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. 7,606,156
Issued: October 20, 2009
Filed: October 14, 2003
Inventor: Eric M DeLangis
Title: Residential communications gateway (RCG) for broadband communications over a plurality of standard pots lines, with dynamic allocation of said bandwidth, that requires no additional equipment or modifications to the associated class 5 offices or the PSTN at large

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

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LIST OF EXHIBITS[1]

Exhibit No.	Description
1001	Declaration of Bill Lin, Ph.D. in support of *Inter Partes* Review
1002	*Curriculum Vitae* 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
1006	Certified File History of U.S. Patent No. 11,418,641
1007	Certified Copy of U.S. Patent No. 10,868,908
1008	Certified File History of U.S. Patent No. 10,868,908
1009	Certified Copy of U.S. Patent No. 9,350,649
1010	Certified File History of U.S. Patent No. 9,350,649
1011	Certified Copy of U.S. Patent No. 8,861,349
1012	Certified File History of U.S. Patent No. 8,861,349
1013	Certified Copy of U.S. Patent No. 8,228,801
1014	Certified File History of U.S. Patent No. 8,228,801
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, *PPP Design, Implementation, and Debugging* (2d ed. 2000) ("Carlson")
1020	Gilbert Held, *Network Design Principles and Applications*, 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 and are indicated in [[brackets]]. Unless otherwise noted, all emphasis and annotations are added.

Exhibit No.	Description
1022	Johnny Chen, *New Approaches to Routing for Large-Scale Data Networks* (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., *A QoS-ensured Transmission Scheme with Content-based Priority for Mobile Cluster Users*, 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, *TCP-IP for Dummies* (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, *A Transport Layer Approach for Achieving Aggregate Bandwidths on Multi-homed Mobile Hosts* (2002) ("Hsieh")
1034	U.S. Patent No. 6,778,495 ("Blair")
1035	Cisco Systems, Inc., T*roubleshooting Async Multilink PPP Operations* (2001) ("Cisco")
1036	U.S. Patent Application Publication No. 60/377,631 ("Tucker")
1037	Konishi et al., *Web SHAKE: A fast WWW access method for mobile terminals on temporary cluster networks*, IEEE Proceedings April 28-May 2, 2022 ("Konishi")
1038	RFC 1990: The PPP Multilink Protocol (MP), August 1996
1039	*Competitive Access Systems, Inc. v. Oracle Corporation, and Oracle America, Inc.*, 1:23-ca-00286-ADA, Dkt. 82 (W.D.TX. Aug. 10, 2023)
1040	*Red Hat, Inc. v. Competitive Access Systems, Inc.*, 4:24-cv-00130-D, Dkt. 1 (E.D.N.C. Sep. 3, 2024)

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1041	*Red Hat, Inc. v. Competitive Access Systems, Inc.*, 4:24-cv-00130-D, Dkt. 1-10 (E.D.N.C. Sep. 3, 2024)
1042	Lai et al., *Measuring Bandwidth*, 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, *Brute-Force Exploitation of Web Application Session IDs*, iALERT White Paper, Nov. 1, 2001 ("Endler")
1050	Rappaport, Theodore S., et al., *Wireless Communications and Application Above 100 GHz: Opportunities and Challenges for 6G and Beyond*, IEEE Access, Vol. 7, 2019 ("Rappaport")
1051	Reex. Control No. 90/019,265
1052	Gast, Matthew S., *802.11 Wireless Networks – The Definitive Guide*, 2002
1053	Shoemake, Matthew B., *Wi-Fi (IEEE 802.11b) and Bluetooth CoExistence Issues and Solutions for the 2.4 GHz ISM Band*, Texas Instruments, Feb. 2001, Ver. 1.1
1054	Furuskär, Anders, et al., *EDGE: Enhanced Data Rates for GSM and TDMA/136 Evolution*, IEEE Personal Communications, June 1990
1055	RFC 2326: Real Time Streaming Protocol (RTSP), April 1998
1056	Random House Webster's Computer & Internet Dictionary,3rd ed., December 1998
1057	Andrew S. Tanenbaum, Computer Networks, Chps. 1 & 5 (3d ed. 1996)
1058	Adolfo Rodriguez *et al.*, TCP/IP Tutorial and Technical Overview, Chps. 1 & 14 (Prentice Hall PTR 2002)

Exhibit No.	Description
1059	Richard O. LaMaire, et al., *Wireless LANs and Mobile Networking: Standards and Future Directions*, IBM, May 31, 1996

Petitioner Red Hat, Inc. ("Red Hat") respectfully requests *inter partes* review of claims 1-5 ("Challenged Claims") of U.S. Patent No. 7,606,156 ("the '156 patent"). EX1015.

I. INTRODUCTION

The Challenged Claims of the '156 patent are unpatentable in view of two references that were not substantively considered during its original prosecution, the Challener and Kotzin references.

The '156 patent is directed to a device referred to by the '156 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." EX1015, 3:35-37. 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.*, 3:41-51, 1:42-44.

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 '156 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*., 11:29-32 ("[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 Challener and Kotzin 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 the following prior art references, which predate the earliest claimed priority date of the '156 patent:

1. U.S. Patent Application Publication No. 2004/0001512 A1 ("Challener") (EX1017) was filed on June 28, 2002, published on January 1, 2004, and is prior art under at least pre-AIA 35 U.S.C. § 102(e).

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

3. U.S. Patent Application Publication No. 2002/0042274 A1 ("Ades") (EX1026) was filed on October 9, 2001, published on April 11, 2002, and is prior art under at least pre-AIA 35 U.S.C. § 102(b).

4. "A QoS-ensured Transmission Scheme with Content-based Priority for Mobile Cluster Users", authored by Xin, W., Fei, L., Ishihara, S., and Mizuno, T. (hereinafter "Xin") (EX1025) is a paper published by IEEE in 2000. It has been publicly available since at least November 3, 1999. EX1023, ¶62. Xin 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, Ph.D.

Ground	Claims	Proposed Statutory Rejection
IA	1-4	Obvious over Challener in view of Ades
IB	3-5	Obvious over Challener in view of Xin, or alternatively obvious over Challener in view of Ades and Xin
IIA	1-4	Obvious over Kotzin in view of Ades
IIB	3-5	Obvious over Kotzin in view of Xin, or alternatively obvious over Kotzin in view of Ades and Xin

III. TECHNOLOGY OVERVIEW

A. Bandwidth Aggregation

Before the alleged invention of the '156 patent, it was well-known that devices like gateways could aggregate bandwidth. It was well-know that gateways extend the connectivity of a network and help achieve greater bandwidth without additional remote hardware or changes to the existing physical infrastructure. EX1017, ¶¶ [0014], [0016], Fig. 3, EX1028, 6:35-40, EX1029, Abstract, ¶¶ [0002], [0085]; EX1020 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 '156 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. EX1020, 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 at §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, Challener 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, 1:50-56.

IV. THE '156 PATENT

The '156 patent is entitled "Residential communications gateway (RCG) for broadband communications over a plurality of standard pots lines, with dynamic allocation of said bandwidth, that requires no additional equipment or modifications

to the associated class 5 offices or the PSTN at large." The '156 patent was filed as U.S. Patent Application No. 10/686,375 ("'375 Application") on October 14, 2003.

Certain patents and patent applications related to the '156 patent claim priority to Provisional Application No. 60/418,521 ("Provisional Application"), filed on October 15, 2002. The '156 patent, however, fails to claim priority to the Provisional Application as required by 35 U.S.C. §119(e) ("No application shall be entitled to the benefit of an earlier filed provisional application under this subsection unless an amendment containing the specific reference to the earlier filed provisional application is submitted at such time during the pendency of the application as required by the Director"). The first paragraph of the '156 specification only provides a general reference to a provisional application. However, as no application number is provided, that reference fails to identify the provisional application with any specificity as required by 35 U.S.C. §119(e). Therefore, the '156 patent is not entitled to the October 15, 2002, priority date. *See* 35 U.S.C. §119(e), 37 C.F.R. §1.78(a)(3)-(4); *see also Droplets, Inc. v. E*TRADE Bank*, 887 F.3d 1309, 1316 (Fed. Cir. 2018). Even if the '156 patent were entitled to a priority date of October 15, 2002, however, each reference applied in the grounds still qualifies as prior art.

A. Claims

The '156 patent has five claims, of which claim 1 is independent. All claims are challenged herein. The claims are referred to herein as follows:

[1.pre.] A method for aggregating, sharing and dynamically routing and allocating bandwidth from a plurality of wired and wireless networks that are geographically disbursed over a wide area, and providing some or all of the aggregated bandwidth to any user on an on-demand basis, the method comprising the steps of:

[1.1] developing and updating a network table that comprises a list of nearby RCGs, their bandwidth capabilities over local, remote and wireless connections, and their location with respect to a requesting RCG;

[1.2] determining an optimum amount of bandwidth needed for an immediate data transfer needs of the requesting RCG;

[1.3] determining which of the nearby RCGs should be contacted for access to unused bandwidth to support a transfer of the requesting RCG, based upon their unused local bandwidth capacity, and a distance and a number of hops between the RCGs and the requesting RCG;

[1.4] sending a request to the supporting RCGs asking for use of a portion of the unused bandwidth;

[1.5] receiving responses from the supporting RCGs with information about how much bandwidth each selected RCG can share;

[1.6] selecting which of the supporting RCGs to use for optimal use of needed bandwidth;

[1.7] contacting the selected RCGs with control information for sending data to the requesting RCG;

[1.8] sending packets of the data from the selected RCGs to the requesting RCG;

[1.9] reassembling the packets of the data at the requesting RCG; and

[1.10] relinquishing the bandwidth of each of the selected RCGs.

[2] The method of claim 1, further comprising the step of sending a request to a single supporting RCG that has sufficient unused bandwidth for satisfying the request of the requesting RCG.

[3.1] The method of claim 1, wherein each of the supporting RCGs can opt out of bandwidth sharing based upon local demand priority, and

[3.2] wherein local demand for bandwidth supersedes a request of a remote RCG for bandwidth sharing.

[4.1] The method of claim 1, further comprising the steps of: dynamically reallocating shared bandwidth of the supporting RCGs during multi-link data transfers as supporting RCGs opt out of bandwidth sharing due to local bandwidth demands; and

[4.2] enlisting additional supporting RCGs to provide additional bandwidth.

[5] The method of claim 1, further comprising the step of scheduling a data transfer to occur at a future date and time based upon at least one of anticipated network bandwidth availability, network congestion, and future notice of availability of the data of interest.

B. Specification

The alleged problem in the art that the '156 patent sets out to solve is that high-speed data services required expensive infrastructure enhancements to local telephone service lines to resolve "last mile" bandwidth issues. EX1015, 2:27-34. 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.*, 2:43-3:2, Fig-7. As discussed below, however, this solution for sharing and aggregating bandwidth among multiple broadband communication devices was already proposed by Challener and Kotzin.

C. Prosecution History

The prosecution of the '156 patent was cursory and minimal. There was no substantive discussion of any prior art reference; no claims were rejected over prior

art; and the applicant never submitted an information disclosure statement (IDS) to the Office.

D. Person of Ordinary Skill in the Art

As Dr. Lin explains in his declaration, a POSITA at the time of the '156 patent would have had 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, ¶¶42-45.

V. CLAIM CONSTRUCTION

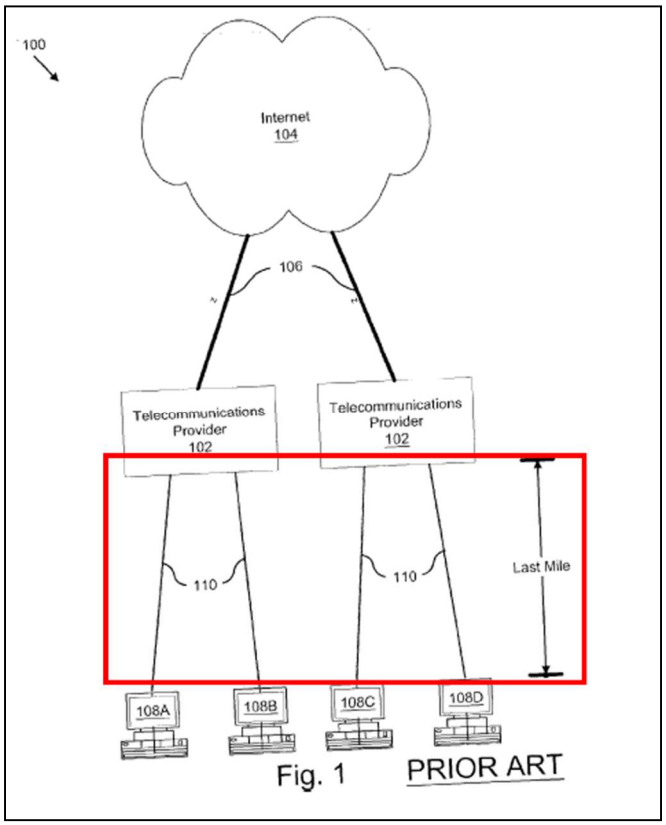
Claims in an IPR are interpreted and construed under *Phillips v. AWH Corp*., 415 F.3d 1303 (Fed. Cir. 2005). For purposes of this proceeding only, terms in the Challenged Claims need not be construed. If Patent Owner ("PO") raises claim construction arguments, Petitioner reserves the right to respond.[2]

[2] 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 '156 Patent satisfies §§ 101 and 112.

VI. OVERVIEW OF THE PRIOR ART

A. Challener

Challener discloses a method and apparatus for bandwidth sharing to increase the bandwidth available to a user connected to the Internet. EX1017, Abstract. Challener explains that in the prior art, a user's access (such as the user of computer 108B in Figure 1 below) to bandwidth was limited by "last mile" communication infrastructure, as shown in Figure 1 reproduced below:



Id., Fig-1; *see also id*. ¶¶[0034]–[0036]. Challener explains that "[d]ue to low bandwidth capability, the last mile telecommunications lines 110 prove to be a

significant bottleneck precluding broadband connectivity between the Internet 104 and the end user terminals 108." *Id*. ¶[0036].

