

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Charter Communications, Inc. and Plume Design, Inc.
Petitioner,

v.

Adaptive Spectrum and Signal Alignment, Inc.
Patent Owner.

IPR2024-00087
U.S. Patent No. 11,477,108

**DECLARATION OF DR. HENRY HOUH,
UNDER 37 C.F.R. § 1.68 IN SUPPORT OF PETITION FOR
INTER PARTES REVIEW**

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I, Henry Houh, do hereby declare as follows:

I. INTRODUCTION

1. I make this declaration based upon my own personal knowledge and, if called upon to testify, would testify competently to the matters stated herein.

2. I have been asked by Petitioner to provide my expert opinion in connection with the *Inter Partes* Review of U.S. Patent No. 11,477,108 (“the ’108 patent”) to Chow et al. concerning whether the ’108 patent is unpatentable over certain prior art. This declaration is a statement of my opinions on issues relating to the patentability of claims 1–20 (the “Challenged Claims”) of the ’108 patent. As I explain more fully below, it is my opinion that all of the Challenged Claims would have been anticipated or obvious to a person of ordinary skill in the art (“POSITA”) at the time of the alleged invention.

3. I am being compensated for my work in this matter at my standard hourly rate. I am also being reimbursed for reasonable and customary expenses associated with my work and testimony in this investigation. My compensation is not contingent on the outcome of this matter or the specifics of my testimony.

4. I have reviewed and considered the following documents in connection with my analysis of the ’108 patent:

Exhibit	Description
1001	U.S. Patent No. 11,477,108 (the “’108 patent”)

Exhibit	Description
1002	Prosecution history of U.S. Patent No. 11,477,108 (“108FH”)
1003	Declaration of Henry Houh, Ph.D. (“Houh Decl.”)
1004	U.S. Patent App. Pub. 2016/0294669 to Chow (“Chow-669”)
1005	U.S. Patent App. Pub. 2006/0164978 to Werner (“Werner”)
1006	U.S. Patent App. Pub. 2008/0049776 to Wiley (“Wiley”)
1007	U.S. Patent No. 6,625,169 to Tofano (“Tofano”)
1008	Excerpts from Tanenbaum, A., et al., “Computer Networks – Fifth Edition”, ISBN 0-13-212695-8 ISBN-10: 0-13-212695-8 TK5105.5.T36 2011 004.6--dc22 2010034366
1009	Copyright Office, Public Record regarding Ex-1008
1010	Prosecution history of U.S. Patent Application No. 15/182,513 (“513FH”)
1011	Prosecution history of U.S. Patent Application No. 16/432,364 (“364FH”)
1012	U.S. Patent No. 10,333,819 (the “’819 patent”)
1013	<i>Adaptive Spectrum and Signal Alignment, Inc. v. Charter Communications, Inc.</i> , No. 2:24-cv-00124 (E.D. Tex.), Amended Complaint
1014	<i>Adaptive Spectrum and Signal Alignment, Inc. v. Charter Communications, Inc.</i> , No. 2:24-cv-00124 (E.D. Tex.), Docket Control Order
1015	Docket Navigator – Time to Milestones for the Eastern District of Texas and District of Colorado
1016	<i>Curriculum Vitae</i> , Henry H. Houh, Ph.D.

5. In forming the opinions expressed below, I have considered:

- a) the documents listed above;
- b) the relevant legal standards, including the standard for obviousness, and any additional authoritative documents as cited in the body of this declaration; and
- c) my own knowledge and experience based upon my work in the field of software systems as described below, as well as the following materials.

6. Unless otherwise noted, all emphasis in any quoted material has been added.

II. QUALIFICATIONS AND PROFESSIONAL EXPERIENCE

7. My complete qualifications and professional experience are described in my *Curriculum Vitae*, a copy of which can be found in Exhibit 1016. The following is a brief summary of my relevant qualifications and professional experience.

8. I received a Ph.D. in Electrical Engineering and Computer Science from the Massachusetts Institute of Technology (“MIT”) in 1998. Beforehand, I received a Master of Science degree in Electrical Engineering and Computer Science in 1991, a Bachelor of Science degree in Electrical Engineering and Computer Science in 1989, and a Bachelor of Science degree in Physics in 1990, all from MIT.

9. I am currently self-employed as an independent technical consultant.

From its founding in 2012 until October 2022, I was also president of a company that provides supplemental science, technology, engineering, and mathematics (“STEM”) education to children of all ages.

10. I first entered telecommunications in 1987 when I worked as a summer intern at AT&T Bell Laboratories as part of a five-year dual degree program at MIT. I continued to work at AT&T Bell Laboratories as part of this MIT program. While at MIT, I was a teaching assistant (“TA”) in the Electrical Engineering and Computer Science Department’s core Computer Architectures course. I first was a TA as a senior for a role typically reserved for graduate students. I later became head TA. The course covered various topics in computer architectures. As a TA, I helped write homework assignments, lab assignments, and exams. I also taught in the recitation sections.

11. Later, as part of my doctoral research at MIT from 1991-1998, I was a research assistant in the Telemedia Network Systems (“TNS”) group at the Laboratory for Computer Science. The TNS group built a high-speed gigabit network and created applications that ran over the network. Example applications included ones for remote video capture, processing, and display of video on computer terminals. In addition to working on the design of core network components (which was based on FPGAs), designing and building the high-speed links (which included programmable logic devices), and designing and writing the

device drivers for the interface cards (which included programmable logic devices), I also set up the group's web server. Also, I helped to maintain, install, and upgrade the networking devices used within the group, along with other graduate students. When I started with the TNS group, the networking infrastructure consisted of shared coaxial cable-based Ethernet, with bridges and repeaters interconnecting various network segments. I became familiar with the Ethernet specifications in order that we not configure our network improperly, typically by chaining too many repeaters together. We gradually replaced the coaxial Ethernet infrastructure with twisted pair 10BASE-T wiring that were interconnect via hub repeaters, for which we also had to mind the Ethernet specifications. Eventually, many of the hub repeaters were upgrade to switches. I also studied the various parts of the Ethernet specifications both independently and through graduate course work in networking. During this time, I was an author on numerous papers about our system, and in many of them we discussed our system along with layering concepts.

12. I also helped to build the web pages that initiated the above-mentioned video sessions via a web interface. Vice President Al Gore visited our group in 1996 and received a demonstration of—and remotely drove—a radio-controlled toy car with a wireless video camera mounted on it that was built by our group. This toy car device received commands transmitted over a network from a remote computer, and video data from the toy car was transmitted wirelessly then over a computer network

back to the user controller. On occasion, we allowed users visiting our web site to drive the toy car from their remote computer while they watched the video on their computer. The video stream was encoded by TNS-designed hardware, streamed over the TNS-designed network, and displayed using TNS-designed software.

13. I defended and submitted my Ph.D. thesis, titled “Designing Networks for Tomorrow’s Traffic,” in January 1998. As part of my thesis research, I analyzed local area and wide area flows to show a more efficient method for routing packets in a network, based on traffic patterns at the time. The traffic flow data included Ethernet, IP, TCP or UDP, and RTP header information, which I analyzed to come to the conclusions in my thesis. I used a packet sniffer to collect data for my thesis, and I wrote custom software to decode and analyze the packet sniffer data I collected.

14. While I was in graduate school, I started a company that provided web site design services and targeted advertising opportunities. We also sold targeted advertising placements. As the web became popular first at colleges and universities, we focused initially on building college recruiting web sites and sold advertisements to companies wishing to target students to recruit at specific colleges. We developed technology that utilized the web user’s college affiliation to customize advertisements targeted to students at that college.

15. From 1997 to 1999, I was a Senior Scientist and Engineer at NBX Corporation, a start-up that made business telephone systems for streaming

packetized audio over data networks instead of using traditional telephone lines. NBX was later acquired by 3Com Corporation and the phone system is still used today by numerous businesses.

16. As part of my work at NBX, I designed the core audio reconstruction algorithms for the telephones, as well as the packet transmission algorithms. I also designed and validated the core packet transport protocol used by the phone system. The protocol was used for all signaling in the phone system, including for the setup of conference calls. In addition, I used a packet sniffer to collect data from our network in order to help determine the cause of errors in call signaling. I wrote custom software to analyze all the packets captured in order to piece together call flows and telephony commands sent over the local area network. The NBX system also featured a computer interface for initiating phone calls, which could also initiate conference calls. The NBX system also supported the Telephony Application Programming Interface (“TAPI”) that allowed other computer programs to integrate with our system telephony features. We obtained U.S. Patent No. 6,967,963, entitled “Telecommunication method for ensuring on-time delivery of packets containing time-sensitive data,” as part of this work. The first release of the phones had integrated Ethernet repeater hubs embedded in them, and I worked with the documentation and field support people to develop sets of guidelines so that customers would not build their networks to violate the Ethernet specifications,

typically by chaining too many hub repeaters and NBX phones together. The first release of the phones also worked using Ethernet-layer packets (without the use of IP). I also programmed the first prototype of our phone which communicated using IP, and I demonstrated our IP phones working over the Internet when we attended a trade show in California. The phone connected over the Internet to our headquarters in Andover, MA.

17. From 1999-2004, I was employed by Empirix or its predecessor company, Teradyne. Teradyne had traditionally made products to test chips and hardware, but the founder and board chairman, Alex d'Arbeloff wanted to expand the company's products to include software systems testing. Teradyne made a number of acquisitions to achieve this goal, and I was hired to work for Mr. d'Arbeloff to work with all the acquired software test divisions. These divisions were later spun-out of Teradyne into a separate company, Empirix. Empirix was a leader in test tools for software systems including telecommunications protocols and systems, providing functional testing tools as well as load testing tools. From 2000-2001, I conceived and built a test platform for testing Voice-over-IP (VoIP). The first application on this new test platform was a cloud emulator for simulating the effects of transmitting VoIP over a busy network. The second application I specified and designed on this platform was a line speed packet sniffer with an associated protocol analyzer. The test platform was based on a network processor chip, which

could be programmed to cut-through packets while processing packet data such as various protocol later headers including addresses included therein and even packet data contents. I also designed a protocol analyzer built on the same platform. The application captured and performed protocol decoding at various layers in the protocol stacks of captured packets, including detailed Ethernet header decoding, IP header decoding, TCP header decoding, UDP header decoding, RTP header decoding, and many other specified protocols. The application was also designed to reconstruct entire conversations that spanned multiple packets.

18. In 2006, as part of my role at BBN Technologies, I helped found PodZinger Inc., now known as RAMP Inc. PodZinger utilized BBN's speech recognition algorithms to search through the spoken words in audio and video segments. While I was Vice President of Operations and Technology, PodZinger followed its initial prototype with a full streaming audio and video search solution. I also created a social networking web site, which BBN sold to a venture-funded startup company. In the process of creating the web site, I designed and specified the authentication and authorization protocols.

III. LEVEL OF ORDINARY SKILL IN THE ART

19. I understand there are multiple factors relevant to determining the level of ordinary skill in the pertinent art, including (1) the levels of education and experience of persons working in the field at the time of the invention; (2) the

sophistication of the technology; (3) the types of problems encountered in the field; and (4) the prior art solutions to those problems.

20. I understand that the '108 patent was filed on July 11, 2020 and purports to claim priority as a:

“[c]ontinuation of application No. 15/182,513, filed on Jun. 14, 2016, now Pat. No. 10,333,819, and a continuation of application No. 16/432,364, filed on Jun. 5, 2019, now Pat. No. 10,757,003, which is a continuation of application No. 15/182,513, filed on Jun. 4, 2016, now Pat. No. 10,333,819, which is a continuation of application No. 13/995,900, filed as application no. PCT/US2011/021003 on Jan. 12, 2011, now Pat. No. 9,369,370.”

(Ex-1001, (63) [pages 1-2].)

21. Note that I may refer to the patents identified in the excerpt above as follows: 10,333,819 as the '819 patent, 10,757,003 as the '003 patent, and 9,369,370 as the '370 patent.

22. I also note that a POSITA would have understood the priority chain above contains an error of some kind. Specifically, the priority chain suggests that the '108 patent is a continuation of the '819 patent and a continuation of the '003 patent, where the '003 patent is also purported to be a continuation of the '819 patent. A POSITA is not a lawyer, but it appears logically inconsistent for the '108 patent to identify the '819 patent twice in the priority chain, once as a parent by continuation and again as a grandparent by continuation through an intervening

continuation.

23. My analysis reflects the views of a person of ordinary skill in the art (“POSITA”) in the field of the ’108 patent. A POSITA would have at least a bachelor’s degree in electrical engineering, or a related field, with at least two years of experience in the field(s) of computer networking/telecommunications, including experience with transmission optimization techniques as well as DSL, cable, and/or wireless networks. Lack of work experience can be remedied by additional education, and vice versa.

24. I understand there is a dispute about whether the ’108 patent is entitled to benefit from the January 12, 2011 filing date of the ’370 patent, or if the ’108 patent is only entitled to its actual filing date of July 11, 2020. I note that a POSITA would be defined in the same manner with respect to July 11, 2020—the difference would be that more prior art would be available and known to a POSITA if the effective filing date of the ’108 patent is its actual filing date of July 11, 2020 rather than the earlier January 12, 2011 filing date of the ’370 patent.

