2020-1441

United States Court of Appeals for the Federal Circuit

MOBILITY WORKX, LLC,
Appellant,

v.

UNIFIED PATENTS, LLC,
Appellees.

Appeal from the United States Patent and Trademark Office, Patent Trial and Appeal Board in Inter Partes Review No. IPR2018-01150.

APPELLANT'S OPENING BRIEF

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Certificate of Interest

Counsel for Appellant, MOBILITY WORKX, LLC certifies the following:

1. The full name of the party represented by me is: MOBILITY WORKX, LLC.

2. The name of the real party in interest is: MOBILITY WORKX, LLC.

3. All parent corporations and any publicly held companies that own 10 percent or more of the stock of the party represented by me are: None.

4. The names of all law firms and the partners or associates that appeared for the party or amicus now represented by me in the trial court or agency or are expected to appear in this court (and who have not or will not enter an appearance in this case) are:

- Tarek N. Fahmi, Ascenda Law Group, LLC;
- Michael Machat, Machat & Associates, PC

5. The title and number of any case known to counsel to be pending in this or any other court or agency that will directly affect or be directly affected by this court's decision in the pending appeal (*see* Fed. Cir. R. 47. 4(a)(5) and 47.5(b)):

- *Mobility Workx, LLC v. Cellco Partnership d/b/a/ Verizon Wireless*, 4:17-cv- 00872-ALM (EDTX).

Dated: July 30, 2020

By: /s/ David A. Randall

David A. Randall

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I. INTRODUCTION

Prior to the Supreme Court's 1927 decision in *Tumey v. Ohio,* a mayor could convict someone for unlawful liquor possession in a mayor's court. 273 U.S. at 516–17. The mayor would receive more compensation when he convicted and fined the defendant, and the extra compensation came from the criminal fines. *Id.* at 520. The fines also supported the village's general treasury fund, which the mayor presided over as the village chief executive officer. *Id.* at 533. This was a due process violation for two reasons. First, the mayor had "a direct, personal, substantial, pecuniary interest" in fining the person because the mayor's bonus pay was tied to convictions. *Id.* at 523. Second, the mayor had a strong "official motive to convict and to graduate the fine to help the financial needs of the village." *Id.* at 535.

The America's Invent Act was signed into law in 2011 with good intentions. But as implemented, it encourages behavior similar to that found unconstitutional almost a century ago in *Tumey*.

The procedural mechanisms in which the new *inter partes* review ("IPR") proceedings work, violate the Due Process Clause of the Constitution for various reasons. First, the salaries of the Administrative Patent Judges (APJs) that decide to institute an IPR proceeding are derived from the filing fees paid by those challenging a

patent—approximately half of which gets refunded if there is no institution decision; thus, the more IPR proceedings instituted, the more money available for the PTAB to pay its body of APJs salaries and bonuses. Shockingly, the system works in such a way that bonuses are awarded for deciding against patent holders, and APJs are discouraged from writing dissenting opinions.

Second, in an apparent cost savings move, the same judges who decide to institute also preside over the IPR proceeding they instituted. Having an impartial set of new judges not familiar with the prior proceedings would prevent prejudging bias, but it would certainly cost more money. However, both the Fifth Amendment and APA are meant to prevent the Director (of the PTO) from delegating the decision of whether to institute an IPR proceeding to the same panel of judges that will ultimately decide whether the institution decision was correct in the first place.

IPR Proceedings also amount to an unlawful taking contrary to the Fifth Amendment when applied to pre-AIA patents as is the case here. The manner in which the IPR hearings are heard and determined is so different from prior procedures relating to post patent review petitions that it can only be described as a case of the government welching on its promises for which patent holders disclosed their inventions.

The manner in which the APJ's were appointed also violated the Appointments Clause of the Constitution, and the *Arthrex* fix didn't

actually cure the matter, but made it worse; now APJ's are terminable at will, making the compensation and inducement issues—contrary to *Tumey* and its progeny—an even greater concern.

There is no quick fix to the plethora of constitutional and APA violations before the Court. But should this Court not totally reverse the decision below, at a minimum, the Final Written Decision should be vacated, a new panel of properly appointed APJs should make the initial decision of whether to institute, and if the decision is to institute, then a different panel of properly appointed APJs need to hear the matter *ab initio*.

Lastly, the PTAB Final Written Decision simply got it wrong when it found claims 1, 2, 4, and 5 unpatentable, and should be reversed.

II. STATEMENT OF RELATED CASES

Pursuant to Federal Circuit Rule 47.5, there is no prior appeal in or from the PTAB proceedings in this case, in this or any other appellate court. The patent in dispute here is at issue in *Mobility Workx, LLC v. Cellco Partnership d/b/a/ Verizon Wireless*, 4:17-cv-00872 - ALM (EDTX).

III. JURISDICTIONAL STATEMENT

This Court has jurisdiction pursuant to 28 U.S.C. § 1295(a)(4)(A), 35 U.S.C. §§ 141(c), 144 and 319 because this appeal arises from the Final

Written Decision ("FWD") in IPR2018–01150. The PTAB had jurisdiction over the matters below under 35 U.S.C. §§ 6(c) and 318(c). The patent owner, Mobility Workx ("Mobility"), timely filed and served the notice of appeal on January 31, 2020, after the PTAB's FWD on December 2, 2019.

IV. STATEMENT OF THE ISSUES

1. Whether the unusual structure for instituting and funding AIA post-grant reviews violates the Due Process Clause in view of *Tumey v. Ohio*, 273 U.S. 510 (1927), and its progeny, which establish "structural bias" as a violation of due process.

2. Whether the Director's delegation of his responsibility to make final unreviewable institution decisions to the same APJ's who make the Final Written Decision violates the Administrative Procedures Act and/or the Due Process Clause of the Constitution.

3. Whether subjecting the Pre-AIA '417 Patent to an AIA Proceeding so fundamentally different from the post review proceedings that existed at the time Mobility's inventors applied for and obtained their patent constitutes an unlawful taking of property.

4. Whether the PTAB's decisions should be vacated and remanded because the PTAB panel that decided the cases was unconstitutional under the Appointments Clause.

5. Whether the PTAB's holding of claims 1, 2, 4, and 5 unpatentable over Liu or Liu and Gwon should be reversed because its finding that Liu or Liu and Gwon teach or suggest a ghost-mobile node "triggering signals" that are "required to allocate resources and initiate mobility on behalf of the mobile node" is not supported by substantial evidence.

V. STATEMENT OF THE CASE AND FACTUAL BACKGROUND

This appeal is from the PTAB's FWD in *Inter Partes* Review No. IPR2018–01150 finding claims 1, 2, 4, 5, and 7 of U.S. Patent No. 8,213,417 ("the "'417 Patent") unpatentable.

The '417 Patent, entitled "System, Apparatus, and Methods for Proactive Allocation of Wireless Communication Resources," was filed March 5, 2010, by its inventors Drs. Edwin A. Hernandez-Mondragon and Abdelsalam A. Helal and issued July 3, 2012. Appx53. Thus, the '417 Patent was filed *prior to* the passage of the Americas Invent Act ("AIA") and issued over two months *prior to* Sections 311–319 of Title 35 becoming effective on September 16, 2012 under the AIA.

A. Procedural Background.

On August 14, 2017, Mobility filed a lawsuit for patent infringement against T-Mobile, in the Eastern District of Texas, *Mobility Workx, LLC v. T-Mobile et al.,* Case No. 4:17-cv-00567 - ALM. Then on December 18,

2017, Mobility filed a lawsuit against Verizon Wireless, *Mobility Workx, LLC v. Cellco Partnership d/b/a/ Verizon Wireless*, 4:17-cv-00872 -ALM (EDTX). While those two lawsuits were pending, on June 1, 2018, Appellee, Unified Patents, LLC ("UPL") filed its petition seeking *inter partes* review of claims 1–7 of Mobility's '417 Patent. Appx77–78, Appx137. On December 3, 2018,[1] the PTAB instituted *inter partes* review ("Institution Decision") on all challenged claims under all asserted grounds. Appx2, Appx186.

Oral hearing was held September 6, 2019, Appx2, following which the PTAB issued its FWD on December 2, 2019, Appx1, Appx49. This appeal followed.

B. Factual Background.

1. The Description of the '417 patent and how it works.

The '417 Patent (Ex. 1001) is titled "System, Apparatus, and Methods for Proactive Allocation of Wireless Communication Resources" and is generally directed to allocation of communications resources in a communications network. Appx55, Appx63, 1:17–19. Mobile communication systems comprise mobile nodes (e.g., cell phones) that communicate with each other through a series of base stations that

[1] The T-Mobile suit settled in December, 2018. The Verizon lawsuit remains pending. Trial was set to begin December 6, 2019, but when the FWD came down on December 2, 2019 (Appx1), trial was suspended pending resolution of this Appeal.

serve distinct zones or cells. Appx63, 1:28–31, Appx64-65, 4:60–5:8 As the mobile node moves from one cell to another, it establishes a new connection with a new base station. Appx63, 1:31–35. The mobile node must be able to let other nodes know where it can be reached when it is moving. Appx63, 1:36–39.

Typically, the mobile node registers with a home agent so the home agent can remain a contact point for other nodes that want to exchange messages or otherwise communicate with the mobile node as it moves from one location to another. Appx63, 1:39–44; Appx65, 5:9–17. Accordingly, a mobile node may use two IP addresses, one being a fixed home address and one being a care-of address, where the care-of address changes as the mobile node moves between networks. Appx63, 1:45–49. When the mobile node links to a network other than the one in which its home agent resides, the mobile node is said to have linked to a foreign network. Appx63, 1:49–52. The mobile node, therefore, receives an IP address from the home network, and when it moves to a foreign network and establishes a point of attachment by registering with a foreign agent, it receives a care-of address assigned by the foreign network. Appx63, 1:52–56; Appx65, 5:47–54.

Delays can occur when setting up a new communication link when the mobile node is handed off from one foreign agent to another because the new communication link cannot be set up until the mobile node arrives in the new foreign agent's physical region of coverage. Appx63,

2:20–36, Appx65, 6:3–10. In addition, data packets may be lost if they arrive during the time when set up is being established. Appx63, 2:36–38, Appx65, 6:10–13.

The invention described in the '417 patent reduces these problems by causing communication network resources to be allocated proactively rather than reactively. Appx63, 2:52–54. The '417 patent accomplishes this through the use of two different types of "ghost entities" that can act on behalf of a mobile node and a foreign agent, namely a ghost mobile node and a ghost foreign agent. Appx63 2:44–47. These ghost entities and how they operate are described in connection with FIG. 2A and 2B of the patent. Appx58–59. FIG. 2A is reproduced below.

A ghost mobile node acts on behalf of a mobile node and "can be a virtual node and need not reside at the same physical location as the mobile node." Appx65, 6:20–22. "The ghost mobile node, for example, can be a set of software instructions running on a device that is remote from the mobile node and that contains a transceiver for communicating with the mobile node. Appx65, 6:22–26. The ghost mobile node operates by signaling the foreign agent before the mobile node arrives in the foreign agent's physical region of coverage, based upon the predicted future state of the mobile node. *Id.* at 6:27–38. The predicted future state of the mobile node may be based upon, for example, an estimated location, trajectory, or speed of the mobile node. *Id.* at 6:39–46. Based upon this predicted future state, the ghost mobile node determines

which foreign agent is likely to serve as the mobile node's next communications link and signals that foreign agent. Appx66, 8:58– 62. This signal can be a registration request to cause an allocation of communications resources in the same way as would be performed if the mobile node were physically present in the foreign agent's region of coverage. Appx67, 9:7–17. Therefore, the signal results in preemptive setup that is performed before the mobile node arrives in the foreign agent's coverage area. Appx67, 9:54–57. This serves to increase the speed with which hand-offs occur, thereby reducing setup delays and avoiding information losses due to dropping of data packets. Appx67, 9:65–10:1.

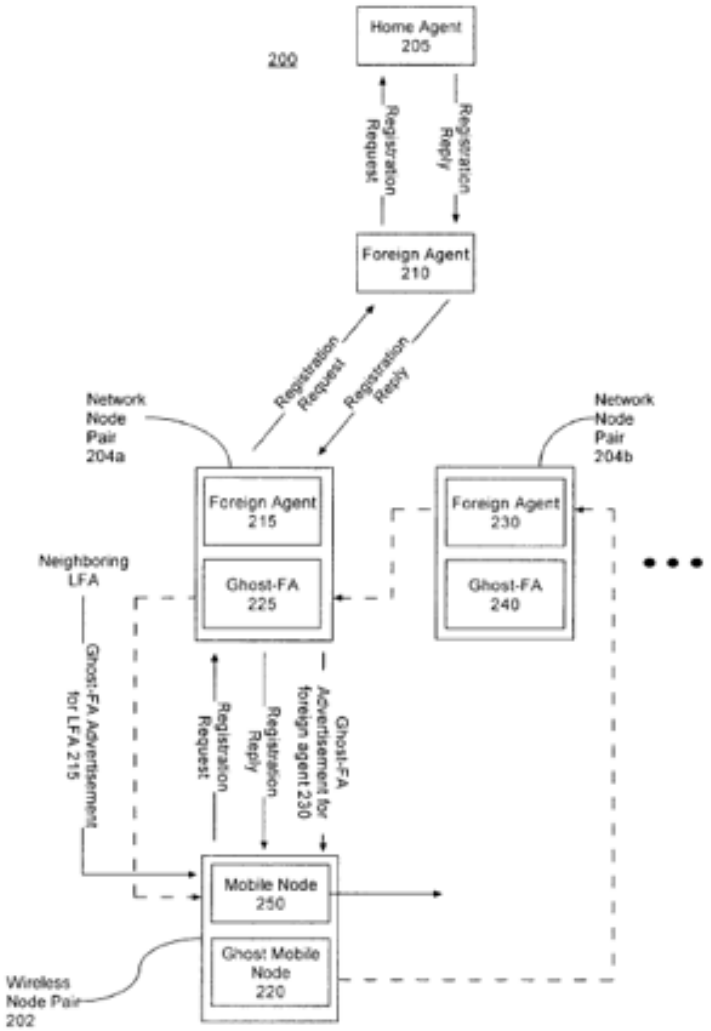


FIG. 2A

The second type of ghost entity described in the '417 patent is a ghost foreign agent. Appx64, 4:1–3. A ghost foreign agent acts on behalf of a foreign agent and notifies the mobile node of the existence of a next foreign agent by transmitting an "advertisement" from the currently connected foreign agent. Appx67, 10:17–21. Thus, for example, in FIG. 2A above, ghost foreign agent 225 sends mobile node 250 an advertisement for foreign agent 230 to alert the mobile node of the

presence of foreign agent 230 before foreign agent 230 can directly inform the mobile node. In this way, the ghost foreign agent makes the mobile node aware of the foreign agent before the mobile node arrives in the coverage region of the foreign agent. Appx67, 10:26–29. Moreover, the vector of care-of addresses may be included in the advertisement. Appx67, 10:30–34.

On December 2, 2019, one year after the date of the institution, the PTAB issued its FWD in which it erroneously found, by a preponderance of the evidence, that challenged claims 1, 2, 4, 5, and 7 of the '417 Patent are unpatentable, setting up this Appeal. Appx2. Claims 3 and 6 survived. *Id.* The FWD found claims 1, 5 of the '417 Patent were obvious over Liu[2] or Liu and Gwon[3], claim 2 obvious over Liu, Gwon, and Lau[4], claim 4 obvious over Liu, Gwon, and IETF RFC 2402[5], and claim 7 obvious over Liu and Lau.

[2] U.S. 5,825,729 (issued Oct. 20, 1998) (Ex. 1003).

[3] U.S. 2012/0131386 A1 (published Sept. 19, 2002) (Ex. 1004).

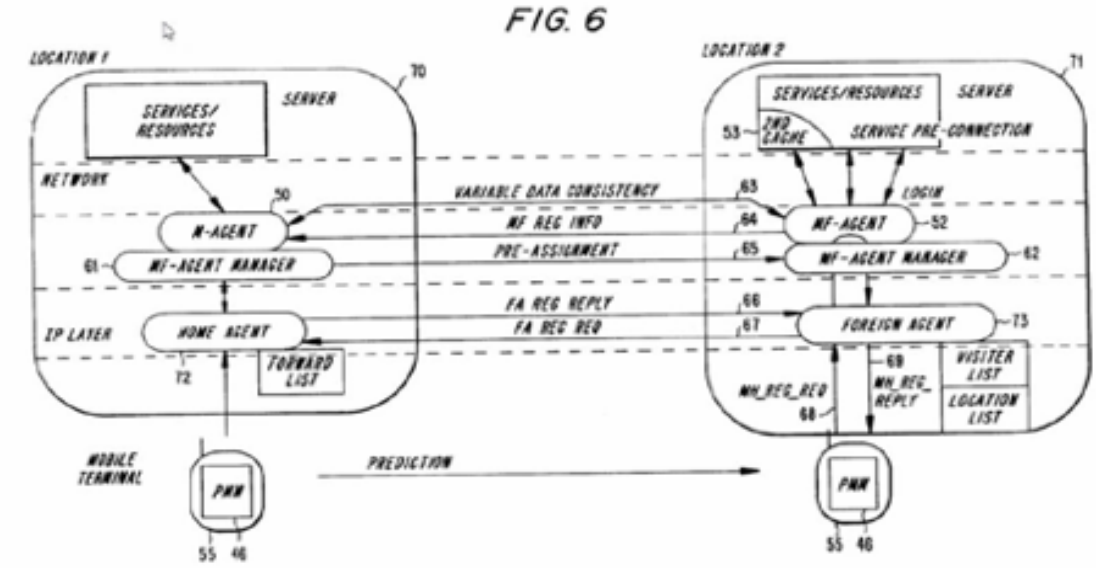
[4] U.S. 7,536,482 B1 (issued May 19, 2009) (Ex. 1005).

[5] Internet Engineering Task Force Request for Comments 2402, *IP Authentication Header* (November 1998) (Ex. 1008).

2. Scope and Content of the Prior Art

a. Liu (Ex. 1003)

Liu describes a mobile floating (MF)-agent protocol that is intended to accommodate the ambulatory nature of mobile users by providing service pre-connection, resource pre-allocation, and data-structure pre-arrangement in wireless local area networks and cellular networks. Ex. 1003 at Appx457, Appx480 1:50–64. The MF-agents are deployed to "decouple network services (such as user authentication data, registration data, etc.) and resources from the underlying network and mov[e] them to follow their mobile users." Appx480, 1:65–2:1. Liu's MF-agent pre-assignment protocol is illustrated in Figure 6:



Appx460, FIG. 6; Appx483, 7:19–20.

Figure 6 depicts an embodiment of the MF-agent pre-assignment protocol. Appx483, 7:19–20. Liu describes the use of mobility agents (M-agents) and mobile-Floating Agents (MF-agents). *See, e.g.,* Appx480, 2:12–34. M-agent 50 is representative of the user and "is preferably a software entity executing on a home fixed host or router, including a set of processes that communicates with and pre-assigns an MF-agent 52 to remote fixed hosts or routers on behalf of a mobile terminal 55." Appx482, 6:57–61; Appx483, 7:23. MF-agent 52 "is preferably a software entity executing on a remote fixed host or mobile support router (MSR), including a set of processes that can communicate and connect with the local host or MSR resources." Appx482, 6:61–65. Liu describes that the M-agent and MF-agent "are not bound to the underlying network," and are, "therefore . . . free to follow the mobile users." Appx483, 7:2–5. The MF-agent pre-connects services by using predictive mobility management (PMM) to predict where a user will be. Appx483, 7:5–9.

"[M]obile terminal 55 sends an MF-agent assignment request to its M-agent 50, with an address of a new location it is traveling to." Appx483, 7:26–28. The new location may have been explicitly provided by the user or it may be predicted through PMM. Appx483, 7:29–31. The assignment request is a request to establish (i.e., pre-assign) an MF-agent 52 at the location mobile terminal 55 is traveling to, so that the necessary services and data are ready for the mobile terminal when it arrives at the new location. Appx483, 7:32–37. "M-agent 50 registers

the request and forwards [it] to remote MF-agent manager 62 at the new location." Appx483, 7:37–38. Upon receiving the request, MF-agent manager 62 assigns or creates an MF-agent 52 for requesting M-agent 50. Appx483,7:38–50. MF-agent 52 registers itself with Foreign Agent 73 (F-agent) and sends an MF-assignment reply back to M agent 50 containing the registration information. Appx483, 7:50–56. "M-agent 50 then sends a reply back to [] mobile terminal 55 and maintains a data consistency link 63 with [] MF-agent 52." Appx483, 7:54–56. When mobile terminal 55 reaches the new location, it registers with MF-agent 52 by sending an MF-agent registration request 68 to F-agent 73 to begin the registration process. Appx483, 8:7–12. F-agent 73 will then link mobile terminal 55 to MF-agent 52. Appx483, 8:15–16. MF-agent 52 may then perform as an acting M-agent (AM-agent) for mobile terminal 55, performing the same function as an M-agent at the new location. Appx483, 8:17–20.

b. Gwon (Ex. 1004)

Gwon describes methods for predicting the mobility of mobile nodes in IP-based data networks and wireless LANs. Ex. 1004 at Appx497, [0002]. Of relevance to this analysis, Gwon describes the use of a standards-based Neighbor Discovery methodology in which a mobile node receives unsolicited Router Advertisement messages from a local

router. Appx501, [0051]. These messages "indicate[ ] the presence of other local routers which could provide network connections for the mobile node." *Id.*

C. The PTAB's Adjudicatory Process, Fee Structure, and Compensation Structure

Before getting into the due process argument below, an overview of the PTAB and its decision making and revenue-generating procedures is necessary.

1. The Two Step Process for AIA Reviews

The AIA fundamentally altered the process for challenging patents. Pub. L. No. 112–29, 125 Stat. 284 (2011). The PTAB adjudicates the new post-grant AIA challenges. 35 U.S.C. § 6(a), (b)(4). The PTAB comprises the "Director, the Deputy Director, the Commissioner for Patents, the Commissioner for Trademarks, and the administrative patent judges." *Id.* § 6. Under the AIA, a petitioner files a petition, and the PTAB first decides whether to grant the petition and institute review. 35 U.S.C. §§ 311, 321. Although the Director has the statutory authority to decide institution, the Director has delegated that authority to the PTAB. *See* generally *Ethicon Endo-Surgery, Inc. v. Covidien LP*, 812 F.3d 1023 (Fed. Cir. 2016). If institution is granted,

the review continues to "trial phase," and the PTAB (not the Director) makes the final decision on patentability. 35 U.S.C. §§ 318, 328.

As of April 2020, over 11,401 AIA petitions were filed—an average of more than 1,300 per year since September 2012. Appx4604. Overall, 62% of completed post-grant challenges have cancelled all patent claims, and 80% have invalidated one or more claims. Appx4611.

2. The Substantial Financial Revenue Generated by AIA Reviews

The specific funding scheme for AIA post-grant proceedings is unlike most adjudicatory processes in other federal agencies. The PTO requires the payment of two fees upon filing. One fee covers the PTAB's costs for the institution phase to decide the petition; the second fee covers costs for the trial phase, if the PTAB grants the petition. 37 C.F.R.§ 42.15(a)-(c). If the petition is denied, the trial phase fee can be returned. Setting and Adjusting Patent Fees, Final Rule, 78 Fed. Reg. 4212, 4233–34 (Jan. 18, 2013). Under this structure, the PTAB generates more revenue when it grants AIA petitions.

The PTO also has substantial autonomy over its budget and revenue. The PTO is a fee-funded agency that "operates like a business." Setting and Adjusting Patent Fees During Fiscal Year 2017, 82 Fed. Reg. 52,780, 52,780 (Nov. 14, 2017). It is generally appropriated the full amount of revenue generated from AIA proceedings. Plus, AIA § 22

established a Patent and Trademark Fee Reserve Fund ("Reserve Fund") in the Treasury. *See* 35 U.S.C. § 42. The Reserve Fund is for fees "collected in excess of the appropriated amount." § 42(c)(2). While the PTO is funded by the congressional appropriations process, the fees in the Reserve Fund are available only to the PTO. § 42(c)(2)[6]

Unlike many other agencies, the PTO sets its own fees, without congressional approval. *See* 35 U.S.C. §§ 311(a), 321(a). The PTO sets AIA post-grant proceeding fees at whatever it deems a "reasonable" amount, taking into account "aggregate costs." 35 U.S.C. §§ 311(a), 321(a). The PTO's current authority to set its fees is another significant departure from other agencies and even from past practice, when the PTO generally needed congressional approval for most fee increases. See, e.g., Pub. L. No. 108–477, § 801, 118 Stat. 2809, 2997 (2004). The PTO sets the AIA fees for cost recovery. 35 U.S.C. § 321(a); Appx4128. The institution and trial phase fees are set to cover the estimated costs of those phases. Appx4259; Appx4127–4128. This permits the PTAB to operate within its budget and to fund APJ salaries, bonuses, and the other operating expenses. For example, for 2021, the PTO proposes to

[6] *See generally* Glenn J. McLoughlin, U.S. Patent and Trademark Office Appropriations Process: A Brief Explanation, CRS Report RS20906 (Aug. 28, 2014). Appx4387-4393.

charge $19,500 plus $375 per claim over 20 claims for an IPR request fee. Appx4127, 4128. For the post-Institution phase, the proposed fee is an additional $18,750 plus $750 per claim over 20. Appx4128.

The PTO also estimates future PTAB workflow in connection with fee and budget setting. Appx4315–4318; Appx4319–4350.[7] For fiscal year 2021, the PTAB's total projected fee collections (*ex parte* appeals and AIA proceedings) are about $94 million. Appx4338 (cell R326). Of that total, about $57 million will be fees for AIA post-grant proceedings. Appx4335- 4338.[8] Projected institution-phase fees are about $34 million, and projected trial-phase fees are about $23 million. Appx4335–4336. Thus, of all AIA-related fees, about 60% are for the institution phase, and 40% are for the post-institution trial phase. *See* Appx4335–4336. In other words, about 40% of the AIA-related fees are collected only if the

[7] Appx4319-4350 is the PTO's spreadsheet that provides, among other information, estimated fee collections, broken down by PTO business units. *See* Aggregate Revenue Tables, https://www.uspto.gov/sites/default/files/documents/Agg_Rev_Tables_July2019.xlsx. Using the second-row column labels, the sum of cells R291:R326 provide estimated fee collections for 2021 for all PTAB collections. Appx4335-4338. AIA-related total fee collections for FY2021 are provided by summing cells R296:R307, R309, and R310. Estimates for AIA-related fees for other years are calculated accordingly. For instance, FY2020 estimated AIA-related collections are the sum of cells O296:O307, O309, and O310 (FY2020), and FY2022 estimates are the sum of cells S296:S307, S309, and S310. *Id.*

[8] Estimated FY2021 AIA petition request fees (institution phase) are calculated by summing R296, R299, R302, R305, and R310. Estimated FY2021 post-institution fees (trial phase) are the sum of R297, R298, R300, R301, R303, R304, R306, and R307.

PTAB grants institution of AIA petitions. This amounts to about 24% of the PTAB's collections being dependent on instituting post-grant trial proceedings.

3. PTAB Organization, Financing, and Compensation

From 2011 to 2020, the PTAB grew from about 60 APJs to about 260 to handle the new AIA reviews. Appx3881–3887. The APJs are organized hierarchically, all supervised by the Chief APJ. Appx4614-4616. The Chief APJ and the Deputy Chief APJ are the PTAB's "senior level executive management" and make up the Office of the Chief Judge. Appx4614. Below them are the Vice Chief APJs, who manage PTAB divisions consisting of judges and patent attorneys. Appx4615. Each division has six sections of APJs, and a "Lead APJ" manages each section of "line APJs." Appx4615.[9]

The Chief APJ, the Deputy Chief APJ, and the Vice Chief APJs have executive/administrative responsibilities, on the one hand, and judicial responsibilities, on the other. *See* Appx4004–4027 (Chief APJ); Appx4028–4033 (Deputy Chief APJ); Appx4106–4113 (Vice Chief APJ). The Chief APJ "perform[s] Business Unit Head functions" of the PTAB, which includes "execut[ing] the operating budget; prepar[ing] budget requests with justifications; and manag[ing] resources."

[9] For clarity, we use the term "line APJ" to distinguish the base APJ from other titles for APJs.

Appx4004–4005; Appx3995–3996.[10] The Deputy Chief APJ and the Vice Chief APJs are similarly involved in the financial management of the PTAB business unit. Appx4030–4031; Appx4108–4109.

While overseeing the PTAB's finances, PTAB leadership also makes decisions on the merits of AIA proceedings. *See* Appx3903. The Chief APJ and others will issue directives, such as the standard operating procedures ("SOPs"). Appx4351–4386.

APJs operate under employment rules, which PTAB leadership uses to incentivize the APJs. *See* Appx3818–3838; Appx3888- 3901. An APJ is rated by supervisors. *See, e*.g., Appx4036–4063. Lead and line APJs receive an overall "Performance Rating" as part of the "Classification and Performance Management Record." Appx3818–3859; Appx4036–4063; Appx4074–4102. The APJ is rated on a scale of 100 to 500. *See, e*.g., Appx4099 ("Total Score"). The numerical rating is the sum of four "Performance Elements," each of which is a numerical rating. *Id.* One Performance Element is "Production," which is based on the number of "decisional units" an APJ produces. Appx3822–3823[11] Each Performance Element independently and generally limits the APJ's final "Performance Rating" because all four Performance

[10] The USPTO is organized as "business units," and the PTAB is a separate "business unit." *See* Appx4406; Appx4484.

[11] A "decisional unit" equates to an action such as writing a decision or order in an AIA proceeding. *See* Appx3823; Appx4043-4046; Appx4081-4084.

Elements are "critical." *See, e.g.*, Appx3835 (noting that "if any critical element is less than fully successful[,] the rating can be no higher than the lowest critical element rating").

For example, line and Lead APJs must earn 84 and 59 decisional units, respectively, to be eligible for the "Fully Successful" rating. Appx3823; Appx3935. If a line APJ produces only 83 decisional units, he/she cannot, according to PTO documents, be rated as "Fully Successful." *See* Appx3823; Appx3945; Appx3971; Appx3975; Appx4060; Appx4063; Appx4066; Appx4099; Appx4102. Indeed, APJs are instructed to "normally seek efficiency gains and utilize available resources to enhance annual production." Appx3814.

Unlike a district court judge, an APJ can receive higher compensation based on his or her rating. Appx3881–3887. The APJ can receive a bonus of $4,000 to $10,000. Appx3881. The APJ's salary can be increased, up to five percent, depending on the APJ's numerical rating and final Performance Rating, Appx3881, which necessarily turns on the APJ's production of "decisional units."

Also unlike a federal judge, an APJ is discouraged from writing a concurrence or dissent. *See* Appx3813. Rather than automatically receiving credit for a concurrence or dissent, the APJ must ask permission from a Vice Chief APJ to receive any credit for that work. *Id.* ("Concurrences, dissents, and remands are not normally efficient mechanisms for securing the 'just, speedy, and inexpensive' resolution

of an appeal before the Board."). *See also* Appx3621. This unusual policy may explain the "surprisingly" few concurrences and dissents. *See* Scott McKeown, Judicial Independence & The PTAB (Dec. 12, 2017) (noting the "it is somewhat surprising that 98% of PTAB merit-based decisions are unanimous").[12]

Importantly, APJs are not administrative law judges ("ALJs"). The APJ-versus-ALJ distinction has meaningful consequences because, as explained below, APJs are not afforded the legal protections that ensure that ALJs are not unduly influenced by political or other non-merit-based factors, including structural pecuniary incentives. The AIA has thus created one of the largest bodies of non-ALJ agency employees who were intended to supplant decisionmaking by Article III judges.

VI. SUMMARY OF THE ARGUMENT

Due process requires an impartial and disinterested tribunal. The inherent tie between the PTAB's decisions to institute and the substantial revenue generated by those decisions—which account for about 40% of the PTAB's trial proceedings budget—has created a structural bias unlike any other in the federal executive branch. PTAB

[12] https://www.patentspostgrant.com/judicial-independence-ptab/#more-12559. *See also* Gene Quinn, Structural Bias at the PTAB: No Dissent Desired, IP Watchdog (June 6, 2018), https://www.ipwatchdog.com/2018/06/06/structural-bias-ptab-nodissent-desired/id=94507/.

executives and APJs impermissibly mix administrative and judicial functions that create, at a minimum, an appearance of bias. Post-institution fees pay for APJ salary increases, and the same APJs make the decisions to grant institution and thus generate revenue for the PTAB. Without continual institutions to cancel patents, the PTAB's budget will diminish, with likely adverse employment consequences on the APJs.

The structural bias is magnified by an APJ's lack of judicial independence. APJs are subject to performance reviews by superiors, including other APJs, as well as other PTO officials. Those performance reviews, which depend in part on productivity, help determine the salaries and possible bonuses earned by an APJ. This situation is completely unlike an Article III judge or an ALJ, who cannot receive bonuses, and the situation further contributes to the impermissible structural bias inherent in the AIA institution decisionmaking process.

