

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TP-LINK CORPORATION LIMITED,
Petitioner

v.

NETGEAR, INC.,
Patent Owner

U.S. PATENT NO. 10,327,242 B2

Case IPR2023-TBD

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

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LIST OF EXHIBITS

Exhibit No.	Description
1001	U.S. Patent No. 10,327,242
1002	Declaration of Dr. Zhi Ding for <i>Inter Partes</i> Review of U.S. Patent No. 10,327,242
1003	<i>Curriculum Vitae</i> of Dr. Zhi Ding
1004	Certified File History of U.S. Patent No. 10,327,242
1005	International Patent Application Publication No. WO 2014/145073 A1 (“Gupta”)
1006	U.S. Patent No. 7,907,562 (“Murty”)
1007	U.S. Patent No. 9,936,028 (“Ganu”)
1008	U.S. Patent Application Publication No. 2015/0085844 A1 (“Tian”)
1009	Perahia and Stacey, <i>Next Generation Wireless LANs</i> , Cambridge University Press, 2nd Edition (2013) (“Perahia”)
1010	Chinese Patent CN 101,583,151 B (“Haitao”) and certified translation
1011	IEEE 802.11v
1012	IEEE 802.11-2012
1013	<i>Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation</i> , Katherine K. Vidal (June 21, 2022)
1014	District Court Stay Order
1015	Publication declaration for IEEE 802.11v
1016	Publication declaration for IEEE 802.11-2012
1017	Levanen et al., <i>Dense small-cell networks: Rethinking the radio interface beyond LTE-advanced</i> , 1st Int’l Conf. on 5G for Ubiquitous Connectivity 163 (2014) (“Levanen”), citing Perahia

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Exhibit No.	Description
1018	Jeon et al., <i>LTE in the Unlicensed Spectrum: Evaluating Coexistence Mechanisms</i> , 2014 IEEE Globecom Workshop 740 (2014) (“Jeon”), citing Perahia

Petitioner TP-Link Corporation Limited (“TP-Link”) requests *inter partes* review (“IPR”) of claims 1-37 (the “Challenged Claims”) of U.S. Patent No. 10,327,242 (Ex.1001, “the ’242 Patent”).

I. INTRODUCTION

The ’242 Patent claims a method of network-initiated roaming, whereby a controller and/or access points (APs) in a wireless mesh network determine if there is a candidate AP that can provide improved connection quality to a client device compared to the client’s current/serving AP, in which case the current/serving AP causes the client to roam within the network. The claimed inventions are unpatentable because such network-initiated roaming was well-known in the art, as demonstrated in this Petition. Petitioner therefore respectfully requests that all claims of the ’242 Patent (the Challenged Claims) be cancelled as unpatentable.

II. OVERVIEW OF CHALLENGE AND RELIEF REQUESTED

The claimed priority date of the ’242 Patent is November 10, 2015.¹ Ex.1001. Petitioner’s challenge is based on the following prior art references:

- **Gupta** - International Patent Application Publication No. WO 2014/145073 A1, published September 18, 2014, from a PCT application filed March 14, 2014. Gupta is AIA §§102(a)(1)-(2) prior art. Gupta is not cited art.

¹ Petitioner reserves the right to challenge the claimed priority date.