To address this shortcoming, Challener discloses "a wireless and automatic aggregation process among separate sharing entities." EX1017, ¶[0012]; *see also id.* ¶[0014]. Challener discloses a "bandwidth sharing device" ("BSD") connected to the Internet that can wirelessly connect to other bandwidth sharing devices also connected to the Internet, so that unused bandwidth can be aggregated to increase the effective bandwidth for a user. *Id*. ¶¶[0040]–[0056]. Figure 2, reproduced below, depicts how bandwidth sharing devices can be used to improve a prior art system:

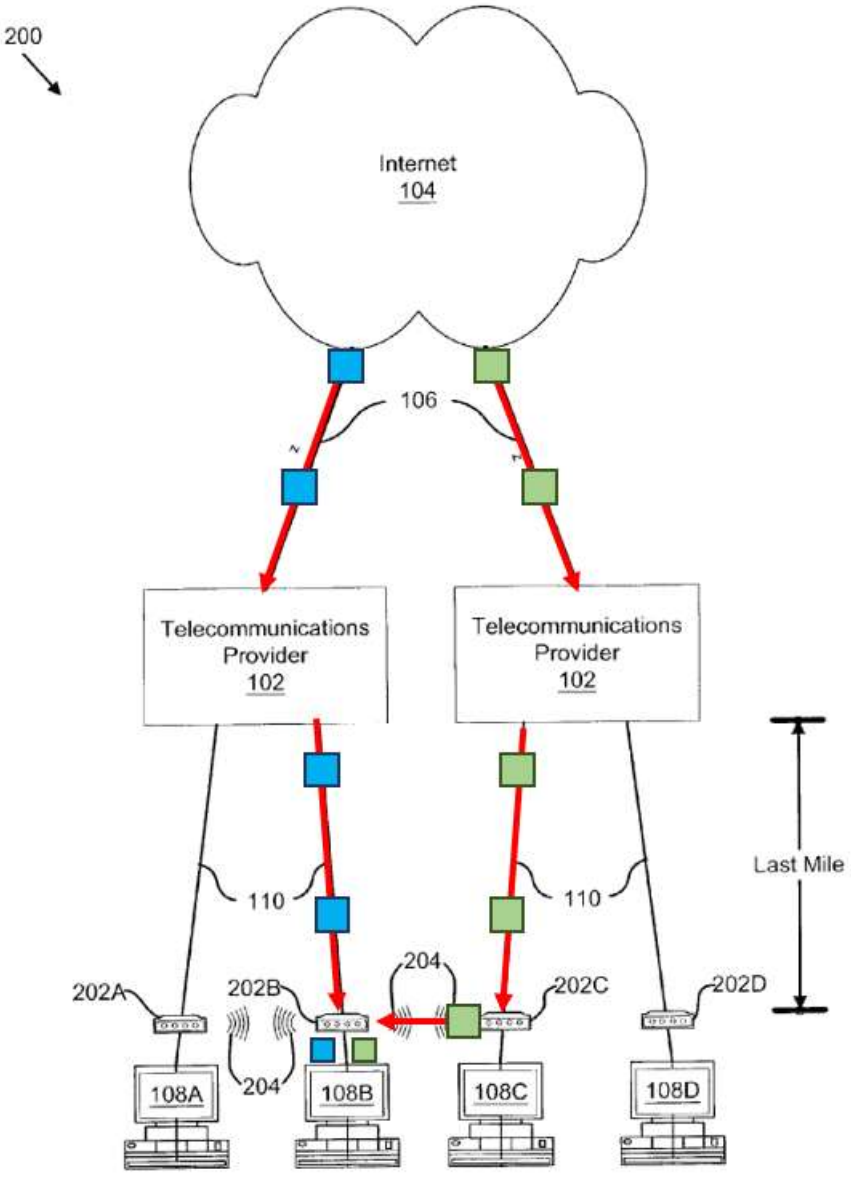


Fig. 2

Id., Fig-2. As shown in the above example, data packets from the Internet 104 destined for computer 108B are split along two paths, one directly to 108B over 202B's last mile connection, and a second path comprised of 202C's last mile connection and its wireless connection 204 with 202B. The data packets, shown above in blue for one path and green for another, are then aggregated together at

202B, thereby increasing the total bandwidth available to computer 108B. *Id.* ¶¶[0018], [0046]. In the above example, Challener refers to BSD 202B as a "master" BSD, and BSD 202C as a "slave" BSD. In Challener's system, the master BSD is in charge of automatically setting up and managing bandwidth sharing with one or more slave BSDs. *Id.* ¶¶[0017], [0020]-[0023].

B. Kotzin

Kotzin discloses a bandwidth aggregation system where the bandwidth available to a plurality of wireless units can be shared with a single wireless unit, thereby increasing the wireless bandwidth available to the single wireless unit. EX1018, Abstract, ¶[0024]. 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*. ¶[0035]; *see also id.* ¶¶[0028], [0031]. Kotzin's system is illustrated below:

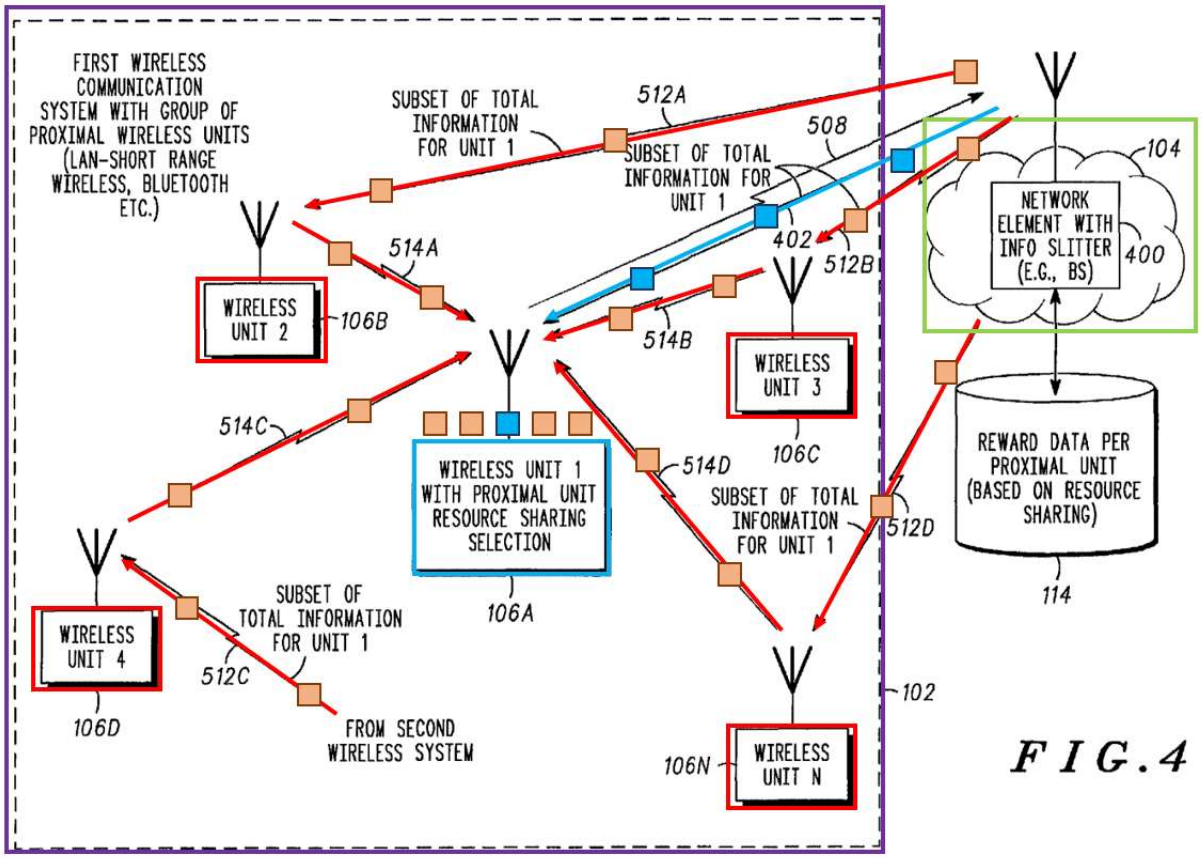


FIG. 4

With reference to Kotzin's exemplary Figure 4 shown above, Kotzin discloses that wireless unit 106A (blue) can make use of bandwidth from wireless units 106B, 106C, 106D, and 106N (red) to receive data from external network 104 (*e.g.*, the Internet) (green). Thus, Internet data packets 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 these wireless units 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. *Id.* ¶¶[0035], [0036].

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

A. Ground IA: Claims 1-4 are Obvious in View of Challener and Ades

1. Motivation to Combine Challener and Ades

Although Challener alone renders all of the Challenged Claims obvious, a POSITA would also have been motivated to combine Challener with Ades for the claim 1 requirement of *"developing and updating a network table that comprises a list of nearby RCGs, their bandwidth capabilities over local, remote and wireless connections, and their location with respect to a requesting RCG*" further rendering the Challenged Claims obvious. EX1001, ¶¶56-61.

A POSITA would have been motivated to incorporate Ades' teachings related to the claimed network table in Challener's system, for multiple reasons. Challener and Ades are in the same field of endeavor and directed to the same problem of improving available bandwidth, and thus a POSITA would have naturally looked to Ades to further improve Challener's system. For example, Challener proposes a solution for peer-to-peer bandwidth sharing, which aggregates and arbitrates available bandwidth over existing lines using a BSD. EX1017, ¶¶[0002], [0013]-[0014]. Ades discloses the same type of system, and proposes a method of improving bandwidth by accommodating peak traffic load, using "inverse multiplex[ing]" data via a plurality of paths. EX1026, ¶¶[0024], [0289]. Ades also teaches selecting the best route to accommodate traffic and storing information about "best routes" in a network table. *Id*., ¶[0541]. Although a best route is assumed to be the route with the

fewest hops, Ades recognizes that the number of links (hops) of a path may not be the only determinant of the best path in some cases. Accordingly, in addition to tracking the number of hops along a path (*i.e.*, *location*), Ades teaches determining a cost of using a link based on the link's traffic capacity (*i.e.*, bandwidth capabilities). *Id*., ¶[0273]. Given Challener's disclosure of "an improved [BSD]" that "is configured to automatically and wirelessly aggregate and arbitrate available bandwidth with a second [BSD]," EX1017, ¶[0014], a POSITA would have looked to Ades' teaching improving bandwidth by using traffic allocation techniques and network tables to improve the operation of Challener's system. EX1001, ¶¶58-59.

As Dr. Lin explains, POSITA would have understood that incorporating into Challener's system Ades' teaching of a network table that is used to select the best route based on metrics such as hop count, link cost, and bandwidth capacity would have improved the operation of Challener's system, including during dynamic bandwidth arbitration used to ensure that efficient network routes are chosen for bandwidth sharing. EX1026, ¶[0543]. EX1001, ¶59.

A POSITA would have been motivated to modify Challener to maintain and update a network table in order to determine an optimal path for a communication link to and from the master BSD in light of the current topology of the network. The use of network tables was ubiquitous in the 2002 timeframe, and network administrators widely used network tables within both local area networks and wide

area networks to manage traffic between nodes such as Challener's BSDs. EX1001, ¶55. The use of a network table such as taught by Ades with Challener would thus have been a use of a known technique to "improve similar devices [and methods] in the same way" and a "combination of familiar [prior art] elements according to known methods. . . [to] yield predictable results," as network tables were a well-known tool for coordinated allocation and aggregation of available bandwidth across multiple devices. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 416-7 (2007); EX1001, ¶59. It would also have been obvious to try using a network table such as taught by Ades' with Challener's system given its known benefits and widespread use, and a POSITA would have had a reasonable expectation of success in implementing such a network table with Challener. As Dr. Lin explains, implementing a network table as taught by Ades with Challener would have required routine modifications to implement the network table and the protocol used to create and update the network table. EX1001, ¶61.

2. <u>Independent Claim 1</u>

a. [1.pre.]

To the extent the preamble is a claim limitation, Challener discloses it or renders it obvious. Challener discloses a "bandwidth sharing device" ("BSD"), which is a communication device that provides broadband communication services to computers and other devices that are connected to it. EX1017, ¶[0014]. Examples

of Challenger's BSDs are illustrated below in annotated Figure 2; they are labeled 202A, 202B, 202C, and 202D. *Id.*, Fig-2, ¶[0037].

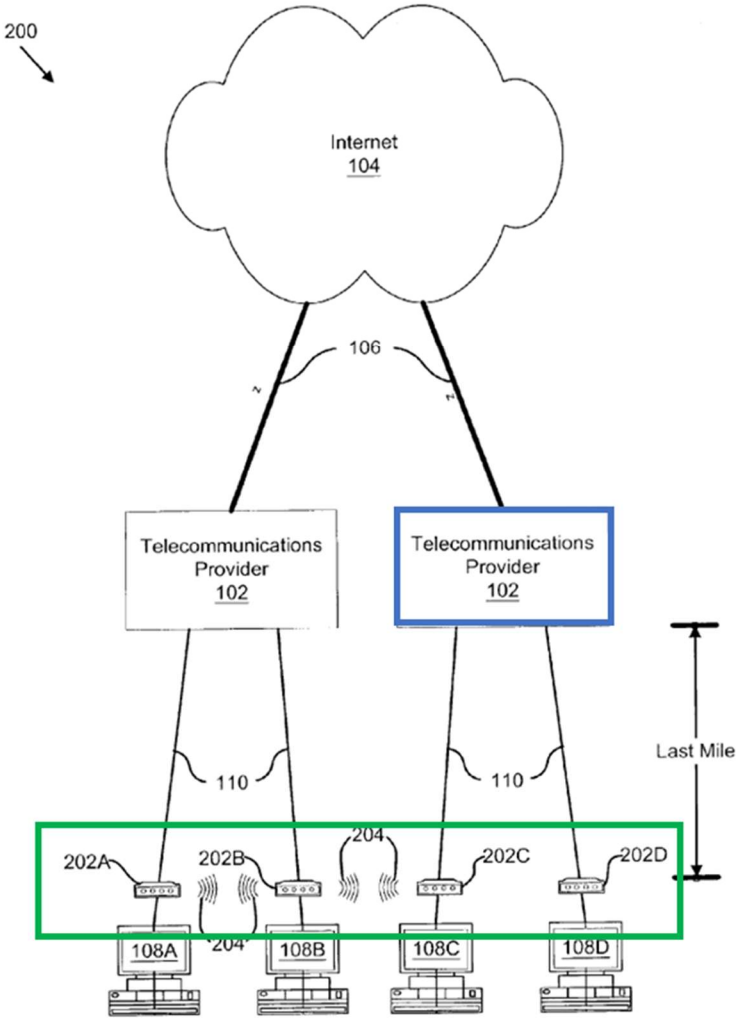


Fig. 2

Id., Fig-2 (BSDs in green). Challener explains that end users are typically connected to the Internet via "low bandwidth copper lines [110], frequently referred to as the 'last mile,' [which] do not provide adequate bandwidth to allow for broadband communication over the Internet, despite the availability of high bandwidth on the fiber backbone." *Id.*, ¶¶[0006], [0034]-[0036], Fig-1. "Without a solution to this 'last

mile' bottleneck, much of the broadband fiber backbone may remain unused indefinitely." *Id*., ¶[0006]. To solve this problem, Challener discloses "*aggregating, sharing and dynamically routing and allocating bandwidth*" as a BSD is installed "[a]t each interface between an end user terminal and a last mile transmission line" and "configured to aggregate the available bandwidth of a plurality of last mile transmission lines for use by a single end user subscriber," thereby providing broadband communication service. *Id*., ¶¶[0018], [0036]-[0038] (to avoid the "significant bottleneck precluding broadband connectivity" the "bandwidth sharing devices . . . aggregat[e] the available bandwidth of the last mile transmission lines"). Further, Challener discloses an arbitration module which adds or removes bandwidth sharing devices to and from the current sharing method and structure in order to accommodate reallocation of BSDs and releasing operations. *Id*., ¶[0056].

Challener further teaches aggregating, sharing, and dynamically routing and allocating bandwidth "*from a plurality of wired and wireless networks that are geographically dispursed over a wide area.*" As shown in annotated Figure 2, Challener discloses the use of a bandwidth sharing device ("BSD") (202B) that connects to a telecommunication provider 102 through a telephone line (*i.e.*, a ***wired*** network) and also "communicates with other nearby bandwidth sharing devices 202A and 202C using ***wireless*** communications 204" (*i.e.*, wireless networks). *Id*., ¶[0038]. Challener's system leverages both proximity (for wireless networking) and

geographic dispersion (for aggregating bandwidth from multiple lines) to overcome the last mile bottleneck. Challener's use of telephone lines for bandwidth sharing reflects operation over a geographically dispersed area because these lines connect individual, physically separated subscribers to the telecommunications network. By enabling bandwidth aggregation without requiring direct physical connections between users—the system facilitates bandwidth sharing among users who may be located in different homes, buildings, or even neighborhoods.