25. For purposes of this Declaration in general and with respect to Ground 2, my statements and opinions, such as those regarding my experience and the understanding of a POSITA generally (and specifically related to the references I consulted herein), are rendered from the perspective of a POSITA as of the January 12, 2011 date. For Ground 1, my statements and opinions are rendered from the

perspective of a POSITA as of July 11, 2020. In brief, this is because I understand that Ground 1 relies on a reference that qualifies as prior art if the '108 patent is not entitled to benefit from the filing date of the '819 patent.

IV. RELEVANT LEGAL STANDARDS

26. I am not an attorney. In preparing and expressing my opinions and considering the subject matter of the '108 patent, I am relying on certain basic legal principles that counsel have explained to me. These principles are discussed below.

27. I understand that prior art to the '108 patent includes patents and printed publications in the relevant art that predate the proper priority date of the alleged invention recited in the '108 patent.

28. I have been informed that a claimed invention is unpatentable under 35 U.S.C. § 103 if the differences between the invention and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. I have also been informed by counsel that the obviousness analysis takes into account factual inquiries including the level of ordinary skill in the art, the scope and content of the prior art, and the differences between the prior art and the claimed subject matter.

29. I have been informed by counsel that the Supreme Court has recognized several rationales for combining references or modifying a reference to show

obviousness of claimed subject matter. Some of these rationales include the following: (a) combining prior art elements according to known methods to yield predictable results; (b) simple substitution of one known element for another to obtain predictable results; (c) use of a known technique to improve a similar device (method, or product) in the same way; (d) applying a known technique to a known device (method, or product) ready for improvement to yield predictable results; (e) choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; and (f) some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

30. I further understand that certain factors may support or rebut the obviousness of a claim. I understand that such secondary considerations include, among other things, commercial success of the patented invention, skepticism of those having ordinary skill in the art at the time of invention, unexpected results of the invention, any long-felt but unsolved need in the art that was satisfied by the alleged invention, the failure of others to make the alleged invention, praise of the alleged invention by those having ordinary skill in the art, and copying of the alleged invention by others in the field. I understand that there must be a nexus—a connection—between any such secondary considerations and the alleged invention. I also understand that contemporaneous and independent invention by others is a

secondary consideration tending to show obviousness.

31. I am not aware of any allegations by the named inventor of the '108 patent or any assignee of the '108 patent that any secondary considerations are relevant to the obviousness analysis of any Challenged Claim of the '108 patent.

V. SUMMARY OF THE '108 PATENT

A. General background regarding the claims and specification

32. The '108 patent has twenty claims, all of which are challenged. Claims 1, 8, and 15 are independent claims.

33. The '108 patent relates generally to “generally to the field of computing, and more particularly, to systems and methods for jointly optimizing WAN and LAN network communications.” (Ex-1001, 1:39-42.)

34. A WAN is a broad network, an example of which is the Internet. (Ex-1001, 1:56-60.)

35. A LAN is a smaller network, like a home network where end-users can connect multiple devices that communicate locally and connect to the Internet. (Ex-1001, 1:61-67.)

36. The claims of the '108 patent require a management device that collects information from a local area network (“LAN”) and uses that analysis to identify an operational condition within a wide area network (“WAN”). (Ex-1001, claim 1 & 7:63-8:20.) The specification also states that even though “failures may be exhibited

and available from the LAN, many such failures may nevertheless be attributable to operational conditions (e.g., configurations, faults, congestion, etc.) within the WAN 205.” (Ex-1001, 9:15-18.)

37. Collecting performance information from a LAN and using that information to identify problems in a WAN was obvious to a POSITA. I discuss this more below, including in the prosecution history section.

38. The claims also require limitation directed to the concept of communication layers. For example, limitations 1.4-1.5 require the following:

[1.4] collecting LAN information from one or more communication layers on the LAN; and

[1.5] identifying one or more operational conditions within the WAN in a different communication layer from the one or more communication layers on the LAN by analyzing at least the collected LAN information.

(Ex-1001, claim 1.)

39. There is some discussion of communication layers in the specification, though the details provided are sparse. For example, the specification discusses that communication layers may be layers from one of two well known models:

“In one embodiment, information collected from the LAN 210 and WAN 205 relates to two distinct communication layers. One example of the two communication layers is two layers of the Open Systems Interconnection model (OSI model). The OSI model is a commonly

used model describing the different data processing layers, in digital communication systems. The communication layers could also correspond to other communication protocols or layers such as TCP/IP which might not directly correspond to one of the layers of the OSI model.”

(Ex-1001, 16:62-17:4.) The ’108 patent assumes that the reader is familiar with the OSI model and “TCP/IP,” which the patent refers to as the “TCP/IP model” in claims 6, 13, and 20. For example, the patent does not describe the sets of layers defined in each model. In the Technology Background section below, I discuss several background references that identify the layers of the OSI model and the TCP/IP model.

B. High-level summary of the prosecution history

40. I adopt counsel’s discussion of the prosecution history rather than discuss it in complete detail here. Below, I highlight two key points from the prosecution of the ’108 patent that are particularly relevant to my analysis.

41. Prosecution of the ’108 patent did not involve any rejections based on prior art. However, the Werner reference (Ex-1005) was identified during prosecution of earlier applications and referenced in the Notice of Allowance regarding the ’108 patent. The examiner stated:

“The following is a statement of reasons for the indication of allowable subject matter: The prior art of record Werner et al (US Publication

2019/0245278¹ A1) discloses a management device 1400 (fig. 1) comprising: a Local Area Network LAN interface 1300 to communicably interface the management device with a LAN 1600; a Wide Area Network WAN interface 1300 to communicably interface the management device with a WAN 1700 (page 2 paragraphs 0023-0024), wherein the WAN is to provide broadband connectivity to the LAN (page 1 paragraph 0007); one or more processors (page 4 paragraph 0076) and a non-transitory computer-readable medium or media storing one or more sequences of instructions which, when executed by the at least one of the one or more processor (page 4 paragraph 0068), cause the management device to perform operations comprising collecting LAN information from one or more communication layers on the LAN (page 2 paragraph 0025). However, the prior art of record fails to teach or make obvious ‘identifying one or more operational conditions within the WAN in a different communication layer from the one or more communication layers on the LAN by analyzing at least the collected LAN information’, when the identifying is considered within the specific structure or combination of steps recited in the device of claims 1 and 15 or in the method of claim 8.”

(Ex-1002-108FH, 120-21.)

42. I agree with the first part of the examiner’s statement: Werner does

¹ I understand this is a typographical error in the Notice of Allowance. Werner is U.S. Patent App. Pub. 2006/0164978, which is Ex-1005 herein.

disclose most of the limitations of claim 1—the statement above indicates that the examiner believed the preamble and limitations 1.1-1.4 were all disclosed in Werner.

I concur, as shown in my analysis below in Ground 2.

43. However, I disagree with the examiner that the “identifying” step of the claims was nonobvious. As I explain in this declaration, it was obvious to a POSITA to collect LAN information from one or more communication layers, analyze it, and use that analysis to identify operational conditions within the WAN in a different communication layer.

VI. TECHNOLOGY BACKGROUND

44. Below I provide a brief overview of the prior art references I discuss in the Grounds, as well as two references that facilitate a background explanation regarding communication layers.

A. Chow-669 (Ex-1004)

45. Chow-669 is U.S. Patent App. Pub. 2016/0294669 to Chow. I understand Chow-669 is prior art only if the ’108 patent is not entitled to claim priority through the ’819 patent based on an error in the priority chain.

46. My analysis of Chow-669 is straightforward: Chow-669 shares a common specification with the ’108 patent and therefore contains the same disclosures as the ’108 patent itself. In my opinion, those disclosures teach each and every limitation of the Challenged Claims.

B. Werner (Ex-1005)

47. Werner is U.S. Patent App. Pub. 2006/0164978 to Werner. I understand Werner is prior art no matter which priority date applies.

48. Werner is in the same field of endeavor as the '108 patent. For example, Werner discloses a network in which an “information device 1400” has an “analyzer 1460,” as shown in FIG. 1:

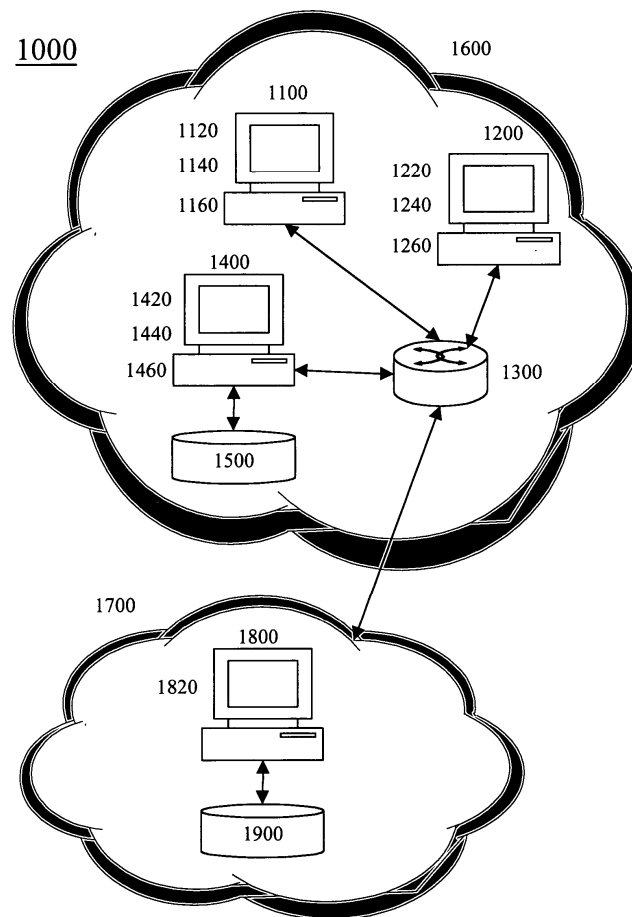


Fig. 1

(Ex-1005-Werner, FIG. 1, 0025.)

49. Werner also discloses collecting packet information via a packet sniffer (or similar mechanism) from router 1300 within LAN 1600:

“Via analyzer 1460, information device 1400 can monitor and/or inspect traffic flowing through router 1300, and particularly traffic traveling between LAN 1600 and WAN 1700. A user interface 1440 for analyzer 1460 can be provided to a user 1420 of information device 1400. Analyzer 1460 can comprise a packet sniffer and/or other packet inspection mechanism and/or an interface to the WAN service provider’s provisioning system.”

(Ex-1005-Werner, FIG. 1, 0025.)

50. The “analyzer 1460” monitors, inspects, gathers, analyzes, stores, renders, and responds to packet traffic conveyed on the LAN and between the LAN and WAN. (Ex-1005-Werner, 0026.) The analysis of this LAN information can then be associated with WAN “capacities,” in order to optimize WAN performance and avoid adverse operational conditions including “packet loss, excess latency, jitter, delay, errors, and/or sub-optimal flow, over-capacity, excess charges, etc.” (Ex-1005-Werner, 0029, 0033.)

C. Wiley (Ex-1006)

51. Wiley is U.S. Patent App. Pub. 2008/0049776, published February 28, 2008. I understand Wiley is prior art no matter which priority date applies.

52. Wiley is in the same field of endeavor as the ’108 patent. For example,

Wiley discloses a “performance data manager” (“PDM”) that includes a “data collector.” (Ex-1006-Wiley, 0237.)

53. The PDM causes the data collector to collect network performance information from other devices in the network. The collected information may comprise transmission quality, connectivity, rate, and bandwidth information. (Ex-1006-Wiley, 0237-40.) The PDM also provided performance reports, load balancing, network topology improvements, automatic responses to alerts/warnings (e.g. by rerouting traffic), bandwidth changes, and closed network ports. (Ex-1006-Wiley, 0262-63.)

54. Wiley also uses performance information packets (“PIPs”). PIPs are used to obtain performance information regarding the network. (Ex-1006-Wiley, 0103-04.) PIPs may “may be communicated over Layer 2 of the OSI model and the network performance information may be determined in Layer 2” to identify problems associated with other layers. (*Id.*, 0116, 0271-78.)

55. Wiley also discusses the OSI model. For example, Wiley explains that the model was developed in 1977 and includes seven different layers:

“[T]he seven layers include: physical layer (Layer 1), data link layer (Layer 2), network layer (Layer 3), transport layer (Layer 4), session layer (Layer 5), presentation layer (Layer 6), and application layer (Layer 7). Each entity interacts directly with the layer immediately beneath it and provides facilities for use by the layer above it.”