The strong institutional bias for generating revenue for the PTAB, along with the financial incentive biases imposed on APJs from bonuses and salary raises, creates a perceived structural bias that exceeds any permissible arrangement under the Due Process Clause. Indeed, these unique features of the AIA post-grant review process—a bipartite payment scheme, in which APJs are incentivized by production and

bonus schemes, and an essentially self-funded adjudicatory board—are features that combine to create the structural bias the Supreme Court and appellate courts have repeatedly warned against.

The Supreme Court's recent decision in *Thryv, Inc. v. Click-to-Call Techs., LP*, 140 S.Ct. 1367 (2020), magnifies the structural appearance of bias. *Thryv* insulates many, if not most, institution decisions from any meaningful review by this Court.

Second, the Director's delegation of his responsibility to make final unreviewable institution decisions to the same APJ's who make the Final Written Decision violates the Administrative Procedures Act in addition to the Due Process Clause of the Constitution. Having the same judges who decide to institute the proceedings be the judges that decide the final outcome subjects them to prejudging bias. The natural inclination for anyone is to reaffirm what they previously found, as the PTAB post-institution statistics confirm. The language of the APA prohibits this as well as Due Process.

Third, subjecting Mobility's Pre-AIA '417 Patent to an AIA proceeding so different from the post review proceedings existing at the time the Patent was granted altered the bargain entered between the Government and Mobility's inventors that it constitutes a Taking of Property contrary to the Fifth Amendment's Takings Clause. Mobility's retroactive loss of the right to freely amend its claims is perhaps the most consequential distinction between IPR and reexamination. The

evidentiary standard was drastically different than it is in district court invalidity litigation. Instead of UPL having to prove unpatentability under a clear-and convincing standard, it only has to convince the APJs of its position using a preponderance of evidence standard. The retroactive imposition of the IPR scheme applied to Mobility was a taking because it had a significant negative economic impact on Mobility and severely diminished the value of the '417 patent, thereby upsetting its investment backed expectations.

Fourth, the taking was done by APJs that were unconstitutionally appointed at the time of the institution of the IPR and at the time of the oral argument. The Arthrex remedy to make APJs terminable at will did not change the fact that the APJs were unconstitutional at the time of the institution of the proceedings, during oral argument and during deliberations. In fact, the Arthrex remedy only heightened the Structural problems discussed above.

Fifth, claim 1 of the '417 Patent requires "a ghost-mobile node that creates replica IP messages on behalf of a mobile node, the ghost-mobile node handling signaling required to allocate resources and initiate mobility on behalf of the mobile node, the ghost-mobile node ***triggering signals*** based on a predicted physical location of such mobile node or distance with relation to the at least one foreign agent." UPL relies on Liu's "M-agent" to satisfy the ghost-mobile node limitation. But, UPL's Petition, Liu, and UPL's supporting expert all make clear that

according to the teachings of Liu, the mobile node itself (and not the M-agent) triggers the signals that allocate resources and initiate mobility on behalf of the mobile node. Thus, no reasonable mind could conclude Liu's M-agent is the entity in the Liu communication network that "triggers" signaling to allocate resources and initiate mobility. The Board's finding of unpatentability of claims 1, 2, 4, and 5 are not supported by substantial evidence and should be reversed.

VII. ARGUMENT

A. Standard of Review.

A due process challenge contending a structural bias, requires a party to show the decisionmaking process creates "a possible temptation to the average man as judge" such that the adjudicator would "not hold the balance nice, clear and true." *Tumey v. Ohio*, 273 U.S. at 532; *Ward v. Vill. of Monroeville*, 409 U.S. 57, 60 (1972).

This Court "review[s] Board decisions in accordance with the Administrative Procedure Act, 5 U.S.C. § 706(2)." *HTC Corp. v. Cellular Commc'ns Equip., LLC*, 877 F.3d 1361, 1367 (Fed. Cir. 2017) (citing *Dickinson v. Zurko*, 527 U.S. 150, 152 (1999)). Under the APA, this Court reviews the PTAB's legal conclusions de novo and its factual findings for substantial evidence. *ACCO Brands Corp. v. Fellowes, Inc.*, 813 F.3d 1361, 1365 (Fed. Cir. 2016).

A reviewing court must set aside any agency action that is arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law. 5 U.S.C. § 706(2)(A). An agency must also "cogently explain why it has exercised its discretion in a given manner." *Motor Vehicle Mfrs. Ass'n of U.S., Inc. v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 48 (1983).

A finding is supported by substantial evidence only if a reasonable mind might accept the evidence to support the finding. *Consol. Edison Co. v. NLRB*, 305 U.S. 197, 229 (1938). Obviousness is a question of law based on factual findings, including what a reference teaches. *In re Baxter Int'l, Inc.*, 678 F.3d 1357, 1361 (Fed. Cir. 2012); *In re Mettke*, 570 F.3d 1356, 1358 (Fed. Cir. 2009). The Board's ultimate determination of obviousness is, therefore, reviewed *de novo*. *In re Kotzab*, 217 F.3d 1365, 1369 (Fed. Cir. 2000).

B. The Implementation of the America Invents Act Violates Due Process Clause of the Constitution and the APA

1. The PTAB's Organization, Decision making Process, Fee Structure, and APJ Compensation Scheme Create a Structural Bias that Violates Due Process

a. The Due Process Clause Entitles a Party to an Impartial and Disinterested Tribunal

The Due Process Clause prohibits procedures that "offer a possible temptation to the average man as a judge." *Tumey v. Ohio*, 273 U.S. at 532. "The Supreme Court has jealously protected the due process requirement of impartiality when the decisionmakers stood to gain substantial, personal pecuniary benefits from their adjudicative decisions." *Doolin Sec. Sav. Bank, F.S.B. v. FDIC*, 53 F.3d 1395, 1406 (4th Cir. 1995). A procedure creates this unconstitutional temptation if the decisionmaker has a "direct, personal, substantial pecuniary interest" in the proceeding's outcome. *Tumey v. Ohio*, at 523. Unconstitutional bias also exists where a decisionmaker with administrative or executive responsibilities has a sufficiently "strong" "motive" to rule in a way that would aid the institution. *Id.* at 533; *see also Ward v. Vill. of Monroeville*, 409 U.S. at 60.

Unconstitutional bias exists in at least two forms. First, a decisionmaker's direct pecuniary or other personal interest in a proceeding's outcome can violate due process. *See, e.g.*, *Gibson v.*

Berryhill, 411 U.S. 564, 578 (1973) (revocation of licenses by the optometry board would "possibly redound to the personal benefit of members" of the board); *Tumey v. Ohio*, 273 U.S. at 520. Second, an institutional bias in procedures can create an impermissibly strong motive—or appearance of motive—to rule in favor of the organization or its members. *See, e.g.*, *id.* at 533–34; *Ward v. Vill. of Monroeville*, 409 U.S. at 60–61; *United Church of the Med. Ctr. v. Med. Ctr. Comm'n*, 689 F.2d 693, 700 (7th Cir. 1982).

Three Supreme Court cases form the general basis for "structural bias" due process claims. In *Tumey*, the Supreme Court found the mayor had "a direct, personal, substantial, pecuniary interest" in fining the person, because the mayor's bonus pay was tied to convictions. *Tumey v. Ohio*, 273 U.S. at 523. Also, the mayor had a strong "official motive to convict and to graduate the fine to help the financial needs of the village." *Id.* at 535.

A year later, in *Dugan v. Ohio*, 277 U.S. 61 (1928), official motivations did not create an unconstitutional bias when the mayor, acting as a judge, was paid from a general fund into which the criminal fines he imposed were deposited. *Id.* at 65. This connection between the general fund and his pay was too "remote," the Court held, to create an unconstitutional temptation. *Id.* The mayor was one of five on the city

commission and had an insufficient connection to the general fund or the city's financial policy to produce too strong a motivation to favor a particular outcome in a case. *See id.*

In 1972, another Ohio mayor's court was challenged in *Ward v. Vill. of Monroeville*, 409 U.S. 57 (1972). The mayor exercised judicial and executive responsibilities and was responsible for the village's finances. 409 U.S. at 58. The mayor reported to the village council on budgetary matters, but a "major part of village income" came from the fines and fees imposed by the mayor. *Id.* This arrangement was unconstitutional as a "possible temptation" because "the mayor's executive responsibilities for village finances may make him partisan to maintain the high level of contribution from the mayor's court." *Id.* at 60.

b. "Structural Bias" is Enough to Violate the Due Process Clause

With structural bias, the constitutional deficiency lies not with a decisionmaker shown to be biased but with an overall process that creates too strong a motive and unfair temptation for "the average man as a judge." *Ward v. Vill. of Monroeville*, 409 U.S. at 60. Indeed, "[t]he administrative process 'requires the appearance of fairness and the absence of a probability of outside influences on the adjudicator; it does not require proof of actual partiality.'" *Hammond v. Baldwin*, 866 F.2d 172, 176 (6th Cir. 1989) (quoting *Utica Packing Co. v. Block*, 781 F.2d

71, 77 (6th Cir. 1986)). Due process "may sometimes bar trial by judges who have no actual bias and who would do their very best to weigh the scales of justice equally between contending parties." *Aetna Life Ins. Co. v. Lavoie*, 475 U.S. 813, 825 (1986).

A major contributing factor to unconstitutional structural bias is the existence of "substantial" institutional funding that is reliant on a particular outcome. *See Ward*, 409 U.S. at 58 (unconstitutional where fines imposed by judge accounted for between 35% to 50% of the village income); *Rose v. Vill. of Peninsula*, 875 F.Supp. 442, 450 (N.D. Ohio 1995) *(Rose)* (O'Malley, J.) (unconstitutional where fines accounted for over 10% of village's revenue).

Indeed, in both *Tumey* and *Ward*, "the Court put great emphasis on the fact that the revenues generated by the Mayor's Court were very substantial and vitally important to the village's fiscal well being." *Wolkenstein v. Reville*, 694 F.2d 35, 43 (2d Cir. 1982). As Judge Wisdom explained, the Supreme Court in those two cases was "not as interested in the probity of the individual judge or perhaps even, of the great majority of judges," but was instead concerned with "the inherent defect in the legislative framework arising from the vulnerability of the average man—as the system works in practice and as it appears to defendants and the public." *Brown v. Vance*, 637 F.2d 272, 282 (5th Cir. 1981).

Another recurring feature of unconstitutional decision making structures is when monetary fines imposed by a decisionmaker flow back to the decisionmaker's benefit, even if somewhat indirectly. *See, e.g.*, *Esso Standard Oil Co. v. Lopez-Freytes*, 522 F.3d 136 (1st Cir. 2008) (holding as unconstitutional an account funded by environmental fines over which the environmental agency has spending discretion because, in part, "any fine imposed will flow directly to the [agency's] budget"). Another contributing factor to unconstitutional structural bias is the mixing of executive and adjudicatory responsibilities in a single agency decisionmaker. *Alpha Epsilon Tau Chapter Hous. Ass'n v. City of Berkeley*, 114 F.3d 840, 847 (9th Cir. 1997) *(Alpha Epsilon Tau)* (Justice White, by designation) ("That the Board is both adjudicator of coverage and executor of its finances may be a less than optimal design for due process purposes.").

c. The PTAB's Organization, Decisionmaking Process, Fee Structure, and APJ Compensation Scheme Create a Structural Bias that Violates Due Process

The AIA review process operates under a set of conditions that very well may be unique in the federal government: (1) 40% of the PTAB's AI trial budget comes from fees generated by institution grants; (2) the PTAB leadership APJs have dual roles, as executive to manage PTAB finances and as adjudicator of AIA proceedings; (3) the line and Lead

APJs who make most institution decisions are subject to performance reviews by PTAB leadership; (4) an APJ's salary and bonus plan incentivizes higher "production," which leads to more institutions; (5) APJs lack the judicial independence of Article III judges and ALJs; (6) the PTO is user-fee funded, sets its own fees, and receives appropriations generally based on its fee collections; and (7) the PTAB operates as a "business unit" with its own budget responsibilities.

d. PTAB Leadership APJs Mix Administrative and Judicial Functions, Creating an Impermissible Appearance of Bias

The mixing of executive and judicial functions in a single agency position is consistently identified as a significant contributor to unconstitutional structural bias. *See Ward*, 409 U.S. at 60; *Rose*, 875 F.Supp. at 453 (identifying the "the combination and level of his or her executive and judicial powers" as an important factor). Here, the PTO impermissibly combines significant executive and judicial responsibilities in PTAB leadership positions that oversee a PTAB budget heavily dependent on institution-generated revenue. The Chief APJ, Deputy Chief APJ, and Vice Chief APJs each have some responsibility for institution decisions. They provide policy direction and ensure the quality and consistency of AIA decisions. *See* Appx4004–4006 (Chief APJ); Appx4030–32 (Deputy Chief APJ);

Appx4108–4110 (Vice Chief APJ). Their oversight of AIA decisions is necessarily intended to maximize conformity in the institution and final written decisions. Those PTAB leaders are also authorized to participate on PTAB institution panels, and in fact do so on occasion. *See* Appx4351- 4374.

At the same time, the leadership APJs have significant responsibilities managing the PTAB's finances as a distinct "business unit" within the PTO. *E.g.*, Appx4005 (Chief APJ: "Manage allocation of budget resources to accommodate business unit needs."). They oversee fiscal planning and expenditures. They make business unit decisions based on the availability of funds. All of these are high-level executive job duties granting the PTAB leadership significant authority over a budget of $94 million. The combination of adjudicatory and executive decisionmaking authority is a major red flag under the *Tumey* line of cases. *See Ward*, 409 U.S. at 60; *Esso Standard Oil Co. v. Lopez-Freytes*, 522 F.3d at 146–47; *Rose*, 875 F.Supp. at 453. It puts PTAB leadership in an untenable dual role of managing the PTAB's finances in a "business-like sense" and deciding AIA petitions solely on the merits.

The internally conflicted judicial/administrative roles of leadership APJs are even more troubling given the institution decision's criticality to such a substantial percentage of the PTAB's finances. Post-

institution fees (trial-phase fees) amount to about $23 million (FY2021). Appx4335- 4336. This is about 24% of the PTAB's total budget and about 40% of the PTAB's AIA trial proceedings budget. Appx4335–4338.

With 24%-40% of its budget dependent solely on granting petitions, the PTAB is in the same or worse situation compared to those cases finding an unconstitutional violation. *See Ward*, 409 U.S. at 58 (fines accounted for between 35% to 50% of village income); *Rose*, 875 F.Supp. at 450 (10%); *see also DePiero v. City of Macedonia*, 180 F.3d 770, 780 (6th Cir. 1999) (adopting 10% from Rose as "articulate and persuasive").

Conversely, the percentage of the PTAB budget dependent on post institution fees is much higher than in those cases where due process challenges have fallen short. *See Hirsh v. Justices of Supreme Court of Cal.*, 67 F.3d 708, 713–14 (9th Cir. 1995) (no violation because attorney disciplinary fines amounted to 1% of state bar funds); *Commonwealth of N. Mariana Islands v. Kaipat*, 94 F.3d 574, 581–82 (9th Cir. 1996) (fines used to build courthouse only 5% of budget); *Alpha Epsilon Tau*, 114 F.3d at 847 (no violation where financial gain tied to board's decisions was only "two to five percent of the entire budget").

PTAB leadership APJs also understand that the PTAB is intended to be self-funded by user fees. *See* Appx4127–4128. This self-funded fiscal approach is consistent with the PTAB's "business unit" designation with respect to the PTO finances and personnel policies. *See* Appx4064–4073; Appx4004. Under the current funding structure, any decrease in

institution grants very likely leads to a decrease in revenue for the PTAB as a business unit. *See* Appx4127–4128; Appx4335–4336. The imperative that the PTAB be fee-funded to cover costs further solidifies the direct connection between post-institution fees and PTAB overall budget.

The impermissible mixing of judicial and administrative/executive roles is perhaps at its extreme with the Precedential Opinion Panel. Appx4375–4386. The Precedential Opinion Panel purports to have the authority to designate PTAB decisions as "precedential," thus effectively binding all future PTAB panels. Appx4377; see also *Hulu, LLC v. Sound View Innovations, LLC, Case IPR2018–01039, Paper 29*, 2019 WL 7000067 (PTAB Dec. 20, 2019) (precedential) (Boalick, Chief APJ).

The Chief APJ is a default member of the Precedential Opinion Panel. Appx4378. The Chief APJ has the ability to participate in substantive policy decision making that binds all PTAB panels, all while managing the PTAB's entire budget. This scenario creates similar problems as in the mayor's courts struck down in *Tumey, Ward,* and *Rose*.

Other aspects of the impermissible combination of financial management authority and petition-phase decisionmaking responsibility in PTAB leadership positions confirm the structural bias.

Ultimately, the PTAB leadership is placed in situations analogous to those struck down as unconstitutional. This alone is enough to vacate the PTAB's decision in the present case.

e. The APJs Make Institution Decisions in the Face of Revenue Consequences, Performance Reviews, Production Requirements, and Bonus Incentives

The line and Lead APJs, who make most institution decisions, also operate under a system that generates incentives to grant institution, regardless of the merits of the petition. In this system, the "average man as judge"—or more aptly "the average person as patent judge"—is exposed to temptations that undermine the appearance of fairness. The APJs decide petitions knowing that denying a petition will adversely affect the PTAB "business unit" revenue and will likely affect their own financial and employment situation. This situation falls squarely within the ambit of *Tumey* and *Ward*.

Looming over the APJs are performance reviews and associated bonus incentives. *See, e.g.*, Appx3881. Every time an APJ decides to institute, that patent judge understands that his or her production scores will likely improve. *See* Appx4042–4045; Appx3881. The APJ also continues to work on the case through final written decision, which

leads to more opportunities to create "decisional units." That in turn increases the likelihood that the APJ will receive a positive review, possible salary increase, and possible bonus. *See, e.g.*, Appx3881.

The institution decision has an immediate impact on an APJ's work for the next 12 months. When an APJ votes to grant institution, that APJ is voting to grant himself or herself work on that post-grant proceeding over the next 12 months. *See* Appx4356–4360. When an AIA proceeding is instituted, the APJ also knows that the PTO and PTAB earn the post-institution fee, thus increasing the revenue for the PTAB business unit as a whole.

Although a decision to institute does not absolutely guarantee an economic benefit for the APJ, a guarantee is not necessary. To violate due process, all that is necessary is a reasonable connection between the decision and the pecuniary benefit. *See Gibson v. Berryhill*, 411 U.S. at 578. The *Gibson* Court found unconstitutional a review process whereby an optometry board revoked licenses of other licensed optometrists. The Court understood that the board's revocations would "possibly redound to the personal benefit of members of the Board." *Id.* (emphasis added).

These incentives are also very similar to the impermissible incentives in *Tumey*. There, the mayor's financial compensation increased as he fined more people for alcohol possession. *Turney*, 273

U.S. at 523. Here, the APJs increase their likelihood of bonuses and salary increases through additional "decisional units." *See* Appx3823; Appx3881.

More so, overall PTAB fee collections and funding are linked to the workload via AIA institution grants. Appx4127–4128. An average APJ is exposed to unfair influences due to this known connection between the PTAB's fee collection/budget and the need to generate revenue to cover costs, as the PTO "operates as a business" and the PTAB is a "business unit." If the PTAB's overall workload decreases—through decreased institutions—then the PTAB may very well decrease the PTAB budget and be left with a need for fewer line and Lead APJs.

The institution decision's possible effect on the individual APJ's financial situation cannot be overstated. For example, if the institution rate were reduced by 25%, that would equate to a reduction in trial phase work by about 25%. This reduction in APJ workload could very well cause many line APJs to fall short of the 84 decisional units required for the "Fully Successful" rating. *See* Appx4043; *see also* Appx4080–4084. That in turn would diminish the possibility of salary raises and monetary bonuses. *See* Appx3881 (tying pay adjustments to numerical performance ratings, which in turn depends on productivity).

This direct connection between granting institution and securing employment and bonuses is barely distinguishable from other situations

where decision makers had a direct pecuniary benefit flowing from a particular decision. *Cf. Cain v. White*, 937 F.3d 446, 448–49 (5th Cir. 2019), with Appx3823; Appx3881.

Ultimately, when viewed as a whole, the temptation on the average APJ is significant, imposing, and omnipresent throughout the institution decision making. It is unlike that in any other federal agency decision making process, and it does not comport with any court-approved process.

f. The APJ's Lack of Judicial Independence Exacerbates the Structural Bias

The APJ's lack of judicial independence amplifies the pecuniary and institutional bias. APJs lack significant independence compared to an Article III judge, or even an ALJ.[13] Without any reasonable independence from the agency, the APJs appear beholden to the PTAB business unit to maintain or increase PTAB revenues. The APJ's lack of independence also creates the appearance that the APJ will be too easily influenced to ensure the workflow for continued employment.

In contrast, ALJs have significant independence through statutory and regulatory protections. Agencies have limited ability to discipline or remove ALJs, except for cause. 5 U.S.C. §§ 7513, 7521. ALJs are

[13] *See generally* Kent Barnett & Russell Wheeler, Non-ALJ Adjudicators in Federal Agencies: Status, Selection, Oversight, and Removal, 53 Ga. L. Rev. 1 (2018).

protected against reduction in force with rights to reassignment, reemployment priority, and to be referred back into OPM's pool of ALJs to be reassigned to other agencies. 5 C.F.R. § 930.210; *see also* 5 C.F.R. Part 351. ALJs do not serve for a set period of time in office. They instead receive "a career appointment . . . exempt from . . . probationary period requirements." 5 C.F.R. § 930.204(a). An agency may not rate job performance or provide any award or incentive to ALJs. 5 C.F.R. § 930.206(a)-(b).

The APJ works in a different environment, lacking the above ALJ protections. *See Arthrex, Inc. v. Smith & Nephew, Inc.*, 941 F.3d 1320, 1336 (Fed Cir. 2019) *(Arthrex)* (severing 5 U.S.C. § 7513(a)). The stark contrast is perhaps most succinctly captured by the fact that an APJ's yearly performance is reduced to a single number. See, e.g., Appx4060. Furthermore, unlike an ALJ, the APJ is not exempt from probationary period requirements. Appx4043. APJs have to "demonstrate ramped up productivity" during their first year at the PTAB. Appx4043.

In the end, all the above illustrates the significant temptation—and importantly the appearance of temptation—for the APJs to rule in favor of institution for non-merits-based reasons. The perceived temptation may be to earn decisional units or satisfy the APJ's supervisor. The perceived temptation may instead be concerns over reduced employment due to decreased PTAB revenues. These structural biases

unfairly influence—or create the appearance of influence—on the "average person as patent judge," particularly after Arthrex and the lack of employment protections under Title 5.

g. The Structural Bias of the AIA should be declared Unconstitutional

The AIA structural bias is similar to, if not worse than, what was at issue in *Esso Standard Oil*, 522 F.3d at 145–48. There, the First Circuit held as unconstitutional an environmental quality review board ("EQB") that assessed environmental fines. *Id.* at 146–48. The court "concluded that the bias stems from the potential financial benefit to the EQBs budget as a result of an imposed fine." *Id.* at 146. The EQB's three board members enforced Puerto Rico's environmental statutes and regulations. *Id.* at 146. These salaried board members had no personal pecuniary interest in the fines imposed and collected, but the board exercised control over funds "which are supplied, at least in part, by fines which it imposes." *Id.* at 147. The court recognized that, "[a]lthough members of the [Board] may not stand to gain personally . . . a pecuniary interest need not be personal to compromise an adjudicator's neutrality." *Id.*

The EQB's unconstitutional structure is analogous to the PTAB's structure. The PTAB leadership manages the finances and also participates in substantive decisions. The PTAB leadership APJs'

review process creates a similar scenario for post-institution fees. The AIA fees generated are used to fund the operations of the PTAB, including salaries and bonuses for APJs. *See* § II.C., *supra*. The First Circuit also struck down the compensation scheme for the hearing examiners, who could be motivated to levy fines "because of the particularities within the pay structure." *Esso Standard Oil*, 522 F.3d at 147. A similar problem exists with APJs, where performance evaluations and bonuses depend, in significant part, on the number of their "decisional units." Appx3823; Appx3835 (noting that 35 percent of an APJ's performance rating depends on "production," which is measured by "decisional units"). And if an APJ grants a petition, benefits inure based on continued workflow, the increased opportunity for "decisional units," and more PTAB revenue. This conforms to the PTAB's instruction to APJs to "utilize available resources to enhance annual production." Appx3814.

Also similar to the bias in the AIA review structure is *Rose v. Village of Peninsula*. There, the district court focused on the substantial percentage (about 11–13%) of the village's revenue tied directly to fines imposed by the mayor, concluding that it fell within "the ambit of *Ward*." *Rose*, 875 F.Supp. at 451. The PTAB situation is even more substantial, with 40% of its AIA trial-related fees, and 24% of its overall fees, wholly dependent on granting petitions to institute. *See* Appx4335–4338.

The Fifth Circuit's decisions in *Cain v. White*, 937 F.3d 446, and *Caliste v. Cantrell*, 937 F.3d 525 (5th Cir. 2019), are equally instructive. In Cain, criminal fines were deposited into a judicial expense fund. *Cain v. White*, at 448–49. The judges had control over the fund and were given $250,000 per year from the fund to support the salaries for each judge's staff. *Id.* at 449, 454. The Fifth Circuit "agree[d] with the district court that the situation here falls within the ambit of *Ward," id.* at 454, noting that, when the collection of the fines and fees decreases, the court would have difficulty with its budgetary needs, *id.* at 449.

In *Caliste,* 20–25% of the court's judicial expense fund depended on the bail decisions. *Caliste v. Cantrell*, 937 F.3d at 526. As explained, "the more often the magistrate requires a secured money bond as a condition of release, the more money the court has to cover expenses. And the magistrate is a member of the committee that allocates those funds." *Id.*

Again, this is not unlike the AIA review structure, where the PTAB leadership APJs have the simultaneous roles of manager of the PTAB's budget and finances as "business unit" and of adjudicator on the merits of AIA petitions. In the words of *Caliste*, this "dual role . . . creates a direct, personal, and substantial interest in the outcome of decisions that would make the average judge vulnerable to the 'temptation . . . not to hold the balance nice, clear, and true.'" *Caliste v. Cantrell*, 937 F.3d at 532 (quoting *Turney*, 273 U.S. at 532). The AIA structure is also

analogous because the post-institution fees make their way to the PTAB through the user-fee funded PTO funding structure, the existence of the Reserve Fund of excess fees (for use only by the PTO), and the internal budgeting of the PTAB as a "business unit." The fees from granting AIA petitions will fund PTAB operations, salaries, and even bonuses, just as in *Cain* and *Caliste*.

In short, the unusual organizational and fee-generating structure of AIA reviews creates a temptation at least as strong in *Esso, Rose, Cain,* and *Caliste.* Because the budget of the PTAB depends so heavily and so disproportionately on the continued granting of initial petitions—particularly when those petitions are decided by agency employees who will benefit from granting petitions, and by the board management who are responsible for budgeting, hiring, and other executive functions, Mobility were deprived of their Due Process Rights and the decision invalidating Claims 1, 2, 4, 5, and 7 of the '417 Patent must be reversed.

2. The Method in which the Director has Delegated his Authority to Unconstitutionally Appointed APJ's to make Final, Unreviewable Institution Decisions Violates the Administrative Procedures Act

The AIA clearly tasks the Director with making the decision to implement an IPR proceeding. 35 U.S.C. § 311. Rather than making each individual initial determination himself, the Director, routinely

delegates that decision to the PTAB (*see generally Ethicon Endo-Surgery, Inc. v. Covidien LP*, 812 F.3d 1023. If institution is granted, the review continues to "trial phase," and the PTAB (not the Director) makes the final decision on patentability. 35 U.S.C. § 318. The practice has been to have the same PTAB Judges who make the initial determination make the final determination too.

Given that the recent decision in *Thryv, Inc. v. Click-to-Call Techs., LP*, 140 S.Ct. 1367 seemingly insulates the Director from any impropriety in instituting proceedings, including perhaps even by the roll of a die (and in this case a loaded die it is, with institution rates ranging from 55% to 87%[14]), the Director should be extra careful to avoid the appearance of impartiality for the sake of public confidence in an independent judiciary. Unfortunately, the practice of delegating the initial decision of whether or not to implement an IPR proceeding to the exact same panel of Judges that ultimately hears the case is simply another Due Process violation as well as a violation of the APA.

The historical US process of separate functions has been embedded into the Administrative Procedures Act ("APA"). Specifically, the APA prohibits an "employee or agent engaged in the performance of investigative or prosecuting functions for an agency in a case" from "participat[ing] or advis[ing] in the decision". 5 U.S.C. § 554(d) ("[U]nder the Administrative Procedure Act (APA) [an agency] generally

[14] Appx4607.

must divide enforcement and adjudication between separate personnel[.]"). *Martin v. Occupational Safety & Health Review Comm'n*, 499 U.S. 144, 151 (1991). Congress enacted this provision to "ameliorate the evils from the commingling of functions" by separating the "discretionary work of the administrator," like "initiat[ing] action," from the work "of the [administrative] judge." *Wong Yang Sung v. McGrath*, 339 U.S. 33, 42 (1950).

Although this Court said that the APA imposes no separation obligation as to those involved in preliminary and final decisions, *Ethicon Endo-Surgery, Inc. v. Covidien LP*, 812 F.3d at 1030 n 3, at the same time it must not be forgotten, as noted by the dissenting Judge, "The bifurcated design of post-grant review is clear not only from the language of §§ 314(a) and 316(c), but pervades the structure of these post-grant proceedings. Congress unambiguously placed these separate determinations in different decisionmakers, applying different criteria."

If the Director simply assigned the decision of whether to conduct the initial review to an examiner, the due process and violation of the APA issues will simply go away. Problem solved. The Director signs all patents when they issue. He delegates the decisions to issue patents to examiners before signing the patents that issue. Likewise, he could just as easily delegate the decisions whether to institute IPR proceedings to examiners and then sign the institution of proceedings order. His failure to do so violates due process and the APA statute.

As the Supreme Court has stated:

> This Court has also held that the "appropriate" remedy for an adjudication tainted with an appointments violation is a new "hearing before a properly appointed" official. And we add today one thing more. That official cannot be Judge Elliot, even if he has by now received (or receives sometime in the future) a constitutional appointment. Judge Elliot has already both heard Lucia's case and issued an initial decision on the merits. He cannot be expected to consider the matter as though he had not adjudicated it before. To cure the constitutional error, another ALJ (or the Commission itself) must hold the new hearing to which Lucia is entitled.

Lucia v. S.E.C., 138 S.Ct. 2044, 2055 (2018) (citations and footnotes omitted).

In footnote 5 of the majority opinion, the Court writes, "That is especially so because (as Justice BREYER points out) the old judge would have no reason to think he did anything wrong on the merits, *see post*, at 2064—and so could be expected to reach all the same judgments." *Id.*

The same logic applies to having the same judges who decide to institute the proceedings be the judges that decide the final outcome. Logically it seems they would be inclined to find at least most of the reasons they decided to institute the proceedings in the first place as being proper and would therefore reach almost all the same conclusions as before. *Cf. Lucia v. S.E.C.*, 138 S.Ct. at 2055.

C. Subjecting the Pre-AIA '417 Patent to an AIA IPR Proceeding So Fundamentally Altered the Bargain Entered Between the Government and Mobility that it Constitutes an Unlawful Taking of Property

The Fifth Amendment ensures that no private property shall be taken for public use without just compensation. In the words of Judge Friendly:

> Revocation of a license is far more serious than denial of an application for one; in the former instance capital has been expended, investor expectations have been aroused, and people have been employed.[15]

This distinction seems to have been conveniently misplaced by some. But, some distinguished jurists think otherwise. As recently put by Justice Gorsuch in his stinging dissent in *Thryv*:

> Like federal court litigation, *inter partes* review holds the advantage of allowing a private party attacking a patent's validity to participate in adversarial proceedings, rather than rely on the agency to direct its own investigation as it does in *ex parte* reexamination. Compare 35 U.S.C. § 316 with §§ 302, 304, 305. *Inter partes* review also allows a party challenging a patent all manner of discovery, including depositions and the presentation of expert testimony. § 316; 37 CFR §§ 42.51–42.65 (2019). At the same time, the burden of proof is lower—requiring challengers like Thryv to prove unpatentability only by a preponderance of the evidence, § 316(e), rather than under the clear and convincing standard that usually applies in court. *Microsoft Corp. v. i4i L. P.*, 564

[15] Judge Henry Friendly, "Some Kind of Hearing," University of Pennsylvania Law Review; Vol 123, 1267, 1296 (April 1975).

> U.S. 91, 131 S.Ct. 2238, 180 L.Ed.2d 131 (2011). Perhaps most appealing, proceedings take place before the Patent Trial and Appeal Board, rather than in an Article III court, so there is no jury trial before a tenure-protected judge, only a hearing before a panel of agency employees.

Thryv, Inc. v. Click-to-Call Techs., LP, 140 S.Ct. at 1378.

Some say the new regime represents a particularly efficient new way to "kill" patents. Certainly, the numbers tell an inviting story for petitioners like Thryv. In approximately 80% of cases reaching a final decision, the Board cancels some or all of the challenged claims. Patent Trial and Appeal Board, Trial Statistics 10 (Feb. 2020), https://www.uspto.gov/sites/default/files/documents/Trial_Statistics_2020_02_29.pdf. The Board has been busy, too, instituting more than 800 of these new proceedings every year. *Id*

The rules changed for all patents, including for all patents issued *before* the AIA went into effect. For those patents, the government breached its contract.

