

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

RED HAT, INC.
Petitioner,

v.

COMPETITIVE ACCESS SYSTEMS, INC.
Patent Owner

U.S. Patent No. 9,350,649
Issued: May 24, 2016
Filed: October 11, 2014
Inventor: Eric M DeLangis
Title: Multipath Communication Devices And Methods

**PETITION FOR *INTER PARTES* REVIEW
UNDER 35 U.S.C. §312 AND 37 C.F.R. §42.104**

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1001	Declaration of Bill Lin, Ph.D. in support of <i>Inter Partes</i> Review
1002	<i>Curriculum Vitae</i> of Bill Lin
1003	Certified Copy of U.S. Patent No. 11,582,343
1004	Certified File History of U.S. Patent No. 11,582,343
1005	Certified Copy of U.S. Patent No. 11,418,641
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1007	Certified Copy of U.S. Patent No. 10,868,908
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1011	Certified Copy of U.S. Patent No. 8,861,349
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1015	Certified Copy of U.S. Patent No. 7,606,156
1016	Certified File History of U.S. Patent No. 7,606,156
1017	U.S. Patent Application Publication No. 2004/0001512 A1 (“Challener”)
1018	U.S. Patent Application Publication No. 2003/0026221 A1 (“Kotzin”)
1019	James Carlson, <i>PPP Design, Implementation, and Debugging</i> (2d ed. 2000) (“Carlson”)
1020	Gilbert Held, <i>Network Design Principles and Applications</i> , 2000 (“Held”)
1021	U.S. Patent No. 6,917,960 (“Decasper”)

¹ Unless otherwise specified, citations are to the original page, column, and line numbers in exhibits rather than the PDF page. Citations corresponding to the PDF pagination are indicated in [[brackets]]. Unless otherwise noted, all emphases and annotations are added.

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1022	Johnny Chen, <i>New Approaches to Routing for Large-Scale Data Networks</i> (Rice University, 1999) (“Chen”)
1023	Declaration of Sylvia Hall-Ellis
1024	Webster's Ninth New Collegiate Dictionary, 1990
1025	Xin, W., Ishihara, S., and Mizuno, T., <i>A QoS-ensured Transmission Scheme with Content-based Priority for Mobile Cluster Users</i> , 2000 (“Xin”)
1026	U.S. Patent Application Publication No. 2002/0042274 A1 (“Ades”)
1027	U.S. Patent No. 7,003,580 (“Cook”)
1028	U.S. Patent No. 5,625,877 (“Dunn”)
1029	U.S. Patent Application Publication No. 2002/010866 A1 (“McCullough”)
1030	Candace Leiden & Marshall Wilensky, <i>TCP-IP for Dummies</i> (3d ed. 1999) (“Dummies”)
1031	U.S. Patent Application Publication No. 2003/0223450 A1 (“Bender”)
1032	U.S. Patent Application Publication No. 2004/0022224 A1 (“Billhartz”)
1033	Hung-Yun Hsieh & Raghupathy Sivakumar, <i>A Transport Layer Approach for Achieving Aggregate Bandwidths on Multi-homed Mobile Hosts</i> (2002) (“Hsieh”)
1034	U.S. Patent No. 6,778,495 (“Blair”)
1035	Cisco Systems, Inc., <i>Troubleshooting Async Multilink PPP Operations</i> (2001) (“Cisco”)
1036	U.S. Patent Application Publication No. 60/377,631 (“Tucker”)
1037	Konishi et al., <i>Web SHAKE: A fast WWW access method for mobile terminals on temporary cluster networks</i> , IEEE Proceedings April 28-May 2, 2002 (“Konishi”)
1038	RFC 1990: The PPP Multilink Protocol (MP), August 1996
1039	<i>Competitive Access Systems, Inc. v. Oracle Corporation, and Oracle America, Inc.</i> , 1:23-ca-00286-ADA, Dkt. 82 (W.D.TX. Aug. 10, 2023)
1040	<i>Red Hat, Inc. v. Competitive Access Systems, Inc.</i> , 4:24-cv-00130-D, Dkt. 1 (E.D.N.C. Sep. 3, 2024)
1041	<i>Red Hat, Inc. v. Competitive Access Systems, Inc.</i> , 4:24-cv-

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1042	Lai et al., <i>Measuring Bandwidth</i> , IEEE (1999)
1043	RFC 2663: IP Network Address Translator (NAT) Terminology and Considerations, August 1999
1044	U.S. Patent No. 5,878,040 (“Peirce”)
1045	“A Novel Mechanism for Data Streaming Across Multiple IP Links for Improving Throughput and Reliability in Mobile Environments,” IEEE INFOCOM 2002 (“Phatak”)
1046	RFC 2543: SIP: Session Initiation Protocol, March 1999
1047	RFC 2131: Dynamic Host Configuration Protocol, March 1997
1048	RFC 1945: Hypertext Transfer Protocol – HTTP/1.0, May 1996
1049	Endler, David, <i>Brute-Force Exploitation of Web Application Session IDs</i> , iALERT White Paper, Nov. 1, 2001 (“Endler”)
1050	Rappaport, Theodore S., et al., <i>Wireless Communications and Application Above 100 GHz: Opportunities and Challenges for 6G and Beyond</i> , IEEE Access, Vol. 7, 2019 (“Rappaport”)
1051	Reex. Control No. 90/019,265
1052	Gast, Matthew S., <i>802.11 Wireless Networks – The Definitive Guide</i> , 2002
1053	Shoemake, Matthew B., <i>Wi-Fi (IEEE 802.11b) and Bluetooth CoExistence Issues and Solutions for the 2.4 GHz ISM Band</i> , Texas Instruments, Feb. 2001, Ver. 1.1
1054	Furuskär, Anders, et al., <i>EDGE: Enhanced Data Rates for GSM and TDMA/136 Evolution</i> , IEEE Personal Communications, June 1990
1055	RFC 2326: Real Time Streaming Protocol (RTSP), April 1998
1056	Random House Webster’s Computer & Internet Dictionary, 3 rd ed., December 1998
1057	Andrew S. Tanenbaum, <i>Computer Networks</i> , Chps. 1 & 5 (3d ed. 1996)
1058	Adolfo Rodriguez <i>et al.</i> , <i>TCP/IP Tutorial and Technical Overview</i> , Chps. 1 & 14 (Prentice Hall PTR 2002)
1059	Richard O. LaMaire, et al., <i>Wireless LANs and Mobile Networking: Standards and Future Directions</i> , IBM, May

Petition for *Inter Partes* Review of U.S. Patent No. 9,350,649

Exhibit No.	Description
	31, 1996

Claim Listing for U.S. Patent No. 9,350,649

No.	Claim Language
1[preamble]	A method for establishing and sending data during a multipath connection comprising:
[1.1.i]	a data-source device receiving multipath information about each of a plurality of network-edge devices that is capable of joining a multipath connection with a data-requesting device,
[1.1.ii]	each of the network-edge devices being connected to one or more networks, and
[1.1.iii]	each of the network-edge devices being connected to the data-requesting device over a different connection; and
[1.2]	the data-source device performing at least one of (i) sending different groups of data packets to different network-edge devices that are participating in the multipath connection, (ii) sending different streams of data to one or more of the network-edge devices that are participating in the multipath connection, and (iii) sending combinations of different streams and different groups of data packets to one or more of the network-edge devices that are participating in the multipath connection.
2	The method of claim 1, wherein the multipath information includes a connection ID that is generated by one of the data-source device, one of the plurality of network-edge devices, the data-requesting device and a network device.
3[preamble]	The method of claim 1, further comprising:
[3.1]	the data-source device receiving second multipath information about a second network-edge device that is capable of joining the multipath connection; and
[3.2]	the data-source device joining the second network-edge device to the multipath connection.
4[preamble]	The method of claim 1, further comprising:

No.	Claim Language
[4.1]	the data-source device receiving multipath information about which network-edge devices are to be removed from the multipath connection; and
[4.1]	the data-source device removing the network-edge devices from being associated with the multipath connection.
5	The method of claim 1, further comprising at least one of the data-source device, the network-edge devices and the data-requesting device determining which of the network-edge devices are to be removed from the multipath connection.
6	The method of claim 1, wherein the data-source device is one of a multipath link aggregator, a network relay, a multipath link server, a server, a network switch, a network router and a device capable of providing multipath services.
7[preamble]	A method for establishing and sending data during a multipath connection, comprising:
[7.1]	the data-source device receiving multipath connection requests from a plurality of data-requesting devices, each of the multipath connection requests involving a particular multipath connection to a data-requesting device;
[7.2]	the data-source device associating a connection ID to each multipath connection request;
[7.3]	the data-source device using multipath information about each of a plurality of network-edge devices that is capable of joining in a particular multipath connection to a particular data-requesting device, the particular multipath connection having a particular connection ID;
[7.4]	the data-source device notifying each of the network-edge devices that is participating in the particular multipath connection associated with the particular connection ID; and
[7.5]	the data-source device sending data associated with the particular connection ID to the network-edge devices participating in the particular multipath connection associated with the particular

No.	Claim Language
	connection ID.
8	The method of claim 7, further comprising: the data-source device sending different groups of data packets to different network-edge devices that are participating in the particular multipath connection associated with the particular connection ID.
9[preamble]	The method of claim 7, further comprising:
[9.1]	the data-source device receiving identification of the network-edge devices to be removed from the particular multipath connection; and
[9.2]	the data-source device removing the identified network-edge devices from the particular multipath connection.
10	The method of claim 7, further comprising the data-source device notifying the data-requesting device when all data has been sent over the particular multilink connection.
11	The method of claim 7, wherein the data-source device is one of a multipath link aggregator, a network relay, a multipath link server, a server, a network switch, a network router and a device capable of providing multipath services.
12	The method of claim 7, wherein the connection ID is generated by one of the data-source device, one of the plurality of network-edge devices, the data-requesting device, and a network device.
13[preamble]	A method for establishing and sending data during a multipath connection, comprising:
[13.1.i]	a data-requesting device sending a multipath request to a network-edge device
[13.1.ii]	where the multipath request indicates that the network-edge device will join a multipath connection associated with the data-requesting device,
[13.1.iii]	the data-requesting device being connected over a first connection to a network and over a second connection to the network-edge device, the multipath connection comprising the first connection and the second

No.	Claim Language
	connection which are capable of receiving data at the same time;
[13.2]	the data-requesting device receiving first data over the first connection from the network; and
[13.3]	after the network-edge device joins the multipath connection, the data-requesting device receiving second data over the second connection from the network-edge device.
14	The method of claim 13, wherein the first connection and the second connection are each a wireless connection, a wired connection or a combination of wired and wireless connections.
15	The method of claim 13, wherein the data-requesting device is one of a cell phone, a tablet, a switch, a network device, a router, a computer, a Wi-Fi device, a Wi-Max device, a communications device, a mobile communications device, a near-field communications device, and a Bluetooth device.
16	The method of claim 13, wherein the network-edge device comprises one or more routers, modems, cell phones, tablets, computers, cellular towers, wireless towers, base stations, wireless base stations, repeaters, wireless repeaters, Wi-Fi devices, networking devices, hot spot devices, Wi-MAX devices, LTE devices, GSM devices, consumer electronic devices, an Internet-ready device, a network switch, a network router, a multipath server and a device capable of providing multipath services.
17	The method of claim 13, wherein the data-requesting device is capable of connecting to another network device which is capable of joining the multipath connection, and further comprising the data-requesting device receiving data from the another network device after the another network device joins the multipath connection.
18[preamble]	A data-requesting device comprising:
[18.1]	at least one interface capable of connecting concurrently to a plurality of network-edge devices during a multipath connection, the multipath connection comprising the connections between the data-requesting device and each of the network-edge devices; and

No.	Claim Language
[18.2]	at least one processor coupled to the at least one interface that
[18.3]	sends multipath information to each of the network-edge devices that is capable of joining the multipath connection; and
[18.4]	receives different data at the data-requesting device from different ones of the network-edge devices that are able to join the multipath connection.
19	The data-requesting device of claim 18, wherein the data-requesting device is one of a cell phone, a tablet, a switch, a network device, a router, a computer, a Wi-Fi device, a Wi-Max device, a mobile communications device, a near-field communications device, and a Bluetooth device.
20	The data-requesting device of claim 18, wherein each of the network-edge devices comprises one or more network devices, communications devices, cellular devices, tablet devices, router devices, computer devices, satellite devices, Wi-MAX devices, wireless devices, mobile communications devices, Bluetooth devices, and Wi-Fi devices, a network switch, a network router, a multipath server and a device capable of providing multipath services.
21[preamble]	A method for creating and using a multipath connection, comprising the steps of:
[21.1]	a data-requesting device sending first multipath control information to or through a first network-edge device, the first multipath control information indicates that the first network-edge device will join the multipath connection, the data-requesting device being connected over a first connection to the first network-edge device;
[21.2]	the data-requesting device sending a second multipath control information to or through a second network-edge device, the second multipath control information indicates that the second network-edge device will join the multipath connection, the data-requesting device being connected over a second connection to the second network-edge device, the data-requesting device capable of receiving different data over the first connection and the second connection at the same time;

No.	Claim Language
	and
[21.3]	after the first network-edge device joins the multipath connection, the data-requesting device receiving first data over the first connection from the first network-edge device; and after the second network-edge device joins the multipath connection, receiving second data at the data-requesting device over the second path from the second network-edge device.
22	The method as in claim 21, wherein the first network-edge device is connected to a network, and wherein the second network-edge device is connected to the network or a different network.
23	The method as in claim 21, wherein the first connection and the second connection are wireless connections, a wired connection or a combination of wired and wireless connections.

Petitioner Red Hat, Inc. (“Red Hat”) respectfully requests *inter partes* review of claims 1-23 (“Challenged Claims”) of U.S. Patent No. 9,350,649 (“the ’649 patent”). EX1009.

I. INTRODUCTION

The Challenged Claims of the ’649 patent are unpatentable in view of two references that were not substantively considered during its original prosecution before the Patent Office, the Kotzin and Phatak references.

The ’649 patent is directed to a device referred to by the ’649 patent as a residential communications gateway (“RCG”). The RCG connects a residence (*e.g.*, an Internet user) to a communications network (*e.g.*, the Internet via an Internet service provider or “ISP”) “over a customer’s existing POTS line, and it doesn’t require any network infrastructure build out like DSL and Cable services.” EX1009, 3:13-15. The RCG was intended “to enhance, not replace, the existing telephone line” by aggregating bandwidth over the “last mile” of copper over which almost all residential customers received their communication services in the 2002 timeframe. *Id.*, 1:20-23, 3:17-23.

Yet, as discussed below, aggregating bandwidth among devices to resolve the “last mile” or similar bandwidth issues was known in the prior art. For example, the ’649 patent acknowledges that it is merely applying RFC 1990, the PPP Multilink Protocol that was published in August 1996, to achieve a multilink

broadband connection. *Id.*, 11:4-6 (“[T]he RCG implements broadband over POTS by employing an 802.11b/g wireless interface to configure a multilink PPP bundle-87 (per RFC 1990)[.]”). The PPP Multilink Protocol teaches using link aggregation to increase bandwidth. EX1038 (RFC 1990).

Against this backdrop, this Petition, supported by the Declaration of Dr. Bill Lin, Ph.D., presents two grounds based on the Kotzin and Phatak references, which render the Challenged Claims obvious as discussed in detail below.

II. OVERVIEW OF CHALLENGE AND RELIEF REQUESTED

Petitioner requests cancellation of the Challenged Claims as unpatentable under 35 U.S.C. §103.

A. Prior Art Patents and Printed Publications

Petitioner’s challenge is based on these references, which predate the earliest claimed priority date of the ’649 patent:

1. U.S. Patent Publication No. 2003/0026221 (“Kotzin”) (EX1018) was filed on August 2, 2001, published on February 6, 2003, and is prior art under pre-AIA 35 U.S.C. § 102(e).

2. “A Novel Mechanism for Data Streaming Across Multiple IP Links for Improving Throughput and Reliability in Mobile Environments,” IEEE INFOCOM 2002 (“Phatak”) (EX1045), was published June 2002. It has been publicly

available since at least August 6, 2002, or shortly thereafter. EX1023, ¶55. Phatak is prior art under at least pre-AIA 35 U.S.C. § 102(a).

3. U.S. Patent No. 5,878,040 (“Peirce”) (EX1044) filed on August 26, 1997, with a priority date of November 17, 1995, issued on March 2, 1999, and is thus prior art under at least pre-AIA 35 U.S.C. § 102(b).

4. NETWORK DESIGN PRINCIPLES AND APPLICATIONS (“Held”) (EX1020) is a textbook published by Auerbach Publications in 2000 and edited by Gilbert Held. It has been publicly available since at least June 14, 2000. EX1023, ¶48. Held is prior art under at least pre-AIA 35 U.S.C. §102(a) and (b).

B. Relief Requested

Petitioner requests cancellation of the Challenged Claims as unpatentable under 35 U.S.C. §103. The grounds are set forth below and supported by the declaration of Dr. Bill Lin.

Ground	Claims	Proposed Statutory Rejection
IA	1-23	Obvious over Kotzin
IB	2, 7, 8, 10, 12	Obvious over Kotzin in view of Peirce and Held
IIA	1-23	Obvious over Phatak
IIB	10	Obvious over Phatak in view of Held

III. TECHNOLOGY OVERVIEW

A. Bandwidth Aggregation

Before the alleged invention of the '649 Patent, it was well-known that devices like gateways could aggregate bandwidth. It was well-known that gateways extend the connectivity of a network and help achieve greater bandwidth without additional remote hardware or changes to the existing physical infrastructure. Ex. 1017, ¶¶ [0014], [0016], Fig. 3, Ex. 1028, 6:35-40, Ex. 1029, Abstract, ¶¶ [0002], [0085]; Ex. 1020 at 256. Algorithms were also developed to effectively aggregate, or “bundle,” multiple connections between source and destination. For example, the Multipath TCP protocol was well known prior to the '649 Patent's earliest priority date. The TCP/IP protocol on which Multipath TCP is based was created in the 1980s. *See* EX1030, 100-12; EX1020, 142, 281-82; EX1022, 8, 119, 124, 143-44; EX1033. And Multipath TCP was proposed as early as 1999. EX1022, 8. Multipath TCP uses two or more paths between a server and client to transmit packets between them, instead of the single path used in traditional TCP. *Id.*, Chapter 7. Additionally, TCP was recognized as helpful to provide flow control and congestion control. *Id.*, 243-44. TCP was also known to employ a tuple (including source address/port and destination address/port) in order to uniquely identify a particular communication session. EX1043 §2.3.

B. Bandwidth Aggregation as a Solution to the Last Mile Problem

In the late 1990s and early 2000s, the “last mile” problem—referring to the final segment of the telecommunications network connecting homes to service providers, typically via low-bandwidth copper wires—was widely recognized as a major bottleneck in residential networking, as most users were limited to Plain Old Telephone Service (POTS) lines despite the availability of high-capacity core infrastructure like fiber optics (see EX1017, ¶[0004]). To address this, solutions emerged that leveraged existing infrastructure with low-cost enhancements rather than costly upgrades. For example, Challenger describes a bandwidth sharing device that allows an end user to aggregate bandwidth from multiple other devices, increasing effective bandwidth without modifying the physical network. *See Id.*, ¶[0040]. Similarly, Cook acknowledged the limitations of single communication paths to the client’s interface and proposed supplementing wireline connections with wireless links, enabling parallel data transmission and higher aggregate bandwidth without the need for additional wireline installations. *See* EX1027, 1:29-33 and 50-56.

IV. THE ’649 PATENT

The ’649 patent claims priority to Provisional Application 60/418,521, filed on October 15, 2002. Petitioner reserves the right to challenge the priority date, but

Kotzin, Phatak, Peirce, and Held are still prior art even if the '649 patent's priority date is October 15, 2002.

A. Claims

The '649 patent has 23 claims. Independent Claims 1, 7, 13, 18, and 21 concern sending/receiving data during a multipath connection. Dependent Claims 2-6, 8-12, 14-17 and 22-23 recite generic variations on the multipath information used, types of connections/devices, and the removal of network-edge devices from the connection.

B. Specification

The alleged problem in the art that the '649 patent set out to solve was that high-speed data services required expensive infrastructure enhancements to local telephone service lines to resolve “last mile” bandwidth issues. EX1009, 1:20-26, 2:4-12. The purported solution provided is sharing and aggregating bandwidth from multiple RCGs, or broadband communications devices such as gateways or routers, which was already known in the art using prior-art protocols such as MPPP. *Id.*, 2:21-47, Fig. 7. While the '649 patent asserts a technological improvement by using RCGs that provide “new combined packetized voice and data services” for aggregating bandwidth as its invention (*Id.*, 3:18-20), the patent admits that RCGs are simply “low cost” gateways that are plugged into a user's telephone line and make use of “the ubiquitous 802.11 wireless protocol,” among

other existing infrastructure, which were widely known in the prior art. *Id.*, 2:40-63, 3:18-28, 4:23-29, Fig. 6. Further, the aggregation among the RCGs is done using the standardized PPP Multilink standard. *Id.*, 11:4-20 (citing EX1038 (RFC 1990)).

C. Prosecution History

During prosecution, the Examiner considered prior art references Perkins (US6,496,477), Pung (US2002/0150099), Li (US2001/0037472), and Cain (US8,370,507), each concerning “multicasting,” a method known for transmitting data to multiple destinations. EX1010, [[429-435]], [[515-519]]. Applicant clarified that the claims concern a “data-requesting device” which “is a device (e.g., computer, tablet, cell phone, router) requesting data over the network from the ‘data-source device’ (e.g., server) using two or more connections to different ‘network-edge device’ during a multipath connection.” *Id.*, [[468]]. The Applicant argued its claims were distinguishable from multicasting, but there was no discussion of Multilink PPP (described in the specification) or Multipath TCP (accused of infringement). The Examiner did not have the benefit of the evidence presented in this Petition, as none of the prior art in Grounds I-II were considered during prosecution. *See id.*, [[515-519]].

V. CLAIM CONSTRUCTION

Claims in an IPR are interpreted and construed under *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005). For purposes of this proceeding only, terms in the Challenged Claims need not be construed to apply the prior art forming the Grounds. If PO raises claim construction arguments, however, Petitioner reserves the right to respond. Petitioner notes that in a prior district court litigation (now settled), PO contended that “multilink connection” means “[a] connection including multiple physical links,” and that “multilink group transfer” means “transferring data over a multilink connection.” EX1039, 8-9. Here, claim 10 recites “the particular multilink connection”. Further, in a demand letter to Petitioner, PO asserted that the “Claims from the DeLangis Patent Portfolio cover MPTCP as described in RFC 6824 as well as many non-standardized proprietary multipath routing techniques.” EX1041 (DJ Compl., Ex. 8).