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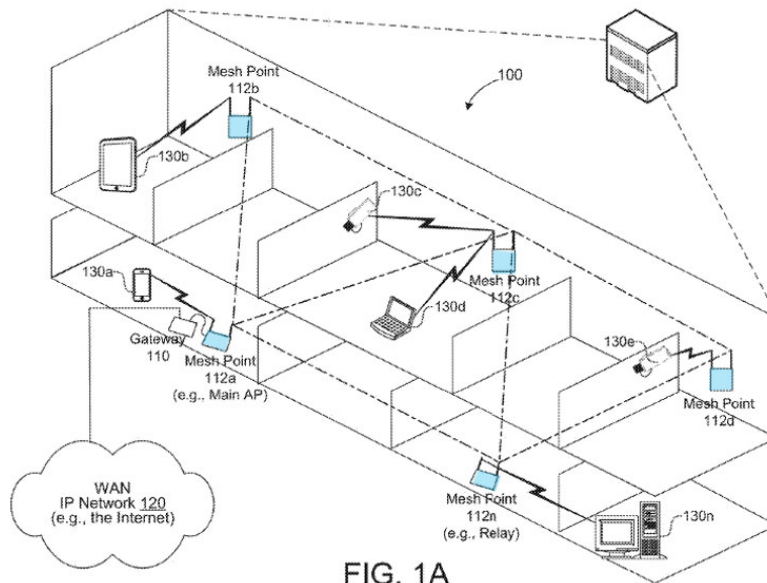
- **Murty** - U.S. Patent No. 7,907,562 issued on March 15, 2011, from an application filed June 20, 2007. Murty is AIA §§102(a)(1)-(2) prior art. Murty is not cited art.
- **Ganu** - U.S. Patent No. 9,936,028 issued on April 3, 2018, from an application filed October 21, 2014 and published April 21, 2016. Ganu is AIA §102(a)(2) prior art, and is not cited art.
- **Perahia** - Perahia and Stacey, “Next Generation Wireless LANs,” Cambridge University Press, 2nd Edition (2013), is publicly available no later than 2014. Exs.1017-1018. Perahia is AIA §102(a)(1) prior art. Perahia is not cited art.
- **Tian** - U.S. Patent Application Publication No. 2015/0085844 A1, published on May 26, 2015, from an application filed September 25, 2013. Tian is AIA §§102(a)(1)-(2) prior art. Tian is not cited art.

Petitioner requests cancellation of the Challenged Claims on the grounds below:

Ground	Basis	Challenged Claims	Reference(s)
I	§ 103	1-10, 14-15, 18-31, 35	Gupta, Murty
II	§ 103	16, 17, 36, 37	Gupta, Murty, Ganu
III	§ 103	11, 32	Gupta, Murty, Perahia
IV	§ 103	1, 5, 8, 9, 12, 13, 19, 21, 22, 26, 29, 30, 33, 34	Murty, Tian

III. BACKGROUND OF THE '242 PATENT

According to the '242 Patent, a better alternative to using a single high-power AP to cover an area such as a home is to use “a wireless mesh network with a multitude of smaller APs [(blue)], deployed ... in a scattered, distributed manner” as illustrated below. Ex.1001, 3:36-39.



Ex.1001, FIG. 1A. According to the patent, traditionally, a client device (such as a cell phone) only starts roaming in the network when the signal strength of the AP it is connected to (current/serving AP) is poor. *Id.*, 20:43-45. Such client-initiated roaming can be “ineffective” because the client device lacks information on the conditions of the wireless mesh network. *Id.*, 20:45-53. The '242 Patent purports to solve this problem using network-initiated roaming whereby the APs measure link quality parameters and pro-actively initiate client roaming. *Id.*, 20:54-59 (“[T]he

disclosed wireless mesh network can measure one or more parameters in addition to the RSSI value to better determine when and how to roam a client.”). This Petition demonstrates that pro-active network-initiated roaming was well-known before the claimed priority date of the ’242 Patent.

IV. LEVEL OF ORDINARY SKILL IN THE ART

As Dr. Ding explains, a person of ordinary skill in the art (“POSITA”) of the subject matter of the ’242 Patent would have had a Bachelor’s degree in electrical engineering, computer engineering, computer science, or a related field, and three years of experience in the design and analysis of wireless communication systems or equivalent work experience. Ex.1002, ¶¶49-52. Additional education might compensate for less experience, and vice-versa. *Id.*

V. CLAIM CONSTRUCTION

Claims only need to be construed to the extent necessary to resolve a controversy. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co. Ltd. Matal*, 868 F.3d 1013, 1017 (Fed. Cir. 2017). Petitioner submits that the Board does not need to construe any claim term for purposes of resolving the issues presented in this Petition.