1. Key Differences Between the Rules Then and Now

Mobility's IPR proceeding differed significantly from the two types of reexamination proceedings that pre-existed the AIA: ex parte reexamination and inter partes reexamination. The PTAB has recognized this difference. "An *inter partes* review is neither a patent examination nor a patent reexamination" but is "a trial, adjudicatory in

nature [which] constitutes litigation." *Google Inc. v. Jongerius Panoramic Techs., LLC,* IPR2013–00191, Paper No. 50, at 4 (P.T.A.B. Feb. 13, 2014).

In reexamination, Mobility would have been free to amend its claims an unlimited number of times. In contrast, "[d]uring IPRs, there is no back-and-forth between the patentee and examiner seeking to resolve claim scope ambiguity; there is no robust right to amend." *In re Cuozzo Speed Techs., LLC*, 793 F.3d 1297, 1301 (Fed. Cir. 2015) (Prost, C.J., Newman, Moore, O'Malley, Reyna, JJ., dissenting from the denial of the petition for rehearing en banc). Crucially, during reexamination, patentees can liberally amend their claims to narrow their scope—much like in the initial examination. *See* id. §§ 305, 314(a) (1999).

The IPR regulations permitted only one opportunity to amend and it would have had to have obtained the permission of the PTAB to do so. *See* 35 U.S.C. § 316(d). And unlike the pre-existing reexamination proceedings the risk of adverse consequences while making an amendment was too great.

The one-bite-at-the-amendment-apple regime was a momentous change over prior reexamination proceedings.

As this Court noted, "[d]espite repeated recognition of the importance of the patent owner's right to amend during IPR proceedings—by Congress, courts, and the PTO alike—patent owners largely have been prevented from amending claims in the context of IPRs." *Aqua Prods.,*

Inc. v. Matal, 872 F.3d 1290, 1299–1300 (Fed. Cir. 2017). Moreover, the evidentiary standard that applied in Mobility's IPR proceeding was drastically different than it is in district court invalidity litigation where Mobility has been simultaneously fending off an attack on its patent. Instead of UPL having to prove the claims unpatentable under the clear-and-convincing standard, it only had to convince the APJs of its position under the preponderance of evidence standard.

Changing the rules of evidence after the inventors behind Mobility sacrificed their time and money undermined and outright vitiated Mobility's investment-backed expectations. Mobility's retroactive loss of the right to freely amend its claims is perhaps the most consequential distinction between IPR and reexamination. *See Aqua Prods., Inc. v. Matal*, 872 F.3d at 1298 (noting "amendments are a key feature of post-grant proceedings").

2. Subjecting the '417 Patent to IPR Was a Regulatory Taking

As Justice Holmes stated in *Pennsylvania Coal Co. v. Mahon,* "while property may be regulated to a certain extent, if regulation goes too far it will be recognized as a taking." 260 U.S. at 415; *accord Murr v. Wisconsin*, 137 S.Ct. 1933, 1942 (2017); *Lingle v. Chevron U. S. A.*, 544 U.S. 528, 537 (2005). In other words, "[a] regulation . . . can be so burdensome as to become a taking. . . . " *Murr v. Wisconsin*, at at 1942.

The primary factors to be considered in a regulatory takings analysis are: "(1) the economic impact of the regulation on the claimant; (2) the extent to which the regulation has interfered with distinct investment backed expectations; and (3) the character of the governmental action." *Id.* at 1943 (citing *Palazzolo v. Rhode Island*, 533 U.S. 606, 617 (2001)); *see also Lingle v. Chevron U. S. A.*, at 538–39; *Kaiser Aetna v. United States*, 444 U.S. 164, 175 (1979); *Penn Cent. Transp. Co. v. City of New York*, 438 U.S. 104, 124 (1978). The economic impact of the change of regulations and the character of the government's action is clear. Mobility has had to spend way more money defending its patent rights and may end up losing them in a proceeding it could have never foreseen.

3. Retrospective Application of IPR Undermines Reasonable Investment-Backed Expectations

The decision to seek a patent is fundamentally a decision to invest. To conceive of a new invention and reduce it to practice often requires a massive dedication of time, capital, and human effort. *See Kewanee Oil Co. v. Bicron Corp.*, 416 U.S. 470, 480 (1974) ("The patent laws promote this progress by offering a right of exclusion for a limited period as an incentive to inventors to risk the often enormous costs in terms of time, research, and development."). In addition, to obtain a patent, inventors are required to disclose the invention, sacrificing their right to keep it

confidential and claim it as a trade secret. *See id.* at 480–81; *see also Ruckelshaus v. Monsanto Co.*, 467 U.S. 986, 1012 (1984) (noting that "disclosure or use by others" of a trade secret destroys its "economic value"). In this sense, the decision to seek a patent is a calculated tradeoff, in which the only consideration the patentee receives is a predictable set of legal rules governing their exclusive right of use.

In *Monsanto,* the Court held that the Environmental Protection Agency's public disclosure of data voluntarily submitted to the Agency may, in some circumstances, constitute a taking. Noting that the disclosure of data constituting a trade secret destroys the holder's property interest in the data, *see* 467 U.S. at 1011, the Court's analysis centered on the legal rules governing the use and disclosure of such data and the "nature of the expectations of the submitter at the time the data were submitted." *Id.* Where, at the time of submission, the relevant statutory scheme allowed the submitter to designate its data as trade secrets not subject to public disclosure, "[t]his explicit governmental guarantee formed the basis of a reasonable investment-backed expectation." *Id.* Accordingly, the Supreme Court held that the Agency could not disclose such data, consistent with the Takings Clause, even though a subsequent act of Congress permitted disclosure of such data. *See id.* at 1013–14.

This case is no different. The inventors (who are now Mobility) disclosed data and information to the public in exchange for exclusive

right to practice the disclosed invention and under an understanding that this right could be abrogated only upon clear and convincing evidence that it was improperly granted or concomitant with an unlimited right to amend the claims of an issued patent. These "explicit governmental guarantee[s] formed the basis of a reasonable investment-backed expectation." *Id.* The AIA abrogated these guarantees and allowed cancellation of claims under a preponderance of evidence standard and absent an opportunity to amend the claims. Under *Monsanto* this "bait-and-switch" constitutes a compensable taking. Thus, the retroactive imposition of the IPR scheme applied to Mobility was a taking because it had a significant negative economic impact on Mobility and severely diminished the value of the '417 patent, thereby upsetting its investment backed expectations.

D. The Appointment of the Judges was Unconstitutional

On October 31, 2019, after Mobility presented its opposition to the IPR case and before the FWD issued, this Court ruled in *Arthrex I*, 941 F.3d 1320 all APJs who had been conducting IPR hearings held office in violation of the Appointments Clause.

The natural logical implication of this decision is that the APJs who decided to institute the IPR against Mobility and who rendered the FWD were unconstitutionally appointed at the time of Institution and at the time of conducting the hearing. This Court sought to remedy the

issue by making the APJs terminable at will. *Arthrex I*, 941 F.3d at 1338. That fix, however, did not alter the history of what had happened, *i.e.,* that unconstitutionally appointed judges took Mobility's property rights away.

An en banc panel of this Circuit in a separate ruling involving the same two parties ruled that since a Constitutional challenge to the APJs was not made by Arthrex in its Opening Brief on Appeal, it upheld a prior determination in that case that Arthrex waived its rights to a new hearing in that case. *Arthrex, Inc. v. Smith & Nephew, Inc.*, 953 F.3d 760 (Fed Cir. 2020) *(Arthrex II)*. It also ruled that only patent holders for cases that were decided before the October 31, 2019 Arthrex decision that did not file an appeal or raise the Appointment issue in their appeal were eligible for a new trial. *Id.* at 764 n4.

However, Mobility respectfully points out that the logic of that opinion is faulty. If the APJ judges were unconstitutionally appointed at the relevant time in the past, there was nothing the Appellate Court could do to change the past. No one has figured out how to time travel and alter history. Instead by making the judges suddenly terminable at will, all that has happened is a change in words going forward. The words written before simply cannot be made to disappear like an illusionist can make objects disappear by engineering a change of

perception. Crossing out words will prevent future readers from seeing what was before. But doing so does not change the reality of what occurred before.

The past cannot be changed, and the APJs were unconstitutionally appointed when they instituted proceedings against Mobility and when they had a hearing in which they decided to take away Mobility's property.

So since the APJs that instituted and presided over Mobility's IPR hearing were unconstitutional appointed at the time of appointment, at the time of institution of the IPR and at the time of Oral Argument and all the way up to Halloween eve of 2019, the decision below must be invalidated. The result is dictated by the logic of *Arthrex I*.

To remedy the situation, a new determination of whether to institute an IPR proceeding should be made by a completely different panel of APJs who are Constitutionally appointed and not subject to the subliminal due process issues discussed above.

E. *Arthrex*'s Remedy of Making the APJs Terminable at Only Heightens the Structural Bias Discussed Above.

A new hearing before the suddenly constitutionally appointed judges does not fix the time travel problem. But assuming arguendo that it did solve the appointment problem, the remedy makes the APJs subject to even more scrutiny than when they were not terminable at will. The

PTAB is a business and all APJs, regardless of how brilliant they are, and regardless of how dedicated they may be to the job, have to make sure their quotas are met—like a meter maid who has to write so many tickets to help fund a city's budget, or risk getting fired for not properly doing her job. The current system is denigrating to the judiciary and must be abolished. The APJs need to be made independent and free from the appearance of impropriety. The Arthrex remedy of making the APJs terminable at will only further heightens the structural bias discussed herein.

F. The Evidence Shows that the Mobile Node Rather than Liu's M-Agent "Triggers" the Signals Required to Allocate Resources and Initiate Mobility of the Mobile Node and thus the Board's Finding that Liu or Liu and Gwon Teach or Suggest the Last Limitation of Claim 1 is Not Supported by Substantial Evidence.

Although Mobility did not present arguments relative to this limitation below, the burden of proving unpatentability by a preponderance of the evidence remains with UPL. 35 U.S.C. § 316. The evidence cited in the FWD makes clear that substantial evidence does not exist to establish the existence of the last limitation of claim 1. That limitation reads:

> a ghost-mobile node that creates replica IP messages on behalf of a mobile node, the ghost-mobile node handling signaling required to allocate resources and initiate mobility on behalf of the mobile node, the ghost-mobile node

> triggering signals based on a predicted physical location of such mobile node or distance with relation to the at least one foreign agent.

Appx68.

In the '417 Patent, the ghost-mobile node is responsible for handling signaling required to allocate network resources and initiate mobility on behalf of the mobile node. It is also responsible for triggering those signals based on a predicted physical location of the mobile node or distance with relation to at least one foreign agent. Appx63, 2:55-67; Appx64, 3:60-66; Appx65-66, 6:27-7:9; Appx67, 9:3-17, 9:54-10-13.

UPL identifies Liu's M-agent as allegedly corresponding to the claimed ghost-mobile node of claim 1. Appx106-109. UPL's arguments and cited evidence, however, establish that Liu's mobile phone/PMM "triggers" the required signals, not the M-Agent. The FWD provides:

> Petitioner asserts Liu, or alternatively, Liu and Gwon, teaches or suggests this limitation. Pet. 30–34. Petitioner, relying on testimony from Dr. Haas, contends a person of ordinary skill in the art would have understood "handling signaling required to allocate resources and initiate mobility" to include "preemptive setup and initiation of the mobility process." *Id.* at 30 (citing Ex. 1006 ¶ 84). Petitioner relies on Liu's M-agent's (ghost-mobile node) pre-assignment signaling that allows for "services and/or data [to] be pre-connected/pre-arranged at the mobile user's destination." *Id.* at 31 (citing Ex. 1003, 2:29–35, Fig. 5). Petitioner further refers to the M-agent sending **the pre-assignment signaling based on the use of predictive mobility management (PMM),** including the predicted physical

> location of the terminal, ***to trigger service and resource pre-arrangement***. *Id.* at 31–33 (citing Ex. 1003, 7:22–38, 19:4–14).

Appx106 (emphasis added).

In fact, Liu, the Petition, and Dr. Haas's supporting declaration all confirm that it is the mobile phone and its PMM functions that perform the required "triggering" of the claimed signals, not the Liu's M-Agent. Page 32 of the Petition, for example, quotes Liu (Ex. 1003) at 7:22–38. Appx108. That portion of Liu—which was repeatedly relied upon by all parties and their experts—provides:

> **The M-agent 50 is a representative of the user 21 in the network and is responsible <u>in part</u> for creating, deleting and managing the MF-agents on behalf of mobile users**. An M-agent 50 requests creation or assignment of MF-agents 52. As shown in FIG. 7 **<u>a mobile terminal 55 sends an MF-agent assignment request to its M-agent 50, in the local network, with an address of a new location it is travelling to (701)</u>**. **The new location may be one that has been explicitly provided by the user 21, or it may be one predicted by the PMM functions 46.** The assignment request is a request to establish (i.e., alternatively create or pre-assign) an MF-agent 52 at the location that the mobile terminal 55 will be travelling to and thus have any necessary services and data ready for the mobile terminal, when it arrives at the new location. **<u>The M-agent 50 then registers the request and forwards the request 65 to the remote MF-agent manager at the new location (702).</u>**

Appx483 at 7:22–38 (emphasis added). Thus, Liu expressly discloses that **the mobile terminal generates and sends the pre-assignment request**, along with the address of the new location of where it is traveling to, **and the M-Agent merely forwards the request to the MF-agent manager(s) at the new location(s) specified by mobile node**.

Forwarding is not triggering. The Petition acknowledges this:

> Liu discloses that the use of Predictive Mobility Management triggers service and resource pre-arrangement for the mobile terminal before it reaches its next destination:
>
> "An aggressive mobility management scheme, called predictive mobility management has been developed. **A Predictive Mobility Management (PMM), as described previously, is used to predict the future location of a mobile user according to the user's movement history patterns. <u>The combination of the mobile floating agent concepts with the predictive mobility management allow for service and resource pre-arrangement.</u> The data or services <u>are preconnected and assigned</u> at the new location before the user moves into the new location.**"

Appx32–33 (quoting Ex. 1003 (Appx489) at 19:4–14 (bold italics added, other emphasis in original).

Liu describes the PMM as being part of the Mobile Application Interface (API) 31 included in the mobile terminal software 39 shown in

FIGS 3 and 4 of Liu. *See* Appx482, 5:36–45, 5:62–6:51. FIGs. 5 and 6 of Liu show the PMM 46 in the mobile node 55. Appx460-61. In addition, Liu describes the PMM functions as follows:

> [T]he most likely destination of a user is determined through the use of Predictive Mobility Management Functions (PMM) 46, which are also located in the MDSP 45. **The PMM 46 has two parts**: location prediction functions and virtual-distributed floating agent assignment functions (FAA). **The FAA functions assign the MF-agent to different locations according to a location prediction. In addition, the PMM 46 aids the Mobile API 31 in establishing service pre-connection and service/ resource mobility**.

Appx482, 6:35–46. Thus, Liu's mobile node, with the assistance of its mobile API, generates the MF-agent assignment request that triggers the signaling required to initiate mobility and allocate resources and then sends that request to its M-agent. *Id.* "The M-agent 50 then registers the request and forwards the request 65 to remote MF-agent manager at the new location." Appx483, 7:37–39. The Petition and Dr. Haas's declaration are in accord. *See*; Appx108–09 (Petition, citing Ex. 1003 at (Appx483) 7:22–38; (Appx489) 19:4–14); Appx578–579 (Ex. 1006) (citing Ex. 1003 at (Appx483) 7:28–39).

By contrast, the '417 Patent discloses and claims that the ghost-mobile node decides when handover is appropriate and then triggers the signaling required to allocate resources and initiate mobility on behalf

of the mobile node: Appx63 (Ex. 1001) at 3:61–65 ("The ghost-mobile node can serve as a virtual repeater capable of registering and allocating communication resources by predicting where the mobile node's next handoff will occur as the mobile node moves relative to the communication network's nodes, including those edge nodes that define foreign agents."); Appx65, 6:27–46; Appx65, 6:55–56 ("The ghost-mobile node can perform the function of determining the closest foreign agent."); Appx66, 8:58–9:17.

On this record, no reasonable mind could conclude that the Liu's M-agent is the entity in the Liu communication network that "triggers" signaling to allocate resources and initiate mobility. Accordingly, the Board's finding that the Liu teaches or suggests this limitation is not supported by substantial evidence. *See Consol. Edison Co. v. NLRB*, 305 U.S. at 229.

The Petition also argued that Liu in combination with Gwon rendered this limitation obvious. Appx109–10. According to the Petition:

> Gwon discloses a "mobility prediction analysis [that] results in the determination of a threshold value" that is selected to indicate when a mobile node has sufficiently moved relative to a network node**. Ex. 1004** [Appx502] at [0057]. The mobility prediction analysis "may be used to **trigger pre-hand-off processing of authentication and security measures" or to "trigger selection of a new network connection to optimize the quality of the mobile node's connection and/or communications."** *Id.*

> (emphasis added). Gwon discloses three different methods of mobility prediction, including a deterministic, stochastic, and adaptive approach. *Id.* at [0060]. Each approach is "generally sufficient by itself to accurately provide a threshold value to trigger desired actions by the mobile node. *Id.*; *see generally id.* at [0059]-[00104].

Appx109 (emphasis in original). The Petition then relies on testimony from Dr. Haas to argue that a "POSITA would have been motivated to substitute Liu's PMM mobility prediction functions with the alternative mobility prediction methods disclosed in Gwon to trigger signaling since this is substituting one known element for another to obtain predictable results. Appx110 (citing Ex. 1006 at (Appx579–80) 7.)

Substituting Gwon's prediction methods for Liu's PMM mobility prediction functions, however, suffers from the same problem that Liu alone does. Namely, as discussed above with respect to Liu, the FAA function in the PMM of the Mobile API would still assign the MF-agent to different locations according to a location prediction, just that that prediction would now be based on one of the Gwon prediction methods carried out in the phone. As a result, Gwon's prediction method and FAA would now aid the Mobile API 31 in establishing service pre-connection and service/resource mobility. *See* Appx482, 6:35–46. As taught in Liu, Liu's mobile node, with the assistance of its Mobile API, will generate the MF-agent assignment request that triggers the signaling required to initiate mobility and allocate resources and then

send that request to its M-agent. *See* Appx482, 6:35–46; Appx483, 26-36; Appx460-62, FIGs. 5-7. The M-agent 50 will then register the request and forward the request 65 to remote MF-agent manager at the new location. *See* Appx483, 7:37–39.

Thus, the combination of Liu and Gwon suffers from the same underlying issue raised above with respect to Liu. Therefore, no reasonable mind could conclude that the Liu's M-agent is the entity in the Liu communication network as modified by Gwon that "triggers" signaling to allocate resources and initiate mobility. Accordingly, the Board's finding that the Liu and Gwon teaches or suggests this limitation is not supported by substantial evidence. *See Consol. Edison Co. v. NLRB*, 305 U.S. at 229.

G. Dependent Claims 2, 4, and 5 are Patentable for the Same Reasons Claim 1 is Patentable

Claim 2, 4, and 5 depend from claim 1 and is therefore patentable over Liu and over Liu and Gwon for at least the same reasons as claim 1. *Hartness Int'l. Inc. v. Simplimatic Eng'g Co.*, 819 F.2d 1100, 1108 (Fed. Cir. 1987). Although the Petition raises additional Grounds with respect to claims 2 and 4, *see* Appx78, the Petition only relies on its claim 1 analysis based on Liu and Gwon to establish the limitations of underlying claim 1, *see* Appx114-13, Appx121-22**13,992**. Thus, the claims depending from claim 1 remain patentable over the combined

teachings of Liu, Gwon, and Lau and Liu, Gwon, and IETF RFC 2402 for at least the reasons presented above and in Section VII.F. *Hartness Int'l. Inc. v. Simplimatic Eng'g Co.*, at 1108.

VIII. CONCLUSION

For at least the forgoing reasons, the Board's patentability determinations should be reversed, or at least vacated and the case remanded for further determinations consistent with the standards identified herein.

HACKLER DAGHIGHIAN MARTINO & NOVAK P.C.

Respectfully submitted,

Dated: July 30, 2020

By: /s/ David A. Randall

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Addendum

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

UNIFIED PATENTS INC.,
Petitioner,

v.

MOBILITY WORKX, LLC,
Patent Owner.

IPR2018-01150
Patent 8,213,417 B2

Before WILLIAM M. FINK, *Vice Chief Administrative Patent Judge,* and MELISSA A. HAAPALA and KARA L. SZPONDOWSKI, *Administrative Patent Judges.*

SZPONDOWSKI, *Administrative Patent Judge.*

JUDGMENT
FINAL WRITTEN DECISION
Determining Some Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

This is a final written decision in *inter partes* review of claims 1–7 of U.S. Patent 8,213,417 B2, issued on July 3, 2012 (Ex. 1001, "the '417 patent"), entered pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons set forth below, we determine that Petitioner has demonstrated by a preponderance of the evidence that challenged claims 1, 2, 4, 5, and 7 are unpatentable. We also determine that Petitioner has not shown by a preponderance of the evidence that claims 3 and 6 are unpatentable.

II. BACKGROUND

A. Procedural History

Unified Patents Inc. ("Petitioner") filed a Petition (Paper 1, "Pet.") requesting *inter partes* review of claims 1–7 of the '417 patent. Mobility Workx, LLC ("Patent Owner") filed a Preliminary Response (Paper 7, "Prelim. Resp.") to the Petition. With our authorization, Petitioner filed a Reply to the Preliminary Response (Paper 8, "Reply") to address a real party in interest issue. Pursuant to 35 U.S.C. § 314(a), on December 3, 2018, we instituted an *inter partes* review (Paper 9, "Inst. Dec." or "Institution Decision") on all challenged claims under all asserted grounds. Inst. Dec. 33.

During the trial, Patent Owner filed a Patent Owner Response (Paper 12, "PO Resp."), Petitioner filed a Reply to Patent Owner's Response (Paper 13, "Pet. Reply"), and Patent Owner filed a Sur-reply to Petitioner's Reply (Paper 15, "PO Sur-reply").

We held an oral hearing on September 6, 2019, and a transcript of the oral hearing has been entered into the record. *See* Paper 25 ("Tr.").

B. Related Proceedings

The parties advise the '417 patent is the subject of two patent infringement lawsuits in the Eastern District of Texas:

Mobility Workx, LLC v. Verizon Communications, Inc. et al., 4-17-cv-00872 (E.D. Tex.), filed Dec. 18, 2017; and

Mobility Workx, LLC v. T-Mobile US, Inc. et al. 4-17-cv-00567 (E.D. Tex.), filed Aug. 14, 2017. Pet. 57; Paper 5, 2.

C. Real Party in Interest

Petitioner identifies United Patents, Inc. as the sole real party in interest. Pet. 57. Patent Owner does not identify any additional real parties in interest. *See* Paper 5, 2.

Patent Owner argued in its Preliminary Response that Petitioner failed to name all real parties in interest (RPIs) in its Petition as required by 35 U.S.C. § 312(a)(a). Prelim. Resp. 13–16. Patent Owner does not present this argument in its Patent Owner Response and, therefore, has waived it. *See* Paper 10, 5; *see generally* PO Resp. We rely on and incorporate our findings and determinations on this issue from the Institution Decision. *See* Inst. Dec. 3–4.

D. The '417 Patent (Ex. 1001)

The '417 patent is titled "System, Apparatus, and Methods for Proactive Allocation of Wireless Communication Resources" and is generally directed to allocation of communications resources in a communications network. Ex. 1001, codes (54, 57), 1:17–19.

Mobile communication systems comprise mobile nodes (e.g., cell phones) that communicate with each other through a series of base stations

that serve distinct cells. *Id*. at 1:28–31, 4:60–5:8. As the mobile node moves from one cell to another, it establishes a new connection with a new base station. *Id*. at 1:31–35. The mobile node must be able to let other nodes know where it can be reached when it is moving. *Id*. at 1:36–39. Typically, the mobile node registers with a home agent so the home agent can remain a contact point for other nodes that want to exchange messages or otherwise communicate with the mobile node as it moves from one location to another. *Id*. at 1:39–44, 5:9–17. Accordingly, a mobile node may use two IP addresses, one being a fixed home address and one being a care-of address, where the care-of address changes as the mobile node moves between networks. *Id*. at 1:45–49. When the mobile node links to a network other than the one in which its home agent resides, the mobile node is said to have linked to a foreign network. *Id*. at 1:49–52. The mobile node, therefore, receives an IP address from the home network, and when it moves to a foreign network and establishes a point of attachment by registering with a foreign agent, it receives a care-of address assigned by the foreign network. *Id*. at 1:52–56; 5:47–54.

According to the ’417 patent, delays can occur in setting up a new communication link when the mobile node is handed off from one foreign agent to another because the new communication link cannot be set up until the mobile node arrives in the new foreign agent’s physical region of coverage. *Id*. at 2:20–36, 6:3–10. In addition, data packets may be lost if they arrive during the time when set up is being established. *Id*. at 2:36–38, 6:10–13. The invention in the ’417 patent seeks to reduce these problems by causing communication network resources to be allocated proactively rather than reactively. *Id*. at 2:52–54. The ’417 patent accomplishes this through

the use of two different types of "ghost entities" that can act on behalf of a mobile node and a foreign agent. *Id*. at 2:44–47.

A ghost mobile node acts on behalf of a mobile node and "can be a virtual node and need not reside at the same physical location as the mobile node." *Id*. at 6:20–22. The ghost mobile node operates by signaling the foreign agent before the mobile node arrives in the foreign agent's physical region of coverage, based upon the predicted future state of the mobile node. *Id*. at 6:27–38. The predicted future state of the mobile node may be based upon, for example, an estimated location, trajectory, or speed of the mobile node. *Id*. at 6:39–46. Based upon this predicted future state, the ghost mobile node determines which foreign agent is likely to serve as the mobile node's next communications link and signals that foreign agent. *Id*. at 8:58–62. This signal can be a registration request to cause an allocation of communications resources in the same way as would be performed if the mobile node were physically present in the foreign agent's region of coverage. *Id*. at 9:7–17. Therefore, the signal results in preemptive setup that is performed before the mobile node arrives in the foreign agent's coverage area. *Id*. at 9:54–57. This serves to increase the speed with which hand-offs occur, thereby reducing setup delays and avoiding information losses due to dropping of data packets. *Id*. at 9:65–10:1.

The second type of ghost entity described in the '417 patent is a ghost foreign agent. *Id*. at 4:1–3. A ghost foreign agent acts on behalf of a foreign agent, and notifies the mobile node of the existence of a next foreign agent by transmitting an "advertisement" from the currently connected foreign agent. *Id*. at 10:17–21. In this way, the ghost foreign agent makes the mobile node aware of the foreign agent before the mobile node arrives in the

coverage region of the foreign agent. *Id*. at 10:26–29. Moreover, the vector of care-of addresses is included in the advertisement. *Id*. at 10:30–34.

E. Exemplary Claims

Among the challenged claims, claims 1 and 7 are independent. Independent claims 1 and 7 (reproduced below) are representative.

> 1. A system for communicating between a mobile node and a communication network; the network having at least one communications network node that is interconnected using a proxy mobile internet protocol (IP), comprising:
>
> at least one mobile node;
>
> at least one home agent;
>
> at least one foreign agent;
>
> a ghost-foreign agent that advertises messages to one of the mobile nodes indicating presence of the ghost-foreign agent on behalf of one of the foreign agents when the mobile node is located in a geographical area where the foreign agent is not physically present; and
>
> a ghost-mobile node that creates replica IP messages on behalf of a mobile node, the ghost-mobile node handling signaling required to allocate resources and initiate mobility on behalf of the mobile node, the ghost-mobile node triggering signals based on a predicted physical location of such mobile node or distance with relation to the at least one foreign agent.

Id. at 12:49–67.

> 7. A method, in a mobile node, for speeding handover, comprising the steps of:
>
> updating, in a mobile node, a location in a ghost mobile node;
>
> determining a distance, in the ghost mobile node in communication with the mobile node, to a closest foreign agent with which the mobile node can complete a handover;

submitting on behalf of the mobile node, from the ghost mobile node, a registration to the foreign agent to which the mobile node is going to complete the handover; and

upon completing the handover, updating a registration in the mobile node.

Id. at 13:32–14:11.

F. Prior Art and Asserted Grounds

Petitioner asserts that claims 1–7 would have been unpatentable on the following grounds:

Claim(s) Challenged	35 U.S.C. §	References
1, 5, 6	103(a)	Liu[1], Gwon[2]
2, 3	103(a)	Liu, Gwon, Lau[3]
4	103(a)	Liu, Gwon, IETF RFC 2402[4]
7	103(a)	Liu, Lau

Pet. 2. Petitioner also relies on the Declarations of Dr. Zygmunt Haas (Exs. 1006, 1010). Patent Owner relies on the Declaration of Suku Nair, Ph.D., P.E. (Ex. 2005).

III. ANALYSIS

A. Principles of Law

A claim is unpatentable under 35 U.S.C. § 103(a) if, to one of ordinary skill in the pertinent art, "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made." *KSR*

[1] U.S. 5,825,729 (issued Oct. 20, 1998) (Ex. 1003).
[2] U.S. 2012/0131386 A1 (published Sept. 19, 2002) (Ex. 1004).
[3] U.S. 7,536,482 B1 (issued May 19, 2009) (Ex. 1005).
[4] Internet Engineering Task Force Request for Comments 2402, *IP Authentication Header* (November 1998) (Ex. 1008).

Int'l Co. v. Teleflex Inc., 550 U.S. 398, 406 (2007) (quoting 35 U.S.C. § 103(a)). The question of obviousness is resolved based on underlying factual determinations, including the "scope and content of the prior art," "differences between the prior art and the claims at issue," "the level of ordinary skill in the pertinent art," and objective evidence of nonobviousness, i.e., secondary considerations.[5] *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). Prior art references must be "considered together with the knowledge of one of ordinary skill in the pertinent art." *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994) (citing *In re Samour*, 571 F.2d 559, 562 (CCPA 1978)).

To establish obviousness, a petitioner must "demonstrate both that a skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention, and that the skilled artisan would have had a reasonable expectation of success in doing so." *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1381 (Fed. Cir. 2016) (internal quotation marks omitted); *see also KSR*, 550 U.S. at 418 (explaining that for an obviousness analysis, "it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does"). A motivation to combine the teachings of two references can be "found explicitly or implicitly in market forces; design incentives; the 'interrelated teachings of multiple patents'; 'any need or problem known in the field of endeavor at the time of invention and addressed by the patent'; and the background knowledge, creativity, and common sense of the person of

[5] The record does not include arguments or evidence regarding objective indicia of non-obviousness.

ordinary skill." *Plantronics, Inc. v. Aliph, Inc.*, 724 F.3d 1343, 1354 (Fed. Cir. 2013) (citation omitted). Further, an assertion of obviousness "cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *KSR*, 550 U.S. at 418 (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)); *In re NuVasive, Inc.*, 842 F.3d 1376, 1383 (Fed. Cir. 2016) (a finding of a motivation to combine "must be supported by a 'reasoned explanation'" (citation omitted)).

B. Level of Ordinary Skill in the Art

Petitioner asserts that one of ordinary skill in the art at the time of invention "would have been a person with a Bachelor of Science Degree in computer science, electrical engineering, or computer engineering or equivalent, and at least two years of industry or academic experience with mobile IP communication methods and devices." Pet. 7 (citing Ex. 1006, ¶¶ 37–39). Patent Owner's declarant, Dr. Nair, testifies that he agrees with Petitioner's assessment of the background of one of ordinary skill in the art. Ex. 2005, ¶ 7.

We find Petitioner's proposal is consistent with the level of ordinary skill in the art reflected by the prior art of record, and, therefore, adopt it for purposes of this Decision. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001).

C. Claim Construction

In an *inter partes* review based on a petition filed prior to November 13, 2018, claim terms in an unexpired patent are interpreted according to their broadest reasonable construction in light of the specification of the

patent in which they appear. 37 C.F.R. § 42.100(b) (2017);[6] *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2142–46 (2016). Under that standard, "words of the claim must be given their plain meaning, unless such meaning is inconsistent with the specification and prosecution history." *Trivascular, Inc. v. Samuels*, 812 F.3d 1056, 1062 (Fed. Cir. 2016).

Petitioner argues the terms "advertise," "advertises," and "advertisement," as recited in independent claim 1 and dependent claim 4, are "at least broad enough to include a notification of the presence of a foreign agent in the foreign network." Pet. 8. In support, Petitioner refers to the claim language (Ex. 1001, 12:56, 13:19) and the Specification (Ex. 1001,[7] 4:1–3). *Id.* Patent Owner does not propose constructions for any terms. *See generally* PO Resp. Because the terms are not in controversy, we determine that we need not construe explicitly any terms to resolve the issues before us. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (citing *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)). To the extent the parties' arguments are based on the scope of the claims, we will resolve the disputed claim scope in the context of the parties' arguments as set forth below.

[6] A recent amendment to this rule does not apply here because the Petition was filed before November 13, 2018. *See* Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51,340 (Oct. 11, 2018) (codified at 37 C.F.R. pt. 42 (2019)) (amending 37 C.F.R. § 42.100(b) effective November 13, 2018).