Petitioner disagrees with PO,² but notes that the Challenged Claims are rendered obvious by Kotzin and Phatak even under Petitioner's broad constructions.³ To the extent that any claim construction positions taken by Petitioner in the related DJ proceeding are inconsistent with an implicit position taken in this petition, that inconsistency is warranted. PO should be required to defend the patentability of the Asserted Patents' claims in light of the broad constructions they pursued in the prior district court proceeding and asserted in their demand letter to Petitioner.

² In its complaint for Declaratory Judgment of Non-Infringement, Petitioner disputes PO's assertion that that Asserted Patents are directed to MPTCP. Petitioner's position is that the Asserted Patents "are (at best) limited to a very different transmission protocol called Multilink PPP (Point-to-Point Protocol)." EX1040 (DJ Compl., no exhibits).

³ Petitioner does not present any § 101 or §112 challenges herein but reserves the right to challenge the patentability under §§ 101 and 112 in litigation or any other appropriate forum. Nothing contained in this Petition or supporting papers is an admission or acknowledgement that the specification of the '349 Patent satisfies §§ 101 and 112.

A. Person of Ordinary Skill in the Art

As Dr. Lin explains in his declaration, a POSITA at the time of the '649 patent would have at least a bachelor's degree in electrical engineering, computer science, or a related field, and at least one year of experience with network design. Individuals with different education and additional experience could still be of ordinary skill in the art if that additional experience compensates for a deficit in their education and experience. EX1001, ¶¶49-52.

VI. OVERVIEW OF THE PRIOR ART

A. Kotzin

Kotzin discloses a bandwidth aggregation system where the bandwidth available to a plurality of wireless units in a wireless network can be shared with a primary wireless unit, thereby increasing the wireless bandwidth available to the primary wireless unit. EX1018, Abstract, ¶[0024]. The primary wireless unit receives data over a first network from an Internet web server, such as a cellular network, and over a second wireless network from one or more of the other wireless units, such as an 802.11 or Bluetooth network in combination with a cellular network. Kotzin explains that wireless units connect with each other so units “receive portions of the communication on behalf of the destination wireless apparatus,” resulting in higher effective bandwidth. *Id.* ¶¶[0028], [0031], [0035]. Kotzin's system is illustrated below:

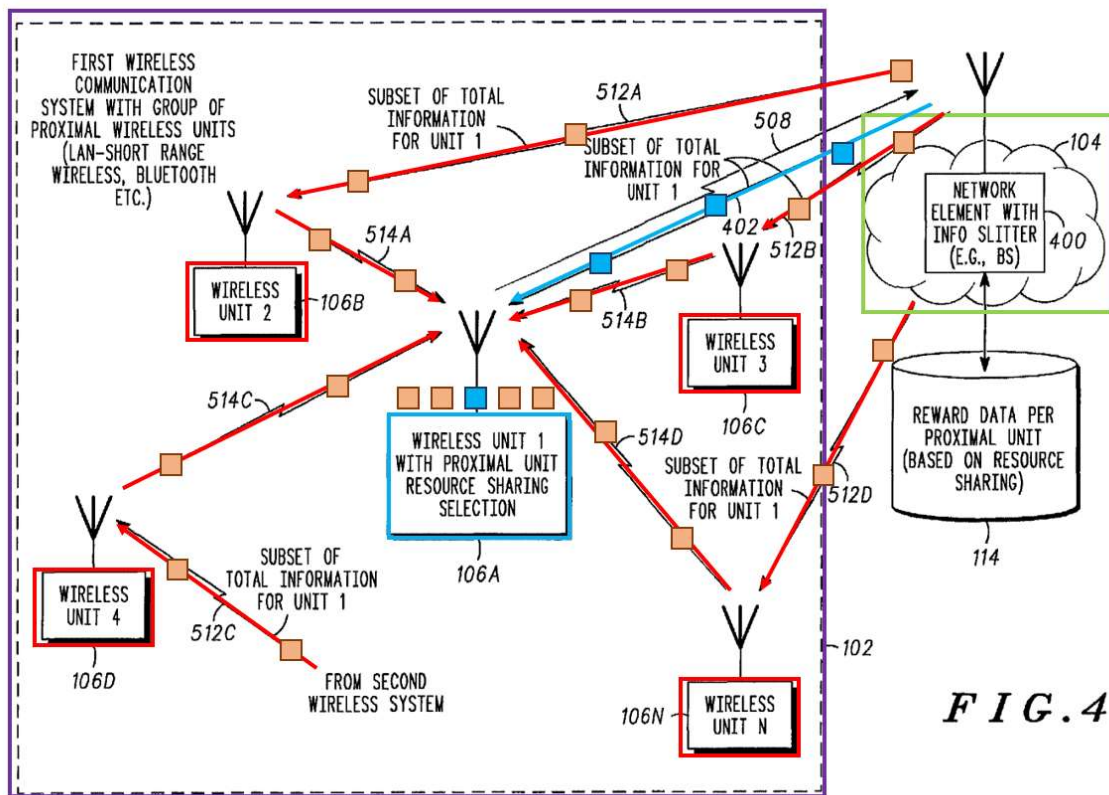


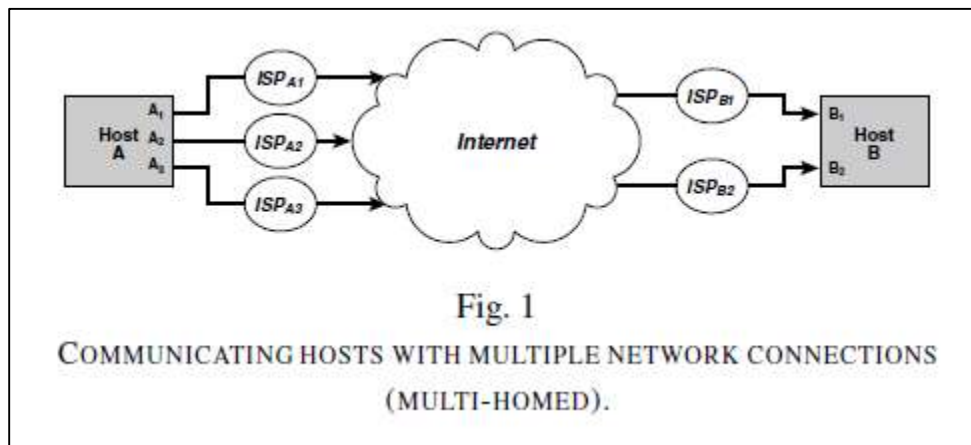
FIG. 4

With reference to Kotzin's Figure 4 shown above, Kotzin discloses that wireless unit 106A (blue), for example, can make use of bandwidth from wireless units 106B, 106C, 106D, and 106N (orange) to receive data from a device on external network 104 (e.g., the Internet) (green). Thus, Internet data packets from an Internet server destined for wireless unit 106A can be split among multiple links to each of the wireless units 106A, 106B, 106C, 106D, and 106N, and then relayed from each of 106B to 106N to be aggregated by 106A. In this manner the bandwidth available to 106A is increased by using, in addition to its own

bandwidth, additional bandwidth allocated to wireless units 106B, 106C, 106D, and 106N.

B. Phatak

Phatak discloses a system that uses a TCP “tunneling” technique for bandwidth aggregation over multiple links. EX1045, Abstract, 774-76. Phatak discloses that two devices, such as a client and server, can exchange a single TCP/IP data flow over multiple interfaces/links—for example a wireless interface such as cellular or WiFi and a wired interface such as Ethernet. *Id.* Figure 1 of Phatak illustrates an exemplary architecture. HOST A has multiple interfaces A1, A2, and A3, while HOST B has interfaces B1 and B2:



Phatak explains that total bandwidth for TCP/IP communications between HOST A and HOST B can be increased by aggregating the bandwidth over multiple interfaces. EX1045, 773. Phatak teaches that a primary connection will use two interfaces, for example A1 and B1. *Id.*, 773-74. A secondary connection may use interfaces A2 and B1, on the other hand. *Id.* Because TCP/IP requires for

successful operation a session ID in the form of a tuple consisting of source IP address, source port, destination IP address, and destination port (in addition to a protocol identifier), the same tuple must be used for all connections in order for the packets to be recognized as part of the same session/connection. *Id.*, 775. To achieve this, Phatak teaches that when data is sent on non-primary interface A2 to interface B1, packets are addressed as if interface A1 were the source address, but then are encapsulated in an IP-in-IP packet that uses interface A2 as the source address and IP-in-IP as the protocol identifier. *Id.* When this encapsulated packet is received at Host B, the outer packet is removed to reveal the primary source interface A1, letting Host B recover the TCP tuple and determine that the packet is for an existing TCP session/connection. As Phatak explains:

Our solution to these problems is to employ *tunneling*. At the sender side, *A*, the transport layer assembles all packets as if they were going through *A*₁ and addressed to *B*₁. The packets going out on interface *A*₂ then get encapsulated in a new IP packet with an extra header having destination address *B*₁ and source address *A*₂. The protocol field for the outer header should be IP-in-IP (also used for tunneling in the mobile IP standard and implementations [28], [29], [30], [31]). The destination, *B*, can then recognize IP-in-IP packets and strip the outer header. This leaves the original packet with proper source and destination addresses to be delivered up the stack to TCP in a transparent manner. The TCP stack at *B* is unaware that *A* tunneled the packet through an alternate interface.

Id. Phatak also teaches that Host B can accept data on multiple interfaces as well, and that the same tunneling mechanism is used:

Note that the same tunneling mechanism can be used when B is accepting data on multiple interfaces. For instance, to send a packet through interfaces A_3 and B_2 , the original packet (having source and destination addresses $\text{Addr}(A_1)$ and $\text{Addr}(B_1)$ respectively) is encapsulated in a packet having source address $\text{Addr}(A_3)$ and destination address $\text{Addr}(B_2)$. The receiving IP stack at B strips the outer header, realizes that the inside packet is for an existing TCP connection, and transparently passes it to TCP.

Id.

In this manner, by combining a single TCP/IP flow over multiple parallel links/connections, total bandwidth is increased. EX1045, Abstract (“Furthermore, since wireless bandwidth is likely to remain a scarce resource, we foresee scenarios wherein mobile hosts will require simultaneous data transfer across multiple IP interfaces to obtain higher overall bandwidth . . . We then propose a new mechanism to aggregate the bandwidth of multiple IP links by splitting a data flow across multiple network interfaces at the IP level. Our method is transparent to transport (TCP/UDP) and higher layers. We have analyzed the performance characteristics of the aggregation scheme and demonstrated significant gain when the links being aggregated have similar bandwidth and latency.”).

VII. SPECIFIC GROUNDS FOR PETITION UNDER 37 C.F.R. §42.104(B)

A. Ground I: Claims 1-23 Are Obvious Over Kotzin and/or in view of Peirce and Held

1. Motivation to Combine

a. Peirce

The '649 patent claims a connection ID associated with a multipath connection. *See* EX1009, cls. 2, 7, 8, 12. Kotzin teaches “the network element 400 receives a message [402] in the form of data indicating an amount of data (i.e. voice, non-voice etc.) to be sent via the wide area network 104 for the wireless apparatus 106a,” and discloses that bandwidth is only shared for a particular session. EX1018, ¶[0037], [0038] (“each [unit indicates] the amount of wireless resources that they are willing to allocate to this *particular communication or session.*”). Although a connection ID is not explicitly disclosed, it would have been obvious to include a connection ID in Kotzin given that Kotzin only shares bandwidth for a particular session, which a POSITA would have known to generate using any of the recited devices, so that data would be properly routed for the specified communication session. EX1001, ¶71.

To the extent that Kotzin does not expressly disclose or render obvious the use of a connection ID as claimed by the '649 patent, it would have been obvious to do so in light of Peirce's session identifier. First, a POSITA would have been motivated to incorporate Peirce's teaching of a session identifier into Kotzin,

rendering claims 2, 7, 8, and 12 obvious. obvious. Kotzin expressly teaches that Kotzin's wireless units only share bandwidth for a *particular communication session*, as noted above. *See also* EX1018, ¶[0021]. A POSITA reading Kotzin would have understood that Kotzin's system needs to provide a way for its wireless units to distinguish between communication sessions. EX1001, ¶71. Kotzin, however, does not provide a discussion of the precise mechanism used. Peirce, which also discloses a system for bandwidth sharing, discloses a mechanism for identifying and coordinating data streams on a per-session basis, namely a "bundle mapping update packet" that includes a connection identifier in the form of an "identification field [that] notifies the other termination units that if they should receive a portion of the data stream via a channel that belongs in the call originator's 'bundle', *representing the session*, they should forward their packets of data to the designated termination unit." EX1044, 2:59-64. This packet includes a bundle ID that identifies the connection. *Id.* 2:57-65. Given Kotzin's express teaching of the need for a connection identifier, it would have been obvious to a POSITA to incorporate Peirce's teaching of a session identifier that the wireless units would reference when they receive data from Internet Web server 104, and based upon which they forward the data to UNIT 1.

As Dr. Lin explains, the use of a connection ID would have been compatible with Kotzin's disclosed architecture, and it would have been obvious to include

such a connection ID with Kotzin's messages 510 and 512, so that the connection ID would be included with all data packets as a coordinating reference that ensures UNIT 1 receives all packets destined for it while at the same time satisfying Kotzin's express teaching that the wireless units only share bandwidth for a particular session. EX1001, ¶75. A POSITA would also have understood and found obvious that this connection ID would also have been helpful in the upload direction, when UNIT 1 is uploading data to Internet Web server 104, as the session ID will ensure the bandwidth-sharing wireless units only forward packets to WAN server 400 for the particular session to which the packets pertain. EX1018, ¶¶[0042], Fig. 7; EX1001, ¶75.

Kotzin and Peirce both relate to using multiple links between a source and destination to send a split data stream that is reconstructed into a single data stream at the destination. EX1018, Abstract; EX1044, Abstract. Given this architectural and functional similarity, a POSITA would naturally have looked to Peirce for a specific mechanism to implement Kotzin's express teaching of the need for a session identifier in order to limit the participation of the bandwidth-sharing wireless units only to a particular session. As Dr. Lin explains, using a mechanism such as Peirce's session ID with Kotzin would have been obvious to try, and nothing more than combining prior art elements according to known methods and applying a known technique to a known device ready for improvement, both to

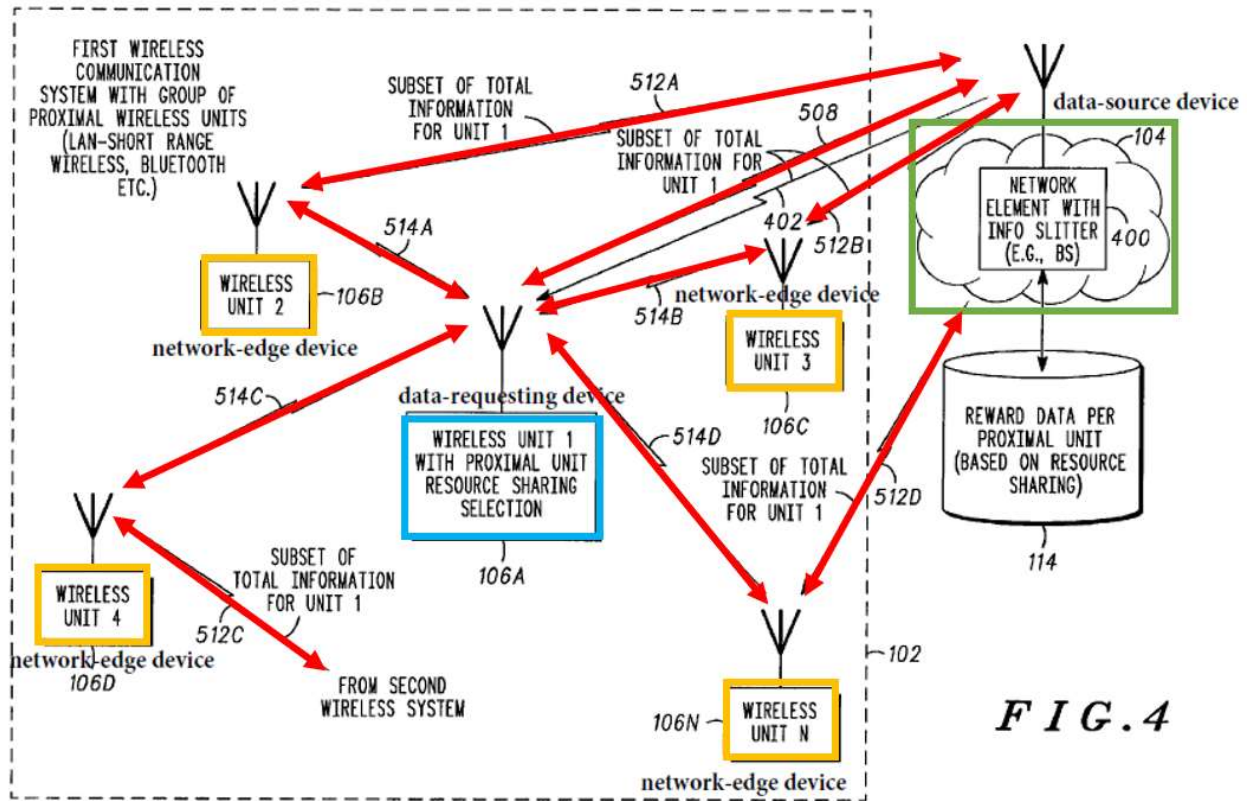
yield predictable result. EX1001, ¶76. Further, given that packet-based communications were well known in the art, a POSITA would have had a reasonable expectation of success in implementing such a common and well-known technology with Kotzin using routine computer programming techniques. *Id.* ¶76.

2. Independent Claim 1

a. [1.pre]

[1.pre] is obvious.

Kotzin discloses a method and apparatus for splitting information into subsets to be communicated via a plurality of wireless devices. EX1018, Abstract. As shown below, Kotzin discloses establishing multiple physical links or paths (red) to send and receive data between two devices (*i.e.*, a multipath connection):



EX1018, Fig. 4 (annotated to label network-edge, data-requesting, and data-source devices), *see* Fig. 7. The details of how the connection is established and data is sent during a multipath connection are explained below. *See* §§VII.A.2.b-VII.A.2.c.

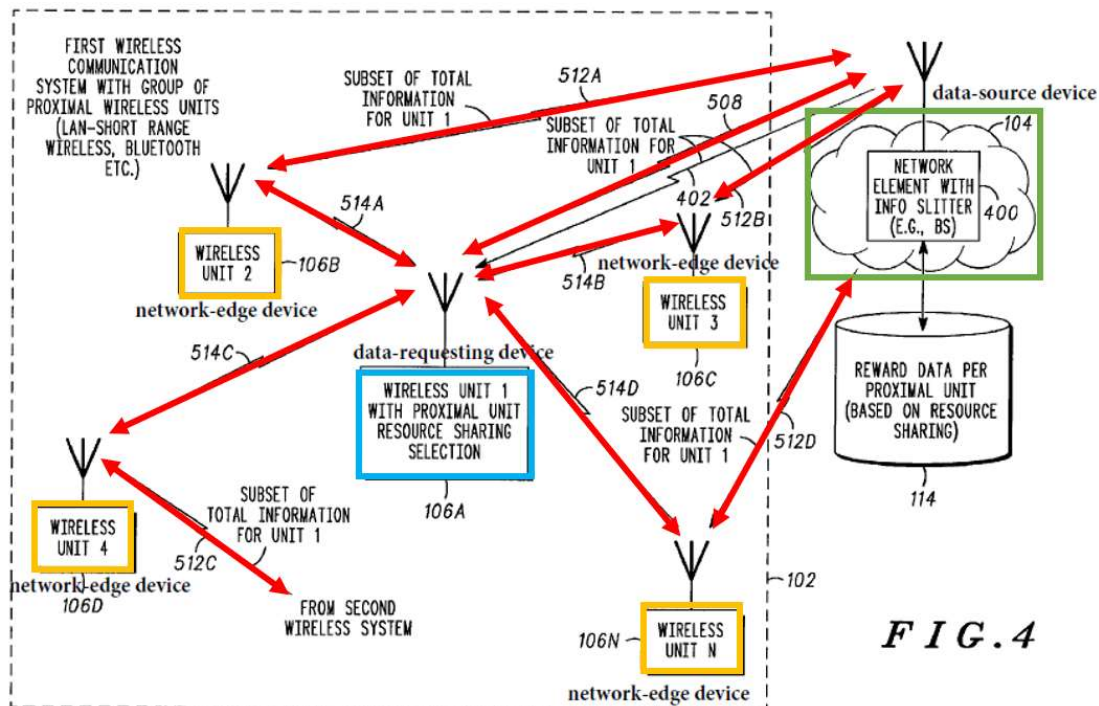
b. [1.1]

i. [1.1.i]

Kotzin discloses [1.1.i]. Kotzin discloses a network element, such as cellular base station, Internet Web server, or other device (data-source device) receiving multipath information about each of a plurality of wireless apparatuses 106b-n

(network-edge devices) capable of joining a multipath connection with a data-requesting device, such as wireless apparatus 106a. EX1018, [0039], Fig. 5.

Kotzin’s wireless units 106b-n constitute network-edge devices capable of joining a multipath connection with a data-requesting device. They are “network-edge devices” because they sit on the network edge between the local area network connecting the units and WAN 104.



EX1018, Fig. 4 (annotated as above). As illustrated below, Kotzin discloses a network element (data-source device)—pictured as a wide-area network (“WAN”) base station—receiving a “bandwidth distribution message 508” indicating “which of the plurality of proximal wireless units will participate in sharing the wireless resources for use in facilitating communication with the wireless apparatus 106a.”

