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.

IPR2025-00088
Patent No. 11,050,654

PETITION FOR *INTER PARTES* REVIEW OF CLAIMS 1-6, 8-12, 16, 18-22, 30, 33-34, AND 36 OF U.S. PATENT 11,050,654

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1004	U.S. Patent App. Pub. 2011/0149720 to Phuah et al. ("Phuah")
1005	U.S. Patent App. Pub. 2011/0119370 to Huang et al. ("Huang")
1006	Bruno P. Ramos, Vasco N. G. J. Soares and Alexandre J. P. D. Fonte, *Internet Access Quality Monitor*, PROCEEDINGS OF THE FOURTH INTERNATIONAL CONFERENCE ON WEB INFORMATION SYSTEMS AND TECHNOLOGIES, 197-201 (2008) ("Ramos") DOI: 10.5220/0001532101970201
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1018	Lex Machina – Time to Trial for the Eastern District of Texas and District of Colorado
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TABLE OF AUTHORITIES

Cases

I. Introduction

Petitioner hereby seeks *inter partes* review of claims 1-6, 8-12, 16, 18-22, 30, 33-34, and 36 (the "Challenged Claims") of U.S. Patent No. 11,050,654 (Ex-1001, the "'654 patent").

II. Mandatory Notices Under 37 C.F.R. §42.8

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

Charter Communications, Inc. ("Charter") and Plume Design, Inc. ("Plume") are the real parties-in-interest.

B. Related Matters Under 37 C.F.R. §42.8(b)(2)

The '654 patent is currently the subject of pending litigation: *Adaptive Spectrum and Signal Alignment, Inc. v. Charter Communications, Inc. et al*, Case No. 2:24-cv-00124-JRG-RSP (E.D. Tex.) (the "ASSIA Litigation"). (Ex-1016.) Petitioner is not aware of any other matters involving the '654 patent that would affect, or be affected by, a decision in this IPR proceeding.

C. Lead and Back-up Counsel Under 37 C.F.R. §42.8(b)(3) and Service Information under 37 C.F.R. §42.8(b)(4)

Petitioner designates the following lead and back-up counsel:

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Service on Petitioner may be made by mail or hand delivery to: Greenberg Traurig, LLP, 1144 15th St., Suite 3300, Denver, CO 80202. Petitioner also consents to and prefers electronic service by emailing Charter-ASSIA-IPRs@gtlaw.com and counsel of record.

III. Word Count

Petitioner certifies this Petition is 13,968 words, as counted by the word-processing program (Microsoft Word for Office 365) used to generate this Petition (excluding the table of contents, table of authorities, mandatory notices, certificate of service, and this certificate). This Petition complies with the 14,000 word limit (37 C.F.R. §42.24(a)(1)(i)).

IV. IPR Eligibility and Fees

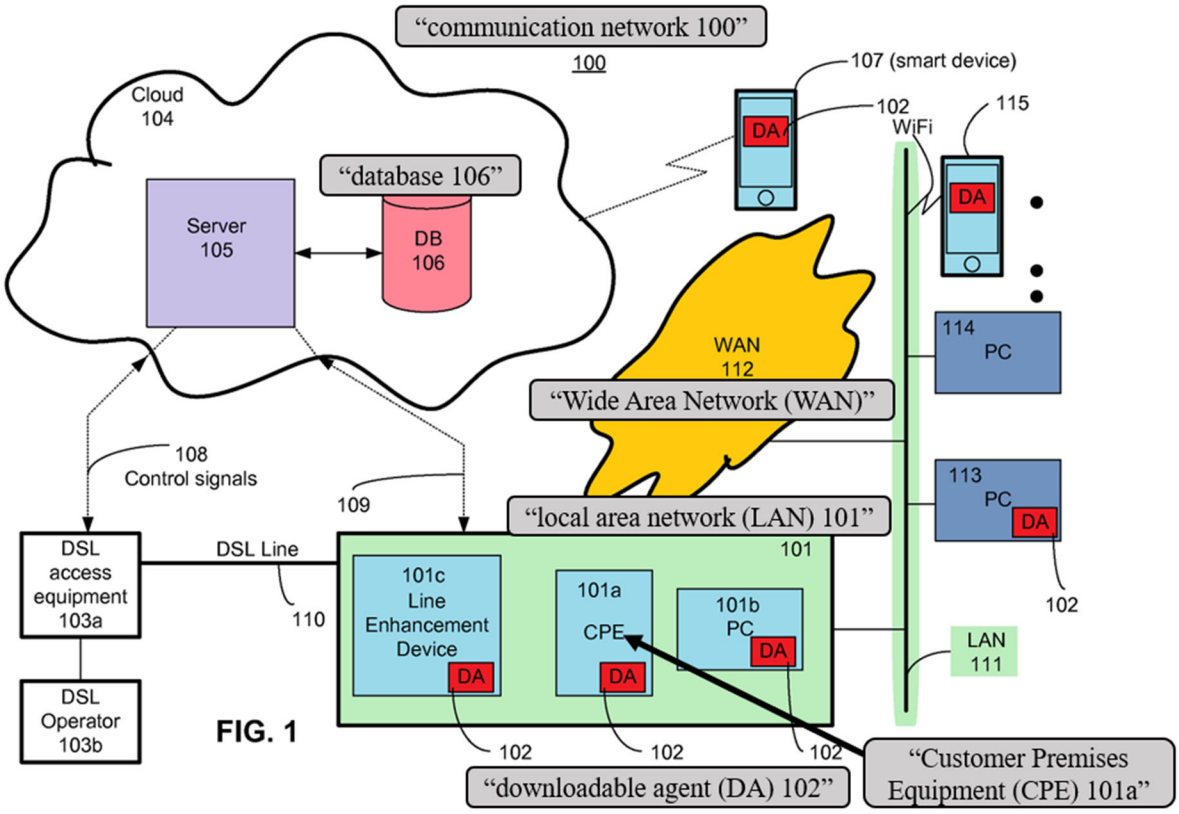
Petitioner certifies under 37 C.F.R. §42.104(a) that the '654 patent is available for IPR and Petitioner is not barred or estopped from requesting cancellation of the Challenged Claims on the grounds identified below.

Ground	'654 Patent Claim	Basis
Ground 1	1-5, 8-10, 12, 16, 18-22, 33-34, 36	Rendered obvious by Phuah (Ex-1004) in view of TR-069 (Ex-1009) and Huang (Ex-1005)
Ground 2	All Challenged Claims	Rendered obvious by Ground 1 art in view of Huang's agent
Ground 3	1-5, 8-10, 12, 16, 18-22, 33-34, 36	Rendered obvious by Ramos (Ex-1006) in view of Werner (Ex-1007) and Schran (Ex-1008)
Ground 4	1, 6, 11, 18, 30	Rendered obvious by Ground 2 art in view of Huang (Ex-1005)

V. The '654 Patent

A. General Overview

The '654 patent generally relates to a downloadable agent that collects performance information. The downloadable agent provides the network with performance data on communication devices (e.g., smart phones, computers, routers) within the network to assess and manage the performance of the communication devices and/or the network connection. (Ex-1001 at 2:25-38.) FIG. 1 illustrates a communication network having downloadable agents:



(Ex-1001 at FIG. 1.)[1]

According to the "Background" section, prior attempts to monitor "Wide Area Network (WAN) and/or Local Area Network (LAN) performance information" were lacking because such information was not collected and analyzed in a central location. (Ex-1001 at 1:26-41, 2:25-38.)

[1] Highlighting and annotations throughout this Petition are Petitioner's unless otherwise noted.

A. Effective Filing Date

The ’654 patent was filed September 25, 2012 and claims priority to a provisional application filed July 13, 2012. (Ex-1001, (60).) Petitioner assumes the July 13, 2012 date applies without conceding that any of the Challenged Claims are actually entitled to that priority date.

B. Prosecution History

The prosecution of the ’654 patent is largely irrelevant to this IPR. The Examiner repeatedly relied on the same base reference (“Zhao,” US2002/0174421) across several office actions. Ultimately, the applicant appealed on the basis that Zhao did not render obvious a change request associated with latency (or throughput). (Ex-1002 at 895-900.) The application was allowed thereafter. (*Id.* at 905.) Petitioner does not rely on Zhao for any ground.

C. The Challenged Claims

Petitioner challenges claims 1-6, 8-12, 16, 18-22, 30, 33-34, and 36; claims 1 and 18 are independent.

VI. Discretionary Denial is Unwarranted

A. The Board Should Not Exercise its Discretion Under §314(a) to Deny Institution

Most of the Challenged Claims are asserted in the ASSIA Litigation; Plume is not a party to that litigation. The non-dispositive factors set forth in *Apple Inc. v.*

Fintiv, Inc., IPR2020-00019, Paper 11 (Mar. 20, 2020) weigh against exercising discretion to deny institution.

Factor 1: Whether the court granted a stay or evidence exists that one may be granted if the proceeding is instituted. Charter has not moved for a stay in the ASSIA Litigation; therefore, Factor 1 is neutral. *See Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 at 14 (Dec. 1, 2020); *Sand Revolution II, LLC v. Continental Intermodal Grp. Trucking LLC*, IPR2019-01393, Paper 24 (June 16, 2020).

Factor 2: Proximity of the court's trial date to the Board's projected statutory deadline for a final written decision. The ASSIA Litigation is in its early stages and, at the time of filing this Petition, the parties have served infringement and invalidity contentions, and Charter's motion to transfer the co-pending litigation to the District of Colorado is pending. The parties have not served discovery responses or taken depositions unrelated to venue issues, nor begun claim construction. A *Markman* hearing is set for March 19, 2025 and trial is currently set for September 22, 2025. (Ex-1017.) However, the Eastern District of Texas' median time-to-trial for patent cases is 727 days, which would result in a trial date of February 17, 2026. (Ex-1018.) If the case is transferred to Colorado, the median time-to-trial for patent cases in that Court is 1,125 days (expected trial date of March 22, 2027). (*Id.*) The projected statutory deadline for a final written decision is around

April, 2026. Thus, given the pending venue decision which may affect case deadlines and based on the Courts' median time-to-trial, this factor is neutral.

Factor 3: Investment in the parallel proceedings by the court and the parties. This factor weighs against discretionary denial. The district court case is in its early stages and the claim construction hearing will not occur until March 2025. (Ex-1017.) Indeed, fact discovery is in its earliest stage and remaining fact-intensive work including expert discovery and claim construction has not yet begun in the co-pending litigation. *See, e.g.*, *Juniper Networks, Inc. v. Huawei Digit. Techs. (Cheng Du) Co.*, IPR2020-01130, Paper 13 at 13 (Jan. 22, 2021); *Sand Revolution II*, IPR2019-01393, Paper 24 at 11. The district court has expended minimal resources.

Where, as here, "the evidence shows that the petitioner filed the petition expeditiously, such as promptly after becoming aware of the claims being asserted, this fact has weighed against exercising discretion to deny institution." *Fintiv, Inc.*, IPR2020-00019, Paper 11 at 10-11. Charter recently served invalidity contentions after receiving amended infringement contentions in early October 2024, while Plume is not a party to the ASSIA Litigation. Thus, Petitioner was "reasonably diligen[t]" in filing this Petition under Factor 3 which weighs against exercising discretion. *Apple Inc. v. Jawbone Innovations, LLC*, IPR2022-01084, Paper 9 at 18-19 (Dec. 16, 2022) (concluding factor 3 weighs against discretionary denial where petitioner waited four months to file the Petition after being served with infringement

contentions containing the asserted claims); *cf. Comcast Cable Commc'ns, LLC v. Touchstream Techs., Inc.*, IPR2024-00324, Paper 13 at 11-12 (July 24, 2024) (determining that waiting 7 months after learning of asserted claims is too long of a delay in filing the Petition, but still instituting on other grounds).

Factor 4: Overlap between issues raised in the petition and the parallel proceeding. This factor weighs against discretionary denial. If this Petition is instituted, Petitioner[2] will not pursue the invalidity references relied on in the Grounds of this Petition in the ASSIA Litigation. *See Sand Revolution II, LLC*, IPR2019-01393, Paper 24.

Factor 5: Whether the petitioner and the defendant in the parallel proceedings are the same party. Charter is the defendant in the ASSIA Litigation, while Plume is not a party. Thus, this factor weighs against discretionary denial or is at most neutral.

Factor 6: Other circumstances that impact the Board's discretion, including the merits. This Petition presents a strong case for invalidity of the '654 patent. Director Vidal's Interim Guidance, dated June 21, 2022, indicated that the Board should not issue discretionary denials where a petition presents compelling evidence. Where, as here, a strong case for anticipation and/or obviousness is

[2] As noted above, Plume is not a party to the litigation.

presented, this factor weighs against discretionary denial. *See Fintiv, Inc.*, IPR2020-00019, Paper 11 at 14-16; *Sand Revolution II, LLC*, IPR2019-01393, Paper 24 at 12-14, 57.

Fintiv factors 3-6 weigh against discretionary denial, and factors 1-2 are neutral. Together, the factors weigh against discretionary denial and the merits of this Petition warrant consideration.

B. 35 U.S.C. §325(d) Does Not Favor Denial

Non-institution under §325(d) would be improper in view of the *Advanced Bionics* framework and the *Becton Dickinson* factors. The prior art cited in Petitioner's Grounds were not before the examiner during prosecution and were not cited by the examiner in any Office Action. (Ex-1001 at 1-2.)

As shown above in §V.C, the applicant overcame arguments relating to the Zhao reference. Petitioner does not rely on Zhao, and the prior art cited herein discloses the limitations that were allegedly missing in Zhao. Furthermore, the examiner did not have the benefit of the Houh declaration, which explains what a POSITA would have understood from the prior art at the time of the '654 patent. (Ex-1003-Houh at §§V-X.) Accordingly, discretionary denial under 35 U.S.C. §325(d) would be improper.

VII. Person of Ordinary Skill in the Art

A person of ordinary skill in the art, in the field of the '654 patent as of its first provisional filing date[3] of July 13, 2012 ("POSITA"), would have had at least a bachelor's degree in electrical engineering, or related field, with at least two years of experience working in the field of computer networking and telecommunications, including experience with performance optimization techniques for DSL, cable, and/or wireless communication systems. Additional education may serve as a substitute for a lack of experience and vice versa. (Ex-1003-Houh at ¶¶19-21.)

VIII. Claim Construction

Petitioner does not believe any claim constructions are required for purposes of this petition and interprets the claims at issue in accordance with their ordinary and customary meanings to the extent possible. 37 C.F.R. §41.100(b). To be clear, Petitioner is not suggesting that there are no disputes regarding claim scope, including with respect to §112 issues. Rather, the invalidity Grounds raised herein render obvious the Challenged Claims under any reasonable interpretation of the claims, and thus the Board need not issue any formal constructions. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co*., 868 F.3d 1013, 1017 (Fed. Cir. 2017).

[3] *But see* §V.B.

IX. Prior Art Overview

A. Phuah (Ex-1004)

Phuah is U.S. Patent App. Pub. 2011/0149720, published June 23, 2011. Phuah is at least pre-AIA §102(b) prior art. Phuah is in the same field of endeavor as the '654 patent. (Ex-1003-Houh at ¶¶41-42.)

Phuah is directed to measuring performance information in a distributed network environment. (Ex-1004-Phuah at Abstract, 0001, 0012.) FIG. 1 illustrates an example network environment:

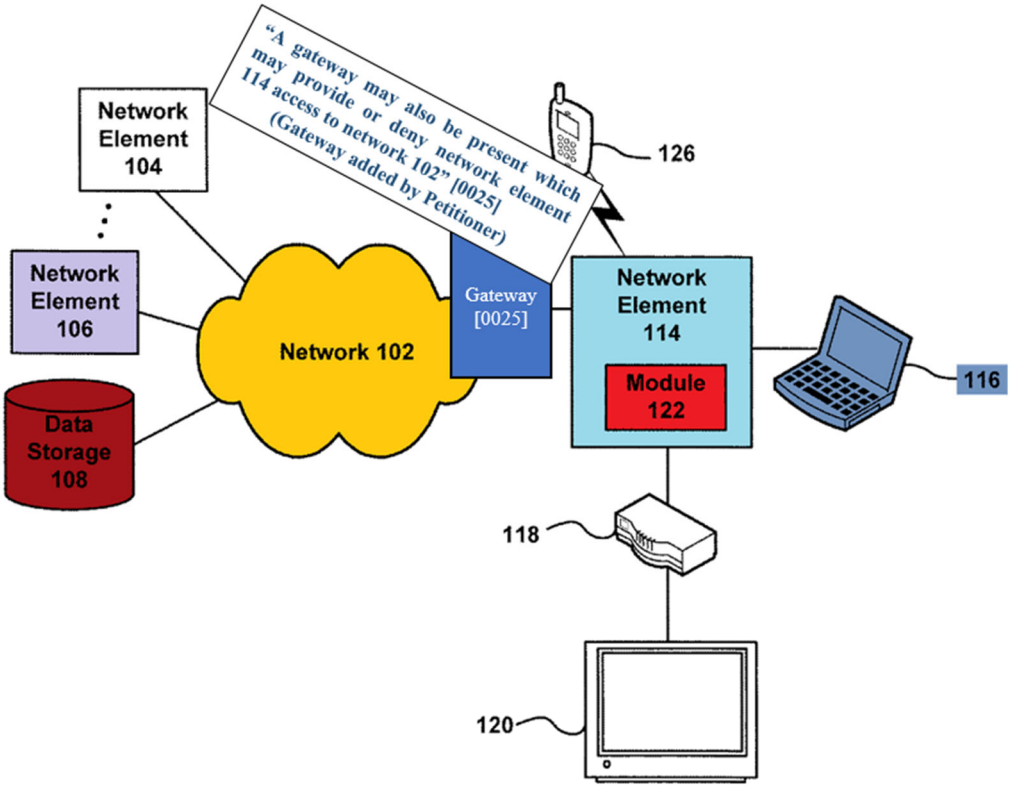


Figure 1

(Ex-1004-Phuah at FIG. 1; 0012-13.)