[7] Petitioner's citation is to Ex. 1003, however, in context, this appears to be a typographical error and we understand the citation is intended to be to Ex. 1001.

D. Summary of Prior Art

1. Liu (Ex. 1003)

Liu is titled "Distributing Network Services and Resources in a Mobile Communications Network" and is generally directed to a mobility data network architecture for accessing data. Ex. 1003, codes (54, 57). Liu uses a mobile floating agent protocol "to dynamically provide service and resource mobility in mobile wireless Local Area Networks and cellular networks." *Id*. at 1:50–60. Liu describes that "[b]y combining Mobile-Floating agent functions with a method of predictive mobility management, the services and user data can be pre-connected and pre-assigned at the locations or cells to which the user is moving," which "allows the users to immediately receive service and maintain their data structures with virtually the same efficiency as they could have at the previous location." *Id*. at 2:3–9. Liu's mobile floating agent pre-assignment protocol is depicted in Figure 6, which is reproduced below:

FIG. 6

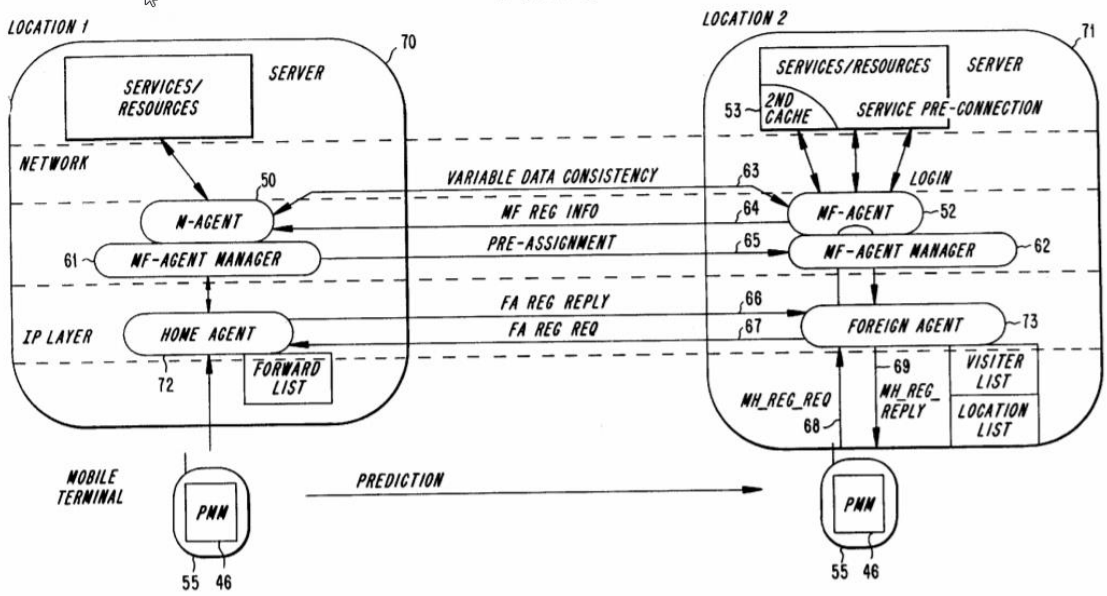

Figure 6 depicts an embodiment of the MF-agent pre-assignment protocol. *Id*. at 7:19–20. Liu describes the use of mobility agents (M-agents) and mobile-Floating Agents (MF-agents). *See, e.g.*, *id*. at 2:12–34. M-agent 50 is representative of the user and "is preferably a software entity executing on a home fixed host or router, including a set of processes that communicates with and pre-assigns an MF-agent **52** to remote fixed hosts or routers on behalf of a mobile terminal **55**." *Id*. at 6:57–61, 7:23. MF-agent 52 "is preferably a software entity executing on a remote fixed host or mobile support router (MSR), including a set of processes that can communicate and connect with the local host or MSR resources." *Id*. at 6:61–65. Liu describes that the M-agent and MF-agent "are not bound to the underlying network," and are, "therefore . . . free to follow the mobile users." *Id*. at 7:2–5. The MF-agent pre-connects services by using predictive mobility management (PMM) to predict where a user will be. *Id*. at 7:5–9.

"[M]obile terminal 55 sends an MF-agent assignment request to its M-agent 50, with an address of a new location it is traveling to." *Id*. at 7:26–28. The new location may have been explicitly provided by the user or it may be predicted through PMM. *Id*. at 7:29–31. The assignment request is a request to establish (i.e., pre-assign) an MF-agent 52 at the location mobile terminal 55 is traveling to, so that the necessary services and data are ready for the mobile terminal when it arrives at the new location. *Id*. at 7:32–37. "M-agent 50 registers the request and forwards [it] to remote MF-agent manager 62 at the new location." *Id*. at 7:37–38. Upon receiving the request, MF-agent manager 62 assigns or creates an MF-agent 52 for requesting M-agent 50. *Id*. at 7:38–50. MF-agent 52 registers itself with Foreign Agent 73 (F-agent) and sends an MF-assignment reply back to M-

agent 50 containing the registration information. *Id*. at 7:50–56. "M-agent 50 then sends a reply back to [] mobile terminal 55 and maintains a data consistency link 63 with [] MF-agent 52." *Id*. at 7:54–56.

When mobile terminal 55 reaches the new location, it registers with MF-agent 52 by sending an MF-agent registration request 68 to F-agent 73 to begin the registration process. *Id*. at 8:7–12. F-agent 73 will then link mobile terminal 55 to MF-agent 52. *Id*. at 8:15–16. In some embodiments, MF-agent 52 may then perform as an acting M-agent (AM-agent) for mobile terminal 55, performing the same function as an M-agent at the new location. *Id*. at 8:17–20. Accordingly, through the use of MF-agent 52, an MF-agent "is waiting with the needed data and services" when the user arrives at a remote location. *Id*. at 8:43–47.

2. Gwon (Ex. 1004)

Gwon is titled "Mobility Prediction in Wireless Mobile Access Digital Networks" and generally describes methods for predicting the mobility of mobile nodes. Ex. 1004, codes (54, 57). Gwon describes "determin[ing] in advance when a network connection hand-off is imminent" so a mobile node can pre-establish a new network connection with a new router or agent. *Id*. ¶ 55.

Gwon uses mobility prediction analysis in mobile nodes so that the mobile node can select from among multiple available network connection nodes. *Id*. ¶¶ 55–59. As a mobile node moves locations, Gwon describes the use of Neighbor Discovery methodology, where the mobile node may receive Neighbor Advertisement messages from its local router and/or unsolicited Router Advertisement messages from its local router. *Id*. ¶¶ 51,

53. These messages "indicate[] the presence of other local routers which could provide network connections for the mobile node." *Id*. ¶ 51.

3. Lau (Ex. 1005)

Lau is titled "Methods and Devices for Enabling a Mobile Network Device to Select a Foreign Agent" and is generally directed to enabling a mobile device to select a foreign agent from among a plurality of foreign agents that are transmitting position information. Ex. 1005, code (54), 4:29–42. This position information may include GPS data. *Id*. at 3:28–31.

4. IETF RFC 2402 ("IETF") (Ex. 1008)

IETF is a request for comments memorandum regarding Internet standards track protocol for "IP Authentication Header." Ex. 1008, 1. Specifically, IETF primarily describes IP Authentication Header formatting and processing, as well as authentication and security measures. Ex. 1008, §§ 1–3.

E. Ground 1 (Based on Liu and Gwon)

Petitioner contends claims 1, 5, and 6 would have been obvious over the combination of Liu and Gwon. Pet. 12–37.

1. Claim 1

a. "A system for communicating between a mobile node and a communication network; the network having at least one communications network node that is interconnected using a proxy mobile internet protocol (IP), comprising:"

Petitioner relies on Liu to teach or suggest the preamble of independent claim 1. Pet. 12–14. For example, Petitioner cites to Liu's mobile floating (MF)-agent protocol, which accommodates the "mobile nature" of mobile users by offering service and resource mobility through intelligent service pre-connection, resource pre-allocation, and data structure pre-arrangement. *Id.* at 12−13 (citing Ex. 1003, 1:58–2:2). Petitioner further relies on Liu's disclosure of proxy entities (e.g., M-agent and MF-agent) to facilitate communications between mobile nodes and networks employing Mobile IP. *Id.* at 13−14 (citing Ex. 1003, 2:11–34, 7:15–17).

Patent Owner does not dispute the teachings of Liu in connection with the preamble of claim 1. *See generally* PO Resp. Based on Petitioner's arguments and evidence, we find Petitioner has shown that Liu teaches or suggests the limitations in the preamble.

b. "at least one mobile node;"

Petitioner contends Liu's mobile terminal 55 teaches "at least one mobile node." Pet. 14–15 (citing Ex. 1003, Fig. 6). Petitioner further asserts Liu's mobile terminals may include cellular phones and laptop computers, and are capable of mobile communications. *Id.* at 15 (citing Ex. 1003, 6:4–7, 17:47–48).

Patent Owner does not dispute the teachings of Liu in connection with

this limitation. *See generally* PO Resp. Based on Petitioner's arguments and evidence, we find Petitioner has shown that Liu's mobile terminal 55 teaches or suggests this limitation.

c. "at least one home agent;"

Petitioner contends Liu's home agent 72 teaches "at least one home agent." Pet. 15–16 (citing Ex. 1003, Fig. 6). Petitioner further asserts Liu's home agent may be a "home fixed host or router." *Id.* at 16 (quoting Ex. 1003, 2:15–21).

Patent Owner does not dispute the teachings of Liu in connection with this limitation. *See generally* PO Resp. Based on Petitioner's arguments and evidence, we find Petitioner has shown that Liu's home agent 72 teaches or suggests this limitation.

d. "at least one foreign agent;"

Petitioner contends Liu's F-agent 73 teaches "at least one foreign agent." Pet. 17–18 (citing Ex. 1003, Fig. 6 ("Foreign Agent"), 7:50–56 ("After the MF-agent 52 is alternatively created or assigned, it registers itself with the Foreign Agent 73 (F-agent) (708).").

Patent Owner does not dispute the teachings of Liu in connection with this limitation. *See generally* PO Resp. Based on Petitioner's arguments and evidence, we find Petitioner has shown that Liu's F-agent 73 teaches or suggests this limitation.

> *e. "a ghost-foreign agent that advertises messages to one of the mobile nodes indicating presence of the ghost-foreign agent on behalf of one of the foreign agents when the mobile node is located in a geographical area where the foreign agent is not physically present"*

Petitioner, relying on Dr. Haas, contends Liu, or alternatively, Liu and Gwon, teach or suggest this limitation. Pet. 18–26 (citing Ex. 1006 ¶¶ 28, 32–34, 43, 72–79).

i. Liu

Petitioner contends Liu's MF-agent 52 teaches the "ghost-foreign agent." *Id.* at 18–19 (citing Ex. 1003, Fig. 6, 8:7–34, 6:53–65). Petitioner relies on Liu's "MF-agent pre-assignment" protocol to teach the remainder of the limitation, and contends the MF-assignment reply back from the MF-agent to the M-agent teaches the "advertises messages" portion of the limitation. *Id.* at 19–20 (citing Ex. 1003, 7:19–31, 7:37–46, 7:51–57). Petitioner argues the registration information in the MF-agent assignment reply "contains information sufficient to notify the mobile node of the MF-agent's presence in the foreign network." Pet. Reply 4. Petitioner argues, and Dr. Haas testifies, that one of ordinary skill in the art would have understood that the MF-agent would acquire the IP address of the foreign agent as part of the registration process, and would then forward that registration information, including the IP address of the foreign agent, to the M-agent in the MF-agent assignment reply, which would then forward it to the mobile terminal. *Id.* (citing Ex. 1010 ¶¶ 10–14); *see also* Pet. 20. Petitioner also asserts, with support from Dr. Haas, that the MF-agent acts on behalf of the F-agent. *Id.* at 5–6 (citing Ex. 1006 ¶¶ 72–73). Petitioner also contends Liu teaches such advertising when the mobile node is located

in a geographical area where the foreign agent is not physically present. Pet. 24–25 (citing Ex. 1003, 7:24–37; Ex. 1006 ¶ 79).

Patent Owner responds that Liu's MF-agent does not perform the actions recited in the claim language. PO Resp. 16. Patent Owner argues the MF-agent assignment reply does not indicate the presence of a foreign agent in a foreign network because it contains the MF-agent's registration information, which only indicates the MF-agent's successful registration with the foreign agent. *Id.* at 17 (citing Ex. 2005 ¶ 29); PO Sur-reply 6, 8. Patent Owner asserts that the M-agent is already aware of the presence of the foreign agent, and does not require the MF-agent to forward registration information of the foreign agent. PO Resp. 17 (citing Ex. 2005 ¶ 29); PO Sur-reply 6, 8. Patent Owner also argues that the MF-agent does not send information about the foreign agent to the mobile terminal, but instead, the foreign agent sends the mobile terminal information about the MF-agent. PO Sur-reply 3–4, n.2 (citing Ex. 1003, 8:9–12; 20:62–21:02).

Liu describes the following sequence of steps: (1) a mobile terminal requests the M-agent to establish an MF-agent at the location the mobile terminal is traveling to; (2) the M-agent is responsible for creating, deleting, and managing the MF-agents; (3) the MF-agent is created or assigned; (4) the MF-agent registers itself with the F-agent; (5) the MF-agent sends an MF-assignment reply back to the M-agent containing the registration information; (6) the M-agent sends a reply back to the mobile terminal and maintains a data consistency link with the MF-agent; and (7) when the mobile terminal reaches the new location, it registers with the MF-agent that has been created or assigned to it by sending an MF-agent registration request to the F-agent. Ex. 1003, 7:18–8:16.

Given the sequence described in Liu, the reply sent from the M-agent to the mobile terminal, regardless of what information it contains, is sufficient to "indicate the presence of the ghost-foreign agent [MF-agent] on behalf of one of the foreign agents." Although we agree with Patent Owner that Liu indicates that a "reply" is sent from the M-agent to the mobile node (e.g., PO Sur-reply 5, 7), as opposed to explicitly forwarding the MF-assignment reply from the M-agent to the mobile node, as Petitioner argues (e.g., Pet. Reply 4), we are not persuaded that the "reply" does not "indicate the presence of the ghost-foreign agent on behalf of one of the foreign agents" as recited in the claim. Because the process begins when the mobile terminal requests that an MF-agent be established at the location it is traveling to, we find Liu teaches that the reply it receives from the M-agent indicates that the MF-agent has been established, is registered with the foreign agent, and is present. We credit Dr. Haas' testimony in this regard, because it is consistent with Liu's disclosures. *See* Ex. 1010 ¶¶ 10–12. Moreover, Patent Owner admits that the MF-assignment reply "indicates only the MF-agent's successful registration [with the foreign agent]." PO Resp. 17; PO Sur-reply 6. We fail to see how an indication of a successful registration with the foreign agent does not also indicate the presence of the MF-agent on behalf of one or more of the foreign agents.

In addition, Petitioner offers testimony from Dr. Haas that the reply would contain "registration information," including the IP address of the foreign router that would indicate the foreign router's presence, as well as the presence of the MF-agent linked to that foreign router. Ex. 1010 ¶¶ 11,

12; Pet. Reply 4.[8] Patent Owner's argument that the MF-agent does not send information about the foreign agent to the mobile terminal, but rather, the foreign agent sends the mobile terminal information about the MF-agent, relies on disclosure describing what happens after the mobile terminal arrives in the new location, not what happens during the pre-assignment process. *See* PO Sur-reply 3–4, n.2; Ex. 1003, 20:62–21:01, 8:7–16 ("when the mobile terminal **55** *reaches the new location* . . . it sends an MF-agent registration request **68** to the F-agent **73** *at the new location* to begin the registration process . . . [and] [t]he F-agent **73** then links the mobile terminal **55** to the MF-agent **52**") (emphasis added).

We are further persuaded by Petitioner's arguments and evidence that Liu teaches advertising messages *to one of the mobile nodes*. Pet. 18–20; Ex. 1003, 7:19–57. We are not persuaded by Patent Owner's argument that the MF-agent assignment reply is a message to the M-agent, not the mobile node. PO Resp. 17 (citing Ex. 2005 ¶¶ 28–29); PO Sur-reply 7–8. Patent Owner contends that because the MF-assignment reply is first sent from the MF-agent to the M-agent, and then a reply sent from the M-agent to the mobile terminal, that the ghost-foreign agent is not advertising messages to one of the mobile nodes. PO Resp. 17. We agree with Petitioner that it is inconsequential (Pet. Reply 5) because the claim language does not preclude transmittal to an intermediary before sending the message to the mobile

[8] We disagree with Patent Owner that this is a new argument. *See* PO Sur-reply 3–4. Rather, we note that Dr. Haas testified in his original declaration accompanying the Petition that Liu's MF-assignment reply is sent "with registration information of the foreign agent," and that MF-assignment reply is "forwarded back to the mobile terminal." Ex. 1006 ¶ 74.

terminal, as occurs in Liu. Moreover, Patent Owner admitted at the hearing that the claim language does not preclude an intermediary. Tr. 32:9–12.

We are further persuaded by Petitioner's arguments and evidence that Liu teaches indicating the presence of the ghost-foreign agent *on behalf of one of the foreign agents*. Dr. Haas provides testimony that "reading the specification and the claim language [of the "417 patent] together, a ghost-foreign agent acts on behalf of a foreign agent when it furthers the proactive allocation of resources by sending advertisements on behalf of the foreign agent." Ex. 1010 ¶¶ 13–15. Dr. Haas further testifies that "Liu's MF-agent employs this same process with this same goal—having resources reconnected and preassigned." *Id.* ¶ 14 (citing Ex. 1003 ¶¶ 6–8; Ex. 1006 ¶¶ 42, 59). Dr. Haas also testifies that Dr. Nair improperly interprets "on behalf of" to mean "directed by," and one of ordinary skill in the art would have understood "on behalf of" to mean "in the interest of." *Id.* ¶ 15.

Patent Owner argues the MF-agent assignment reply is not sent on behalf of the foreign agent, but rather, is sent on behalf of the M-agent. PO Resp. 18 (citing Ex. 2005 ¶ 30); Tr. 28:10–11; PO Sur-reply 8–10. Patent Owner asserts that "when the MF-agent is reporting its registration with the foreign agent it is acting on <u>its own</u> behalf and doing so at the direction of the M-agent." PO Sur-reply 9 (citing Ex. 2005 ¶ 30; Ex. 1003, 7:24–38). Patent Owner draws our attention to column 2, lines 11 through 34 of Liu in support of this argument. *Id.* at 9–10. In support of its argument, Patent Owner also relies on an embodiment of Liu where the MF-agent may perform as an acting M-agent (AM-agent) for the mobile terminal. PO Resp. 18 (citing Ex. 1003, 8:17–20); Ex. 2005 ¶ 30.

We are not persuaded by Patent Owner's arguments that Liu's MF-agent does not indicate presence *on behalf of one of the foreign agents* because we find Dr. Haas' testimony credible and persuasive. We disagree with Patent Owner's conclusion that "the role of the MF-agent is always to act on behalf of the M-agent and not the foreign agent." *See* PO Sur-reply 10–11. The portion of column 2 relied upon by Patent Owner indicates that the MF-agent may perform some processes on behalf of the M-agent, but we agree with Petitioner that the MF-agent may also be acting on behalf of the F-agent in other circumstances. *See* Tr. 12:22–13:14 ("[T]he MF-assignment reply . . . indicates the particular foreign router [with its assigned] MF-agent . . . [and] it is . . . doing so on behalf of the foreign agent, even if it's also doing so on behalf of the M-agent as well."). Indeed, the MF-agent is "established for use by the mobile user at each of the remote fixed hosts or routers," and it must register itself with the F-agent after it is created or assigned. Ex. 1003, 2:28–30, 7:50–51. We are also not persuaded by Patent Owner's arguments regarding the embodiment of Liu that describes the MF-agent acting as an AM-agent. Rather, we agree with Petitioner and Dr. Haas that this is an alternative embodiment that describes separate functionality performed "only after the mobile node has reached its new location and thus after the resource pre-allocation process has been completed." *See* Pet. Reply 6–7; Ex. 1010 ¶ 16 (emphasis removed); Ex. 1003, 8:7–22 ("the MF-agent *now performs* as an acting M-agent (AM-agent) for the mobile terminal **55**, performing the same function as an M-agent *at the new location*.") (emphasis added).

For the foregoing reasons, we find Petitioner establishes that Liu teaches or suggests this limitation.

ii. Liu and Gwon

Petitioner alternatively contends that to the extent that the claimed advertisement message must be unsolicited, Gwon teaches unsolicited advertisements from a router (i.e. a foreign agent) via its Neighbor Discovery methodology. Pet. 20–22 (citing Ex. 1004 ¶¶ 50–54, 58). Dr. Haas provides testimony that these unsolicited router advertisements "are consistent with the advertisement messages . . . disclosed in the '417 patent" because both "notify the mobile device of the foreign agent's presence in the foreign network to facilitate resource pre-allocation." Ex. 1006, ¶ 75. Petitioner explains that:

> In the proposed modification, MF-agents, operating as software on foreign routers, simply begin the resource pre-allocation process by advertising their presence and the IP address of the foreign router they are linked to, to the mobile device. [Ex. 1010] ¶¶ 20, 21. The mobile device is communicatively linked to the M-agent operating on the home router. *Id.* As the M-agent becomes aware of which MF-agents are available in the foreign network, the M-agent can initiate a data link between the next MF-agent and itself for proactive resource allocation. *Id.* The mobile device updates the M-agent with its location information as it travels, including its predicted destination, allowing the M-agent to initiate the data link with the optimal MF-agent. *Id.* This simplifies and enhances the pre-allocation process by obtaining the presence of available MF-agents and foreign agents early on, without the need for an original request by the mobile device. *Id.*

Pet. Reply 9–10; *see also id.* at 12–13. Petitioner also contends Gwon teaches such advertising when the mobile node is located in a geographical area where the foreign agent is not physically present. Pet. 25–26 (citing Ex. 1004 ¶¶ 52–53, Fig. 2).

Petitioner, with testimony from Dr. Haas, argues that a person of

ordinary skill in the art would have been motivated to modify Liu to allow Liu's MF-agent to proactively broadcast its presence to the mobile node since it is "simply applying a known technique to a known device ready for improvement to yield predictable results." *Id.* at 23 (citing Ex. 1006 ¶¶ 77–78). Petitioner asserts proactive broadcasts were well known and would have (1) "facilitated the pre-assignment of a mobile device before it reached the foreign network, decreasing the time required to complete a handover with a foreign agent at a new network to which the mobile device was travelling" and (2) "decreased the computational burden on the mobile device by removing the need to request the assignment of a MF-agent, shifting this burden to the MF-agent on a router in the foreign network." *Id.* (citing Ex. 1006 ¶¶ 77–78); *see also* Pet. Reply 10. Therefore, Petitioner contends combining Gwon's known Neighbor Discovery protocol with the MF-agent pre-assignment protocol of Liu "comports with the actual historical evolution of the technology at the time, which resulted in a more efficient and simplistic method to pre-allocate resources," and therefore, would have been obvious to one of skill in the art. Pet. 24–26 (citing Ex. 1006 ¶¶ 77–79).

Patent Owner does not dispute the teachings in Gwon, but, rather, disputes the combination of Liu with Gwon. PO Resp. 19–25; PO Sur-reply 11–14. Patent Owner argues that Gwon is a router, not a proxy acting on behalf of a router, and Petitioner does not "explain why a person of ordinary skill in the art would adopt a process performed by a foreign router ('foreign agent') itself (transmission of Gwon's unsolicited Router Advertisement message) in a proxy such as a ghost-foreign agent." PO Resp. 21. According to Patent Owner, relying on testimony by Dr. Nair, Petitioner's

proposed modification "is an entire change in the principle of operation of Liu's MF-agent" because the MF-agent would be proactively broadcasting its presence rather than the MF-agent reporting its successful registration back to the M-agent, which would result in elimination of the means for provisioning the data link with the M-agent. *Id.* at 22 (citing Ex. 2005 ¶¶ 33–35). Patent Owner argues that because the proposed modification eliminates this vital component of Liu, the MF-agent assignment request through the mobile terminal, "it is not an obvious modification." *Id.* (citing *In re Ratti*, 270 F.2d 810, 813 (CCPA 1959) and *In re Gordon*, 733 F.2d 900, 902 (Fed. Cir. 1984)); PO Sur-reply 12. Patent Owner also argues that because the M-agent requests creation of the MF-agent and the MF-agent reports its registration to the M-agent, "the MF-agent does not need to perform any neighbor discovery." PO Resp. 24 (citing Ex. 1004 ¶¶ 51, 53; Ex. 2005 ¶ 35).

We find that Petitioner has established that the combination of Liu and Gwon teaches or suggests the limitation. We further find Petitioner has provided persuasive rationale to combine Liu and Gwon in the proposed manner. *See* Pet. 23–26. Specifically, the modification applies a known technique (broadcasting unsolicited advertisements) to a known device (Liu's MF-agent) ready for improvement to yield predictable results (e.g., to pre-connect, resource pre-allocate resources, and prearrange data structure). *See* Ex. 1006 ¶ 77; *KSR*, 550 U.S. at 418–419.

Petitioner offers unrebutted testimony that proactive broadcasting was well known at or before the time of filing of the invention. *See* Pet. 23–25 (citing Ex. 1006 ¶¶ 77–78; Ex. 1010 ¶ 19); Pet. Reply 10. Further, Petitioner offers testimony from Dr. Haas, which we find credible, explaining how and

why the proposed modification would optimize Liu's pre-allocation of network resources, and would comport with the natural progression of the industry at or around the time of filing of the '417 patent. Pet. 22–25 (citing Ex. 1006 ¶¶ 77–78); Pet. Reply 9 (Ex. 1006 ¶ 77; Ex. 1010 ¶¶ 18–19). We agree with Petitioner that the proposed modification is consistent with Liu's process to provide pre-connection, resource pre-allocation, and data structure-prearrangement to accommodate the mobile nature of mobile users through the use of a MF-agent. Pet. Reply 9 (citing Ex. 1010 ¶¶ 17–19); *see* Ex. 1003, 1:58–64. The modification proposed by Petitioner causes the MF-agent to broadcast its presence at the outset, and then proceed with the rest of what Liu teaches. *See* Ex. 1006 ¶ 77; Ex. 1010 ¶ 27; Tr. 15:23–25. In this way, the process is initiated by the MF-agent, rather than waiting for the MF-agent to be identified in response to a request from the mobile terminal. Pet. 23, Pet. Reply 9–10; Ex. 1010 ¶¶ 20, 27; Tr. 15:23–25. We find credible Dr. Haas' testimony that explains that the role of the M-agent does not change in the proposed modification. *See* Ex. 1010 ¶¶ 20–21. For example, the M-agent continues to be responsible for creating, deleting, and managing MF-agents, as well as to send a reply back to the mobile terminal and maintain a data consistency link with the MF-agent. Ex. 1003, 7:23–25, 55–57; Ex. 1010 ¶¶ 20–21. The proposed modification provides that the M-agent will already be aware if an MF-agent exists and is present, based upon the MF-agent broadcast.

The combination of Liu and Gwon, therefore, would operate in the same manner as Liu alone to provide pre-connection, resource pre-allocation, and data structure-prearrangement to accommodate the mobile nature of mobile users through the use of a MF-agent. Accordingly, as we

find the combination does not change the principle of operation of Liu, we find Patent Owner's reliance on *Ratti* and *Gordon* inapplicable here. *See, e.g., In re Umbarger,* 407 F.2d 425, 430–31 (C.C.P.A. 1969) (finding *Ratti* inapplicable where the modified apparatus will operate "on the same principles as before").

We are also not persuaded by Dr. Nair's testimony that a person of skill in the art would be dissuaded from making the combination because it "deliberately add[s] redundant (indeed, unnecessary) messages with a wireless communication network as they would only serve to consume bandwidth while providing no additional capabilities of advantages." Ex. 2005 ¶ 35. It is not necessary for a combination to be the most desirable combination described in the prior art to provide motivation for making the combination. *PAR Pharm., Inc. v. TWI Pharms., Inc.*, 773 F.3d 1186, 1197–98 (Fed. Cir. 2014) (citing *Galderma Labs., L.P. v. Tolmar, Inc.*, 737 F.3d 731, 738 (Fed. Cir. 2013)) (obviousness "does not require that the motivation be the *best* option, only that it be a *suitable* option from which the prior art did not teach away"); *In re Fulton*, 391 F.3d 1195, 1200 (Fed. Cir. 2004). We find any potential redundancies alleged by Patent Owner are not sufficient to obviate the rationale and motivation provided by Petitioner. *E.g.*, Pet. 22–25 (citing Ex. 1006 ¶¶ 77–78); Pet. Reply 9 (Ex. 1006 ¶ 77; Ex. 1010 ¶¶ 18–19); *see also* Ex. 1006 ¶¶ 20–21. For the same reasons, we are not persuaded by Patent Owner's arguments that the natural progression of the industry would dissuade a person of ordinary skill in the art from making the modification because the foreign agent itself would announce its own presence, rather than relying on a proxy. *See* PO Resp. 24.

We agree with Petitioner that the notification provided by the M-agent in Liu is a reply, sent after the MF-agent sends an MF-assignment reply back to the M-agent, containing the registration information. *See* Pet. Reply 11 (citing Ex. 1010 ¶ 11). Thus, we are also unpersuaded by Patent Owner's argument that the MF-agent does not need to perform neighbor discovery (as in Gwon). *See* PO Resp. 24. In the proposed combination of Liu and Gwon, the MF-agent will still be responsible for notifying the mobile node of the presence of neighboring nodes, as it was in Liu alone. *See* Pet. Reply 11 (citing Ex. 1010 ¶¶ 20–21).

We are also unpersuaded by Patent Owner's assertions that Dr. Haas is "wrong" that the modification requires only a simple modification of software on a router in the foreign network. PO Sur-reply 13–14 (citing Ex. 1010 ¶ 18). Patent Owner does not provide persuasive evidence that Dr. Haas is "wrong" or to persuasively rebut Dr. Haas' testimony that only a simple modification of software on the router on the foreign network is required.

Accordingly, based on Petitioner's arguments and evidence, we find Petitioner articulates sufficient reasoning for the proposed modification of Liu with Gwon to support the legal conclusion of obviousness. *See KSR*, 550 U.S. at 398, 417–418. For the foregoing reasons, we find Petitioner has established that Liu, in combination with Gwon, teaches or suggests this limitation.

f. "a ghost-mobile node that creates replica IP messages on behalf of a mobile node,"

Petitioner relies on Liu to teach or suggest this limitation. Pet. 27–29. Petitioner, with testimony from Dr. Haas, contends one of ordinary skill in the art would have understood a "replica IP message" to "at least include a reproduction of an original IP message." *Id.* at 27 (citing Ex. 1006 ¶ 80, Ex. 1001, 10:1–6). Petitioner asserts that in Liu, the request to create or assign an MF-agent at a predicted location is initiated by the mobile terminal and sent to the M-agent (the ghost-mobile node). *Id.* at 29 (citing Ex. 1003, 7:22–38). Petitioner contends the M-agent then "forwards" the request to the remote MF-agent manager at the predicted location. *Id.* (citing Ex. 1003, 7:22–38). According to Petitioner, and with support of testimony from Dr. Haas, one of ordinary skill in the art would have understood this forwarding request to a remote location on a different network teaches "*creat[ing] replica IP messages on behalf of the mobile node*" because this "forwarding process results in a reproduction of the original message request." *Id.* at 29–30 (citing Ex. 1006 ¶ 83).

Patent Owner does not dispute the teachings of Liu in connection with this limitation. *See generally* PO Resp. Similar to the '417 patent, Liu explicitly discusses Mobile *IP* protocol. *See, e.g.* Ex. 1003, 1:28, 5:55–61; Ex. 1001, 1:44–56. Dr. Haas provides unrebutted testimony describing Mobile IP protocol, Ex. 1006 ¶¶ 25–36, and, more specifically, stating that Mobile IP encapsulation, such as that described in Liu, teaches the recited "creating replica IP messages." *Id.* ¶¶ 80–83. Based on Petitioner's arguments and evidence, we find Petitioner has shown that Liu teaches or suggests this limitation.

> *g. "the ghost-mobile node handling signaling required to allocate resources and initiate mobility on behalf of the mobile node, the ghost-mobile node triggering signals based on a predicted physical location of such mobile node or distance with relation to the at least one foreign agent."*

Petitioner asserts Liu, or alternatively, Liu and Gwon, teaches or suggests this limitation. Pet. 30–34. Petitioner, relying on testimony from Dr. Haas, contends a person of ordinary skill in the art would have understood "handling signaling required to allocate resources and initiate mobility" to include "preemptive setup and initiation of the mobility process." *Id.* at 30 (citing Ex. 1006 ¶ 84). Petitioner relies on Liu's M-agent's (ghost-mobile node) pre-assignment signaling that allows for "services and/or data [to] be pre-connected/pre-arranged at the mobile user's destination." *Id.* at 31 (citing Ex. 1003, 2:29–35, Fig. 5). Petitioner further refers to the M-agent sending the pre-assignment signaling based on the use of predictive mobility management (PMM), including the predicted physical location of the terminal, to trigger service and resource pre-arrangement. *Id.* at 31–33 (citing Ex. 1003, 7:22–38, 19:4–14).