EX1018, ¶[0039]. Accordingly, the network element (data-source device) receives multipath information about a plurality of units (network-edge devices) capable of joining a multipath connection, shown by step 508 below:

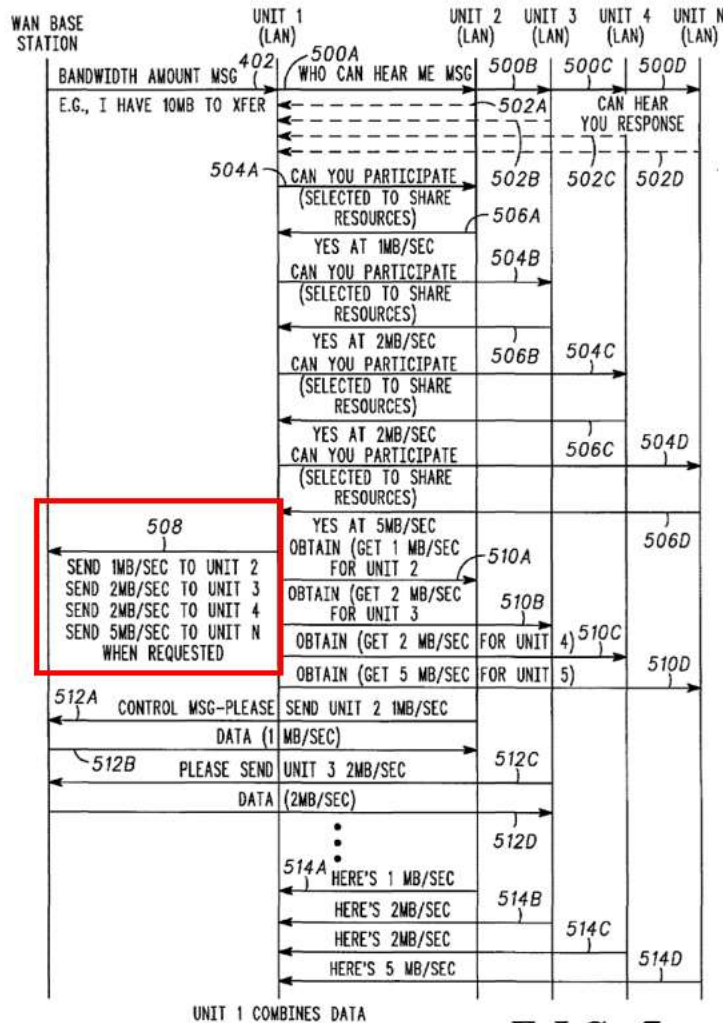


FIG. 5

Id. Fig. 5; EX1001, ¶62.

This information is generated through wireless unit 106a (data-requesting device) after learning how much data the data-source device will send (*i.e.*, through the bandwidth amount message 402) by sending “query messages” to proximal

wireless units (network-edge devices). EX1018, ¶[0037]. “[E]ach of the proximal units in the group indicate the amount of wireless resources that they are willing to allocate” (*id.* ¶[0038]), as illustrated below:

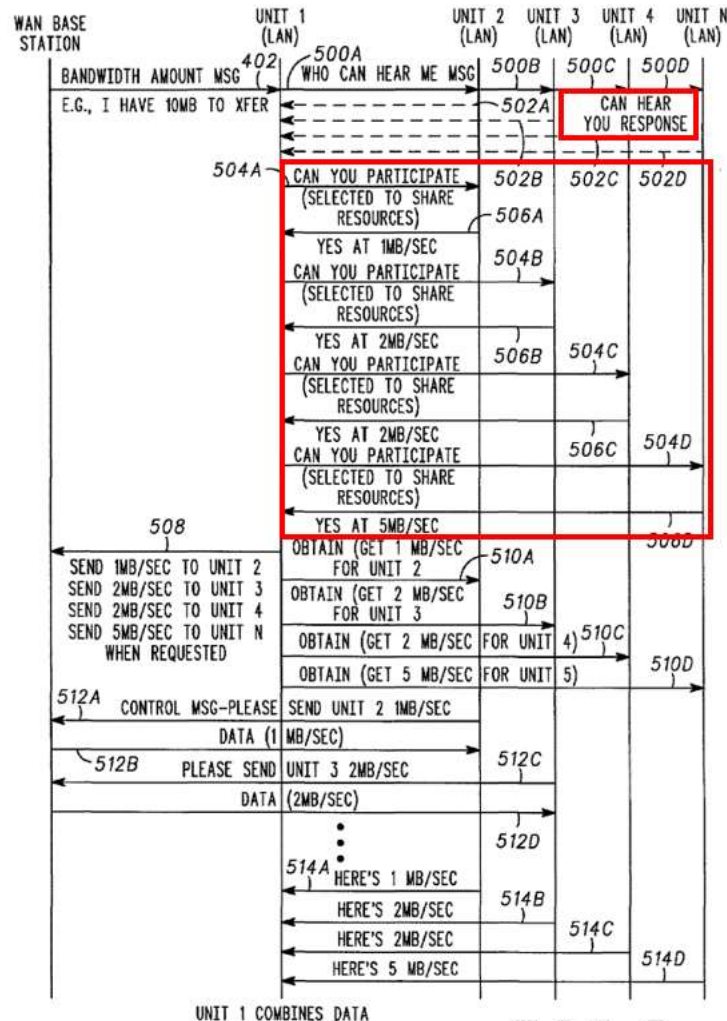
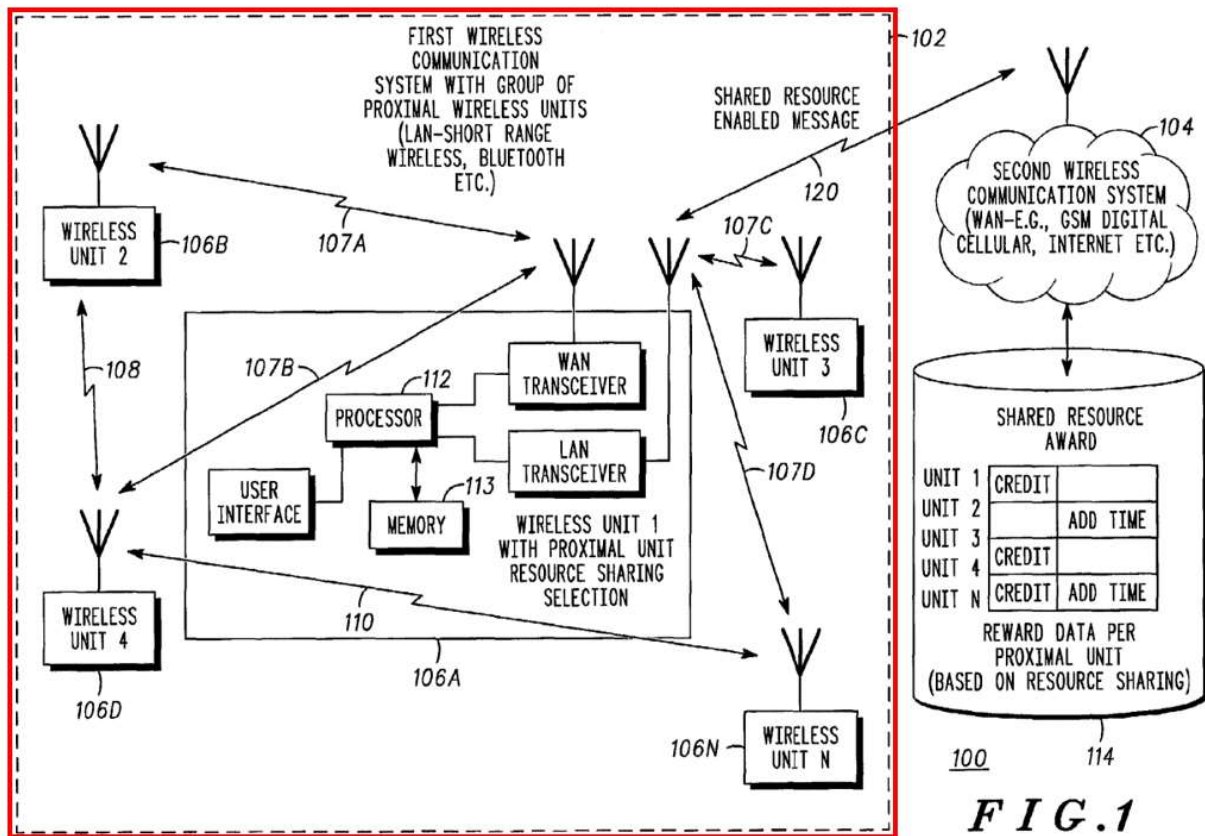


FIG. 5

Id. Figs. 5-6; EX1001, ¶61.

ii. [1.1.ii]

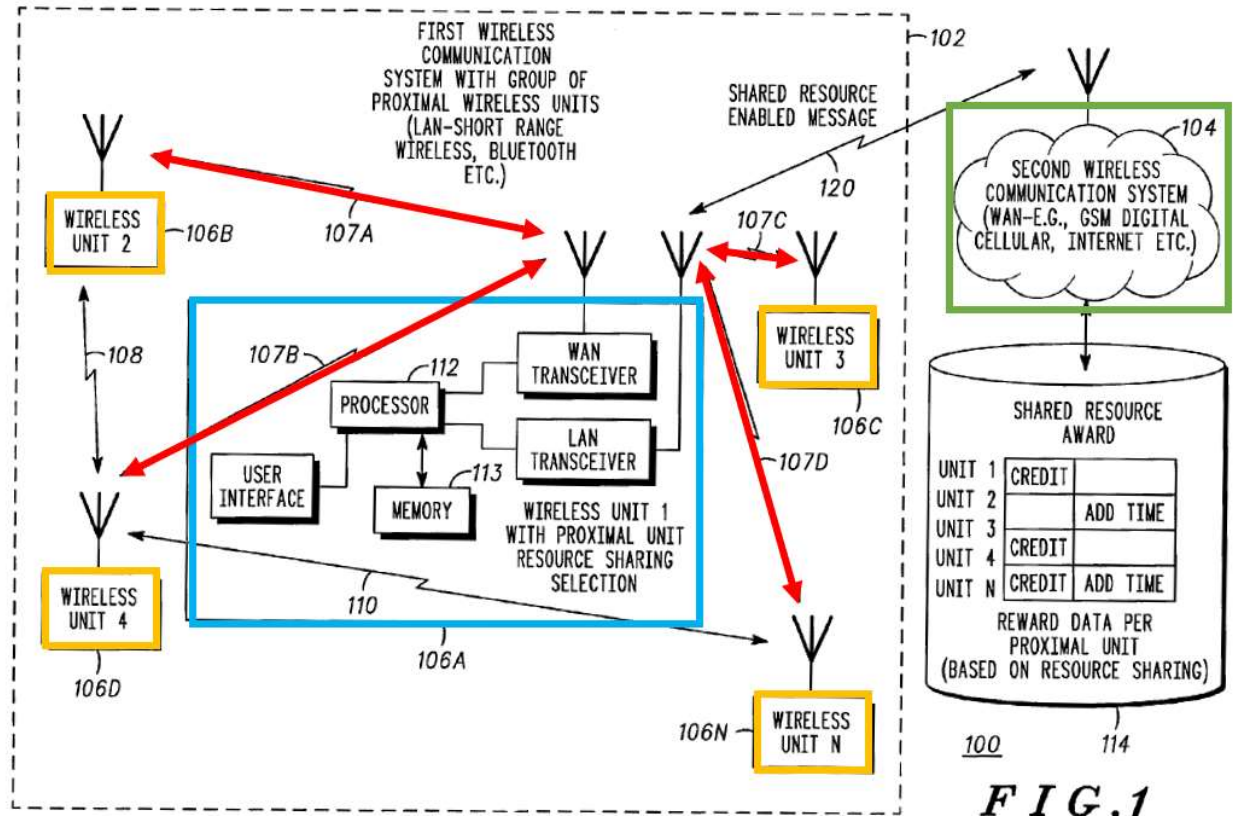
Kotzin discloses [1.1.ii]. Devices 106b-n (network-edge devices) are each connected to at least a wireless local area network (“LAN”), as illustrated below:



EX1018, Fig. 1, ¶[0022]. Kotzin further teaches “network element 400 is in communication via a WAN with each of the proximal wireless units 106b-106n in the group.” EX1018, ¶[0040]. Accordingly, devices 106b-n are each connected to at least a LAN and are further connected to a WAN.

iii. [1.1.iii]

Kotzin discloses [1.1.iii]. As shown below, devices 106b-n (network-edge devices, orange) are each connected to device 106A (blue) over a different connection, 107A-107D (red). Each wireless unit has its own connection to unit 106a, as illustrated in Figure 1 of Kotzin:



EX1018, Fig. 1; *see also id.* Figs. 4, 7.

c. [1.2]

Kotzin discloses [1.2]. Kotzin explains “each of the proximal wireless units [(network-edge devices)] communicates via a control message ... with the [network element 400 (data-source device)] to receive the portion of the bandwidth of the communication ... destined for the wireless apparatus 106a [(data-requesting device)].” EX1018, ¶[0040]. In response, “network element 400” on the WAN 104 “responds by transmitting to each of the participating wireless units, *subsets of the total information* destined for the wireless apparatus 106a” and receives “*portions of a communication.*” *Id.* Each participating network-edge

device then “retransmits the respective *portions of the communication* to the wireless apparatus 106a” (data-requesting device) which recombines the portions of the data “to obtain the *complete data stream or message*.” *Id.* ¶¶[0040]-[0041]. Accordingly, Kotzin discloses the device 400 on the WAN 104 (data-source device) transmits different portions of a data stream to proximal wireless units 106b-n (network-edge devices) so the full stream can be assembled at device 106a (data-requesting device). EX1001, ¶64. Further, it would have been obvious to a POSITA that a combination of data streams and packets would be transmitted. EX1001, ¶65. A POSITA would have known that data streams are comprised of packets. EX1001, ¶65. It would have further been obvious that for some messages a group of data packets may be a more effective way to transmit the data instead of a stream. EX1001, ¶66. It would have been a minor modification and required nothing more than basic engineering to transmit groups of data packets in place of or in addition to the streams disclosed in Kotzin. *Id.*

3. Dependent Claim 2

[1] is obvious. *See* § VII.A.2.

Kotzin renders [2] obvious. Kotzin teaches at the outset of the multipath connection, “the network element 400 receives a message in the form of data indicating an amount of data (i.e. voice, non-voice etc.) to be sent via [WAN] 104 for the wireless apparatus 106a.” EX1018, ¶[0037]. It would have been obvious for

this to include a connection ID, which a POSITA would have known would be generated by any of the recited devices, so data would be properly routed. EX1001, ¶71. Indeed, Kotzin expressly teaches that Kotzin’s wireless units only share bandwidth for a “*particular communication session*.” EX1018, ¶[0021]. For example, it is obvious an identifier would have been used to route packets sent from the data-source device to the data-requesting device, and a POSITA would have expected to use such an identifier for routing data as described in Kotzin. EX1022, ¶[0035]; EX1001, ¶71; *see also* §VII.B.7.c.

Kotzin in view of Peirce further renders this limitation obvious. As noted above, Kotzin’s wireless units only share bandwidth for a given communication session. EX1018, ¶[0021]. As such, a POSITA would have understood and found obvious to include with Kotzin’s messages a connection ID so that the bandwidth-sharing wireless units may differentiate different communication sessions from one another, and only participate in the specific session they have agreed to participate in. EX1001, ¶71. The use of arbitrary or randomly generated numbers for tracking sessions was well known in the art as of 2002. For example, randomly generated connection IDs have been used with web-based applications since at least 2001. These connection IDs were typically generated by the web server and stored in a cookie “to associate a group of online actions with a specific user.” EX1001, ¶70 (citing EX1049 at 3). As another example, as early as 1998, the Real Time

Streaming Protocol (RTSP, RFC2326) used a randomly generated connection ID in client-server packet headers. *Id.* (citing EX1055, §3.4 Session Identifiers); *see also id.* (citing EX1046 (RFC 2543) (SIP); EX1047 (RFC 2131) (DHCP), §2).

Another example of a session identifier that would already be present in Kotzin's system, and that would have been known and obvious to a POSITA, is the tuple used in TCP/IP. The TCP protocol running on top of the IP protocol, known as TCP/IP, is used with Web browsing, and would have been obvious to use with Kotzin. TCP uses a tuple comprised of source and destination IP address/port number (and the protocol in use) to uniquely identify a communication session. As RFC 2663 (the 1999 standard addressing network address translation for Internet communications) explains, "TCP/UDP sessions are uniquely identified by the tuple of (source IP address, source TCP/UDP port, target IP address, target TCP/UDP port)". EX1043 at §2.3. TCP/IP runs underneath the HTTP protocol that is used to browse web pages. EX1001, ¶71 (citing EX1048).

Given Kotzin's express teaching of Internet Web browsing and the need to differentiate different communication sessions for purposes of data sharing, a POSITA would have been motivated to use the TCP/IP identification tuple, for example the tuple between 106A and website 400, for this purpose since it already exists in the system. In view of Kotzin's teaching of the need for a session identifier, a POSITA would have understood and found obvious to include the

TCP/IP tuple for the primary flow between 106a and 400, just like a randomly generated session ID, as part of the data payload in communications associated with that session including the messages exchanged with the bandwidth-sharing units, thereby enabling the bandwidth-sharing wireless units to identify a specific multilink communication session. EX1001, ¶70; *see also* EX1043.

It also would have been obvious to incorporate Peirce’s teaching of a session identifier into Kotzin, as explained in Section VII.A.1.a above.

4. Dependent Claim 3

Claim 3 simply recites connecting a second network-edge device whereas Claim 1 already requires a plurality of network-edge devices. *See* §VII.B.3.

a. [3.pre]

[3.pre] is obvious. *See* §VII.A.2.

b. [3.1]

[3.1] is obvious. Kotzin discloses the data-source device receiving multipath information about each of a plurality of devices capable of joining a multipath connection. *See* §VII.A.2.b.i. As shown below, in step 508, Unit 1 sends “a bandwidth distribution message 508 which notifies the [WAN]” which units will participate in sharing with 106a.

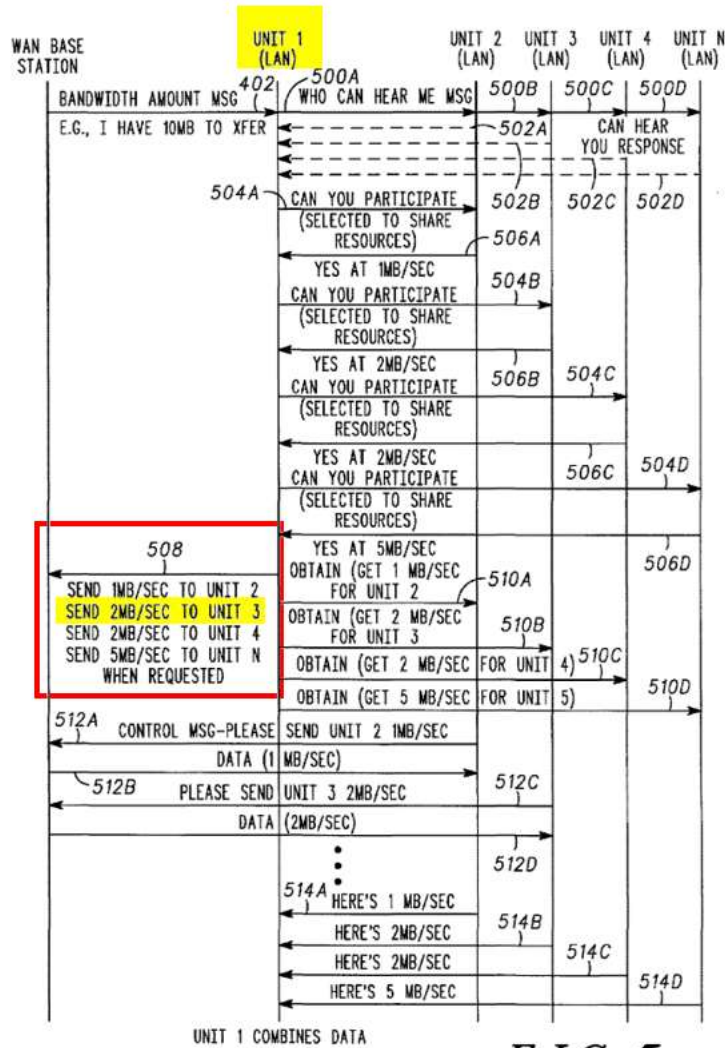
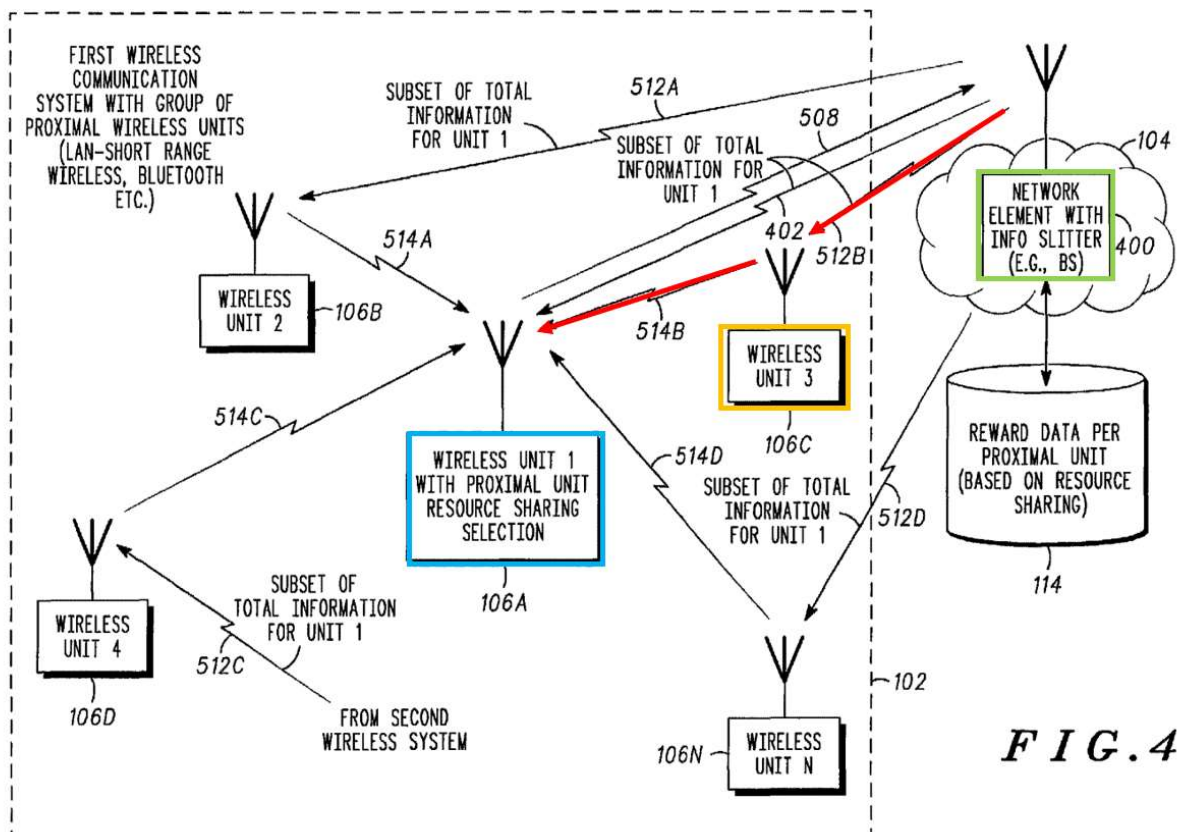


FIG. 5

EX1018, ¶[0039] (identifying specific amounts sent to each apparatus, e.g. “one megabit per second”), Fig. 5. Accordingly, the data-source device receives second multipath information about additional devices like 106c (second network-edge device) capable of joining the connection.

c. [3.2]

[3.2] is obvious. Kotzin discloses a data-source device (a network element, such as a WAN base station or web server) joining a second network-edge device (apparatus 106c) to the multipath connection.