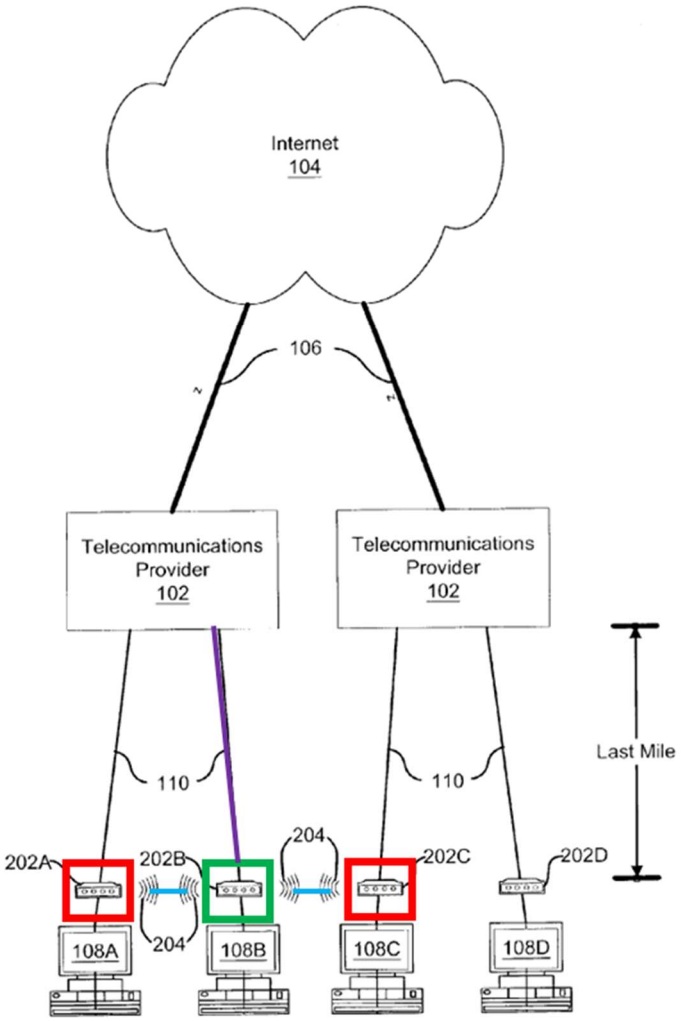


Fig. 2

Id., Fig-2.

Challener teaches aggregating communications over separate "last mile" lines, and thus wired [**purple**] and wireless [**blue**] networks over these "last miles" would be "geographically disbursed over a wide area." *Id*., ¶¶[0002],[0037]-[0038] ("FIG. 2 illustrates an Internet system 200 in which end users employ [BSD]s 202 capable of aggregating the available bandwidth of the ***last mile transmission lines***

110."), claim 8 ("the first and second telecommunications lines are ***hard-wired land telecommunications lines***.").

Challener further teaches "*providing some or all of the aggregated bandwidth to any user*" as it discloses "***aggregat[ing] the available bandwidth*** of a plurality of last mile transmission lines ***for use by a single end user subscriber***." *Id*., ¶[0018]. A POSITA would have understood that "*any user*" using the bandwidth sharing device in "master mode" constitutes the "end user subscriber." EX1017, ¶[0046]; *See* EX1001 ¶52. Further, a POSITA would have understood that "***the aggregated bandwidth***" would be provided to a user of the device operating in the master mode "*on an on-demand basis*" because the master device initiates the bandwidth sharing. *See* EX1017, ¶[0057], Fig-5; EX1001 ¶53.

b. [1.1]

Challener renders obvious "*developing and updating a network table*." Challener describes, for example, a master BSD with a detection module for detecting other BSDs: the detection module is configured to detect "any and all other last mile telecommunications lines 110 that are connected to operational bandwidth sharing devices 202." EX1017, ¶[0047]. Once it detects other BSDs, the master BSD sends queries and each BSD "affirmatively makes known the availability of bandwidth to the requesting bandwidth sharing device 202," because the master BSD does not in itself have this information. *Id.* ¶¶[0047]-[0048]. To track the addresses

of the BSDs, a master BSD would use an "address book," *i.e.*, a network table. In fact, using a network table would have been obvious to a POSITA given Challener's description of the BSD's logic unit as using the TCP/IP protocol, which a POSITA would have known relies on network tables. *Id*., ¶[0015] ("the logic unit is preferably configured to allow for packet transmission among multiple bandwidth sharing devices ***using commonly employed protocol families, such as TCP/IP*** and ATM."); EX1020, 275; EX1001, ¶55.

Further, after receiving the BSD bandwidth availability information from devices on the network, the master BSD has an arbitration module that tracks the information and updates the routing schemes as needed. EX1017, ¶[0056] ("Finally, the logic unit 310 includes an arbitration module 416 configured to arbitrate the wireless communications 204 between the first and second bandwidth sharing devices 202. ***Such arbitration involves frequent and regular verification of the continued availability of last mile telecommunications lines 110 and re-evaluation of the amount of available bandwidth to the master bandwidth sharing device 202***. The arbitration module 416 implements necessary changes, i.e., adding or removing bandwidth sharing devices to and from the current sharing method and structure in order to accommodate dynamic availability and releasing operations."). It would have been obvious to a POSITA that a master BSD would have needed some

mechanism by which to track and record the information provided by the slave BSDs and a network table would have been an obvious solution. EX1001, ¶54.

In addition, at the time of the invention, a POSITA would have understood that network tables were created and updated to transmit and receive packets and/or messages to and from multiple devices. *See* EX1030, 369; EX1019, 254, 260; EX1001 ¶54. A POSITA would also have understood that network tables store information about the paths available to transfer data from the source to the destination. *See* EX1030, 369; EX1001 ¶¶55-57. For example, a POSITA would have understood that a network table may store information about the next hop, number of hops, packet loss, and network delay. EX1001 ¶¶55-57. These data points would be used to determine the optimal path for transmitting data packets between network devices. EX1001 ¶¶55-57. A POSITA would further have understood that network tables can be updated dynamically, meaning the tables are automatically updated when network changes occur. *See* EX1020, 275–76; EX1001 ¶58. Therefore, a POSITA would have understood that a network table would be created and updated to ensure the data packets are transmitted to the designated destination over the optimal path. *Id*.

Given the known uses and benefits of network tables, a POSITA would have been motivated to use them in each of Challener's BSDs in order to keep track of the other BSDs it is borrowing bandwidth from and the amount of bandwidth they

have to share with the requesting BSD, so that a BSD can make an efficient and optimal decision on how it should route packets to the Internet via the other BSDs. *Id*., ¶54. Challener is not merely concerned with downloads (*e.g.*, Figure 7) from remote sites on the Internet, but with uploads as well (*e.g.*, Figure 6). Challener also explains that the requesting BSD needs to be aware of available bandwidth of other BSDs. EX1017, ¶[0060]. To that end, an arbitration module 514 "necessitates frequent and regular re-evaluation of device and bandwidth availability status." *Id*., ¶[0061]. A POSITA would have found a network table to be a logical and straightforward choice to keep track of the availability status of BSDs in the bandwidth sharing system, including metrics such as signal quality and bandwidth, in order to select other wireless units for bandwidth sharing and how to split packets among them. EX1001 ¶54.

In addition, to the extent that Challener does not expressly disclose "*a network table that comprises a list of nearby RCGs, their bandwidth capabilities over local, remote and wireless connections, and their location with respect to a requesting RCG*," the use of a network table tracking the claimed information would have been obvious in view of Ades for the reasons discussed above in Section VII.A.1.

Challener also discloses an "*RCG*." An "RCG" is an acronym for residential communication gateway. As stated in the '156 patent, RCGs are gateway devices that provide broadband access in residences, such as voice and data communications.

See EX1015, Abstract. Challener's BSDs serve as "RCGs" because they provide broadband access in subscriber homes (i.e., residences). *See* EX1017, ¶[0010], Fig-3; *Compare* EX1017, Fig-3 (showing BSDs) (left) *with* EX1015, Fig-6 (showing RCGs) (right):

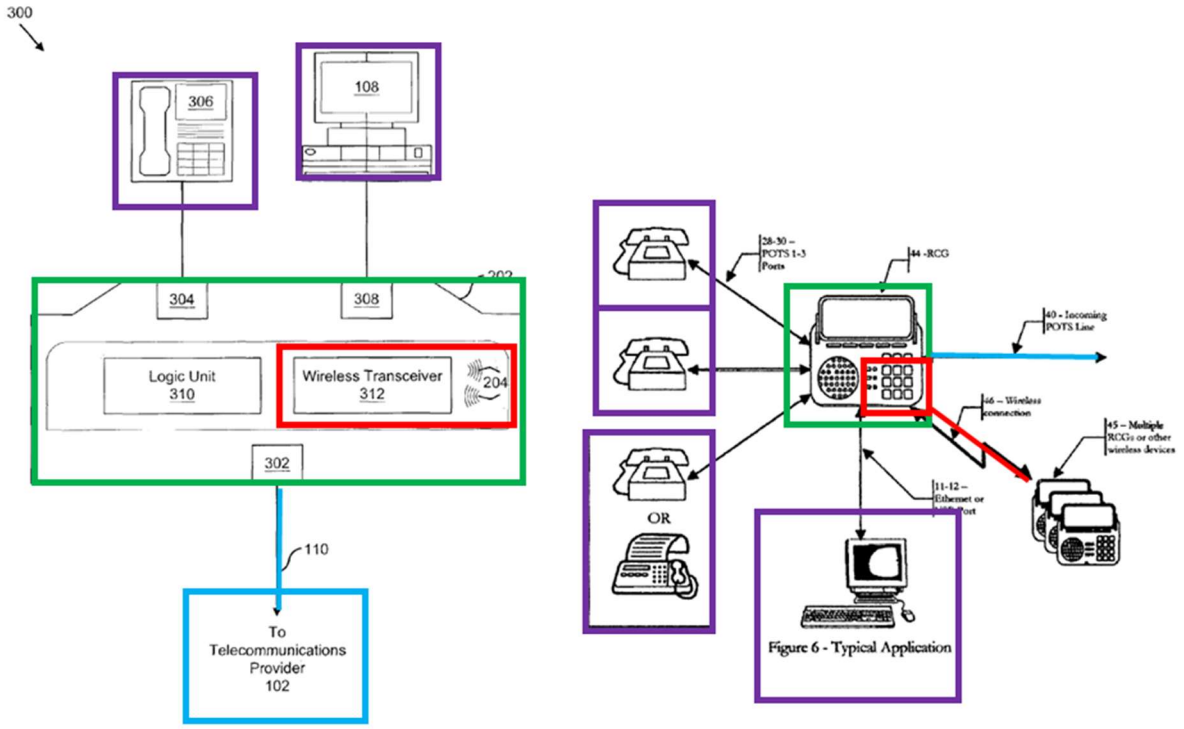


Fig. 3

Both Challener's BSD (green) and the 156 patent's RCG (green) are gateway devices connecting various communication devices, such as telephones and computers (purple). *See*, *e.g.*, EX1017, ¶¶[0040]-[0041]; EX1015, 5:51-6:3, 9:44-52. Challener's BSD and the 156 patent's RCG also connect to telecommunications provider (blue) while also wirelessly communicating with other BSDs (red). *See*, *e.g.*, EX1017, ¶¶[0016], [0040]-[0042]; EX1015, Fig-6. Further, Challener's BSD

and the '156 patent's RCG service subscribers, or people in their homes that subscribe to a telecom provider. *See, e.g.*, EX1017, ¶[0002], Fig-2; EX1015, 2:62-63. In addition, according to Challener, a BSD connected to a last mile telecommunications line 110 with full or partial bandwidth available "affirmatively makes known the availability of bandwidth" to a requesting BSD. EX1017, ¶¶[0047]-[0048]. Accordingly, Challener's "BSDs" located at various locations disclose the claimed "RCGs" with "*local, remote and wireless connections*."

c. [1.2]

Challener renders obvious "*determining an **optimum amount** of bandwidth needed*" as it describes a solution to avoiding the well-known "bottleneck" caused by insufficient bandwidth provided through "last mile" lines. EX1017, ¶[0006] ("These low bandwidth copper lines, frequently referred to as the 'last mile,' do not provide adequate bandwidth to allow for broadband telecommunication over the Internet, despite the availability of high bandwidth on the fiber backbone. Without a solution to this 'last mile' bottleneck, much of the broadband fiber backbone may remain unused indefinitely."). A POSITA would understand that "an optimum amount of bandwidth" is the amount of bandwidth needed to avoid the bottleneck. EX1001, ¶¶62-63.

Further, Challener's Figure 5 below shows the steps of "bandwidth sharing arbitration" whereby a "*requesting RCG*" communicates with sharing devices to ***arbitrate*** and share bandwidth:

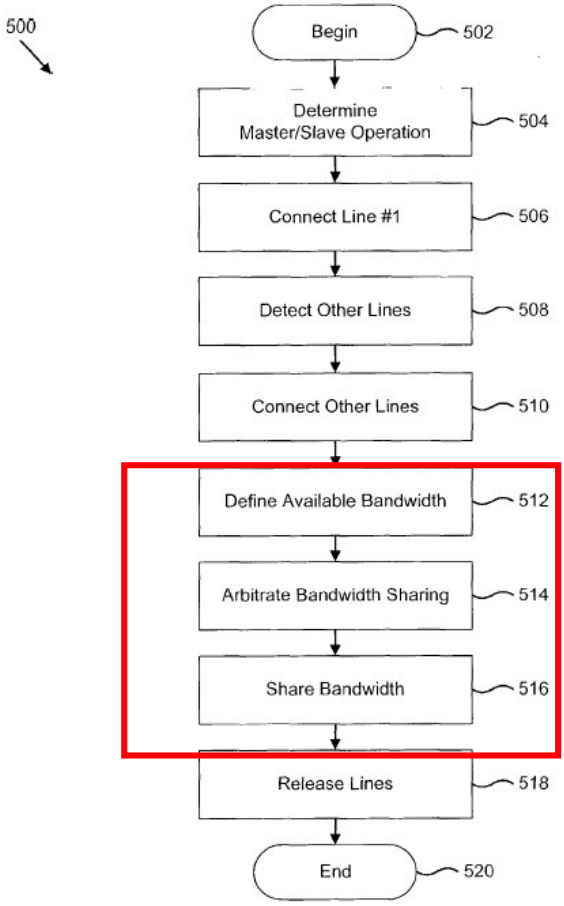


Fig. 5

EX1017, Fig-5. This process includes "***initial configuration*** of the bandwidth sharing system, which is characterized by the number of active [BSDs] 202 and the ***corresponding amount of available bandwidth*** for each device. The arbitration 514 of the bandwidth sharing also necessitates frequent and regular ***re-evaluation*** of device and bandwidth availability status." *Id.,* ¶[0061]. A POSITA would have

understood that conducting "regular re-evaluation" of "device and bandwidth availability status" achieves "*optimum bandwidth*" (*i.e.*, "*optimum amount of bandwidth needed for an immediate data transfer need*") based on available resources in real-time. EX1001, ¶¶62-63.

d. [1.3]

Challener discloses "*determining which of the nearby RCGS should be contacted for access to unused bandwidth*" as it teaches that a BSD "detection module" "is ***configured to detect the availability*** of any and all other last mile telecommunications lines 110 that are connected to operational bandwidth sharing devices." EX1017, ¶[0047].