(Ex-1006-Wiley, 0004.) The layers of the model are illustrated in FIG. 31:

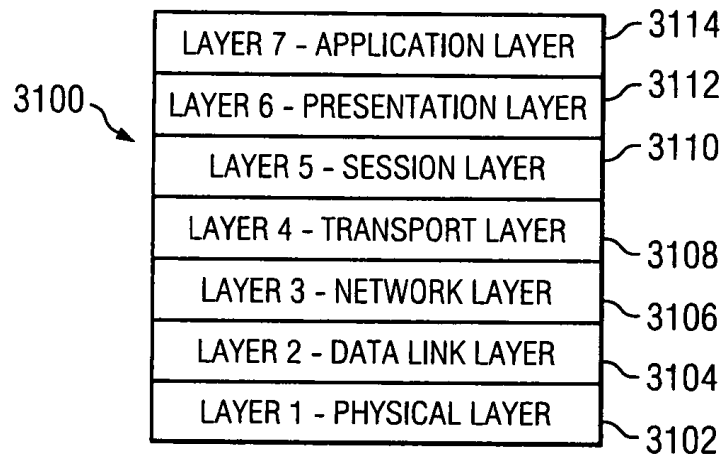


FIG. 31

(Ex-1006-Wiley, FIG. 31, 0266.)

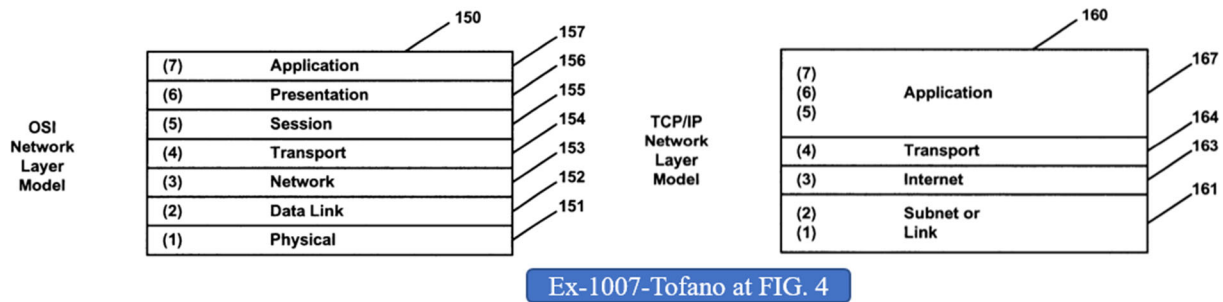
D. Tofano (Ex-1007) and Tanenbaum (Ex-1008)

56. Tofano is U.S. Patent 6,625,169, issued September 23, 2003. I understand Tofano is prior art no matter which priority date applies.

57. Tanenbaum is the 5th edition of a well-known reference text titled “Computer Networks” by Tanenbaum and Wetherall. (Ex-1008-Tanenbaum, 1.) I understand Tanenbaum is prior art no matter which priority date applies.

58. I cite Tofano and Tanenbaum to fill in the background knowledge that a POSITA would have had regarding communication layers and conventional network models, since that information is not provided in the ’108 patent.

59. For example, Tofano provides a helpful figure for correlating the layers of the OSI and TCP/IP network layer models:



(Ex-1007-Tofano, FIG. 4 (label added), 11:29-12:22.)

60. As FIG. 4 shows, there are seven layers in the OSI model and four layers in the TCP/IP model. The models each have an Application layer and a Transport layer that at least loosely correspond across the two models. Likewise, the “Network” layer of the OSI model corresponds to the “Internet” layer of the TCP/IP model, and the “Data Link” and “Subnet or Link” layers correspond as well.

61. Tanenbaum provides additional context that is helpful for understanding the basics. For example, Tanenbaum explains:

1.4 REFERENCE MODELS

Now that we have discussed layered networks in the abstract, it is time to look at some examples. We will discuss two important network architectures: the OSI reference model and the TCP/IP reference model. Although the *protocols* associated with the OSI model are not used any more, the *model* itself is actually quite general and still valid, and the features discussed at each layer are still very important. The TCP/IP model has the opposite properties: the model itself is not of much use but the protocols are widely used. For this reason we will look at both of them in detail. Also, sometimes you can learn more from failures than from successes.

(Ex-1008-Tanenbaum, 41.) As shown, the OSI model and TCP/IP model are useful for different reasons. The OSI model is useful for understanding networking

concepts, but associated protocols are not of much (or any) use, while the TCP/IP model is mostly useful in relation to well-known networking protocols. (*Id.*) Notably, even a lay person may be familiar with at least the names of several protocols associated with the TCP/IP model—Application layer protocols include DNS, FTP, HTTP, and HTTPS, while TCP is a Transport layer protocol and IP is an Internet layer protocol.

62. Tanenbaum also provides a helpful diagram of the OSI model:

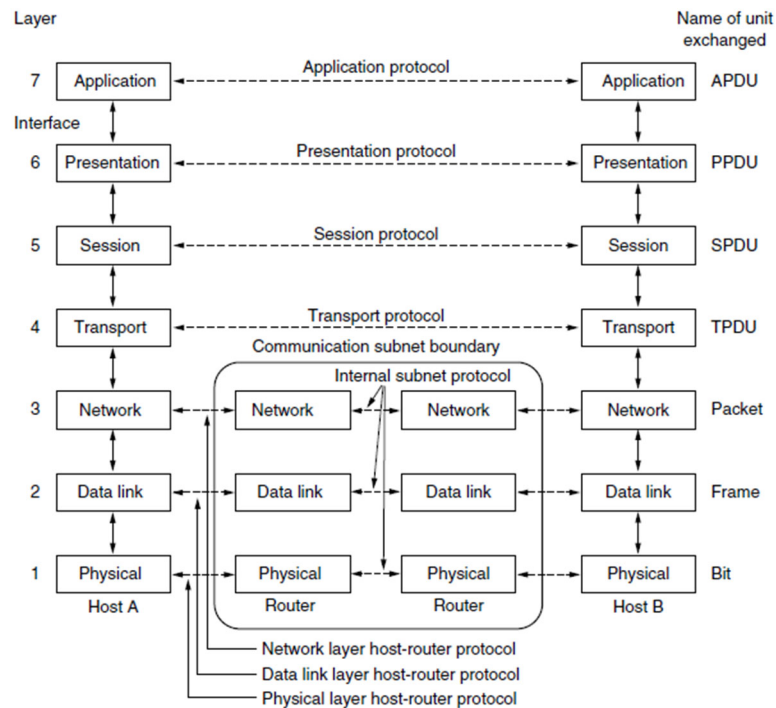


Figure 1-20. The OSI reference model.

(Ex-1008-Tanenbaum, 42.)

63. As shown in the diagram, each layer is associated with a type of “unit” that may be exchanged across each layer—packets across the Network layer, frames

across the Data link layer, and bits across the Physical layer, for example.

64. Tanenbaum further describes each layer. I provide highlights of these descriptions below, beginning first with the OSI model layers.

1. OSI model layers

65. First, the Physical layer relates to transmitting bits over a channel. (Ex-1008-Tanenbaum, 43.) Various mechanical, electrical, and timing interfaces, as well as the physical transmission medium, are implicated by the Physical layer.

66. Second, the role of the Data Link layer is generally to translate bits into data frames having a known structure. (Ex-1008-Tanenbaum, 43.) Tanenbaum notes that a key design issue at the Data Link layer is avoiding a problem where a fast transmitter drowns a slow receiver in excess data—naturally, some traffic regulation mechanisms may be used to coordinate this functionality. The Data Link layer also includes a sublayer called the “medium access control” or MAC sublayer, which helps control access to shared channels. (Ex-1008-Tanenbaum, 43.)

67. Third, the Network layer controls subnet operations, including how packets are routed from a source to a destination. (Ex-1008-Tanenbaum, 43.) Tanenbaum notes that quality of service concerns (including delay, transit time, and jitter) are Network layer issues. (Ex-1008-Tanenbaum, 43-44.)

68. Fourth, the Transport layer is an end-to-end layer that carries data from its source to its destination. Unlike the first three layers of the OSI model, which

relate to transmissions between a machine and its immediate neighbors, the Transport layer (and higher layers) is concerned with end-to-end transmission between a source and a destination, which may be separated by many network nodes (e.g., routers). (Ex-1008-Tanenbaum, 44.)

69. The fifth and sixth layers are often not discussed or referenced in detail. (See Ex-1008-Tanenbaum, 47.) Tanenbaum provides a brief overview of these layers, but they are not pertinent here. (Ex-1008-Tanenbaum, 44-45.)

70. The seventh layer is the Application layer, which contains a variety of protocols that users typically need—HTTP being an example. (Ex-1008-Tanenbaum, 45.)

2. TCP/IP model layers

71. First, the Link layer in the TCP/IP model is not a layer in the typical sense, but instead represents an interface between hosts and transmission links. The model itself is not often described in detail. (Ex-1008-Tanenbaum, 46.)

72. Second, the Internet layer is the “linchpin” of the TCP/IP model. It roughly corresponds to the OSI Network layer. (Ex-1008-Tanenbaum, 46.) The IP protocol is an Internet layer protocol; the purpose of the Internet layer is to deliver IP packets where they are supposed to go, with packet routing and congestion being the key issues associated with this layer. (Ex-1008-Tanenbaum, 47.)

73. Third, the Transport layer roughly corresponds to the OSI model’s

Transport layer. The TCP protocol is a Transport layer protocol that provides a reliable connection-oriented protocol for delivering a byte stream on one machine to be delivered without error to any other machine on the Internet. (Ex-1008-Tanenbaum, 47.)

74. Fourth and finally, the Application layer in the TCP/IP model corresponds to the OSI model's Application layer. Application layer protocols include higher-level protocols like HTTP and DNS. (Ex-1008-Tanenbaum, 47.)

75. As noted above, the OSI model is useful as a model and not for its corresponding protocols, while the opposite is true of the TCP/IP model. Accordingly, Tanenbaum provides a figure identifying the layers of the TCP/IP model and some notable protocols associated with each layer:

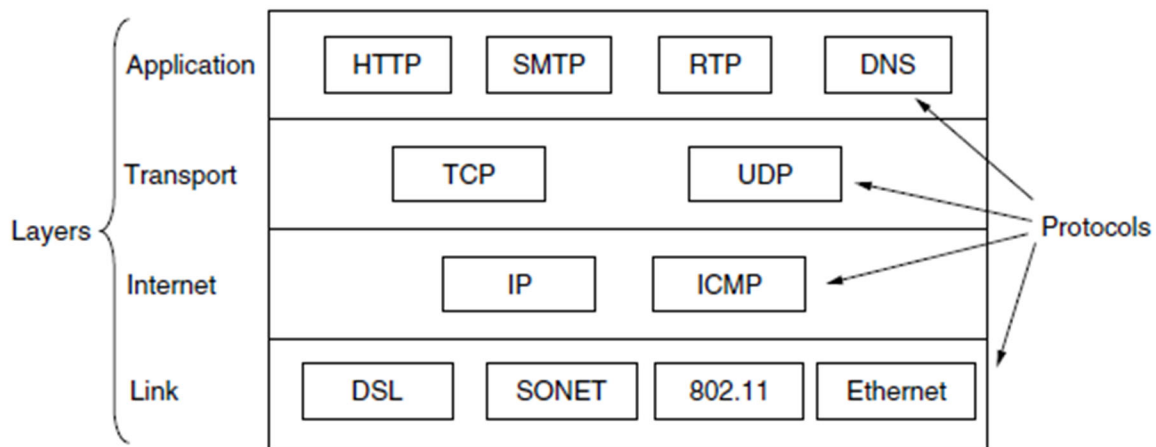


Figure 1-22. The TCP/IP model with some protocols we will study.

(Ex-1008-Tanenbaum, 48.)

76. At a more general level, the concept of “layers” in both models is used

to capture the types of functions and concepts required at each layer, and so are used for shorthand to convey those particular functions and concepts.

77. For example, the OSI Network or TCP/IP Internet layers typically specify data packets that use global addressing, and the network nodes at this layer utilize these global addresses in order to determine the node's next forwarding path or output port to forward a packet towards the destination address.

78. In contrast, the OSI Data Link layer involves how to access the medium to which a device is connected. For example, in a shared medium such as an Ethernet, a device may need to listen to see if another entity is transmitting before transmitting data, and if a "collision" happens to occur, may have to "back-off" (i.e., wait) for a random period of time that increases exponentially with consecutive collisions.

79. Still further, the OSI Physical layer captures concepts related to the actual transmission medium itself, such as what frequency to use for transmission, how to modulate the data onto the channel, and how to insert error correcting codes, for example. The communication layers group these different concepts into different layers.

80. While some layers may share similar concepts, such as addressing, often the addresses are of a different scope, such as global IP addresses in the Network layer in contrast to local Media Access Control ("MAC") addresses at the

Data Link layer. While the layers themselves are distinct, that need not imply that processing of communications on different layers be kept strictly segregated.

VII. CLAIM CONSTRUCTION

81. It is my understanding that in order to properly evaluate the '108 patent, the terms of the claims must first be interpreted. It is my understanding that for the purposes of this inter partes review, the claims are to be construed under the so-called *Phillips* standard, under which claim terms are given their ordinary and customary meaning as would have been understood by one of ordinary skill in the art in light of the specification and prosecution history, unless the inventor has set forth a special meaning for a term. For the purposes of this declaration, it is my opinion that none of the claim terms requires a specific construction and all will be given their plain and ordinary meaning.