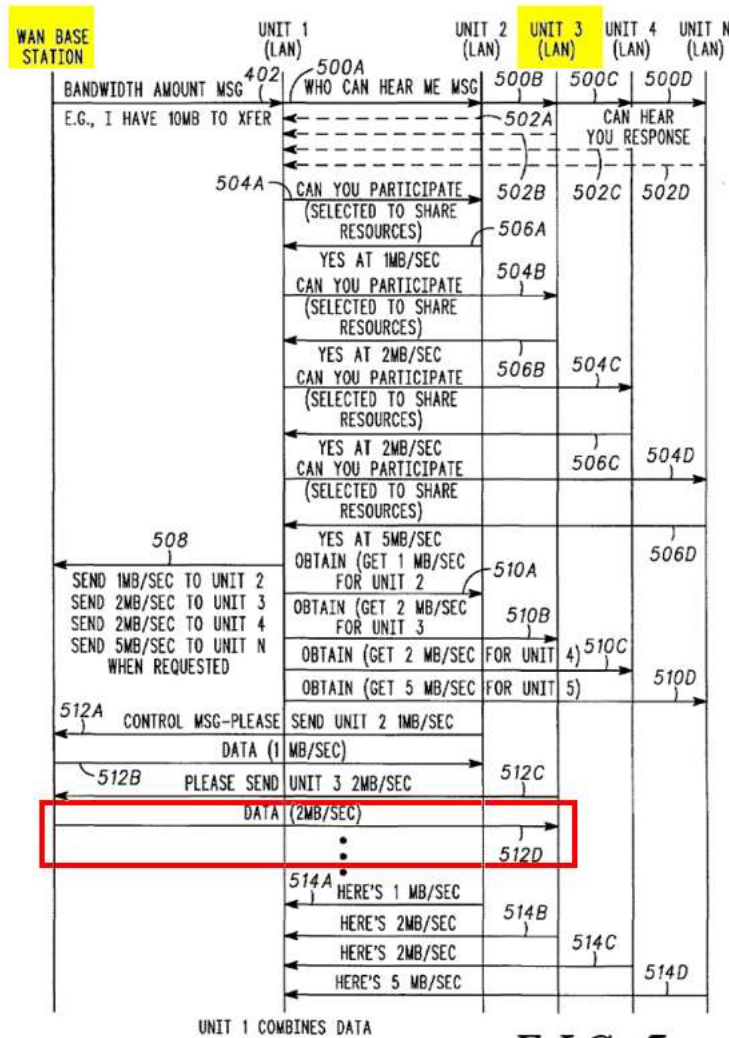


FIG. 5

EX1018, Figs. 4-5, ¶[0040] (network element 400 responds to control messages by sending a portion of the requested data); EX1001, ¶78. A POSITA would find it obvious that for the WAN base station in Fig. 5 to send data to unit 3 as indicated it would need to first join unit 3 to the connection. *Id.* As such, A POSITA would have understood that the network element on the WAN joins the second device to the multipath connection. *Id.*

5. Dependent Claim 4

a. [4.pre]

[4.pre] is obvious. *See* §VII.A.2.

b. [4.1]

[4.1] is obvious.

As discussed above with reference to claim 1, Kotzin's wireless units 106b-n constitute network-edge devices capable of joining a multipath connection with a data-requesting device. Kotzin explains that network element 400 may reallocate downlink packets to different network edge devices 106b-n based on information received from wireless unit 106. EX1018, ¶[0043] (signal strength information informs how a communication is split). Thus, when network element 400 receives a message from UNIT 1 (which is a multilink packet because it is part of a multilink packet communication as discussed above) that the signal strength on a particular network-edge device is too low for efficient transmission, a POSITA would have understood and found obvious that that interface would be removed from the multilink session by the server so that the server does not send any packets to that interface. EX1001, ¶¶79-80. Accordingly, Kotzin discloses a data-source device receiving multipath information about which network-edge devices are to be removed from the multipath connection.

c. [4.2]

[4.2] is obvious. As explained in [4.1], when Internet web server 400 (*i.e.*, data source device) receives a message that indicates a device should be removed from the transmission, the Internet web server 104 would not send further data to the device, effectively removing the network-edge device from the multipath connection. EX1001, ¶80.

6. **Dependent Claim 5**

[1] is obvious. *See* §VII.A.2.

Kotzin renders [5] obvious. As explained above in Section VII.A.5.b, it would have been obvious for the data-source device to receive information about which devices are to be removed from the connection. EX1001, ¶80. It would have been obvious to a POSITA that this determination would have been made by the data-source device. EX1018, ¶[0043]; EX1001, ¶80. If the signal strength for the connection between a data-source device and network-edge device is not adequate, the data-source device may determine that a network-edge device should be removed from the multipath connection. *See* §VII.A.5; EX1001, ¶80.

7. **Dependent Claim 6**

[1] is obvious. *See* §VII.A.2.

Kotzin renders [6] obvious. Kotzin discloses the data-source device as being a network element in a WAN. *See* §VII.A.2.b.i; EX1018, ¶[0035]. For example, Figure 4 depicts “a network element 400, such as ... [an] *Internet Web server* , or

any other suitable unit within the second wireless communication system 104, splits [] a communication destined for the wireless apparatus 106a.” EX1018, ¶[0035]. Accordingly, Kotzin discloses at least the data-source device being a server. EX1001, ¶82. Further, it would have been obvious to a POSITA that other suitable units for network element 400 for providing the communication services disclosed in Kotzin would further include a multipath link aggregator, a network relay, a multipath link server, a network switch, a network router and a device capable of providing multipath services. EX1001, ¶83. Each of these devices was known in the art and it would have been obvious to use any of these devices to provide Kotzin’s communication services. *Id.*

8. Independent Claim 7

a. [7.pre]

[7.pre] is obvious. *See* §VII.A.2.a.

b. [7.1]

[7.1] is obvious. Kotzin discloses a WAN network element (data-source device) receiving multipath connection requests from an apparatus 106a (data-requesting device) to establish and send data during a multipath connection. *See* §VII.A.2.b. Specifically, “network element 400 receives a message in the form of data indicating an amount of data ... to be sent via the [WAN] 104[.]” EX1018, ¶[0037]; *see* §VII.A.2.b. This is message 402 on Kotzin’s Fig. 5, indicating it transmits an amount of data to send (*e.g.*, 10MB):

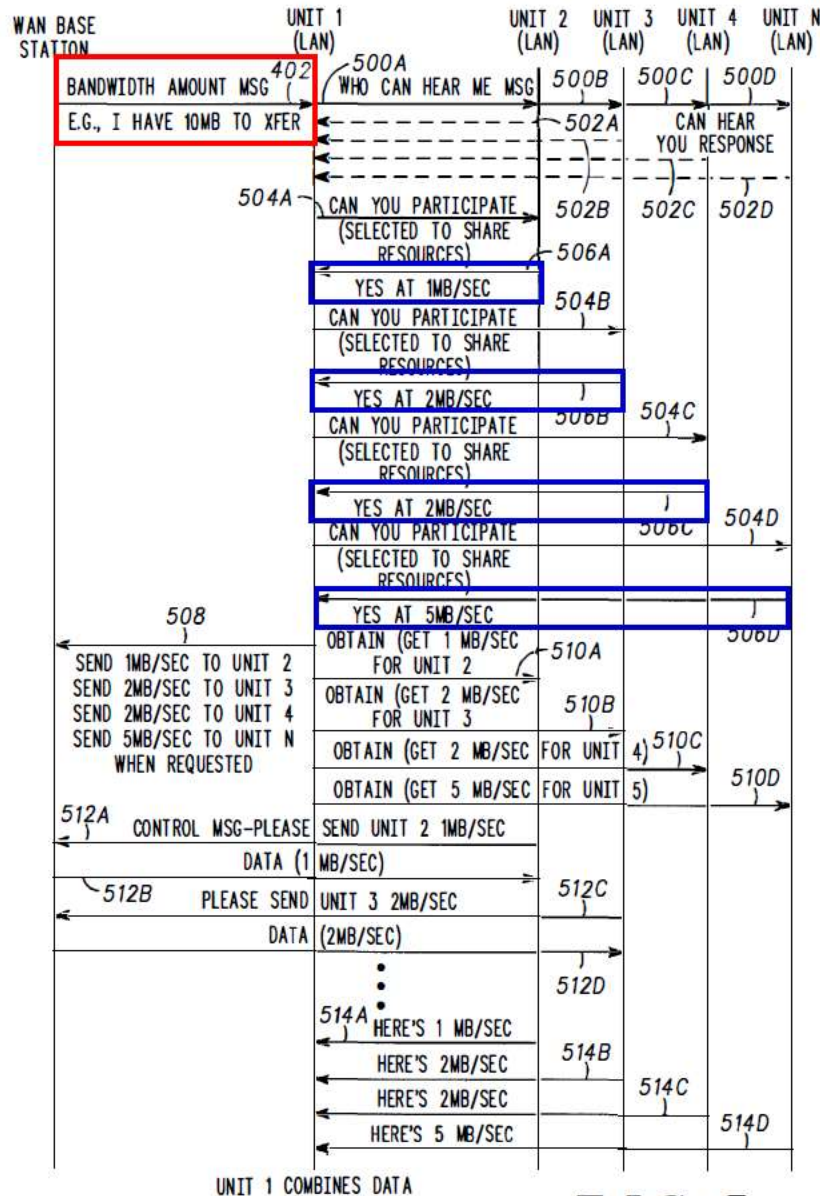


FIG. 5

Id., Fig. 5. Further, a POSITA would have known that connection requests would be sent by a plurality of data-requesting devices, each of which requests data from network element 400 and has a particular multipath connection. EX1001, ¶86; §VII.A.2.b.i. A POSITA would find it obvious that the multipath connection requests (*see* EX1018, Fig. 5 above, messages 500a-n, blue) would not be

coordinated as separate responses, but rather, likely to occur simultaneously. EX1001, ¶86. Accordingly, Kotzin renders [7.1] obvious. EX1001, ¶¶85-87.

c. [7.2]

[7.2] is obvious. As explained for [2], the bandwidth amount message 402 includes a connection ID. *See* §VII.A.3. A POSITA would have known and found it obvious that network element 400, such as a WAN base station or web server (data-source device), uses the connection ID and associates it to each multipath connection request, including in messages 402 to device 106a and messages 512B and 512D to wireless devices 106b and 106c, so data transmissions can be properly routed. EX1001, ¶88.

d. [7.3]

[7.3] is obvious. Network element 400 (data-source device) receives and uses multipath information via message 508 about a plurality of devices 106b-n (network-edge devices) capable of joining the particular multipath connection. *See* §VII.A.2.b.i. A POSITA would have known this multipath information identifies the network-edge devices capable of providing bandwidth to the particular connection request between network element 400 and device 106a (the particular data-requesting device). EX1001, ¶90. This connection has a connection ID, as discussed above. *See* §VII.A.3.

e. [7.4]

[7.4] is obvious. Kotzin teaches that before network element 400 (data-source device) sends data to devices 106b-n (network-edge devices), the particular multipath connection between the WAN network element and the device must be established. Kotzin explains each wireless unit “communicates via a control message ... with the [WAN].” EX1018, ¶[0040]. This is shown by, *e.g.*, messages 512a and 512c from the network-edge devices to the data-source device:

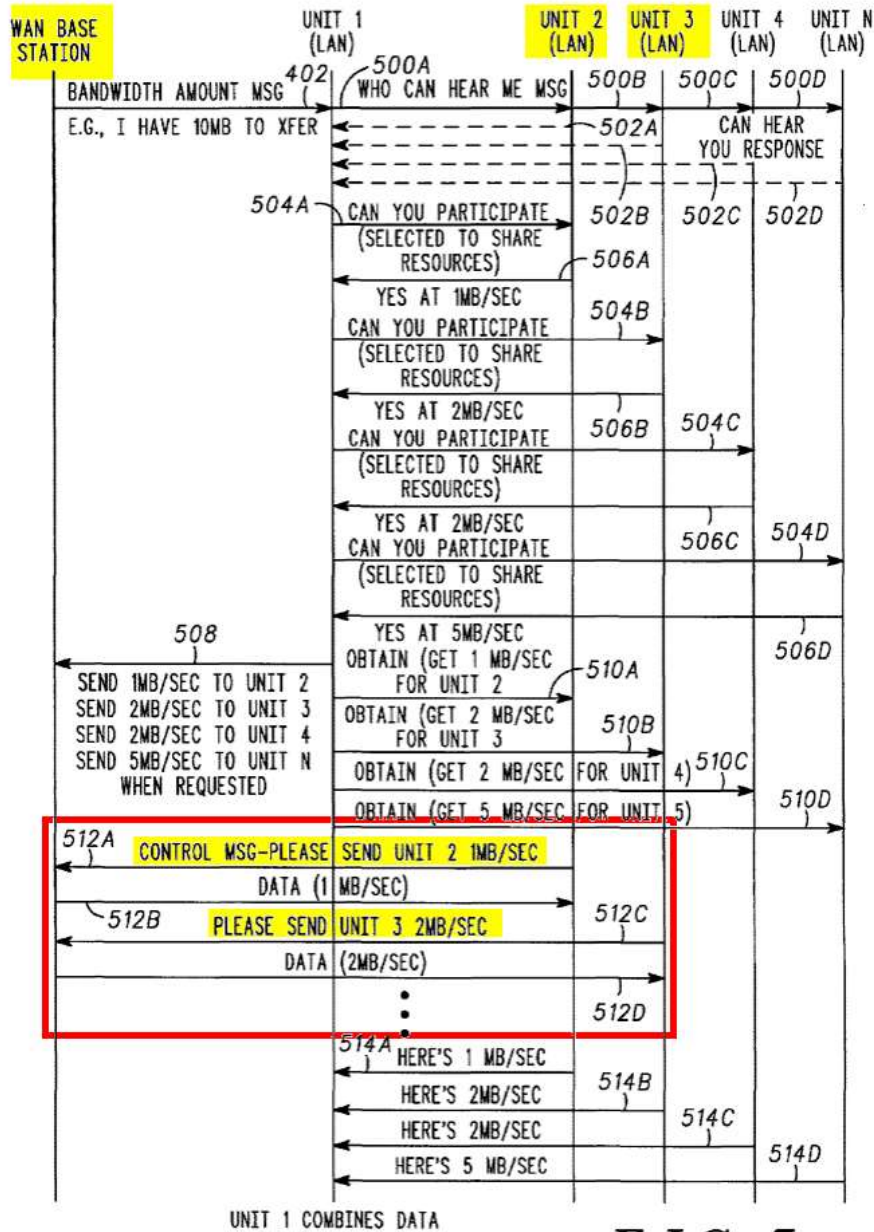


FIG. 5

Id. Fig. 5; EX1001, ¶92. A POSITA would have understood that before the network element 400 sends the data back to the wireless devices (steps 512B and 512D), the network element 400 would first notify the devices that the control message was received and that the device will be participating in the multipath

connection. EX1001, ¶93. Indeed, using such notifications through handshakes and acknowledgments were well-known methods of establishing a connection between devices. EX1020, 654; *Id.*

f. [7.5]

[7.5] is obvious. Kotzin discloses transmitting portions of the requested data associated with the particular connection ID to each of the wireless devices (network-edge devices) participating in the particular multipath connection associated with the particular connection ID. *See* §VII.A.8.c (Kotzin discloses a connection ID specific to a multipath request). Kotzin discloses that each participating unit receives “portions of a communication destined for the wireless apparatus 106a.”

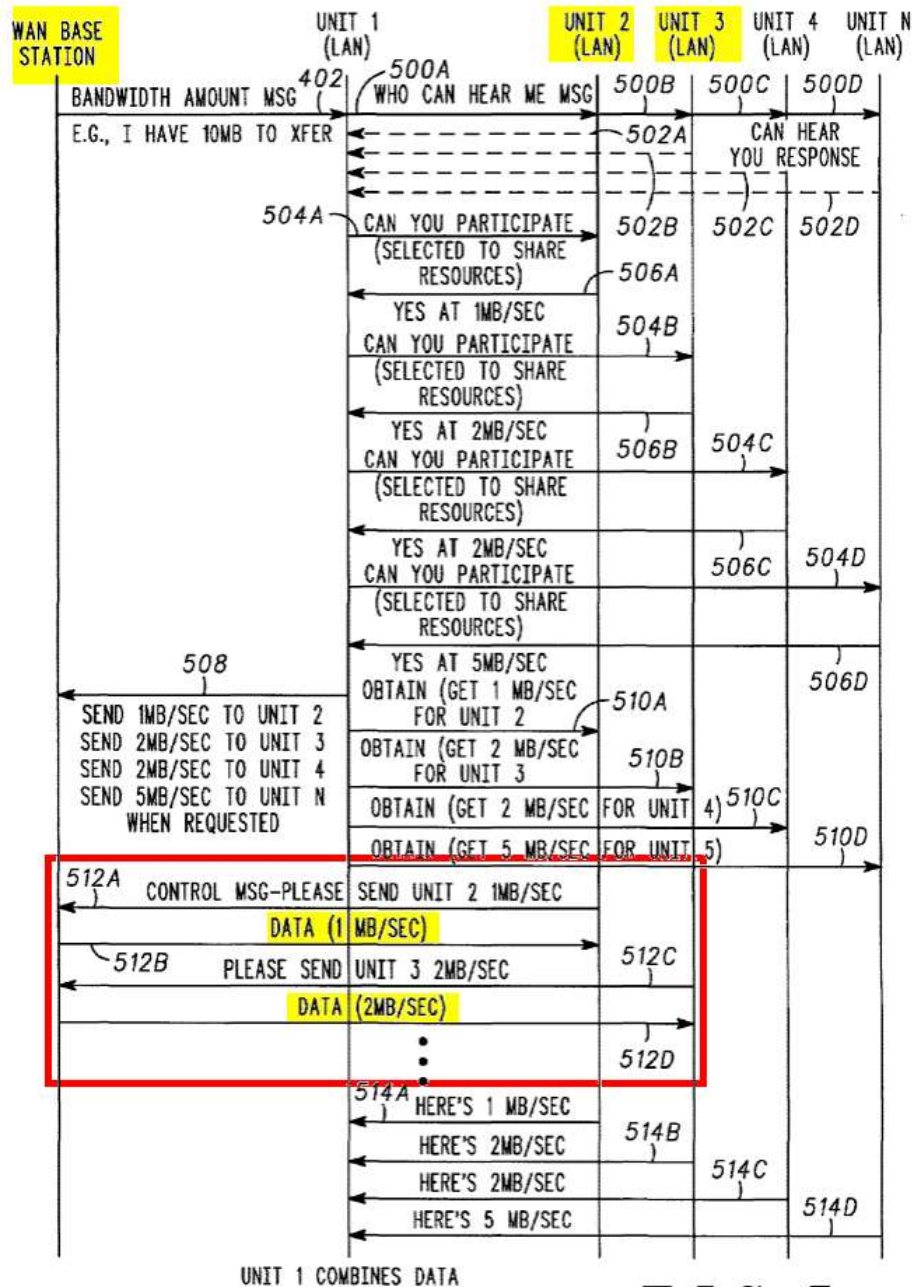


FIG. 5

EX1018, ¶[0040], Fig. 5; *see also id.* Fig. 6, ¶[0041]. Thus, network element 400 (data-source device) sends data associated with the connection ID to each proximal wireless device (network-edge devices). EX1001, ¶95.

9. Dependent Claim 8

Kotzin renders [8] obvious. *See* §§VII.A.8.f, VII.A.2.c.

10. Dependent Claim 9

a. [9.pre]

[9.pre] is obvious. *See* §VII.A.8.

b. [9.1]

[9.1] is obvious. *See* §VII.A.5.b.

c. [9.2]

[9.2] is obvious. *See* §VII.A.5.c.

11. Dependent Claim 10

[7] is obvious. *See* §VII.A.8.

Kotzin further renders [10] obvious. A POSITA would have known that a sometimes packets would not be delivered properly, and so it was known in the art to notify a data-requesting device when all data has been sent. EX1001, ¶96. Moreover, Kotzin indicates the wireless devices “allocate” resources to a “particular communication or session.” EX1018, ¶[0038]. It would have been obvious to a POSITA to send a notification from the data-source device notifying the data-requesting device when all data has been sent over the particular multilink connection, including so that the data-source device can release the allocated resources reserved for the communication. EX1001, ¶97.

a. Held

Although Kotzin alone (Ground IA) renders the Challenged Claims obvious, a POSITA would have been motivated to combine Kotzin with Held (Ground IB) in order to incorporate into Kotzin's system commonly employed protocol families such as TCP and the notification that all data has been sent required by Claim 10, further rendering that claim obvious.

Held further confirms it would have been obvious to a POSITA that, when packets are sent over networking protocols, the data-sending and data-requesting devices receive various notifications, and Held discloses using TCP for this purpose. EX1020, 654 (“[TCP] contains error detection and correction features. ... A handshake is simply the exchange of control information between the two computers. This information enables the computers to determine which packets go where and ensure that all the information in the message has been received. When a connection is desired between two systems, Host A and Host B, using TCP/IP, a three-way handshake must occur.”) It would have thus been obvious in view of Held to send a notification from the data-source device notifying the data-requesting device when all data has been sent over the particular multilink connection. EX1001, ¶¶98-102.

12. Dependent Claim 11

[11] is obvious. *See* §VII.A.8, VII.A.7.

13. Dependent Claim 12

[12] is obvious. *See* §§VII.A.8, VII.A.3.