Further, as described below, Challener teaches "*to support a transfer of the requesting RCG, based upon their unused local bandwidth capacity, and a distance and a number of hops between the RCGs and the requesting RCG*." §§VII.A.2.g, VII.A.2.h.

e. [1.4]

As discussed above, Challener explains that a BSD may operate "in either a master or a slave mode." EX1017, ¶[0017]. After determining which slave BSDs to contact, Challener's master BSD "*send[s] a request to the supporting RCGs*" "[t]hrough wireless communications . . . [it] detects other bandwidth sharing devices connected to last mile telecommunications lines that are not currently in use." *Id.*,

¶[0020]. "These other devices are then configured to operate in slave mode, controlled by instructions from the master device." *Id*., ¶¶[0020], [0017] ("The operations of the slave devices are determined by the commands from the master device[.]"), [0044], [0045].

Logic unit 310 contains "a plurality of modules," including a detection module 406. *Id*., ¶[0043]. The master BSD uses the detection module to "detect[] other [BSDs]" that have availability for participating in a multilink connection *(e.g*., "that are not currently in use"). *Id*., ¶[0020]. It does so by requesting those BSDs to identify to the master BSD via return message "the amount of bandwidth on the line ***that is available*** for use by [the master BSD]." *Id*. Challener explains that a "bandwidth sharing device 202 connected to a last mile telecommunications line 110 with full or ***partial bandwidth*** available employs the slave module 404 ***and affirmatively makes known the availability of bandwidth to the requesting bandwidth sharing device 202***. The detection module is initiated by a bandwidth sharing device 202 that is operating in master mode." *Id*., ¶[0047].

Challener further discloses that when sufficient bandwidth is available at a slave BSD, the master BSD is free to use that bandwidth to receive and transmit packets, *i.e.*, to assist in the transfer. *Id*., ¶¶[0060]-[0061], [0063]. Thus, the detection module both requests assistance from the slave BSDs in transferring data, and also

does so by requesting the use of "*a portion of*" the slave BSD's "*unused bandwidth*" (*i.e.*, partial bandwidth).

f. [1.5]

Challener discloses that a slave BSD "affirmatively makes known the availability of bandwidth to the requesting bandwidth sharing device 202 [the master BSD]," which is unused portion of the slave BSD's bandwidth. EX1017, ¶[0047]; *see also* ¶¶[0020], [0048]. This response is received by the detection module 406 of logic unit 313 (the claimed "processor") in the master BSD. *Id.*; *see also* ¶[0060] ("Upon connection 510, the slave bandwidth sharing device 202 ***defines*** 512 the ***amount of available bandwidth*** on the last mile telecommunications line 110 to which it is connected 510 and transmits any necessary information to the master bandwidth sharing device 202 for arbitration 514 purposes. This is conducted for each available bandwidth sharing device.").

g. [1.6]

Challener teaches "*determining an optimum amount of bandwidth needed for . . . the requesting RCG*." For example, the master BSD has an arbitration module that tracks devices on the network and relevant information such as their bandwidth availability. EX1017, ¶[0056] ("Finally, the logic unit 310 includes an arbitration module 416 configured to arbitrate the wireless communications 204 between the first and second bandwidth sharing devices 202. The arbitration

module 416 implements necessary changes, i.e., adding or removing bandwidth sharing devices to and from the current sharing method and structure in order to accommodate dynamic availability and releasing operations."). Challener also teaches that when a slave BSD responds to a master BSD that it has available bandwidth, the master BSD will make use of that unused bandwidth through either the sharing module 410, where there is a single master BSD, or its pro rata module 412, where there are multiple master BSDs sharing a single slave BSD. EX1017, ¶¶[0050]-[0051]; *see also id.*, ¶¶[0020]-[0021]. The master BSD's decision to use a slave BSD's bandwidth is a selection of that slave BSD.

h. [1.7]

Challener discloses that the logic unit of the master BSD sends control information, *e.g.*, commands and instructions, to the slave BSD to control its operations when it is sharing bandwidth with the master. EX1017, ¶[0017] ("The operations of the slave devices are determined by the commands from the master device, which is connected to the end user terminal initiating the bandwidth"). Further, "the logic unit [is] capable of controlling a sharing of available bandwidth" between the master device and the selected slave device. *Id*., cl. 21; *see also* ¶¶[0017], [0044]-[0045]. The slave devices are "controlled by instructions from the master device." *Id*., ¶[0020]. Thus, Challener discloses *contacting the selected RCGs with control information for sending data to the requesting RCG*.

Moreover, the '156 patent acknowledges and a POSITA would have known that using control information when sending data was a well-known technique, including in prior art that teaches routing a phone call from one device to another: "The SIP Proxy Server process sends a SIP Invite to the IXC's Media Gateway 60 device, **as well as other control information,** to direct the Media Gateway 60 device to terminate the call." EX1015, 9:3-9; EX1001, ¶¶64-65.

i. [1.8]

Challener teaches sending packets of data from one BSD to another. When sharing bandwidth to receive information—for example, an image from a website—the website generates packets and sends a first portion of the packets to the master BSD and a second portion of the packets to one or more slave BSDs. EX1017, ¶¶[0065], [0066], Fig-7. The slave BSD(s) then transmits the second portion to the master device. *Id.*, ¶[0066] ("The packets received by the slave bandwidth sharing devices 202 are then transmitted 710, preferably wirelessly, to the master[.]"). "The master [BSD] 202 then **receives** 712 and assembles 714 the packets." *Id.*; *see also* Fig-7 below.

j. [1.9]

As shown in Figure 7 reproduced below, the master BSD receives packets from a remote Internet site over its own Internet connection in step 706,[3] receives packets from a slave BSD in step 712, and aggregates and assembles those packets in step 714. EX1017, Fig. 7, ¶[0066].

[3] Figure 7 has a typographical error where steps 706 and 708 are both titled "Master Receives Packets," but a POSITA would have understood that at step 708, slave BSDs receive packets. EX1017, Fig. 7, ¶[0066]. This has been corrected in the annotated Figure 7.

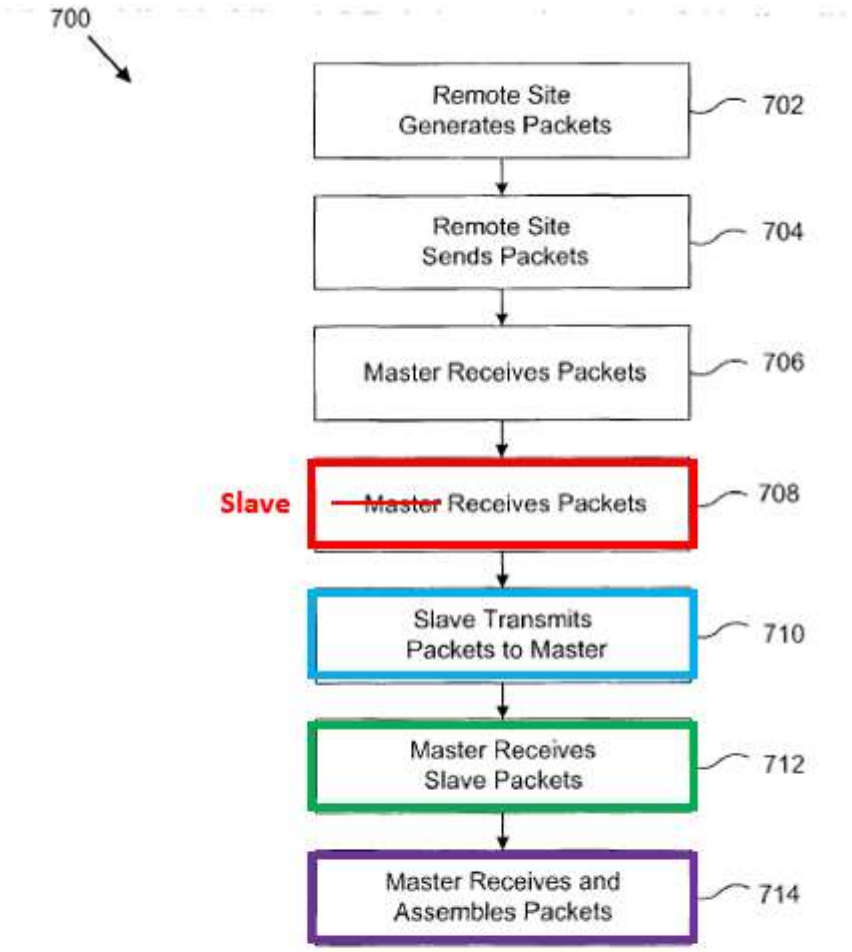


Fig. 7

Id., Fig. 7. Accordingly, packets begin at a remote site (*i.e.*, a server), are split among different paths to be sent to the slave BSD and the master BSD, and are collected and reassembled by the master BSD. *Id.*, Fig. 7, ¶[0066]. As such, Challener

explicitly discloses reassembling the packets of data at the requesting RCG (i.e., the master BSD). *Id.*

k. [1.10]

Challener explains that "any last mile telecommunications line 110 that is needed for other purposes of higher priority . . . ***is released 518 and bandwidth sharing with that entity is terminated 520***. Released devices may be reconnected under an embodiment of the present invention upon detection that the device is once again available." EX1017, ¶¶[0062], [0053]-[0055], Fig-5.

3. Claim 2

[1] is obvious. *See* § VII.A.2.

Challener discloses a master BSD sharing bandwidth with only one slave BSD: "arbitration module 416 [is] configured to arbitrate the wireless communications 204 ***between the first and second bandwidth sharing devices 202***." EX1017, ¶[0056]; *see also* ¶[0048].

Challener also teaches sending a request to a single RCG "*that has sufficient unused bandwidth for satisfying the request of the requesting RCG*." Challener explains that "***a master bandwidth sharing device 202 may be allowed to use the entire amount of bandwidth available on a last mile telecommunications line 110***." EX1017, ¶[0050]. Further, the "arbitration module" may "add[] or remov[e] bandwidth sharing devices … to ***accommodate dynamic availability*** and releasing

operations." *Id.*, ¶[0056]. A POSITA would have understood that, if sufficient bandwidth is available from a single BSD, then the master device does not need to arbitrate with additional devices for additional bandwidth. EX1001, ¶66.

4. Claim 3

a. [3.1]

[1] is obvious. *See* § VII.A.2.

Challener describes various "release modules" based on "*priority*" events, including "*local demand priority*." In this example, a "*supporting RCG opt[s] out*" when "any ***last mile telecommunications line 110*** [] is needed for other purposes of ***higher priority*** … *[the supporting RCG]* ***is released*** 518 and ***bandwidth sharing with that entity is terminated 520***." EX1017, ¶[0062], Fig-5. Challener teaches that an end user subscriber (*i.e.*, "*local demand*") always has priority and thus the ability to opt out of a bandwidth sharing arrangement: "***without sacrificing any of the bandwidth currently available to any single subscriber—an end user subscriber always has priority over the telecommunications line to which the subscriber is connected***." *Id.*, ¶¶[0024], [0053]-[0055], [0062]. When bandwidth sharing is terminated, the "*local demand for bandwidth supersedes a request of a remote RCG for bandwidth sharing*."

Further, a POSITA would have known to allocate bandwidth based on priority, including local bandwidth priority. *See* §VII.B.3.a.

b. [3.2]

Challener describes various "release modules" based on "*priority*" events, whereby the priority event "supersedes" another event. *See* §VII.A.4.a. For example, Challener describes a slave BSD "releasing" the bandwidth requesting device when the slave BSD receives a telephone call ("*local demand*"), *i.e.*, the telephone call supersedes (*i.e.*, has priority over) bandwidth sharing. EX1017, ¶¶[0052]-[0054], [0062], Fig-5.

5. Claim 4

a. [4.1]

[1] is obvious. *See* §VII.A.2.

Challener renders obvious "*dynamically reallocating shared bandwidth of the supporting RCGs during multi-link data transfers*." *See* §VII.A.4.a. A POSITA would have understood that Challener's request to a slave device is a "*multi-link data transfer*" because it requests that the slave device provide one of multiple physical links that will be used to receive or transmit data on behalf of the master BSD. EX1017, ¶[0015]; EX1001, ¶68. Further, Challener discloses "*dynamically reallocating shared bandwidth*" as it describes an arbitration module whereby the master BSD tracks devices on the network and relevant information such as their bandwidth availability. EX1017, ¶[0056]. As Challener describes, "the arbitration module 416 implements necessary changes, ***i.e., adding or removing bandwidth***

sharing devices to and from the current sharing method and structure in order to accommodate dynamic availability and releasing operations." *Id.*

Challener also discloses reallocating shard bandwidth "*as supporting RCGs opt out of bandwidth sharing due to local bandwidth demands*" as it describes RCGs opting out based on local demand priority. §VII.A.4.

Further, bandwidth sharing as described by Challener was one of numerous known ways of aggregating multiple links. Other forms of multiple link communications were well known in the industry including inverse multiplexing, bonding, load balancing, and multilink PPP according to RFC 1990. *See, e.g.,* EX1019, 203-207; *see also* EX1001, ¶69.

b. [4.2]

Challener discloses the "arbitration module," that "implements necessary changes [to provide additional bandwidth], *i.e.,* ***adding*** or removing ***bandwidth sharing devices*** to and from the current sharing method and structure in order ***to accommodate dynamic availability and releasing operations***." EX1017, ¶[0056].

B. Ground IB: Claims 3-5 are Obvious In View of Challener, Ades, and Xin

1. Motivation to Combine Challener, Ades, and Xin

Although Challener and Ades (Ground IA) render the Challenged Claims obvious, a POSITA would have been motivated to combine Challener and Ades with Xin for those Challenged Claims requiring opting out of bandwidth sharing,

dynamically reallocating shared bandwidth, and scheduling data transfer requests—specifically claims 3-5 (Ground IB)—further rendering the Challenged Claims obvious. EX1001, ¶¶70-77.

A POSITA would have been motivated to incorporate Xin's teachings of opting out of bandwidth sharing, dynamically reallocating shared bandwidth as supporting devices opt out, and scheduling data transfers, for multiple reasons. Challener, Ades, and Xin are in the same field of endeavor and directed to the same problem. Challener and Ades are directed to the problem of improving available bandwidth. *See* § VII.A.1. Xin similarly discloses methods to improve bandwidth in a network. For example, to improve bandwidth and throughput, Xin proposes dividing the mobile hosts into different priority classes recognizing that the mobile hosts may have different communication requirements. EX1025, 569-71. Based on these priority requirements, Xin teaches methods for opting out of bandwidth sharing based on priority and dynamically reallocating shared bandwidth as supporting devices opt out. *Id.*, 570. Similarly, Xin recognizes the importance of scheduling data transfers (e.g., "resource reservation") and the ability to prearrange resource availability to guarantee bandwidth and avoid delay and error. *Id.*, 569-70. All of these methods relate to improving bandwidth sharing and would have been obvious for a POSITA to integrate in Challener given that they are directed to the same field and goal. EX1001 ¶75.

As Dr. Lin explains, a POSITA would have understood that incorporating into Challener's system Xin's teachings on dynamic bandwidth allocation, opting out of the transfer, and scheduling data transfers would have improved the operation of Challener's system, and applied known techniques to "improve similar devices [and methods] in the same way" and a "combination of familiar [prior art] elements according to known methods … [to] yield predictable results," as methods for dynamically reallocating shared bandwidth and scheduling data transfers were well known. *KSR Int'l Co.*, 550 U.S. at 416-17; EX1001, ¶¶75-77. A POSITA would have been motivated to modify Challener to prioritize the bandwidth needs of the end user 106 based on the content being transmitted from the WAN communication system 104 to the end user. A QoS-ensured priority scheme such as proposed by Xin optimizes performance of high priority traffic such as video and voice. *Id*. Further, Challener recognizes the benefit of providing its BSD end user the ability to opt-in or opt-out of resource (*i.e*., bandwidth) sharing. *See, e.g.*, EX1017, ¶¶[0053]-[0055]. Additionally, implementing Xin's solution in Challener's system would not present any additional technical complexity and combining Xin's, Challener's and Ades's teachings would have required only routine experimentation and would have a predictable result—the improvement of bandwidth allocation and throughput in a network. *Id*. Accordingly, a POSITA would have had a high likelihood of success in making this combination. *Id*.