Alternatively, Petitioner argues Gwon teaches three different methods of mobility prediction analysis that may be used to "trigger pre-hand-off processing of authentication and security measures" or to "trigger selection of a new network connection." *Id.* at 33 (citing Ex. 1004 ¶¶ 57, 59–104) (emphasis omitted). Petitioner argues, with supporting testimony from Dr. Haas, that a person of ordinary skill in the art would have been motivated to substitute Liu's PMM mobility functions with the alternative mobility prediction functionality disclosed in Gwon, because it is simply

substituting one known element for another to obtain predictable results. *Id.* at 34 (citing Ex. 1006, ¶ 87). Petitioner further argues the substitution would have been a suitable and obvious variation to one of ordinary skill in the art. *Id.*

Patent Owner does not dispute the teachings of Liu or Gwon in connection with this limitation. We are persuaded by Petitioner's unrebutted evidence that Liu or, alternatively, Liu and Gwon, teach or suggest this limitation. First, we agree with Petitioner that Liu's M-agent handles pre-assignment signaling on behalf of the mobile device to prearrange services (allocate resources) and initiate mobility on behalf of the mobile device, and further does so based on a predicted physical location of the mobile device. *See* Ex. 1006 ¶¶ 85, 86; Ex. 1003, 7:22–38, 19:4–14. We also agree with Petitioner that Gwon teaches alternative location prediction methods that may be substituted for Liu's PMM location prediction method. *See* Ex. 1006 ¶ 87; Ex. 1004 ¶¶ 60–62. Petitioner persuasively demonstrates that Gwon's method could be substituted for Liu's PMM to produce an accurate predicted location. Ex. 1006 ¶ 87 ("well known to utilize more than one location determination method to verify the results of the first method . . . [as] [t]he particular method for determining the predicted location of the mobile device could be selected for efficiency and convenience…").

Accordingly, based on Petitioner's arguments and evidence, we find Petitioner has shown that Liu, or alternatively, Liu and Gwon, teaches or suggests this limitation.

In view of the foregoing, we find Petitioner has shown by a preponderance of the evidence that the subject matter of claim 1 would have been obvious in view of Liu and Gwon.

2. Claim 5

Claim 5 depends from claim 1 and further recites "wherein allocation of resources on behalf of the mobile node is triggered based at least in part on location information, the location information determined by at least one of: a global positioning system (GPS) receiver, a triangulation process, and indirect measurements of location." Ex. 1001, 13:21–26.

Petitioner relies on Liu, or alternatively, Liu and Gwon, to teach or suggest the limitations in dependent claim 5. Pet. 34–36. Petitioner contends Liu teaches "indirect measurements of location that trigger resource allocation on behalf of a mobile terminal utilizing predictive mobility management (PMM) functions to measure the user's historical movement patterns." *Id.* at 34 (citing Ex. 1001, 6:57–64; 8:56–57). Dr. Haas provides testimony that a person of ordinary skill in the art would have understood Liu's PMM functions to constitute indirect measurements of location. Ex. 1006 ¶ 89.

Alternatively, Petitioner contends Gwon teaches providing location information by a triangulation process and/or a global positioning system. Pet. 35 (citing Ex. 1004 ¶ 76). Petitioner, with supporting testimony from Dr. Haas, contends it would have been obvious to one of skill in the art "to substitute one location determination method for another, as this is substituting one known element for another to obtain predictable results." *Id.* at 36 (citing Ex. 1006 ¶ 90).

Patent Owner does not dispute the teachings of Liu or the combination of Liu and Gwon in connection with this limitation. Based on Petitioner's arguments and evidence, we find Petitioner has shown by a preponderance of the evidence that the subject matter of claim 5 would have been obvious

in view of Liu and Gwon.

3. Claim 6

Claim 6 depends from claim 1 and further recites "wherein the at least one ghost-foreign agent populates mobile IP Advertisement messages with at least one care-of-address of neighboring foreign agents in order to extend the range of neighboring foreign agents." Ex. 1001, 13:27–31.

Petitioner relies on Gwon to teach that an advertisement message may also include the care-of address of neighboring foreign agents. Pet. 36 (citing Ex. 1004 ¶ 51). Petitioner asserts one of ordinary skill in the art "would have recognized that Gwon's disclosure of a Router Advertisement message that indicates the presence of other local routers would contain the IP address of those other local routers (i.e. their care-of-address in the network) to indicate their presence." *Id.* at 37 (citing Ex. 1006 ¶ 91).

In our Institution Decision, we were not persuaded Petitioner had shown a reasonable likelihood that it would prevail in showing that claim 6 is unpatentable over Liu and Gwon. Inst. Dec. 22. We stated:

> However, based on our review of the Petition, Gwon describes providing a new care-of IP address to the mobile node's home router as part of the registration process (after the new local router has been identified), but does not disclose populating the advertisement message with care-of addresses of at least one neighboring foreign agent (during the router identification process). Ex. 1004 ¶ 54; *see also* Ex. 1006 ¶ 52.

Id. Petitioner has not provided further evidence or argument as to claim 6. For the reason noted above, we reiterate our finding that the Liu-Gwon combination does not teach or suggest "at least one ghost-foreign agent populates mobile IP Advertisement messages with at least one care-of-

address of neighboring foreign agents." Accordingly, we determine Petitioner has not demonstrated by a preponderance of the evidence that the subject matter of claim 6 would have been obvious over Liu and Gwon.

F. Ground 2 (Based on Liu, Gwon, and Lau)

Petitioner contends claims 2 and 3, which depend from claim 1, would have been obvious over the combination of Liu, Gwon, and Lau. Pet. 37–45. Aside from its arguments with respect to claim 1, Patent Owner has not disputed Petitioner's analysis as to these claims. *See* PO Resp. 26.

1. Claim 2

Claim 2 depends from claim 1 and further recites "wherein signaling further comprises registration with a replica of the mobile node by the ghost-mobile node to communicate with the foreign agents, triggering tunneling and communication with a mechanism configured to maintain routing information to a mobile node." Ex. 1001, 13:1–5.

Petitioner, with support from Dr. Haas, relies on Liu and Lau to teach or suggest the limitations in claim 2. Pet. 38–42. Specifically, Petitioner refers to Liu's AM-agent as teaching the "replica of the mobile node" and Liu's M-agent as teaching the "mobile node," and asserts the M-agent registers and maintains a data consistency link with the AM-agent to communicate with a foreign agent. *Id.* at 38–39 (citing Ex. 1003, 2:6–10, 2:44–53, 8:7–34; Ex. 1006 ¶ 93). Petitioner relies on Lau to teach or suggest "tunneling and communication with a mechanism configured to maintain routing information to a mobile node." *Id.* at 40–41 (citing Ex. 1005, 2:48–59). Specifically, Petitioner refers to Lau's teaching a packet forwarding mechanism implemented by the Home and Foreign Agents that is referred to

as "tunneling." *Id.* at 41 (citing Ex. 1005, 2:48–59).

Petitioner, with supporting testimony from Dr. Haas, contends one of ordinary skill in the art would have been motivated to combine the M-agent registration signaling of Liu with the well-known technique of Lau for tunneling because it is "applying a known technique to a known device ready for improvement to yield predictable results." *Id.* (citing Ex. 1006 ¶ 94). We credit Dr. Haas's testimony because we agree that tunneling was commonplace in mobile networks and provided many benefits that would have been well known to a person of ordinary skill in the art, such as providing a secure channel between two disjoint IP networks and allowing for circumvention of traditional routing limitations. *Id.* at 41–42 (citing Ex. 1006 ¶ 94).

Patent Owner does not dispute the teachings of Liu or Lau, or the combination of Liu and Lau in connection with claim 2. Based on Petitioner's arguments and evidence, we find Petitioner has shown by a preponderance of the evidence that the subject matter of claim 2 would have been obvious in view of Liu and Lau.

2. Claim 3

Petitioner contends Liu, Lau, and Gwon teach or suggest the limitations in claim 3. Pet. 42–45. Petitioner relies on its arguments made with respect to claim 2 to support its assertion that Liu in combination with Lau discloses "signaling further comprises at least one of a tunnel and a communication network to allocate resources between the mobile node and foreign agent." *Id.* at 42–43. In addition, Petitioner argues Gwon teaches the recited "signaling being triggered at a threshold distance to one of the foreign agents reported by one of the mobile nodes, the threshold distance

reported to one of the foreign agents at least one of a projected trajectory and a speed." *Id.* at 43. Specifically, Petitioner contends "Gwon teaches a mobility prediction analysis that provides a threshold value indicating a distance from a mobile node to a node in the network, which informs the mobile node to begin signaling to establish a new network connection." *Id.* (citing Ex. 1004 ¶ 57). Petitioner further contends Gwon "teaches the use of GPS information to provide the threshold value indicating how close the mobile node is to another node in the network." *Id.* at 44 (citing Ex. 1004 ¶ 59). Petitioner asserts one of ordinary skill in the art would have understood "'information such as that provided by GPS' to include both a trajectory and a speed when calculating an estimated destination." *Id.* (citing Ex. 1006 ¶¶ 95–96).

In our Institution Decision, we were not persuaded Petitioner had shown a reasonable likelihood that it would prevail in showing that claim 3 is unpatentable over Liu, Lau, and Gwon. Inst. Dec. 24–25. We stated:

> However, based on our review of the Petition, we do not find Petitioner's analysis convincing. Although Gwon describes determining a threshold value as part of the mobility prediction analysis to determine when some desired action should be taken by the mobile node (Ex. 1004 ¶ 57), Petitioner has not identified where Gwon teaches reporting the "threshold distance . . . to one of the foreign agents."

Id. at 25.

Petitioner disputes our interpretation of claim 3. Petitioner argues, with supporting testimony from Dr. Haas, that our interpretation "requiring the mobile node to report the threshold distance to a foreign agent would be inconsistent with the claimed resource pre-allocation process . . . [because] the foreign agent in the foreign network would have no use for this threshold

indication" because it is the ghost-mobile node that makes use of the distance calculations. Pet. Reply 22 (citing Ex. 1010 ¶¶ 33–34); *see also* Tr. 24:26–25:21. Petitioner argues that the specification of the '417 patent teaches that "the ghost-mobile node contains the algorithms and thresholds required to determine when to send the signaling information to the next foreign agent," which supports that in claim 3 "the ghost-mobile node's signaling process is triggered upon receipt of the mobile node's distance calculation to a foreign agent." *Id.* at 21–22 (citing Ex. 1010 ¶¶ 32–34). Petitioner, therefore, argues claim 3 does not require "the mobile node to report (i.e., transmit) a threshold distance calculation to a foreign agent in a foreign network." *Id.* at 20–21.

At the hearing, Petitioner argued "[w]e have a threshold distance to a foreign agent first; and second, we have that the distance is reported by one of the mobile nodes . . . [but] it is not actually reported to a foreign agent." Tr. 20:15–17, 22. Petitioner also asserted that the claim language was ambiguous because there is no antecedent basis for a threshold distance that has been reported to a foreign agent, but rather, only antecedent basis for a threshold distance that is reported by the mobile node. *Id.* at 22:15–23. Petitioner also argued that it is ambiguous if the term "reported" is modifying a threshold distance or a threshold distance to one of the foreign agents, but at any rate, the intrinsic evidence indicates that it makes no sense to report to the foreign agent, but rather, it is reported by the mobile node to the ghost-mobile agent. *Id.* at 24:5–25. Petitioner further argued the last limitation is not adding reporting the threshold distance to the foreign agent, but is just stating that the threshold distance is at least one of a projected trajectory and speed. *Id.* at 23:22–25. Patent Owner does not present

separate arguments for claim 3.

We do not find Petitioner's arguments, or Dr. Haas' supporting testimony, to be persuasive. Claim 3 depends from claim 1 and recites "wherein signaling further comprises at least one of a tunnel and a communication network to allocate resources between the mobile node and foreign agent, *the signaling being triggered at a threshold distance to one of the foreign agents reported by one of the mobile nodes, the threshold distance reported to one of the foreign agents at least one of a projected trajectory and a speed*." Ex. 1001, 13:6–12 (emphasis added).

As an initial matter, we are not persuaded the claim language is ambiguous or lacks antecedent basis. The limitation "a threshold distance to one of the foreign agents reported by one of the mobile nodes" indicates a threshold distance is reported by one of the mobile nodes, and the following limitation, "the threshold distance reported to one of the foreign agents at least one of a projected trajectory and a speed," requires that the threshold distance is reported to one of the foreign agents and further requires that at least one of a projected trajectory and speed is reported to the foreign agent.

Petitioner's interpretation of claim 3 urges us to read out the claim language "reported to one of the foreign agents." We decline to do so. *See K-2 Corp. v. Salomon S.A.*, 191 F.3d 1356, 1364–1365 (Fed. Cir. 1999) ("Courts do not rewrite claims; instead, we give effect to the terms chosen by the patentee."). The words of the claim are clear that the threshold distance is reported to one of the foreign agents. *See, e.g., Texas Instruments Inc. v. Int'l Trade Comm'n*, 988 F.2d 1165, 1171 (Fed.Cir.1993) ("[T]o construe the claims in the manner suggested by TI would read an express limitation out of the claims. This, we will not do because '[c]ourts

can neither broaden nor narrow claims to give the patentee something different than what he has set forth.'" (quoting *Autogiro Co. of Am. v.U.S.*, 384 F.2d 391, 396 (Ct. Cl. 1967))).

We find Petitioner has not demonstrated that the combination of Liu, Lau, and Gwon teach or suggest the limitations in claim 3 because Petitioner has not shown that the references teach or suggest "the threshold distance reported to one of the foreign agents at least one of a projected trajectory and a speed." Accordingly, we determine Petitioner has not demonstrated by a preponderance of the evidence that the subject matter of claim 3 would have been obvious over Liu, Lau, and Gwon.

G. Ground 3 (Based on Liu, Gwon, and IETF)

Petitioner contends claim 4 would have been obvious over the combination of Liu, Gwon, and IETF. Pet. 45–49. Aside from its arguments with respect to claim 1, Patent Owner has not disputed Petitioner's analysis as to claim 4. *See* PO Resp. 26–27.

Claim 4 depends from claim 1 and further recites

> wherein the at least one ghost-mobile node is a proxy element for the at least one foreign agent and the at least one mobile node, the at least one ghost-mobile node triggering registration based on a distance to a foreign agent by relaying security and shared secrets from a mobile node, and at least one advertisement message from a foreign agent in a vicinity of the ghost-mobile node.

Ex. 1001, 13:14–20.

Petitioner relies on Liu, Gwon, and IETF to teach or suggest the limitations in claim 4. Pet. 45–49. Petitioner asserts Liu's M-agent is a proxy element between a mobile terminal and a foreign agent, and functions

as a proxy for both the mobile node and the foreign agent. *Id.* at 45 (citing Ex. 1006 ¶ 98). Petitioner also asserts Gwon teaches triggering registration using security information and authentication data based on a distance to a foreign agent. *Id.* at 46 (citing Ex. 1004 ¶ 57). Petitioner further contends IETF discloses the use of MD5 authentication algorithms and security protocols during registration of the mobile node, to provide security and confidentiality services between a mobile node connecting with a foreign agent. *Id.* at 47 (citing Ex. 1008 §§ 1, 3). Petitioner further contends Liu teaches an advertisement message, for the reasons asserted with respect to claim 1, and Gwon teaches a distance based triggering mechanism for foreign agent advertisements. *Id.* at 48 (citing Ex. 1004 ¶ 57; Ex. 1006 ¶ 98).

With respect to the combination, Petitioner, with supporting testimony from Dr. Haas, contends a person of ordinary skill in the art would have found it obvious to combine Liu's pre-registration signaling and foreign agent advertising with Gwon's triggering mechanism for these processes. *Id.* (citing Ex. 1006 ¶¶ 99–100). Petitioner asserts such a modification to Liu "would eliminate the need for a mobile device to use solicitation processing abilities or location prediction methods for registration, thereby increasing the processing speed of the mobile device and decreasing the overall computational complexity of the system." *Id.* (citing Ex. 1006 ¶¶ 99–100). Petitioner argues adding IETF would be similarly obvious because Gwon provides an explicit motivation for the combination by incorporating the reference in its own disclosure. *Id.* at 49 (citing Ex. 1006 ¶¶ 99–100). Petitioner also contends implementing software algorithms for security protocols "would have been commonplace for preregistration and

would have added negligible complexity to the system." *Id.* (citing Ex. 1006 ¶¶ 99–100).

Patent Owner does not present separate arguments in connection with claim 4. Based on Petitioner's arguments and evidence, which we find credible, we find Petitioner has shown by a preponderance of the evidence that the subject matter of claim 4 would have been obvious over the combination of Liu, Gwon, and IETF.

H. Ground 4 (Based on Liu and Lau)

Petitioner contends claim 7 would have been obvious over the combination of Liu and Lau. Pet. 49–56.

1. Claim 7

a. "A method, in a mobile node, for speeding handover, comprising the steps of:"

Petitioner relies on Liu to teach or suggest the preamble of independent claim 7. Pet. 49–50. For example, Petitioner relies on Liu's Mobile-Floating agent functions, which "allow[] the users to immediately receive service and maintain their data structures with virtually the same efficiency as they could have at the previous location. It also provides 'soft data structure handoff' capability." *Id.* (citing Ex. 1003, 2:3–10 (emphasis omitted)).

Patent Owner does not dispute the teachings of Liu in connection with the preamble of claim 7. Based on Petitioner's arguments and evidence, we find Petitioner has shown that Liu teaches or suggests the limitations in the preamble.

b. "updating, in a mobile node, a location in a ghost mobile node;"

Petitioner relies on Liu to teach or suggest this limitation. Pet. 49–50. Specifically, Petitioner argues "Liu discloses a mobile terminal ('mobile node') that updates an M-agent ('ghost-mobile node') with respect to its future travel and the M-agent then determines the closest foreign agent to that future predicted location." *Id.* at 50–51 (citing Ex. 1003, 7:26–32). Petitioner further relies on Lau, which "discloses a mobile device (mobile node) that maintains its own current location information to calculate a distance between itself and approaching foreign agents." *Id.* at 51 (citing Ex. 1005, 4:29–41).

Petitioner, with supporting testimony from Dr. Haas, contends one of ordinary skill in the art "would have been motivated to modify the mobile node in Liu to send current location information to the M-agent as it travels as disclosed in Lau, to supplement the predictive mobility analysis." *Id.* (citing Ex. 1006 ¶¶ 102–103). Petitioner asserts "[t]his is merely using a known technique to improve a similar device in the same way and/or combining prior art methods according to known methods to yield predictable results." *Id.* (citing Ex. 1006 ¶¶ 102–103). Petitioner further argues one of ordinary skill in the art would have understood the benefits of sending current location data, such as, for example, creating a more efficient system for locating the closest handoff point in the foreign network. *Id.* at 51–52 (citing Ex. 1006 ¶¶ 102–103).

Patent Owner argues that Petitioner's analysis concerns updating the ghost mobile node (M-agent) with respect to future travel of a mobile terminal (mobile node), which is the reverse of what is claimed. PO Resp.

30. Patent Owner argues that "the mobile node is provided notification (i.e., the mobile node is updated) of a next foreign agent proximate the estimated future location of the mobile node (i.e., a location in a ghost mobile node)." *Id.* at 28 (citing Ex. 1001, 3:11–18). Patent Owner explains that "the mobile node is updated with a next foreign agent proximate its predicted future location—that is, a location in a ghost mobile node." *Id.* at 29 (citing Ex. 1001, 2:55–67; 6:14–17, 7:4–7, 8:58–61). At the hearing, Patent Owner clarified that essentially, the mobile node is being updated with a location that has been determined by the ghost-mobile node. Tr. 37:2–5.

Petitioner argues that under Patent Owner's interpretation, there is no reason for the ghost-mobile node to calculate the distance of the foreign agent, as claimed in the following limitation, because the mobile node would already have that location information. Pet. Reply 15–16 (citing Ex. 1010 ¶¶ 30–31). Petitioner further argues that Patent Owner's arguments are contradicted by the Specification of the '417 patent, which indicates that "the ghost mobile node acts according to a predicted future state, such as location, of the mobile node." *Id.* at 16. Petitioner also states that two distinct district court proceedings involving the '417 patent construed this limitation to mean "updating the ghost mobile node with a location of the mobile node." *Id.* at 18. Petitioner also provides supporting testimony from Dr. Haas and points out that Patent Owner did not present any expert testimony as to how one of skill in the art would understand this limitation. *Id.* at 19; *see* Ex. 1010 ¶¶ 30–31.

As we stated in the Institution Decision,

> Patent Owner's argument is based on a claim construction: whether the mobile node itself must be updated with the location in a ghost mobile node. Patent Owner, however, does

> not direct our attention to any portion of the '417 patent that supports its interpretation of this limitation. Rather, the '417 patent indicates that the ghost mobile node acts according to a predicted future state, such as location, of the mobile node. *E.g.*, Ex. 1001, 2:58–65, 6:27–30, 6:39–42, 6:46–56, 6:65–67, 7:4–7). The claim language recites "updating, in a mobile node, a location in a ghost mobile node," which, for purposes of this decision, we understand to mean that the mobile node updates the ghost mobile node with its location. *See id*.

Inst. Dec. 28–29.

The central points of the parties' dispute are (1) what is being updated (a location of a mobile node or a next foreign agent proximate the mobile node's predicted location); and (2) where is the update occurring (in a ghost-mobile node or in a mobile node). The claim language recites "updating, in a mobile node, a location in a ghost mobile node." When the claim language is not clear on its face, we may consider the rest of the intrinsic evidence, including the specification, to attempt to resolve the lack of clarity. *See Interactive Gift Exp., Inc. v. Compuserve, Inc.*, 256 F.3d 1323, 1331 (Fed. Cir. 2001).

After review of the complete record, we maintain our decision that "updating, in a mobile node, a location in a ghost mobile node" means the mobile noted updates the ghost mobile node with its location. As Petitioner points out, the Specification supports this interpretation. *E.g.*, Ex. 1001, 2:58–65, 6:27–30, 6:39–42, 6:47–56, 6:65–67, 7:4–7. Specifically, the Specification describes that location information of the mobile node can be obtained from a GPS unit, for example, and be used by the ghost-mobile node to estimate future locations of the mobile node. *Id.* at 6:47–61; 7:4–9. We have reviewed the portions of the Specification relied upon by Patent Owner, *see* PO Resp. 28–29, but do not agree they describe that a mobile

node is updated with a location in a ghost mobile node, as Patent Owner argues. For example, Patent Owner cites to portions of the Specification describing that the ghost-mobile node predicts future locations of the mobile node, e.g., PO Resp. 29 (citing Ex. 1001, 2:55–67, 7:4–7), but none of these disclosures indicate that the location is updated in the mobile node. Patent Owner also cites to portions of the Specification describing sending a notification to the mobile node indicating a presence of a next foreign agent proximate to the estimated future location of the mobile node, e.g., PO Resp 28, 29 (citing Ex. 1001, 3:11–18; 8:58–61), however, such a notification indicating presence is not a location in a ghost-mobile node. We credit Dr. Haas' testimony on this point. *See* Ex. 1010 ¶¶ 30–31.

Accordingly, we interpret this term as meaning that the mobile node updates the ghost mobile node with its location. Moreover, we note that our interpretation, is consistent with the district court's interpretation. *See Mobility Workx, LLC v. Cellco P'ship d/b/a Verizon Wireless, et al.*, No. 4:17-CV-872 (E.D. Tex.) at Dkt. 74; *Mobility Workx, LLC v. T-Mobile US, Inc., et al.*, No. 4:17-CV-567 (E.D. Tex.) at Dkt. 48.

Based on Petitioner's arguments and evidence, we find Petitioner has shown that the combination of Liu and Lau teach or suggest this limitation as construed. We further find Petitioner articulates sufficient reasoning for the proposed modification of Liu with Lau to support the legal conclusion of obviousness.

c. "determining a distance, in the ghost mobile node in communication with the mobile node, to a closest foreign agent with which the mobile node can complete a handover;"

Petitioner, with support from Dr. Haas, relies on Liu and Lau to teach or suggest this limitation. Pet. 52–53. For example, Petitioner argues "Liu teaches a system where the M-agent ('ghost-mobile node') uses the predicted location of the mobile terminal in conjunction with an MF-agent protocol to assign the closest MF-agents with which the mobile device may complete a handover." *Id.* at 52–53 (citing Ex. 1004, 12:52–66). Petitioner also asserts "Lau allows for the mobile network device to utilize its own location information in conjunction with GPS information sent from foreign agents to calculate the distance to the closest foreign agent." *Id.* at 53 (citing Ex. 1005, 3:43–57).

Petitioner, with supporting testimony from Dr. Haas, further contends one of ordinary skill in the art would have been motivated to modify Liu "with the method in Lau for measuring the position of a mobile device in relation to the position of the foreign agents in the network to calculate the nearest foreign agent since this is combining prior art methods according to known methods to yield predictable results." *Id.* at 54 (citing Ex. 1006 ¶¶ 102–103). Petitioner asserts this "would have provided a more accurate method of finding the shortest distance to the next closest handoff point" and "would also have provided a faster system for finding the next handover location when the mobile device deviates from its original course." *Id.* (citing Ex. 1006 ¶¶ 102–103).

Patent Owner does not dispute the teachings of Liu and Lau in connection with this limitation. Based on Petitioner's arguments and

evidence, we find Petitioner has shown that the combination of Liu and Lau teach or suggest this limitation. We further find Petitioner articulates sufficient reasoning for the proposed modification of Liu with Lau to support the legal conclusion of obviousness. *See KSR*, 550 U.S. at 398, 417–418.

> *d. "submitting on behalf of the mobile node, from the ghost mobile node, a registration to the foreign agent to which the mobile node is going to complete the handover; and"*

Petitioner relies on Liu to teach or suggest this limitation. Pet. 54. For example, Petitioner argues Liu's "M-agent ('ghost-mobile node') submits registration request on behalf of the mobile terminal ('mobile node') to register with a foreign agent where handoff is to occur." *Id.*

Patent Owner does not dispute the teachings of Liu in connection with this limitation. *See generally* PO Resp. Based on Petitioner's arguments and evidence, we find Petitioner has shown that Liu teaches or suggests this limitation.

> *e. "upon completing the handover, updating a registration in the mobile node."*

Petitioner relies on Liu to teach or suggest this limitation. Pet. 55. For example, Petitioner argues "[i]n Liu, a registration reply is sent to the mobile terminal from the MF-agent linked to a foreign agent." *Id.* (citing Ex. 1003, 7:51–57). Petitioner further argues "once the mobile terminal reaches its destination, it links with the MF-agent that has been assigned there and registers with the foreign agent to complete the registration process." *Id.* (citing Ex. 1003, 8:7–16). Petitioner contends a person of

ordinary skill in the art "would have understood that this link also completes the updating of the registration with the new F-agent and linked MF-agent in the mobile node." *Id.* at 56 (citing Ex. 1006 ¶ 105; Ex. 1003, 8:7–16, Fig. 8).

Patent Owner does not dispute the teachings of Liu in connection with this limitation. *See generally* PO Resp. Based on Petitioner's arguments and evidence, we find Petitioner has shown that Liu teaches or suggests this limitation.

In view of the foregoing, we find that Petitioner has shown by a preponderance of the evidence that the subject matter of claim 7 would have been obvious in view of Liu and Lau.

IV. CONCLUSION

For the foregoing reasons, we determine Petitioner has demonstrated by a preponderance of the evidence that claims 1, 2, 4, 5, and 7 are unpatentable. We determine Petitioner has not demonstrated that claims 3 and 6 are unpatentable.

Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceedings subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. *See* 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. § 42.8(a)(3), (b)(2).

In summary:

Claims	35 U.S.C. §	References	Claims Shown Unpatentable	Claims Not shown Unpatentable
1, 5, 6	103(a)	Liu, Gwon	1, 5	6
2, 3	103(a)	Liu, Gwon, Lau	2	3
4	103(a)	Liu, Gwon, IETF RFC 2402	4	
7	103(a)	Liu, Lau	7	
Overall Outcome			1, 2, 4, 5, 7	3, 6

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, claims 1, 2, 4, 5, and 7 of the ’417 patent have been shown by a preponderance of the evidence to be unpatentable;

FURTHER ORDERED that, claims 3 and 6 of the ’417 patent have not been shown by a preponderance of the evidence to be unpatentable;

FURTHER ORDERED that, because this is a Final Written Decision, the parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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(12) **United States Patent**
Hernandez-Mondragon et al.

(10) **Patent No.: US 8,213,417 B2**
(45) **Date of Patent: *Jul. 3, 2012**

(54) **SYSTEM, APPARATUS, AND METHODS FOR PROACTIVE ALLOCATION OF WIRELESS COMMUNICATION RESOURCES**

(75) Inventors: **Edwin A. Hernandez-Mondragon**, Coral Springs, FL (US); **Abdelsalam A. Helal**, Gainesville, FL (US)

(73) Assignee: **University of Florida Research Foundation, Inc.**, Gainesville, FL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **12/718,185**

(22) Filed: **Mar. 5, 2010**

(65) **Prior Publication Data**

US 2010/0157947 A1 Jun. 24, 2010

Related U.S. Application Data

(63) Continuation of application No. 10/909,818, filed on Aug. 2, 2004, now Pat. No. 7,697,508.

(60) Provisional application No. 60/491,436, filed on Jul. 31, 2003.

(51) **Int. Cl.**
H04L 12/66 (2006.01)

(52) **U.S. Cl.** **370/352**; 370/329; 370/328; 455/432.1

(58) **Field of Classification Search** 370/352, 370/329, 328, 238, 235, 401, 351; 455/432.1, 455/433, 439; 709/239

See application file for complete search history.

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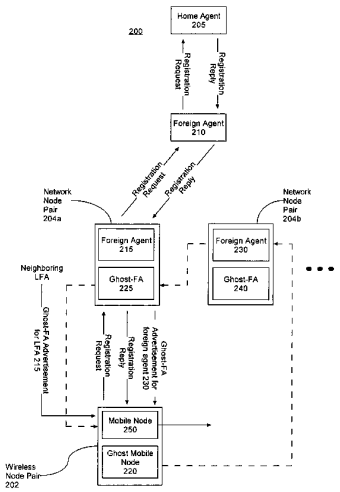
Primary Examiner — Minh D Dao

(74) *Attorney, Agent, or Firm* — Thomas, Kayden, Horstemeyer & Risley, LLP

(57) **ABSTRACT**

A system for communication between a mobile node and a communications network is provided for use with a communications network having one or more communications network nodes that define a foreign agents and that communicate with the mobile node in a predefined region. The system includes a ghost-foreign agent that advertises a foreign agent so that the mobile node is aware of the foreign agent when the mobile node is located outside the predefined region. The system further includes a ghost-mobile node that signals the foreign agent in response to the foreign agent advertising and based upon a predicted future state of the mobile node.