14. Independent Claim 13

a. [13.pre]

[13.pre] is obvious. *See* §VII.A.2.a.

b. [13.1]

i. [13.1.i]

[13.1.i] is obvious. Kotzin discloses apparatus 106a (data-requesting device) sending a multipath request to devices 106b-n. Apparatus 106a sends “query messages” to determine which proximal wireless devices are capable of joining a connection, indicated in red below:

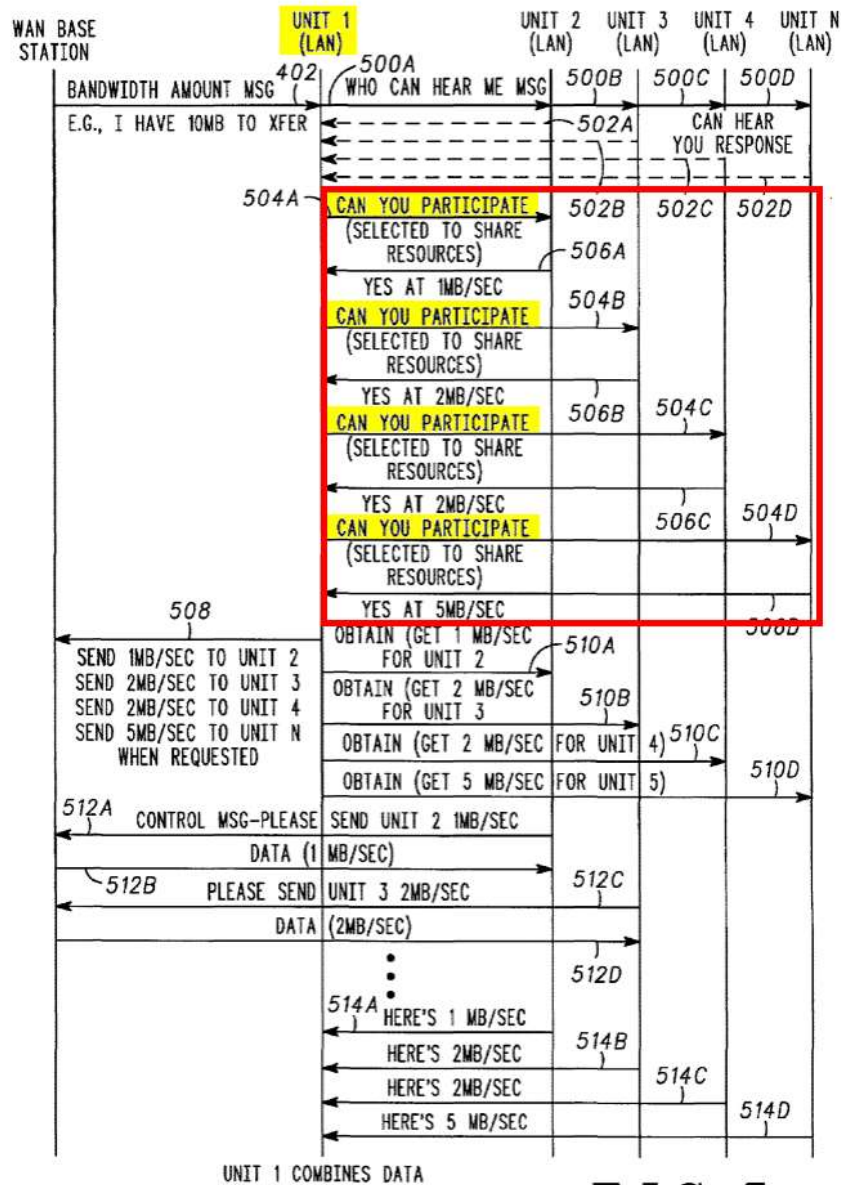


FIG. 5

EX1018, ¶[0037], Fig. 5; *See* §VII.A.2.b.i. If a device has been designated as a device that will share resources, it responds, confirming it will allow shared use of its resources and further “indicate[s] the amount of wireless resources that they are willing to allocate to *this particular communication or session.*” EX1018, ¶[0038]. Accordingly, device 106a (data-requesting device) sends a request for

devices 106b-n (network-edge devices) to join the particular multipath communication.

ii. [13.1.ii]

[13.1.ii] is obvious. Apparatus 106a sends a multipath request to proximal wireless apparatus 106b-n. *See* §VII.A.2.b.i. Kotzin discloses “the wireless apparatus 106a sends additional shared resource participation queries 504a-504d to each of the wireless apparatus 106b-106n to determine which of these units has been selected by its user to participate...” EX1018, ¶[0037]. As illustrated below, the wireless apparatus 106a (data-requesting device) sends messages 504 to network-edge devices asking if they can participate and selecting them to share resources:

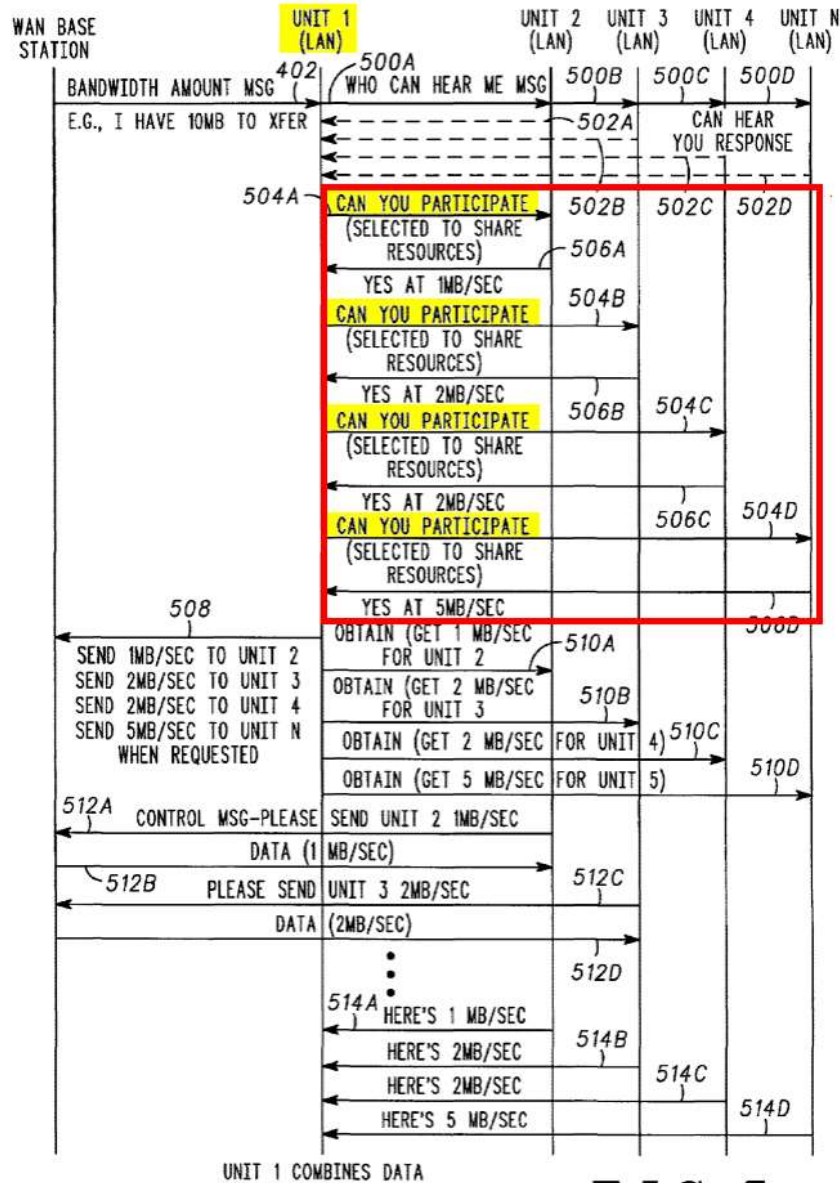


FIG. 5

Id. Fig. 5; EX1001, ¶104. With messages 510, it then requests them to share a certain amount and participate in the connection:

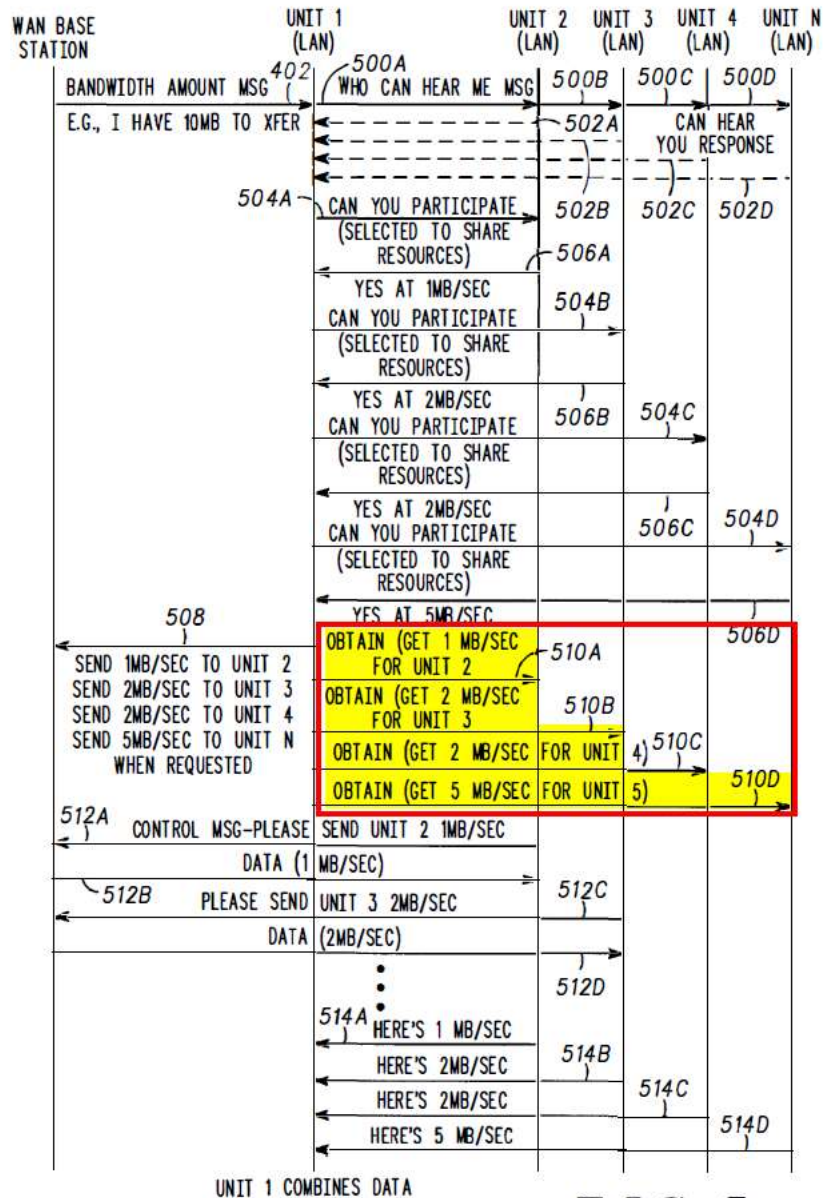


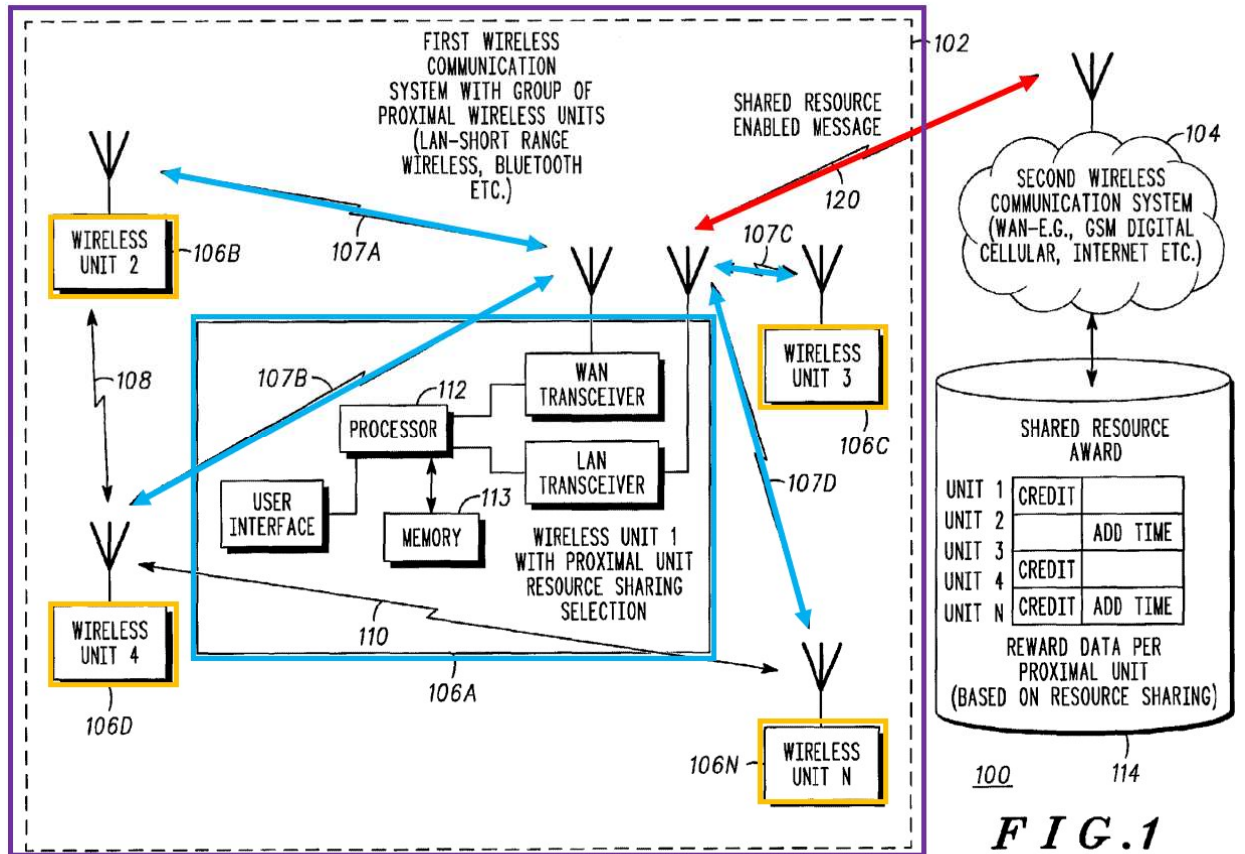
FIG. 5

Id. Fig. 5. These requests indicate that the network-edge devices will join a multipath connection associated with the data-requesting device.

iii. [13.1.iii]

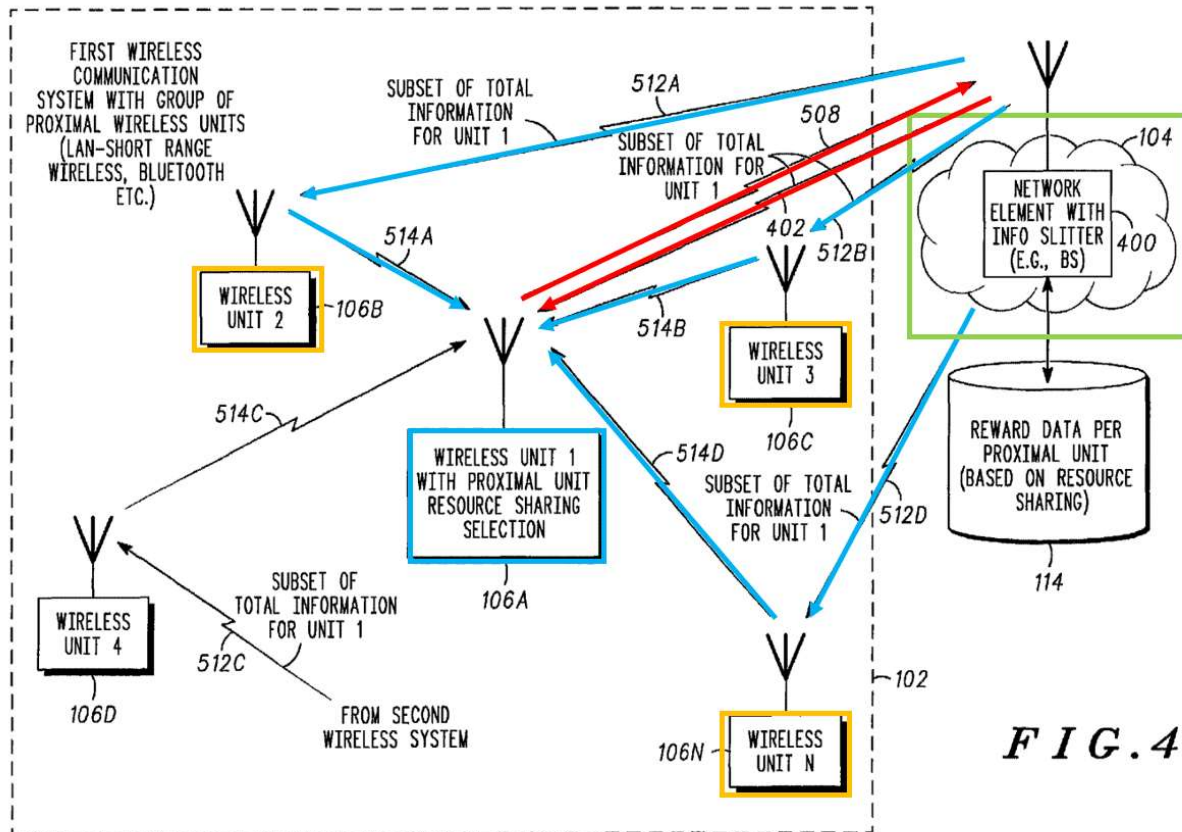
[13.1.iii] is obvious. Kotzin discloses apparatus 106a is connected over a first connection (red) to a WAN and is connected over a plurality of additional

connections (blue) to a plurality of wireless devices (network-edge devices, orange) over a LAN (purple).



EX1018, Fig. 1; EX1001, ¶106. Specifically, each wireless unit in Kotzin’s system “includes both a wireless [LAN] communication transceiver ... and a wireless [WAN] transceiver.” *Id.* ¶[0022]. “As illustrated, wireless units 106b-106n are operative to communicate using a wireless [LAN] protocol with wireless unit 106a via wireless LAN communication links 107a-107d.” *Id.* “Also as shown, wireless unit 106a is in communication with the wireless [WAN] 104 via link 120.” *Id.*

The multipath connection established between 106a and the WAN can use the first and second paths simultaneously to receive data at the same time:

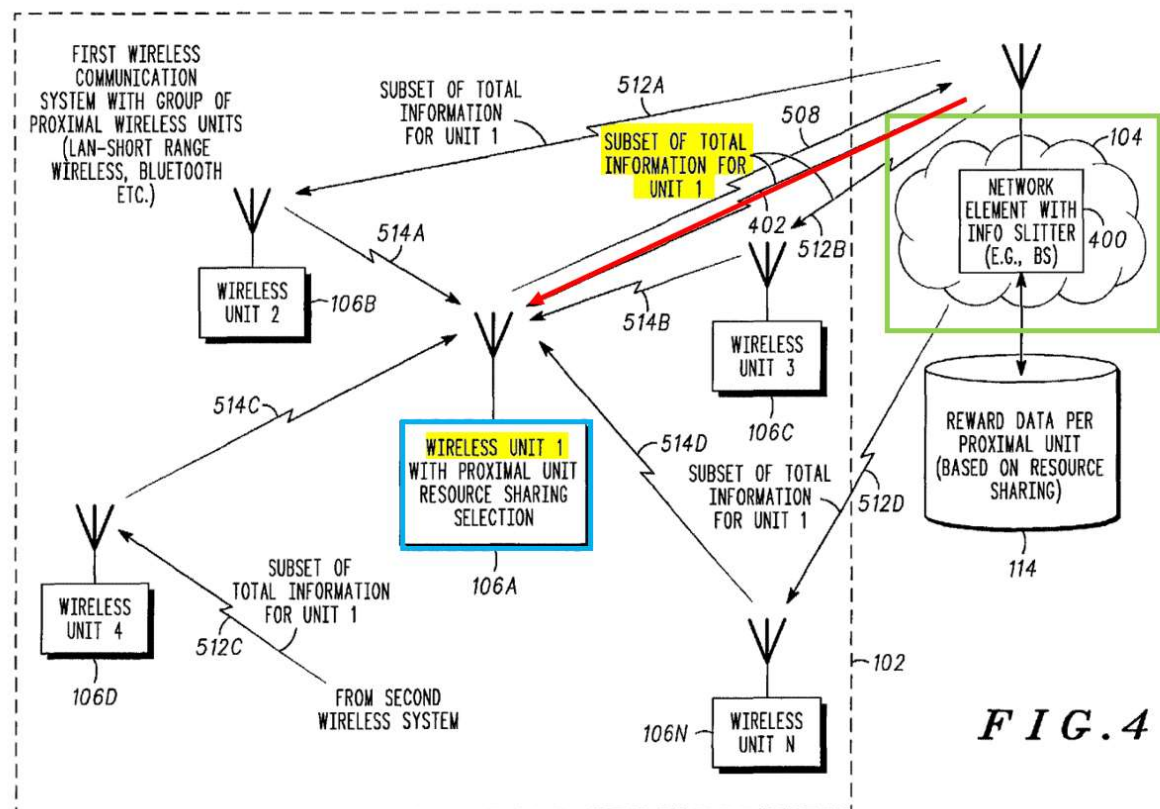


Id. Fig. 4. In this example, each of the participating wireless units “receive the portion of the bandwidth ... destined for the wireless apparatus 106a” so the total message can be received “in a period of about ten seconds or less.” *Id.* ¶¶[0039]-[0040]. By combining the transmission speeds across the links, the overall transmission speed is improved through the link’s concurrent use. EX1001, ¶107. A POSITA would have known these transmissions occur at the same time, rather than serially, so the amount of time it takes for the data-receiving device 106a to

receive all the data is reduced and overall throughput is advanced. *Id.* ¶¶[0006], [0019]; EX1001, ¶107.

c. [13.2]

[13.2] is obvious. Kotzin discloses that in addition to receiving data via additional wireless devices, device 106a (data-requesting device), “the wireless apparatus 106a itself may also participate in receiv[ing] a portion of the message destined for it.”