82. I do note, however, that there are concepts recited in the Challenged Claims that are potentially ambiguous. The first relates to “communication layers,” which I discussed in the preceding section.

83. The second potentially-ambiguous concept is embodied in limitations 1.4-1.5 and corresponding limitations of the other independent claims:

[1.4] collecting LAN information from one or more communication layers on the LAN; and

[1.5] identifying one or more operational conditions within the WAN in a different communication layer from the one or more

communication layers on the LAN by analyzing at least the collected LAN information.

(Ex-1001, claim 1.)

84. Limitation 1.4 requires collecting information from “one or more communication layers.” Limitation 1.5 then refers back to the layers from which information was collected when the limitation says that operational conditions within the WAN must be identified in “a different communication layer from the one or more communications on the LAN.”

85. In my opinion, the plain meaning of the phrasing above would have been clear to a POSITA and means that an operational condition must be identified in a different layer from the collection layers. An example using the OSI layers helps explain what I mean: if LAN information is collected from each of the seven layers (Physical layer 1 through Application layer 7), then the “different communication layer” limitations cannot be met because operational conditions cannot be identified on a “different layer” from the collection layers. Conversely, if LAN information were only collected from lower layers (say, the Physical, Data Link, and Network layers), then “a different layer” could be any of the higher layers (Transport layer, Session layer, Presentation layer, or Application layer).

VIII. CLAIMS 1-20 ARE UNPATENTABLE

86. I have been asked to provide my opinion as to whether the Challenged

Claims of the '108 patent would have been anticipated or obvious in view of the prior art. The discussion below provides a detailed analysis of how the prior art references identified below teach the limitations of the Challenged Claims of the '108 patent.

87. As part of my analysis, I have considered the scope and content of the prior art and any differences between the alleged invention and the prior art. I describe in detail below the scope and content of the prior art, as well as any differences between the alleged invention and the prior art, on an element-by-element basis for each Challenged Claims of the '108 patent.

88. As described in detail below, the alleged invention of the Challenged Claims would have been obvious in view of the teachings of the identified prior art references as well as the knowledge of a POSITA.

Grounds	Claim(s)	Basis
#1	1-20	Chow-669 (Ex-1004)
#2	1-20	Werner (Ex-1005) in view of Wiley (Ex-1006)

A. Ground 1: Chow-669 discloses every limitation of claims 1-20

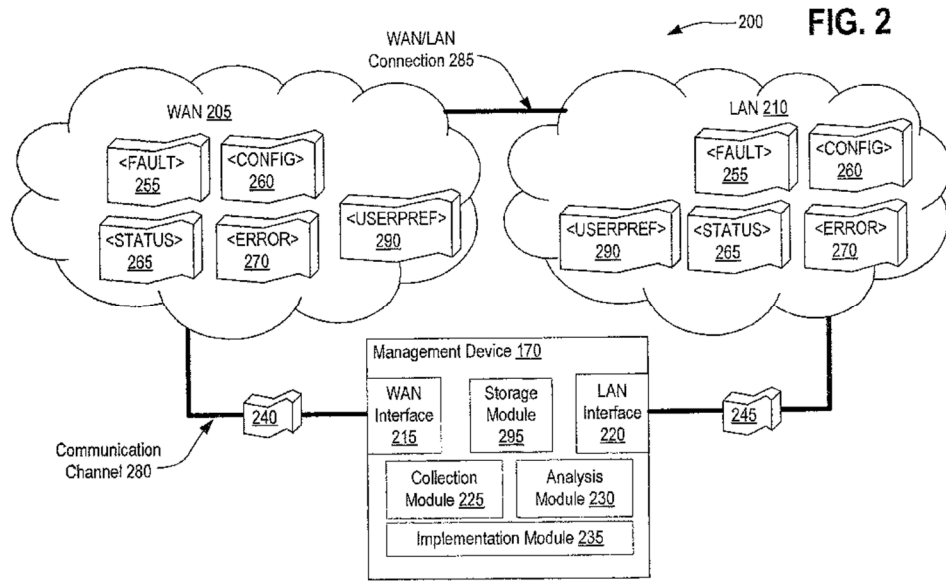
1. Summary of Ground 1

89. Ground 1 relies on Chow-669, which shares the same specification as the '108 patent. Thus, Chow-669 discloses claims 1-20 to the same extent as the '108 patent.

2. Challenged Claims

[1.0] A management device, comprising:

90. Chow-669 a management device as shown in FIG. 2:



(Ex-1004-Chow, FIG. 2.)

91. Chow-669 describes FIG. 2 as follows:

“FIG. 2 illustrates an alternative exemplary architecture 200 in which embodiments may operate. Architecture 200 depicts a Wide Area Network (WAN) 205 and Local Area Network (LAN) 210, each communicatively interfaced with management device 170.”

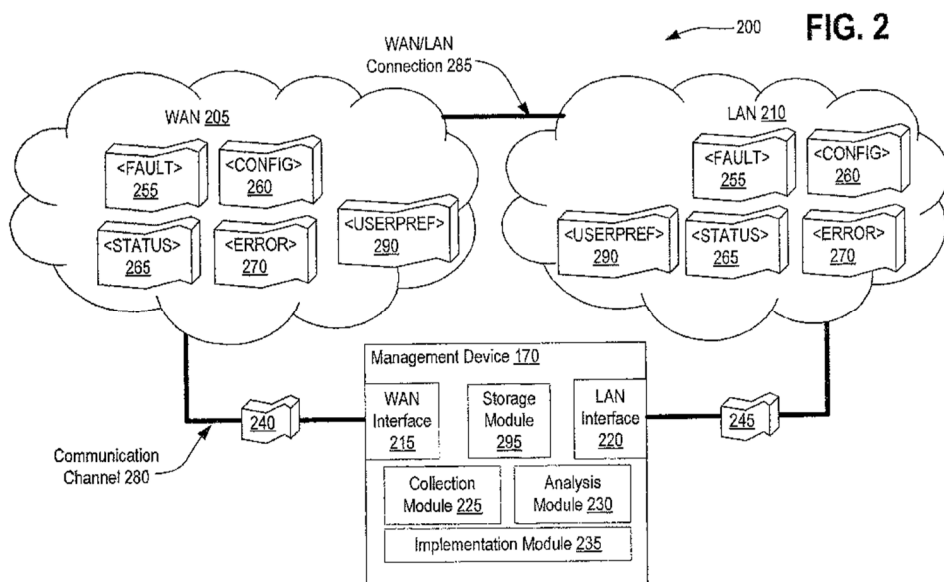
(Ex-1004-Chow, 0037.)

92. Thus, Chow-669 discloses the preamble.

[1.1] a Local Area Network (LAN) interface to communicably interface the management device with a LAN;

[1.2] a Wide Area Network (WAN) interface to communicably interface the management device with a WAN, wherein the WAN is to provide broadband connectivity to the LAN;

93. Chow-669 discloses a management device having LAN and WAN interfaces wherein the WAN provides broadband connectivity to the LAN:



(Ex-1004-Chow, FIG. 2.)

94. The device is communicably interfaced with both the LAN and the WAN, as FIG. 2 depicts above and stated in the excerpt below:

“[M]anagement device 170 includes a Wide Area Network (WAN) interface 215 to communicably interface the management device 170 with the WAN 205 and a Local Area Network (LAN) interface 220 to

communicably interface the management device 170 with the LAN 210.”

(Ex-1004-Chow, 0038.)

95. Chow-669 also notes that the WAN provides broadband connectivity to the LAN. (See Ex-1004-Chow, 0031 (noting that the management device is interfaced to a LAN and the WAN may simply be the Internet), claim 1 (“the WAN provides broadband connectivity to the LAN”).)

96. Thus, Chow-669 discloses these limitations.

[1.3] one or more processors; and a non-transitory computer-readable medium or media storing one or more sequences of instructions which, when executed by at least one of the one or more processors, cause the management device to perform operations comprising:

97. Chow-669 discloses this limitation. Specifically, Chow-669 discloses a system that includes one or more processors, and non-transitory memory for storing instructions that are executed on the processor(s) of a management device to perform the operations of limitations 1.4-1.5. (Ex-1004-Chow, 0094-95.)

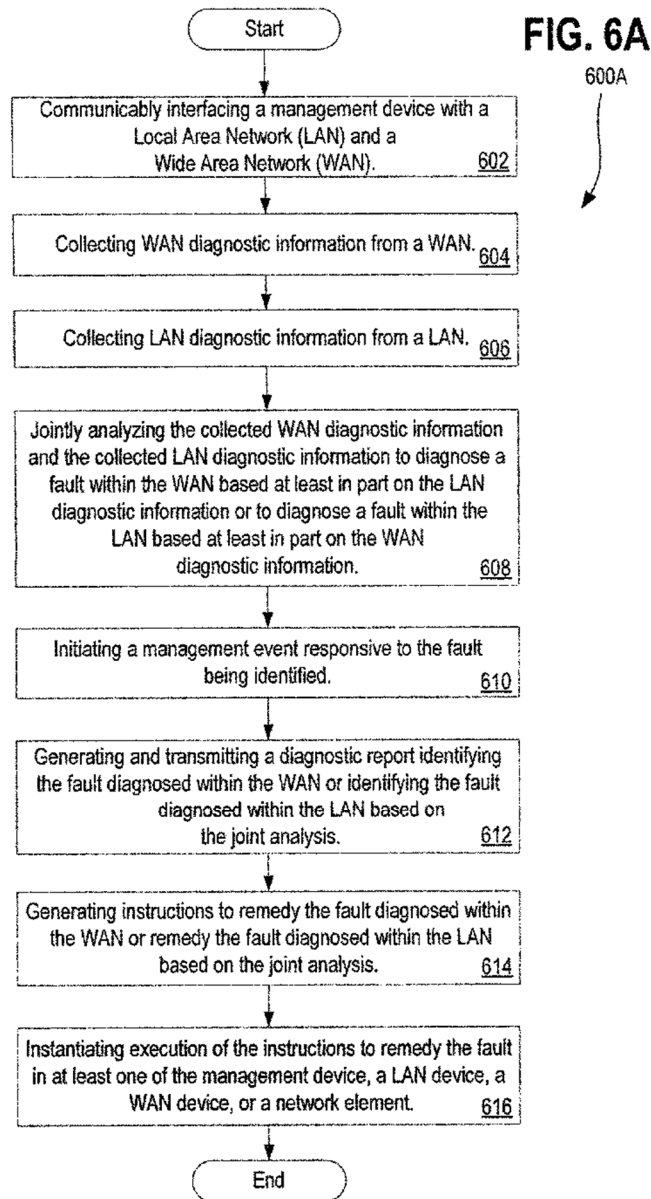
98. Thus, Chow-669 discloses this limitation.

[1.4] collecting LAN information from one or more communication layers on the LAN; and

[1.5] identifying one or more operational conditions within the WAN in a different communication layer from the one or more communication layers on the LAN by analyzing at least the collected LAN information.

99. Chow-669 discloses that LAN information is collected (step 606) and then WAN operational conditions are identified (step 608) from an analysis that

includes the collected LAN information:



(Ex-1004-Chow, FIG. 6A.)

100. Accordingly, Chow-669 discloses identifying operational conditions based on analyzing at least the collected LAN information. (*See also* Ex-1004-Chow, 0044 (“Although failures may be exhibited and available from the LAN,

many such failures may nevertheless be attributable to operational conditions (e.g., configurations, faults, congestion, etc.) within the WAN 205.”))

101. Chow-669’s specification also suggests that LAN information collected from the Application or Networking layers may be used to identify operational conditions in the Physical layer:

“For example, information from one layer on the WAN 205 may be used to diagnose or improve the performance on a different layer on the LAN 210, or vice versa. ...In one example, a management event may include adjusting settings and configurations on a WAN 205 (for example a DSL network) in response to the analysis. Information collected from the LAN 210 may be from different layers of the LAN 210, such as from the application layer and the networking layer. ***The settings and configuration on the DSL system may be implemented at the physical layer, by setting physical layer parameters of the DSL system.***”

(Ex-1004-Chow, 0077; *see id.*, 0078-79 (providing additional examples).)

102. Chow-669 thereby discloses examples in which a management device collects information from a subset of communication layers and uses an analysis of that information to identify operational conditions within a WAN in a different layer—e.g., the Physical layer.

103. Thus, Chow-669 discloses these limitations and anticipates claim 1.

[Claim 2] The management device of claim 1 wherein the operations further comprising: initiating a management event responsive to at least one of the one or more operational conditions being identified.

104. Chow-669 discloses a management event being initiated in response to identifying a fault on the WAN. (Ex-1004-Chow, FIG. 6A, 0077-79 (disclosing the initiation of Physical layer configuration changes on the WAN in response to identifying operational conditions at that layer).)

105. Thus, Chow-669 discloses this limitation and anticipates claim 2.

[Claim 3] The management device of claim 2 wherein initiating the management event comprises one or more of: decreasing WAN rate to improve link stability and quality; increasing one or more Impulse Noise Protection (INP) parameter settings; and increasing one or more margin parameter settings.