VI. OVERVIEW OF THE PRIOR ART

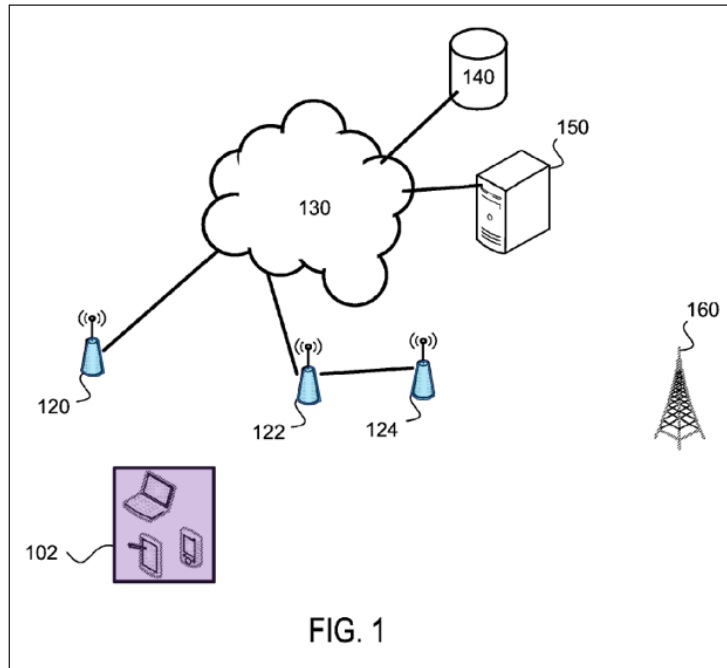
A. Overview of Gupta

Like the ’242 Patent, Gupta is directed to pro-active network-initiated roaming (“redistribution of wireless clients”) in a wireless mesh network. Ex.1005,

Abstract (“Systems and methods for instituting redistribution of wireless clients to improve service [whereby]... *multiple APs acting in concert, and/or a central entity* []... *deciding that an associated client should be redistributed [(roam)] based on a connection metric*, wherein the decision is based on at least... [a] network metric and a threshold comparison; and ... sending the associated client a trigger, wherein the *trigger* is at least one of, a redistribution request and a disconnect message.”), [0004], [0035] (“The above redistributions may be referred to as a proactive approach to client distribution.”); Ex.1002, ¶¶55-61.² As Gupta teaches, connection metrics are obtained from a plurality of link quality parameters measured by APs, such as “received signal strength indication (RSSI), number of clients, airtime utilization, and physical layer data rate.” *Id.*, [0054]-[0055]. Those link quality parameters match the “qualitative parameters” of the ’242 Patent. Ex.1001, 20:54-59, claim 19.

Gupta Figure 1 illustrates “WiFi Access Points (APs)” (blue) forming a wireless mesh network, and exemplary client devices (purple). Ex.1005, [0028]-[0031], [0033] (“networks that are configured for APs to mesh” with “[a] number of hops from one AP to a root node”).

² Emphasis added unless otherwise noted.



Ex.1005, FIG. 1.³ Like the '242 Patent, Gupta teaches that the decision to roam a client (“redistribution decisions”) can be made in a centralized or distributed manner, such as by a “central ... controller, or ...one [AP] is designated as a controller, or a distributed controller where APs collectively control each other to make redistribution decisions.” Ex.1005, [0051]-[0052]; Ex.1001, 20:66-21:4. As Gupta teaches, in a centralized architecture, “[a] controller could monitor the *connection metrics* of the clients through the various APs [and] ...could communicate with the respective APs in order to affect change and redistribute the clients.” *Id.*, [0045]. In a distributed architecture, “[t]he AP could receive information *from other APs* and

³ Colors and colored annotations added unless otherwise noted.