EX1018, ¶[0039], Fig. 4.

d. [13.3]

[13.3] is obvious. As explained in [1], after wireless devices 106b-n (network-edge devices) join the multipath connection, each receives data from network element 400 (data-source device) on the WAN. *See* §VII.A.2.c. Once a device participating in the multipath connection receives data, “each of the units then retransmits the respective portions of the communication to the wireless apparatus 106a [(data-requesting device)] as shown by messages 514a-514d.” EX1018, ¶[0040].

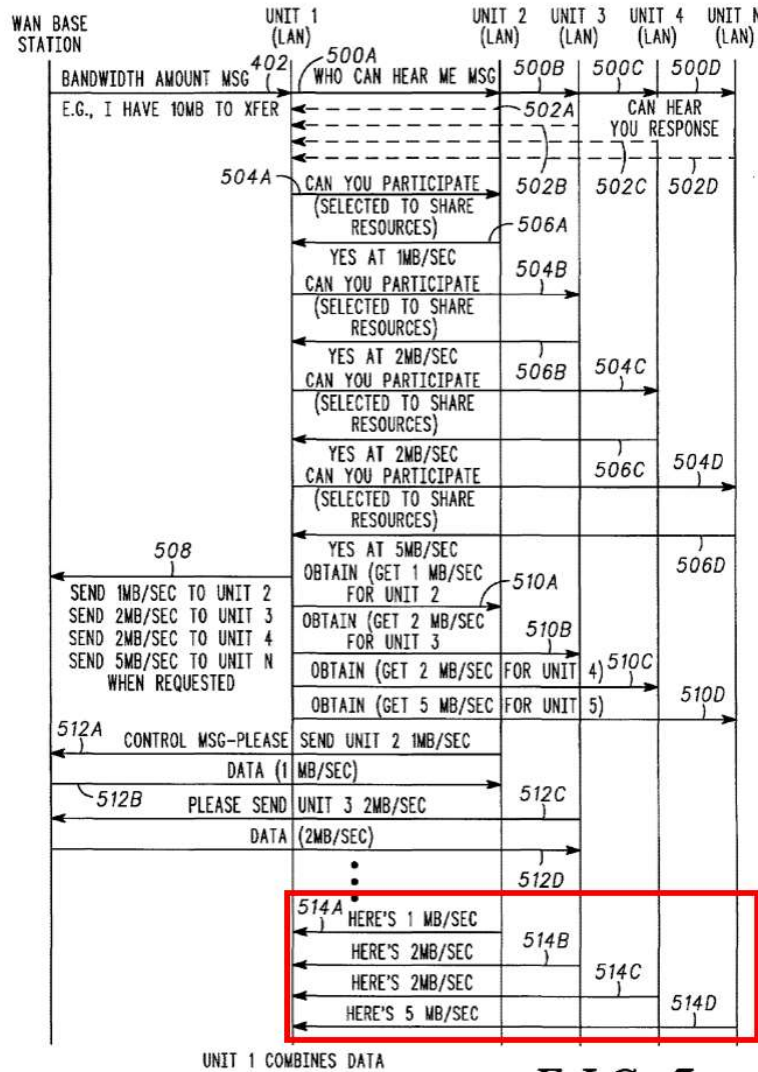


FIG. 5

Id. Fig. 5. As shown below, this data is received by unit 106a (data-requesting device) over a second connection (blue).

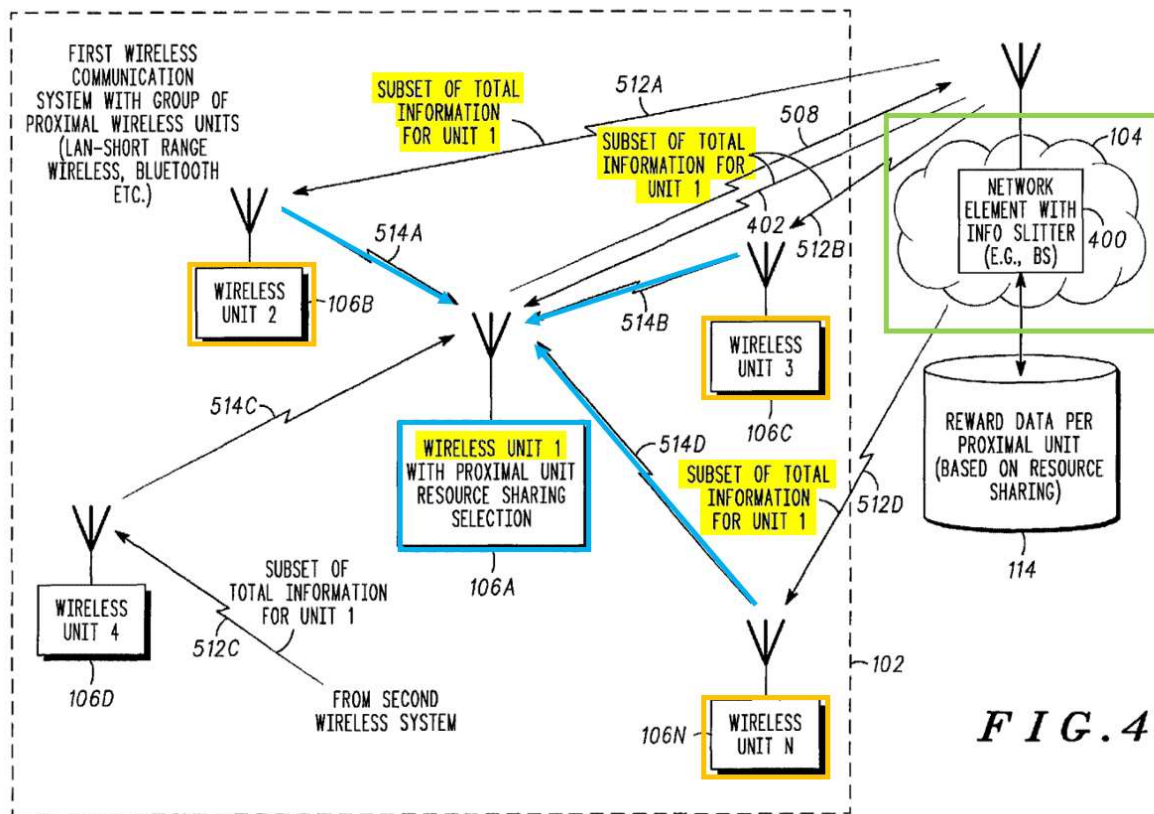


FIG. 4

Id. Fig. 4.

15. Dependent Claim 14

[13] is obvious. *See* §VII.A.14.

Kotzin further renders [14] obvious. Kotzin's system comprises a wireless LAN and a wireless WAN, and each of the devices are expressly wireless units such that the connections are wireless. EX1018, ¶[0022]. Moreover, it would have been obvious to a POSITA for any of the connections to be wired or a combination of wired and wireless, as such techniques were known in the art. EX1001, ¶¶108-109.

16. Dependent Claim 15

[13] is obvious. *See* §VII.A.14.

Kotzin expressly discloses at least Wi-Fi devices, Bluetooth devices, communication devices, and mobile communication devices. EX1018, ¶[0022]. Kotzin further renders [15] obvious. It would have been obvious to a POSITA for the data-requesting device to be any one of the recited devices, as each was known in the art. EX1001, ¶110. Additionally, Kotzin expressly discloses wireless unit 106a (data-requesting device) can be one of a plurality of wireless units including “an Internet appliance, radiotelephone appliance, including, but not limited to, hand held apparatus, laptop computers, desk top computers, or any other suitable wireless communication apparatus.” EX1018, ¶[0022]. Further, device 106a has wireless communication capabilities including a “BluetoothTM-based transceiver” and a “CDMA cellular transceiver.” *Id.*; EX1001, ¶110.

17. Dependent Claim 16

[13] is obvious. *See* §VII.A.14.

Kotzin further renders [16] obvious. It would have been obvious to a POSITA for the data-requesting device to be any one of the recited devices, as each was known in the art. EX1001, ¶111. Kotzin expressly discloses wireless units 106b-n (network-edge devices) can be one of a plurality of wireless units

described in [15] and listed in [16]. *See* §VII.A.16; EX1001, ¶110; EX1018, ¶[0022].

18. Dependent Claim 17

[13] is obvious. *See* §VII.A.14.

Kotzin further renders [17] obvious. Device 106a (data-requesting device) connects to a plurality of additional wireless devices 106b-n (network-edge devices). *See id.* For example, in a multipath connection data can be sent to wireless apparatus 106b, 106c, 106d, and 106n. EX1018, ¶[0039]; *see also* Figs. 4-6; EX1001, ¶113.

19. Independent Claim 18

a. [18.pre]

[18.pre] is obvious. *See* VII.A.14.b.

b. [18.1]

[18.1] is obvious. As explained in [13], device 106a (data-requesting device) concurrently connects to a plurality of network-edge devices 106b-n during a multipath connection. The multipath connection comprises the connections between the data-requesting device and each of the network-edge devices. *See* §VII.A.14; EX1001, ¶115. Kotzin discloses a wireless air interface to make such connections, including “Blue Tooth, 802.11, Hiperlan, etc.” EX1018, ¶[0003]; EX1001, ¶115. Kotzin further discloses a “common air interface ... [that] can

simultaneously provide a connection to a [WAN] and other local subscriber units.”

EX1018, ¶[0003].

c. [18.2]

[18.2] is obvious. Kotzin discloses wireless unit 106a includes a “processing apparatus 112, such as a digital signal processor, microprocessor, discrete logic or any other suitable circuitry that provides the proximal unit resource sharing selection.” EX1018, ¶[0023]. “When the apparatus is so enabled, the processor allows shared use of wireless resources, by the wireless apparatus, in response to the selected enablement of shared use.” *Id.* ¶[0044]. Accordingly, this processor is coupled to the at least one interface in [18.1].

d. [18.3]

[18.3] is obvious. Kotzin discloses wireless unit 106a (data-requesting device) requests data from network 104 via network element 400 (data-source device). EX1018, ¶[0037]. Then, the wireless unit 106a sends messages 500, 504, and 510 to proximal wireless units 106b-n (network-edge devices), as illustrated below:

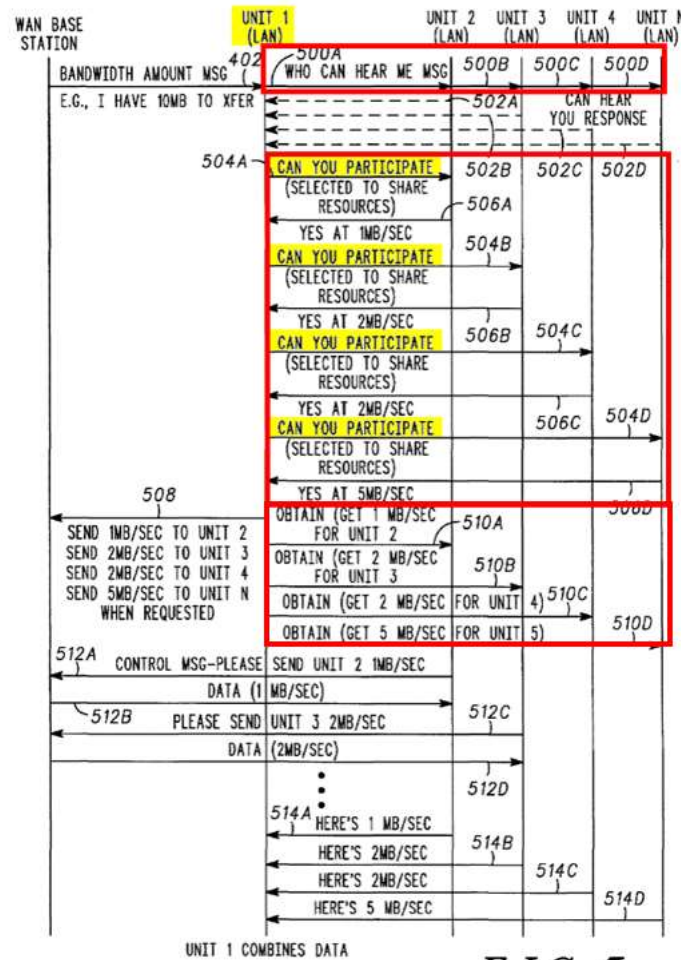


FIG. 5

Id. Fig. 5; *see also id.* ¶[0037]; EX1001, ¶117.

A POSITA would have understood both messages 500 and 512 to identify the proximal units, and messages 504 and 510 to determine which units can share bandwidth sent by device 106a (data-requesting device), and that these messages would have included multipath information because they send information needed to carry out a transmission between unit 106a and network element 400 over multiple paths. EX1001, ¶118. Moreover, these messages are sent to devices 106b-n capable of joining that have not yet joined the multipath connection. *Id.*

e. [18.4]

[18.4] is obvious. *See* §§VII.A.14.c-VII.A.14.d.

20. Dependent Claim 19

[19] is obvious. *See* §§VII.A.19, VII.A.16.

21. Dependent Claim 20

[20] is obvious. *See* §§VII.A.19, VII.A.17.

22. Independent Claim 21

a. [21.pre]

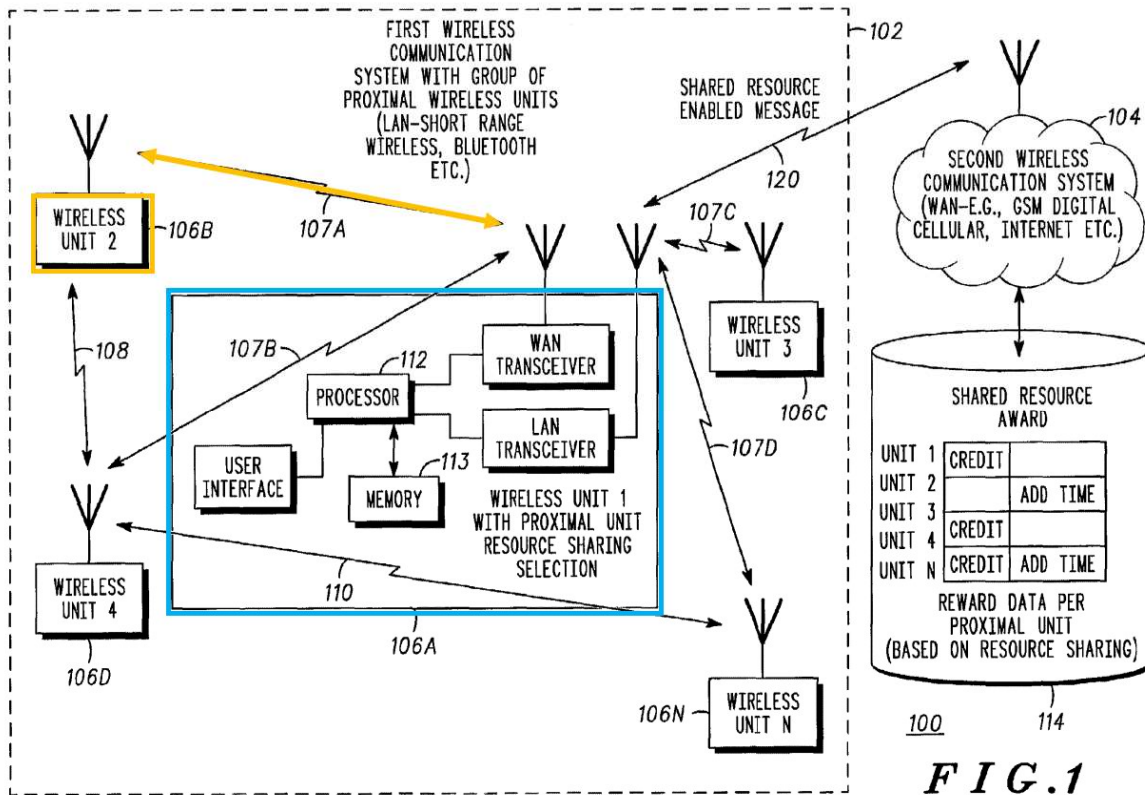
[21.pre] is obvious. *See* §VII.A.2.a.

b. [21.1]

[21.1] is obvious. Kotzin discloses device 106a (data-requesting device) sends “a partial bandwidth request [510] indicating an amount of data to be received by a party from the [WAN].” EX1018, ¶[0040]. “In response thereto, each of the proximal wireless units communicates via a control message [512] or any other suitable scheme, with the [WAN] to receive the portion of the bandwidth of the communication [] destined for the wireless apparatus 106a.” *Id.* A POSITA would have understood that for each of the proximal wireless units 106b-n (network-edge devices) to send a message with control information to the WAN to receive data from network element 400 as disclosed, the wireless unit would need to have first received the control information from wireless unit 106a. EX1001,

¶119. When devices 106b-n receive message 510, the device joins the multipath connection. *See* EX1018, ¶[0040], Fig. 5; EX1001, ¶120.

The data-requesting device 106a (blue) is connected to network-edge device 106b (orange) via a first connection (107A) (orange):

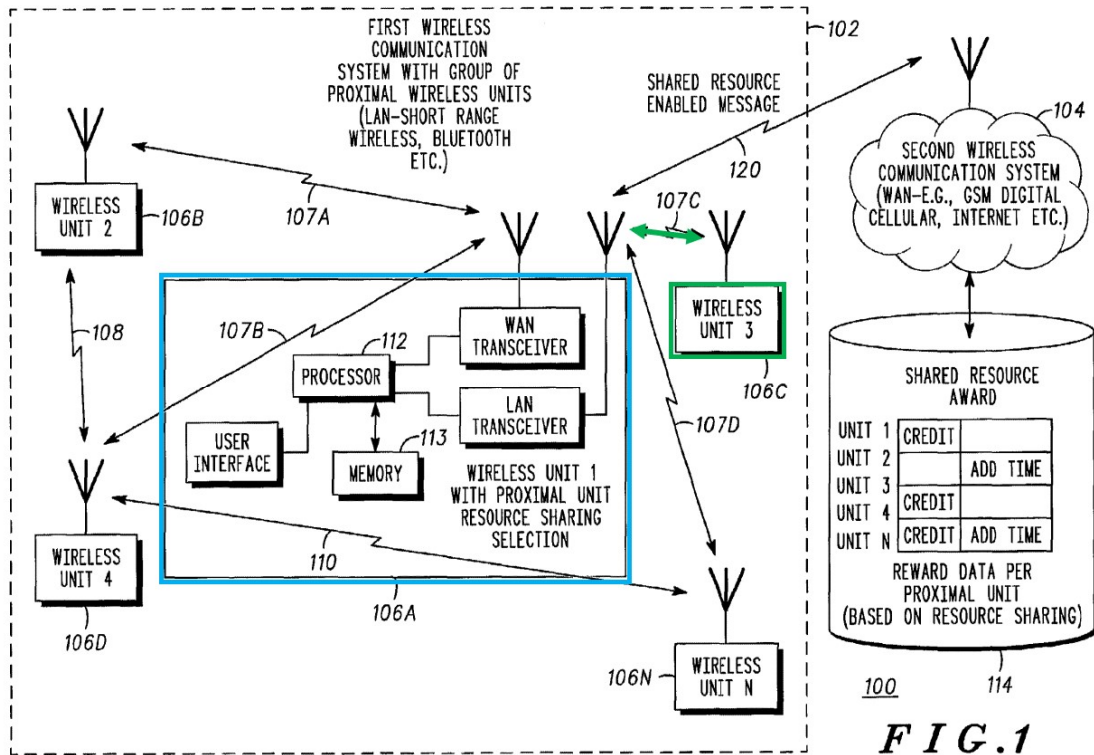


EX1018, Fig. 1; EX1001, ¶121.

c. [21.2]

[21.2] is obvious. As explained for [21.1], Kotzin's device sends multipath control information to network-edge devices 106b-n via messages 510. *See* §VII.A.22.b.

Additionally, the data-requesting device 106a (blue) is connected to a second network-edge device 106c (green) via a second connection (107C) (green):

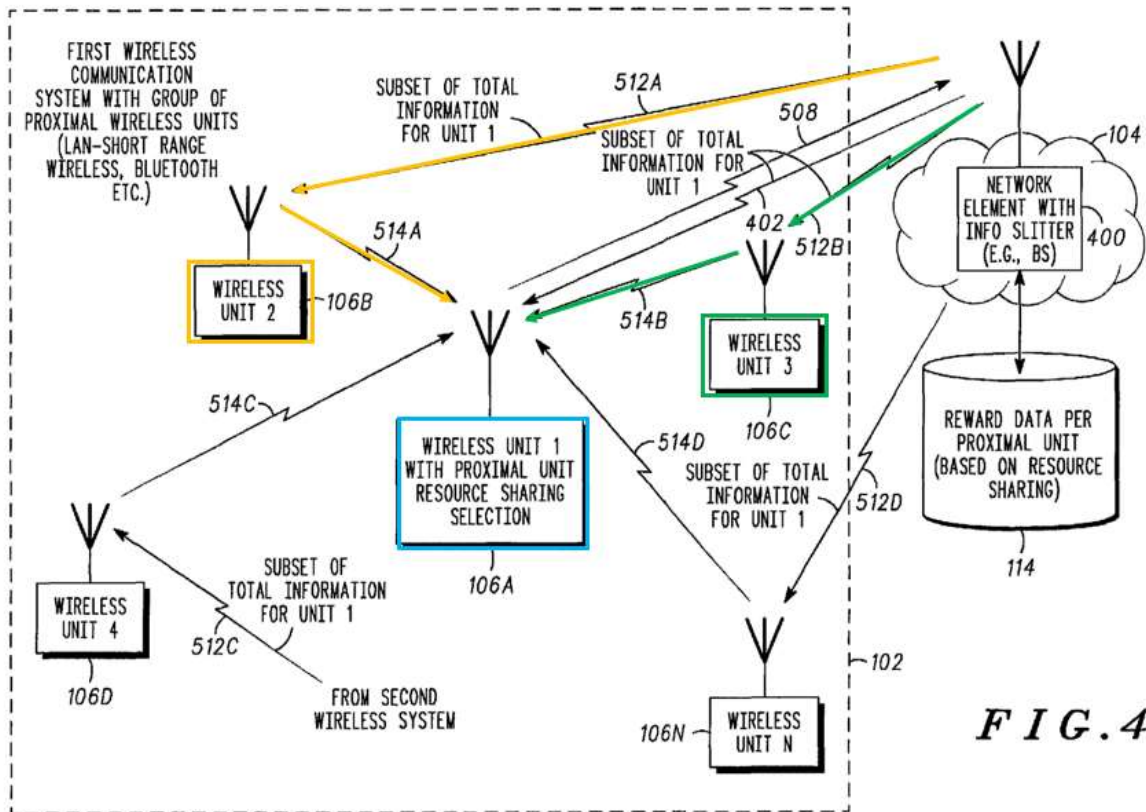


EX1018, Fig. 1; EX1001, ¶122. The data is received over the multiple connections at the same time. EX1018, ¶[0049] (describing “*simultaneous*” transmission of data).

d. [21.3]

[21.3] is obvious. As explained for [21.1] and [21.2], devices 106b-n are joined to the multipath connection *See* §§VII.A.22.b-VII.A.22.c. Then each device 106b-n receives a portion of the total data from network element 400 on the WAN network. *See* §VII.A.2.c. After devices 106b-n receive data from the WAN, “each

of the units then retransmits the respective portions of the communication to the wireless apparatus 106a.” EX1018, ¶[0040], Fig. 4 (messages 514); EX1001, ¶125. As shown below, the first device transmits data over the first connection (orange) and the second device transmits data over the second connection (green):



Id. Fig. 4; EX1001, ¶126.