Phuah explains that a network element (specifically, "114" above) may be a gateway, router or Customer Premises Equipment (CPE). (*Id.* at 0023, 0025, 0029.) Phuah discloses deploying modules on network elements (e.g., the red-highlighted "module 122" above) for measuring LAN, WAN, and other performance information. (*E.g.*, *id.* at 0013, 23-28.) Phuah also discloses corrective actions that range from displaying errors to users via a web page to suggesting configuration updates and rebooting/resetting equipment. (*Id.* at 0029-30.)

B. TR-069 (Ex-1009)

TR-069 is v.1.1, Issue 1, Amendment 2 of TR-069 CPE WAN Management Protocol specification, which published in December 2007. TR-069 is prior art under at least pre-AIA §102(b) and is incorporated by reference in Phuah. (Ex-1004-Phuah at 0028; Ex-1003-Houh at ¶¶45-46, 383-91.)

TR-069 defines a mechanism for configuring and managing Consumer Premise Equipment. (Ex-1009-TR069 at 8). TR-069 discloses "tools to manage downloading of CPE software/firmware image files." (*Id.* at 8, 14.)

C. Huang (Ex-1005)

Huang is U.S. Patent App. Pub. 2011/0119370, published May 19, 2011. Huang is at least pre-AIA §102(b) prior art. Huang is in the same field of endeavor as the '654 patent. (Ex-1003-Houh at ¶¶50-51.)

Huang is directed to technology by which clients download an "active content measuring tool object" (Huang's "agent" or "MTO"). (Ex-1005-Huang at 0007.) When a client requests content (e.g., a web page) from a server, Huang's agent is downloaded and runs on the client's browser. (*Id.* at 0007, 0012.)

D. Ramos (Ex-1006)

Ramos, titled "Internet Access Quality Monitor," is a paper published in the *Proceedings of the Fourth International Conference on Web Information Systems and Technologies* in 2008. Ramos is prior art under at least pre-AIA §102(b). Ramos is in the same field of endeavor as the '654 patent. (Ex-1003-Houh at ¶¶57-58.)

Ramos seeks to "provide a client-server application that allows assessing and studying of underlying perceived quality of basic connectivity services offered on the Internet…." Accordingly, Ramos discloses the Internet Access Quality Monitor ("IAQM") system, depicted below:

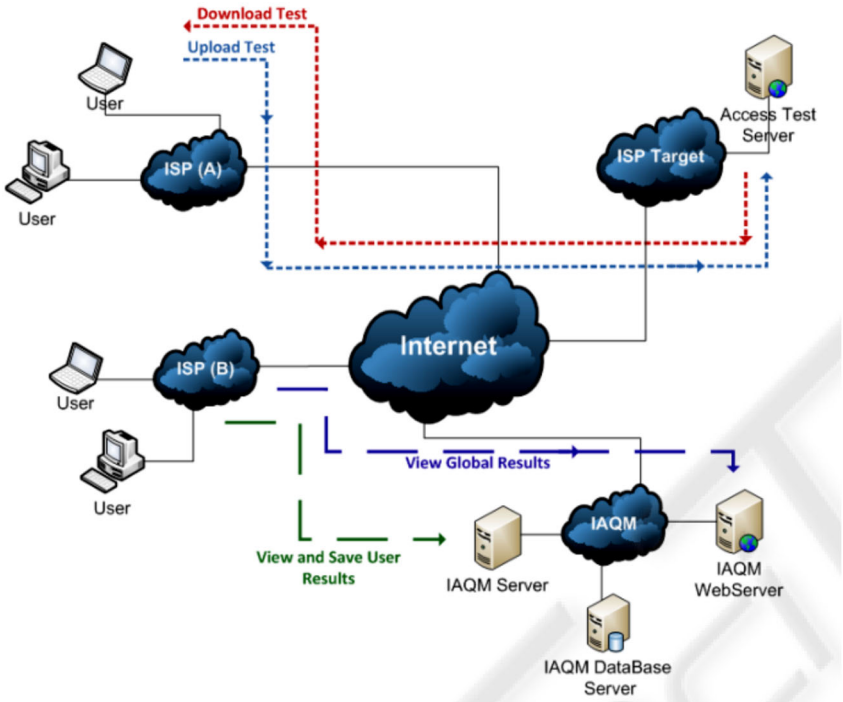


Figure 1: IAQM System architecture.

(Ex-1006-Ramos at Figure 1.)

Ramos's IAQM system measures Internet performance by using a "thin-client"/"software agent" that is downloaded by a user. (Ex-1006-Ramos at 198, 200.) Ramos's agents collect and transmit performance metrics including download/upload rates, latency, jitter or DNS lookup times. (*Id.* at 199, Abstract.)

E. Werner (Ex-1007)

Werner is U.S. Patent App. Pub. 2006/0164978, filed January 21, 2005 and published July 27, 2006. Werner is at least pre-AIA §102(b) prior art. Werner is in the same field of endeavor as the '654 patent. (Ex-1003-Houh at ¶¶61-62.)

Werner is directed to analyzing network traffic to determine whether a change of network "capacity" is required, which Werner defines as "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-1007-Werner at 0029; 0045.) FIG. 1 depicts an exemplary network environment including a LAN 1600 connected to WAN 1700 through a router 1300. (Ex-1007-Werner at FIG. 1, 0023.)

F. Schran (Ex-1008)

Schran is U.S. Patent App. Pub. 2002/0138443 published September 26, 2002. Schran is pre-AIA §102(b) prior ar. Schran is in the same field of endeavor as the '654 patent. (Ex-1003-Houh at ¶¶67-68.)

Schran is directed to a system for modifying network configuration settings on a client machine using an application program on the client that monitors network performance. (Ex-1008-Schran at 0020.) The application program includes a network performance monitor which "executes network performance tests to obtain performance metrics," such as download throughput speed, upload throughput, latency, and stability. (*Id.* at 0021-22.) The remote server can receive and aggregate performance metrics from one or more client machines in order to recommend network configurations for a client machine "in order to determine the optimal network configuration for that machine." (*Id.* at 0027-28, 0023, 0046.)

X. GROUND 1: Phuah in view of TR-069 and Huang renders obvious claims 1-5, 8-10, 12, 16, 18-22, 33-34, and 36

Ground 1 relies on Phuah in view of TR-069 and Huang. As shown in the discussion of the challenged claims, a POSITA would have been motivated to apply the teachings of TR-069 and Huang to Phuah with a reasonable expectation of success. (Ex-1003-Houh at ¶78.)

[Claim 1, 1.0] A method performed by a downloadable agent, the method comprising:

Phuah alone and Phuah in view of TR-069 teach the preamble. Specifically, Phuah discloses a network (102), having a ***network element*** (114), which contains ***module*** (122) ("Mod-122"):

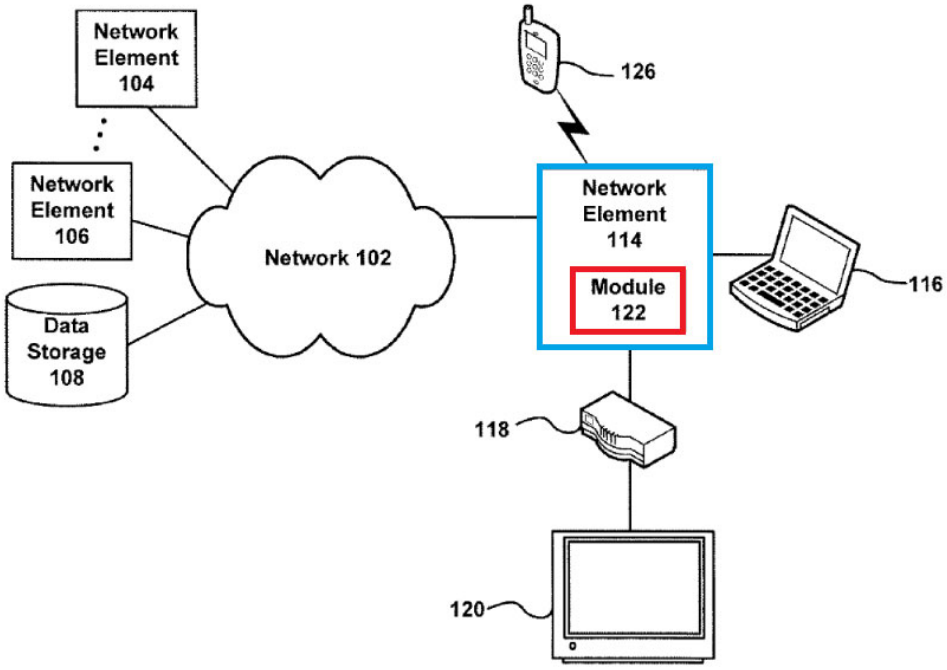


Figure 1

(Ex-1004-Phuah at FIG. 1; 0013.) Mod-122 discloses a downloadable agent.

Specifically, Phuah's network (102) may be the Internet and the ***network element*** ("NE114") may be a residential gateway, broadband router, or Customer Premises Equipment [CPE]. (*Id.* at 0015, 0023, 0025, 0029.) Mod-122 may be "computing software, firmware, hardware, and/or various combinations thereof," "may be implemented across multiple devices and/or other components local or ***remote*** to one another" and "***may be moved*** from one device and ***added*** to another device, and/or may be included in both devices." (*Id.* at 0014.) Mod-122 may be "executable software stored on electronic storage of network element 114," and may

include "***an agent*** or a process for performing diagnostic test results or corrective actions process." (*Id.* at 0026.) Phuah's network element 106 (NE106) may "***administer*** an agent, process, ***or module on*** a residential gateway, a broadband home router, or [CPE]." (*Id.* at 0023.)

Mod-122 discloses a *downloadable* module (agent) for use on NE114. (Ex-1003-Houh at ¶¶83-86.) It was routine and conventional to "administer" software, especially "executable software," on a regular basis by downloading current versions or new versions of the appropriate executable files for use on a device. (*Id.* at ¶86.) A POSITA would have found it obvious to download and install Phuah's Mod-122 on appropriate target devices. (*Id.*) Indeed, Phuah's module performs "a software version test" (Ex-1004-Phuah at 0027), indicating to a POSITA that it or the underlying software on NE114 would be updated on a regular basis, such as via download over the Internet. (Ex-1003-Houh at ¶86.) Further, as shown in the limitations that follow, Phuah's Mod-122 performs the same steps as the claimed downloadable agent. Thus, Phuah teaches "a downloadable agent." (*Id*. at ¶¶86-89)

TR-069 confirms Phuah's Mod-122 was downloadable. Specifically, TR-069 is an industry standard, CPE WAN management protocol expressly incorporated into Phuah. (Ex-1004-Phuah at 0028.) While Phuah initially relies on TR-069 as providing one manner of storing diagnostic test results (*id.*), a POSITA would have recognized that TR-069 was applicable to other aspects of Phuah. For instance,

Phuah states that TR-069 extension parameters "may be used to administer an agent, process, or module" including "activation/deactivation, scheduling, and saving one or more returned results." (*Id.* at 0153.) TR-069 also expressly provides for the download of software from a server to CPE. (Ex-1003-Houh at ¶90 (citing Ex-1009-TR-069 at 8, §§1.1 & 1.1.2).) Accordingly, Phuah in view of TR-069 show that Phuah's Mod-122 was a downloadable agent. (*Id.*)

A POSITA would have been motivated to apply the teachings of TR-069 to Phuah. Phuah already incorporates TR-069 by reference in its entirety (Ex-1004-Phuah at 0028), and the software download teachings of TR-069 align with Phuah's module mobility disclosures. (*Id.* at 0014 (explaining Mod-122 may be implemented remotely, across multiple devices and may be moved or added to devices), 0023, 2006 (explaining that a network element may administer a module on a network element, such as a residential gateway, a broadband home router, or CPE).) A POSITA would also have had a reasonable expectation of successfully applying TR-069's software download teachings to Phuah. As explained previously, it was routine and conventional to administer Phuah's Mod-122 via download to any suitable network element (e.g., NE114) based on the teachings of Phuah and TR-069. (Ex-1003-Houh at ¶¶79-93.)

Thus, Phuah alone and Phuah in view of TR-069 teaches the preamble.

[1.1] collecting WAN performance information,

"WAN performance information" may include one or more of "network throughput…, latency, jitter, connectivity, error rates, power consumption, transmit power, etc[.]" (Ex-1001 at 3:27-39; *see id.* at claims 8, 33.)

Phuah teaches this limitation. Specifically, Phuah's Mod-122 may perform diagnostic tests, and may store, analyze and/or take corrective action based on diagnostic test results. (Ex-1004-Phuah at 0026.) Phuah's tests may be performed relative to a WAN, including to "ensure that a connected residential gateway has a single WAN interface active," "verify that a WAN interface transmission rate meets a specified threshold," "verify that errors of a WAN Ethernet port are below a specified threshold," or the tests may be "a WAN IP assignment test, a WAN IP connectivity test, and a WAN interface bandwidth test." (*Id.* at 0027, 0076-84.) A POSITA would have recognized that such tests disclose "collecting WAN performance information." (Ex-1003-Houh at ¶¶97-98.) For instance, performing diagnostic testing to ensure "that a WAN interface transmission rate meets a specified threshold" discloses collecting information relating to at least "network throughput" and connectivity to a POSITA. (Ex-1003-Houh at ¶¶97-99.) Similarly, conducting a "WAN IP connectivity test" reads on "latency" and "connectivity" while a WAN interface bandwidth test" reads on network "throughput." (*Id*.)

Thus, Phuah teaches this limitation.

[1.2] wherein the downloadable agent is executable on a computing device coupled to a LAN of a broadband subscriber,

"Coupled" is defined broadly and includes two or more elements that may or may not be in direct contact, but still cooperate or interact with each other. (Ex-1001 at 4:14-20.) A "computing device" includes things like "an access gateway," "a router" and CPE. (Ex-1001 at claims 10, 34; *see id.* at Ex-1001 at 6:28-50.)

Phuah teaches this limitation. Phuah's Mod-122 (downloadable agent) may be an executable file located on network element 114 (NE114), and the NE114 may be a router, gateway, or CPE (i.e., a computing device). (*See* 1.0; Ex-1004-Phuah at 0025-26.) Therefore, Phuah discloses "wherein the downloadable agent is executable on a computing device." Phuah further discloses that NE114 is coupled to a LAN at least because its Mod-122 is configured to run diagnostics on the LAN. (*Id.* at 0027; FIG. 1.) (Ex-1003-Houh at ¶¶104-07.)

Thus, Phuah teaches this limitation.

[1.3] wherein the LAN is coupled by another device to a WAN;

Phuah teaches this limitation. Phuah discloses a gateway that connects NE114 and other elements in a subscriber's LAN to the WAN. (Ex-1004-Phuah at 0025 ("A gateway may ***also*** be present which may provide or deny network element 114 access to network 102.") (Ex-1003-Houh at ¶¶109-10.)

Thus, Phuah teaches this limitation.

[1.4] transmitting the WAN performance information to a machine,

Phuah teaches this limitation. As explained relative to limitation 1.1, Phuah's Mod-122 runs diagnostic tests and collects WAN performance information. Phuah's Mod-122 transmits that WAN performance information to ***network element 106*** (NE106; a "machine") to facilitate administration of Phuah's NE114 and/or Mod-122:

> "***Network element 106 may receive or query diagnostic test results and other data from*** *residential gateways, broadband home routers, and other Customer Premise Equipment (CPE). Network element 106 may store diagnostic test results locally or remotely such as on data storage 108.* ***Network element 106 may administer an agent, process, or module on a residential gateway***, a broadband home router, or other Customer Premise Equipment (CPE). For example, *network element 106 may activate module 122, configure module 122, or initiate the execution of one or more diagnostic test results or corrective actions by module 122*." (Ex-1004-Phuah at 0023.)
>
> "Module 122 may transmit diagnostic test results or provide an interface to diagnostic test results. For example, *module 122 may transmit diagnostic test results to network element 106 or be queried by network element 106. According to some embodiments, module 122 may transmit diagnostic test data using TR-069 to network element 106*." (*Id.* at 0028.)