8 Claims, 6 Drawing Sheets



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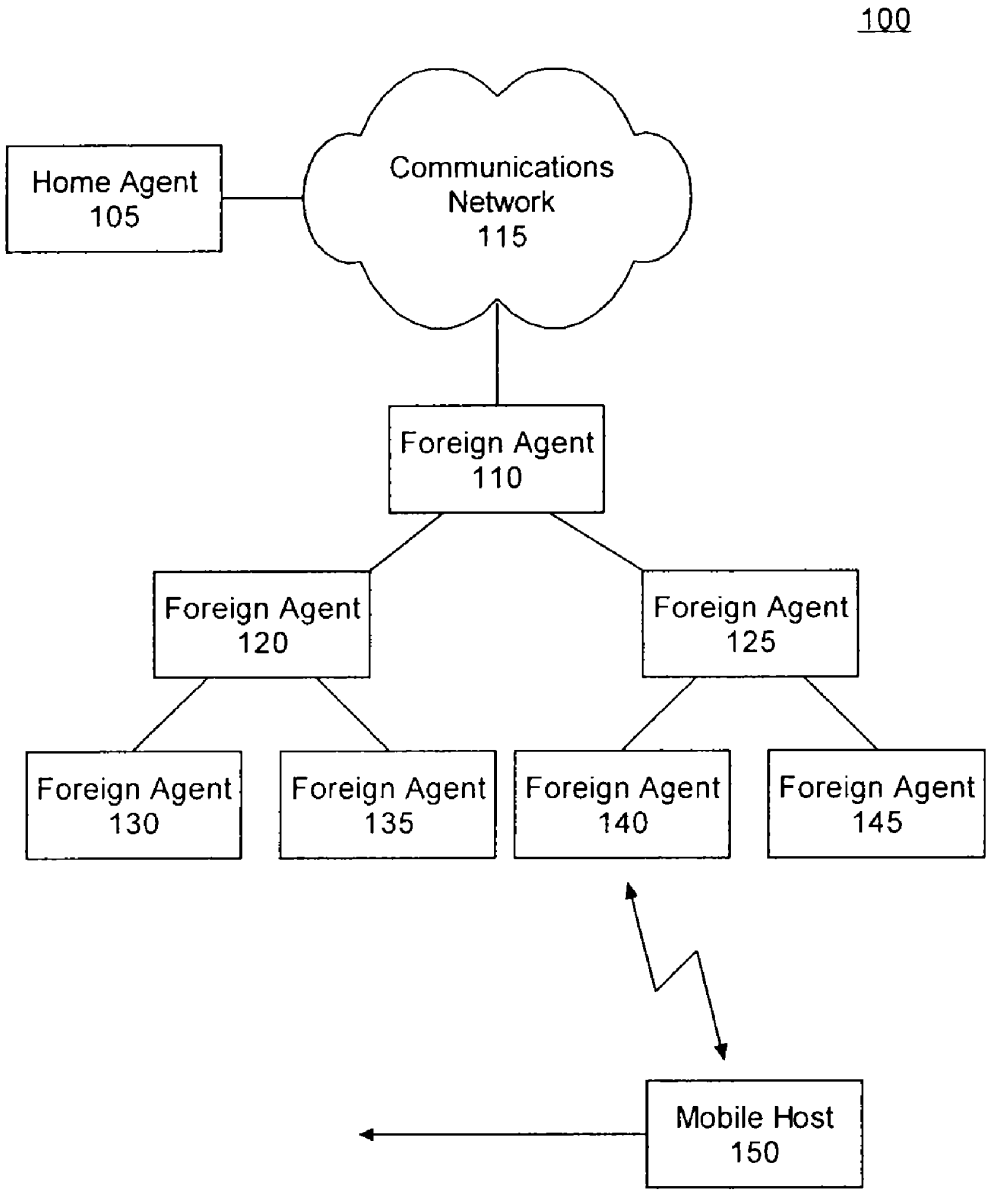

FIG. 1
(Prior Art)

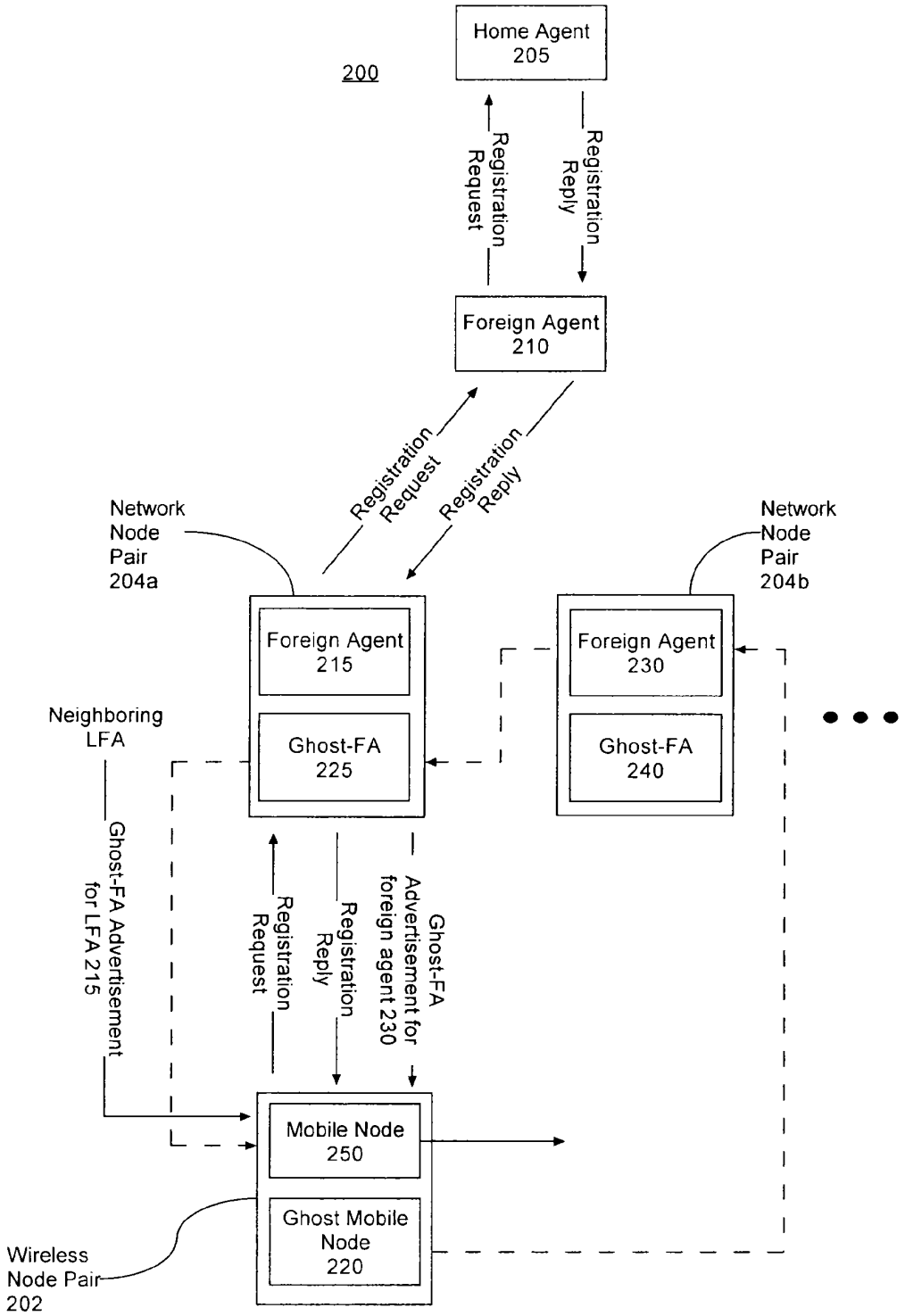
200
Home Agent 205
Registration Request
Registration Reply
Foreign Agent 210
Registration Request
Registration Reply
Network Node Pair 204a
Network Node Pair 204b
Foreign Agent 215
Ghost-FA 225
Foreign Agent 230
Ghost-FA 240
Neighboring LFA
Ghost-FA Advertisement for LFA 215
Registration Request
Registration Reply
Ghost-FA Advertisement for foreign agent 230
Mobile Node 250
Ghost Mobile Node 220
Wireless Node Pair 202

FIG. 2A

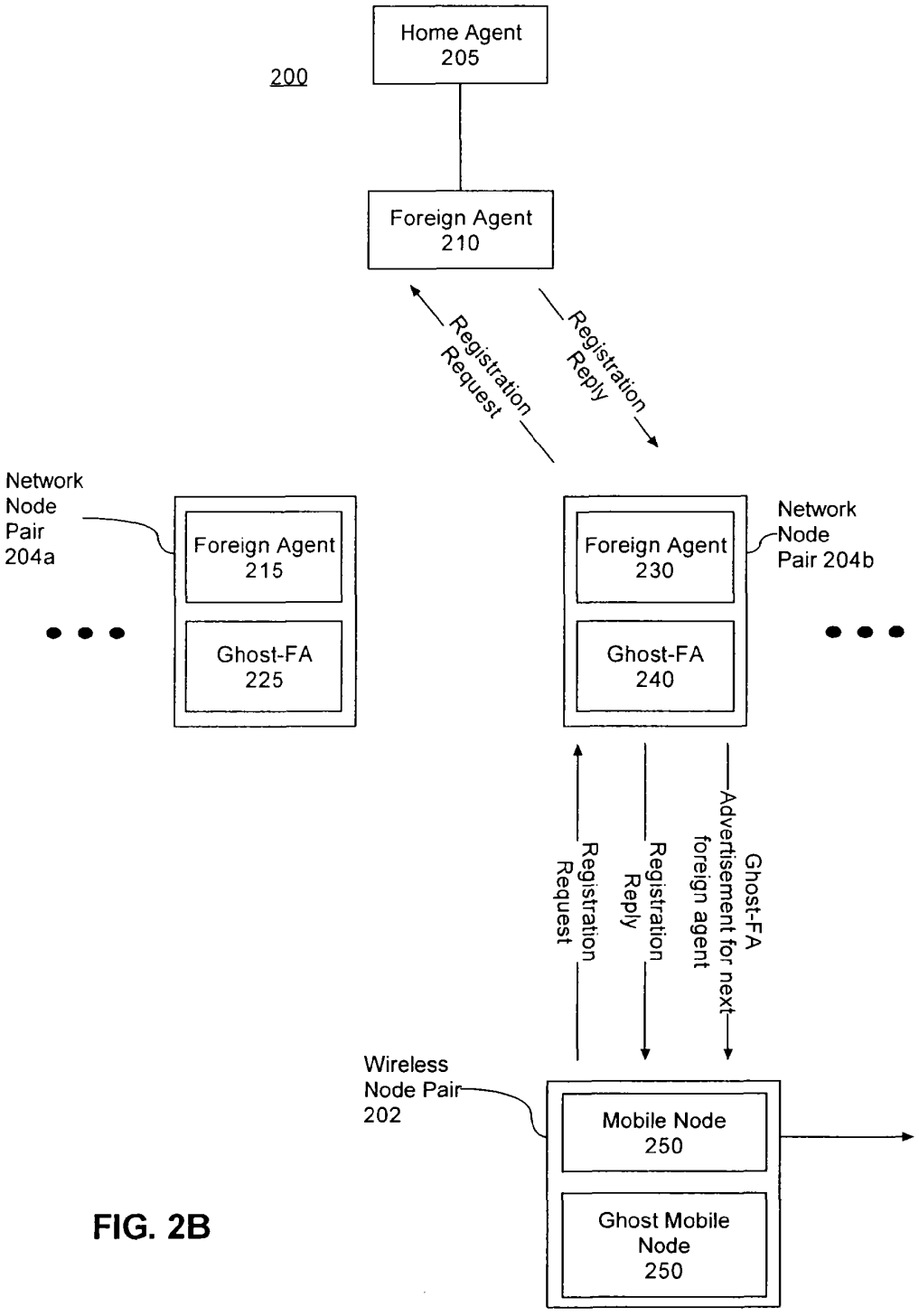
200
Home Agent 205
Foreign Agent 210
Registration Request
Registration Reply
Network Node Pair 204a
Foreign Agent 215
Ghost-FA 225
Network Node Pair 204b
Foreign Agent 230
Ghost-FA 240
Registration Request
Registration Reply
Ghost-FA Advertisement for next foreign agent
Wireless Node Pair 202
Mobile Node 250
Ghost Mobile Node 250

FIG. 2B


Foreign Agent 260
Foreign Agent 265
Foreign Agent 280
Foreign Agent 270
Foreign Agent 275

FIG. 2C

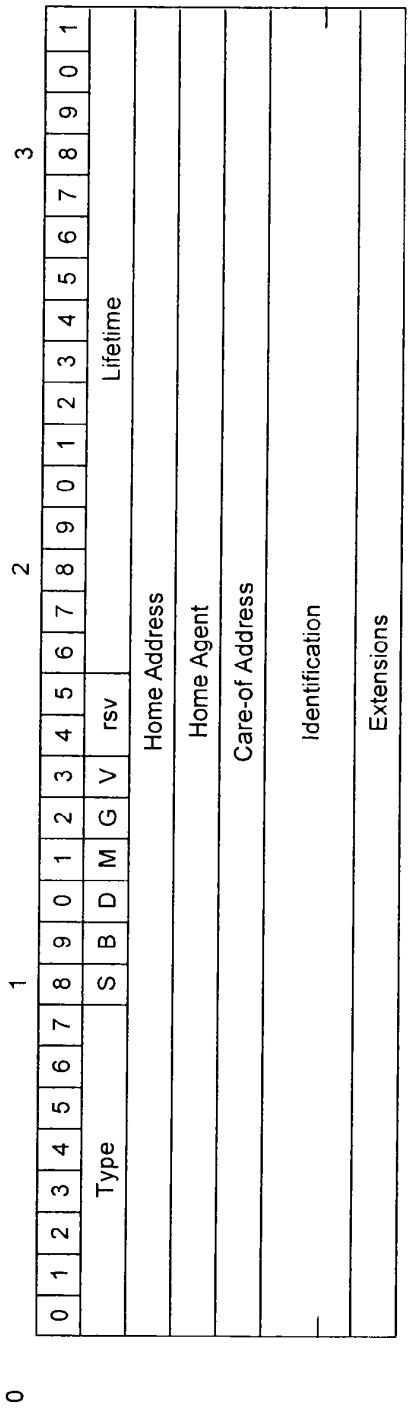
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
Type
S B D M G V rsv
Lifetime
Home Address
Home Agent
Care-of Address
Identification
Extensions

FIG. 3

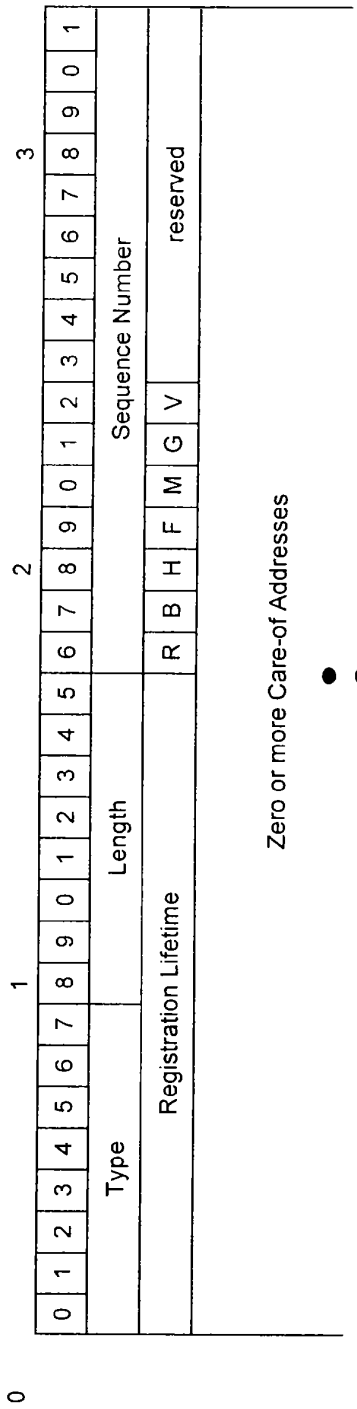
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
Type
Length
Sequence Number
Registration Lifetime
R B H F M G V
reserved
Zero or more Care-of Addresses

FIG. 4

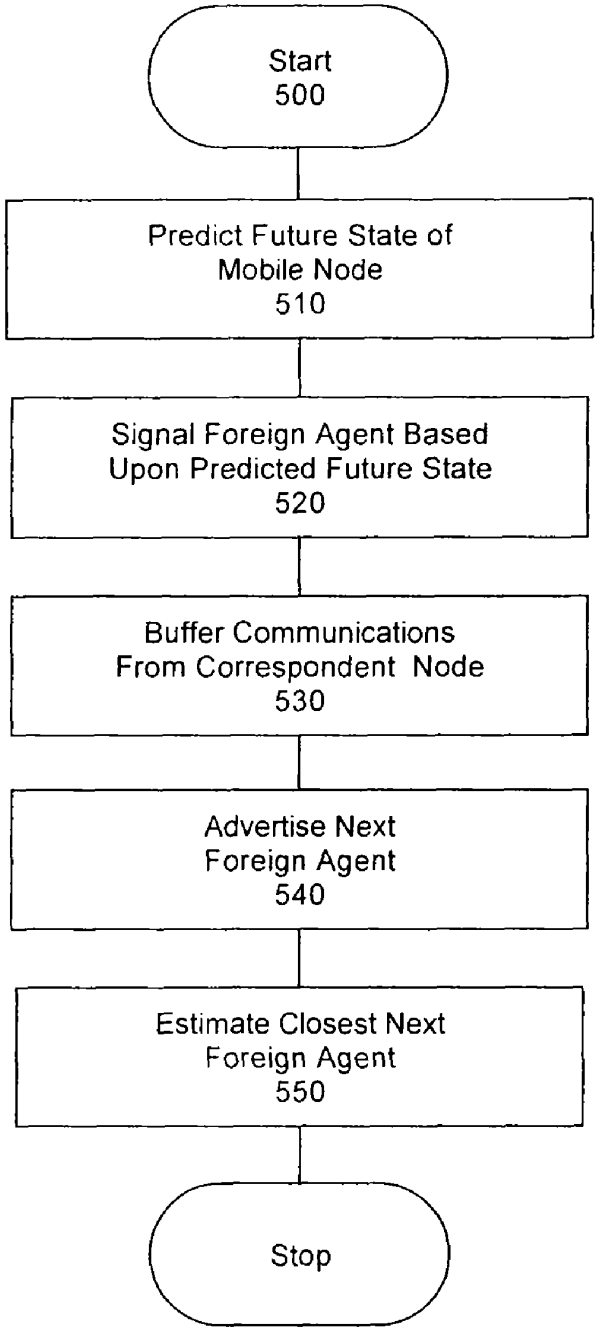
Start
500
Predict Future State of
Mobile Node
510
Signal Foreign Agent Based
Upon Predicted Future State
520
Buffer Communications
From Correspondent Node
530
Advertise Next
Foreign Agent
540
Estimate Closest Next
Foreign Agent
550
Stop

FIG. 5

SYSTEM, APPARATUS, AND METHODS FOR PROACTIVE ALLOCATION OF WIRELESS COMMUNICATION RESOURCES

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation of U.S. application Ser. No. 10/909,818, filed Aug. 2, 2004, which claims the benefit of U.S. Provisional Application No. 60/491,436, filed in the United States Patent and Trademark Office on Jul. 31, 2003, the entirety of which is incorporated herein by reference.

BACKGROUND

1. Field of the Invention

This invention relates to the field of communications, and, more particularly, to allocation of resources of a communications network for supporting wireless communications.

2. Description of the Related Art

Mobile communications broadly encompass the various devices and techniques that enable individuals to communicate without having to rely on a static network infrastructure. Laptop computers, palmtops, personal digital assistants (PDAs), and cellular phones are all part of the growing array of computing and telephony-based mobile devices that can be used to exchange voice signals and digitally encoded data from remote locations. The general architecture for mobile systems entails mobile nodes, or hosts, communicating with one another through a series of base stations that serve distinct zones or cells. According to this architecture, a mobile node remains in contact with a communication network by repeatedly tearing down old connections and establishing new connections with a new base station as the host moves from one cell to another.

What is generally needed for such architectures to function adequately is some way for the mobile node to let other nodes know where the mobile node can be reached while the host is moving or located away from home. In accordance with a typical mobile networking protocol, a mobile node registers with a home agent so that the home agent can remain a contact point for other nodes that wish to exchange messages or otherwise communicate with the mobile node as it moves from one location to another. An example of such a protocol is Mobile Internet Protocol (Mobile IP). Mobile IP allows a mobile node to use two IP addresses, one being a fixed home address and the other being a care-of address. The care-of address changes as the mobile node moves between networks thereby changing its point of attachment to a network. When the mobile node links to a network other than one in which the home agent resides, the mobile node is said to have linked to a foreign network. The home network provides the mobile node with an IP address and once the node moves to a foreign network and establishes a point of attachment, the mobile node receives a care-of address assigned by the foreign network.

Mobile IP v. 4 depends on the interaction between a home agent and foreign agents, the foreign agents serving as wireless access points distributed throughout a coverage area of a network or an interconnection of multiple networks. This architecture, however, does have disadvantages. These have led to assorted proposals for enhancing the capabilities of Mobile IP. One such proposal is to use a hierarchy of foreign agents intended to reduce the number of registrations required for the mobile node.

FIG. **1** is a schematic diagram illustrating an exemplary architecture for a mobile communications system **100** using

hierarchical foreign agents as is known in the art. As shown, the system **100** can include a home agent **105** and a foreign agent **110**, each communicatively linked via a communications network **115** such as the Internet. The foreign agent **110** further is communicatively linked with the hierarchy of foreign agents **120**, **125**, **130**, **135**, **140**, and **145**. Accordingly, a mobile host **150** can choose a foreign agent which is closer than the others as a registration point. Registration messages are constrained to that region only.

The mobile node **150** travels in range of foreign agent **145**. The mobile node **150** registers with foreign agent **145**, foreign agent **125**, and foreign agent **110** as the mobile node's **150** care-of addresses. A registration request also reaches the home agent **105**. The registration reply reaches the mobile node **150** via the reverse path. Accordingly, packets received at the home agent **105** that are to be routed to the mobile node **150** can be tunneled to foreign agent **110**, which tunnels the packets to foreign agent **125**, and finally to foreign agent **145** prior to transmitting the packets to the mobile node **150**.

Nevertheless, registration delays and associated information losses can still represent significant obstacles for wireless communications involving a mobile node. This stems mainly from the inevitable delay associated with the setting up of a new communication link each time the mobile node is handed off from one foreign agent to another. The setup requires time for the network to negotiate protocol details, establish communication rates, and decide the applicable error-handling approaches to be employed. These should each be resolved as a prelude to establishing the actual connection for the exchange of data. With conventional systems and devices, the setting up typically must await the arrival of the mobile node in the predefined region of coverage for the foreign agent to which the mobile node is to be handed off. Depending upon the mobile network configuration, the time required for registration can rival the time in which the mobile node dwells within a given cell coverage area. Moreover, data packets may be lost if they arrive for the mobile node during the time in which the setup is being worked out.

SUMMARY OF THE INVENTION

The present invention provides a preemptive and predictive solution for communications in wireless communications networks. More particularly, the present invention provides two different types of ghost-entities that can be used individually or jointly in setting up a wireless connection between a mobile node and a foreign agent. The ghost entities can act on behalf of a wireless node and a foreign agent. They can determine and use predicted information to improve the performance of wireless communications, especially those involving a mobile node moving at moderate or high speeds. As explained herein, the ghost entities cause communication network resources to be allocated proactively rather than reactively.

One aspect of the present invention pertains to a wireless node pair for mobile wireless communications. The wireless network node can include a mobile node and a ghost-mobile node. The ghost-mobile node can be configured to register the mobile node and allocate resources for communicating with the mobile node according to a predicted future state of the mobile node. Notably, the ghost-mobile node can be instantiated in at least one additional wireless network node proximate to the predicted future location of the mobile node. Additionally, the ghost-mobile node can be configured to predict the future location of the mobile node. The ghost-mobile node also can buffer data packets intended for the mobile node and sent by a correspondent node.

Another aspect of the present invention includes a network node pair that includes a foreign agent and a ghost-foreign agent. The ghost-foreign agent can be configured to provide an advance notification to the mobile node of a presence of a next wireless network node proximate to the predicted future location of the mobile node. In particular, a ghost-foreign agent corresponding to a second foreign agent can make the mobile node aware of the presence of the second foreign agent by signaling an advertisement to the mobile node from a first foreign agent.

Another aspect of the present invention can include a method of mobile communications. The method can include estimating a future location of a mobile node, sending a notification to the mobile node indicating a presence of a next foreign agent proximate to the estimated future location of the mobile node, and registering the next wireless network node as the care-of-address to be used to communicate with the mobile node.

BRIEF DESCRIPTION OF THE DRAWINGS

There are shown in the drawings, embodiments which are presently preferred, it being understood, however, that the invention is not limited to the precise arrangements and instrumentalities shown.

FIG. **1** is a schematic diagram illustrating an exemplary system for mobile communications that incorporates hierarchical foreign agents as known in the art.

FIGS. **2**A and **2**B are schematic diagrams illustrating a method of operation for an exemplary system for mobile communications in accordance with the inventive arrangements disclosed herein.

FIG. **2**C is a schematic diagram illustrating another exemplary network architecture where a foreign agent is surrounded by a plurality of other foreign agents.

FIG. **3** is a schematic diagram illustrating a message structure that can be assembled for the home agent and/or foreign agent by the ghost-mobile node in accordance with one embodiment of the inventive arrangements disclosed herein.

FIG. **4** is a schematic diagram illustrating a data packet that can be formulated and sent by the ghost-foreign agent in accordance with one embodiment of the inventive arrangements disclosed herein.

FIG. **5** provides a flowchart illustrative of a method aspect of the invention.

DETAILED DESCRIPTION OF THE INVENTION

The present invention provides a system, apparatus, and methods for reducing delays and information losses in a single wireless communication network or interconnection of multiple communication networks. The system, apparatus, and methods of the present invention, more specifically, reduce registration overhead and setup times associated with mobile node handoffs. The system, apparatus, and methods also reduce or eliminate losses due to dropped data packets. The advantageous results are achieved by causing communication network resources to be allocated proactively rather than reactively.

More particularly, the present invention provides a ghost-mobile node and a ghost-foreign agent. The ghost-mobile node can serve as a virtual repeater capable of registering and allocating communication resources by predicting where the mobile node's next handoff will occur as the mobile node moves relative to the communication network's nodes, including those edge nodes that define foreign agents. Time delays and information losses also can be reduced by the

ghost-foreign agent. The ghost-foreign advertises the foreign agent's presence in the communication network using a neighboring foreign agent. The ghost-foreign agent can thus make a mobile node aware of a corresponding foreign agent's presence in a communication network before the mobile node actually arrives in the physical region covered by the foreign agent.

Accordingly, the ghost-mobile node and the ghost-foreign agent, operating either individually or jointly, can cause network communication resources to be allocated preemptively rather than passively as in conventional communications networks in which handoffs typically only follow an exchange of setup information following a mobile node's arrival in the physical region covered by the foreign agent. The ghost-mobile node and ghost-foreign agent can also serve to "hide" handoff operations from network layers, thereby hiding operations that would otherwise tend to reduce system performance.

FIGS. **2**A and **2**B are schematic diagrams illustrating an exemplary interconnection of communication networks **200**, including one home and a plurality of foreign networks, that facilitate wireless communication involving at least one mobile host in accordance with the inventive arrangements disclosed herein. As shown in FIGS. **2**A and **2**B, the interconnected communication networks **200** can include a wireless node pair **202**, described in more detail below, as well as two network node pairs **204***a*, **204***b* that are also described more fully below. The interconnection of communication networks **200** also illustratively includes a network node that defines a home agent **205** and another network node that defines a foreign agent **210**.

Each of the network node pairs **204***a*, **204***b* also includes a network node, each defining a foreign agent **215**, **230**. More particularly, these two foreign agents **215**, **230** can be identified as leaf foreign agents to emphasize the hierarchical tree structure of the network nodes, in which the home agent **205** serves as the root, one foreign agent **210** serves as an intermediate branch, and the other two foreign agents serve as leaves. Illustratively, the interconnection of communication networks **200** further includes a mobile node **250**.

As will be readily understood by those of ordinary skill in the art, the term node is used herein to denote any addressable device that connects to a communication network and that can recognize, process, or forward data or other communication transmissions. Therefore, each of the network nodes defining the foreign agents **210**, **215**, **230** can be general purpose computers on which is running specialized routing software, or alternately, application-specific devices such as routers for relaying communication transmissions. Indeed, as will be readily appreciated by those of ordinary skill in the art, the network nodes can be implemented with any information processing systems having the ability to communicate with one another via suitable wired and/or wireless communications links. Moreover, those of ordinary skill in the art will also recognize that the interconnection of networks **200** can include additional foreign agents as needed to create an interconnection of networks of any size and configuration. The interconnection of networks **200** itself can comprise a single network comprising a plurality of interconnected nodes.

The mobile node **250**, as part of normal use, changes its point of attachment to the networks forming the interconnection of networks **200**. The mobile node **250** can be a computing device having suitable operational software and a wireless transceiver. Accordingly, the mobile node **250** can engage in two-way wireless communications with the communication network edge nodes, defining leaf foreign agents or simply foreign agents **215**, **230**. The mobile node **250**, for example,

can be implemented as a standalone portable computing system, or it can be a device embedded within a larger system such as an automobile, a train, or another form of transportation. The mobile node **250** alternately can be, for example, a mobile or laptop computer, a hand-held personal digital assistant (PDA), a cellular phone, or similar device for the wireless exchange of data and/or other communications with the interconnected networks **200**.

The home agent **205** is a network node belonging to the network that is designated as the home network. The network is a home network in the sense that it serves as a virtual permanent residence at which the mobile node **250** can receive communications from other network nodes, designated as correspondent nodes. By providing an addressable home, the home agent effectively allows the mobile node **250** to be reachable at its home address even when the mobile node **250** is not attached to the home network. This is done in a manner analogous to the forwarding of mail to an out-of-town resident or call forwarding a telephone communication from a fixed to a mobile number. According to one embodiment of the present invention, the home agent **205** can be implemented as a software component executing on a suitable computing system, such as a server or other computing device. The home agent **205** can be communicatively linked with a network such as the Internet, thereby enabling two-way communications between the home agent **205** and a foreign agent **210**.

The foreign agents **210**, **215**, **230** exist foreign networks in so far as they are part of networks to which the mobile node **250** is communicatively linked when the mobile node **250** is not linked directly with its home network. Even when the mobile node **250** is not directly linked with its home network, though, it can receive communications. These communications are typically in the form of datagrams having an appropriate care-of address, as will be readily understood by those of ordinary skill in the art. Accordingly, the foreign agents **210**, **215**, **230** assist the mobile node **250** in receiving datagrams delivered to the care-of address.

In order for the network nodes to relay datagrams to the mobile node **250** when the mobile node is in a foreign network, the mobile node must be communicatively linked to a foreign agent **215**, **230** corresponding to that particular foreign network. As the mobile node **250** moves from one foreign network to another, a handoff is required from the foreign agent **215** of the foreign network the mobile node is leaving to the foreign agent **230** of the foreign network at which the mobile node is arriving. The handoff typically entails the mobile node **250** signaling the next foreign agent **230**, requesting registration. Registration typically precedes an updating of the care-of address and an appropriate reallocation of communication network resources so that communications addressed to the home agent can be properly relayed to the mobile node **250** by "tunneling" messages through a different set of hierarchically arranged network nodes.

As used herein, tunneling refers to the transmission of data intended for use only within a private, such as a corporate, network through a public network wherein the transmission is performed in such a way that the routing nodes in the public network are unaware that the transmission is part of a private network. Tunneling is generally performed by encapsulating the private network data and protocol information within the public network transmission units so that the private network protocol information appears to the public network as data. Tunneling allows the use of the Internet, which is a public network, to convey data on behalf of a private network. Common examples of tunneling techniques can include, but are not limited to, Point-to-Point Tunneling Protocol (PPTP) and generic routing encapsulation (GRE). Still, any of a variety of different tunneling techniques can be used.

Conventional techniques typically require that the mobile node **250** be in the physical region covered by a particular foreign agent **215**, **230** in order for the handoff to occur. The processing and updating of relevant information that accompanies the handoff thus exacts a time delay before the mobile node **250** is able to begin communication with the interconnection of networks **200** through the foreign agent of the region in which the mobile node has newly arrived. During the time delay, moreover, any datagrams that arrive from a correspondent node will be dropped because of the temporary lack of a communication link with the mobile node **250**.

The present invention overcomes these problems. According to one embodiment of the present invention illustrated in FIGS. **2**A and **2**B, the wireless node pair **202** includes a ghost-mobile node **220** in addition to the mobile node **250**. Although illustratively the ghost-mobile node **220** is adjacent the mobile node **250**, it is to be understood that the ghost-mobile node can be a virtual node and need not reside at the same physical location as the mobile node **250**. The ghost-mobile node **220**, for example, can be set of software instructions running on a device that is remote from the mobile node **250** and that contains a transceiver for communicating with the mobile node.

Regardless of its physical embodiment, the ghost-mobile node **220** operates by signaling a communication network node based upon a predicted future state of the mobile node **250**. As illustrated in FIG. **2**A, the ghost-mobile node signals **220** an edge node that defines a foreign agent **215**, **230**. The foreign agent **215** communicatively links the mobile node **250** to a communications network when the mobile node is in a predefined region served by the foreign agent. The ghost-mobile node **220**, however, signals the foreign agent before the mobile node arrives in the predefined region based upon the prediction of the mobile node's **250** future state.

The future state can be a physical state such as the location of the mobile node **250**, and the prediction can be the time that the mobile node will be in the predefined region served by the foreign agent **215**. Accordingly, the predicted future state of the mobile node **250** can based, for example, upon the trajectory of the mobile node or upon its speed. Alternately, the predicted future state of the mobile node **250** can be based upon an estimated location of the mobile node.

According to one embodiment of the present invention, the mobile node pair **202** can further include a Global Positioning System (GPS) unit to facilitate the above-described predictions of the future state of the mobile node **250**. Using the GPS unit, location information on the mobile node **250** can be obtained and subsequently used, for example, to estimate which of multiple foreign agents are closest and when the mobile node is likely to arrive in the region served by the closest foreign agent. The ghost-mobile node **220** can perform the function of determining the closest foreign agent.

It be will readily appreciated, that other systems for determining location information can be used and that the present invention is not limited to embodiments using GPS units. Any of various mobile communication techniques employed for mobile telephony can similarly be used, for example. Alternately, for example, the foreign agents **215**, **230** can be configured to triangulate the position of the mobile node **250** using signal strength or through the use of wireless sensors. Thus, the mobile node **250** can be configured to notify the foreign agents **215**, **230** of its position from time to time or at regular intervals. Alternatively, the foreign agents **215**, **230**

can be configured to determine the location of the mobile node **250** from time to time or at regular intervals as the case may be.

By continuously and/or periodically determining its position via the GSP unit or other technique, the ghost-mobile node **220** can extrapolate from the current location and predict future locations of the mobile node **250**.

Any of a variety of different location prediction techniques can be used by the ghost-mobile node **220**. According to one embodiment of the present invention, a Kalman filter is used. The Kalman filter is described generally, for example, in "An Introduction to the Kalman Filter", by Welch G. and Bishop G., University of North Carolina TR 95-041, UNC, Chappell Hill, N.C. (2002). The Kalman filter can be implemented within the ghost-mobile node **220** to determine the amount of time before the ghost-mobile node can send a registration message and act on behalf of the mobile node **250**. The Kalman filter addresses the problem of trying to estimate the state $x \epsilon R^n$ of a discrete-time controlled process that is governed by a linear stochastic difference equation. In general, the process is composed of a state vector (Equation 1, below) and measurement vectors (Equation 2, below).