23. Dependent Claim 22

[21] is obvious. *See* §VII.A.22.

Kotzin further renders [22] obvious. Kotzin discloses each wireless device (network-edge device) is connected to the same LAN 102, and that at least devices 106b, 106c, ... 106n are all connected to the same WAN 104. Specifically,

“wireless apparatus 106a sends query messages ... to determine which proximal wireless units in the LAN can hear the query message” (EX1018, ¶[0037]) as depicted below:

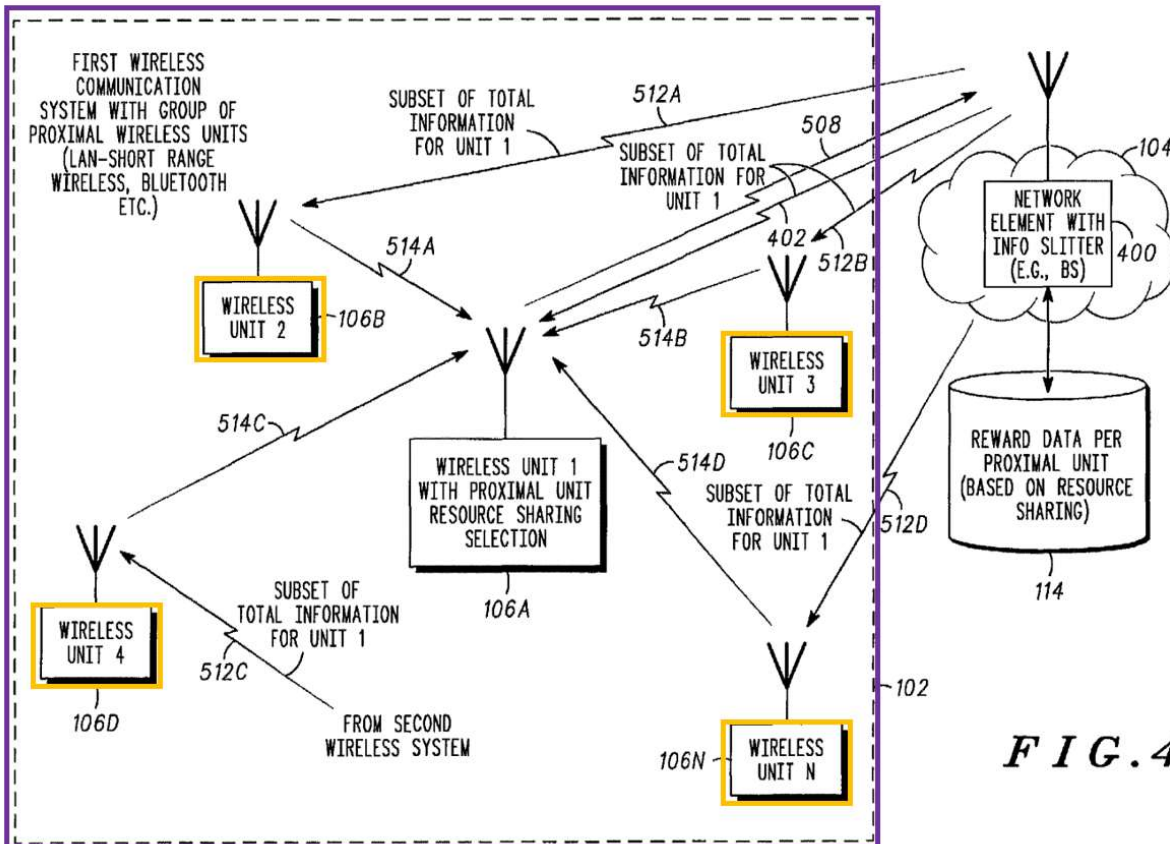
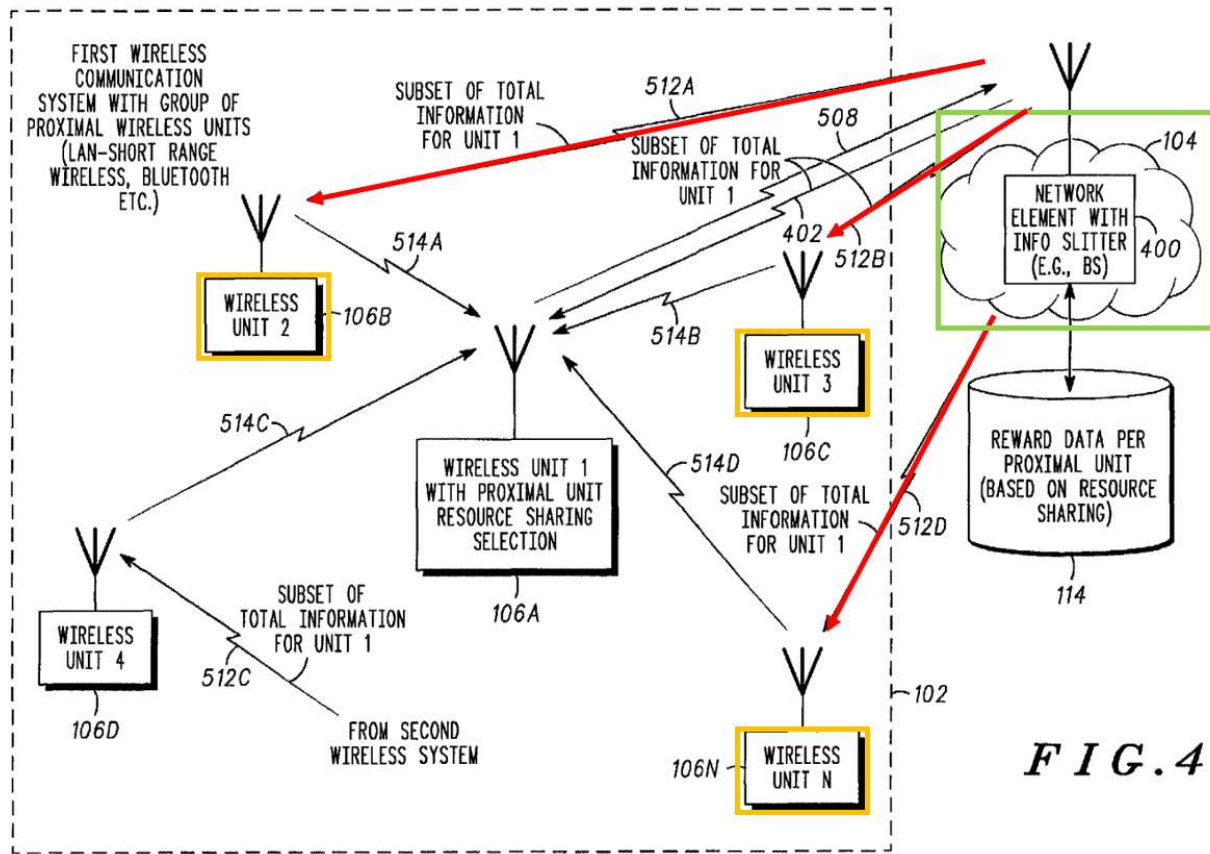
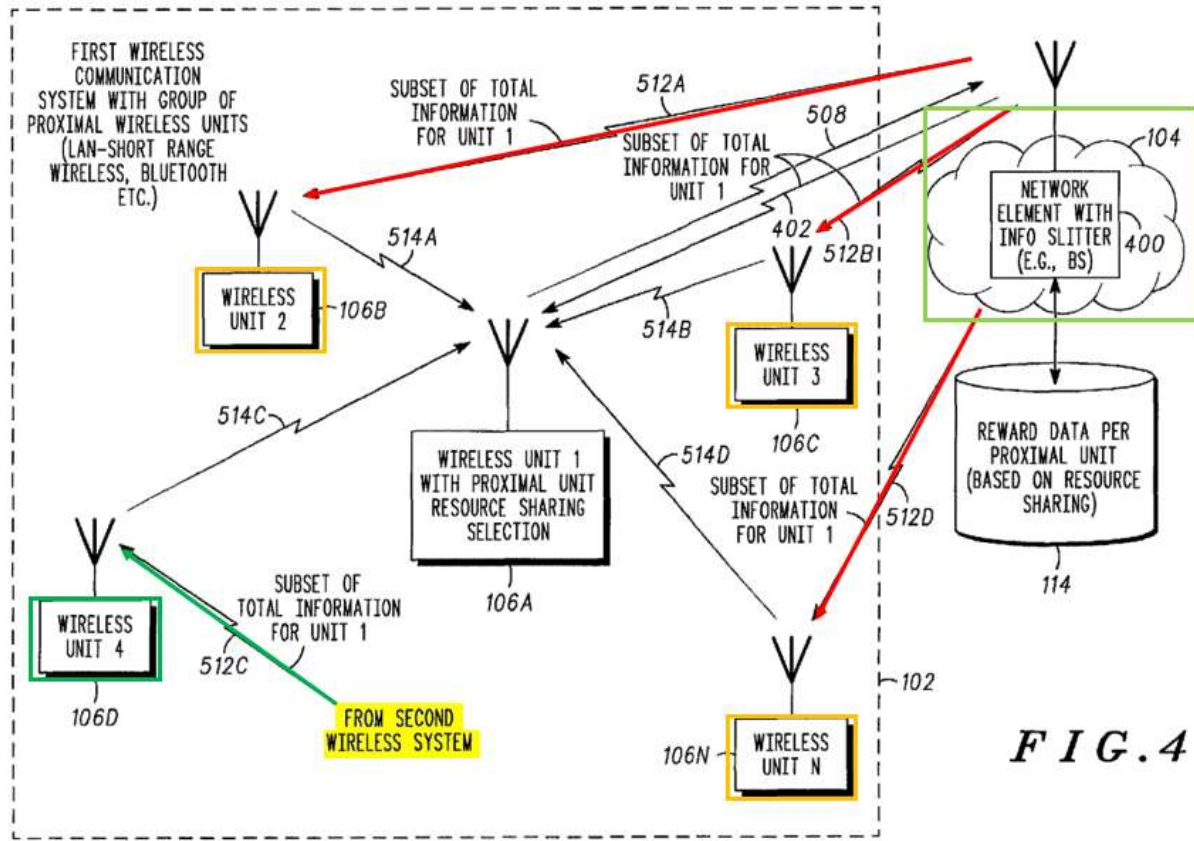


FIG. 4

Id. Fig. 4 (where devices 106b-n (orange) are in the same LAN communication system 102 (purple)); *see also id.* ¶[0022]. Further, at least devices 106b, 106c, ... 106n are also connected to the same WAN 104 (green).



Id. Fig. 4; EX1001, ¶127. In addition, the second network-edge device can be connected to a second network. EX1018 ¶[0035] (“wireless apparatus 106a-106n may be subscriber radios on completely different WAN systems”). Figure 4 confirms that a “second wireless system” can be used for a second network edge device:



Id. Fig. 4 (showing unit 106D connected to a “second wireless system” and units 106B, 106C, and 106N connected to network 104); EX1001, ¶128.

24. Dependent Claim 23

Kotzin expressly discloses the connections in this claim to be wireless. *See* §§VII.A.22, VII.A.15.

B. Grounds IIA and IIB: Claims 1-23 Are Obvious Over Phatak Alone Or In View Of Held

1. Independent Claim 1

a. [1.pre]

To the extent [1.pre] is limiting, it is disclosed or at least obvious.

Phatak proposes a mechanism for streaming data across multiple IP interfaces (A_1 , A_2 , A_3 , B_1 , B_2). EX1045, 773, Fig. 1. These interfaces are a multipath connection, as illustrated in Figure 1 below, and improve network throughput and reliability.

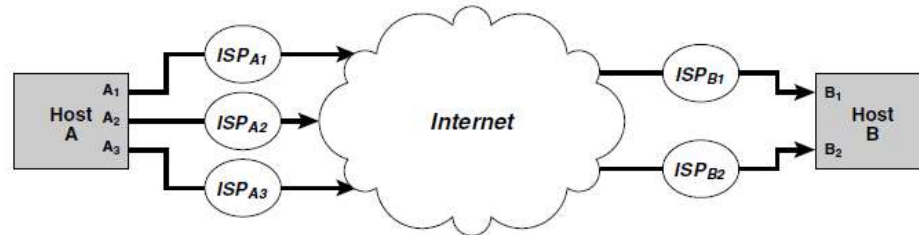


Fig. 1

COMMUNICATING HOSTS WITH MULTIPLE NETWORK CONNECTIONS
(MULTI-HOMED).

Id., Fig. 1 (showing multiple paths from Host A to Internet and from Internet to Host B).

i. [1.1.i]

[1.1.i] is disclosed or at least obvious. Phatak describes a data-source device (e.g., Host A) that is aware of multiple interfaces, both wired and wireless, and their properties (e.g., bandwidth, latency). See EX1045, 774-776 (Section II, “Proposed Aggregation Mechanism,” discussing the data-source being aware of multiple IP interfaces and their properties).

Phatak discloses that, “a mobile host might have access to the Internet via multiple networking technologies such as Bluetooth, wireless LAN..., and cellular phone modem, where each technology has a corresponding service provider.”)

EX1045, 773. A POSITA would have understood that a given local interface (such as 802.11 LAN, Bluetooth, or a cellular modem) connects to the Internet through a corresponding network-edge device (such as a Wi-Fi access point, Bluetooth gateway, or cellular base station). EX1001, ¶132. These network-edge devices are essential components of the end-to-end path for each interface and are implicitly part of the architecture for bandwidth aggregation and multipath communication as described by Phatak. These devices are further capable of joining a multipath connection with the data-requesting device, as the purpose of Phatak is to aggregate bandwidth across such network-edge devices connected to the data-requesting device. *See* EX1045, 773.

For each such device, Phatak discloses *receiving multipath information* in the form of each host receiving information about the multiple IP addresses (*i.e.*, the available interfaces, which are each connected to a respective *network-edge device* at their respective ISPs) of the other. EX1045, 775 (“The first issue is how to *make [Hosts] A and B aware of any multiple IP addresses the other may have.*”) The IP addresses of each interface are also multipath information about each network-edge device, because each interface corresponds to an edge device at the ISP. A POSITA would have understood this to be a form of “multipath information,” as it enables each host to know the set of possible paths through interfaces (*i.e.*, IP addresses) that can be used for data transmission. EX1001, ¶133.

Phatak suggests accomplishing this by modifying protocol headers to include lists of available IP addresses, similar to how SCTP handles multi-homing. EX1045, 775.

A POSITA would have understood that the exchange of this information is essential for the hosts to coordinate which interfaces to use for sending and receiving data, and to enable the aggregation of bandwidth across those interfaces.

ii. [1.1.ii]

Phatak discloses [1.1.ii]. Each network-edge device is connected to one or more networks:

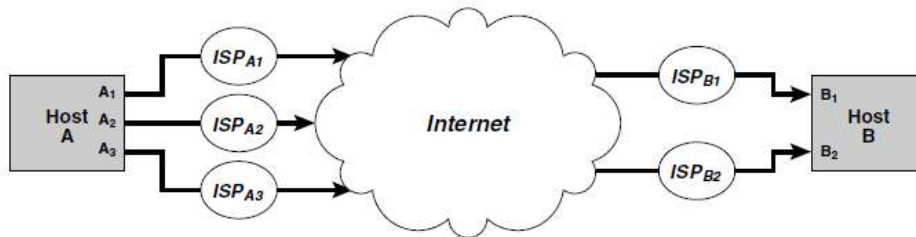


Fig. 1

COMMUNICATING HOSTS WITH MULTIPLE NETWORK CONNECTIONS
(MULTI-HOMED).

EX1045, Fig. 1. These networks include, for example, the ISPs connecting each network-edge device to the Internet. *See id.* Thus, each network-edge device is connected to one or more networks.

iii. [1.1.iii]

Phatak discloses [1.1.iii]. Each local interface, such as a 802.11 LAN interface, Bluetooth scatternet, or a cellular interface (EX1045, 773), connects to

an ISP at a network-edge device such as a Wi-Fi router, a Bluetooth scatternet, and a cellular phone modem; each of these network-edge devices corresponds exactly to an interface. Each network-edge device is connected to Host B (the data-requesting device) over a different connection. EX1045, Fig. 1; EX1001, ¶132. As illustrated in Fig. 1, each such device (corresponding to interfaces located at A₁, A₂, A₃, B₁, and B₂) connects to Host B via a separate path:

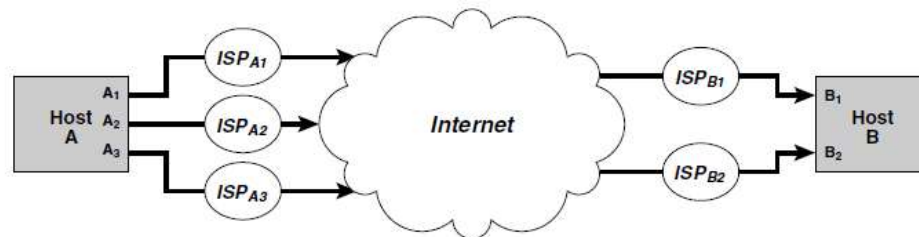


Fig. 1

COMMUNICATING HOSTS WITH MULTIPLE NETWORK CONNECTIONS
(MULTI-HOMED).

EX1045, Fig. 1.

b. [1.2]

Phatak discloses [1.2].⁴ Phatak teaches Host A splitting a data flow at the IP layer and distributing packets across multiple interfaces (*i.e.*, over the multiple

⁴ Petitioner notes that the specification of the '649 Patent does not discuss “groups of data packets” or differentiate groups of data packets from a stream. Petitioner reserves the right to challenge sufficiency of the written description of this term in other proceedings.

paths forming a multipath connection), which may have different characteristics. *E.g.*, EX1045, 774 (“We propose a solution at the network (IP) layer. The idea is to manipulate the routing entities (daemons, tables, etc.) so as to send packets across different interfaces.”) The mechanism is transparent to higher layers, and the data is striped across the available links. *See* EX1045, 774-781 (Section II; Section III (TCP Performance Analysis), describing splitting and scheduling data packets across multiple interfaces; Section IV (Implementation and Results), showing experimental results for sending data over multiple links).

2. Dependent Claim 2

[1] is obvious. *See* §VII.B.1.

Phatak renders [2] obvious.

Phatak describes the use of session-identifying information to manage and associate data flows with the correct multipath session. EX1045, 774-776 (Section II (Proposed Aggregation Mechanism)). In particular, Phatak describes the use of multipath information in several places, focusing on the need to preserve the original connection identifiers (IP addresses and ports), including the original TCP/IP tuple, when striping data across multiple interfaces. EX1045, 775. The TCP/IP tuple uniquely identifies the connection. EX1045, 774 (“a TCP connection is uniquely identified by the tuple”). The primary mechanism is IP-in-IP tunneling, which encapsulates the original packet (with its session-identifying headers) inside

another IP packet for transmission over alternate interfaces. EX1045, 775. When Host B is using an alternate interface to communicate with Host A, such as interface B2 in Figure 1 which may be a cellular interface or an Ethernet interface for example, it will send packets to Host A in IP-in-IP format, where the outer packet include interface B2 as the destination address, but encapsulates the original TCP/IP tuple from the primary connection via interface B1. *Id.* These connection identifiers consist of the encapsulated TCP/IP tuple, as in all TCP/IP communications. *Id.*; EX1001, ¶135.

This IP-in-IP packet includes the “connection ID” (which is “multipath information about each of a plurality of network-edge devices”) because it includes the TCP/IP tuple based off of interface B1 and contains the address of interface B2, which can be used to received streamed packets from Host A in addition to interface B1. *Id.*; EX1001, ¶135. Phatak further explains that the tuple is unique to a given communication session. EX1045, 775 (“[A] TCP connection is uniquely identified by the tuple (source IP address, source port, destination IP address, destination port).”); EX1001, ¶135. This ensures that, after decapsulation, the receiving host can associate the data with the correct multipath session.

Phatak further teaches that packets can be sent from Host A to Host B such that packets are received on both interfaces B1 and B2, where all packets include the connection-identifying tuple. EX1045, 775 (“Note that the same tunneling

mechanism can be used when *B* is accepting data on multiple interfaces. ... The receiving IP stack at *B* strips the outer header, realizes that the inside packet is for an existing TCP connection, and transparently passes it to TCP.”). Thus, when packets are being streamed from Host A to interfaces B1 and B2 on Host B, all packets will contain the TCP/IP tuple uniquely identifying the connection/session. EX1045, 775; EX1001, ¶135.

Phatak also discloses using protocol extensions or header modifications to facilitate the exchange of multiple IP addresses between endpoints. EX1045, 775 (“The first issue is how to make A and B aware of any multiple IP addresses the other may have ... we believe that using some more of the full header length allowed (by TCP, IPv4 and IPv6) and employing some of the unused fields is a fairly transparent solution.”)

This connection ID is further generated by one of the data-source device, one of the plurality of network-edge devices, the data-requesting device and a network device, as the tuple is created by Host B at the initial request. EX1001, ¶135.

3. Dependent Claim 3

Claim 3 simply recites connecting a second network-edge device whereas [1] already requires a plurality of network-edge devices.

a. [3.pre]

[3.pre] is obvious. *See* §VII.B.1.

b. [3.1]

Phatak renders [3.1] obvious. Phatak discloses multiple network-edge devices. EX1045, 773, Fig. 1. A POSITA would have understood this to mean that the data-source device is expected to receive multipath information (such as an IP address/interface) about a second (or subsequent) network-edge device that can join the multipath connection, and the additional device would join. EX1001, ¶136.