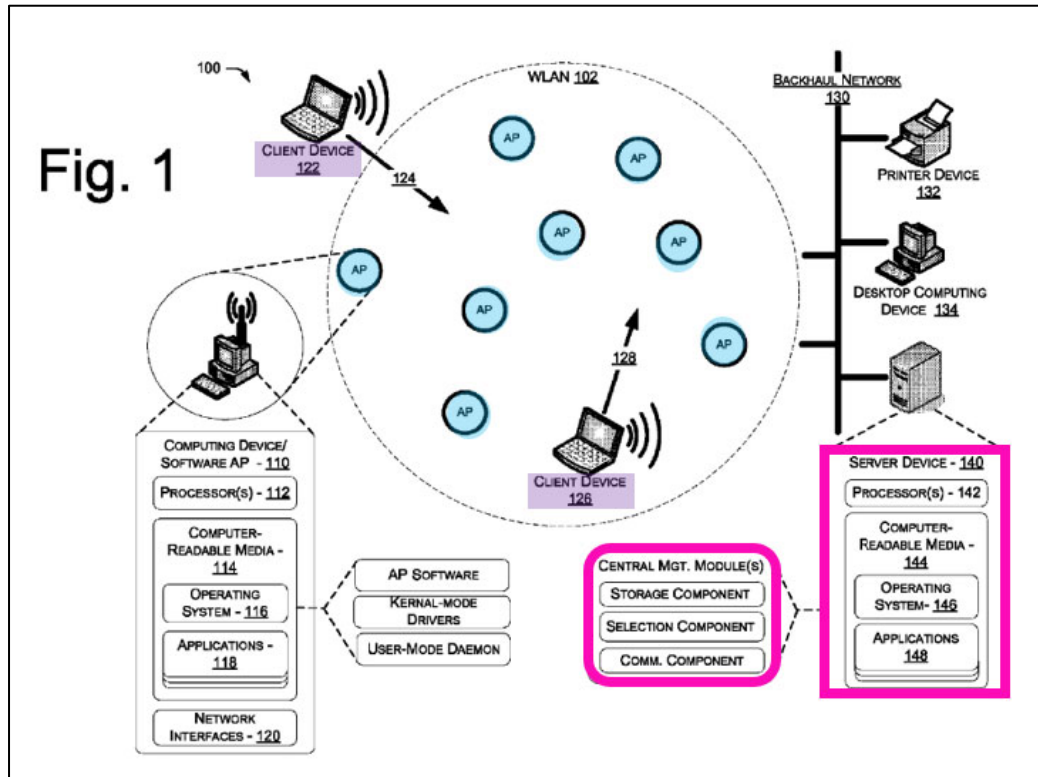
use that information, in conjunction with *local information*, to make [roaming] decisions.” *Id.*, [0052].

Like the '242 Patent, Gupta also teaches sending appropriate messages to a client device to cause it to roam, depending on whether the client device supports intelligent roaming. As Gupta explains and consistent with the '242 Patent, the current AP transmits deauthentication (“DeAuth”) and/or disassociation (“DisAssoc”) frames to a legacy client that does not support intelligent roaming, forcing it to disconnect and to roam. Ex.1005, [0067]; Ex.1001, claim element [1.7]. On the other hand, if the client device supports intelligent roaming (*e.g.*, it is an 802.11v-compliant client), the current AP sends 802.11v BSS Transition Management (BTM) frames to have it roam to another AP. Ex.1005, [0070] (“[T]he [current] AP may not disconnect a client but instead attempt to *redirect it to find another AP* with which to associate ... using a Basic Service Set (BSS) Transition Management (BTM) frame exchange.”), *id.*, [0072] (BTM message includes a “list of candidate APs”). This is also consistent with the '242 Patent. Ex.1001, claim element [22.7].

B. Overview of Murty

Like the '242 Patent and Gupta, Murty teaches a wireless mesh network, illustrated in Figure 1, in which a central controller (magenta) manages client-AP associations (mappings). Ex.1006, Abstract, 1:15-33, 2:18-31, 4:16-18 (“a central

controller (with an ‘infrastructure-wide view’) coordinates[s] the client-to-AP mapping for each AP.”); Ex.1001, 20:66-21:4; Ex.1002, ¶¶62-65.



Ex.1006, FIG. 1.

The central controller is configured to “periodically or continuously collect (i.e., receive) and monitor AP information centrally” and “uses AP information it has collected to determine (i.e. select) which AP should associate to with the client device.” *Id.*, 12:40-50, 15:29-36, FIG. 3. As Murty teaches, each AP (blue) transmits to the controller multiple parameters indicative of the quality of the link between that AP and the client (purple), such as its *available airtime* (FreeAirtime) and *expected data rate* (ExpectedRate), and the controller uses that information to determine the AP that would provide “the *most available air time* (i.e., [it has] the

least load burden) and/or the ***highest average expected data rate*** between it and [a] client device” to associate with a client device. *Id.*

Murty further discloses that the central controller maintains a list (“APlist”) of available APs that are candidates for association with a client device. *Id.*, 17:44-45, 17:57-64. Each AP in the list is assigned a score (“single value”) indicative of the quality of the access link between itself and the client device. *Id.*, 17:64-18:5. Murty explains that the score “assigned to each AP (in the selected group) is intended to represent the ***available throughput capacity*** of that AP [and] can be used uniformly for comparing various possible APs (‘candidates’) to identify (i.e., select) a preferable AP (having the ***highest single value***) to associate with” the client device. *Id.*, 18:9-14.