2. Claim 3

a. [3.1]

b. [3.2]

Challener discloses or renders [3.1] and [3.2] obvious. *See* § VII.A.4. Xin further renders obvious [3.2]. As discussed in Section VII.B.1, the use of a method with Challener for opting out given local demand priority "*wherein local demand for bandwidth supersedes a request of a remote RCG for bandwidth sharing*" would have also been obvious to a POSITA in view of Xin.

Xin describes a method for improving bandwidth in a network through sharing bandwidth among mobile hosts in a mobile cluster-type network. EX1025, 568.

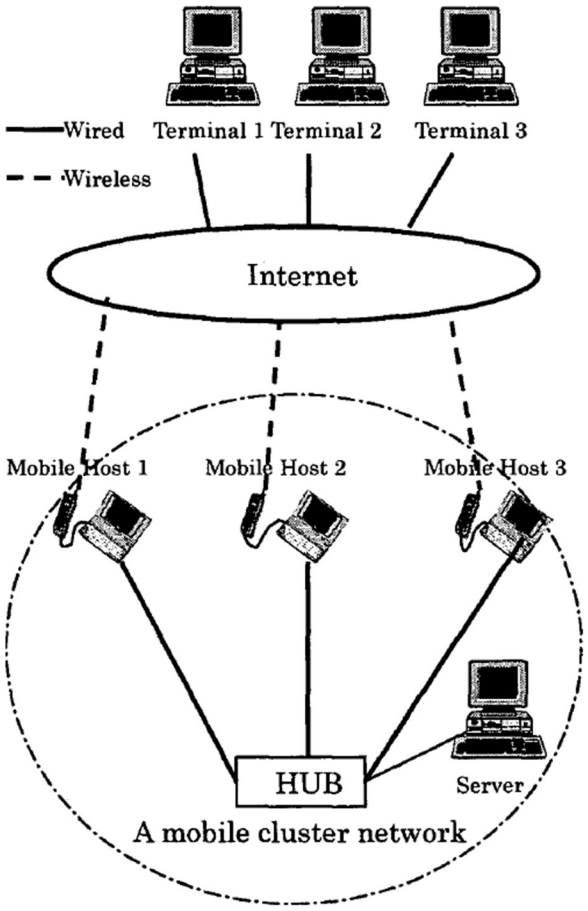
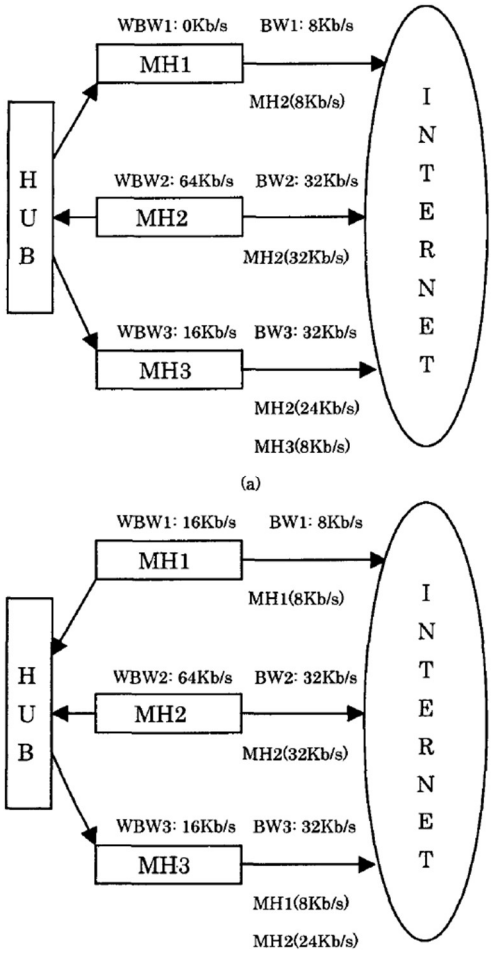


Figure 1: An example of the system

Id., Fig-1. Xin recognizes that the mobile hosts may have different communication requirements and thus proposes dividing the mobile hosts into different priority classes. *Id*., 569-71. In Xin's exemplary embodiment (Figure 2), mobile host 1 ("MH1") is assigned the highest priority, mobile host 2 ("MH2") has the second highest priority, and the third mobile host ("MH3") has the lowest priority. *Id.*



Id., Fig-2. At time T1, the required bandwidth of the three mobile hosts is 0, 64Kb/s and 16Kb/s, respectively. MH2 enjoys the bandwidth shared by MHl, a part of MH3's bandwidth and its own bandwidth. MH3 only uses the remaining 8Kb/s of bandwidth not being shared with MH2. *Id*., 570. At time T2, however, MH1's bandwidth requirements ***take priority***, so it occupies the 8Kb/s bandwidth of MH3 and its own 8Kb/s. MH2 possesses the 24kb/s bandwidth of MH3 and its own. *Id*. And MH3 has no access to any outside bandwidth. *Id*. A POSITA would have

understood this to mean that MH2 has opted out of bandwidth sharing based upon its local demand priority. EX1001, ¶¶71-74.

In the case of Challener, which is concerned with bandwidth allocation, it would have been obvious to a POSITA to use a priority system as taught by Xin with Challener's system in order to ensure proper allocation of bandwidth, for all of the same reasons it would have been obvious to do so based on the knowledge of a POSITA discussed above and set forth in the Motivation to Combine section above. *See* §VII.B.1.

3. Claim 4

a. [4.1]

Challener renders [4] obvious. *See* §VII.A.5. Xin further renders [4.1] obvious. As discussed in Section VII.B.1, the use of a method with Challener for "*dynamically reallocating shared bandwidth of the supporting RCGs during multi-link data transfers as supporting RCGs opt out of bandwidth sharing due to local bandwidth demands*" would have also been obvious to a POSITA in view of Xin.

As discussed above, Xin describes dynamically reallocating shared bandwidth at time T2 in response to a change in local bandwidth demand for MH1. *See* §VII.B.2.a. As further discussed above, in the case of Challener, which is concerned with bandwidth allocation, it would have been obvious to a POSITA to use a

dynamic reallocation system based on priority as taught by Xin with Challener's system in order to ensure proper allocation of bandwidth. *See* §VII.B.1.

b. [4.2]

A POSITA would have understood and found it obvious to add links to additional wireless units (*e.g.*, MH4) under Xin's dynamic reallocation of shared bandwidth method in order to provide additional bandwidth. EX1001, ¶¶78-80. It was well known that protocols such as RFC 1990 Multilink protocol taught changing bandwidth by dynamically adding or dropping links between two nodes without interrupting the original connection. *Id.*

In the case of Challener, it would likewise have been obvious to a POSITA to use Xin's dynamic reallocation system with Challener's system to ensure proper allocation of bandwidth. *See* §VII.B.1.

4. <u>Claim 5</u>

The use of a method for "*scheduling a data transfer to occur at a future date and time*" with Challener would also have been obvious to a POSITA in view of Xin, as discussed above in Section VII.B.1. Xin explains in its dynamic bandwidth sharing example, due to its low priority, MH3 is unable to access an outside network due to congestion at time T2. EX1025, 570. A POSITA would have known that one solution to MH3's inability to transfer common data to a remote terminal at time T2 would be to schedule that transfer for a later time. EX1001, ¶¶81-82. In fact, Xin

specifically considers the availability and complexities around "reserving resources," (*i.e.*, *scheduling a data transfer*), in wired and wireless networks, and describes its proposal of a "content-based priority transmission scheme" as a direct response to the need "to ensure the QoS parameters of priority mobile hosts." EX1025, 569 ("With resource reservation one can ***prearrange*** for resources to be dedicated for the duration of the flow, thereby guaranteeing the bandwidth, delay, and error rates contracted for by the application"), 570 ("Every mobile host will report to the server in any time when it wants to begin or end its communication with outside terminals or changes its communication content type."). In the case of Challener, which is concerned with bandwidth allocation, it would have been obvious to a POSITA to use a method for "*scheduling a data transfer to occur at a future date and time*" to ensure proper resource allocation given anticipated network conditions. EX1001, ¶83; §VII.B.1.

C. Ground IIA: Claims 1-4 are Obvious in View of Kotzin, Or Alternatively in View of Kotzin and Ades

1. Motivation to Combine Kotzin and Ades

Although Kotzin alone renders all of the Challenged Claims obvious, a POSITA would also have been motivated to combine Kotzin with Ades for Claim 1 requiring "*developing and updating a network table that comprises a list of nearby RCGs, their bandwidth capabilities over local, remote and wireless connections, and*

their location with respect to a requesting RCG," further rendering the Challenged Claims obvious. EX1001, ¶¶94-96.

A POSITA would have been motivated to incorporate Ades's teaching of the claimed network table in Kotzin's system, for multiple reasons. Kotzin and Ades are in the same field of endeavor and directed to the same problem of improving available bandwidth. Kotzin identified a need for "aggregation of shared resource usage of wireless resources." EX1018, ¶¶[0004], [0006]. Kotzin discloses a device that "can allow aggregation of its wireless resources capabilities with other proximal wireless units to enhance throughput with a wide area network." *Id*. ¶[0019]. Ades proposes a method of improving bandwidth Ades teaches improving bandwidth by using traffic allocation techniques and network tables, including using "inverse multiplex[ing]" data via a plurality of paths. EX1026, ¶¶[0024], [0289]. Ades also teaches selecting the best route to accommodate traffic and storing information about best routes in a network table. *Id*., ¶[0541]. Although a best route is assumed to be the route with the fewest hops, Ades recognizes that the number of links (hops) of a path may not be the only determinant of the best path in some cases. Accordingly, in addition to tracking the number of hops along a path (location), Ades teaches determining a cost of using a link based on the link's traffic capacity (bandwidth capabilities). *Id*., ¶[0273]; EX1001 ¶¶94-95.

As Dr. Lin explains, a POSITA would have understood that incorporating into Kotzin's system Ades's teaching of a network table that is used to select the best route based on metrics such as hop count, link cost, and bandwidth capacity would have improved the operation of Kotzin's system, including during dynamic bandwidth arbitration used to ensure that efficient network routes are chosen for bandwidth sharing. EX1001, ¶86-96; EX1026, ¶[0543]. The use of network tables was ubiquitous in the 2002 timeframe, and network administrators widely used network tables within both local area networks and wide area networks to manage traffic between nodes such as Kotzin's wireless units. EX1001, ¶90. The use of a network table such as taught by Ades with Kotzin would have thus been use of a known technique to "improve similar devices [and methods] in the same way" and a "combination of familiar [prior art] elements according to known methods. . . [to] yield predictable results," as network tables were a well known tool for coordinated allocation and aggregation of available bandwidth across multiple devices. *KSR Int'l Co.*, 550 U.S. at 416-17; EX1001, ¶95. A POSITA would have been motivated to modify Kotzin to maintain and update a network table in order to determine an optimal path for a communication link to and from the requesting wireless unit in light of the current topology of the network. The use of network tables was ubiquitous and Ades's "inverse-multiplexing" between nodes in its multi-hop network is substantially the same as Kotzin's bandwidth sharing among wireless

units. Thus, as Dr. Lin explains, implementing a network table as taught by Ades with Kotzin would have required routine modifications to implement the network table and the protocol used to create and update the network table. EX1001, ¶96.

2. Independent Claim 1

a. [1.pre]

Kotzin discloses "*[a] method for aggregating, sharing and dynamically routing and allocating bandwidth*" as it describes a plurality of wireless units that use short-range wireless system 102 (*e.g.*, an 802.11 WiFi network) for sharing (*i.e.*, aggregating) their bandwidth for use by one of the wireless units, for example Unit 106A, when communicating with external network 104, such as the Internet. EX1018, Abstract, ¶[0024]. Kotzin's wireless units connect with each other wirelessly so units "receive portions of the communication on behalf of the destination wireless apparatus 106 *a*" from the external network, resulting in higher effective bandwidth for Unit 106A. *Id*., ¶[0035], *see also* ¶¶[0028], [0031]. Further, Kotzin describes "*dynamically routing and allocating bandwidth*" as it describes keeping track of quality of service information to make selections on which wireless units to select for bandwidth sharing. For example, in discussing the wireless units of Figure 4, Kotzin explains that "some of the wireless apparatus 106*a*-106n may not experience the same quality of communication with the wide area network 104. Accordingly***, a wireless apparatus in the group of proximal units that is located in***

a more optimal location (e.g., near [a] window) is used to carry a larger burden of the traffic for the group. This quality information (*e.g.*, signal strength) may be determined by the network element 400 (one or more) or by the wireless apparatus themselves using conventional signal quality detection techniques. The resulting link quality information is then provided to other members of the group of proximal units via peer-to-peer communication and results are communicated with the wide area network to increase efficiency in maintaining an acceptable level of quality of service." *Id.*, ¶[0035].

Kotzin further discloses "*from a plurality of wired and wireless networks that are geographically disbursed over a wide area*" as it describes the external network as "a wireless wide area network (WAN) communication system 104 such as a digital cellular communication system, the Internet, or any other suitable communication system." A POSITA would have understood that the Internet includes a wired network. *Id*., ¶[0022]; EX1001, ¶84.

Further, Kotzin discloses "*providing some or all of the aggregated bandwidth to any user on an on-demand basis*" as it describes how when additional bandwidth is needed, the destination communication device (*e.g*., unit 106A) sends "to each of the participating proximal wireless units, a partial bandwidth request indicating an amount of data to be received by a party from the wide area network." EX1018, ¶[0040]. EX1001, ¶84. A POSITA would have understood that "***the aggregated***

bandwidth" would be provided to the destination communication device "*on an on-demand basis*" because it initiates the bandwidth sharing. *See* EX1018, ¶[0038], Fig-5; EX1001, ¶85.

b. [1.1]

Kotzin renders obvious "*developing and updating a network table*." Kotzin describes a bandwidth aggregation system wherein the bandwidth available to a plurality of wireless units can be shared with a single wireless unit, thereby increasing the wireless bandwidth available to the single wireless unit. EX1018, Abstract, ¶[0024]. To track the addresses of wireless units, a requesting wireless unit would need an "address book," *i.e.*, a network table. EX1001, ¶¶86-93. In fact, using a network table would have been obvious to a POSITA given Kotzin's description of relying upon an 802.11 WiFi network for sharing bandwidth, which a POSITA would have known relies on network tables. EX1018, Abstract, ¶[0022]; EX1001, ¶¶86-93.

Kotzin further 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*. ¶[0035]; *see also id.* ¶¶[0028], [0031]. In order to aggregate bandwidth, each wireless unit must know how to locate and contact the other units. For example, Kotzin's wireless units enable "location discovery by other peer proximal wireless units and sharing protocols to

allow. . . resource sharing on the wireless apparatus." EX1018, ¶[0020]. Kotzin explains that messaging is utilized to "indicate the number of megabits per second that each proximal wireless apparatus is capable of providing." *Id.*, ¶[0038]. Further, the information is accumulated "***in memory 113 or any other suitable location***." *Id.* ¶¶[0037]-[0039]. A POSITA would thus have found it obvious that this information must be stored in a table such as a network table. EX1001, ¶87.