106. Chow-669 discloses:

“Alternatively, DSL rate may be decreased to improve link stability and quality. Other management events could include higher INP (Impulse Noise Protection) parameter setting, improved margin parameter settings and/or power parameter settings.” (Ex-1004-Chow, 0078.)

107. Thus, Chow-669 discloses this limitation and anticipates claim 3.

[Claim 4] The management device of claim 2 wherein initiating the management event comprises performing one or more of the following operations: generating instructions to change transmit power of WAN elements; generating instructions to modify one or more parameters affecting WAN forward error correction (FEC), WAN latency, WAN transmit power levels, and WAN data rate; and generating instructions to modify an active profile or configuration settings based on at least identified network traffic related to the WAN.

108. Chow-669 discloses a management device that generates instructions

to modify at least WAN transmit power levels and WAN data rate. (Ex-1004-Chow, 0078.)

109. Thus, Chow-669 discloses this limitation and anticipates claim 4.

[Claim 5] The management device of claim 1 wherein the one or more communication layers on the LAN and the different communication layer in the WAN are layers of Open Systems Interconnection (OSI) model.

110. Chow-669 discloses limitations 1.4-1.5 in the context of the OSI model (e.g., the Application layer, Network layer, and Physical layer), as discussed above. (See also Ex-1004-Chow, 0076-78.)

111. Thus, Chow-669 discloses this limitation and anticipates claim 5.

[Claim 6] The management device of claim 1 wherein the one or more communication layers on the LAN and the different communication layer in the WAN are layers of TCP/IP model.

112. Chow-669 discloses this limitation to the same extent it is described in the '108 patent. Specifically, Chow-669 discloses that TCP/IP model layers may be used instead of OSI layers:

“The OSI model is a commonly used model describing the different data processing layers, in digital communication systems. The communication layers could also correspond to other communication protocols or layers such as TCP/IP which might not directly correspond to one of the layers of the OSI model.”

(Ex-1004-Chow, 0076; see *id.*, 0078 (referring to TCP/IP layers).)

113. Thus, Chow-669 discloses this limitation and anticipates claim 6.

[Claim 7] The management device of claim 1 wherein the one or more operational conditions identified within the WAN comprise at least one of: network congestion within the WAN; excess power consumption by communication elements within the WAN; bandwidth utilization of the WAN in excess of a maximum threshold; bandwidth availability of the WAN below a minimum threshold; errors on WAN connection; performance measures on the WAN; quality of WAN connection; and failure of WAN connection.

114. Chow-669 discloses the claimed operational conditions within the WAN. (Ex-1004-Chow, 0050.)

115. Thus, Chow-669 discloses this limitation and anticipates claim 7.

[Claims 8-20]

116. I agree with Petitioner that claims 1-7 (“Claim Set 1”) generally correspond to Claims 8-14 (“Claim Set 2”) and Claims 15-20 (“Claim Set 3”) as shown in the table below:

Claim Set 1	Claim Set 2	Claim Set 3
[Claim 1, 1.0] A management device, comprising:	[Claim 8, 8.0] A method for communication management comprising:	[Claim 15, 15.0] A non-transitory computer-readable medium or media comprising one or more sequences of instructions which, when executed by at least one processor, causes steps for communication management comprising:
[1.1] a Local Area Network (LAN) interface to communicably interface the management device with a LAN;	[8.1] communicably interfacing, via a Local Area Network (LAN) interface, a management device with a LAN;	[15.1] communicably interfacing, via a Local Area Network (LAN) interface, a management device with a LAN;

[1.2] a Wide Area Network (WAN) interface to communicably interface the management device with a WAN, wherein the WAN is to provide broadband connectivity to the LAN;	[8.2] communicably interfacing, via a Wide Area Network (WAN) interface, the management device with a WAN, wherein the WAN is to provide broadband connectivity to the LAN;	[15.2] communicably interfacing, via a Wide Area Network (WAN) interface, the management device with a WAN, wherein the WAN is to provide broadband connectivity to the LAN;
[1.3] one or more processors; and a non-transitory computer-readable medium or media storing one or more sequences of instructions which, when executed by at least one of the one or more processors, cause the management device to perform operations comprising:		[See preamble 15.0]
[1.4] [cause the management device to perform operations comprising:] collecting LAN information from one or more communication layers on the LAN; and	[8.3] collecting, at the management device, LAN information from one or more communication layers on the LAN; and	[15.3] collecting, at the management device, LAN information from one or more communication layers on the LAN;
[1.5] [cause the management device to perform operations comprising:] identifying one or more operational conditions within the	[8.4] identifying, at the management device, one or more operational conditions within the WAN in a different communication layer	[15.4] and identifying, at the management device, one or more operational conditions within the WAN in a different communication layer

WAN in a different communication layer from the one or more communication layers on the LAN by analyzing at least the collected LAN information.	from the one or more communication layers on the LAN by analyzing at least the collected LAN information.	from the one or more communication layers on the LAN by analyzing at least the collected LAN information.
[Claim 2] The management device of claim 1 wherein the operations further comprising: initiating a management event responsive to at least one of the one or more operational conditions being identified.	[Claim 9] The method of claim 8 further comprising: initiating a management event responsive to at least one of the one or more operational conditions being identified.	[Claim 16] The non-transitory computer-readable medium or media of claim 15 further comprising one or more sequences of instructions which, when executed by at least one processor, causes steps for communication management comprising: initiating a management event responsive to at least one of the one or more operational conditions being identified.
[Claim 3] The management device of claim 2 wherein initiating the management event comprises one or more of: decreasing WAN rate to improve link stability and quality; increasing one or more Impulse Noise Protection (INP)	[Claim 10] The method of claim 9 wherein initiating the management event comprises one or more of: decreasing WAN rate to improve link stability and quality; increasing one or more Impulse Noise Protection (INP)	[Claim 17] The non-transitory computer-readable medium or media of claim 16 wherein initiating the management event comprises one or more of: decreasing WAN rate to improve link stability and quality; increasing one or more Impulse Noise Protection (INP)

parameter settings; and increasing one or more margin parameter settings.	parameter settings; and increasing one or more margin parameter settings.	parameter settings; and increasing one or more margin parameter settings.
[Claim 4] The management device of claim 2 wherein initiating the management event comprises performing one or more of the following operations: generating instructions to change transmit power of WAN elements; generating instructions to modify one or more parameters affecting WAN forward error correction (FEC), WAN latency, WAN transmit power levels, and WAN data rate; and generating instructions to modify an active profile or configuration settings based on at least identified network traffic related to the WAN.	[Claim 11] The method of claim 9 wherein initiating the management event comprises performing one or more of the following operations: generating instructions to change transmit power of WAN elements; generating instructions to modify one or more parameters affecting WAN forward error correction (FEC), WAN latency, WAN transmit power levels, and WAN data rate; and generating instructions to modify an active profile or configuration settings based on at least identified network traffic related to the WAN.	[Claim 18] The non-transitory computer-readable medium or media of claim 16 wherein initiating the management event comprises performing one or more of the following operations: generating instructions to change transmit power of WAN elements; generating instructions to modify one or more parameters affecting WAN forward error correction (FEC), WAN latency, WAN transmit power levels, and WAN data rate; and generating instructions to modify an active profile or configuration settings based on at least identified network traffic related to the WAN.
[Claim 5] The management device of claim 1 wherein the one or more communication layers on the LAN and the different communication layer in the WAN are layers of	[Claim 12] The method of claim 8 wherein the one or more communication layers on the LAN and the different communication layer in the WAN are layers of Open Systems	[Claim 19] The non-transitory computer-readable medium or media of claim 15 wherein the one or more communication layers on the LAN and the different communication

Open Systems Interconnection (OSI) model.	Interconnection (OSI) model.	layer in the WAN are layers of Open Systems Interconnection (OSI) model.
[Claim 6] The management device of claim 1 wherein the one or more communication layers on the LAN and the different communication layer in the WAN are layers of TCP/IP model.	[Claim 13] The method of claim 8 wherein the one or more communication layers on the LAN and the different communication layer in the WAN are layers of TCP/IP model.	[Claim 20] The non-transitory computer-readable medium or media of claim 15 wherein the one or more communication layers on the LAN and the different communication layer in the WAN are layers of TCP/IP model.
[Claim 7] The management device of claim 1 wherein the one or more operational conditions identified within the WAN comprise at least one of: network congestion within the WAN; excess power consumption by communication elements within the WAN; bandwidth utilization of the WAN in excess of a maximum threshold; bandwidth availability of the WAN below a minimum threshold; errors on WAN connection; performance measures on the WAN; quality of WAN connection; and failure of WAN connection.	[Claim 14] The method of claim 8 wherein the one or more operational condition within the WAN identified comprise at least one of: network congestion within the WAN; excess power consumption by communication elements within the WAN; bandwidth utilization of the WAN in excess of a maximum threshold; bandwidth availability of the WAN below a minimum threshold; errors on WAN connection; performance measures on the WAN; quality of WAN connection; and failure of WAN connection.	

117. Thus, Chow-669 anticipates claims 8-20 for the reasons discussed above regarding claims 1-7.

B. Ground 2: Werner in view of Wiley teaches claims 1-20

1. Summary of Ground 2

118. Ground 2 relies on Werner for most limitations of the Challenged Claims. As I show below, it was also obvious to combine Werner with Wiley, which discloses that information collected from one communication layer may be used to identify operational conditions in other layers. This combination renders claims 1-20 obvious.

2. Reasons to Combine Werner and Wiley

119. A POSITA would have been motivated and found it obvious to combine the teachings of Werner and Wiley. In particular, Werner discloses a COS [“class of service”] Determination & Provisioning Support System (CDPSS) that includes a LAN coupled to a WAN via a router. (Ex-1005-Werner, 0023; FIG. 1.)

120. The CDPSS:

“can gather, analyze, and/or provide historical information from any past time period (e.g., the past month, the past few seconds, etc.) for network traffic ingressing and/or egressing a customer's LAN from/to a service provider's WAN.” (Ex-1005-Werner, 0021.)

“Such information can include the types of packets, the applications associated with the packets, application port numbers, addresses, and/or packet quantity, flowrate, and/or changes therein, etc.” (*Id.*, 0008.)

121. The CDPSS gathers packet information and uses it to:

“promptly and properly determine, recognize, respond to, provision, provide, account for, and/or bill, etc., changes in WAN capacity for any portion of LAN-WAN traffic on an as-needed basis, thereby automatically and/or continuously optimizing WAN capacity, costs, and/or charges for that traffic.” (*Id.*, 0031.)

122. Additionally, the CDPSS:

“can automatically provide information and/or a request to a network service provider’s provisioning system sufficient to allow the network service provider’s provisioning system to automatically and dynamically change the WAN bandwidth and/or COS subscription profiles provisioned for the customer on-demand and/or in real-time.” (*Id.*, 0021.)

123. Thus, a POSITA would have understood that the CDPSS collects LAN information (including information about LAN-only traffic and traffic transmitted out to or received via the WAN) and uses that information to adjust WAN capacities as needed. Here, Werner is using the term “capacity” broadly:

“capacity—an available traffic flow capability and/or limit, such as a transport bandwidth, Class of Service subscriptions, Class of Service profile, Quality of Service subscription, etc.” (Ex-1005-Werner, 0045.)

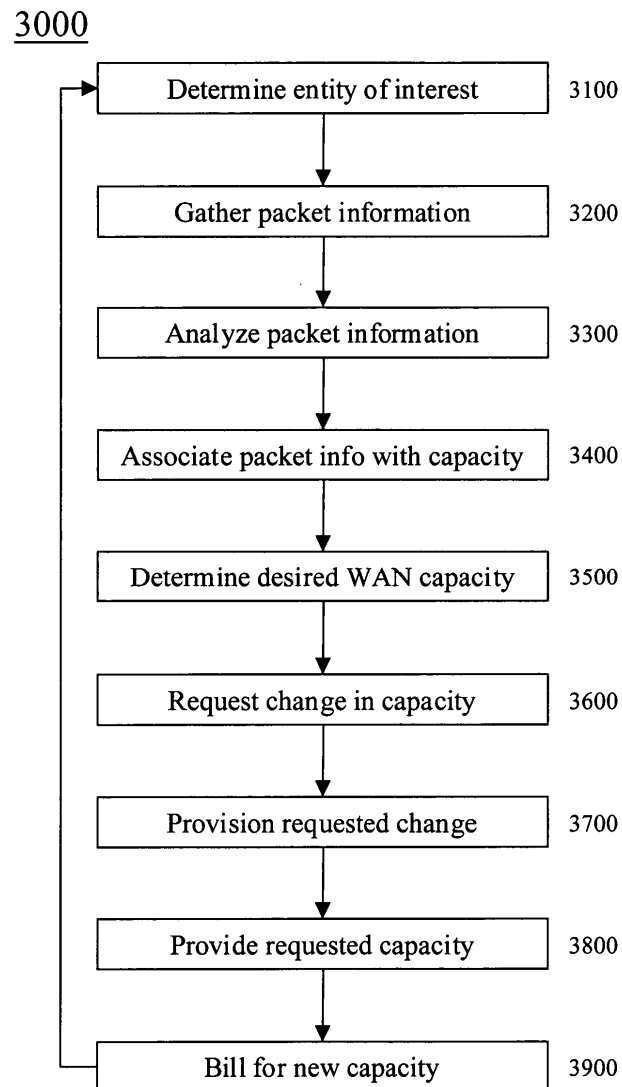
124. This functionality is made possible by the CDPSS’s information device (1400), which has a packet analyzer (1460). (*Id.*, 0025.) The analyzer associates the packet traffic information with one or more WAN capacities and can “provide one

or more notifications when adequate capacity is not available on the WAN...” (*Id.*, 0029.)

