Terminate This Proceeding (Paper 10) is granted;

FURTHER ORDERED that the Petition (Papers 1, 7) is dismissed; and

FURTHER ORDERED that IPR2023-00584 is terminated.

FOR PETITIONER:

Michelle Aspen
Ellyar Barazesh
Roshan Mansinghani
UNIFIED PATENTS, LLC
michelle@unifiedpatents.com
ellyar@unifiedpatents.com
roshan@unifiedpatents.com

FOR PATENT OWNER:

Jason A. Engel
Katherine L. Allor
Nolan R. Hubbard
Samuel P. Richey
K&L GATES LLP
Jason.Engel.PTAB@klgates.com
Katy.Allor@klgates.com
Nolan.Hubbard@klgates.com
Samuel.Richey@klgates.com

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/161,787	05/23/2016	Eric M. Delangis	ED 3000

CONFIRMATION NO. 3396

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

POWER OF ATTORNEY NOTICE

OC000000076525672

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/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/161,787	05/23/2016	Eric M. Delangis	ED 3000

CONFIRMATION NO. 3396

29156
K&L Gates LLP-ADMINRPL
P.O. Box 1135
CHICAGO, IL 60690

POA ACCEPTANCE LETTER

OC000000076525738

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/

RED HAT 1008
RED HAT V. CAS

PTO/AIA/81B (07-13)
Approved for use through 09/30/2025. OMB 0651-0035
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 displays a valid OMB control number

REEXAMINATION OR SUPPLEMENTAL EXAMINATION – PATENT OWNER POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS FOR REEXAMINATION OR SUPPLEMENTAL EXAMINATION AND PATENT

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

I. Power of Attorney. This form may be used to change the Power of Attorney in a reexamination or supplemental examination proceeding (or multiple proceedings where merged). This form may also be used to change the Power of Attorney in the patent file; in such a case, a copy of this form will be placed in both the patent file and the reexamination or supplemental examination proceeding.

A. Revocation of Previous Power of Attorney. I hereby revoke all previous patent owner powers of attorney, if any, given:

☒ in the above-identified reexamination or supplemental examination proceeding control number(s) (more than one may be changed only if the proceedings are merged).

☐ in the file of the above-identified patent.

(check BOTH boxes if change in BOTH the patent file and the reexamination or supplemental examination proceeding is requested).

B. Designation of Power of Attorney.

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the Customer Number identified in the box at right as my/our attorney(s) or agent(s) to prosecute the proceeding(s)/patent identified above and selected in section I(A), and to transact all business in the United States Patent and Trademark Office connected therewith: 29156

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s) to prosecute the proceeding(s) identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

Practitioner(s) Name	Registration Number

Authorization for the Power of Attorney is provided by the signature on page 2 of this form.

A Federal agency may not conduct or sponsor, and a person is not required to respond to, nor shall a person be subject to a penalty for failure to comply with an information collection subject to the requirements of the Paperwork Reduction Act of 1995, unless the information collection has a currently valid OMB Control Number. The OMB Control Number for this information collection is 0651-0035. Public burden for this form is estimated to average 15 minutes hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the information collection. Send comments regarding this burden estimate or any other aspect of this information collection, including suggestions for reducing this burden to the Chief Administrative Officer, United States Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450 or email InformationCollection@uspto.gov. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **If filing this completed form by mail, 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.

Copied from 90019265 on 08/14/2024

RED HAT 1008
RED HAT V. CAS

II. Change of Correspondence Address

Please recognize or change the correspondence address for the above-identified reexamination or supplemental examination proceeding control number(s) (more than one may be changed **only** if they are merged proceedings) **and for the file of the above-identified patent** to be:

■ The address associated with the above-identified Customer Number.
OR
☐ The address associated with the Customer Number identified in the box at right:
OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

NOTE: THE CORRESPONDENCE ADDRESS FOR THE REEXAMINATION OR SUPPLEMENTAL EXAMINATION PROCEEDING CONTROL NUMBER(S) MUST BE THE SAME AS THAT FOR THE PATENT. SEE 37 CFR 1.33.

III. Authorization for Power of Attorney and (if selected) Change of Correspondence Address

I am the:
■ Inventor, having ownership of the patent being reexamined.
OR
☐ Patent owner.
Statement under 37 CFR 3.73(c) (Form PTO/AIA/96) submitted herewith or filed on _____.

Signature of Inventor or Patent Owner	Eric M. Delangis	Date	8/13/24
Name	Eric M. Delangis	Telephone	970-310-3576
Title and Company	Inventor		

NOTE: Signatures of all the inventors or patent owners of the entire interest or their representative(s) are required. If more than one signature is required, submit multiple forms, check the box below, and identify the total number of forms submitted in the blank below.

■ A total of 1 forms are submitted. *If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

Copied from 90019265 on 08/14/2024

RED HAT 1008
RED HAT V. CAS

TO: USpatentmail@klgates.com
FROM: noreply@uspto.gov
CC: patentcenter_eofficeaction@uspto.gov
SUBJECT: USPTO: Patent Electronic System - Correspondence Notification for Customer Number 29156

Thu Aug 15 05:02:39 EDT 2024

Dear Patent Center Customer:

Correspondence Address:

K&LGates LLP-ADMINRPL
P.O. Box 1135
CHICAGO,ILLINOIS,60690
UNITED STATES

This is a courtesy notification regarding the following USPTO patent application(s) associated with your Customer Number, 29156, that have new outgoing correspondence. This correspondence is now available for viewing in Patent Center.

The official date of notification of the outgoing correspondence will be indicated on the form (e.g., PTOL-90) accompanying the correspondence.

Disclaimer:
The list of documents shown below are provided as a courtesy and is not part of the official file wrapper. The content of the images shown in the Image File Wrapper is the official record.

Application	Document	Mailroom Date	Attorney Docket No.
15161787	N570	08/15/2024	ED 3000
15161787	N570	08/15/2024	ED 3000

To view your correspondence online, please sign in to Patent Center and then select Workbench/View correspondence. To update your email address(es), select Manage/Manage customer numbers.

If you have any questions, please contact the Patent Electronic Business Center (EBC) at ebc@uspto.gov or 866-217-9197 Monday – Friday, 6 a.m. to midnight ET.

Please do not reply to this email as it was sent from an unmonitored mailbox.

Sincerely,

The Patent Center Team