The Kalman filter assumes that there is a state vector x such that:

$$x_k = Ax_{k-1} + Bu_k + w_{k-1} \tag{1}$$

with a measurement vector $z \epsilon R^n$ such that:

$$z_k = Hx_k + v_k \tag{2}$$

The equations also include the values of w_k and v_k, which are random variables representing the process noise of the measurement and state vectors. The matrices A, B, and H relate the states and the dynamics of the system under study. In the context of a mobile communication protocol such as Mobile IP, the ghost-mobile node **220** can give the velocity and position of the mobile node **250** at any given time.

The following equation (Equation 3) shows a relationship of the state vector and the basic dynamics of a mobile node with the well-known relationship of a 2-D object moving at constant speed.

$$\begin{pmatrix} x \\ y \\ v_x \\ v_y \end{pmatrix} = \begin{pmatrix} 1 & 0 & t & 0 \\ 0 & 1 & 0 & t \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \\ v_x \\ v_y \end{pmatrix} + \begin{pmatrix} w_x \\ w_y \\ w_x^s \\ w_y^s \end{pmatrix} \tag{3}$$

The measurement vector $z_k = [x\ y]^T$ can be used in the recursive mechanics of the Kalman Filter. The filter uses an ongoing cycle where time-update equations determine the state ahead of time, and the measurement update is used to adjust the internal parameters of the filter. With these variables, the problem can be posed as a linear Kalman Filter equation:

$$X_k = AX_{k-1} + w_k \tag{4}$$

$$Z_k = Hz_k + v_k \tag{5}$$

where,

$$A = \begin{pmatrix} 1 & 0 & t & 0 \\ 0 & 1 & 0 & t \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix};\ H = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \end{pmatrix}\ v_k = \begin{pmatrix} v_s \\ v_y \end{pmatrix}\ w_k = \begin{pmatrix} w_x \\ w_y \\ w_x^s \\ w_y^s \end{pmatrix} \tag{6}$$

The time-update equations for the Kalman Filter are:

$$x_k = Ax_{k-1} + Bu_k + w_{k-1} \tag{7}$$

$$P_k = AP_{k-1}A^T + Q \tag{8}$$

In one scenario B=0 and P_k is the covariance matrix which is estimated from time step k−1 to step k. The matrix $Q = E[w_k w_k^T]$.

For measurement-update equations, the first equation (Equation 9, below) computes the Kalman gain, K_k, the second equation (Equation 10, below) calculates the value of x_k which is used in Equation 7 to compute the predicted value of the state vector. The third equation (Equation 11, below) updates the covariance matrix P_k. The value of the co-variance matrix $R = E[v_k\ v_k^T]$ is needed and, in general, is the easier to determine since it is generally known how to measure the position vector. Further, samples can be dedicated to determine the co-variance of v_k.

$$K_k = P_k^- H^T (HP_k^- H^T + R)^{-1} \tag{9}$$

$$x_k = x_k^- + K_k(z_k - Hx_k^-) \tag{10}$$

$$P_k = (I - K_k H)P_k^- \tag{11}$$

Using an information processing tool, the values of the matrices R and Q (Equation 12) can be empirically determined to be for, example,

$$Q = 0.001 * \begin{pmatrix} 15 & 0 & 0 & 0 \\ 0 & 15 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \tag{12}$$

$$R = 0.000001 * \begin{pmatrix} 100 & 0 \\ 0 & 0.001 \end{pmatrix}.$$

The following is an example of an algorithm that can be used in the ghost-mobile node to find a closest foreign agent using the measurement vector $z_k = [x\ y]^T$:

```
g-MN (Home Address, HomeAgentAddress)
    while (true) do
        FA FindClosestFA(MN)
        if distance (FA, MN) within threshold then
            HFA FindHighestFA(FA, HomeAgentAddress)
            Register(FA, HomeAddress, HFA)
        end
```

Those of ordinary skill in the art will readily recognize that other techniques beside the Kalman filter can be used by the ghost-mobile node **220** for location prediction. Other techniques for predicting a location of the mobile node **250** include, for example, neural networks, linear prediction mechanisms, and modeling of stochastic processes.

Based upon the predicted future state of the mobile node **250**, the ghost-mobile node **220** can determine which foreign agent **210**, **215**, **230** is likely to serve as the mobile node's next communicative link. For example, a simple look-up database can be maintained by the network listing each foreign agent and its location information. The location can be represented, for example, by a two-element vector, (x, y). The ghost-mobile node **220** can receive updated (x, y) information on the location. Using the updated information, the ghost-mobile node **220** can calculate a distance to the closest foreign agent

in the path of the mobile node **250** based upon an estimated speed or trajectory of the mobile node **250**.

The ghost-mobile node **220** signals the network communications node that defines the mobile node's **250** next foreign agent **215**, **230**. The ghost-mobile node **220** signals the foreign agent **215**, **230** ahead of the mobile node's **250** arriving in the predefined region served by the foreign agent. The signal from the ghost-mobile node **220** can be a registration request. The signal from the ghost-mobile node **220** can cause an allocation of communications network resources, the resources being those needed for relaying communications between the communications network and the mobile node. Indeed, the signal from the ghost-mobile node **220** can elicit the same response from the network nodes defining the foreign agents **215**, **230** as would be elicited were the mobile node **250** physically present in the predefined region covered by the particular foreign agent.

In the context of an IP-based network, the ghost-mobile node **220** can create "spoofed" Universal Datagram Packets (UDP) with the contents of a legitimate mobile node packet. The procedure can utilize raw sockets to construct the message, create all the registration and IP headers, and add the authentication extensions using, for example, the MD5 checksum and a shared key.

As used herein, MD5 refers to an algorithm used to verify data integrity through the creation of a 128-bit message digest from data input, which may be a message of any length. MD5 is intended for use with digital signature applications, which require that large files must be compressed by a secure method before being encrypted with a secret key, under a public key cryptosystem. MD5 is a standard based on the Internet Engineering Task Force (IETF) Request for Comments (RFC) 1321, which is fully incorporated herein by reference. Nonetheless, it will be readily appreciated by those of ordinary skill in the art that other methods of ensuring data security can be used.

Many implementations of Mobile IP include protection against registration replay attacks by adding time-stamps and a "nonce," a random value sent in a communications protocol exchange and frequently used to detect replay attacks. Accordingly, the protocol is able to keep a consistent and secure Location Directory (LD). The nonce is a parameter that varies with time, but also can include a visit counter on a Web page or a special marker intended to limit or prevent the unauthorized replay or reproduction of a file. In any case, as the ghost-mobile node **229** essentially forges registration packets on behalf of the mobile node **250**, no time-stamping or nonce numbers need be used. As an alternative, a shared key authentication can be required between the home agent, foreign agents, and the mobile node. Asymmetric authentication as in a protocol such as 802.1X can be used as an alternate to symmetric authentication for delegating authority to the ghost-mobile node **220**.

The signal from the ghost-mobile node **220** results in a preemptive setup, one that is effected before the mobile node **250** arrives in the predefined area of coverage of the next foreign agent. The setup can entail all the aspects that occur in the beginning phase of a standard network connection negotiation, including the negotiation of protocol details, communication rates, and error-handling approaches. These are needed to allow the connection to proceed correctly and reliably, but absent the participation of the ghost-mobile node **220** would have to await the arrival of the mobile node **250** in the predefined region covered by the foreign agent **215**, **230**.

Accordingly, the ghost-mobile node **220** can increase the speed with which handoff occurs, thereby reducing setup delay and avoiding information loses due to the dropping of datagram packets. The ghost-mobile node **220** can replicate the registration request, handle the creation of tunnels, and replicate authentication and authorization information from the mobile node **250**, thus acting on behalf of the mobile node **250** before the mobile node is in range of a next foreign agent **215**, **230**. The ghost-mobile node **220** also can buffer incoming traffic from a correspondent host ring handoff to further insure against the loss of information during a handoff. When the mobile node **250** leaves one foreign agent **215** and moves into the vicinity of the next foreign agent **230**, registration will have already taken place and resources will already have been allocated for connecting the mobile node to the communication network.

Referring still to FIGS. **2**A and **2**B, each of the network node pairs **204***a*, **204***b* further includes ghost-foreign agents **225**, **240** in addition to network nodes defining foreign agents **215**, **230**. A ghost-foreign agent **225**, **240** transmits an advertisement notifying the mobile node **250** of the existence of a next foreign agent **230**, transmitting the advertisement from a foreign agent **215** currently connected with the mobile node **250**. That is, the ghost-foreign agent **225** advertises a first foreign agent **230** but does so using a second foreign agent **215**. Thus, the advertisement of foreign agent **230** by its ghost-foreign agent **225** is able to reach the mobile node **250** while the mobile node is in the predefined region covered by foreign agent **215**. Therefore, the ghost-foreign agent **225** makes the mobile node aware of the foreign agent **230** before it arrives in the predefined region covered by the foreign agent.

A foreign agent **210**, **215**, **230** typically includes in an advertisement message the vector of care-of addresses. As noted above, the vector of care-of addresses provide an IP address for each of the foreign agent's ancestors, as well as the foreign agent's own IP address. As a mobile node **250** enters a predefined coverage region within the range of communication of a foreign agent **215**, the mobile node can submit a registration request to the foreign agent, as described above. The foreign agent **215**, in turn, can initiate a registration request to the foreign agent **210**, which can forward the registration request to the home agent **205**.

The home agent **205** can initiate a tunnel to the foreign agent **210** and transmit a registration reply. The foreign agent **210** can create a tunnel to the foreign agent **215**, defining a leaf foreign agent, and forward the registration reply to the foreign agent. The foreign agent **215** then can transmit the registration reply to the mobile node **250**. According to one embodiment of the present invention, the ghost-foreign agent **225** acts as an extension of a foreign agent **230** defining a leaf foreign agent. Accordingly, the ghost-foreign agent **225** is able to transmit the advertisement of foreign agent **230** to the mobile node **250** as already described above.

Referring now particularly to FIG. **2**B, as the mobile node **250** leaves the first foreign agent **215** and moves toward the next foreign agent **230**, the ghost-mobile node **220** can send a registration request to the foreign agent **215**. Accordingly, the foreign agent **215** can open a tunnel to the next foreign agent **230** and send a registration reply. As the mobile node **250** enters the communications range of the next foreign agent **230**, and as the mobile node **250** has already received the advertisement from the ghost-foreign agent **225**, the mobile node **250** can send a registration request to the next foreign agent. The mobile node **250** can then receive a registration reply as the ghost-mobile node **220** has already registered and allocated resources for the mobile node **250**.

FIG. **2**C is a schematic diagram illustrating another exemplary network architecture where foreign agent **280** is surrounded by foreign agents **260**, **265**, **270**, and **275**. If mobility

ratio is high, then foreign agent **280** can create instances of a ghost-foreign agent corresponding to foreign agent **280** at foreign agent **260**, **265**, **270**, and/or **275**. These instances can represent foreign agent **280** before the mobile node actually reaches the foreign agent within which it is disposed.

Each foreign agent **215**, **230** creates ghost-foreign agent instances at the vicinity of other foreign agents. A ghost-foreign agent results in a virtual augmentation of the signal strength of a certain foreign agent, so that the signal strength appears to have increased and the coverage area appears to have been augmented by a certain factor. Indeed, a ghost-foreign agent appears to increase the amount of resources available for facilitating communication among interconnected communication networks.

As already described, a basis of the proactive allocation of communication resources for a stationary or moving mobile node is the virtual instantiation of the ghost-mobile node in at least one additional wireless network node proximate to the predicted future location of the mobile node. So, too, each foreign agent can create its ghost-foreign agent instances or virtual foreign agents around particular thresholds. For example, if foreign agent coverage is denoted as r, a foreign agent can find all foreign agents within k*r, where k is a factor determined according to the expected mobility conditions of the foreign agent. Ghost-foreign agents can thus function as passive repeaters of the operations of the corresponding foreign agent.

FIG. **3** is a schematic diagram illustrating a message structure assembled for the home agent and/or foreign agent from the ghost-mobile node in accordance with one embodiment of the inventive arrangements disclosed herein. The ghost-mobile node includes as the IP source and IP destinations the values of the original home agent's home address and the home agent and/or foreign agent addresses respectively.

The home address and care-of-address are generally known, since the decapsulation process takes place at the foreign agent. For example, the care-of address matches the foreign agent address. The foreign agent address allows the content of the message to be forwarded to the mobile node while the mobile node remains within the foreign network. For hierarchical Mobile IP, the leaf foreign agent address is used as a destination for the registration message. Once the message has reached the foreign agent, the foreign agent forwards the registration packet to a higher foreign agent which forwards it to a still higher foreign agent or on to the home agent, depending upon the wired network infrastructure and the topology of foreign agents. This depends, for example, upon whether the mobile node switches domains with no common foreign agents.

The present invention facilitates the use of any mobile node, while allowing the code for the mobile node to remain unchanged. During the absence of a ghost-mobile node, the mobile node can rely upon reactive mechanisms of the communications protocol in use, whether Mobile IP or another mobile communications protocol. In general, a ghost-mobile node can locate the closest foreign agent in the vicinity of the mobile node. If the distance is within a given threshold, then the highest foreign agent within the hierarchy, that is the home foreign agent, can be located and the mobile node can be registered with that home foreign agent.

FIG. **4** is a schematic diagram illustrating a data packet that can be formulated and sent by the ghost-foreign agent in accordance with one embodiment of the inventive arrangements disclosed herein. The ghost-foreign agent determines all the foreign agents within a ratio (threshold) and creates a packet, for example an Internet Control Message Protocol (ICMP), with the information as shown in FIG. **4**. The care-of-addresses are already a persistent part of the foreign agent configuration file and sequence numbers can be spoofed. Additionally, the ghost-foreign agent should assemble the raw socket using the foreign agent address as a source with a broadcast address as destination.

FIG. **5** provides a flowchart of steps illustrative of a method aspect of the invention. The method **500** includes in step **510** predicting a future physical state of the mobile node. In step **520**, the method **500** includes signaling the foreign agent based upon the predicted future state of the mobile node. The method **500** optionally includes in step **530** buffering communications communicated to the mobile node from a correspondent node of the communications network.

Optionally, the method **500** further includes in step **540** advertising the foreign agent so that the mobile node is aware of the foreign agent when the mobile node is located outside the predefined region. In step **550**, the method **500** also optionally includes estimating which next foreign agent is closest to the mobile node.

The present invention can be realized in hardware, software, or a combination of hardware and software. The present invention can be realized in a centralized fashion in one computer system, or in a distributed fashion where different elements are spread across several interconnected computer systems. Any kind of computer system or other apparatus adapted for carrying out the methods described herein is suited. A typical combination of hardware and software can be a general purpose computer system with a computer program that, when being loaded and executed, controls the computer system such that it carries out the methods described herein.

The present invention also can be embedded in a computer program product, which comprises all the features enabling the implementation of the methods described herein, and which when loaded in a computer system is able to carry out these methods. Computer program in the present context means any expression, in any language, code or notation, of a set of instructions intended to cause a system having an information processing capability to perform a particular function either directly or after either or both of the following: a) conversion to another language, code or notation; b) reproduction in a different material form.

This invention can be embodied in other forms without departing from the spirit or essential attributes thereof. Accordingly, reference should be made to the following claims, rather than to the foregoing specification, as indicating the scope of the invention.

What is claimed is:

1. A system for communicating between a mobile node and a communication network; the network having at least one communications network node that is interconnected using a proxy mobile internet protocol (IP), comprising:

at least one mobile node;

at least one home agent;

at least one foreign agent;

a ghost-foreign agent that advertises messages to one of the mobile nodes indicating presence of the ghost-foreign agent on behalf of one of the foreign agents when the mobile node is located in a geographical area where the foreign agent is not physically present; and

a ghost-mobile node that creates replica IP messages on behalf of a mobile node, the ghost-mobile node handling signaling required to allocate resources and initiate mobility on behalf of the mobile node, the ghost-mobile node triggering signals based on a predicted physical location of such mobile node or distance with relation to the at least one foreign agent.

2. The system of claim 1, wherein signaling further comprises registration with a replica of the mobile node by the ghost-mobile node to communicate with the foreign agents, triggering tunneling and communication with a mechanism configured to maintain routing information to a mobile node.

3. The system of claim 1, wherein signaling further comprises at least one of a tunnel and a communication network to allocate resources between the mobile node and foreign agent, the signaling being triggered at a threshold distance to one of the foreign agents reported by one of the mobile nodes, the threshold distance reported to one of the foreign agents at least one of a projected trajectory and a speed.

4. The system of claim 1, wherein the at least one ghost-mobile node is a proxy element for the at least one foreign agent and the at least one mobile node, the at least one ghost-mobile node triggering registration based on a distance to a foreign agent by relaying security and shared secrets from a mobile node, and at least one advertisement message from a foreign agent in a vicinity of the ghost-mobile node.

5. The system of claim 1, wherein allocation of resources on behalf of the mobile node is triggered based at least in part on location information, the location information determined by at least one of: a global positioning system (GPS) receiver, a triangulation process, and indirect measurements of location.

6. The system of claim 1, wherein the at least one ghost-foreign agent populates mobile IP Advertisement messages with at least one care-of-address of neighboring foreign agents in order to extend the range of neighboring foreign agents.

7. A method, in a mobile node, for speeding handover, comprising the steps of:

updating, in a mobile node, a location in a ghost mobile node;

determining a distance, in the ghost mobile node in communication with the mobile node, to a closest foreign agent with which the mobile node can complete a handover;

submitting on behalf of the mobile node, from the ghost mobile node, a registration to the foreign agent to which the mobile node is going to complete the handover; and

upon completing the handover, updating a registration in the mobile node.

8. A method, comprising the steps of:

creating, in a network, a plurality of ghost foreign agents corresponding to a foreign agent, the ghost foreign agents configured to replicate mobile advertisements of the foreign agent, the mobile advertisements including at least one of: an IP address of the foreign agent, a care-of-address of the foreign agent, and at least one mobile IP registration, the ghost foreign agents created at a distance surrounding the foreign agent;

detecting, in a mobile node, the foreign agent in the network;

receiving, in the mobile node, an advertisement message corresponding to the foreign agent from one of the ghost foreign agents;

registering, in the mobile node, with the foreign agent through the ghost foreign agent; and

broadcasting advertisement messages from the plurality of ghost foreign agents to the mobile node to extend a reach of the foreign agent, wherein a distance from the mobile node to one of the ghost foreign agents is less than the distance from the mobile node to the foreign agent.

* * * * *

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Paper 9
Filed: December 3, 2018

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

UNIFIED PATENTS INC.,
Petitioner

v.

MOBILITY WORKX, LLC,
Patent Owner

Case IPR2018-01150
Patent 8,213,417 B2

Before WILLIAM M. FINK, *Vice Chief Administrative Patent Judge,* MELISSA A. HAAPALA, *Acting Vice Chief Administrative Patent Judge,* and KARA L. SZPONDOWSKI, *Administrative Patent Judge.*

SZPONDOWSKI, *Administrative Patent Judge.*

DECISION
Institution of *Inter Partes* Review
37 C.F.R. § 42.108

I. INTRODUCTION

Unified Patents Inc. ("Petitioner") filed a Petition (Paper 1, "Pet.") to institute an *inter partes* review of claims 1–7 of U.S. Patent 8,213,417 B2, issued on July 3, 2012 (Ex. 1001, "the '417 patent"). Mobility Workx, LLC ("Patent Owner") filed a preliminary response (Paper 7, "Prelim. Resp.") to the Petition. With our authorization, Petitioner filed a reply to the Preliminary Response (Paper 8, "Reply"). We have jurisdiction under 35 U.S.C. § 314.

Institution of an *inter partes* review is authorized when "the information presented in the petition . . . and any response . . . shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." 35 U.S.C. § 314(a). Having considered the Petition, the Preliminary Response, the Reply, and the associated evidence, we determine that Petitioner has established a reasonable likelihood that it would prevail with respect to at least one challenged claim. Accordingly, we institute an *inter partes* review as to all challenged claims and all grounds raised in the Petition.

II. BACKGROUND

A. Related Proceedings

The parties advise the '417 patent is the subject of two patent infringement lawsuits in the Eastern District of Texas:

Mobility Workx, LLC v. Verizon Communications, Inc. et al., 4-17-cv-00872 (E.D. Tex.), filed Dec. 18, 2017; and

Mobility Workx, LLC v. T-Mobile US, Inc. et al. 4-17-cv-00567 (E.D. Tex.), filed Aug. 14, 2017. Pet. 57; Paper 5, 2.

B. Real Party In Interest

The statute governing *inter partes* review proceedings sets forth certain requirements for a petition for *inter partes* review, including that "the petition identif[y] all real parties in interest." 35 U.S.C. § 312(a)(2); *see also* 37 C.F.R. § 42.8(b)(1) (requiring identification of real parties-in-interest in mandatory notices). Petitioner identifies Unified Patents, Inc. as the sole real party in interest and states "[n]o other party exercised control or could exercise control over Petitioner's participation in this proceeding, the filing of this petition, or the conduct of any ensuing trial." Pet. 57.

In its Preliminary Response, Patent Owner argues the Petition is deficient in addressing the identities of the real parties in interest and that Petitioner is required to "disclose its relationships to parties presently involved in litigation concerning the '417 patent and demonstrate an absence of privies in those parties." Prelim. Resp. 14 (citing *Applications in Internet Time, LLC v. RPX Corp.*, 897 F.3d 1336 (Fed. Cir. 2018)). Patent Owner argues this is necessary "so as to ensure proper estoppel effect attaches to them from any final decision in the IPR." *Id.* Patent Owner cites to several statements on Petitioner's web site in support of its argument. *Id.* at 15–16.

Petitioner filed a Reply addressing Patent Owner's arguments as to this issue. Petitioner argues, *inter alia*, that Patent Owner has not brought Petitioner's real party in interest identification into dispute because it has not presented sufficient evidence. Reply 2–3. Petitioner further argues neither *Applications in Internet Time* nor any other statute or regulation requires a petitioner to disclose all the relationships it may have to parties involved in litigation. *Id.* at 3. In addition, Petitioner argues it has properly identified

itself as the sole real party in interest and submitted the Declaration of Kevin Jakel, CEO and Co-Founder of Petitioner, in support of its argument. *Id.* at 4–7; *see* Ex. 1009.

"[A]n IPR petitioner's initial identification of the real parties in interest should be accepted unless and until disputed by a patent owner." *Worlds Inc. v. Bungie, Inc.*, 903 F.3d 1237 (2018). To put the issue into dispute, "a patent owner must produce *some* evidence that tends to show that a particular third party should be named a real party in interest. A mere assertion that a third party is an unnamed real party in interest, without any support for that assertion, is insufficient to put the issue into dispute." *Id.*

On this record, and at this stage of the proceedings, the evidence presented by Patent Owner is insufficient to put the issue into dispute. Specifically, Patent Owner has presented no evidence that tends to show that either Verizon Communications, Inc. or T-Mobile U.S., the two parties in litigation, should have been named a real party in interest. Rather, Patent Owner's evidence consists solely of generic statements from Petitioner's web page that generally describe Petitioner's business, but do not refer to either of the two parties. Accordingly, on this record, we are not persuaded the Petition should be denied for failure to name all real parties in interest.

C. The '417 Patent (Ex. 1001)

The '417 patent issued from Application No. 12/718,185 claiming benefit of the filing date of an earlier filed application, which claims benefit of Provisional Application No. 60/491,436 filed July 31, 2003. Ex. 1001, 1:7–11. The '417 patent is titled "System, Apparatus, and Methods for Proactive Allocation of Wireless Communication Resources" and is

generally directed to allocation of communications resources in a communications network. Ex. 1001, Abstract, 1:17–19.

Mobile communication systems comprise mobile nodes (e.g., cell phones) that communicate with each other through a series of base stations that serve distinct cells. *Id*. at 1:28–30, 4:60–5:8. As the mobile node moves from one cell to another, it establishes a new connection with a new base station. *Id*. at 1:31–35. The mobile node must be able to let other nodes know where it can be reached when it is moving. *Id*. at 1:36–39. Typically, the mobile node registers with a home agent so the home agent can remain a contact point for other nodes that want to exchange messages or otherwise communicate with the mobile node as it moves from one location to another. *Id*. at 1:39–44, 5:9–17. Accordingly, a mobile node may use two IP addresses, one being a fixed home address and one being a care-of address, where the care-of address changes as the mobile node moves between networks. *Id*. at 1:45–49. When the mobile node links to a network other than the one in which its home agent resides, the mobile node is said to have linked to a foreign network. *Id*. at 1:49–52. The mobile node, therefore, receives an IP address from the home network, and when it moves to a foreign network and establishes a point of attachment by registering with a foreign agent, it receives a care-of address assigned by the foreign network. *Id*. at 1:52–56; 5:47–54.

According to the ’417 patent, delays can occur in setting up a new communication link when the mobile node is handed off from one foreign agent to another because the new communication link cannot be set up until the mobile node arrives in the new foreign agent’s physical region of coverage. *Id*. at 2:20–35, 6:4–11. In addition, data packets may be lost if

they arrive during the time when set up is being established. *Id*. at 2:36–38, 6:12–14. The invention in the '417 patent seeks to reduce these problems by causing communication network resources to be allocated proactively rather than reactively. *Id*. at 2:52–54. The '417 patent accomplishes this through the use of two different types of "ghost entities" that can act on behalf of a mobile node and a foreign agent. *Id*. at 2:44–47.

A ghost mobile node acts on behalf of a mobile node and "can be a virtual node and need not reside at the same physical location as the mobile node." *Id*. at 6:20–22. The ghost mobile node operates by signaling the foreign agent before the mobile node arrives in the foreign agent's physical region of coverage, based upon the predicted future state of the mobile node. *Id*. at 6:27–38. The predicted future state of the mobile node may be based upon, for example, an estimated location, trajectory, or speed of the mobile node. *Id*. at 6:38–46. Based upon this predicted future state, the ghost mobile node determines which foreign agent is likely to serve as the mobile node's next communications link and signals that foreign agent. *Id*. at 8:58–62. This signal can be a registration request to cause an allocation of communications resources in the same way as would be performed if the mobile node were physically present in the foreign agent's region of coverage. *Id*. at 9:7–17. Therefore, the signal results in preemptive setup that is performed before the mobile node arrives in the foreign agent's coverage area. *Id*. at 9:54–56.

A ghost foreign agent acts on behalf of a foreign agent, and notifies the mobile node of the existence of a next foreign agent by transmitting an advertisement from the currently connected foreign agent. *Id*. at 10:17–21. In this way, the ghost foreign agent makes the mobile node aware of the

foreign agent before the mobile node arrives in the coverage region of the foreign agent. *Id*. at 10:26–28. Moreover, the vector of care-of addresses is included in the advertisement. *Id*. at 10:30–34.

D. Exemplary Claims

Among the challenged claims, claims 1 and 7 are independent. Independent claims 1 and 7 (reproduced below) are representative.

> 1. A system for communicating between a mobile node and a communication network; the network having at least one communications network node that is interconnected using a proxy mobile internet protocol (IP), comprising:
>
> at least one mobile node;
>
> at least one home agent;
>
> at least one foreign agent;
>
> a ghost-foreign agent that advertises messages to one of the mobile nodes indicating presence of the ghost-foreign agent on behalf of one of the foreign agents when the mobile node is located in a geographical area where the foreign agent is not physically present; and
>
> a ghost-mobile node that creates replica IP messages on behalf of a mobile node, the ghost-mobile node handling signaling required to allocate resources and initiate mobility on behalf of the mobile node, the ghost-mobile node triggering signals based on a predicted physical location of such mobile node or distance with relation to the at least one foreign agent.

> 7. A method, in a mobile node, for speeding handover, comprising the steps of:
>
> updating, in a mobile node, a location in a ghost mobile node;

determining a distance, in the ghost mobile node in communication with the mobile node, to a closest foreign agent with which the mobile node can complete a handover;

submitting on behalf of the mobile node, from the ghost mobile node, a registration to the foreign agent to which the mobile node is going to complete the handover; and

upon completing the handover, updating a registration in the mobile node.

E. The Prior Art

Petitioner relies on the following references (*see* Pet. 2), as well as the Declaration of Dr. Zygmunt Haas (Ex. 1006):

Reference	Exhibit(s)	Patent/Printed Publication
Liu	1003	U.S. Patent No. 5,825,759 to Liu issued Oct. 20, 1998
Gwon	1004	U.S. Patent Pub. No. 2002/0131386 A1 to Gwon published Sept. 19, 2002
Lau	1005	U.S. Patent No. 7,536,482 B1 to Lau filed Feb. 4, 2003 and issued May 19, 2009
IETF RFC 2402	1008	Internet Engineering Task Force Request for Comment 2402 IP (November 1998)

F. The Asserted Grounds

For purposes of the Petition, Petitioner assumes all challenged claims are entitled to the July 31, 2003 priority date. Pet. 1. The specific statutory grounds of unpatentability, claims challenged, and prior art relied on for each ground are summarized in the table below. *See* Pet. 2.

Ground	Claim(s) Challenged	Basis	References
1	1, 5, 6	§ 103(a)	Liu in view of Gwon
2	2, 3	§ 103(a)	Liu in view of Gwon and Lau
3	4	§ 103(a)	Liu in view of Gwon and IETF RFC 2402
4	7	§ 103(a)	Liu in view of Lau

II. ANALYSIS

We turn now to Petitioner's asserted grounds of unpatentability and Patent Owner's arguments in its Preliminary Response to determine whether Petitioner has met the threshold standard of 35 U.S.C. § 314(a).

A. Claim Interpretation

Petitioner proposes a construction of the term "advertisement" as recited in independent claim 1 and dependent claim 4. Pet. 8. Patent Owner does not address Petitioner's proposed construction.

In an *inter partes* review, claim terms in an unexpired patent are interpreted according to their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b) (2016); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2142–46 (2016). However, only terms that are in controversy need to be construed, and only to the extent necessary to resolve the controversy. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (citing *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)). Other than as discussed below in Section F.1.b, we determine that it is unnecessary to expressly construe any claim terms at this time to resolve the disputed issues before us.

B. Summary of Prior Art

1. Liu (Ex. 1003)

Petitioner contends Liu issued on October 20, 1998, and, therefore, is prior art under (pre-AIA) 35 U.S.C. § 102(b). Pet. 9. Patent Owner does not dispute these contentions. Based on the present record, we agree Liu is prior art under 35 U.S.C. § 102(b).

Liu is titled "Distributing Network Services and Resources in a Mobile Communications Network" and is generally directed to a mobility data network architecture for accessing data. Ex. 1003, Abstract. Liu uses a mobile floating agent protocol to dynamically provide service and resource mobility in mobile wireless Local Area Networks and cellular networks. *Id*. at 1:50–60. Liu describes that "[b]y combining Mobile-Floating agent functions with a method of predictive mobility management, the services and user data can be pre-connected and pre-assigned at the locations or cells to which the user is moving," which "allows the users to immediately receive service and maintain their data structures with virtually the same efficiency as they could have at the previous location." *Id*. at 2:4–10. Liu's mobile floating agent pre-assignment protocol is depicted in Figure 6, which is reproduced below:

FIG. 6

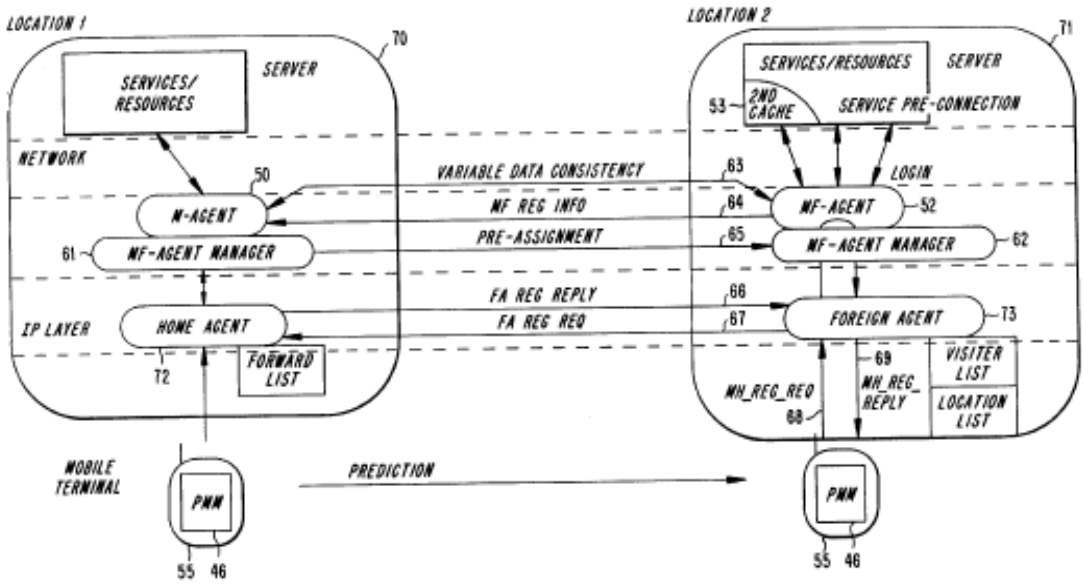

Figure 6 depicts an embodiment of the MF-agent pre-assignment protocol. *Id.* at 7:19–20. Liu describes the use of mobility agents (M-agents) and mobile-Floating Agents (MF-agents). *See e.g.*, *id*. at 2:12–34. M-agent 50 is representative of the user and "is preferably a software entity executing on a home fixed host or router, including a set of processes that communicates with and pre-assigns an MF-agent **52** to remote fixed hosts or routers on behalf of a mobile terminal **55**." *Id*. at 6:57–61, 7:22. MF-agent 52 "is preferably a software entity executing on a remote fixed host or mobile support router (MSR), including a set of processes that can communicate and connect with the local host or MSR resources." *Id*. at 6:61–65. Liu describes that the M-agent and MF-agent are not bound to the underlying network, and are, therefore, free to follow the mobile users. *Id*. at 7:2–5. The MF-agent pre-connects services by using predictive mobility management (PMM) to predict where a user will be. *Id*. at 7:5–9.