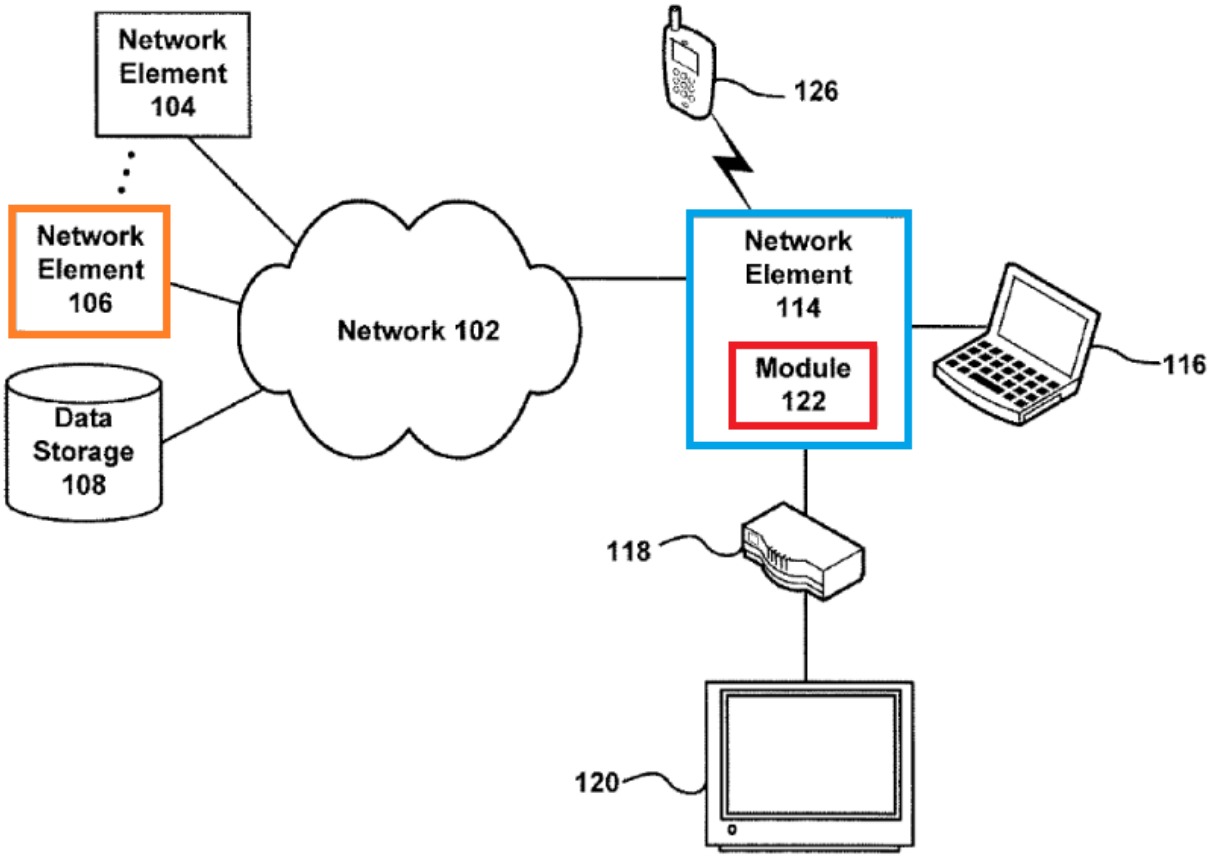


Figure 1

(*Id.* at FIG. 1.)

Thus, Phuah teaches this limitation. (Ex-1003-Houh at ¶¶112-14.)

[1.5] wherein the machine is operable to:
[1.5.1] store the WAN performance information in a database associated with the machine,

Phuah teaches this limitation. As explained relative to limitation 1.4, NE106 is "the machine," and it stores diagnostic test results on "***data storage 108***," with which NE106 is associated.

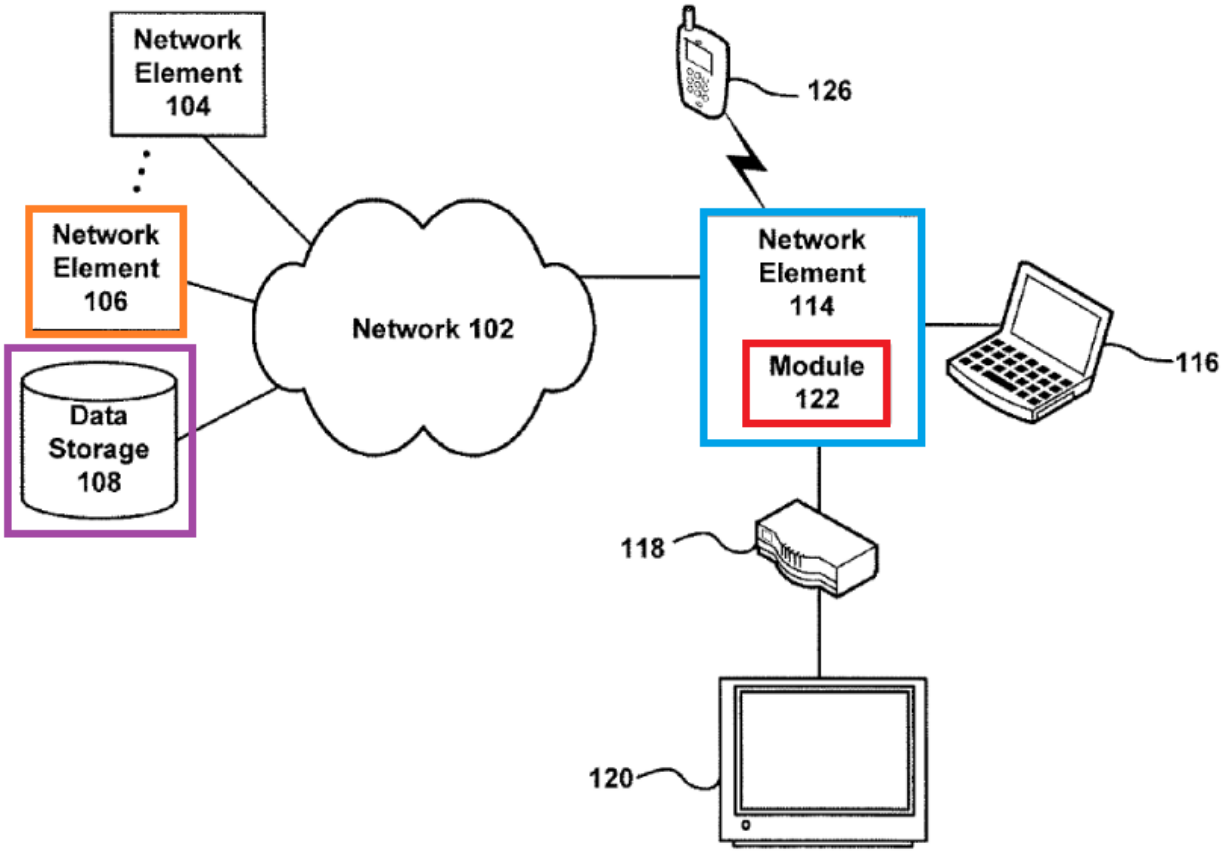


Figure 1

(Ex-1004-Phuah at 0023 ("Network element 106 may store diagnostic test results…on data storage 108"); FIG. 1.) Phuah further discloses that "data storage 108" is a database. (*Id.* at 0020-21.) (Ex-1003-Houh at ¶115.)

Thus, Phuah teaches this limitation.

[1.5.2] [wherein the machine is operable to] analyze the WAN performance information to generate an analysis result, the analysis result comprises at least throughput; and

Phuah alone and in view of Huang teaches this limitation.

(a) *"analyze the WAN performance information to generate an analysis result"*

Phuah's NE106 (the "machine") analyzes the WAN performance information received from Mod-122 and generates results that associate "corrective actions" with "diagnostic test results:"

> "Network element 106 may be a [broadband home router, CPE or residential gateway] ***management system***.…[N]etwork element 106 may activate module 122, ***configure module 122***, or initiate the execution of one or more diagnostic test results ***or corrective actions*** by module 122….Network element 106 may configure network element 114. Configuration may include configuring module 122 to run one or more diagnostic tests on a periodic schedule. *Configuration may also include providing network element 114 with data associating one or more corrective actions with one or more diagnostic test results*. Module 122 may be capable of running diagnostic tests and performing corrective actions independently of network element 106 and independent of a status of network connectivity for network element 114." (Ex-1004-Phuah at 0023.)

(*See also id.* at 0021 (noting that stored test results may be used to associate "issues identified in the diagnostic data and appropriate corrective actions"), 0026 ("Tests and ***corrective actions*** performed by module 122 *may be performed in response to a request,* ***such as a request from an equipment management system***."), 0030 (explaining that test results may be analyzed to generate error codes, error descriptions, suggested actions, pictures of network equipment identifying features

or aspects of the equipment, screenshots showing configuration information, and support group contact information).)

Additionally, FIGS. 4-9 illustrate various "exemplary screen diagram[s] of a system for performing residential gateway diagnostics and corrective actions," which a POSITA would understand as being a result of an analysis done by Phuah's management system.

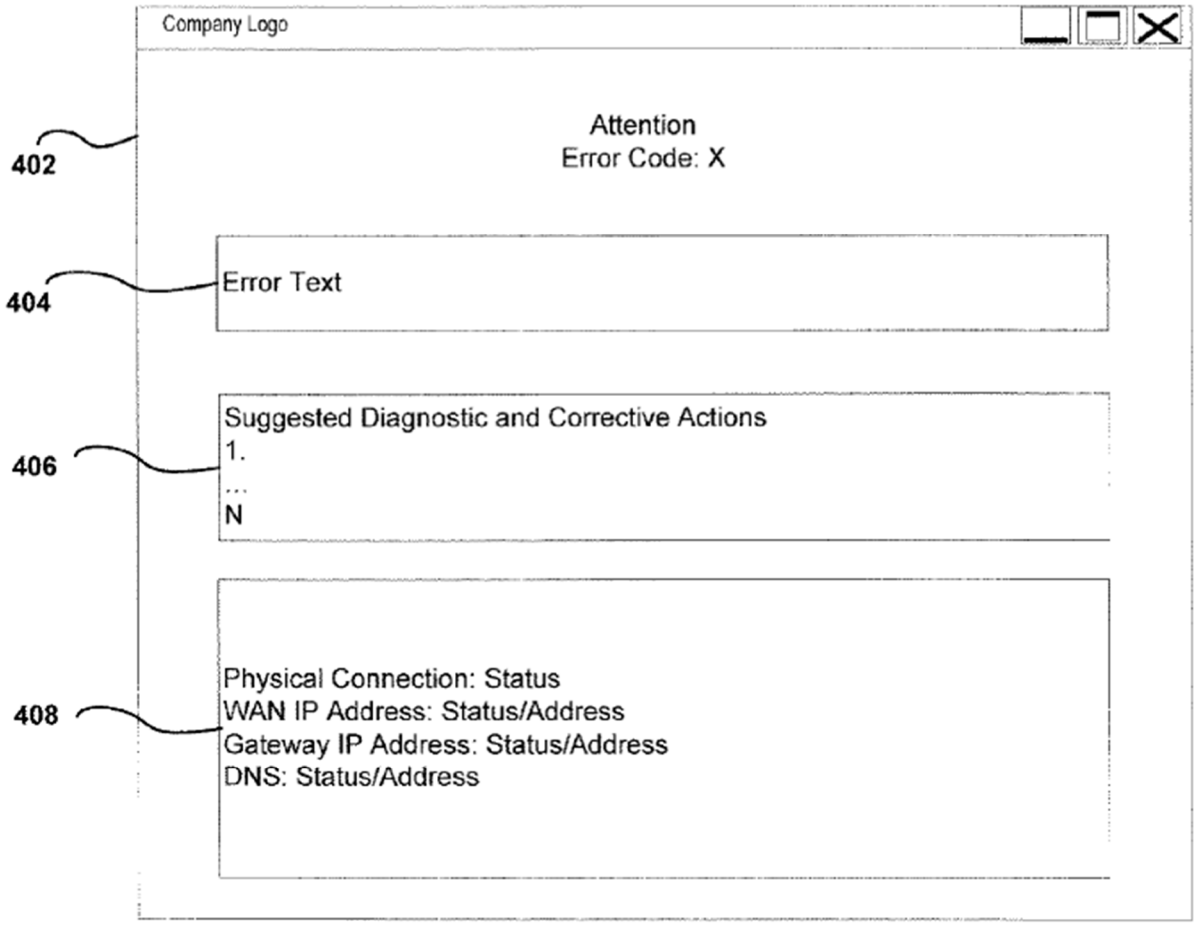


Figure 4

(Ex-1004-Phuah at FIG. 4.)

Thus, Phuah's "machine" (NE106) teaches analyzing the WAN performance information to generate an analysis result. (Ex-1003-Houh at ¶¶118-20.)

(b) *"the analysis result comprises at least throughput"*

The '654 patent states that throughput includes "instantaneous speed or data rate, average data rate, and/or information on the peak and minimum data rates of a connection or communication link associated with the LAN and/or with the associated WAN." (Ex-1001 at 7:42-48.)

Phuah alone and in view of Huang teaches "the analysis result comprises at least throughput." As explained relative to limitation 1.1, Phuah's Mod-122 generates test results to ensure "that a WAN interface transmission rate meets a specified threshold" and that the tests may include "a WAN IP connectivity test and a WAN interface bandwidth test." (Ex-1004-Phuah at 0027.) Phuah's "WAN interface transmission rate meets a specified threshold" discloses "throughput" to a POSITA because it relates to the current (instantaneous) speed or data rate" of the WAN. (Ex-1003-Houh at ¶121-22.) Similarly, "a WAN interface bandwidth test" relates to the "information on the peak and minimum data rates of a connection." (*Id.*)

Thus, Phuah alone teaches limitation 1.5.2.

Phuah in view of Huang also disclose limitation 1.5.2. Like Phuah, Huang discloses downloadable agents, called "measuring object tools" (MTOs). These

MTOs include a Silverlight or Flash object or a Java applet. (Ex-1005-Huang at 0007-8, 0017-20.) "When the MTO is loaded into an end-users' web browser, instead of displaying an advertisement or image icon, the tool performs a number of measurements," including those relating to throughput and latency. (*Id.* at 0020, 0040-43.) Indeed, latency and throughput were typically used to evaluate network performance and make informed decisions regarding network improvements, as Huang shows. (Ex-1003-Houh at ¶124.) A POSITA would have been motivated to apply Huang's throughput and latency data collection teachings to Phuah to ensure sufficient information was being gathered regarding LAN and WAN conditions, as Phuah desires, (Ex-1004-Phuah at 0026-29), which enables broadband subscribers and service providers to make informed decisions regarding "corrective actions," as discussed below regarding limitations 1.5.3 and 1.6. A POSITA would have had no difficulty using Phuah's diagnostic test results, including those resulting from WAN interface transmission rate and WAN interface bandwidth tests, to generate conventional analytical results relating to latency and throughput. (Ex-1003-Houh at ¶¶124-25.)

Thus, Phuah in view of Huang also teaches limitation 1.5.2.

[1.5.3] [wherein the machine is operable to] report the analysis result to at least one of the broadband subscriber and the broadband subscriber's service provider; and

Phuah teaches this limitation. Specifically, NE106 reports analysis results to broadband subscribers and service providers through "corrective actions," which NE106 initiates via Mod-122:

> "For example, *network element 106 may* activate module 122, configure module 122, or *initiate the execution of* one or more diagnostic test results or *corrective actions by module 122*." (Ex-1004-Phuah at 0023; *see id.* at 0024-25 (describing interfaces that NE106 may use to send and receive information to, *inter alia*, users and service providers).)

As Phuah explains, "corrective actions" include providing a user interface for displaying analysis results (e.g., test results, error codes, error descriptions, and suggested actions) to broadband subscribers and/or service providers (e.g., users of wireless device 126 or network client 116):

> "[C]orrective actions may comprise providing *a user interface to a user of the network access equipment*. For example, *a user interface may be a web page served by module 122 to wireless device 126 or network client 116. The user interface may provide results of a diagnostic test, such as an error code, an error description, suggested corrective actions*, pictures of network equipment identifying features or aspects of the equipment, screenshots showing configuration information, and support group contact information...." (Ex-1004-Phuah at 0030.)