Moreover, Kotzin renders obvious developing and updating a network table that comprises a list of nearby RCGs, "*their bandwidth capabilities over local, remote and wireless connections, and their location with respect to a requesting RCG*." For example, it teaches that each unit, e.g., the wireless apparatus 106a, "sends query messages via a broadcast message or individually via a peer-to-peer communication to determine ***which proximal wireless units in the LAN can hear*** the query message from" it, and thus, Kotzin teaches finding and updating the location information of nearby units. *Id.*, ¶[0037]. "Responses to the query messages 500a-500d from each of the wireless units are shown as responses 502a-502d. In this example, all of the wireless units 106b-106n ***are within range*** of the wireless apparatus 106a and are therefore considered proximal wireless units in the local area network. Once the wireless apparatus 106a has ***located*** other proximal wireless units, the wireless apparatus 106a sends additional shared resource participation queries." *Id.*; *see also id.*, Fig-5 (annotated below), ¶[0020], ¶[0039]. Thus, Kotzin teaches

developing and updating the list of nearby units (RCGs), their bandwidth capabilities over local, remote and wireless connections, and their location with respect to a requesting unit (RCG). Further, it would have been obvious to a POSITA that such information is routinely kept in a "network table," especially since Kotzin teaches that the information is accumulated "***in memory 113 or any other suitable location***." Kotzin, [0038]; EX1001 ¶87.

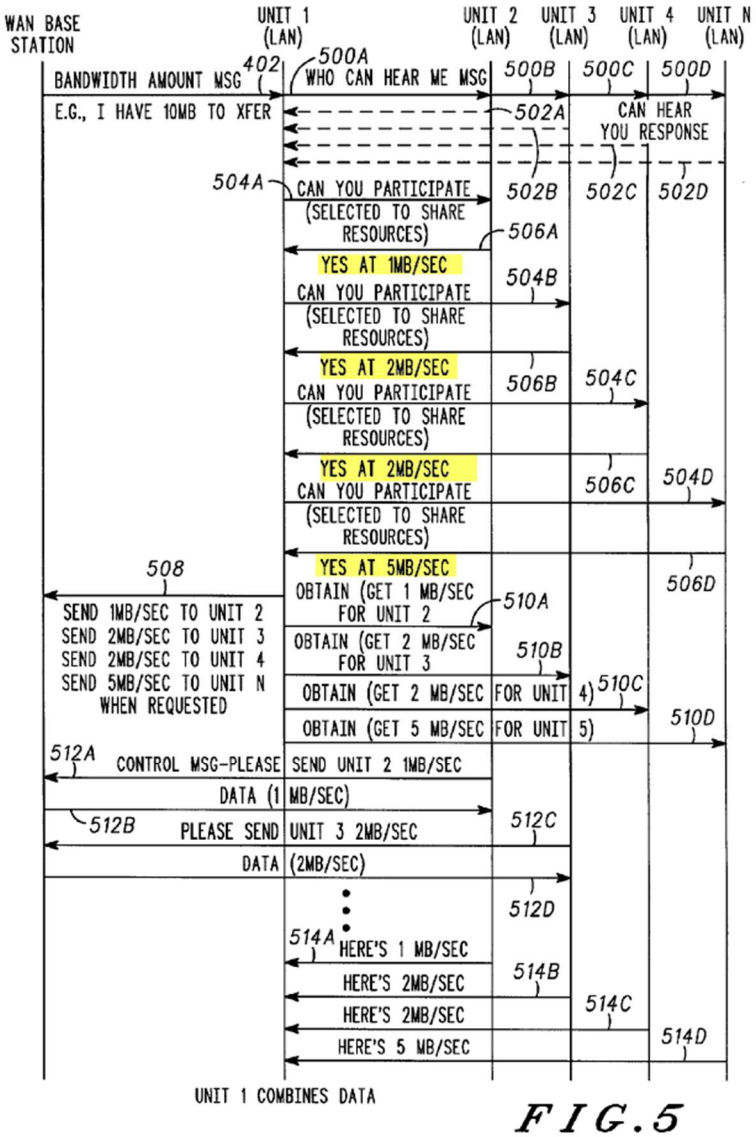


FIG.5

Kotzin also explains that it is important to keep track of quality of service information to make selections on which wireless units to select for bandwidth sharing. For example, in discussing the wireless units of Figure 4, Kotzin explains that "some of the wireless apparatus 106*a*-106n may not experience the same quality of communication with the wide area network 104. ***Accordingly, a wireless apparatus in the group of proximal units that is located in a more optimal location (e.g., near [a] window) is used to carry a larger burden of the traffic for the group.*** This quality information (*e.g.*, signal strength) may be determined by the network element 400 (one or more) or by the wireless apparatus themselves using conventional signal quality detection techniques. The resulting link quality information is then provided to other members of the group of proximal units via peer-to-peer communication and results are communicated with the wide area network to increase efficiency in maintaining an acceptable level of quality of service." EX1018, ¶[0035]. A POSITA would thus understand the importance of tracking and updating a table with the bandwidth capabilities of nearby wireless units based on their location and "local, remote and wireless connections." EX1001, ¶89.

Further, at the time of the invention, a POSITA would have understood that network tables are *create[d] and update[d]* to transmit and receive packets and/or messages to and from multiple devices. EX1001, ¶90 (citing EX1030, 369; EX1019, 254, 260). For example, Kotzin discloses that its wireless units can communicate

with the Internet including an Internet web server. EX1018, ¶[0035]. A POSITA would have understood that Internet communications use the TCP/IP protocol, which uses *network tables* that are created and updated with address and other information concerning other devices. EX1020, 275; EX1001, ¶86. Indeed, network tables were well known and widely used for this purpose. *Id*.

A POSITA would also have understood that network tables store information about the paths available to transfer data from the source to the destination and that those entries may be dynamically updated based on quality metrics such as available bandwidth, packet loss, number of hops, and network delay, as discussed above with regard to Challener. EX1001, ¶91 (citing EX1030, 369); §VII.A.2.b. Therefore, a POSITA would have understood and found obvious to use network tables with Kotzin's wireless units. *Id*. Indeed, given the known uses and benefits of network tables, a POSITA would have been motivated to use them so that a particular UNIT can make an efficient and optimal decision on how it should route packets to the Internet. *Id*., ¶89. Kotzin is not merely concerned with downloads from the Internet, but with uploads as well. EX1018, Abstract, Fig-7.

In addition, a POSITA would have found a dynamically updatable network table to be a logical and straightforward choice to keep track of the configuration of Kotzin's bandwidth sharing system, including metrics such as signal quality and bandwidth, in order to select other wireless units for bandwidth sharing and how to

split packets among them. EX1001, ¶92. The use of such network tables with Kotzin thus would have been obvious to try and would have required 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. *Id*. ¶96. Further, given that routing protocols and tables were so well known in the art, a POSITA would have had a reasonable expectation of success in implementing such a common and well-known technology using routine software programming. EX1001, ¶96.

In addition, to the extent that Kotzin does not expressly disclose or render obvious on its own *network table that comprises a list of nearby RCGs, their bandwidth capabilities over local, remote and wireless connections, and their location with respect to a requesting RCG,* it would have been obvious to use such a table in Kotzin's system as taught by Ades for the same reasons as discussed in Section VII.C.1.

Kotzin also renders obvious an "*RCG*." An "RCG" is an acronym for residential communication gateway. As stated in the '156 patent, RCGs are gateway devices that provide broadband communications in residences, such as voice and data communications. *See* EX1015, Abstract. Kotzin's wireless units (UNITS1-N) serve as "RCGs" because they provide broadband access in residences. *Compare*

EX1018, Fig-1 (showing wireless unit) (left) *with* the EX1015, Fig-6 (showing RCGs) (right):

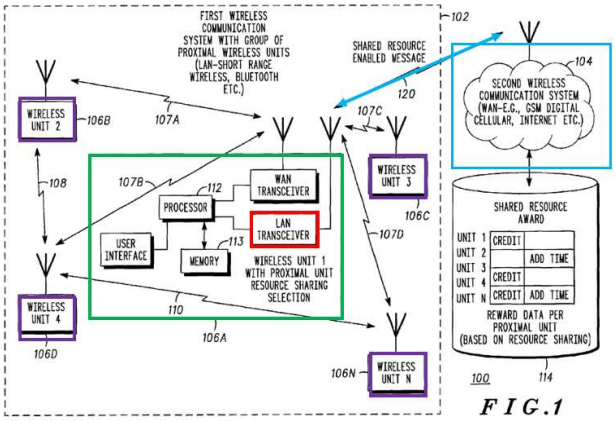
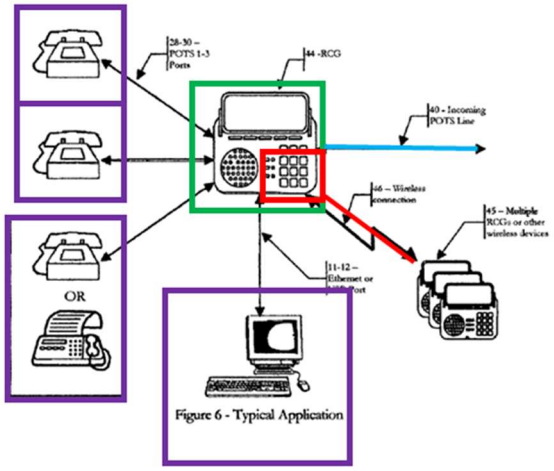


FIG.1



Both Kotzin's wireless unit (green) and the 156 patent's RCG (green) are gateway devices connecting various communication devices, such as telephones and computers (purple), and are used in residences. *See*, *e.g.*, EX1018, ¶[0022]; EX1015, 5:51-6:3, 9:44-52. Kotzin's wireless unit and the 156 patent's RCG also connect to telecommunications provider (blue) while also wirelessly communicating with other wireless units (red). *See*, *e.g.*, EX1017, ¶¶[0016], [0040]-[0042]; EX1015, Fig-6. Moreover, Kotzin's aggregation techniques, like in an RCG, permit broadband wireless access at the Units. EX1017 ¶¶ [0035] ("If wireless apparatus 106a decides that it wants to download a very large file from the WAN 104, the information destined for the wireless apparatus 106a is distributed among the independent

members of the aggregated group" . . . "The system shown in FIG. 4 increases system capacity and operational performance by aggregating the capabilities of several independent wireless apparatus 106b-106n."); [0019].

c. [1.2]

Kotzin discloses "determining ***an optimum amount*** of bandwidth needed" as it describes determining the required amount of bandwidth needed to deliver a certain amount of data, *i.e.* an optimum bandwidth. Kotzin's aggregation process works both for uplink and download communications. EX1018 ¶[0018]. For example, Kotzin describes that if a wireless unit, such as wireless unit 106 d, wishes to send a large amount of data while also having a telephone call, and it does not have the necessary bandwidth to perform both operations, data (or voice) may be communicated to the wide area network 104 via wireless unit 106 a on behalf of the wireless unit 106 d. *Id*., ¶¶[0036]-[0041] ("In this example, the wireless apparatus 106a is the destination unit within the wireless local area network 102. ***However, since it has insufficient bandwidth to receive the entire communication from the wide area network, other wireless apparatus 106b-106n that have agreed to participate to share their short range wireless resources, are used to retransmit portions of the communication that have been split by the wide area network 104 for distribution***.").

d. [1.3]

After determining an optimum amount of bandwidth needed, Kotzin describes determining which wireless units to contact for access to unused bandwidth: "In response to receiving the data indicating the amount of data to be sent via the wide area network, ***the wireless apparatus 106a carries out local communication via the wireless short range communication system to determine which of the wireless apparatus 106b-106n is within range of the wireless unit 106a***. In other words, the wireless apparatus, 106a sends query messages via a broadcast message ***or individually via a peer-to-peer communication to determine which proximal wireless units in the LAN can hear the query message from the LAN wireless apparatus 106a***." EX1018, ¶[0037]. Kotzin illustrates these query messages in Figure 4 at 500A-500D. As illustrated, Unit 106A, referred to as "UNIT 1," sends the query to UNIT2-N:

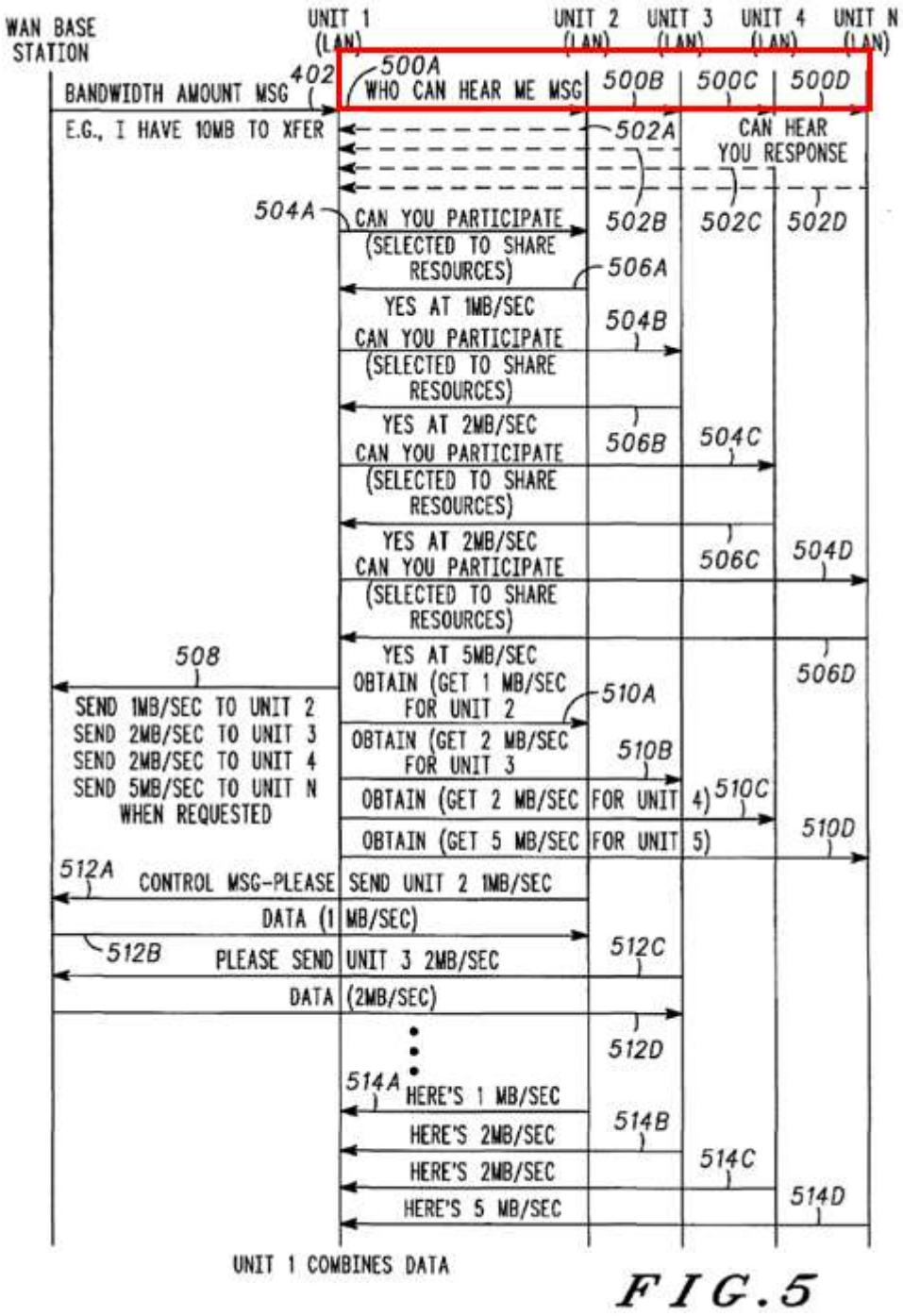

WAN BASE STATION
UNIT 1 (LAN)
UNIT 2 (LAN)
UNIT 3 (LAN)
UNIT 4 (LAN)
UNIT N (LAN)
402
500A
WHO CAN HEAR ME MSG
500B
500C
500D
BANDWIDTH AMOUNT MSG
E.G., I HAVE 10MB TO XFER
502A
CAN HEAR YOU RESPONSE
504A
CAN YOU PARTICIPATE
502B
502C
502D
(SELECTED TO SHARE RESOURCES)
506A
YES AT 1MB/SEC CAN YOU PARTICIPATE
504B
(SELECTED TO SHARE RESOURCES)
YES AT 2MB/SEC CAN YOU PARTICIPATE
506B
504C
(SELECTED TO SHARE RESOURCES)
YES AT 2MB/SEC CAN YOU PARTICIPATE
506C
504D
(SELECTED TO SHARE RESOURCES)
508
YES AT 5MB/SEC OBTAIN (GET 1 MB/SEC FOR UNIT 2
506D
510A
SEND 1MB/SEC TO UNIT 2
SEND 2MB/SEC TO UNIT 3
SEND 2MB/SEC TO UNIT 4
SEND 5MB/SEC TO UNIT N
WHEN REQUESTED
OBTAIN (GET 2 MB/SEC FOR UNIT 3
510B
OBTAIN (GET 2 MB/SEC FOR UNIT 4)
510C
OBTAIN (GET 5 MB/SEC FOR UNIT 5)
510D
512A
CONTROL MSG-PLEASE SEND UNIT 2 1MB/SEC
DATA (1 MB/SEC)
512B
PLEASE SEND UNIT 3 2MB/SEC
512C
DATA (2MB/SEC)
512D
514A
HERE'S 1 MB/SEC
HERE'S 2MB/SEC
514B
HERE'S 2MB/SEC
514C
HERE'S 5 MB/SEC
514D
UNIT 1 COMBINES DATA

FIG. 5

Id., Fig-5.