Mobile terminal 55 sends an MF-agent assignment request to its M-agent 50, with an address of a new location it is traveling to. *Id*. at 7:26–28. The new location may have been explicitly provided by the user or it may be predicted through PMM. *Id*. at 7:29–31. The assignment request is a request to establish (i.e., pre-assign) an MF-agent 52 at the location mobile terminal 55 is traveling to, so that the necessary services and data are ready for the mobile terminal when it arrives at the new location. *Id*. at 7:32–37. M-agent 50 registers the request and forwards it to remote MF-agent manager 62 at the new location. *Id*. at 7:37–38. Upon receiving the request, MF-agent manager 62 assigns or creates an MF-agent 52 for requesting M-agent 50. *Id*. at 7:38–50. MF-agent 52 registers itself with Foreign Agent 73 (F-agent) and sends an MF-assignment reply back to M-agent 50 containing the registration information. *Id*. at 7:50–56. M-agent 50 then sends a reply back to mobile terminal 55 and maintains a data consistency link 63 with MF-agent 52. *Id*. at 7:55–57.

When mobile terminal 55 reaches the new location, it registers with MF-agent 52 by sending an MF-agent registration request 68 to F-agent 73 to begin the registration process. *Id*. at 8:7–12. F-agent 73 will then link mobile terminal 55 to MF-agent 52. *Id*. at 8:15–16. In some embodiments, MF-agent 52 may then perform as an acting M-agent (AM-agent) for mobile terminal 55, performing the same function as an M-agent at the new location. *Id*. at 8:17–20. Accordingly, through the use of MF-agent 52, an MF-agent is waiting with the needed data and services when the user arrives at a remote location. *Id*. at 8:43–47.

2. Gwon (Ex. 1004)

Petitioner contends Gwon was filed on January 26, 2001 and published on September 19, 2002, and, therefore, is prior art under (pre-AIA) 35 U.S.C. §§ 102(a) and (e). Pet. 11. Patent Owner does not dispute these contentions. Based on the present record, we agree Gwon is prior art under 35 U.S.C. §§ 102(a) and (e).

Gwon is titled "Mobility Prediction in Wireless Mobile Access Digital Networks" and generally describes methods for predicting the mobility of mobile nodes. Ex. 1004, Abstract. Gwon describes determining in advance when a network connection hand-off is imminent so that a mobile node can pre-establish a new network connection with a new router or agent. *Id*. ¶ 55. Gwon uses mobility prediction analysis in mobile nodes so that the mobile node can select from among multiple available network connection nodes. *Id*. ¶¶ 55–59. As a mobile node moves locations, Gwon describes the use of Neighbor Discovery methodology, where the mobile node may receive Neighbor Advertisement messages from its local router and/or unsolicited Router Advertisement messages from its local router. *Id*. ¶¶ 51, 53. These messages "indicate[ ] the presence of other local routers which could provide network connections for the mobile node." *Id*. ¶ 51.

3. Lau (Ex. 1005)

Petitioner contends Lau was filed on Feburary 4, 2003 and published on May 19, 2009, and, therefore, is prior art under (pre-AIA) 35 U.S.C. § 102(e). Pet. 39. Patent Owner does not dispute these contentions. Based on the present record, we agree Lau is prior art under 35 U.S.C. § 102(e).

Lau is titled "Methods and Devices for Enabling a Mobile Network Device to Select a Foreign Agent" and is generally directed to enabling a mobile device to select a foreign agent from among a plurality of foreign agents that are transmitting position information. Ex. 1005, Abstract, 4:29–42. This position information may include GPS data. *Id*. at 3:28–31.

4. IETF RFC 2402 ("IETF") (Ex. 1008)

Petitioner contends IETF was published in November 1998 and is incorporated by reference in its entirety in Gwon. Pet. 47 (citing Gwon ¶ 54). Patent Owner does not dispute that IETF is prior art. Based on the present record, and for purposes of this Decision, we agree IETF is prior art under 35 U.S.C. § 102(b). IETF is a request for comments memorandum regarding Internet standards track protocol for "IP Authentication Header." IETF 1. Specifically, IETF primarily describes IP Authentication Header formatting and processing, as well as authentication and security measures. IETF Sections 1–3.

C. Ground 1 (Based on Liu and Gwon)

Petitioner contends claims 1, 5, and 6 would have been obvious over the combination of Liu and Gwon. Pet. 12–37.

1. Claim 1

a. "A system for communicating between a mobile node and a communication network; the network having at least one communications network node that is interconnected using a proxy mobile internet protocol (IP), comprising:"

Petitioner relies on Liu to teach or suggest the preamble of independent claim 1. Pet. 12–14. For example, Petitioner refers to Liu's mobile floating (MF)-agent protocol, which accommodates the "mobile nature" of mobile users by offering service and resource mobility through intelligent service pre-connection, resource pre-allocation, and data structure pre-arrangement. *Id.* at 12−13 (citing Ex. 1003, 1:58–2:2). Petitioner further relies on Liu's disclosure of proxy entities (e.g., M-agent and MF-agent) to facilitate communications between mobile nodes and networks employing Mobile IP. *Id.* at 13−14 (citing Ex. 1003, 2:11–34, 7:15–17).

At this stage of the proceeding, Patent Owner does not dispute Petitioner's analysis. For purposes of institution, we find that Petitioner has adequately shown Liu teaches or suggests the preamble.

b. "at least one mobile node;"

Petitioner contends Liu's mobile terminal 55 teaches "at least one mobile node." Pet. 14–15 (citing Ex. 1003, Fig. 6). Petitioner further asserts Liu's mobile terminals may include cellular phones and laptop computers, and are capable of mobile communications. *Id.* at 15 (citing Ex. 1003, 17:47–48, 6:4–7).

At this stage of the proceeding, Patent Owner does not dispute Petitioner's analysis. For purposes of institution, we find that Petitioner has

adequately shown Liu teaches or suggests this limitation.

c. "at least one home agent;"

Petitioner contends Liu's home agent 72 teaches "at least one home agent." Pet. 14–15 (citing Ex. 1003, Fig. 6). Petitioner further asserts Liu's home agent may be a "home fixed host or router." *Id.* at. 15 (citing Ex. 1003, 2:15–21).

At this stage of the proceeding, Patent Owner does not dispute Petitioner's analysis. For purposes of institution, we find that Petitioner has adequately shown Liu teaches or suggests this limitation.

d. "at least one foreign agent;"

Petitioner contends Liu's F-agent 73 teaches "at least one foreign agent." Pet. 17–18 (citing Ex. 1003, Fig. 6, 7:50–56).

At this stage of the proceeding, Patent Owner does not dispute Petitioner's analysis. For purposes of institution, we find that Petitioner has adequately shown Liu teaches or suggests this limitation.

e. "a ghost-foreign agent that advertises messages to one of the mobile nodes indicating presence of the ghost-foreign agent on behalf of one of the foreign agents when the mobile node is located in a geographical area where the foreign agent is not physically present; and"

Petitioner contends Liu, or alternatively, Liu and Gwon teach or suggest this limitation. Pet. 18–26. Petitioner contends Liu's MF-agent 52 teaches the "ghost-foreign agent." *Id.* at 18–19 (citing Ex. 1003, Fig. 6, 8:7–34, 6:53–65). Petitioner further relies on Liu's "MF-agent pre-assignment" protocol to teach the remainder of the limitation, and contends the MF-

assignment reply back from the MF-agent to the M-agent teaches the "advertises messages" portion of the limitation. *Id.* at 19–20 (citing Ex. 1003, 7:19–31, 7:37–46, 7:51–57). Alternatively, Petitioner contends that to the extent that the claimed advertisement message must be unsolicited, Gwon teaches unsolicited advertisements from a router (i.e. a foreign agent) via its Neighbor Discovery methodology. *Id.* at 20–22 (citing Ex. 1004 ¶¶ 50–54, 58). Petitioner also contends both Liu and Gwon teach such advertising when the mobile node is located in a geographical area where the foreign agent is not physically present. *Id.* at 24–26 (citing Ex. 1003, 7:24–37; Ex. 1004 ¶¶ 52–53, Fig. 2).

At this stage of the proceeding, Patent Owner does not dispute Petitioner's analysis. For purposes of institution, we find that Petitioner has adequately shown Liu, alone or in combination with Gwon, teaches or suggests this limitation.

f. "a ghost-mobile node that creates replica IP messages on behalf of a mobile node,"

Petitioner contends one of ordinary skill in the art would understand a "replica IP message" to "at least include a reproduction of an original IP message." Pet. 27 (citing Ex. 1006 ¶ 80, Ex. 1001, 10:1–6). Petitioner relies on Liu to teach or suggest this limitation. *Id.* at 27–29. Petitioner contends Liu's M-agent 50 teaches the "ghost-mobile node." *Id* at. 27 (citing Ex. 1003, Fig. 6). Petitioner asserts that in Liu, the request to create or assign an MF-agent at a predicted location is initiated by the mobile terminal and sent to the M-agent. *Id.* at 28 (citing Ex. 1003, 7:22–38). Petitioner contends the M-agent then "forwards" the request to the remote MF-agent manager at the predicted location. *Id.* at 28 (citing Ex. 1003, 7:22–38). According to

Petitioner, one of ordinary skill in the art would understand this forwarding request to a remote location on a different network teaches "*creat[ing] replica IP messages on behalf of the mobile node*" because this "forwarding process results in a reproduction of the original message request." Pet. 28–29 (citing Ex. 1006 ¶ 83).

Patent Owner contends Petitioner does not "explain *why* such forwarded requests would be *IP messages*." Prelim Resp. 7. Referring to Figure 6 of Liu, Patent Owner argues request 65 is sent outside of the IP layer. *Id.* at 10.

At this stage of the proceeding, we do not find Patent Owner's argument persuasive. Similar to the '417 patent, Liu explicitly discusses Mobile *IP* protocol. *See, e.g.* Ex. 1003, 1:28, 5:55–60; Ex. 1001, 1:44–56. Petitioner's declarant, Dr. Haas describes the Mobile IP protocol (Ex. 1006 ¶¶ 25–36) and, more specifically, states that Mobile IP encapsulation, such as described in Liu, teaches the recited "creating replica IP messages" (*id.* ¶ 83). For purposes of this Decision, we find this explanation to sufficiently support Petitioner's contention. With respect to Patent Owner's arguments about Figure 6, it is unclear from the Figure whether the dotted lines are meant to delineate between different layers, given that only a network and IP layer are identified. Therefore, for purposes of institution, we find that Petitioner has adequately shown Liu teaches or suggests this limitation.

> *g. "the ghost-mobile node handling signaling required to allocate resources and initiate mobility on behalf of the mobile node, the ghost-mobile node triggering signals based on a predicted physical location of such mobile node or distance with relation to the at least one foreign agent."*

Petitioner asserts Liu, or alternatively, Liu and Gwon, teaches or suggests this limitation. Pet. 30–34. Petitioner contends a person of ordinary skill in the art would have understood "handling signaling required to allocate resources and initiate mobility" to include "preemptive setup and initiation of the mobility process." *Id.* at 30 (citing Ex. 1006 ¶ 84). Petitioner relies on Liu's M-agent's (ghost-mobile node) pre-assignment signaling that allows for "services and/or data [to] be pre-connected/pre-arranged at the mobile user's destination." *Id.* at 31 (citing Ex. 1003, 2:29–35, Fig. 5). Petitioner further refers to the M-agent sending the pre-assignment signaling based on the use of PMM, including the predicted physical location of the terminal, to trigger service and resource pre-arrangement. *Id.* at 31–33 (citing Ex. 1003, 7:22–38, 19:4–14). Alternatively, Petitioner argues Gwon teaches a mobility prediction analysis. *Id.* at 33 (citing Ex. 1004 ¶¶ 57, 59–104).

At this stage of the proceeding, Patent Owner does not dispute Petitioner's analysis. For purposes of institution, we find that Petitioner has adequately shown Liu, alone or in combination with Gwon, teaches or suggests this limitation.

2. Rationale for Combining Liu and Gwon

Petitioner contends a person of ordinary skill in the art would have been motivated to modify Liu's MF-agent to proactively broadcast its

presence to the mobile node since it is "simply applying a known technique to a known device ready for improvement to yield predictable results." Pet. 23 (citing Ex. 1006 ¶¶ 77–78). Petitioner asserts proactive broadcasts were well known and would have (1) "facilitated the pre-assignment of a mobile device before it reached the foreign network, decreasing the time required to complete a handover with a foreign agent at a new network to which the mobile device was travelling" and (2) "decreased the computational burden on the mobile device by removing the need to request the assignment of a MF-agent, shifting this burden to the MF-agent on a router in the foreign network." *Id.* at 23 (citing Ex. 1006 ¶¶ 77–78). Therefore, Petitioner contends combining Gwon's known Neighbor Discovery protocol with the MF-agent pre-assignment protocol of Liu "comports with the actual historical evolution of the technology at the time, which resulted in a more efficient and simplistic method to pre-allocate resources," and therefore, would have been obvious to one of skill in the art. *Id.* at 24–26 (citing Ex. 1006 ¶¶ 77–79).

In addition, Petitioner contends one of skill in the art would have been motivated to substitute Gwon's mobility prediction analysis into Liu, because it is merely substituting one known element for another. Pet. 34 (citing Ex. 1006 ¶ 87). Petitioner asserts a person of ordinary skill in the art "would have understood that any available method of determining an accurate predicted location would have been a suitable and obvious variation." *Id.* (citing Ex. 1006 ¶ 87).

Patent Owner does not dispute Petitioner's analysis. For purposes of this Decision, we determine Petitioner has provided evidence as well as "articulated reasoning with some rational underpinnings" in support of its

obviousness contentions. *See In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2008). For the foregoing reasons, we determine Petitioner has established a reasonable likelihood of prevailing on its challenge to claim 1 as unpatentable over Liu and Gwon.

3. Claim 5

Dependent claim 5 depends from claim 1 and further recites "wherein allocation of resources on behalf of the mobile node is triggered based at least in part on location information, the location information determined by at least one of: a global positioning system (GPS) receiver, a triangulation process, and indirect measurements of location." Ex. 1001, 13:21–26.

Petitioner relies on Liu, or alternatively, Liu and Gwon, to teach or suggest the limitations in dependent claim 5. Pet. 34–36. Petitioner contends Liu teaches indirect measurements of location in that it measures the user's historical movement patterns to predict a new location. *Id.* at 34 (citing Ex. 1006 ¶ 89). Alternatively, Petitioner contends Gwon teaches providing location information by a triangulation process and/or a global positioning system. *Id.* at 35 (citing Ex. 1004 ¶ 76). Petitioner contends it would have been obvious to one of skill in the art "to substitute one location determination method for another, as this is substituting one known element for another to obtain predictable results." *Id.* at 36.

At this stage of the proceeding, Patent Owner does not dispute Petitioner's analysis. For purposes of institution, we find that Petitioner has adequately shown Liu, alone or in combination with Gwon, teaches or suggests this limitation. Therefore, we determine Petitioner has established a reasonable likelihood of prevailing on its challenge to claim 5 as

unpatentable over Liu and Gwon.

4. Claim 6

Dependent claim 6 depends from claim 1 and further recites "wherein the at least one ghost-foreign agent populates mobile IP Advertisement messages with at least one care-of-address of neighboring foreign agents in order to extend the range of neighboring foreign agents." Ex. 1001, 13:27–31.

Petitioner relies on Gwon to teach that an advertisement message may also include the care-of address of neighboring foreign agents. Pet. 36 (citing Ex. 1004 ¶ 51). Petitioner asserts one of ordinary skill in the art "would have recognized that Gwon's disclosure of a Router Advertisement message that indicates the presence of other local routers would contain the IP address of those other local routers (i.e. their care-of-address in the network) to indicate their presence." *Id.* at 37 (citing Ex. 1006 ¶ 91).

At this stage of the proceeding, Patent Owner does not dispute Petitioner's analysis. However, based on our review of the Petition, Gwon describes providing a new care-of IP address to the mobile node's home router as part of the registration process (after the new local router has been identified), but does not disclose populating the advertisement message with care-of addresses of at least one neighboring foreign agent (during the router identification process). Ex. 1004 ¶ 54; *see also* Ex. 1006 ¶ 52.

Based on the record before us, we are not persuaded that the evidence presented in the Petition shows a reasonable likelihood that Petitioner would prevail in showing that claim 6 is unpatentable over Liu and Gwon.

D. Ground 2 (Based on Liu, Gwon, and Lau)

Petitioner contends claims 2 and 3 would have been obvious over the combination of Liu, Gwon, and Lau. Pet. 37–45.

1. Claim 2

Dependent claim 2 depends from claim 1 and further recites "wherein signaling further comprises registration with a replica of the mobile node by the ghost-mobile node to communicate with the foreign agents, triggering tunneling and communication with a mechanism configured to maintain routing information to a mobile node." Ex. 1001, 13:1–5.

Petitioner relies on Liu and Lau to teach or suggest the limitations in claim 2. Pet. 38–42. Specifically, Petitioner refers to Liu's AM-agent as teaching the "replica of the mobile node" and Liu's M-agent as teaching the "mobile node," and asserts the M-agent registers and maintains a data consistency link with the AM-agent to communicate with a foreign agent. *Id.* at 38–39 (citing Ex. 1003, 2:6–10, 2:44–53, 8:7–34; Ex. 1006 ¶ 93). Petitioner relies on Lau to teach or suggest "tunneling and communication with a mechanism configured to maintain routing information to a mobile node." *Id.* at 40–41 (citing Ex. 1005, 2:48–59). Specifically, Petitioner refers to Lau's teaching a packet forwarding mechanism implemented by the Home and Foreign Agents that is referred to as "tunneling." *Id.* at 41 (citing Ex. 1005, 2:48–59).

Petitioner contends one of ordinary skill in the art would have been motivated to combine the M-agent registration signaling of Liu with the well-known technique of Lau for tunneling because it is "applying a known technique to a known device ready for improvement to yield predictable results." Pet. 41 (citing Ex. 1006 ¶ 94). Petitioner asserts tunneling was

commonplace in mobile networks and provided many benefits that would have been well known to a person of ordinary skill in the art, such as providing a secure channel between two disjoint IP networks and allowing for circumvention of traditional routing limitations. *Id.* at 41–42 (citing Ex. 1006 ¶ 94).

At this stage of the proceeding, Patent Owner does not dispute Petitioner's analysis. For purposes of institution, we find that Petitioner has adequately shown Liu and Lau teach or suggest this limitation and has provided sufficient evidence and "articulated reasoning with some rational underpinnings" in support of its obviousness contentions. Therefore, we determine Petitioner has established a reasonable likelihood of prevailing on its challenge to claim 2 as unpatentable over Liu, Gwon, and Lau.

2. Claim 3

Dependent claim 3 depends from claim 1 and further recites "wherein signaling further comprises at least one of a tunnel and a communication network to allocate resources between the mobile node and foreign agent, the signaling being triggered at a threshold distance to one of the foreign agents reported by one of the mobile nodes, the threshold distance reported to one of the foreign agents at least one of a projected trajectory and a speed." Ex. 1001, 13:6–12.

Petitioner contends Liu, Lau, and Gwon teach or suggest the limitations in claim 3. Pet. 43–45. In addition to arguments made with respect to claim 2, Petitioner further argues Gwon teaches the recited "signaling being triggered at a threshold distance to one of the foreign agents reported by one of the mobile nodes, the threshold distance reported to one

of the foreign agents at least one of a projected trajectory and a speed." *Id.* at 43. Specifically, Petitioner contends "Gwon teaches a mobility prediction analysis that provides a threshold value indicating a distance from a mobile node to a node in the network, which informs the mobile node to begin signaling to establish a new network connection." *Id.* at 43 (citing Ex. 1004 ¶ 57). Petitioner further contends Gwon "teaches the use of GPS information to provide the threshold value indicating how close the mobile node is to another node in the network." *Id.* at 44 (citing Ex. 1004 ¶ 59). Petitioner asserts one of ordinary skill in the art would have understood "information such as that provided by GPS" to include both a trajectory and a speed when calculating an estimated destination." *Id.* at 44 (citing Ex. 1006 ¶¶ 95–96).

At this stage of the proceeding, Patent Owner does not dispute Petitioner's analysis. However, based on our review of the Petition, we do not find Petitioner's analysis convincing. Although Gwon describes determining a threshold value as part of the mobility prediction analysis to determine when some desired action should be taken by the mobile node (Ex. 1004 ¶ 57), Petitioner has not identified where Gwon teaches reporting the "threshold distance . . . to one of the foreign agents."

Based on the record before us, we are not persuaded that the evidence presented in the Petition shows a reasonable likelihood that Petitioner would prevail in showing that claim 3 is unpatentable under Liu, Lau, and Gwon.

E. Ground 3 (Based on Liu, Gwon, and IETF)

Petitioner contends claim 4 would have been obvious over the combination of Liu, Gwon, and IETF. Pet. 45–49.

Dependent claim 4 depends from claim 1 and further recites "wherein the at least one ghost-mobile node is a proxy element for the at least one foreign agent and the at least one mobile node, the at least one ghost-mobile node triggering registration based on a distance to a foreign agent by relaying security and shared secrets from a mobile node, and at least one advertisement message from a foreign agent in a vicinity of the ghost-mobile node." Ex. 1001, 13:13–20.

Petitioner relies on Liu, Gwon, and IETF to teach or suggest the limitations in claim 4. Pet. 45–49. Petitioner asserts Liu's M-agent is a proxy element between a mobile terminal and a foreign agent, and functions as a proxy for both the mobile node and the foreign agent. *Id.* at 45 (citing Ex. 1006 ¶ 98). Petitioner also asserts Gwon teaches triggering registration using security information and authentication data based on a distance to a foreign agent. *Id.* at 46 (citing Ex. 1004 ¶ 57). Petitioner further contends IETF discloses the use of MD5 authentication algorithms and security protocols during registration of the mobile node, to provide security and confidentiality services between a mobile node connecting with a foreign agent. *Id.* at 47 (citing Ex. 1008 §§ 1, 3). Petitioner further contends Liu teaches an advertisement message, as discussed above, and Gwon teaches a distance based triggering mechanism for foreign agent advertisements. *Id.* at 48 (citing Ex. 1004 ¶ 57; Ex. 1006 ¶ 98).

With respect to the combination, Petitioner contends a person of ordinary skill in the art would have found it obvious to combine Liu's pre-registration signaling and foreign agent advertising with Gwon's triggering mechanism for these processes. *Id.* at 48 (citing Ex. 1006 ¶¶ 99–100). Petitioner asserts such a modification to Liu "would eliminate the need for a

mobile device to use solicitation processing abilities or location prediction methods for registration, thereby increasing the processing speed of the mobile device and decreasing the overall computational complexity of the system." *Id.* at 48 (citing Ex. 1006 ¶¶ 99–100). Petitioner argues adding IETF would be similarly obvious because Gwon provides an explicit motivation for the combination by incorporating the reference in its own disclosure. *Id.* at 49 (citing Ex. 1006 ¶¶ 99–100). Petitioner also contends implementing software algorithms for security protocols would have been commonplace for preregistration and would have added negligible complexity to the system." *Id.* at 49 (citing Ex. 1006 ¶¶ 99–100).

At this stage of the proceeding, Patent Owner does not dispute Petitioner's analysis. For purposes of institution, we find that Petitioner has adequately shown Liu, Gwon, and IETF teaches or suggests this limitation and has provided sufficient evidence and "articulated reasoning with some rational underpinnings" in support of its obviousness contentions. Therefore, we determine Petitioner has established a reasonable likelihood of prevailing on its challenge to claim 4 as unpatentable over Liu, Gwon, and IETF.

F. Ground 4 (Based on Liu and Lau)

Petitioner contends claim 7 would have been obvious over the combination of Liu and Lau. Pet. 49–56.

1. Claim 7

a. "A method, in a mobile node, for speeding handover, comprising the steps of:"

Petitioner relies on Liu to teach or suggest the preamble of

independent claim 7. Pet. 49–50. For example, Petitioner relies on Liu's Mobile-Floating agent functions, which "allow[] the users to **immediately receive service** and maintain their data structures with virtually the same efficiency as they could have at the previous location. It also provides 'soft data structure handoff' capability." *Id.* at 49–50 (citing Ex. 1003, 2:3–10 (emphasis omitted).

At this stage of the proceeding, Patent Owner does not dispute Petitioner's analysis. For purposes of institution, we find that Petitioner has adequately shown Liu teaches or suggests the preamble.

b. "updating, in a mobile node, a location in a ghost mobile node;"

Petitioner relies on Liu to teach or suggest this limitation. Pet. 49–50. Specifically, Petitioner argues "Liu discloses a mobile terminal ('mobile node') that updates an M-agent ('ghost-mobile node') with respect to its future travel and the M-agent then determines the closest foreign agent to that future predicted location." *Id.* at 50–51 (citing Ex. 1003, 7:26–32). Petitioner further relies on Lau, which "discloses a mobile device (mobile node) that maintains its own current location information to calculate a distance between itself and approaching foreign agents." *Id.* at 51 (citing Ex. 1005, 4:29–41).

Patent Owner argues "the claim requires updating the mobile node with a location in a ghost mobile node." Prelim. Resp. 12. Patent Owner asserts Petitioner "directs its arguments to teachings concerning updating an M-agent (an alleged 'ghost-mobile node') with respect to future travel of a

mobile terminal (or 'mobile node') [which is] the reverse of what is claimed." *Id.* At this stage of the proceeding, we disagree.

Patent Owner's argument is based on a claim construction: whether the mobile node itself must be updated with the location in a ghost mobile node. Patent Owner, however, does not direct our attention to any portion of the '417 patent that supports its interpretation of this limitation. Rather, the '417 patent indicates that the ghost mobile node acts according to a predicted future state, such as location, of the mobile node. *E.g.*, Ex. 1001, 2:58–65, 6:27–30, 6:39–42, 6:46–56, 6:65–67, 7:4–7). The claim language recites "updating, in a mobile node, a location in a ghost mobile node," which, for purposes of this decision, we understand to mean that the mobile node updates the ghost mobile node with its location. *See id*. At this stage of the proceeding, and in light of our review of the '417 patent, Petitioner has identified support Liu discloses a mobile terminal that updates the ghost mobile node (i.e., "an M-agent") with its location. Accordingly, for purposes of institution, Petitioner has adequately shown Liu and Lau teach or suggest this limitation.

c. "determining a distance, in the ghost mobile node in communication with the mobile node, to a closest foreign agent with which the mobile node can complete a handover;"

Petitioner relies on Liu and Lau to teach or suggest this limitation. Pet. 52–53. For example, Petitioner argues "Liu teaches a system where the M-agent ('ghost-mobile node') uses the predicted location of the mobile terminal in conjunction with an MF-agent protocol to assign the closest MF-agents with which the mobile device may complete a handover." *Id.* at 52

(citing Ex. 1004, 12:52–66). Petitioner also asserts "Lau allows for the mobile network device to utilize its own location information in conjunction with GPS information sent from foreign agents to calculate the distance to the closest foreign agent." *Id.* at 53 (citing Ex. 1005, 3:43–57).

At this stage of the proceeding, Patent Owner does not dispute Petitioner's analysis. For purposes of institution, we find that Petitioner has adequately shown Liu and Lau teach or suggest this limitation.

d. "submitting on behalf of the mobile node, from the ghost mobile node, a registration to the foreign agent to which the mobile node is going to complete the handover; and"

Petitioner relies on Liu to teach or suggest this limitation. Pet. 54. For example, Petitioner argues Liu's "M-agent ('ghost-mobile node') submits registration request on behalf of the mobile terminal ('mobile node') to register with a foreign agent where handoff is to occur." *Id.*

At this stage of the proceeding, Patent Owner does not dispute Petitioner's analysis. For purposes of institution, we find that Petitioner has adequately shown Liu teaches or suggests this limitation.

e. "upon completing the handover, updating a registration in the mobile node."

Petitioner relies on Liu to teach or suggest this limitation. Pet. 55. For example, Petitioner argues "[i]n Liu, a registration reply is sent to the mobile terminal from the MF-agent linked to a foreign agent." *Id.* (citing Ex. 1003, 7:51–57). Petitioner further argues "once the mobile terminal reaches its destination, it links with the MF-agent that has been assigned there and registers with the foreign agent to complete the registration

process." *Id.* at 55 (citing Ex. 1003, 8:7–16). Petitioner contends a person of ordinary skill in the art "would have understood that this link also completes the updating of the registration with the new F-agent and linked MF-agent in the mobile node." *Id.* at 56 (citing Ex. 1006 ¶ 105; Ex. 1003, 8:7–16, Fig. 8).

At this stage of the proceeding, Patent Owner does not dispute Petitioner's analysis. For purposes of institution, we find that Petitioner has adequately shown Liu teaches or suggests this limitation.

2. Rationale for Combining Liu and Lau

Petitioner contends one of ordinary skill in the art "would have been motivated to modify the mobile node in Liu to send current location information to the M-agent as it travels as disclosed in Lau, to supplement the predictive mobility analysis." Pet. 51 (citing Ex. 1006 ¶¶ 102–103). Petitioner asserts "[t]his is merely using a known technique to improve a similar device in the same way and/or combining prior art methods according to known methods to yield predictable results." *Id.* (citing Ex. 1006 ¶¶ 102–103). Petitioner further argues one of ordinary skill in the art would have understood the benefits of sending current location data, such as, for example, creating a more efficient system for locating the closest handoff point in the foreign network. *Id.* at 51–52 (citing Ex. 1006 ¶¶ 102–103).

Petitioner further contends one of ordinary skill in the art would have been motivated to modify Liu "with the method in Lau for measuring the position of a mobile device in relation to the position of the foreign agents in the network to calculate the nearest foreign agent since this is combining prior art methods according to known methods to yield predictable results."

Id. at 54 (citing Ex. 1006 ¶¶ 102–103). Petitioner asserts this "would have provided a more accurate method of finding the shortest distance to the next closest handoff point" and "would also have provided a faster system for finding the next handover location when the mobile device deviates from its original course." *Id.* at 54 (citing Ex. 1006 ¶¶ 102–103).

For purposes of this Decision, we determine Petitioner has provided evidence as well as "articulated reasoning with some rational underpinnings" in support of its obviousness contentions. Patent Owner has not disputed Petitioner's analysis. Therefore, at this stage of the proceeding, we determine Petitioner has established a reasonable likelihood of prevailing on its challenge to claim 7 as unpatentable over Liu and Lau.

G. Conclusion

For the foregoing reasons, we determine Petitioner has demonstrated a reasonable likelihood that it would prevail in establishing the unpatentability of claims 1, 2, 4, 5, and 7 of the '417 patent based on the grounds asserted in the Petition. Petitioner has not, however, shown on the current record a reasonable likelihood that it would prevail in establishing the unpatentability of claims 3 and 6 of the '417 patent. We nevertheless institute an *inter partes* review of all challenged claims on all of the grounds set forth in the Petition. *See SAS Inst., Inc. v. Iancu*, 138 S. Ct. 1348, 1359–60 (2018).

At this stage of the proceeding, the Board has not made a final determination as to the patentability of any challenged claim. Any findings of fact and conclusions of law made herein are not final, but are made for the sole purpose of determining whether Petitioner meets the threshold for

initiating review. Any final decision shall be based on the full trial record, including any response timely filed by Patent Owner.

III. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, pursuant to 35 U.S.C. § 314(a), an inter partes review is hereby instituted as to claims 1–7 of the '417 patent on the following asserted grounds:

Claims 1, 5, and 6 under 35 U.S.C. § 103(a) as obvious over the combination of Liu and Gwon;

Claims 2 and 3 under 35 U.S.C. § 103(a) as obvious over the combination of Liu, Gwon, and Lau;

Claim 4 under 35 U.S.C. § 103(a) as obvious over the combination of Liu, Gwon, and IETF; and

Claim 7 under 35 U.S.C. § 103(a) as obvious over the combination of Liu and Lau.

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial, the trial commencing on the entry date of this Decision.

Case IPR2018-01150
Patent 8,213,417 B2

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Dated: July 30, 2020

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APPELLANT'S OPENING BRIEF

was filed with the Clerk of the United States Court of Appeals for the Federal Circuit via the CM/ECF SYSTEM. Counsel registered with the CM/ECF system have been served by operation of the Court's CM/ECF SYSTEM per Fed. R. App. P. 25 and Fed. Cir. R. 25(c) on the 30th day of July 2020.

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