125. Based on information from the analyzer, the WAN’s provisioning system can:

“automatically provision[] changes in capacity on WAN 1700. Such changes in capacity can be provisioned and/or provided by, on, and/or within WAN 1700 automatically, continuously, dynamically, on-demand, and/or in real-time.” (*Id.*, 0030.)

126. Thus, the WAN collects LAN information, analyzes it, and uses it to adjust WAN capacities. (*See, e.g., id.*, claim 1, 0025-0033.) FIG. 3 depicts a simple, high-level flow chart of Werner’s methodology:

**Fig. 3**

(Ex-1005-Werner, FIG. 3.)

127. Although Werner discloses conventional computer network features (LAN, WAN, routers, computers, packet communications) and collecting LAN information and using it to identify problems adjust in the WAN capacity or bandwidth, Werner does not specify how conventional communication layers relate to those disclosures.

128. Conventional networking models (OSI and TCP/IP in particular) were well known and it was routine, conventional, predictable, and obvious to characterize and interpret networks with reference to communication layers within those models. (*See* §VII.A & §§VIII.C-E (describing the layers of both conventional models).) For example, like Werner, Wiley seeks to ensure proper network performance by collecting and analyzing LAN information. For instance, Wiley discloses:

“Service providers often have trouble isolating and diagnosing network problems. To attempt to locate a packet loss problem along a node segment (i.e., a path between two network communications devices) over a network a probe that may be used to trace data packets being communicated over the node segment. This probe, however, is typically an external device from the network communications devices and operates to run a trace over an instant of time to determine network performance information, such as packet loss, jitter, and delay.” (Ex-1006-Wiley, 0016.)

129. Wiley discloses using a performance information packet (“PIP”) to obtain performance information about network communications:

“For purposes of this application, a performance information packet (a ‘PIP packet’ or ‘PIP data packet’) shall mean a packet communicated over data paths of a data packet network that is used by the data packet network to obtain performance information associated with path

transmission states of the data packet network.” (Ex-1006-Wiley, 0103.)

130. Wiley transmits PIP and standard data packets to obtain network performance information:

“FIG. 4 is an illustration of an exemplary data packet stream 400 including PIP data packets 402 and data packets 404 a-404 n (collectively 404), the latter including a packet payload of either real-time or non-real-time content. ... Additional information, such as the distribution, burstiness, or timing of the real-time flows, may also be made available within the PIP packets 402....Other network performance information may be determined by monitoring the PIP data packets 402, including jitter, packet loss, and delay, as the PIP data packets 402 may include information indicative of time sent and counter value indicative of number of data packets sent between the previous and current PIP packet. The network performance information may further be categorized as real-time, non-real-time, and/or total network performance information....” (Ex-1006-Wiley, 0111.)

131. Wiley also discloses collecting information from one layer and using it to diagnose network conditions on other layers:

“Data Link Layer 3104 from and to Physical Layer 3102.

In one embodiment, real-time transmission performance information acquired in the Data Link Layer 3104 may be communicated to the Physical Layer 3102. In one embodiment, the degradation of a copper-based link due to induced noise or any other source of impairment,

delay, or loss of data could limit the quantity of information that can be carried error-free across the link. The transmission performance information carried in the PIP packet is capable of identifying this degradation. This degradation may be reported to the Physical Layer 3102, where a protocol operating on the Physical Layer 3102 realizes the degradation and modifies the route to optimize throughput and overcome the impairment, such as rerouting the link to an alternative physical copper link or a reduction in the number of Quadrature Amplitude Modulation (QAM) windows or change to another transmission schema all together.” (Ex-1006-Wiley, 0271; *see id.*, 0272-78.)

132. A POSITA would have been motivated and found it obvious to combine Wiley with Werner. Specifically, it was obvious to use Wiley’s PIP data packets in Werner to enable Werner’s analyzer 1406 to better analyze network conditions and determine packet loss, jitter and other useful network information. Werner was expressly interested in collecting this type of information in order to optimize WAN performance and avoid associated network problems. For example:

“In certain exemplary embodiments, via one or more user interfaces 2600, such as a graphical user interface, a user can view a rendering of, and/or information related to, historical packet traffic, etc. For example, a user can view a notification indicating that certain LAN-WAN traffic is trending toward requiring and/or predicted to require a change in WAN capacity to avoid packet loss, excess latency, jitter, delay, errors,

and/or sub-optimal flow, over-capacity, excess charges, etc.” (Ex-1005-Werner, 0033.)

133. Werner focused on addressing issues associated with WAN capacities. (*Id.*, 0028.) Employing Wiley’s PIP data packets would further enable Werner’s system to determine issues in one layer relative to another, such as determining a degradation in the physical layer by analyzing data in the data link layer, as described above. A POSITA would have found it useful to employ Wiley’s methodology (checking different layers to ensure proper network performance) with Werner to ensure Werner’s WAN was configured in accordance with the required capacity and/or bandwidth requirements of its network.

134. A POSITA would also have a reasonable expectation of successfully implementing Wiley’s teachings with Werner. A POSITA also would have had a reasonable expectation of successfully implementing Wiley’s PIP teachings with Werner. As shown above, Wiley’s PIPs traversed nodes in typical packet-switched networks (e.g., networks characterized in terms of layers of the well-known networking models including the OSI model and TCP/IP model), like Werner’s LAN-WAN environment. As also shown above, Wiley expressly indicates that the PIPs may be used by computers with appropriate software/hardware, including Werner’s computing devices and routers. (Ex-1005-Werner, FIG. 1, 0023-25.) Accordingly, a POSITA would find it straightforward to apply Wiley’s teachings

with respect to PIP packets and performance information analysis in Werner's CDPSS.

3. Challenged Claims

[1.0] A management device, comprising:

135. Werner discloses “analyzer 1460” (“A1460”), which is part of “information device 1400” (“ID1400”) in Werner's “CDPSS” (“COS Determination & Provisioning Support System”):

“Via analyzer 1460, information device 1400 can monitor and/or inspect traffic flowing through router 1300, and particularly traffic traveling between LAN 1600 and WAN 1700. ...Analyzer 1460 can comprise a packet sniffer and/or other packet inspection mechanism and/or an interface to the WAN service provider's provisioning system.”

(Ex-1005-Werner, 0025.)

136. ID1400 discloses a “management device” because A1460 within ID1400 performs management functions:

- “analyzer 1460 can automatically monitor, inspect, gather, analyze, store, report, render, and/or respond to information regarding packet traffic conveyed on LAN 1600, from LAN 1600 to WAN 1700, and/or from WAN 1700 to LAN 1600 (the latter two traffic types referred to herein as ‘LAN-WAN’ traffic).” (Ex-1005-Werner, 0026.)

- “analyzer 1460 can store, query, retrieve, relay, and/or report information, such as packet traffic information, via database 1500.” (Ex-1005-Werner, 0027; *id.*, 0028-29.)
- “analyzer 1460 can determine and/or request any one or more desired capacity (e.g., bandwidth and/or Class of Service level) and/or change in capacity.” (Ex-1005-Werner, 0029.)

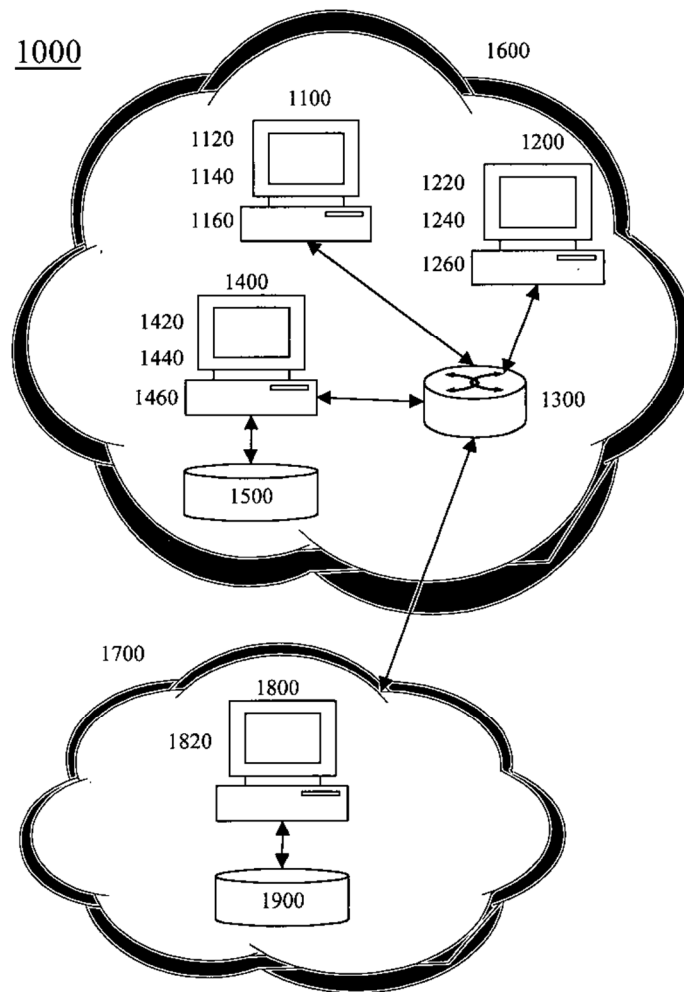
137. Accordingly, Werner discloses that the A1460 of ID1400 manages various aspects of traffic within local and wide area networks for ID1400.

138. I also note that the examiner agreed that Werner teaches the preamble during prosecution. (Ex-1002-108FH, 120 (“[Werner] discloses a management device 1400 (fig. 1)”).)

139. Thus, Werner teaches the preamble.

[1.1] a Local Area Network (LAN) interface to communicably interface the management device with a LAN;

140. Werner teaches a LAN 1600 including a router 1300, which is used to “communicably interface” Werner’s ID1400 with the LAN:

**Fig. 1**

(Ex-1005-Werner, FIG. 1.)

141. Werner further describes a router within LAN 1600 being communicably interfaced to other devices, including the management device ID1400:

“Within LAN 1600, router 1300 can be *coupled to* other entities, such as information devices 1100, 1200, and/or 1400.”

(Ex-1005-Werner, 0024.)

142. I also note that the examiner agreed that Werner teaches this limitation during prosecution. (Ex-1002-108FH, 120 (“[Werner discloses] a Local Area Network LAN interface 1300 to communicably interface the management device with a LAN 1600”).)

143. Thus, Werner teaches this limitation.

[1.2] a Wide Area Network (WAN) interface to communicably interface the management device with a WAN, wherein the WAN is to provide broadband connectivity to the LAN;

144. The meaning of “broadband” is potentially ambiguous (e.g., it could refer to a particular speed or simply to a connection that is always on as opposed to older dial-up connections). However, it at least includes network speeds that allow for the use of voice and/or video applications.

145. Werner teaches “a local area network (LAN) 1600 *coupled to a wide area network (WAN) 1700 via a router 1300.*” (Ex-1005-Werner, 0023.)

146. In turn, router 1300 allows for communications between the WAN, LAN and ID1400. (*Id.*, 0023-24.)

147. Thus, Werner discloses “a Wide Area Network (WAN) interface to communicably interface the management device with a WAN.”

148. Werner also discloses WAN network connectivity provided by a service provider to customers and their corresponding LANs. (Ex-1005-Werner, Abstract, 0007-12, 0016-25 (describing customer ability to control service levels

offered by service provider); 0036-37 (offering definitions of terms including those indicative of a typical customer/provider relationship, including “customer” and “service provider”).)

149. Werner’s disclosures are also provided in the context of broadband services like voice and video. (Ex-1005-Werner, 0001-02, 0037 (disclosing a cable modem).)

150. Accordingly, a POSITA would have reasonably understood Werner’s disclosure of WAN service providers to include broadband service providers that provide services to customers and their corresponding LANs.

151. I also note that the examiner agreed that Werner teaches this limitation during prosecution. (Ex-1002-108FH, 120 (“[Werner discloses] a Wide Area Network WAN interface 1300 to communicably interface the management device with a WAN 1700 (page 2 paragraphs 0023-0024), wherein the WAN is to provide broadband connectivity to the LAN (page 1 paragraph 0007)”).)