As described below, Kotzin also teaches "*to support a transfer of the requesting RCG, based upon their unused local bandwidth capacity, and a distance and a number of hops between the RCGs and the requesting RCG*." *See* §§VII.C.2.f, VII.C.2.g.

e. [1.4]

Kotzin discloses that a wireless unit, for example wireless unit 106A, seeking to use the available bandwidth from other wireless units sends a request to the other wireless units that request assistance in transferring data to wireless unit 106A, and does so by requesting use of "*a portion of unused bandwidth*" of wireless units.

In one example depicted in Figures 4 to 6, Kotzin teaches procedures for setting up resource sharing on behalf of unit 106A. *See* EX1018, Figs-4-6, ¶¶[0037]-[0038]. In Figure 5, which illustrates the messaging that is used to configure bandwidth sharing in Kotzin's system, Unit 106A is referred to as "UNIT 1." *Id*., Fig-5. Kotzin teaches that UNIT 1 sends message 504A—referred to by Kotzin as a "shared resource participation quer[y]"—to UNIT 2 asking whether UNIT 2 can participate in a multilink communication by sharing its unused bandwidth. *Id.,* Fig-5.

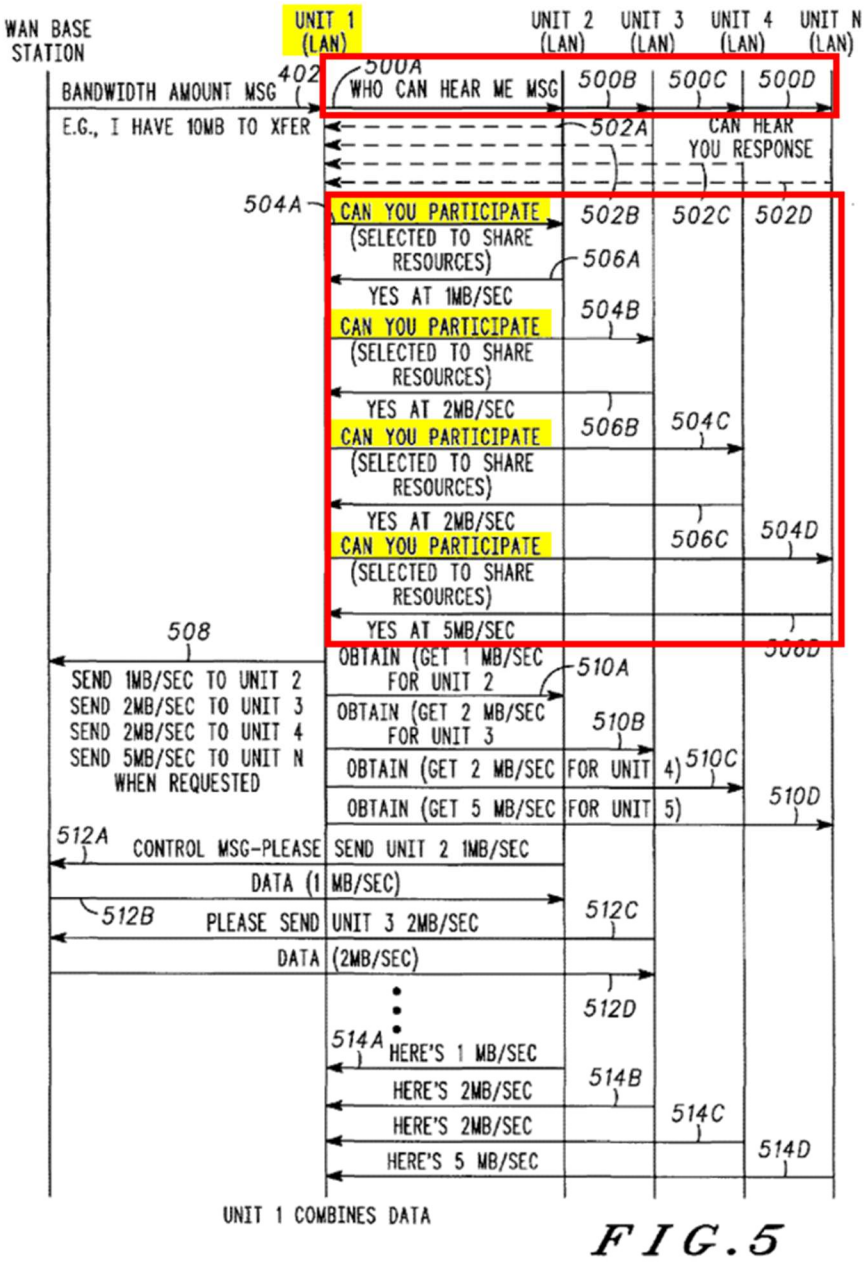


FIG. 5

Id., Fig-5. Kotzin's UNIT 1 sends similar request to UNITS 3, 4, and N (messages 504B, 504D, and 505C). These shared resource participation queries not only request assistance in transferring data on behalf of UNIT 1, but also request use of a portion of the unused bandwidth of the other units. *Id*.

f. [1.5]

As shown in Figure 5, each of the UNITS that receives request 504 from UNIT 1 responds with the amount of available bandwidth that it can share with UNIT 1. EX1018, Fig-5. For example, as shown in Figure 5, UNIT 2 responds with message 506A indicating it can share a bandwidth of 1MB/sec; UNIT 3 responds with message 506B indicating it can share a bandwidth of 2MB/sec; UNIT 4 responds with message 506C indicating it can share a bandwidth of 2MB/sec; and UNIT N responds with message 506D indicating it can share a bandwidth of 5MB/sec. *Id*.

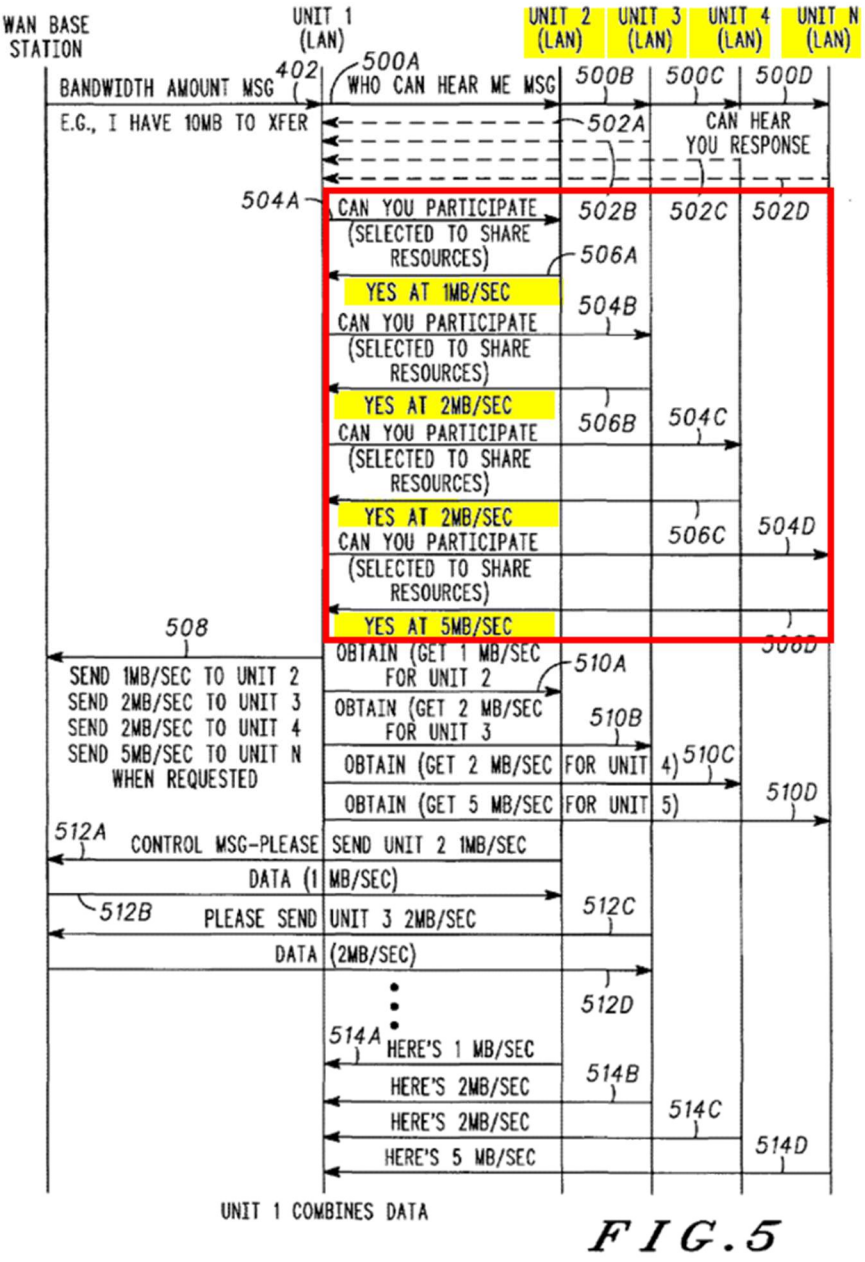


FIG. 5

Id., Fig-5; ¶¶[0038] ("[P]articipation response messages 506a-506d indicate the ***number of megabits per second*** that each proximal wireless apparatus is ***capable of providing***"—*i.e.*, based on "*unused local bandwidth capacity*"), [0039] (querying the proximal units to "determine the amount of available bandwidth").

g. [1.6]

UNIT 1 selects the UNITS it will borrow from in order to ensure optimal use of needed bandwidth, and then sends a control message to the units, notifying them of their selection as described below EX1018, ¶[0039] ("sending a bandwidth distribution message 508 which notifies the wide area network ***which of the plurality of proximal wireless units will participate in sharing*** . . . for use in facilitating communication with the [*requesting RCG*]"); ¶[0042] (illustrating similar operation in the uplink direction), Figs-7-8; *see* §VII.C.2.h. As described UNIT 1 makes this selection based on such factors as the optimum amount of bandwidth needed, §VII.C.2.c, the bandwidth available from the wireless units, §VII.C.2.f, among other factors such as the wireless units' proximity and signal strength. *See id*., Fig-3, Fig-9, ¶¶[0026] ("controls locating the proximal wireless units that are in the local area network . . . ."), [0043] (the WAN may "obtain the signal strength level . . . and attempt to split the communication such that a majority of the information is sent to the wireless units with the higher signal quality levels.").

h. [1.7]

Messages 510A, B, C, and D depicted in Figure 5 are control messages that tell the UNITS 2, 3, 4, and N the amount of bandwidth they are to share with UNIT 1. EX1018, ¶[0040], Fig-5. These are control messages because they do not carry data, but rather control information that tells the other units how much bandwidth

they are to share with UNIT 1. *Id*.; EX1001, ¶¶97-99. Further, messages 510A, B, C, and D set up a multilink transfer, because the multiple links to external network 104 will be used to transfer data to and from UNIT 1. *Id*.

Moreover, the '156 patent acknowledges and a POSITA would have known that using control information when sending data was a well-known technique. *See* § VII.A.2.h.

i. [1.8]

In step 512B of Figure 5, a Base Station or server on external network 104 sends 1MB/SEC of data to UNIT 2. EX1018, Fig-5. And, in step 514A, UNIT 2 forwards 1MB/SEC of data to UNIT 1. *Id*. UNITS 3, 4, and N also forward data to UNIT1 if they were selected to share bandwidth. *Id*. Thus, UNIT 1 receives data packets from each of the other units, which are remote communications devices for the reasons discussed above. *Id.*

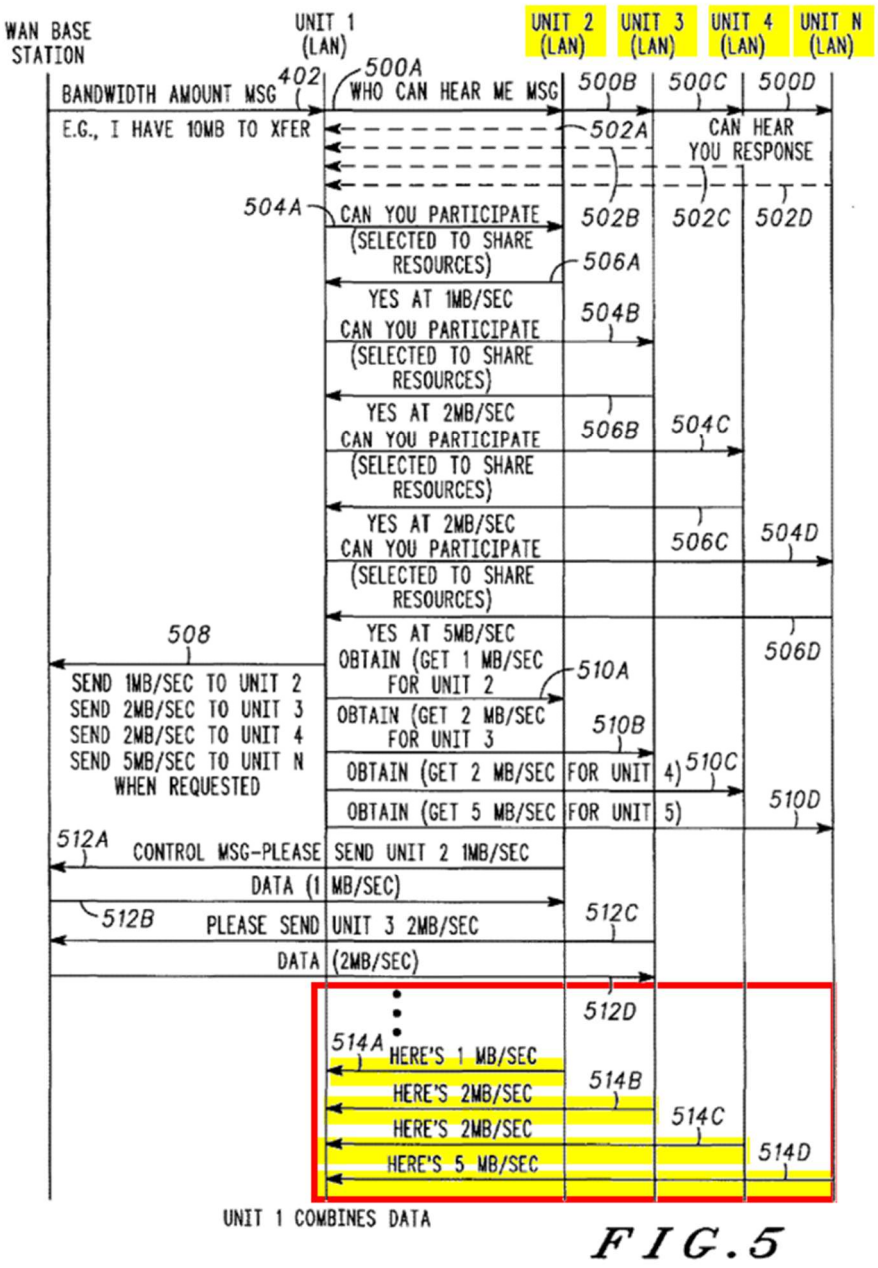


FIG. 5

Id., Fig-5.