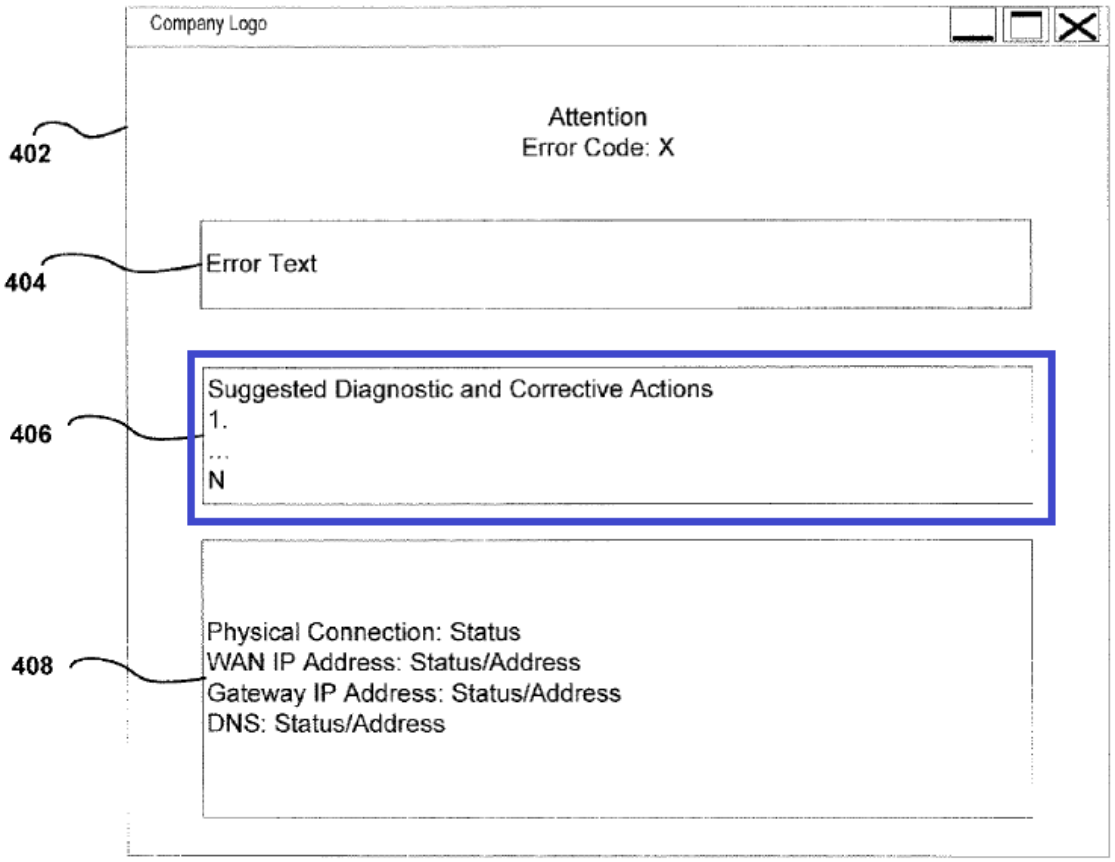


Figure 4

(*Id.* at FIG. 4.) As shown, Phuah's "machine" (NE106) reports the analysis result to broadband subscribers. (Ex-1003-Houh at ¶¶128-30.)

Additionally, Phuah teaches that NE106 "may be [a] server[] of a service provider." (Ex-1004-Phuah at 0022.) Phuah further teaches that NE106 stores "diagnostic data, configuration data, and data associated with corrective actions" in "data storage 108." (*Id.* at 0020-21.) Phuah also teaches that "corrective actions may be initiated … by a support personnel using a network access device management system." (*Id.* at 0162.) Accordingly, Phuah's "machine" (NE106) reports the

analysis result to a broadband subscriber's service provider, including the provider's support personnel. (Ex-1003-Houh at ¶131.)

Thus, Phuah teaches this limitation.

[1.6] sending an on-demand change request associated with at least one of throughput, or latency.

The '654 patent offers a single example of an "on-demand change request:"

> "DA 102 of the PC 101b sends a request via connection 109 to the server 105 to acquire higher throughput than current throughput for its DSL line 110. In such an embodiment, the server 105 performs analysis based on available data in the database 106 and determines if the on-demand request by the PC 102c can be met. If it can be met, a report is provided to the DA 102 by the server 105 with information (e.g., cost etc) about how to improve throughput." (Ex-1001 at 8:64-9:5.)

During prosecution, the applicant cited this disclosure and characterized limitation 1.6 as "an active step, performed by the downloadable agent, to request change for at least one of throughput or latency." (Ex-1002-654FH at 824 (applicant's appeal reply brief).)

Phuah teaches this limitation. Specifically, Phuah's Mod-122 performs corrective actions on its own or as requested by NE106:

> "[N]etwork element 106 may activate module 122, configure module 122, or initiate the execution of one or more diagnostic test results ***or corrective actions*** by module 122. …Module 122 may be capable of

> running diagnostic tests ***and performing corrective actions*** independently of network element 106 and independent of a status of network connectivity for network element 114." (Ex-1004-Phuah at 0023.)

Phuah also discloses executing corrective actions (on-demand change requests) in response to test results, including resetting and/or rebooting network equipment:

> "Corrective actions performed by module 122 may include *resetting* a network interface of network access equipment such as a residential gateway or broadband home router. Corrective actions performed by module 122 may also include *rebooting* a residential gateway, and *resetting* one or more parameters of the residential gateway to a default setting (e.g., a factory setting). *Corrective actions to execute may be identified based on stored data associating a corrective action with a diagnostic test result*. According to one or more embodiments, corrective actions for a particular test result may be prioritized *indicating a first corrective action to try and one or more subsequent corrective actions to try if a fault or error persists*." (Ex-1004-Phuah at 0029.)

That is, Phuah's Mod-122 sends on-demand change requests in response to diagnostic test results, persistent faults/errors, and the like. (Ex-1003-Houh at ¶¶136-38.) Given the disclosures above, a POSITA would have understood that Phuah's "corrective actions" were associated with latency and throughput. (Ex-1003-Houh at ¶¶136-39; *see* limitations 1.1, 1.5.2, 1.5.3.) More particularly, Phuah's Mod-122 sent on-demand change requests to reboot, reset, reconfigure, troubleshoot, and

rewire networking equipment to improve latency and throughout issues revealed by diagnostic test results and persistent faults/errors. (Ex-1003-Houh at ¶¶136-39; *see* limitations 1.1, 1.5.2, 1.5.3; Ex-1004-Phuah at 0029-30.)

Thus, Phuah teaches this limitation and Phuah in view of TR-069 and Huang renders obvious claim 1.

[Claim 2] The method of claim 1, wherein the other device is a router.

Claim 2 is indefinite as it refers to "the other device," when none is recited in claim 1. To the extent claim 2 is understood to refer to the "another device" of limitation 1.3, Phuah teaches it.

Specifically, as explained above regarding limitation 1.3, the "another device" in limitation 1.3 may be a gateway or router. (Ex-1004-Phuah at 0023, 0029.) (Ex-1003-Houh at ¶¶142-43.)

Thus, Phuah teaches this limitation, and Phuah in view of TR-069 and Huang renders obvious claim 2.

[Claim 3] The method of claim 1, wherein the machine is operable to store the WAN performance information with an associated timestamp.

Phuah teaches this limitation. As explained relative to limitation 1.5.1, Phuah's NE106 (machine) stores WAN performance information. Phuah further discloses storing test results in log files with a timestamp indicating the test's start date and time. (Ex-1004-Phuah at 0135-40.) (Ex-1003-Houh at ¶¶146-47.)

Thus, Phuah teaches this limitation, and Phuah in view of TR-069 and Huang renders obvious claim 3.

[Claim 4] The method of claim 1 wherein the downloadable agent is operable to collect LAN performance data from at least one of the computing device and other device coupled to the LAN.

Phuah teaches this limitation to the extent it can be understood. (*See* claim 2.) Specifically, Phuah's Mod-122 collects LAN performance data from devices connected to the LAN, including NE114 (the "computing device" of claim 1) and other devices. (Ex-1004-Phuah at 0027.) Given NE114 may be a gateway, router, and/or CPE, a POSITA would have recognized the tests recited in paragraph 27 of Phuah as applying to the NE114 because they check for common hardware issues associated with gateways, routers and CPEs. Accordingly, Phuah's Mod-122 collects LAN performance data by conducting diagnostic tests relating to LAN performance. (Ex-1003-Houh at ¶¶150-51.)

Thus, Phuah teaches this limitation, and Phuah in view of TR-069 and Huang renders obvious claim 4.

[Claim 5] The method of claim 4 further comprises transmitting by the downloadable agent the LAN performance data to the machine.

Phuah teaches this limitation. For example, Phuah's Mod-122 "may transmit diagnostic test data using TR-069 to network element 106." (Ex-1004-Phuah at 0028; *see* limitation 1.4, claim 4; Ex-1004-Phuah at 0023-27.) (Ex-1003-Houh at ¶154.)

Thus, Phuah teaches this limitation, and Phuah in view of TR-069 and Huang renders obvious claim 5.

[Claim 8] The method of claim 1, wherein the WAN performance information includes at least one of… latency….

Phuah alone and in view of Huang teaches this limitation for the reasons discussed above regarding limitations 1.5.2 and 1.6. (Ex-1003-Houh at ¶156.)

Thus, Phuah in view of TR-069 and Huang renders obvious claim 8.

[Claim 9] The method of claim 1, wherein the machine is a server that resides in a cloud.

The term "cloud" per the '654 patent "refers generally to cloud computing which is the delivery of computing and storage capacity as a service to a community of end-recipients." (Ex-1001 at 4:48-50.)

Phuah alone and in view of Huang teaches this limitation. In particular, the "machine" is NE106, which is one networked element among many networked elements providing services including storage for other users and computer elements in a distributed network, as shown in FIG. 1:

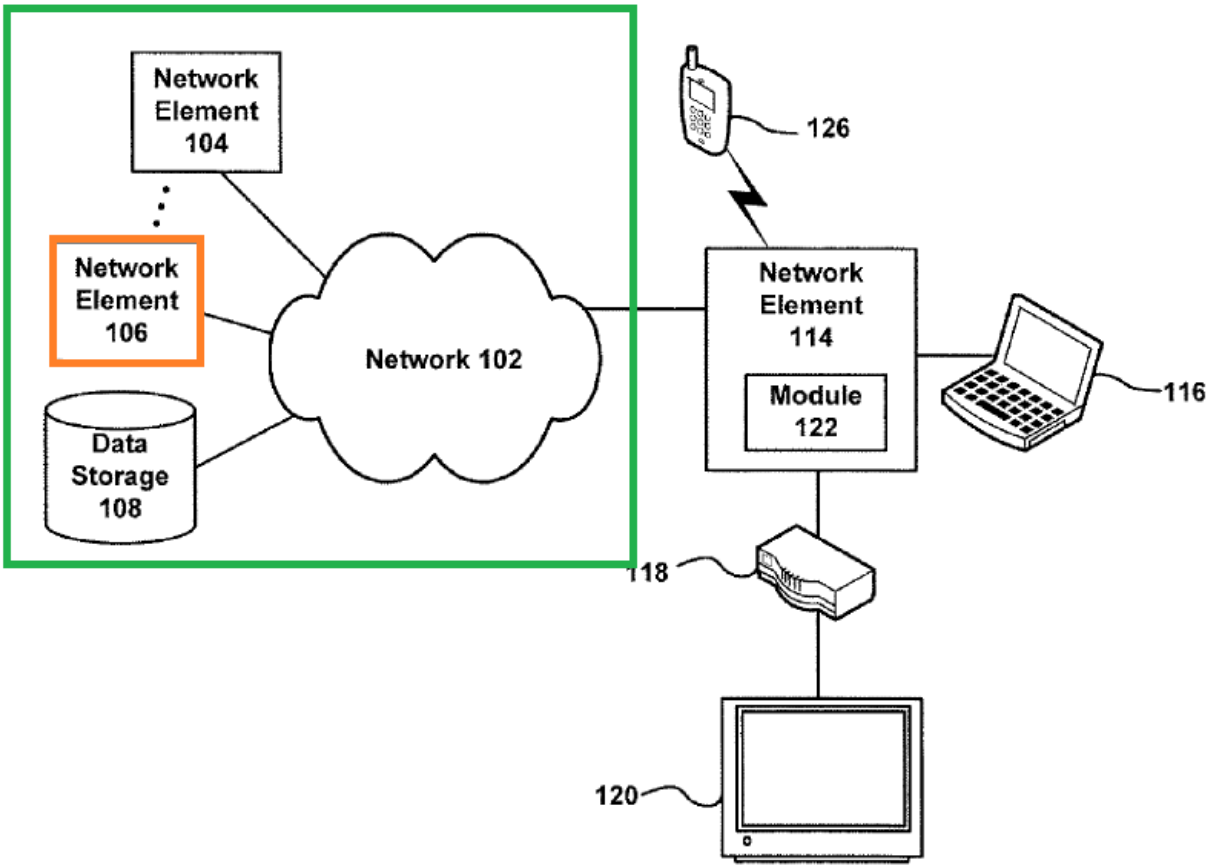


Figure 1

Indeed, network 102 is even illustrated in the form of a "cloud." (Ex-1004-Phuah at FIG. 1.)

Accordingly, Phuah teaches a machine (***NE106***) that resides in "a cloud;" computing and storage capacity are provided to a community of end-recipients over a distributed network—e.g., service provider users or the users of devices in the LAN of FIG. 1 (as well as many other LANs utilizing network 102) are provided with computing and storage capacity via NE106. (*Id.* at 0022 ("Network elements 104

and 106 may be servers of a service provider, the Internet, a broadcaster, a cable television network, or another media provider."); Ex-1003-Houh at ¶¶158-61.) Accordingly, a POSITA would have understood that Phuah's network elements disclose "a server that resides in a cloud." (Ex-1003-Houh at ¶¶158-61.)

Huang also teaches the benefits of cloud servers, and a POSITA would have found it obvious that Phuah's network element 106 (server) may "reside in the cloud" as it would provide the cloud computing benefits noted in Huang. (Ex-1003-Houh at ¶162-63; Ex-1005-Huang at 0001, 0019, 0045-46, 0050.)

Thus, Phuah alone and in view of Huang teaches this limitation, and Phuah in view of TR-069 and Huang renders obvious claim 9.

[Claim 10] The method of claim 1, wherein the computing device is one of….

Phuah teaches this limitation. Specifically, Phuah's NE114 may be a gateway, a router, and/or CPE. (Ex-1004-Phuah at 0023, 0025, 0029).) (Ex-1003-Houh at ¶¶166-67.)

Thus, Phuah teaches this limitation, and Phuah in view of TR-069 and Huang renders obvious claim 10.

[Claim 12] The method of claim 1, wherein the downloadable agent is accessible remotely via the Internet.

Phuah teaches this limitation. As explained previously, network 102 may be the Internet and NE106 accesses Phuah's Mod-122 via network 102. ((Ex-1003-Houh at ¶¶170 (citing Ex-1004-Phuah at FIG. 1; 0023-25).)

Thus, Phuah teaches this limitation, and Phuah in view of TR-069 and Huang renders obvious claim 12.

[Claim 16] The method of claim 1, wherein the machine is operable to collect WAN performance information by polling or by a scheduled based system.

Phuah teaches this limitation. Specifically, Phuah's Mod-122 is configured "to run one or more diagnostic tests on a periodic schedule." (Ex-1004-Phuah at 0023; *see id.* at 0026 ("Module 122 may include an agent…for performing diagnostic test results or corrective actions. …Module 122 may also perform tests and corrective actions as a periodic scheduled event."); *see id.* at 0035, 0043; Ex-1003-Houh at ¶173.) These periodic tests would then be transmitted to NE106, as discussed above, resulting in the machine collecting WAN performance information in "a scheduled based system." (Ex-1003-Houh at ¶174 (citing Ex-1004-Phuah at 0023, 0028, 0157).)

Thus, Phuah teaches this limitation, and Phuah in view of TR-069 and Huang renders obvious claim 16.

[Claim 18] A system comprising:

Phuah teaches the preamble. Specifically, Phuah's FIG. 1 shows a system that reads on claim 18, as explained herein.

[18.1] a database; and

Phuah teaches this limitation. Specifically, Phuah's FIG. 1 illustrates ***data storage 108***, which may be a database. (Ex-1004-Phuah at 0020-21; Ex-1003-Houh at ¶181.)