Murty also teaches that handoff/roaming is only warranted if there is a candidate AP that can provide substantially improved throughput compared to the current AP, *e.g.*, where there is a net throughput improvement above a select level, for example an improvement of at least 20%:

[F]or a client device to be considered a device that would benefit from being handed off, there should be an available candidate AP (for the client device to be handed off to) that is capable of providing the client device with an ***improved throughput capacity*** ... [A] client device handoff [(roaming)] could be considered inappropriate ***unless*** the throughput capacity available to the client device (on the candidate AP) could be ***improved by a certain fraction (e.g., 20%)***. This would

minimize handoffs due to small fluctuations in loads and/or interference levels.

Ex.1006, 19:35-54.

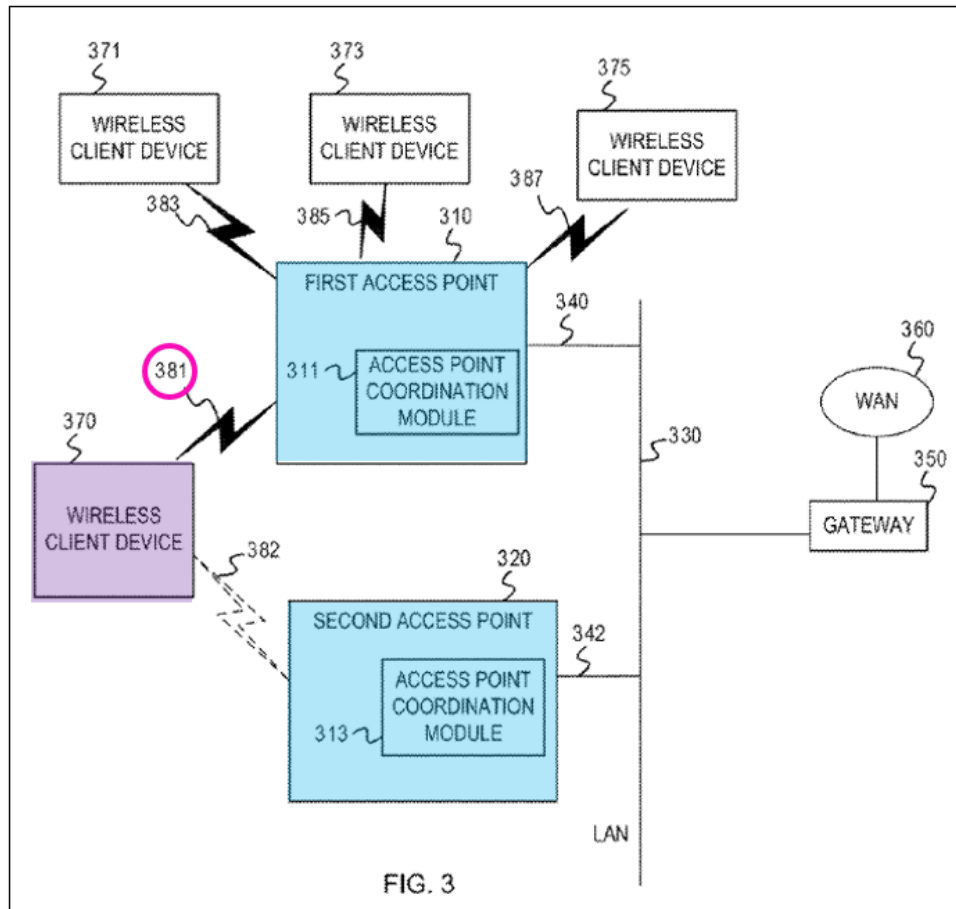
C. Overview of Ganu

Ganu is directed to roaming in a wireless network in which “a network infrastructure needs to determine whether the client device should be steered to another radio and/or access point” when “the client device ... is in the midst of a *delay-sensitive* or *disruption-sensitive* transaction,” such as an active voice or video call. Ex.1007, 1:15-24, 3:17-19, 3:63-65; Ex.1002, ¶66. Ganu teaches that, when signal quality of a client degrades during delay-sensitive or disruption-sensitive applications, the network may decide to *delay roaming* and “allow the client device to be associated with the same radio [of the same AP] even though a better radio exists in the network that can provide better signals to the client.” *Id.*, 4:1-9. This “*Not Move Client Device*” strategy “minimize[es] the disruption of the ongoing session from roaming events.” *Id.*