Further, although Kotzin does not use the explicit term "packet," Kotzin discloses or renders obvious that the data sent is ***packet-based***, as digital data communications as disclosed by Kotzin are typically packet-based. EX1018,

¶[0035]; EX1001, ¶¶100-102. For example, Kotzin discloses that its wireless units communicate with Internet Web servers. EX1018 ¶[0033]. A POSITA would have understood and found obvious that Internet Web communications use data packets based on the TCP/IP protocol. EX1001, ¶¶101-102. Kotzin also discloses that its wireless units communicate with a GSM or CDMA network. A POSITA would have understood and found obvious that GSM and CDMA networks also use packet-based communication. *Id.* Kotzin also discloses that its wireless units can communicate using the IEEE 802.11 and Bluetooth protocols, which also use packet-based communications. EX1018, ¶[0022].

j. [1.9]

Kotzin illustrates in Figures 4 and 5 that UNIT 1 reassembles the data received from Units 2, 3, 4, and N and the data it receives directly from the external network 104. EX1018, Figs-4-5. Although not illustrated in Figure 5, Kotzin explains that "the wireless apparatus ***106a itself may also participate in receiv[ing] a portion of the message destined for it***" and depicts this in Figure 4. *Id.*, ¶[0039]. Kotzin further explains that the UNIT 1 (106a) can direct the base station or server message 508 as to how "to split the portions of message so that apparatus 106a knows how to combine the message 514a-d" received from the other wireless units. *Id.*, ¶[0041]. Thus, in situation where UNIT 1 is receiving packets directly from the internet but also packets from the other wireless units, UNIT 1 will reassemble those packets to

retrieve the overall communication. Because multiple parallel links are being used by UNIT 1, its bandwidth increases to the sum of the bandwidth of all of the multiple links. This packet splitting and reassembly is illustrated in annotated Figure 4 below.

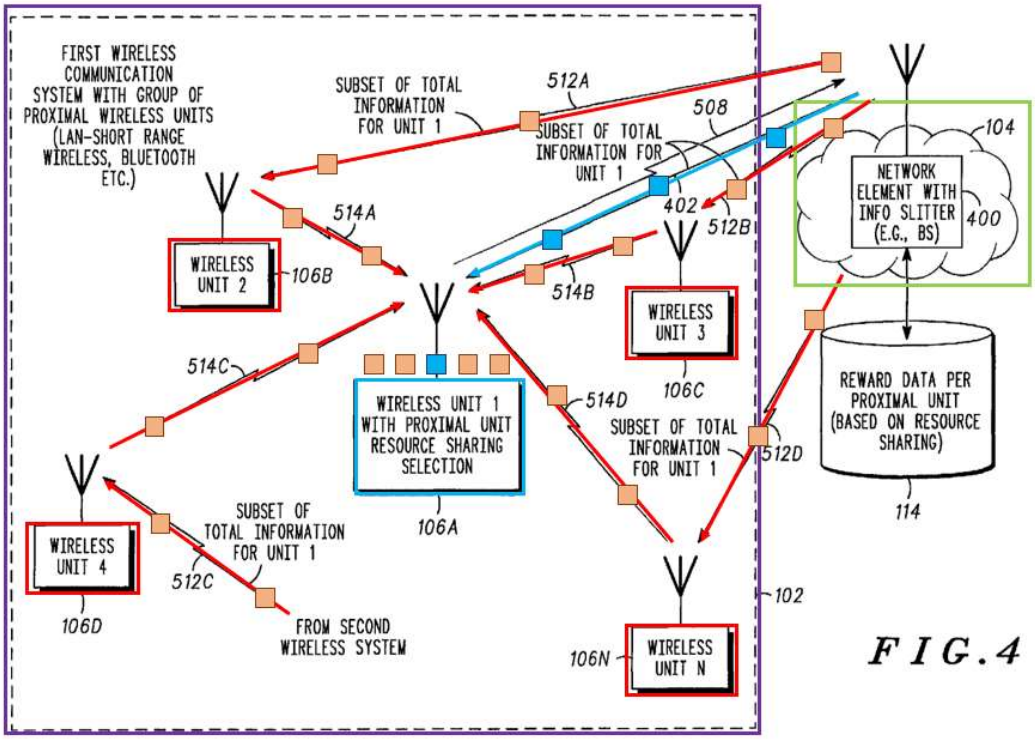


FIG. 4

Id., Fig-4.

k. [1.10]

It is clear from Kotzin that the bandwidth provided by the wireless units is relinquished. Kotzin repeatedly emphasizes that resource sharing is for "a given communication session including a data transmission session, voice or audio transmission session, or any other information as desired" making it clear that the allocation of bandwidth is not permanent but is instead relinquished once the session

ends. EX1018 ¶[0021]. Furthermore, Kotzin's user interface allows participants to dynamically enable or disable sharing (Kotzin, FIG. 2), and the reward mechanism is tied to actual participation, reinforcing that sharing—and thus bandwidth allocation—ceases when no longer needed. *Id.* ¶[0031]. Thus, Kotzin's demonstrate that relinquishment of bandwidth is an outcome of its session-based, on-demand aggregation method.

3. Claim 2

[1] is obvious. *See* §VII.C.2.

Kotzin explains that query messages are sent to "other wireless apparatus 106b-106n" when wireless unit 106a has insufficient bandwidth. EX1018, ¶[0036]. If only one unit is in range when unit 106a sends its initial request asking which units are in range (*e.g.*, messages 500A-500D in Figure 5), then when 106a sends its query asking for participation of additional resources, this query will only be sent "*to a single supporting RCG that has sufficient unused bandwidth for satisfying the request of the requesting RCG*." *Id*., ¶[0037]. Additionally, if only one candidate supporting device elected to allow resource sharing, then the single supporting RCG limitation would be met. *Id*., ¶¶[0026],[0044].

4. Claim 3

a. [3.1]

[1] is obvious. *See* §VII.C.2.

Kotzin teaches that the wireless units 106 have user interfaces which permit "selectable enabling" by a user whether their wireless unit will permit resource sharing. EX1018, ¶[0044]. It would have been obvious to a POSITA that through this selectable enabling, a supporting RCG can opt out of bandwidth sharing based upon higher priority demands, such as local demand priority. EX1001, ¶103.

b. [3.2]

Kotzin discusses the relationship between local demand for bandwidth and requests from remote units for bandwidth sharing by explaining that each wireless unit evaluates its own current bandwidth utilization and local service requirements before agreeing to participate in bandwidth sharing with a remote requesting unit. EX1018 ¶[0031]. It would have been obvious to a that, if a unit's local demand for bandwidth is high—such as when it is engaged in its own data or voice transmissions—it can deny or limit the amount of bandwidth it shares with remote units. EX1001, ¶¶104-105. Further, it would have been obvious to a POSITA that when a user's device has an option to opt-out of bandwidth sharing, the user's decision to opt out would be based on a variety of factors including the user's own "*local demand priority,*" *e.g.*, high-priority traffic, thereby opting out of sharing its bandwidth for low or non-priority traffic. EX1001, ¶106.

5. <u>Claim 4</u>

a. [4.1]

[1] is obvious. *See* §VII.C.2.

Kotzin renders this limitation obvious as it describes steps for "***maintaining*** an acceptable level of quality of service" based on the bandwidth capabilities of wireless units. EX1018, ¶[0035]. For example, Kotzin describes "a wireless apparatus in the group of proximal units that is located in a more optimal location (e.g., near window) is used to carry a larger burden of the traffic for the group. This quality information (e.g., signal strength) may be determined by the network element 400 (one or more) or by the wireless apparatus themselves using conventional signal quality detection techniques. ***The resulting link quality information is then provided to other members of the group of proximal units*** via peer-to-peer communication and results are communicated with the wide area network to increase efficiency in ***maintaining*** an acceptable level of quality of service." *Id*., ¶[0035]. It would have been obvious to a POSITA that because the network can determine different bandwidth abilities among wireless units and "maintain[] acceptable level of quality of service," the network is "dynamically reallocating" shared bandwidth among the wireless units.

b. [4.2]

Kotzin teaches that if proximal unit 106b's participation message responds with message 506*a* indicating no bandwidth is available, an additional proximal unit 106c is enlisted to provide the additional bandwidth. *See* EX1018, ¶¶[0038]-[0039].

D. Ground IIB: Claims 3-5 are Obvious in View of Kotzin and Xin,

Or Alternatively in view of Kotzin, Ades and Xin

1. Motivation to Combine Kotzin, Ades, and Xin

Although Kotzin and Ades (Ground IIA) render the Challenged Claims obvious, a POSITA would have been motivated to combine Kotzin and Ades with Xin for those Challenged Claims requiring opting out of bandwidth sharing, dynamically reallocating shared bandwidth, and scheduling data transfer requests—specifically claims 3-5 (Ground IIB)—further rendering the Challenged Claims obvious. EX1001, ¶¶108-110.

A POSITA would have been motivated to incorporate Xin's teachings of opting out of bandwidth sharing based on priority, dynamically reallocating shared bandwidth as supporting devices opt out, and scheduling data transfers in Kotzin's system, for multiple reasons. Kotzin, Ades, and Xin are in the same field of endeavor and directed to the same problem. Kotzin and Ades are directed to the problem of improving available bandwidth. *See* §VII.C.1. Xin also teaches techniques to improve bandwidth in a network. For example, to improve bandwidth and throughput, Xin proposes dividing the mobile hosts into different priority classes recognizing that the mobile hosts could have different communication requirements. EX1025, 569-71. Based on these priority requirements, Xin teaches methods for opting out of bandwidth sharing based on priority and dynamically reallocating shared bandwidth as supporting devices opt out. *Id.*, 570. Similarly, Xin recognizes

the importance of scheduling data transfers (e.g., "resource reservation") and the ability to prearrange resource availability to guarantee bandwidth and avoid delay and error. *Id.*, 569-70. All of these methods relate to improving bandwidth sharing and would have been obvious for a POSITA to integrate in Kotzin given that they are directed to the same field and goal. EX1001, ¶¶108-109.

As Dr. Lin explains, a POSITA would have understood that incorporating into Kotzin's system Xin's teachings on dynamic bandwidth allocation, opting out of the transfer, and scheduling data transfers would have improved the operation of Kotzin's system and applied known techniques to "improve similar devices [and methods] in the same way" and a "combination of familiar [prior art] elements according to known methods . . . [to] yield predictable results," as methods for dynamically reallocating shared bandwidth and scheduling data transfers were well known. *KSR Int'l Co.*, 550 U.S. at 416-17; EX1001, ¶108-109. A POSITA would have been motivated to modify Kotzin to prioritize the bandwidth needs of the wireless units 106 based on the content being transmitted from the WAN communication system 104 to the wireless units. Further, A QoS-ensured priority scheme such as proposed by Xin optimizes performance of high priority traffic such as video and voice. *Id*. ¶111. Kotzin recognized the benefit of providing its wireless unit end user the ability to opt-in or opt-out of resource (*i.e.*, bandwidth) sharing. *See* EX1018, Fig-2. Prioritizing the bandwidth of a wireless unit in a resource sharing

scheme such as described by Kotzin based on the type of content to be downloaded would not present any additional technical complexity and thus a POSITA would have had a reasonable expectation of success in implementing a priority scheme as taught by Xin. *Id*.

2. <u>Claim 3</u>

a. [3.1]

b. [3.2]

Xin further renders [3.1] and [3.2] obvious for the same reasons as described for Ground IB. *See* §VII.B.2.

As understood from Xin's example, at time T2 MH1's bandwidth requirements take priority over MH2's bandwidth needs, thus MH2's enjoyment of MH1's bandwidth at T1 is ended. EX1025, 570 EX1001, ¶73. As discussed in Section VII.D.1, a POSITA would have been motivated to modify Kotzin to prioritize the bandwidth needs of the wireless units 106 based on the content being transmitted from the WAN communication system 104 to the wireless units at taught by Xin because Kotzin is concerned with bandwidth allocation and recognizes the importance of "selectable enabling" of resource sharing by wireless units. EX1018, ¶[0044]; EX1001, ¶¶108-110.

3. Claim 4

a. [4.1]

Xin further renders [4.1] obvious for the same reasons as described in Ground IB. *See* §VII.B.3.a. It would have been obvious to combine Xin's method with Kotzin's system. §VII.D.1.

b. [4.2]

Xin further renders [4.2] obvious for the same reasons as described in Ground IB. *See* §VII.B.3.b. It would have been obvious to combine Xin's method with Kotzin's system. §VII.D.1.

4. Claim 5

[5]

Xin further renders [5] obvious for the same reasons as described in Ground IB. *See* §VII.B.4. It would have been obvious to combine Xin's method with Kotzin's system. §VII.D.1.

VIII. SECONDARY CONSIDERATIONS

Petitioner is unaware of any evidence of alleged secondary indicia that would support non-obviousness of the '156 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 five 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 '156 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 '156 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. The Challenged Claims also have not been the subject of a prior IPR or a finally concluded district court 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 that Petitioner will show that they are obvious.

Dated: August 4, 2025.

Respectfully submitted,

/Todd M. Friedman/
Todd M. Friedman (Reg. No. 42,559)
Attorneys for Petitioner Red Hat, Inc.

CERTIFICATE OF COMPLIANCE

This Petition complies with the type-volume limitations as mandated in 37 C.F.R. § 42.24, totaling 13,718 words. Counsel has relied upon the word count feature provided by Microsoft Word.

/Todd M. Friedman/
Todd M. Friedman (Reg. No. 42,559)

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 5, 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
Orange, CA 92856

A courtesy copy is also being served via electronic mail and FTP on August 4, 2025 on the attorneys of record listed below for the following related matter:

Red Hat, Inc. v. Competitive Access Systems, Inc. Case No. 5:24-cv-505 (EDNC)

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