152. Thus, Werner teaches this limitation.

[1.3] one or more processors; and a non-transitory computer-readable medium or media storing one or more sequences of instructions which, when executed by at least one of the one or more processors, cause the management device to perform operations comprising:

153. Werner teaches that ID1400 would include standard computer components:

“FIG. 2 is a block diagram of an exemplary embodiment of an *information device 2000*, *which in certain operative embodiments can comprise, for example*, server customer information device 1100, router 1300, 1700, 1800, 1900, *and/or server 1400*, etc. of FIG. 1. Information device 2000 can comprise any of numerous well-known components, such as for example, one or more network interfaces 2100, *one or more processors 2200, one or more memories 2300 containing instructions 2400*, one or more input/output (I/O) devices 2500, and/or one or more user interfaces 2600 coupled to I/O device 2500, etc.”

(Ex-1005-Werner, 0032.)

154. FIG. 2 also illustrates the presence of a processor and memory with constructions as recited in this limitation:

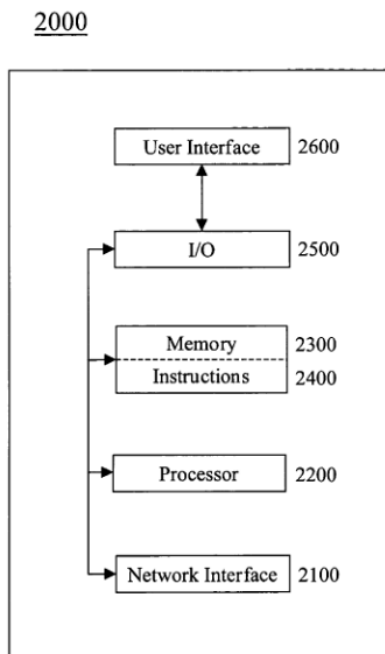


Fig. 2

(Ex-1005-Werner, FIG. 2.)

155. Thus, Werner discloses the first part of limitation 1.3 (“one or more processors; and a non-transitory computer-readable medium or media storing one or more sequences of instructions”).

156. A1460 within ID1400 performs the operations required by the second part of limitation 1.3, as shown below relative to limitations 1.4 and 1.5.

157. Werner also discloses that A1460 performs conventional computing tasks that teach and suggest the presence of processors and non-transitory media, including monitoring, inspecting, gathering, analyzing, storing, reporting, rendering, and responding to information regarding packet traffic. (Ex-1005-Werner, 0007 (“information device[s] comprise] a situation-appropriate processor, memory containing instructions (e.g., operating system, application specific programming, etc.), I/O, network interfaces, and/or a user interface, etc.”), 0025-28 (conventional computing tasks).)

158. I also note that the examiner agreed that Werner teaches this limitation during prosecution. (Ex-1002-108FH, 120 (“[Werner discloses] one or more processors (page 4 paragraph 0076) and a non-transitory computer-readable medium or media storing one or more sequences of instructions which, when executed by the at least one of the one or more processor (page 4 paragraph 0068)”)).)

159. Thus, Werner teaches this limitation.

[1.4] collecting LAN information from one or more communication layers on the LAN; and

160. Werner alone and in view of Wiley teaches this limitation. For example, Werner discloses analyzing packets in a network characterized by multiple communication layers, as was routine and conventional. The OSI and TCP/IP layer models capture common concepts found throughout networks, and Werner also confirms to a POSITA that it is describing these typical networks:

“Analyzer 1460 can analyze packet traffic information for any one or more user-specified and/or predetermined entity (such as a packet type, Class of Service level, Quality of Service level, time period, application type, application, information device type, information device, origin, destination, IP address, MAC address, user type, and/or user, etc.).”

(Ex-1005-Werner, 0028.)

161. As the excerpt shows, Werner refers to packets, IP addresses, and MAC addresses, which all indicate that Werner’s disclosures relate to a typical networking environment. For example, I previously described the OSI and TCP/IP model layers as well as the protocols that are typically associated with TCP/IP layers, including IP. (*See also* Ex-1008-Tanenbaum, 43 (the MAC sublayer is part of the Data Link layer in the OSI model), 48 (the IP protocol is associated with the Internet layer of the TCP/IP model).)

162. Werner’s A1460 monitors and inspects traffic flowing through router 1300 within the LAN:

“Via analyzer 1460, information device 1400 can monitor and/or inspect traffic flowing through router 1300, and particularly traffic traveling between LAN 1600 and WAN 1700. A user interface 1440 for analyzer 1460 can be provided to a user 1420 of information device 1400. Analyzer 1460 can comprise a packet sniffer and/or other packet inspection mechanism and/or an interface to the WAN service provider’s provisioning system.

Based upon parameters specified by a user, customer, and/or WAN service provider, analyzer 1460 can automatically monitor, inspect, gather, analyze, store, report, render, and/or respond to information regarding packet traffic conveyed on LAN 1600, from LAN 1600 to WAN 1700, and/or from WAN 1700 to LAN 1600 (the latter two traffic types referred to herein as ‘LAN-WAN’ traffic).”

(Ex-1005-Werner, 0025-26; *see id.*, 0058 (“gather—to collect, obtain, and/or receive.”))

163. A1460 uses a “packet sniffer” or other “packet inspection mechanism” to collect LAN information by inspecting packets flowing through router 1300, including LAN traffic and LAN-WAN traffic. Werner thereby discloses collecting LAN information from one or more communication layers on the LAN (e.g., “packet type, Class of Service level, Quality of Service level, time period, application type, application, information device type, information device, origin, destination, IP address, MAC address, user type, and/or user”), because Werner’s LAN would have been characterized in terms of communication layers. (Ex-1005-Werner, 0028,

0033, claim 1.)

164. Werner also discloses collecting LAN information related to various performance metrics that indicate and/or predict various network problems:

“For example, a user can view a notification indicating that certain LAN-WAN traffic is trending toward requiring and/or predicted to require a change in WAN capacity to avoid packet loss, excess latency, jitter, delay, errors, and/or sub-optimal flow, over-capacity, excess charges, etc.”

(Ex-1005-Werner, 0033.)

165. I also note that the examiner agreed that Werner teaches this limitation during prosecution. (Ex-1002-108FH, 120-21 (“[Werner discloses] collecting LAN information from one or more communication layers on the LAN (page 2 paragraph 0025)”).)

166. Thus, Werner alone teaches and at least suggests “collect[ing] LAN information from one or more communication layers on the LAN.”

167. Werner in view of Wiley also teaches this limitation. As I detail above in §VIII.B.2 regarding the reasons to combine Werner and Wiley, Wiley uses PIPs to collect DPI (namely, network performance information from data packets), and it was obvious to use both standard data packets and Wiley’s PIPs in Werner’s network to enhance data collection with a reasonable expectation of success.

168. Specifically, Wiley discloses that its PIP packets are communicated

over the Data Link Layer of the OSI model. (Ex-1006-Wiley, 0106 (“In one embodiment, the PIP data packets 302 may be communicated over Layer 2 of the OSI model and the network performance information may be determined in Layer 2.”)) Elsewhere, Wiley explains that packets are encoded and decoded in the Data Link layer, with network performance information being stored in that same layer:

“FIG. 31 illustrates an embodiment 3100 of **the OSI basic reference model of networking that include seven different layers**. The reference numerals (3102-3114) on the left side of the model are used to describe these different layers of the reference model. Each of the layers provides protocols for certain types of operations. More specifically, the seven layers include: physical layer 3102 (Layer 1), data link layer 3104 (Layer 2), network layer 3106 (Layer 3), transport layer 3108 (Layer 4), session layer 3110 (Layer 5), presentation layer 3112 (Layer 6), and application layer 3114 (Layer 7). Typically, physical layer 3102 conveys bit streams, such as bits containing electrical impulses, light or radio signals, through a network at the electrical and mechanical level. The physical layer 3102 provides the hardware means for sending and receiving data, including defining cables, cards, physical aspects, data coding, and medium (B8ZS, DS-3, etc.). ***At the data link layer 3104, data packets are encoded and decoded into bits. The data link layer 3104 further furnishes transmission protocol knowledge and management, and handles errors in the physical layer, flow control, and frame synchronization, including Ethernet, Frame Relay (FR), ATM, Multi-Protocol Label Switching (MPLS), etc. In the following***

examples, the network performance information is stored in the data link layer 3104, and, optionally, the other layers 3106-3114.”

(Ex-1006-Wiley, 0266.)

169. Wiley further discloses:

“FIG. 55 illustrates a typical packet network 5502 including a broadband remote access server (BRAS) 5504 and a DSLAM 5506 interconnected across the packet network 5502 in which the network traffic shaping method operates. ***Typically, the packet network 5502 operates in Data Link Layer 3102 (FIG. 31) of the OSI reference model*** and typically includes data link communication devices, or data link layer devices, such as bridges and switches.”

(Ex-1006-Wiley, 0338.)

170. Thus, a POSITA would have been motivated and found it obvious to use Werner’s “packet sniffer” to collect LAN information relating to “network traffic ingressing and/or egressing a customer’s LAN from/to a service provider’s WAN” via Wiley’s PIPs from the OSI Data Link layer, where Wiley discloses relevant network performance information would be available for collection. (§VIII.B.2; Ex-1005-Werner, 0025, 0028.)

171. Thus, Werner alone and Werner in view of Wiley teaches this limitation.

[1.5] identifying one or more operational conditions within the WAN in a different communication layer from the one or more communication layers on the LAN by analyzing at least the collected LAN information.

172. Werner in view of Wiley teaches this limitation. As I explain above in §VIII.B.2 and regarding limitation 1.4, Werner's management device does the following:

“Thus, CDPSS can gather, analyze, and/or provide historical information from any past time period (e.g., the past month, the past few seconds, etc.) for network traffic ingressing and/or egressing a customer's LAN from/to a service provider's WAN. CDPSS can automatically provide information and/or a request to a network service provider's provisioning system sufficient to allow the network service provider's provisioning system to automatically and dynamically change the WAN bandwidth and/or COS subscription profiles provisioned for the customer on-demand and/or in real-time. Any projected, requested, and/or actual changes in provisioned WAN bandwidth and/or COS subscription profile can be communicated to the service provider's billing system and/or to the customer.”

(Ex-1005-Werner, 0021.)

173. Claim 1 in Werner also reiterates the point, i.e., Werner collects LAN traffic, analyzes it, and responds to problems identified in that analysis by changing capacities in the WAN:

“A method comprising a plurality of activities, comprising:
repeatedly and automatically:

analyzing historical information regarding packet traffic conveyed on a local area network associated with a customer, the packet traffic associated with a predetermined entity and also conveyed on a wide area network managed by a service provider and coupled to the local area network; and

requesting from the service provider an on-demand change in capacity provisioned for packet traffic conveyed on the wide area network.”

(Ex-1005-Werner, Claim 1.)

174. The quotes above show that Werner identifies operational conditions within the WAN (e.g., conditions relating to available bandwidth and provided class-of-service [“COS”] levels) using packet data collected at the LAN.

175. A POSITA would have recognized that WAN bandwidth and COS levels may be impacted by many network factors, including characteristics of the physical link(s) in a network. For example, Werner teaches that packet traffic can be associated with WAN “capacity” such as bandwidth and COS levels, which relate to the available traffic flow capability/limit. (Ex-1005-Werner, 0045 (defining “capacity” as “an available traffic flow capability and/or limit, such as a transport bandwidth, [COS] subscriptions, [COS] profile, [QOS] subscription, etc.”); *see id.*, 0010-13, 0029-35, 0047-48.)

176. Wiley further discloses that physical link degradation may be the root problem that is limiting the actual bandwidth or COS actually provided in the

system:

“In one embodiment, the degradation of a copper-based link due to induced noise or any other source of impairment, delay, or loss of data could limit the quantity of information that can be carried error-free across the link.”

(Ex-1006-Wiley, 0271.)

177. Likewise, Wiley discloses collecting data from the Data Link Layer via PIPs, analyzing the performance information carried in the PIPs, and using that analysis to identify and ultimately respond to network problems:

“In one embodiment, real-time transmission *performance information acquired in the Data Link Layer 3104 may be communicated to the Physical Layer 3102*. In one embodiment, *the degradation of a copper-based link due to induced noise or any other source of impairment, delay, or loss of data could limit the quantity of information that can be carried error-free across the link. The transmission performance information carried in the PIP packet is capable of identifying this degradation*. This degradation may be reported to the Physical Layer 3102, where a protocol operating on the Physical Layer 3102 realizes the degradation and modifies the route to optimize throughput and overcome the impairment, such as rerouting the link to an alternative physical copper link or a reduction in the number of Quadrature Amplitude Modulation (QAM) windows or change to another transmission schema all together.”

(Ex-1006-Wiley, 0271.)

178. The combination of Werner and Wiley therefore discloses this limitation 1.5. In particular, Werner in view of Wiley discloses collecting network performance information from the Data Link layer in Werner's LAN. That collected information is then analyzed by Werner's CDPSS, which in view of Wiley determines if there is an operational condition associated with one or more WAN capacities (e.g., bandwidth limitations, unmet COS levels and the like). As Wiley notes, the source of those conditions can then be identified and fixed. In the example above, the source of the condition was an operational condition within the WAN in the physical layer. (Ex-1006-Wiley, 0271.) Wiley also discloses other conditions may be identified at other layers. (*Id.*, 0273 (network layer), 0274 (transport layer), 0275 (session layer), 0276 (presentation layer), and 0277-78 (application layer).)