D. Overview of Tian

Like the '242 Patent, Tian discloses methods of facilitating roaming (“re-association”) of a wireless client device in a wireless network. Ex.1008, [0004]; Ex.1002, ¶¶67-73. Such a network including multiple APs (blue) is illustrated in Figure 3. *Id.*, [0009]. As shown, client device 370 (purple) is associated with AP 310 and communicates with it over wireless link 381 (magenta). *Id.*, [0035]. Figure 3

also “depicts a wireless link 382 [(dashed lines)] between the wireless client device 370 and the second AP 320 that will result *after completing the re-association* of the wireless client device 370 from the first AP 310 to the second AP 320.” *Id.*



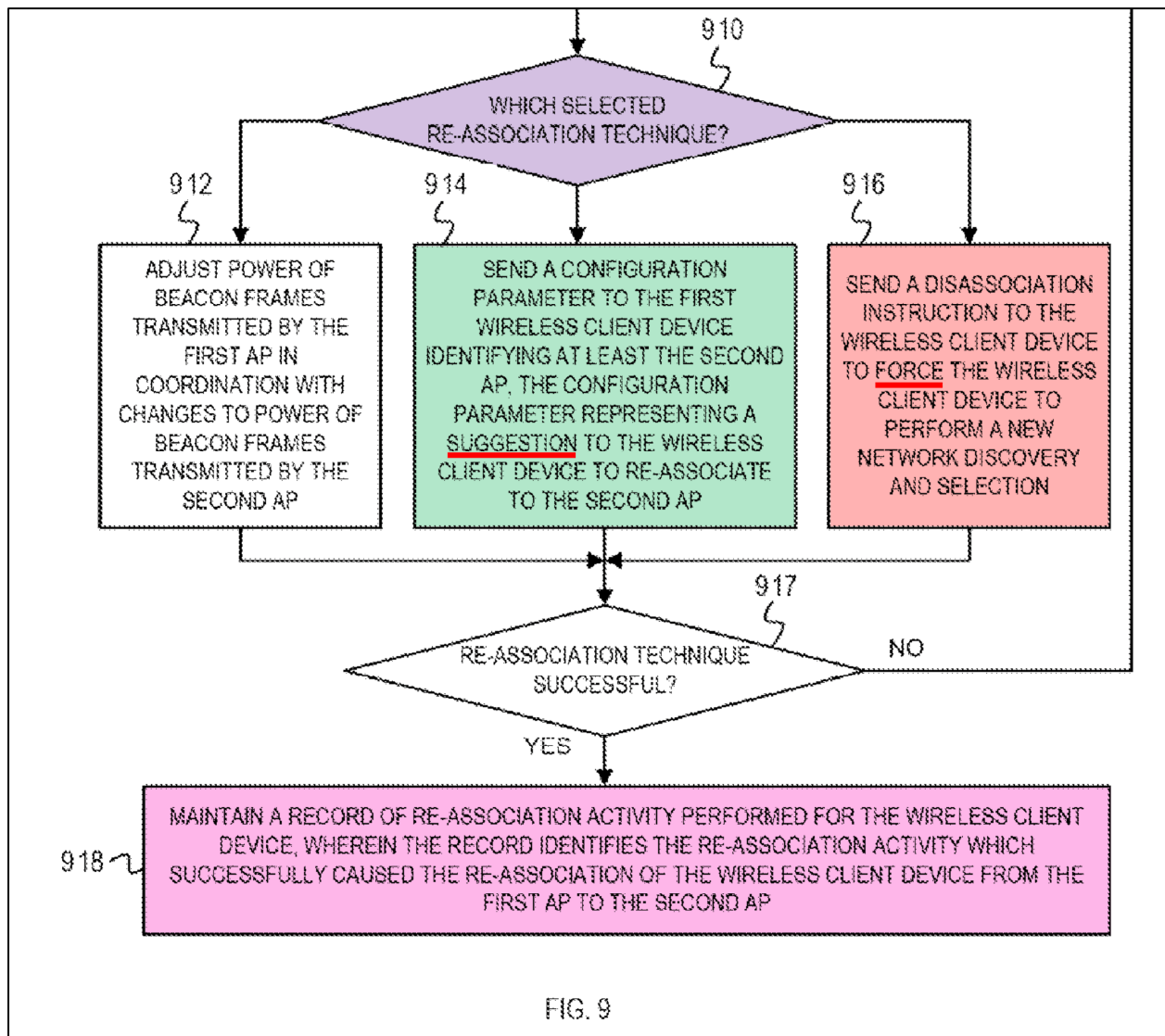
Ex.1008, FIG. 3. Tian teaches that the current AP 310 uses the link quality information it receives from the candidate AP 320 to calculate “an *expected throughput gain* that might result from the wireless client device 370 being associated with the second AP 320.” *Id.*, [0040]. “If the [expected] throughput gain is *above a predefined threshold*,” the current AP determines to re-associate (roam) the client device to the candidate AP 320. *Id.*, [0043], [0040].