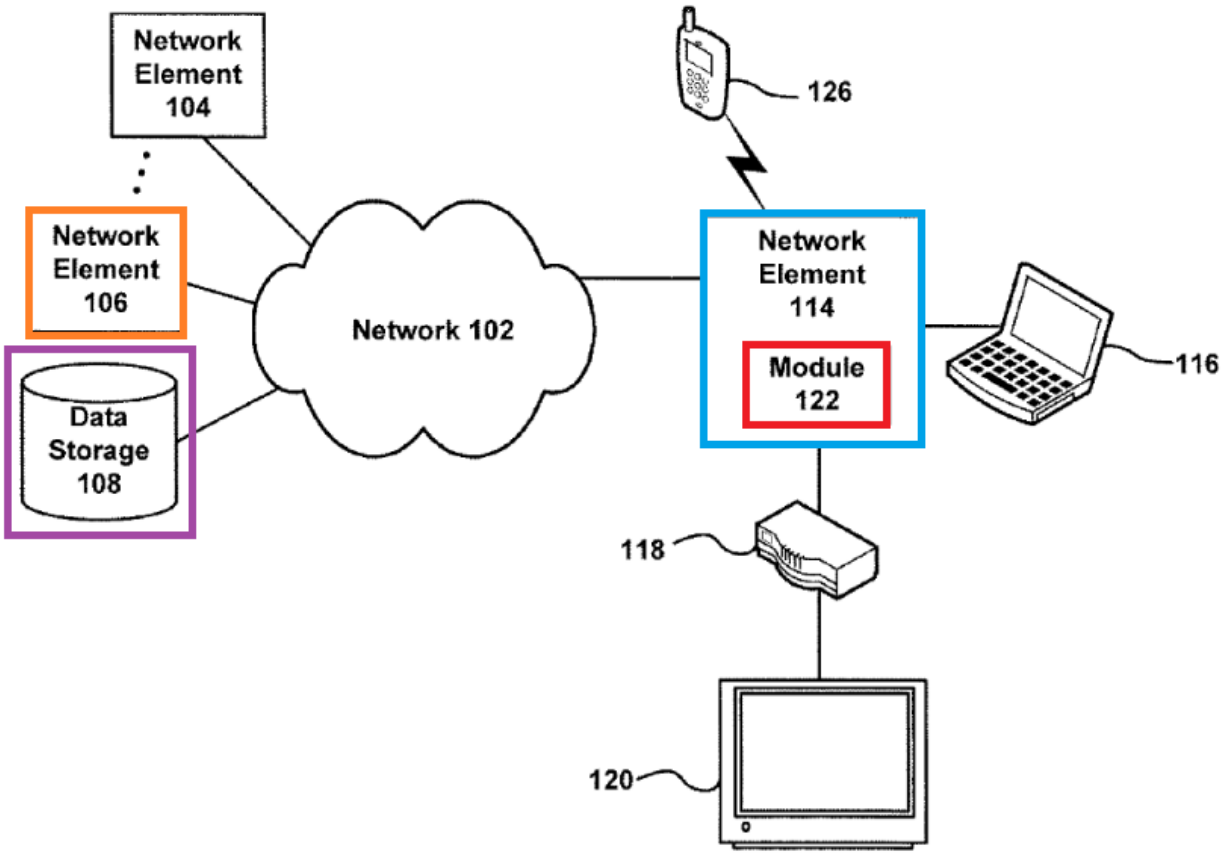


Figure 1

Thus, Phuah teaches this limitation.

[18.2] a server coupled to the database,

Phuah teaches this limitation. As shown in FIG. 1, Phuah's ***network element 106 (NE106)*** is coupled to a data storage element 108. NE106 may be a server. (Ex-1004-Phuah at 0019, 0022; Ex-1003-Houh at ¶¶182-83.)

Thus, Phuah teaches this limitation.

[18.3] the server operable to: receive WAN performance information from a downloadable agent,

Phuah and Phuah in view of TR-069 teaches this limitation for the reasons discussed above relative to limitations 1.0, 1.1 and 1.4, as Phuah teaches the collection and analysis of WAN performance information on a downloadable agent (Mod-122) and Phuah teaches a server (NE106) operable to receive WAN performance information. (Ex-1003-Houh at ¶185.)

Thus, Phuah and Phuah in view of TR-069 teaches this limitation.

[18.4.1] wherein the downloadable agent is executable on a computing device coupled to a LAN of a broadband subscriber,
[18.4.2] wherein the LAN is coupled by another device to a WAN; and

Phuah teaches these limitations for the reasons discussed above relative to limitations 1.2-1.3. (Ex-1003-Houh at ¶187.)

[18.5.1] [the server operable to] store the WAN performance information in the database associated with the server,
[18.5.2] [the server operable to] analyze the WAN performance information to generate an analysis result, the analysis result comprises at least throughput; and
[18.5.3] [the server operable to] report the analysis result to at least one of the broadband subscriber and the broadband subscriber's service provider;
[18.5.4] [the server operable to] wherein the server is operable to receive an on-demand change request associated with at least one of: throughput, or latency.

Phuah in view of Huang teaches limitations 18.5.1 through 18.5.4 for the same reasons discussed above relative to limitations 1.5.1 through 1.6, respectively; the "machine" described with respect to limitations 1.5.1 through 1.6 is a "server." (Ex-1003-Houh at ¶189.)

Thus, Phuah in view of Huang teaches these limitations, and Phuah in view of TR-069 and Huang renders obvious renders obvious claim 18.

[Claims 19-22, 33-34, and 36]

Claims 19-22, 33-34, and 36 correspond to claims 9 and 3-5, 8, 10, and 16, respectively, and are obvious for the reasons discussed above.

XI. Ground 2: Phuah in view of TR-069 and Huang (including Huang's downloadable agent) renders obvious all Challenged Claims

Ground 2 relies on the same art as Ground 1, but relies on Huang's downloadable agent in a browser. As shown in the discussion of the challenged claims, a POSITA would have been motivated to combine the teachings of TR-069, Huang and Phuah and with a reasonable expectation of success. (Ex-1003-Houh at ¶194.)

[Claim 1, 1.0]…downloadable agent…

As explained in Ground 1, Phuah's Mod-122 discloses a downloadable agent that runs diagnostic tests for use in determining things such as whether "a WAN interface transmission rate meets a specified threshold," a "WAN IP connectivity test" and "a WAN interface bandwidth test." (Ex-1004-Phuah at 0027.) Phuah provides one manner of providing such information. (*Id.* at 0044, 0060-63, 0076-84, 0085-89.) Huang provides an alternative and improved manner of determining things related to latency, WAN bandwidth and transmission rates.

Specifically, Huang discloses downloadable agents ("measuring tool objects" or "MTOs") that are deployed by cloud service providers in a simple manner via a web browser. (Ex-1005-Huang at 0020.)

> "When the [MTO] is loaded into an end-users' web browser, instead of displaying an advertisement or image icon, the tool performs a number of measurements." (*Id.*)

Huang's MTOs "make network measurements, including by direct socket access," and "return those [measurement] results to the central controller." (*Id.* at 0007-8.) The MTOs determine "a round trip time/latency," "packet loss profile" and throughput. (*Id.* at 0008.) Because direct socket access is provided "the HTTP request/reply exchange bypasses the internal HTTP transport engine of the browser," which "allows for a more accurate round trip time (RTT) measurement[s]" as well

as measuring "performance metrics that cannot be measured through HTTP transport, e.g., packet loss rate." (*Id.* at 0017, 0024.)

A POSITA would have been motivated and found it obvious to include Huang's MTOs in the Phuah system, and Huang's downloadable agent (MTO) reads on "a downloadable agent," as claimed.[4] (Ex-1003-Houh at ¶¶195-200.) Indeed, Phuah discloses Mod-122 "*may include* ***an agent***…for performing diagnostic test results." (Ex-1004-Phuah at 0026.) Phuah's Mod-122 also serves a webpage to user devices (116/126) (*id.* at 0030), and it was obvious to utilize Huang's MTO in Phuah's system to enhance Phuah's performance information collection efforts. Doing so would have enabled Phuah's system to obtain additional, end-to-end, and more accurate results relating to WAN data transmission rates and WAN bandwidth. Huang's data supplements the data Mod-122 provides to Phuah's management system (e.g., located on Phuah's network element 106), providing a more robust profile of network activity data for Phuah's management system to use in determining WAN characteristics. (Ex-1003-Houh at ¶200.; Ex-1004-Phuah at 0023, 0027-28.)

[4] The '654 patent states: "[i]f the specification or claim refers to 'a' or 'an' element, that does not mean there is only one of the elements." Thus, "a downloadable agent" allows for multiple downloadable agents.

A POSITA would also have had a reasonable expectation of successfully implementing Huang's MTOs with Phuah. Phuah's Mod-122 already serves a webpage to devices 116/126 and it was trivial to configure that webpage to contact the server containing Huang's MTO for download and use in determining network statistics.[5] (Ex-1003-Houh at ¶¶200-01.)

Thus, Phuah in view of TR-069 and Huang discloses the preamble.

[1.1] collecting WAN performance information,

Phuah teaches this limitation as shown in Ground 1. For Ground 2, Huang provides enhanced WAN performance information collection for use by Phuah's system because "object access at the socket level is described, as it provides for more accurate measurement and more variety with respect to performance parameter measurement," including "more accurate round trip time (RTT) measurement between the client and the target web site," including improved latency measurements. (Ex-1005-Huang at 0017, 0024, 0037-38, 0040-42.) Throughput and packet loss measurements are also completed. (*Id.* at 0043-44.) Thus, Huang's MTO

[5] There would be no issues with network connectivity to download Huang's agent as Phuah's system would run normally with Internet access while also allowing for the use of public wireless access during troubleshooting. (Ex-1003-Houh at ¶201 & n.2 (citing Ex-1004-Phuah at 0030).)

also collects WAN performance information, and Phuah in view of Huang teaches this limitation.

[1.2] wherein the downloadable agent is executable on a computing device coupled to a LAN of a broadband subscriber,

Phuah teaches this limitation as shown in Ground 1. For Ground 2, Phuah in view of Huang also teaches this limitation because Huang's MTO is located on user device 116 or 126 (both computing devices) coupled to Phuah's LAN when the webpage containing the MTO is loaded:

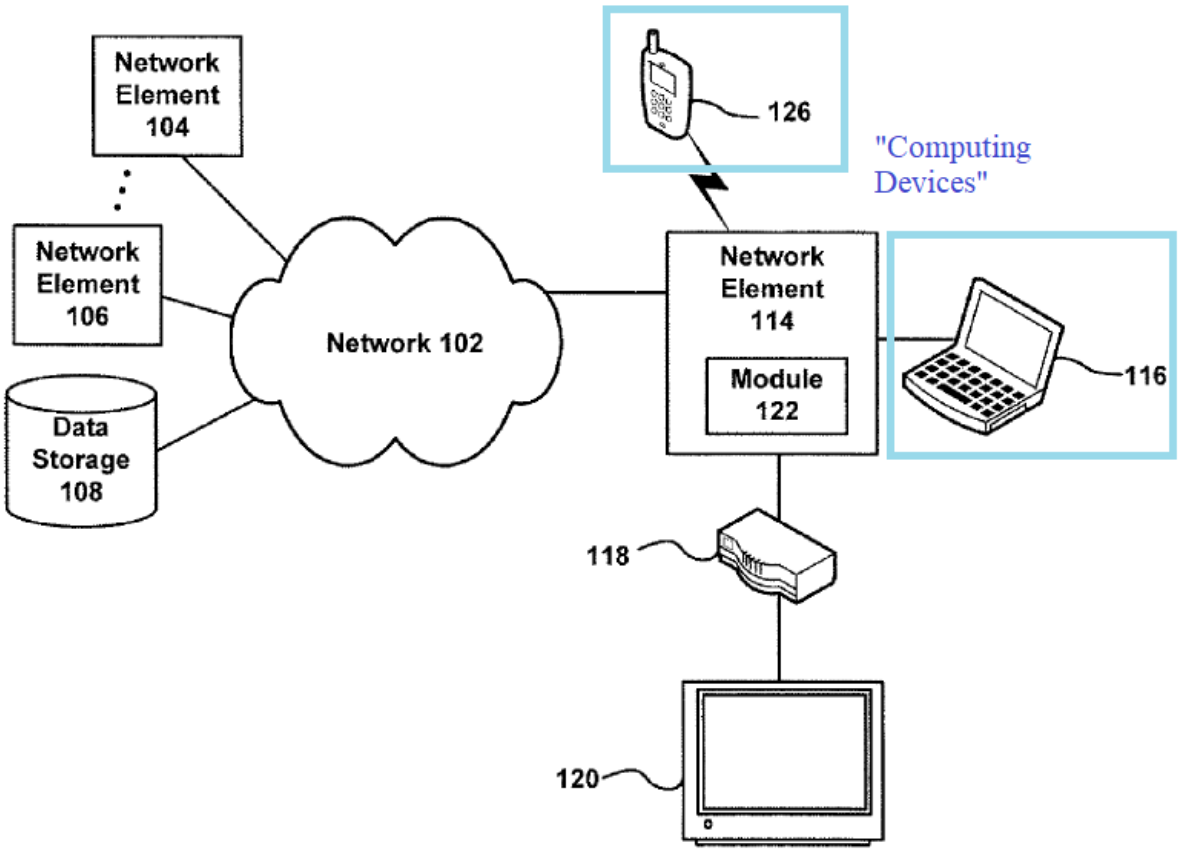


Figure 1

(Ex-1003-Houh at ¶206 (citing Ex-1004-Phuah at FIG. 1; 0017-18).)

Thus, Phuah in view of Huang teaches this limitation.

[1.3]-[1.5.1]

Phuah teaches these limitations for the reasons provided above relative to Ground 1. (Ex-1003-Houh at ¶208.)

[1.5.2] [wherein the machine is operable to] analyze the WAN performance information to generate an analysis result, the analysis result comprises at least throughput; and

Phuah alone and in view of Huang teaches this limitation per Ground 1.

For Ground 2, Phuah in view of Huang also teaches this limitation. As explained above, a POSITA would have been motivated to use Huang's MTOs to obtain more accurate or additional data relating to things like throughput and latency. (Ex-1005-Huang at 0042-43.) For Ground 2, Huang's data supplements the data Mod-122 provides to Phuah's management system (e.g., NE106), providing a more robust profile of network activity data for Phuah's management system to determine WAN characteristics. (Ex-1004-Phuah at 0023, 0027-28.) As explained in Ground 1, NE106 analyzes the received WAN performance information and generates results that associate "corrective actions" with "diagnostic test results." (*Id.* at 0021, 0023, 0026, 0030.)

Additionally, FIGS. 4-9 illustrate various "exemplary screen diagram[s] of a system for performing residential gateway diagnostics and corrective actions,"

which a POSITA would understand as being a result of an analysis done by Phuah's management system.

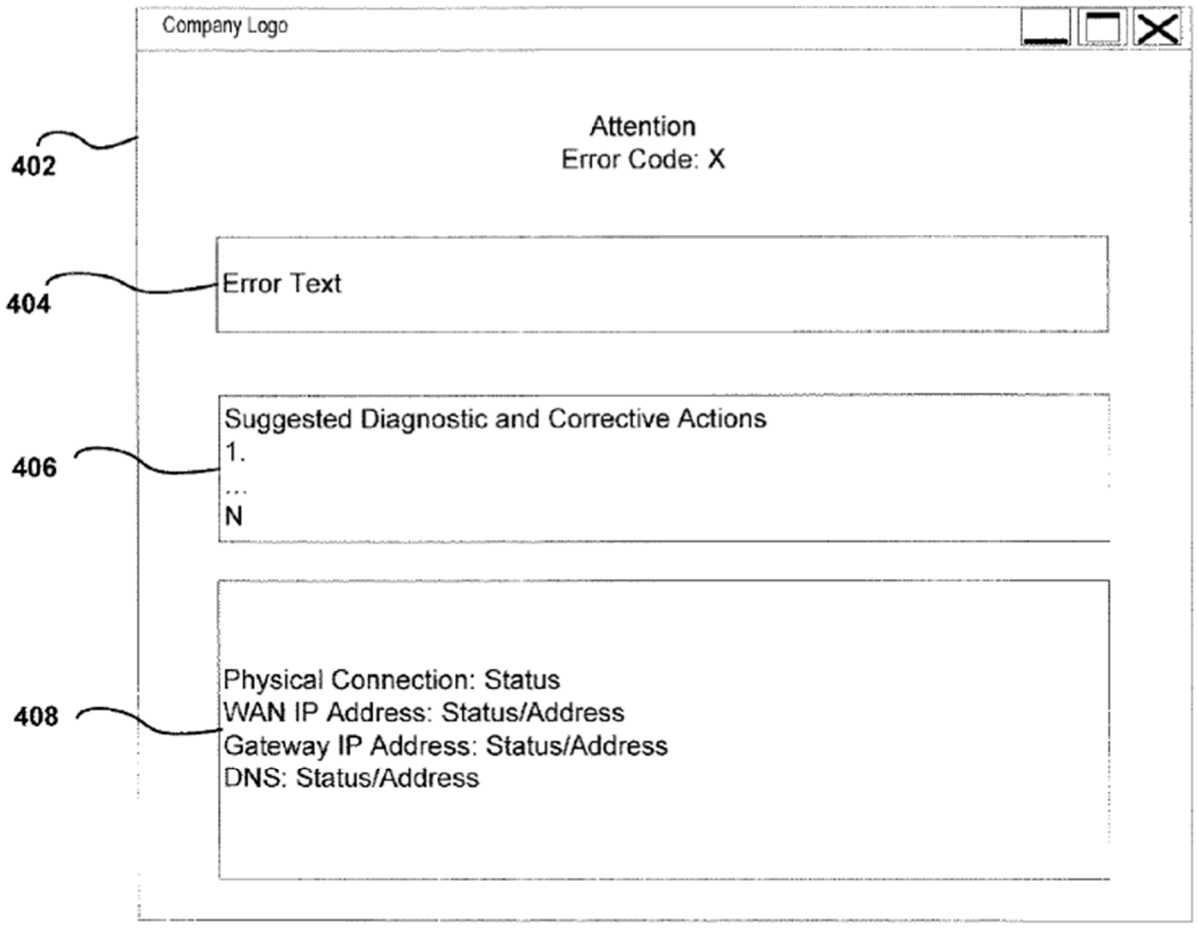


Figure 4

(Ex-1004-Phuah at FIG. 4.)