See also §VII.B.1.a.i.

c. [3.2]

Phatak discloses [3.2]. Phatak primarily discloses a method by which *multiple* devices (“multiple IP links”) can be added to a multipath connection. EX1045, 773, Fig. 1. Because IP links are added (*i.e.*, interfaces such as B1, B2, etc.), network-edge devices that correspond to each interface are also added. A POSITA would thus have understood that Phatak discloses adding network-edge devices to a multipath connection. EX1001, ¶136.

4. Dependent Claim 4

a. [4.pre]

[4.pre] is obvious. *See* §VII.B.1.

b. [4.1]

Phatak discloses [4.1]. Phatak includes the ability to dynamically reconfigure the set of interfaces used for a connection, which necessarily involves both the addition and removal of interfaces. EX1045, 774 (“The proposed approach can be highly dynamic. If the route through an interface becomes congested packets can simply be sent through an alternate interface. ... If one interface goes down, another interface can be used.”) A POSITA would have understood these passages to mean that the data-source device is designed to receive and process information about the status of each participating network-edge device, and remove those that are no longer available or optimal. EX1001, ¶137.

c. [4.2]

Phatak discloses [4.2]. *See* §§VII.B.3.c, VII.B.4.b.

5. Dependent Claim 5

[1] is obvious. *See* §VII.B.1.

Phatak further renders [5] obvious.

According to Phatak, the determination of which network-edge devices (interfaces) are to be removed from the multipath connection can be made by any of the following entities, depending on the context.

The data-source device (the sender or originator of the data stream) is explicitly described as monitoring the status and performance of each interface. It

can detect issues such as congestion, excessive delay, or outright failure (e.g., loss of connectivity, repeated timeouts, or lack of acknowledgments). Upon detecting such conditions, the data-source device can decide to stop sending data over a problematic interface, effectively removing it from the multipath connection. EX1045, 774; *see* §VII.B.4.b.

Network-edge devices (the intermediate devices or interfaces participating in the multipath connection) can also play a role in determining their own participation. For example, if a network-edge device experiences local resource constraints, failures, or is otherwise unable or unwilling to continue participating (e.g., due to local policy, power management, or user intervention), it can signal its unavailability or simply stop forwarding data. EX1045, 773 (“[I]f one interface goes down or one network is congested the end-to-end connection is not interrupted.”) A POSITA would have understood the phrase “if one interface goes down” encompasses scenarios where the network-edge device itself becomes unavailable, either intentionally or due to failure, thus removing itself from the multipath connection, because the network-edge device’s failure would result in the interface ‘going down’ (*i.e.*, failing). EX1001, ¶139.

6. Dependent Claim 6

[1] is obvious. *See* §VII.B.1.

Phatak further renders [6] obvious. Phatak states “As **wireless networks**, services and computing continue their explosive growth, it is clear that **multiple network transport mechanisms will become available to hosts**. For instance, a mobile host might have access to the Internet via multiple networking technologies...,” and Phatak repeatedly refers to the nodes at which data is split for a multipath connection as “network interfaces.” EX1045, 773. A POSITA would thus find it obvious that Phatak’s data-source device (*e.g.*, Host A) is at least a network router or a device capable of providing multipath services. EX1001, ¶140.

It would further be obvious to a POSITA that the host would similarly be a multipath link aggregator, a network relay, a multipath link server, a server, or a network switch. EX1001, ¶140.

7. Independent Claim 7

a. [7.pre]

[7.pre] is obvious. *See* §VII.B.1.a.

b. [7.1]

Phatak renders [7.1] obvious. While Phatak’s primary embodiment discussed HOST B streaming video from Host A, nothing in Phatak limits Host A to streaming video to a single host. For example, a third host, Host C, could also stream video from Host A at the same time Host B is streaming video from Host A when Host A is acting as a server. Indeed, as explained by Rodriguez *et al.* in TCP/IP Tutorial and Technical Overview, “[a]server can usually deal with multiple

requests and multiple requesting clients at the same time.” EX1058, 9. Further, Phatak operates at the IP layer and is transparent to higher layers. *See* EX1045, 773 (Abstract). As a result, from the perspective of the transport layer (one layer above the IP layer), the multipath connection appears to be a series of normal connections. EX1001, ¶142. As such, a POSITA would have understood that, like ordinary connections over the transport layer, Phatak’s solution does not preclude establishing connections to multiple different hosts simultaneously, each over one or more interfaces. EX1001, ¶142. It would thus be obvious to a POSITA to use Phatak for multiple multipath connections to different Hosts.

When HOST B and C are streaming video from HOST A at the same time, they will each set up a multipath connection with HOST A as described with regard to claim 1 above. A POSITA would have understood that the process of making these Hosts aware of each other and negotiating their use constitutes receiving and processing multipath connection requests. EX1001, ¶141. *See also* §VII.B.1 (Phatak discloses establishing a multipath connection).

c. [7.2]

As discussed above, when a host such as Host B establishes a multipath connection with Host A, Host B will associate a connection ID with the request comprising the TCP/IP tuple. *See* §VII.B.2.

d. [7.3]

Phatak renders [7.3] obvious.

As discussed in §VII.B.1.a.i, Host A (data-source device) receives multipath information about a plurality of network-edge devices capable of joining the particular multipath connection by receiving address information for the interfaces on Host B (and Host C) that correspond to those network-edge devices. *See* §VII.B.1.a.i. In TCP/IP, all communications carry the tuple connection ID. EX1043 at §2.3.

e. [7.4]

Phatak discloses that the multipath connection uses TCP. EX1045, 774 (“[W]e illustrate our method for TCP[.]”). TCP requires a handshake protocol for server interfacing, by which servers notify each other of the ongoing connection. EX1001, ¶144. When the connection uses tunneling, the outer header uses IP-in-IP protocol and the inner header uses TCP. EX1045, 775. A POSITA would have understood that for the data receiver to know what to do with data packets, this protocol still requires an understanding between the sender and receiver. EX1001, ¶144. As such, the process of sending encapsulated packets to specific interfaces (and the need for both endpoints to be aware of the mapping) involves notifying each network-edge device about its role in the multipath connection. EX1001, ¶144. A POSITA would be familiar with IP-in-IP and have understood that

network-edge devices are ‘notified’ when the IP-in-IP messages are delivered, stripped, accepted, and rerouted to a direct communication in progress by network-edge devices. EX1001, ¶144.

See also §§VII.B.7.d, VII.B.10.

f. [7.5]

Phatak splits a data flow (*e.g.*, a TCP connection) across multiple interfaces by sending data packets (*e.g.*, via tunneling) to different interfaces, all associated with the same logical connection. EX1045, 775. The encapsulation ensures that, regardless of the physical path, the data is associated with the correct logical connection at the receiver. *Id.* Thus, the data-source device sends data associated with the particular connection ID to the participating network-edge devices, which forward that data to the interfaces on the corresponding host device. This is how transmission protocols, which were known in the art, operated. EX1001, ¶145.

See also §VII.B.7.d.

8. Dependent Claim 8

[8] is obvious. Host A sends different groups of data packets to network-edge devices B1 and B2. *See* §§VII.B.7.f, VII.B.1.b, VII.B.2.

9. Dependent Claim 9

a. [9.pre]

[9.pre] is obvious. *See* §VII.B.7.

b. [9.1]

Phatak discloses [9.1]. *See* §VII.B.4.b.

c. [9.2]

Phatak discloses [9.2]. *See* §VII.B.4.c.

10. Dependent Claim 10

[7] is obvious. *See* §VII.B.7.

Phatak further renders [10] obvious. Phatak's multipath mechanism itself is agnostic to the semantics of data completion and does not introduce new signaling for this purpose. EX1045, 773. Packets in Phatak generally use TCP, and Phatak's method is transparent to TCP and higher layers. *Id.* TCP operates above the multipath aggregation mechanism, is designed to handle such session management tasks, and requires a handshake protocol by which the data-requesting network-edge device is notified that all data has been sent. EX1001, ¶146. A POSITA would have known that devices provide a notification once all data has been sent, as was known in TCP/IP. For example, the FIN flag in TCP indicates that the sender is finished sending data. EX1001, ¶146.

In order to solve problems associated with multipathing, Phatak additionally uses tunneling, in which case TCP is not necessarily the protocol of the outer header. EX1045, 775. Phatak describes that when tunneling is used, "The packets going out on interface A₂ then get encapsulated in a new IP packet with an extra header having destination address B₁ and source address A₂. The protocol field for

the outer header should be IP-in-IP[.]” EX1045, 775. In this case, a POSITA would have understood that for these packets to be sent back and forth, there must be a meeting of the minds between the data-sending and data-requesting interfaces by which the data-requesting network-edge devices are notified when all data has been sent. EX1001, ¶146.

a. Held

Although Phatak alone (Ground IIA) renders the Challenged Claims obvious and discloses the use of commonly employed protocol families, a POSITA would have been motivated to combine Phatak with Held (Ground IB) in order to incorporate into Phatak’s system the notification that all data has been sent required by Claim 10, further rendering this claim obvious.

Held further confirms it would be obvious to a POSITA that when packets are sent back and forth over networking protocols, the data-sending and data-requesting interfaces receive various notifications. EX1020, 654 (“TCP uses what is known as a three-way handshake. ... This [control] information enables the computers to determine which packets go where and ensure that all the information in the message has been received. When a connection is desired between two systems, Host A and Host B, using TCP/IP, a three-way handshake must occur.”); *see also* EX1020, 232 (discussing forward explicit congestion notification and backward explicit congestion notification bits and use in TCP), 270 (“[Routers]

notify transmitting end stations when packets are being discarded.”), 272 (IP and VIP enable nondelivery notifications at the network layer); EX1001, ¶¶147-152. A POSITA would have understood one such notification to include notification that all data has been sent. EX1001, ¶¶147-152.

11. Dependent Claim 11

[11] is obvious. *See* §§VII.B.6, VII.B.7.

12. Dependent Claim 12

[12] is obvious. *See* §§VII.B.2, VII.B.7.

13. Independent Claim 13

a. [13.pre]

[13.pre] is obvious. *See* §VII.B.1.a.

b. [13.1]

i. [13.1.i]

Phatak renders [13.1.i] obvious. While Phatak does not use the term “multipath request,” it describes the process of Host A learning about Host B’s multiple interfaces and using them for a single connection. EX1045, 775. A POSITA would have understood that the connection setup and address exchange indicates the presence of such a “request” from Host B to a network-edge device associated with interface B1 or B2. EX1001, ¶153.

See also §§VII.B.1.

ii. [13.1.ii]

Phatak renders [13.1.ii] obvious. *See* §VII.B.13.b.i. As both endpoints coordinate to use multiple paths, they in essence *join a multipath connection*. Accordingly, a POSITA would have understood that the request indicates the network-edge device will join a multipath connection associated with the data-requesting device. EX1001, ¶154.

iii. [13.1.iii]

Phatak discloses [13.1.iii]. Host B connects over a first connection to a network including B1, the Internet, and one or more of Host A's interfaces; it also connects over a second connection through B2 to a data-requesting network-edge device. *See* EX1045, 773, Fig. 1. Phatak describes simultaneous use of multiple connections (interfaces/links) between the data-requesting device and the network-edge device for a single data flow. EX1045, 773 (describing how “this paper investigates the *simultaneous use* of multiple network interfaces to enhance the overall bandwidth available”). It would have been obvious to a POSITA that these connections are capable of receiving data at the same time. EX1001, ¶155.

c. [13.2]

Phatak discloses [13.2]. Phatak describes the sender (Host A) and receiver (Host B) using multiple interfaces, with data being transmitted and received over each interface. EX1045, 773, Fig. 1. The receiver receives data over each of the available links. *Id.*; EX1001, ¶156.

d. [13.3]

Phatak discloses [13.3]. After the multipath session is established (*i.e.*, the network-edge device is configured to use multiple interfaces), the data-requesting device receives data over the second connection as well. EX1045, 773, Fig. 1; EX1001, ¶157.

14. **Dependent Claim 14**

[13] is obvious. *See* §VII.B.13.

Phatak further renders [14] obvious. *See* §VII.B.13.b.iii.

The connections may each be wireless, in the expected use case for Phatak's solution. With a stated purpose of Phatak being "to enhance the overall bandwidth available to a wireless node," Host B is capable of connecting wirelessly through the Internet to Host A via both the first and second connection. EX1045, 773, Fig. 1.

The connections may each be wired. EX1045, 775 ("Also, since our solution is at the IP level it can be applied to wired scenarios as well.")

The connections may each be a combination of wired and wireless. EX1045, 775 ("A typical desktop at a campus today may likely have a wired Ethernet connection as well as an 802.11 wireless LAN connection.... The proposed connection striping scheme would be applied in this case, *with some packets being*

sent across the wired interface and some across the wireless link. In this case there is obviously no interference between the two interfaces.”)

15. Dependent Claim 15

[15] is obvious. *See* §§VII.B.13, VII.B.6.

16. Dependent Claim 16

[13] is obvious. *See* §VII.B.13.

Phatak further renders [16] obvious. As noted in Section VII.B.1.a.i, a POSITA would have understood that a local interface of the kind disclosed in Phatak (such as 802.11 LAN, Bluetooth, or a cellular modem) connects to the Internet through a corresponding network-edge device (such as a Wi-Fi access point, Bluetooth gateway, or cellular base station on the interface’s respective ISP). EX1001, ¶158. A POSITA would further understood that these network-edge devices would comprise one or more of the devices listed in [16]. EX1001, ¶158.

17. Dependent Claim 17

[13] is obvious. *See* §VII.B.13.

Phatak further renders [17] obvious. Host B may be associated with a third interface and corresponding third network-edge device, the *another network device*. This interface and network-edge device is capable of joining the multipath connection for the same reasons the other network-edge devices are. *See* §§VII.B.1.a, VII.B.3. The same is true of Host B receiving data from the third network-edge device. *See* §VII.B.13.

18. Independent Claim 18

a. [18.pre]

[18.pre] is obvious. Phatak discusses a host (e.g., node B) that receives data over multiple IP interfaces, acting as a data-requesting device in the context of multipath data streaming. EX1045, 773, Fig. 1; *see also* §VII.B.13.b.

b. [18.1]

Phatak discloses [18.1]. Phatak describes a host with multiple network interfaces (e.g., wired Ethernet, 802.11, Bluetooth, cellular) that can be used simultaneously. EX1045, 773 (“multiple network conduits will be available ... (for instance, wired connections, 802.11 style LANs, Bluetooth, cellular phone modems, etc). ... we foresee scenarios wherein mobile hosts will require simultaneous data transfer across multiple IP interfaces to obtain higher overall bandwidth.”); §VII.B.13.b.iii. The mechanism allows the device to receive data over multiple interfaces concurrently, each potentially connected to a different network-edge device (e.g., different access points, routers, or networks). EX1045, 773 (Abstract). A POSITA would have further understood that when simultaneously using multiple paths, a data-requesting device would be capable of concurrently connecting to a plurality of network-edge devices. EX1001, ¶159.

See also §§VII.B.1.a, VII.B.3.

c. [18.2]

[18.2] is obvious. Phatak discusses the need for both endpoints, including Host B, to be aware of each other's multiple IP addresses and interfaces. EX1045, 775. It proposes mechanisms (e.g., header modifications, tunneling, address exchange) so that the sender and receiver can coordinate and utilize multiple paths. *Id.* Host B must process and manage this information, which is handled by a processor. *See id.* (discussing processing overhead caused by tunneling and headers). A POSITA would have understood that the host would have a processor for these tasks. EX1001, ¶160.

d. [18.3]

Phatak discloses [18.3]. Phatak's core proposal is to split a data flow across multiple interfaces/links, so the data-requesting device (receiver) receives data from multiple sources (network-edge devices located at ISPs including connected directly to the data-source host) simultaneously. EX1045, 773. Experimental results show increased throughput when data is received over multiple links; thus, data is sent to the data-source side network-edge devices and received by the data-requesting side network-edge devices. EX1045, 780-781 (Section IV, Implementation and Results).

e. [18.4]

Phatak discloses [18.4]. *See* §VII.B.18.d.

19. Dependent Claim 19

[19] is obvious. *See* §§VII.B.18, VII.B.15.

20. Dependent Claim 20

[20] is obvious. *See* §§VII.B.18, VII.B.16.

21. Independent Claim 21

a. [21.pre]

[21.pre] is obvious. *See* §VII.B.1.a.

b. [21.1]

[21.1] is obvious. Phatak discusses the need for the endpoints (source and destination) to be aware of each other's multiple IP addresses and interfaces, and describes mechanisms for exchanging this information (e.g., header modifications, tunneling, address exchange). EX1045, 775. The process of making a network-edge device (interface) part of the multipath connection is described through the coordination and signaling between endpoints. *Id.*

A POSITA would have understood that, when the data-requesting device communicates (via protocol or header exchange) to establish which interfaces/links will participate in the multipath connection, that communication includes “multipath control information.” EX1001, ¶161. The connection to the first network-edge device is established as part of this process. EX1045, 775; EX1001, ¶161.

See also §VII.B.18.d.

c. [21.2]

[21.2] is obvious. Phatak describes the process of using multiple interfaces (e.g., A1, A2, ...; B1, B2, ...) and the need for the endpoints to be aware of and coordinate the use of these multiple interfaces. EX1045, 773, 775. The mechanism allows the data-requesting device to receive data over multiple connections (interfaces) simultaneously, with each interface potentially corresponding to a different network-edge device. *Id.*

See also §VII.B.21.b. A POSITA would have found it obvious to send “second” multipath control information to a “second” network-edge device for joining the multipath connection and being connected over a “second” connection for the same reasons. *See* EX1001, ¶161.

See also §VII.B.18.e.

d. [21.3]

[21.3] is obvious. Phatak describes that, once a link/interface is part of the multipath connection, and after additional interfaces/links are added to the multipath connection, data is received over those links. The experimental results show data being received over each participating interface, and the mechanism ensures that data is split and received over all participating interfaces. EX1045, 780-781 (Section IV, Implementation and Results). *See also* §§VII.B.13.c-VII.B.13.d.

22. Dependent Claim 22

[21] is obvious. *See* §VII.B.21.

Phatak further renders [22] obvious. Phatak illustrates each host as having “multiple network connections” corresponding to each interface. *See* EX1045, 773, Fig. 1. A “network connection” indicates that the associated network-edge device is *connected* to a *network*. Phatak illustrates that each network-edge device is connected to the network of an internet service provider, which may be different for different network-edge devices. EX1045, 773 (“In general, the IP addresses assigned to interfaces A₁, A₂, and A₃ will be controlled by separate Internet Service Providers (ISPs)”), Fig. 1. The network-edge devices are further connected to the same network where that network is the Internet. *See* EX1045, 773, Fig. 1.

23. Dependent Claim 23

[23] is obvious. *See* §§VII.B.21, VII.B.14.

VIII. SECONDARY CONSIDERATIONS

Petitioner is unaware of any evidence of alleged secondary indicia that would support non-obviousness of the ’649 patent. To the extent Patent Owner subsequently presents such evidence, Petitioner respectfully requests the right to respond.

IX. MANDATORY NOTICES

As set forth below and pursuant to 37 C.F.R. §42.8(a)(1), the following mandatory notices are provided as part of this Petition.

A. Real Party in Interest Under 37 C.F.R. §42.8(b)(1)

Red Hat, Inc. is the real party in interest for Petitioner.

B. Related Matters

Red Hat has filed a complaint for declaratory judgment in *Red Hat, Inc. v. Competitive Access Systems, Inc.*, 5-24-cv-00505-D-BM. This case may affect, or be affected by, decisions in these proceedings.

C. Lead and Back-Up Counsel Under 37 C.F.R. §42.8(b)(3)

Pursuant to 37 C.F.R. §42.8(b)(3), Petitioner provides the following designation of counsel:

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D. Service Information Under 37 C.F.R. §42.8(b)(4)

Red Hat concurrently submits a Power of Attorney, 37 C.F.R. §42.10(b), and consents to electronic service by email at Red_Hat_III@kirkland.com.

X. PAYMENT OF FEES UNDER 37 C.F.R. §42.103

The undersigned authorizes the Office to charge the fee set forth in 37 C.F.R. §42.15(a)(1) for this Petition to Deposit Account No. 506092, consistent with the requested review of 23 claims, and any additional fees that may be due in connection with this Petition to be charged to the above-referenced deposit account.

XI. GROUNDS FOR STANDING UNDER 37 C.F.R. §42.104(A)

Petitioner hereby certifies that the '649 patent is available for IPR and that the Petitioner is not barred or estopped from requesting IPR challenging the Challenged Claims on the grounds identified herein. Neither Petitioner, nor any party in privity with Petitioner: (i) has filed a civil action challenging the validity of the Challenged Claims; (ii) has been served a complaint alleging infringement of the '649 patent more than one year prior to the present date; or (iii) is estopped from challenging the claims on the grounds identified in the Petition. A subset of the Challenged Claims, Claims 1-12 and 21-22, were challenged by Oracle Corporation in IPR2023-00880. Petitioner was not a party to that action and was not in privity with any party in that action. IPR2023-00880 was terminated following a joint motion to terminate prior to the Institution Decision. IPR2023-00880, Paper 11. The '649 patent was also challenged in 1:23-cv-00286 (WDTX) and 2:22-cv-00287 (EDTX), (collectively "Oracle Litigation"), both of which were

concluded by settlement between Competitive Access Systems, Inc. and Oracle Corporation. Red Hat was not a party nor in privity with any party to that litigation.

XII. DISCRETIONARY DENIAL IS NOT APPROPRIATE

To the extent Patent Owner contends that discretionary denial is appropriate for any reason, Petitioner intends to oppose such arguments pursuant to the bifurcated briefing process set forth in the March 26, 2025 Stewart Memorandum.

XIII. CONCLUSION

Petitioner requests *inter partes* review of the Challenged Claims; there is a reasonable likelihood they are obvious.

Dated: August 7, 2024

Respectfully submitted,

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CERTIFICATE OF COMPLIANCE

This Petition complies with the type-volume limitations as mandated in 37 C.F.R. §42.24, totaling 13,309 words. Counsel has relied upon the word count feature provided by Microsoft Word.

/Todd M. Friedman/

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that a copy of the foregoing document with accompanying exhibits, as listed in Petitioner's Exhibit List, will be served on August 8 2025, via overnight delivery directed to the attorney/agent of record for the patent as identified on USPTO Patent Center at the following address:

The Law Office of Clay McGurk
P.O. Box 1488
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A courtesy copy is also being served via electronic mail and FTP on August 7, 2025 on the attorneys of record listed below for the following related matter:

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