179. Combining Werner and Wiley merely required combining known prior art elements and methods in a predictable way. In particular, Werner would collect LAN information from one layer and adjust WAN capacities associated to address operational conditions within the WAN occurring in other communication layers, as disclosed in Wiley. (§VIII.B.2; Ex-1006-Wiley, 0271, 273-78.)

180. A POSITA would have succeeded in making this combination, which merely required using Wiley's PIPs and using information contained therein to identify network performance conditions in other layers.

181. There were no technological hurdles to implementing this combination.

For example, Werner already uses an analyzer to analyze normal data packets, and it would have been routine to use Wiley's PIPs to obtain additional or enhanced network information. Werner also already discloses a system that collects LAN information and analyzes it to identify operational conditions in a WAN, which would encompass Wiley's narrower teaching that information may be collected from one layer (the OSI Data Link layer) and used to determine that a problem exists at a different layer (e.g., the OSI Physical layer).

182. Thus, Werner in view of Wiley teaches this limitation and renders obvious claim 1.

[Claim 2] The management device of claim 1 wherein the operations further comprising: initiating a management event responsive to at least one of the one or more operational conditions being identified.

183. A "management event" is described broadly in the '108 patent:

"[T]he management event initiated responsive to the operational condition being identified may include generating and transmitting a diagnostic report, conducting additional diagnostics and/or analysis, issuing probes to trigger the output and collection of output from connected devices, such as a LAN device, WAN device, or a network element connected with the management device. In some embodiments, the management device generates and implements instructions responsive to the operational condition being identified, such as corrective actions to remedy a fault or instructions to trigger the adoption of a new device configuration."

(Ex-1001, 3:55-66.) As the quoted text above shows, management events include generating diagnostic reports as well as providing instructions to remedy a fault or trigger new configurations.

184. Werner in view of Wiley teaches this limitation. First, Werner teaches that its management device (A1460) automatically and dynamically changes WAN bandwidth and/or COS levels through an automatic provisioning system. (Ex-1005-Werner, 0021, 0029-36, claim 1.) By automatically and dynamically changing the WAN bandwidth, Werner discloses “initiating a management event responsive to at least one of the one or more operational conditions being identified.”

185. Werner in view of Wiley also discloses using PIP packets to identify with specificity the network degradation causing network performance issues, such as inadequate bandwidth availability or performance in association with COS levels. (See Ex-1006-Wiley, 0271, 0273-78.) In response, Werner in view of Wiley discloses a management device that would initiate a management event—examples in Wiley include rerouting a physical link or reducing QAM windows in response to link degradation in the physical layer (Ex-1006-Wiley, 0271), and as well as several proposed remediation steps for addressing degradation at the application layer (*id.*, 0277-78).

186. Thus, Werner in view of Wiley teaches this limitation and renders obvious claim 2.

[Claim 3] The management device of claim 2 wherein initiating the management event comprises one or more of: decreasing WAN rate to improve link stability and quality; increasing one or more Impulse Noise Protection (INP) parameter settings; and increasing one or more margin parameter settings.

187. This limitation is met if initiating the management event comprises any one of the steps listed above—for example, “increasing one or more Impulse Noise Protection (INP) parameter settings” is sufficient.

188. Werner in view of Wiley discloses initiating management events to address operational conditions within the WAN, including Physical layer conditions. (See Ground 2, claims 1-2.)

189. Wiley further discloses dynamically configuring other performance information parameters:

“[D]ynamic configuration changes based on network performance may be made by the Network Management System 4508 to optimize circuit performance. For instance, if a DSL circuit 4502 suddenly experienced a peak or spike in impulse noise on the non-Ethernet segment, appropriate diagnostic information may be inserted into the Ethernet management stream and adjustments may be temporarily made by the network management system 4508 to the DSL Signal-to-Noise ratio to compensate for the interference and to ensure line stability. ...Other exemplary network performance information parameters that may be captured and inserted into the management stream include: near-end failures, far-end failures, last state transmitted (downstream and upstream), actual signal-to-noise ratio, maximum attainable data rate,

actual power spectrum density, actual aggregate transmit power, xDSL profile, xDSL limit PSD mask and band-plan, xDSL Power Spectral Density mask, estimated upstream power back-off electrical loop length, trellis code use, actual cyclic extension, band number, line attenuation per band, signal attenuation per band, signal-to-noise ratio margin per band, actual data rate (downstream and upstream), previous data rate (downstream and upstream), actual interleave delay (downstream and upstream), actual impulse noise protection, impulse noise protection report, actual size of Reed-Solomon codeword, actual number of Reed-Solomon redundancy bytes, actual number of bits per second, actual interleaving depth, actual interleaving block depth, actual latency path, interval number, interval status (valid and complete; invalid or incomplete), forward error correction seconds, errored seconds-line, severely errored seconds-line, loss of signal seconds-line, unavailable seconds-line, full initializations, failed full initializations, short initializations, failed short initializations, sync mode, or other capabilities identified in xDSL (e.g., ADSL1, ADSL2, ADSL2+, VDSL2, etc.).”

(Ex-1006-Wiley, 0308-09.)

190. As shown, Wiley teaches adjusting Impulse Noise Protection (INP) parameter settings and margin parameter settings to ensure line stability. The excerpt above discloses, for example, dynamically adjusting a “DSL Signal-to-Noise ratio” parameter setting to maintain link stability, as well as adjusting an “impulse noise protection” parameter setting.

191. A POSITA would have understood that these parameters may be increased or decreased, as appropriate given the observed performance. Increasing and decreasing performance parameters like transmission rate and transmit power were well known. (*See, e.g.*, Ex-1006-Wiley, 0313 (“network performance information may be used to dynamically alter some performance parameters of the Physical Link, such as transmit power.”); Ex-1008-Tanenbaum, 535-41 (explaining that it was typical to decrease transmission rate as part of achieving a fair operating point).)

192. Wiley also discloses temporary adjustments to the “Signal-to-Noise” ratio margin parameter. (Ex-1006-Wiley, 0308, 0313.) Naturally, temporary adjustments imply adjusting such a margin parameter by adjusting it both up and down, given the temporary nature of the adjustment. It was obvious to include this functionality for dynamically adjusting known network performance parameters in Werner, as doing so would predictably improve Werner by facilitating dynamic adjustments that alleviate problems associated with impulse noise.

193. Thus, Werner in view of Wiley teaches this limitation and renders obvious claim 3.

[Claim 4] The management device of claim 2 wherein initiating the management event comprises performing one or more of the following operations: generating instructions to change transmit power of WAN elements; generating instructions to modify one or more parameters affecting WAN forward error correction (FEC), WAN latency, WAN transmit power levels, and WAN data rate; and generating instructions to modify an active profile or configuration settings based on at least identified network traffic related to the WAN.

194. This limitation is met by performing any one of the operations listed above—for example, “generating instructions to change transmit power of WAN elements” is sufficient.

195. Werner in view of Wiley teaches initiating management events to address operational conditions within the WAN, including Physical layer conditions. (See Ground 2, claims 1-2.)

196. Wiley further discloses that “network performance information may be used to dynamically alter some performance parameters of the Physical Link, such as transmit power.” (Ex-1006-Wiley, 0313.)

197. A POSITA would have understood from Wiley that dynamically altering transmit power included generating instructions to cause the change by “issu[ing] the proper AOC Bit Swapping commands (see FIG. 46) to affect the necessary performance requirements.” (Ex-1006-Wiley, 0313; *id.*, 308-09.) A POSITA also would have understood from Wiley that other parameters may be dynamically adjusted in a similar way, including to modify FEC seconds and data rates. (Ex-1006-Wiley, 308-309; *id.*, 313 (“network performance information may

be used to dynamically alter some performance parameters of the Physical Link, such as transmit power.”))

198. Thus, Werner in view of Wiley teaches this limitation and renders obvious claim 4.

[Claim 5] The management device of claim 1 wherein the one or more communication layers on the LAN and the different communication layer in the WAN are layers of Open Systems Interconnection (OSI) model.

199. Werner in view of Wiley teaches this limitation—in particular, Wiley describes the 7-layer OSI model in detail. (Ex-1006-Wiley, 0004 (describing the OSI layers and describing related history of the model), 0269 (referring to FIG. 31 and noting that the invention uses services at the Data Link layer level).) As I described above, a POSITA would have recognized that Werner’s networks comprised various communication layers. (*See, e.g.*, §VI.D, Ground 2, limitation 1.4; Ex-1008-Tanenbaum, 41-48.)

200. More specifically, Werner in view of Wiley discloses that the “one or more communication layers on the LAN” is the Data Link layer of the OSI model, and the “different communication layer in the WAN” may be any other layer of the OSI model. (*See* Ground 2, limitations 1.4-1.5.) Wiley discloses examples in which the “different” layer may be the Physical layer, or any of the higher layers above the Data Link layer. (Ex-1006-Wiley, 0271, 0273-78.)

201. Thus, Werner in view of Wiley teaches and renders obvious claim 5.

[Claim 6] The management device of claim 1 wherein the one or more communication layers on the LAN and the different communication layer in the WAN are layers of TCP/IP model.

202. As I explain above in §VI, the '108 patent does not disclose or teach anything meaningful about the TCP/IP model and its associated layers. Instead, the '108 patent states:

“[I]nformation collected from the LAN 210 and WAN 205 relates to two distinct communication layers. One example of the two communication layers is two layers of the Open Systems Interconnection model (OSI model). The OSI model is a commonly used model describing the different data processing layers, in digital communication systems. The communication layers could also correspond to other communication protocols or layers such as TCP/IP which might not directly correspond to one of the layers of the OSI model.”

(Ex-1001, 16:62-17:4.)

203. The TCP/IP model was nevertheless well-known. As described in §VI, the layers of the OSI model loosely correspond to the TCP/IP model as shown in Tofano and described in Tanenbaum. (Ex-1007-Tofano, FIG. 4; Ex-1008-Tanenbaum, 41-48.)

204. Werner in view of Wiley discloses “the one or more communication layers on the LAN” is the Data Link layer of the OSI model, which corresponds to the lowest layer of the TCP/IP model (the “Subnet or Link” layer). (*See also* Ground

2, limitations 1.4-1.5 & claim 2.)

205. Werner in view of Wiley also discloses that “the different communication layer in the WAN” may be the Network, Transport, Session, Presentation, or Application layer, all of which correspond to a layer that is “different” in the TCP/IP model from the “Subnet or Link” layer. (Ex-1006-Wiley, 0273-78.)

206. Thus, Werner in view of Wiley teaches this limitation and renders obvious claim 6.

[Claim 7] The management device of claim 1 wherein the one or more operational conditions identified within the WAN comprise at least one of: network congestion within the WAN; excess power consumption by communication elements within the WAN; bandwidth utilization of the WAN in excess of a maximum threshold; bandwidth availability of the WAN below a minimum threshold; errors on WAN connection; performance measures on the WAN; quality of WAN connection; and failure of WAN connection.

207. This limitation is met if one operational condition identified within the WAN comprises any one of the listed conditions—for example, identifying a network congestion condition within the WAN is sufficient.

208. Werner in view of Wiley teaches this limitation. For example, as discussed relative to claim 1, Werner in view of Wiley discloses analyzing data collected from the Data Link layer “to automatically and dynamically *change the WAN bandwidth*...on-demand and/or in real-time.” (See Ex-1005-Werner, 0021.)

209. As I also explain above in relation to limitations 1.4-1.5 and claim 2,

Werner in view of Wiley discloses identifying operational conditions on layers other than the Data Link layer. For instance, Wiley discloses collecting information about connection degradations from the Data Link layer, analyzing that information, and using it to identify a network congestion condition in any one of the Network, Transport, and Application layers, as well as bandwidth availability conditions in the physical layer. (Ex-1006-Wiley, 0271, 0273-74, 0277-78.)

210. Thus, Werner in view of Wiley teaches this limitation and renders obvious claim 7.

[Claims 8-20]

211. As in Ground 1, I agree with Petitioner that Claims 1-7 (“Claim Set 1”) generally correspond to Claims 8-14 (“Claim Set 2”) and Claims 15-20 (“Claim Set 3”) as shown in the table set forth above in Ground 1.

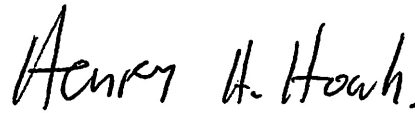
212. Thus, Werner in view of Wiley renders claims 8-20 obvious for the reasons discussed above regarding claims 1-7.

IX. CONCLUSION

213. This declaration and my opinions herein are made to the best of my knowledge and understanding, and based on the material available to me, at the time of signing this declaration. I declare that all statements made herein on my own knowledge are true and that all statements made on information and belief are believed to be true, and further, that these statements were made with the knowledge

that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 or Title 18 of the United States Code.

Date: October 31, 2024

A handwritten signature in black ink that reads "Henry H. Houh." The signature is written in a cursive, slightly slanted style.

Henry H. Houh