As it relates to "throughput," Huang discloses the benefits of calculating throughput for use by a server (Ex-1005-Huang at 0029 (Step 210: central controller receives measurement results), 0033 (MTO performs Internet measurements and submits them to central controller), 0043 (explaining throughput calculation), and it

would be obvious in the Ground 2 combination of Phuah and Huang for this same data to be provided to Phuah's management server (NE106) for the same purpose. (Ex-1003-Houh at ¶¶213-14.)

Thus, Phuah in view of Huang teach this limitation.

[1.5.3]-[1.6]

Phuah teaches these limitations for the reasons provided above relative to Ground 1. (Ex-1003-Houh at ¶216.)

Thus, Phuah in view of TR-069 and Huang renders obvious claim 1.

[Claims 2-3]

Phuah teaches these limitations for the same reasons provided in Ground 1. (Ex-1003-Houh at ¶217.) Accordingly, Phuah in view of TR-069 and Huang renders obvious claims 2-3.

[Claim 4]

Phuah in view of Huang teaches this limitation. Specifically, Huang's MTOs collect LAN performance data. (Ex-1005-Huang at 0004-05 (disclosing that Huang measures end-to-end performance, which includes LAN performance data), 0052-54 (disclosing performance data collection relating to nearby servers, including in the context of proxy server detection), 0066-67; Ex-1003-Houh at ¶220 (explaining that Huang's agent collects both LAN- and WAN-related performance data).)

Thus, Phuah in view of Huang teach this limitation, and Phuah in view of TR-069 and Huang (including Huang's MTO) renders obvious claim 4.

[Claim 5]

Phuah in view of Huang teaches this limitation. As explained in claim 4, Huang collects LAN performance data, and as explained in Ground 2, claim 1, Huang's agent transmits its collected data to NE106. (Ex-1003-Houh at ¶¶223-24.)

Thus, Phuah in view of Huang teach this limitation, and Phuah in view of TR-069 and Huang (including Huang's MTO) renders obvious claim 5.

[Claim 6]

According to the '654 patent, a virtual machine "is a software implementation of a machine (e.g., a computer) that executes programs like a physical machine." (Ex-1001 at 5:28-32.)

Phuah in view of Huang teaches this limitation. As explained above, it would be obvious to use Huang's MTOs in Phuah's system. Huang's MTOs may be a Silverlight or Flash object or a Java applet, which are downloadable to Phuah's computing devices 116 or 126. (Ex-1005-Huang at 0017-18.) Silverlight and Flash objects are executed in the Silverlight and Flash Player virtual machines, respectively. (Ex-1003-Houh at ¶229 (citing Ex-1013-Mahajan; Ex-1014-Kapoor; Ex-1015-DeAnna).) A POSITA would have understood that a Java applet would be executed in a Java virtual machine ("JVM") on the receiving computing device (NE114). (Ex-1003-Houh at ¶230 (citing Ex-1010-Lakhdhir at 1:20-35; Ex-1011-Szabo at 18:48-19:16; Ex-1012-Meyer at 54:1-43).)

Thus, Phuah in view of Huang teaches this limitation, and Phuah in view of TR-069 and Huang (including Huang's MTO) renders obvious claim 6.

[Claim 8]

Phuah in view of Huang teaches this limitation. Specifically, Huang's MTO collects enhanced latency data (Ex-1005-Huang at 0040-42), and as explained in Ground 2, claim 1, Huang's MTO transmits its collected data to NE106 (e.g. via Mod-122). (Ex-1003-Houh at ¶232.) Thus, Phuah in view of TR-069 and Huang renders obvious claim 8.

[Claim 9]

Phuah alone and in view of Huang teaches this limitation for the reasons provided in Ground 1, and Phuah in view of TR-069 and Huang (including Huang's MTO) renders obvious claim 9. (Ex-1003-Houh at ¶234.)

[Claim 10]

Phuah in view of Huang teaches this limitation. Specifically, as explained in Ground 2, claim 1, it was obvious to download Huang's MTO to a network device (116), which may be a "desktop computer, a laptop computer, a server, a personal digital assistant," coupled to a LAN. (Ex-1004-Phuah at 0018; FIG. 1; *see also id.* at 0017 (disclosing wireless devices).) Phuah's devices read on several of the devices of claim 10, including "tablet computing device; a personal computer; a gaming console;…a wireless smartphone device;…a computing device connected to the LAN." (Ex-1003-Houh at ¶237-38.) Thus, Phuah in view of Huang teaches claim

10, and Phuah in view of TR-069 and Huang (including Huang's MTO) renders obvious claim 10.

[Claim 11]

Phuah in view of Huang teaches this limitation. As explained in Ground 2, claim 1, Phuah's Mod-122 serves a webpage to user devices (116/126) (*Id.* at 0030) and it was obvious to request Huang's MTO using Phuah's existing webpage to obtain additional or more accurate WAN data. Huang's MTOs, such as Silverlight or Flash object or a Java applet, are "executable on an Internet browser," as Huang expressly indicates. (Ex-1005-Huang at 0018 (explaining Silverlight® and Flash® objects and Java® "are loaded within browsers."); Ex-1003-Houh at ¶240-41).)

Thus, Phuah in view of Huang teaches this limitation, and Phuah in view of TR-069 and Huang (including Huang's MTO) renders obvious claim 11.

[Claim 12]

Phuah in view of Huang teaches this limitation. Huang's downloadable agents are accessible remotely via the Internet. (Ex-1005-Huang at 0033 (explaining MTOs obtain workload lists, perform Internet measurements, and submit results back to the central controller 110); Ex-1003-Houh at ¶244).)

Thus, Phuah in view of Huang teaches this limitation, and Phuah in view of TR-069 and Huang (including Huang's MTO) renders obvious claim 12.

[Claim 16]

Phuah teaches this limitation for the reasons stated in Ground 1, and it would be obvious to extend Phuah's scheduling teachings to the combination of Phuah and Huang to regularly collect WAN performance information. (Ex-1003-Houh at ¶246.) Thus, Phuah in view of TR-069 and Huang renders obvious claim 16.

[Claim 18], Limitations [18.1]-[18.2]

Phuah teaches these limitations for the reasons stated in Ground 1, limitation 1.5.1. (Ex-1003-Houh at ¶248.)

[18.3]…receive WAN performance information from a downloadable agent,

The combination of Phuah and Huang teaches this limitation. As explained in Ground 2, limitations 1.0, 1.1, and 1.4, it was obvious to collect information from Huang's downloadable agent and send that information to Phuah's server (NE106). Indeed, the "machine" of claim 1 is the "server" of claim 18, and Phuah's NE106 reads on both a machine and a server. (Ex-1003-Houh at ¶¶249-52.)

[18.4.1]

Phuah in view of Huang teaches this limitation for the reasons discussed above relative to Ground 2, limitation 1.2. (Ex-1003-Houh at ¶253.)

[18.4.2-18.5.1], [18.5.3-18.5.4]

Phuah teaches these limitations for the reasons discussed above relative to Ground 1, limitations 1.3, 1.5.1, 1.5.3, and 1.6, respectively. (Ex-1003-Houh at ¶¶254.)

[18.5.2]

Phuah in view of Huang teaches this limitation for the reasons discussed above relative to Ground 2, limitation 1.5.2. (Ex-1003-Houh at ¶255.)

Thus, Phuah in view of Huang renders obvious claim 18.

[Claims 19-22, 30, 33-34, and 36]

Claims 19-22, 30, 33-34 and 36 generally correspond to claims 9, 3-6, 8, 10 and 16, respectively, and are obvious for the reasons discussed above.

XII. Ground 3: Ramos in view of Werner and Schran renders obvious claims 1-5, 8-10, 12, 16, 18-22, 33-34, 36

Ground 3 relies on Ramos in view of Werner and Schran. Ramos discloses measuring Internet performance using a "software agent" (IAQM Client) that is downloaded by a user. (Ex-1006-Ramos at 198, 200.) Ramos's IAQM Clients collect the results of performance tests and transmit them to the IAQM Server, while also collecting information regarding a user's "local area network characteristics." (*Id.* at Abstract, 199-200.) Ramos explains that the results are analyzed on the IAQM Server and this analysis can be later reviewed via the IAQM Client or the IAQM Web Server. (*Id.* at 200.) A figure depicting Ramos's IAQM (Internet Access Quality Monitor) system is reproduced below:

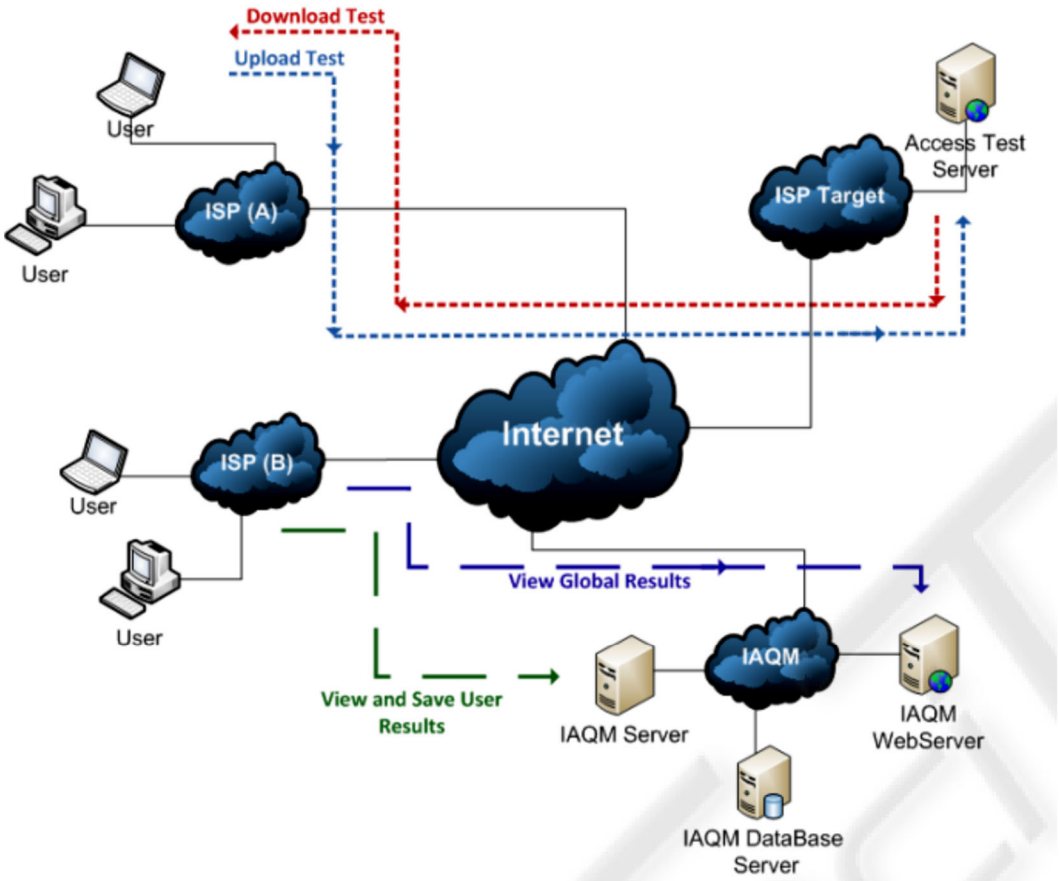


Figure 1: IAQM System architecture.

(*Id*. at FIG. 1.)

Although Ramos references the "local area network characteristics" of a user's client system, Ramos omits discussion of a typical LAN. (Ex-1003-Houh at ¶¶259-261.) Additionally, while Ramos discloses that IAQM Server is "responsible for storing and processing measurements samples collected" and illustrates an IAQM DataBase Server coupled to the IAQM Server (FIG. 1), Ramos does not expressly state *where* the measurements are stored or *what* information is stored in

the IAQM DataBase. (Ex-1003-Houh at ¶¶259-261.) Werner and Schran supplement the teachings of Ramos in relation to these details.

Werner is directed to analyzing network traffic with software on a client device (e.g., "analyzer 1460" or a "packet sniffer") to determine whether a change of network "capacity" is required. (Ex-1007-Werner at 0025-29, 0045; Ex-1003-Houh at ¶262.) FIG. 1 of Werner depicts an exemplary network environment including a LAN 1600 connected to WAN 1700 through a router 1300:

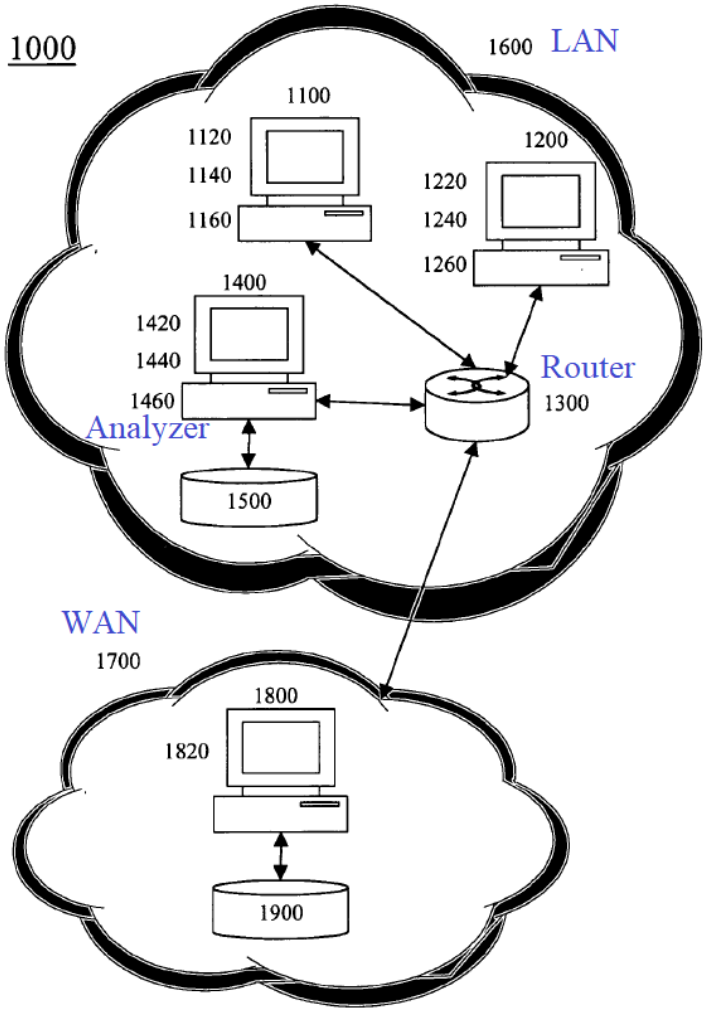


Fig. 1

(Ex-1007-Werner at FIG. 1, 0023.)

First, a POSITA would have been motivated and found it obvious to combine Ramos's teachings with Werner to provide details regarding the LAN referenced in Ramos. Although Ramos depicts users connected to the Internet without explicitly illustrating a user's LAN, it would have been routine and conventional for users to have multiple devices in a LAN that connects to larger networks through a router. For example, Werner depicts a LAN which includes multiple devices coupled to a WAN through a router. (Ex-1003-Houh at ¶263 (citing Ex-1007-Werner at FIG. 1, 0023-25).) It was conventional to couple a LAN to a WAN via a router as evidenced by Werner. A POSITA also would have had a reasonable expectation of successfully applying Werner's LAN teachings to Ramos. It would have been routine for a POSITA to provide the necessary hardware and/or software to implement a LAN, as per Werner, with Ramos. (Ex-1003-Houh at ¶263.)

Second, Ramos does not disclose a specific way to use its performance measurements to improve network operations. Werner does. Specifically, Werner discloses collecting performance information associated with both LAN and WAN networks using a "packet sniffer" (part of "Analyzer 1460"). (Ex-1007-Werner at 0025.) Werner's analyzer 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)." (*Id.* at 0026.) Werner's Analyzer 1460 is configured to "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-1007-Werner at 0029.) "Capacity" in Werner refers to "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." (*Id.* at 0045.) Thus, Werner's disclosure of "automatically, continuously, dynamically, on-demand, and/or in real-time" requesting and provisioning changes in capacity discloses on-demand change requests that are associated with throughput. (*Id.* at 0030; *see id.* at 0031 & 0036 (explaining that capacity may be increased to meet an entity's needs in real-time, with a customer being billed accordingly) A POSITA would have been motivated and found it obvious to include this same change request functionality in the IAQM Clients to ensure that network performance can not only be evaluated but fixed in accordance with a user's needs. (Ex-1003-Houh at ¶¶264-66.)

A POSITA also would have had a reasonable expectation of success in implementing Werner's analyzer teachings with Ramos. Both Werner's analyzer and Ramos's IAQM Clients are implemented in software, and it was straightforward to update Ramos's IAQM to include Werner's analyzer teachings, including the ability to "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-1007-Werner at 0029.) It was also straightforward for a Ramos service provider (ISP) to receive change in capacity requests from the IAQM system, whether directly from the IAQM Clients or from the IAQM Servers. On-demand changes are implemented by, for example, Werner's provisioning system (1820), which may be associated with a service provider (e.g., an ISP) using customized software for interacting with the on-demand requests. (*Id.* at 0013-14, 0030.) It would be straightforward for an ISP to implement a provisioning system, such as Werner's, to allow for on-demand capacity change requests. Doing so would benefit the ISP by allowing a quick response when "a higher priority traffic class begins to consistently starve out the other classes," which the ISP can act "upon dynamically, on-demand, and/or in real-time" using the provisioning system. (Ex-1007-Werner at 0013.) It also allows the ISP to charge more for enhanced quality of service. (*Id.* at 0016-21.) Accordingly, a POSITA would have been motivated to implement Werner's on-demand capacity change request teachings with Ramos with a reasonable expectation of success. (Ex-1003-Houh at ¶¶264-67.)

Schran is directed to a system for modifying network configuration settings on a client machine using an application program on the client that monitors network performance. Schran explains that performance metric test results are transmitted

from client machines to a remote server and stored in a database. (Ex-1008-Schran at 0020, 0027-28, 0023, 0046, FIGS. 1-2; Ex-1003-Houh at ¶268.)

A POSITA would have been motivated and found it obvious to combine Schran's teachings with Ramos. Like Ramos, Schran describes the use of a database connected to a central server, and additionally provides details as to how performance test results may be stored in such a database. A POSITA would have been motivated and found it obvious to combine Schran's teachings with Ramos, wherein Ramos's IAQM DataBase is used to store performance test results. (Ex-1003-Houh at ¶¶268-70 (citing Ex-1008-Schran at ¶28, FIG. 2).)

Ramos does not explicitly reference "throughput" metrics or reports, but Ramos states that its metrics are "not limited to" the metrics recited (namely, "download and upload rates, latency, jitter or DNS (Domain Name System) lookup times"). (Ex-1006-Ramos at 199.) Measuring "throughput" to generate a performance score, however, was known as shown by Schran. (Ex-1003-Houh at ¶271 (citing Ex-1008-Schran at 0012, 0035-36).) It would have been obvious to include such information in Ramos as well, as it merely requires incorporating a typical performance metric (throughput) in the performance analysis. (Ex-1003-Houh at ¶271.)

A POSITA also would have had a reasonable expectation of successfully applying Schran's teachings to Ramos. It would have been routine for a POSITA to

implement the software teachings of Schran, in Ramos, which would facilitate storing performance test results as well as creating a performance score based on throughput. (Ex-1003-Houh at ¶272.)

A. Challenged Claims

[1.0]…downloadable agent…

Ramos teaches the preamble. Specifically, Ramos's IAQM system includes "a thin client—a software agent—which basically performs the measurement tests" (Ex-1006-Ramos at 198.) This thin agent (IAQM Client) is downloadable by users. (*Id.* at 200 ("The correct fulfilling of the user profile…will permit to download and install IAQM Client.").) (Ex-1003-Houh at ¶274-75.)

Thus, Ramos teaches the preamble.

[1.1] collecting…,

Ramos teaches this limitation. Ramos discloses gathering Internet (WAN) performance information. (*E.g.*, Ex-1006-Ramos at 199.)

Specifically, Ramos's IAQM Clients collect "several quality of service metrics of an Internet connection, such as (but not limited to) download and upload rates, latency, jitter or DNS lookup times." (Ex-1006-Ramos at 199.) Ramos further notes that additional metrics such as "influence of user's computer hardware and software (e.g. operating system, firewall, anti-virus, anti-malware), and its local area network characteristics" are also considered. (*Id.*) Ramos's agent thus collects

WAN performance information. Indeed, Ramos specifically distinguishes QoS metrics of the Internet connection from other test information, including the "user's computer['s]…local area network characteristics." (Ex-1003-Houh at ¶¶278-80 (citing Ex-1006-Ramos at 199-200).)

Thus, Ramos teaches this limitation.

[1.2] … executable on a computing device coupled to a LAN of a broadband subscriber…,

Ramos teaches this limitation. Ramos discloses installing and executing IAQM Clients on broadband subscribers' computers. (Ex-1006-Ramos at 198 ("IAQM software agent is installed on computers of end-Users…. This software component is launched automatically"), 197 and 201 (describing the context of Ramos's disclosures in relation to broadband Internet access by users/customers).) Further, as explained previously, Ramos specifically differentiates its collected WAN data from the data it collects from the user's LAN:

> "The influence of ***user's computer*** hardware and software (e.g. operating system, firewall, anti-virus, anti-malware), and ***its*** *local area network* characteristics is also considered." (*Id.* at 199.)

Because the user's computer and ***its*** LAN characteristics are considered, a POSITA would have recognized that Ramos's computing devices are coupled to a LAN. (Ex-1003-Houh at ¶¶283-85.

Thus, Ramos teaches this limitation.

[1.3]…coupled by another device…

Ramos in view of Werner teaches this limitation. Ramos's system architecture is shown below:

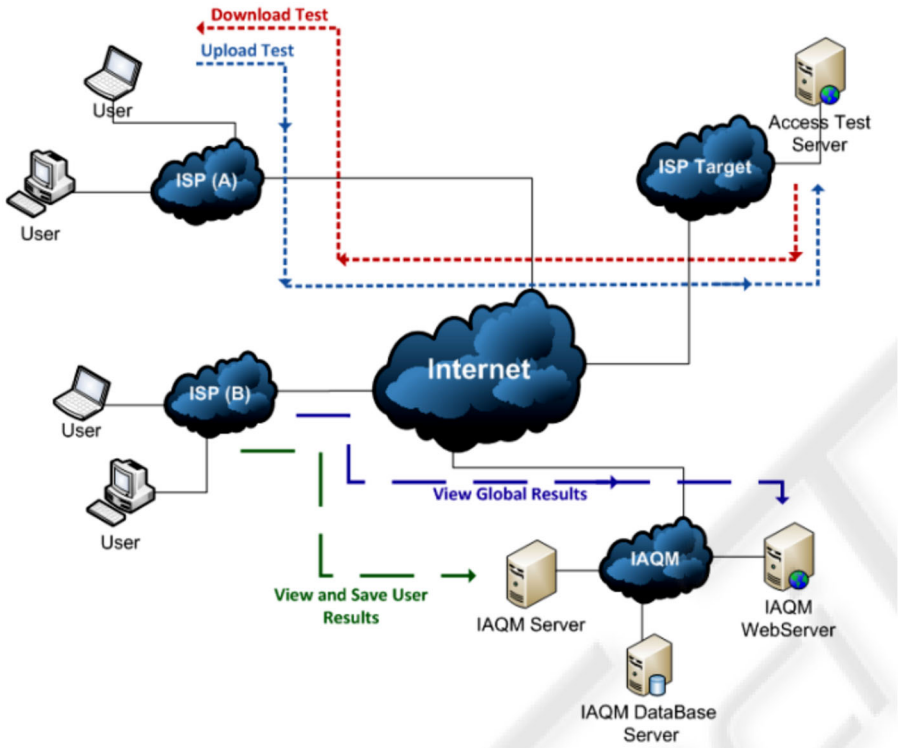


Figure 1: IAQM System architecture.

(Ex-1006-Ramos at Figure 1.) As shown, Ramos discloses several user computers connected to the Internet via Internet Service Providers (ISPs). Further, as shown in limitation 1.2, Ramos discloses that such computers are coupled to a LAN. Ramos does not specifically disclose conventional features, such as how users' LANs are typically coupled to the Internet. Werner does.

Specifically, Werner discloses:

> "FIG. 1 is a block diagram of an exemplary embodiment of a system 1000…which can comprise *a local area network (LAN) 1600 coupled to a wide area network (WAN) 1700* ***via a router 1300***. LAN 1600 and/or WAN 1700 can be owned, operated, and/or managed by a customer and/or a WAN service provider." (Ex-1007-Werner at 0023.)

A POSITA would have recognized that Werner discloses a typical LAN-WAN configuration, in which ***a router*** couples users' devices in a LAN to a WAN (e.g., the Internet). (Ex-1003-Houh at ¶¶288-90.)

Thus, Ramos in view of Werner teach this limitation.

[1.4] transmitting…

Ramos teaches this limitation. Specifically, Ramos's IAQM Clients perform measurement tests and then "send[] the measurements to the central server," which Ramos calls the IAQM Server. (Ex-1006-Ramos at 198.) The IAQM Server of Ramos discloses the claimed machine. Ramos explains:

> "*IAQM Server* is responsible for preparing and scheduling tests, *receiving the results sent by the IAQM clients*, assuring the validity of the user's credentials and results, and for the analysis of the measurements." (Ex-1006-Ramos at 199.)

Thus, Ramos teaches this limitation. (Ex-1003-Houh at ¶¶293-95.)

[1.5]
[1.5.1] store…

Ramos alone and in view of Schran teaches this limitation. Specifically, Ramos's discloses an "IAQM DataBase Server" (database) coupled to the IAQM Server (machine):

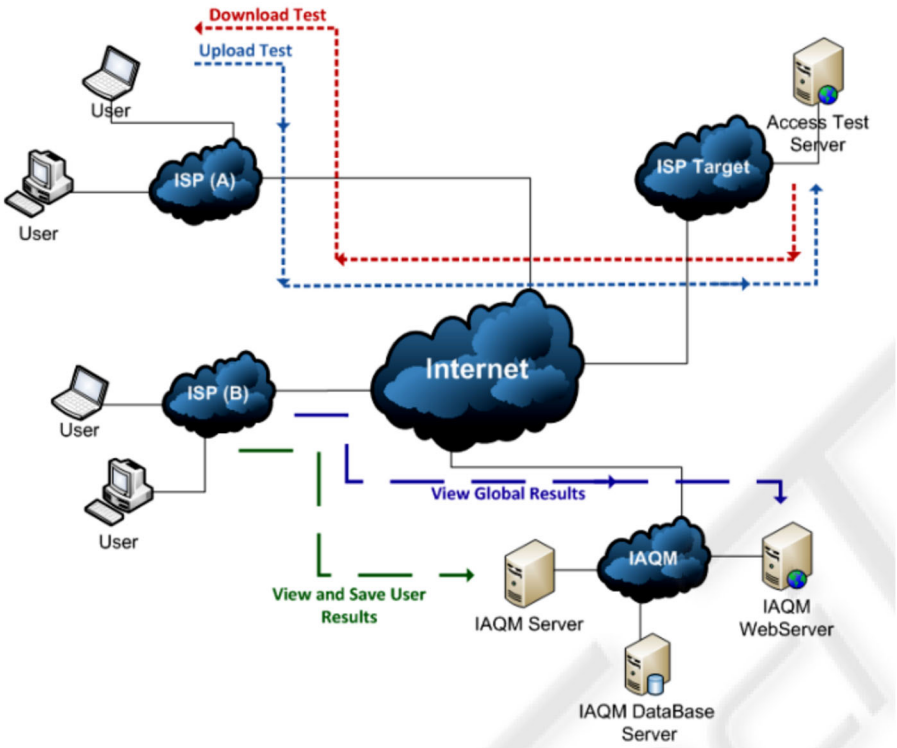
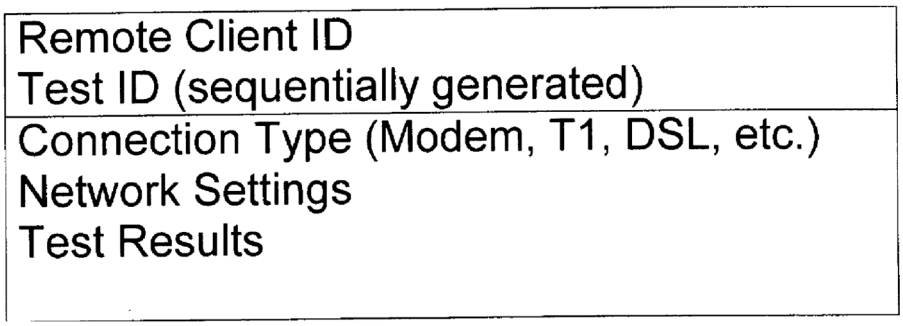


Figure 1: IAQM System architecture.

(Ex-1006-Ramos at Figure 1.) Ramos further discloses that its IAQM Server stores test results, including WAN performance information. (Ex-1006-Ramos at 198-99 ("[When] the measurements tests are completed, [the IAQM software agent] sends the measurements to the central server. …[T]he central server, besides controlling the agents activities and giv[ing] them tests to run, *is responsible for storing and processing the measurements samples collected during the tests*.").) Ramos also

analyzes the results of its measurements over time and across geographies. (*Id.* at 199 ("The analysis of the measurements returned by clients will allow to identify variations on the Internet access quality on different ISPs, regions and districts a country (e.g., Portugal), and also to locate points of congestion on national and international Internet accesses."), 201 ("association of the geographic location to the quality of each access will allow building a map with the distribution of levels of quality of service or asymmetries throughout a country and identifying eventual bottlenecks in the Internet.").) A POSITA would have recognized Ramos's IAQM DataBase would be used for this purpose as it was common for a database to be used to store information for analysis over time and in a way that can be recalled and displayed. Thus, Ramos alone teaches storing "the WAN performance information in a database associated with the machine." (Ex-1003-Houh at ¶¶297-301.)

Schran confirms it was obvious to store performance information in a database associated with a remote server. Specifically, Schran describes a system that "store[s] aggregate data received from one or more client machines 115 on the remote server 105[, such as] network performance metric test results from the client machine(s) 115." (Ex-1008-Schran at 0028.) Schran further depicts how test result "data is stored in a database" in FIG. 2:



(*Id.* at FIG. 2, 0015, 0028, 0041.) Accordingly, Schran confirms that it was obvious to use Ramos's IAQM DataBase to store WAN performance information, as doing so merely required using a conventional network element (a database) in a conventional manner to achieve a predictable result (storing performance information collected at a server). (Ex-1003-Houh at ¶¶302-03.)

Thus, Ramos in view of Schran also teaches this limitation.

[1.5.2]…the analysis result comprises at least throughput…

Ramos in view of Schran teaches this limitation. Specifically, Ramos's IAQM Server receives test results from IAQM Clients and performs analysis thereof. (Ex-1006-Ramos at 199.) The testing is designed to:

> "measure several quality of service metrics of an Internet connection, such as (but not limited to) *download and upload rates*, latency, jitter or DNS lookup times. *Diagnosing route congestion* is also an interesting feature to be explored." (*Id.*)

The IAQM Server analyzes the measurements and makes them available for view by registered users:

> "IAQM Server *analysis of the measurements is only available for registered users and can be viewed either by consulting the IAQM Client, or the IAQM Web Server. By using the IAQM Client GUI a user may check his individual results*, analyzing and comparing them through time…. *A consult of the data stored on the IAQM Web Server allows viewing* the global study, enabling users to evaluate Internet access quality on different ISPs, regions and districts." (*Id.* at 200; *see id.* (noting that "Ping" may be used in the testing).)

Thus, Ramos discloses that the "machine" (the IAQM Server) analyzes the WAN performance information to generate an analysis result. The analysis result comprises "throughput," because the analysis result allows a user to check individualized results regarding download/upload rates and route congestion, which comprises throughput information. Although Ramos does not use the express term "throughput," the broad usage of throughput in the '654 patent expressly includes data rates (including instantaneous, average, peak, and minimum rates), which encompasses download rate, upload rate, and route congestion information. (Ex-1003-Houh at ¶¶306-08; Ex-1001 at 7:42-48.)

It was also obvious to generate an analysis result comprising throughput. Indeed, Schran discloses analyzing measurements including throughput:

> "Any appropriate performance metrics 130 may be used, including download throughput speed (measured in bytes received per second), upload throughput speed (measured in bytes transmitted per second), latency (measured in milliseconds of ping time), and stability

> (measured in the percentage of network data packets lost and/or retransmitted)." (Ex-1008-Schran at 0022.)

Schran uses that information to generate weighted percentage score for various metrics including throughput and generates a resulting performance score. (*Id.* at 0012, 0035-36.) It would have been obvious to include such information in Ramos as well, as it merely requires incorporating a typical performance metric (throughput) in the performance analysis. (Ex-1003-Houh at ¶¶309-10; §XII.)

Thus, Ramos in view of Schran teaches this limitation.

[1.5.3]…report the analysis result…

Ramos teaches this limitation. Specifically, Ramos allows registered users to view the "IAQM Server analysis of the measurements," and "[b]y using the IAQM Client GUI a user may check his individual results, analyzing and comparing them through time. (Ex-1006-Ramos at 200.)

Ramos's users at least include "broadband subscribers." (Ex-1006-Ramos at Abstract (explaining that Ramos's assessment relates to perceived QoS offered on Broadband Internet accesses from end-user standpoint), 198 (noting that IAQM offers benefits to broadband users"), 201 (noting that IAQM provides a useful study of broadband Internet QoS "that would for sure benefit the customers").)

Thus, Ramos teaches this limitation. (Ex-1003-Houh at ¶¶312-13)

[1.6]…on-demand change request…

Ramos in view of Werner teaches this limitation. Although Ramos's IAQM Clients make several useful measurements, those Clients are not configured to take action when a user's service is inadequate, e.g., when there are latency and/or throughput issues associated with connection. (Ex-1003-Houh at ¶315-16.) However, as explained previously, a POSITA would have been motivated to apply Werner's analyzer and provisioning teachings to Ramos and with a reasonable expectation of success. (*See* §XII.) Specifically, a POSITA would have been motivated to update Ramos's IAQM Client to allow it "determine and/or request any one or more desired capacity (e.g., bandwidth and/or Class of Service level) and/or change in capacity," wherein "capacity" in Werner refers to "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-1003-Houh at ¶¶315-17 (citing Ex-1007-Werner at 0029, 0045).)

Thus, Ramos in view of Werner teaches this limitation, and Ramos in view of Werner and Schran renders obvious claim 1.

[Claim 2]

Ramos in view of Werner teaches this limitation. As discussed above regarding limitation 1.3, Werner discloses the "other device" (referred to as "another

device" in limitation 1.3) is a router that connects a LAN to a WAN. (Ex-1007-Werner at FIG. 1, 0025-26.)

Thus, Ramos in view of Werner and Schran renders obvious claim 2.

[Claim 3]

Ramos teaches this limitation. In particular, Ramos discloses executing performance tests "at specific times of the day and on specific days of the week." (Ex-1006-Ramos at 199.) Ramos also discloses allowing registered users to view their "results, comparing through time (day, week, month, and year)." (*Id.* at 200.) A POSITA would have reasonably expected (found obvious) that the performance information stored in Ramos would be stored with an associated timestamp in order to make such functionality possible (i.e., providing users with results that compare performance through time). (Ex-1003-Houh at ¶322 (citing Ex-1004-Phuah at 0135-40).)

Thus, Ramos in view of Werner and Schran renders obvious claim 3.

[Claim 4]

Ramos in view of Werner teaches this limitation. Specifically, Ramos discloses that the IAQM system considers "the user's local area network characteristics." (Ex-1006-Rarmos at 201.) Werner provides details regarding a LAN. (Ex-1003-Houh at ¶325-26; §XII.) A POSITA would have reasonably

understood and expected Ramos's IAQM Clients to collect LAN performance data in order to consider the user's LAN characteristics. (Ex-1003-Houh at ¶324-26.)

Thus, Ramos in view of Werner teaches this limitation, and Ramos in view of Werner and Schran renders obvious claim 4.

[Claim 5]

Ramos teaches this limitation. As shown above Ramos teaches that the IAQM system considers "the user's local area network characteristics," and a POSITA would reasonably expect the IAQM Client to transmit such LAN characteristics to the IAQM Server so that server could properly analyze the data collected by the IAQM Client. (Ex-1003-Houh at 328; Ex-1006-Ramos at 198-99.)

Thus, Ramos teaches claim 5, and Ramos in view of Werner and Schran renders obvious claim 5.

[Claim 8]

Ramos teaches this limitation for the reasons discussed above regarding limitation 1.1. (Ex-1006-Ramos at Abstract, 199 (both describing collection of WAN performance information including latency and jitter).)

Thus, Ramos in view of Werner and Schran renders obvious claim 8.

[Claim 9]

The term "cloud" per the '654 patent "refers generally to cloud computing which is the delivery of computing and storage capacity as a service to a community of end-recipients." (Ex-1001 at 4:48-50.)

Ramos teaches this limitation. In particular, Ramos's IAQM Server (the "machine") is a server that resides in a cloud with other servers (e.g., the IAQM DataBase Server and IAQM WebServer) and provides computing and storage capacity to end users, as previously explained. (*See, e.g.*, limitations 1.5-1.5.3; Ex-1003-Houh at ¶¶332-33.).)

Thus, Ramos in view of Werner and Schran renders obvious claim 9.

[Claim 10]

Ramos in view of Werner teaches this limitation. Specifically, Ramos's "user computers" disclose several items of claim 10, including a "tablet computing device; a personal computer;" and "a computing device connected to the LAN." (Ex-1003-Houh at ¶335.)

Thus, Ramos in view of Werner and Schran renders obvious claim 10.

[Claim 12]

Ramos teaches this limitation. For example, IAQM Clients ("the downloadable agent") are accessible remotely by the IAQM Server via the Internet. (Ex-1006-Ramos at 198-99; Ex-1003-Houh at ¶337.)

Thus, Ramos in view of Werner and Schran renders obvious claim 12.

[Claim 16]

Ramos teaches this limitation. Specifically, Ramos's IAQM Server (the "machine") uses "a scheduled based system" to collected WAN performance information. (*See* limitation 1.1; Ex-1006-Ramos at 198 ("This software component

[the IAQM Client] is launched automatically at periods of time pre-defined and accesses to a central server [the IAQM Server] from which it downloads the tests to run. Upon the measurements tests are completed, it sends the measurements to the central server.")) A POSITA would have understood in view of these teachings that Ramos teaches that the measurement tests are performed after the tests are downloaded, and thus, teaches "a schedule based system" to "collect WAN performance information." (Ex-1003-Houh at ¶339.)

Thus, Ramos in view of Werner and Schran renders obvious claim 16.

[Claim 18]

Ramos teaches a system. (*E.g.*, Ex-1006-Ramos at 198 ("More specifically, IAQM system follows the client-server architecture model."); Ex-1003-Houh at ¶341.)

Thus, Ramos teaches the preamble.

[18.1-18.2]

Ramos in view of Schran teaches these limitations for the reasons discussed above relative to limitations 1.4-1.5.1.

[18.3] the server operable to: receive WAN performance information from a downloadable agent,

Ramos teaches this limitation for the reasons discussed above relative to limitations 1.1 and 1.4, as Ramos teaches the collection of WAN performance information on a downloadable agent (IAQM Client) and Ramos teaches a server

(IAQM Server) operable to receive WAN performance information. (Ex-1003-Houh at ¶343.)

[18.4.1-18.4.2]

Ramos in view of Werner teaches this limitation for the reasons discussed above relative to limitation 1.2-1.3.

[18.5.1-18.5.4]

Ramos in view of Werner and Schran teaches limitations 18.5.1 through 18.5.4 for the same reasons discussed above relative to limitations 1.5.1 through 1.6, respectively, as the "machine" described with respect to limitations 1.5.1 through 1.6 is a "server."

Thus, Ramos in view of Werner and Schran renders obvious claim 18.

[Claims 19-22, 33-34, and 36]

Claims 19-22, 33-34, and 36 correspond to claims 9, 3-5, 8, 10, and 16, respectively, and are obvious for the reasons discussed above.

XIII. Ground 4: Ramos in view of Werner, Schran and Huang renders obvious claims 1, 6, 11, 18 and 30

Ground 4 relies on the same art as Ground 3, but relies on Huang's downloadable agent. As shown in the discussion of the challenged claims, a POSITA would have been motivated to combine the teachings of Ramos, Werner, Schran, and Huang with a reasonable expectation of success.

[Claim 1, 1.0]…downloadable agent…

As explained in Ground 3, Ramos's IAQM Client discloses a downloadable agent that collects "several quality of service metrics of an Internet connection, such as…download and upload rates, latency, jitter…." (Ex-1006-Ramos at 199.) Although Ramos's IAQM Client executes on a user's computer, Ramos does not specifically disclose whether an agent in a browser would be suited to gather network information for reporting to Ramos's IAQM Server. Nonetheless, it was obvious in view of Huang to use such an agent.

Specifically, Ramos's user computers access the Internet and register for the IAQM Client, which a POSITA would recognize commonly entails the use of an Internet browser. (Ex-1006-Ramos at 200 (explaining that to download the IAQM client the user must contact IAQM Web Server and register); Ex-1003-Houh at ¶353.) Huang discloses downloadable agents ("measuring tool objects" or "MTOs") that are deployed by cloud service providers in a simple manner via a web browser. (Ex-1005-Huang at 0020.)

> "When the MTO is loaded into an end-users' web browser, instead of displaying an advertisement or image icon, the tool performs a number of measurements." (*Id.*)

Huang's MTOs "make network measurements, including by direct socket access," and "return those [measurement] results to the central controller." (*Id.* at 0007-8.) The MTOs determine "a round trip time/latency," "packet loss profile" and

throughput. (*Id.* at 0008.) Because direct socket access is provided "the HTTP request/reply exchange bypasses the internal HTTP transport engine of the browser," which "allows for a more accurate round trip time (RTT) measurement[s]" as well as measuring "performance metrics that cannot be measured through HTTP transport, e.g., packet loss rate." (*Id.* at 0017, 0024.)

A POSITA would have been motivated and found it obvious to include Huang's MTOs in the Ramos's system, and Huang's downloadable agent (MTO) reads on "a downloadable agent" to supplement the measurements made by Ramos's IAQM Client. (Ex-1003-Houh at ¶¶352-55.) Ramos seeks the "building [of] a map with the distribution of levels of quality of service or asymmetries throughout a country and identifying eventual bottlenecks in the Internet (e.g., internal links, access links or peering links)," and Huang's MTOs facilitate that goal by accurately detecting "middle boxes," (e.g., proxy servers) whose presence affects the accurate determination of infrastructure, while providing enhanced latency, throughput and packet loss rate determinations. (Ex-1005-Huang at 0002-3, 0009 ("The results may be used to evaluate hypothetical deployment."), 0029 (explaining the received results may be used "to estimate deployment, detect middle boxes"), 0033 (deploying MTOs "for evaluating RTT measurement accuracy and detecting middle boxes"), 0038-39 (explaining its improved "accuracy of RTT measurements" "works well for measuring latency from clients to a Cloud Service provider's own

infrastructure, and thus helps answer important what-if questions, such as predicting performance after re-mapping clients from one front-end to another" and "whether additional infrastructure deployments can help the cloud service provider"), 0040-42 (explaining improved latency measurements using MTO and random CDN work assignments from central controller), 0043 (explaining throughput measurements), 0044 (explaining packet loss rate), 0045-049 (explaining deployment based on measured data from MTOs).)

A POSITA also would have had a reasonable expectation of successfully implementing Huang's MTOs with Ramos. The IAQM System already requires users "access the IAQM Web Server" to register and receive the IAQM Client download (indicating Internet browser use) and it would be trivial to serve and configure a webpage to contact the server containing Huang's MTO for download and use in determining network statistics, e.g., when the user registers or consults "the IAQM Web Server" to view "the global study, enabling users to evaluate Internet access quality on different ISPs, regions and districts." (Ex-1006-Ramos at 200; Ex-1003-Houh at ¶¶352-56.)

Thus, Ramos in view of Huang discloses the preamble.

[1.1] collecting WAN performance information,

Ramos teaches this limitation as shown in Ground 3. For Ground 4, Ramos in view of Huang also teaches this limitation. Huang provides enhanced WAN

performance information collection for use by Ramos's system because "object access at the socket level is described, as it provides for more accurate measurement and more variety with respect to performance parameter measurement," including "more accurate round trip time (RTT) measurement between the client and the target web site," including improved latency measurements. (Ex-1005-Huang at 0017, 0024, 0037-38.) Throughput and packet loss measurements are also completed. (*Id.* at 0043-44.) Thus, Huang's MTO also collects WAN performance information, and Ramos in view of Huang teaches this limitation. (Ex-1003-Houh at ¶358-59.)

[1.2] wherein the downloadable agent is executable on a computing device coupled to a LAN of a broadband subscriber,

Ramos teaches this limitation as shown in Ground 3. For Ground 4, Ramos in view of Huang teaches this limitation because Huang's downloadable agent is located on Ramos's user computers when the webpage containing the MTO is loaded. (Ex-1003-Houh at ¶360-61.)

Thus, Ramos in view of Huang also teaches this limitation.

[1.3]-[1.5.1]

Ramos in view of Werner and Schran teaches these limitations for the reasons provided above relative to Ground 3.

[1.5.2] [wherein the machine is operable to] analyze the WAN performance information to generate an analysis result, the analysis result comprises at least throughput; and

Ramos in view of Schran teaches this limitation as shown in Ground 3. For Ground 4, Ramos in view of Huang teaches this limitation. As explained above, a POSITA would have been motivated to use Huang's MTOs to obtain more accurate or additional data relating to metrics including latency and throughput. (Ex-1005-Huang at 0043.) In the combination of Ramos and Huang, Huang's data supplements Ramos's IAQM Client data, providing a more robust profile of network activity data for Ramos's IAQM Server to use in determining WAN characteristics. As explained in Ground 3, Ramos's IAQM Server receives test results from IAQM Clients and performs analysis thereof to "measure several quality of service metrics of an Internet connection, such as…*download and upload rates*, latency, jitter or DNS lookup times. *Diagnosing route congestion* is also an interesting feature to be explored." (*Id.* at 199.) Thus, Ramos's IAQM Server is operable to "analyze the WAN performance information to generate an analysis result." (Ex-1003-Houh at ¶365.)

As it relates to "throughput," Huang discloses calculating throughput for use by a server (Ex-1005-Huang at 0029 (Step 210: central controller receives measurement results to determine deployment), 0033 (MTO performs Internet measurements and submits them to central controller), 0043 (explaining throughput

calculation), and it was obvious in the combination of Ramos and Huang for this same data to be provided to Ramos's IAQM Server for the same purpose. (Ex-1003-Houh at ¶365-66.)

Thus, Ramos in view of Huang teach this limitation.

[1.5.3]-[1.6]

Ramos in view of Werner and Schran teach these limitations for the reasons provided above relative to Ground 1.

Thus, Ramos in view of Werner, Schran, and Huang renders obvious claim 1.

[Claim 6]

Ramos in view of Huang teaches this limitation.

As explained above, it would be obvious to use Huang's MTOs in Ramos's system. (Ex-1003-Houh at ¶¶370-73.) Huang's MTOs may be a Silverlight or Flash object or a Java applet, which are downloadable to Phuah's computing devices 116 or 126. (Ex-1005-Huang at 0017-18.) Silverlight and Flash objects are executed in the Silverlight and Flash Player virtual machines, respectively. (Ex-1003-Houh at ¶370 (citing Ex-1013-Mahajan; Ex-1014-Kapoor; Ex-1015-DeAnna).) A POSITA would have understood that a Java applet would be executed in a Java virtual machine ("JVM") on the receiving computing device (NE114). (Ex-1003-Houh at ¶371 (citing Ex-1010-Lakhdhir at 1:20-35; Ex-1011-Szabo at 18:48-19:16; Ex-1012-Meyer at 54:1-43).)

Thus, Ramos in view of Huang teaches claim 6, and Ramos in view of Werner, Schran, and Huang render obvious claim 6.

[Claim 11]

Ramos in view of Huang teaches this limitation.

As explained with respect to claim 1 above, a POSITA would have been motivated and found it obvious in to use Huang's MTOs, which are downloadable agents retrieved using a web browser (i.e., an Internet browser) in the form of a Silverlight or Flash object or a Java applet. (Ex-1005-Huang at 0020 ("When the measuring tool object is loaded into an end-users' web browser…the tool performs a number of measurements. As with advertisement, the measuring tool object is launched without any end-user intervention."), 0018 ("For example, while a Silverlight(R) or Flash® object is described, Java® applets can also be used for such active content, since they are loaded within browsers.")) (Ex-1003-Houh at ¶376.)

Thus, Ramos in view of Huang teaches this limitation, and Ramos in view of Werner, Schran, and Huang renders obvious claim 11.

[18.1-18.2]

Ramos in view of Schran teaches these limitations for the reasons discussed above relative to limitations 1.4-1.5.1.

[18.3] the server operable to: receive WAN performance information from a downloadable agent,

Ramos in view of Huang teaches this limitation. As explained in Ground 4, limitation 1.4, it was obvious to collect WAN performance information using Huang's downloadable agent and send that information to Ramos's IAQM Server. Indeed, the "machine" of claim 1 is the "server" of claim 18, and Ramos's IAQM Server reads on both a machine and a server. (Ex-1003-Houh at ¶379.)

[18.4.1-18.4.2]

Ramos in view of Huang and Werner teaches this limitation for the same reasons discussed above relative to limitations 1.2-1.3.

[18. 5.1-18.5.4]

Ramos in view of Werner, Schran and Huang teaches limitations 18.4.2 through 18.6 for the same reasons discussed above relative to limitations 1.4, and 1.5.1 through 1.6, respectively; the "machine" described with respect to limitations 1.5.1 through 1.6 is a "server."

[Claim 30]

Claim 30 corresponds to claim 6 and is obvious for the reasons discussed above.

XIV. Conclusion

For the foregoing reasons, Petitioner respectfully requests cancellation of claims 1-6, 8-12, 16, 18-22, 30, 33-34, and 36.

Respectfully submitted,
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Date: November 8, 2024

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CERTIFICATE OF SERVICE

The undersigned certifies that a true and correct copy of the Petition together with all exhibits identified in the above Table of Exhibits and Petitioner's Powers of Attorney, have been served on the Patentee via Priority Mail Express or by means at least as fast and reliable as Priority Mail Express on the below date, at the following address:

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