In addition, like the '242 Patent, Tian teaches selecting the appropriate re-association technique to roam a client device based on the client's roaming capability and past roaming behavior. *Id.*, [0029].

As shown at block 914 (green) in Figure 9 below, to initiate roaming of a client device that supports intelligent roaming, the AP sends a request ("configuration parameter") "identifying at least the second AP, the configuration parameter representing *a suggestion* to the wireless client device to reselect and [re]-associate[] with the second AP." *Id.*, [0074].

As shown at block 916 (red), to roam a legacy client device that does not support intelligent roaming, the AP instead sends a "*disassociation instruction* ... to the wireless client device to *force* the wireless client device" to disconnect and "to perform a new network discovery and selection." *Id.*, [0075].

The network also maintains a record of previous re-association activities, as shown at block 918 (magenta). Ex.1008, [0077], [0029]. APs use this record (profile) to determine a client's roaming capabilities and behavior and to "select a particular re-association technique" to roam the client, shown at block 910 (purple). *Id.*, [0072].



Id., FIG. 9 (excerpted).

VII. SPECIFIC GROUNDS FOR PETITION

A. Ground I: Claims 1-10, 14-15, 18-31, 35 Are Rendered Obvious by Gupta, Alone or in Combination with Murty

1. Reasons to Combine Gupta and Murty

As Dr. Ding explains and as further detailed at the element-by-element level in Sections VII.A.2 and VII.A.9, a POSITA would have had compelling reasons to

combine the teachings of Gupta and Murty. Ex.1002, ¶¶74-77. Gupta and Murty are analogous references with compatible teachings, and a POSITA would recognize that Murty’s detailed software architecture could be used to improve and enhance the operation of Gupta’s system. For example, both references are directed to ***the same*** subject matter—roaming in a wireless mesh network, whereby the network pro-actively initiates roaming of client devices to improve service. *See* Section VII.A.2.(a). Both references also describe ***the same*** software-based centralized architecture in which a central controller manages all client device-to-AP associations in the mesh network.⁴ *Id.* Murty, however, describes its software architecture in more detail than Gupta, and a POSITA would have found it obvious and beneficial to use Murty’s teachings in Gupta’s system to flexibly support Gupta’s software-intensive roaming strategies. *Id.*

Gupta and Murty also both teach that the network initiates client roaming after determining that a candidate AP can offer better quality of service (connection metric) to a client than what is offered by the current AP. *See* Section VII.A.2.(e)-(f). Gupta and Murty notably teach using ***the same*** connection metric, achievable throughput, to make roaming decisions. *See* Section VII.A.2.(e)-(f). To support roaming decisions, Gupta’s and Murty’s central controller collects and monitors

⁴ Gupta also teaches distributed control architectures.

many of the ***the same*** link quality parameters measured by the APs, such as data rate and available airtime. *See* Sections VII.A.2.(c)-(d) and VII.A.8. Gupta and Murty teach sending ***the same*** messages (deauthentication and/or disassociation frames) to force-disconnect the client. *See* Section VII.A.2.(h). A POSITA would therefore understand that Murty's teachings are compatible with Gupta's, and that a POSITA could use Murty's teaching to improve Gupta's system with predictable results. Ex.1002 ¶76.

Murty also provides a detailed procedure for determining the best candidate AP from the collected link quality parameters, and a POSITA would have found it useful and obvious to implement it in Gupta's system because it is efficient, improves decision-making speed, and minimizes unnecessary roaming. *Id.*; Sections VII.A.2.(f) and VII.A.9.

As Dr. Ding explains, the results of combining Gupta and Murty would have been predictable, and there would have been a reasonable expectation of success, because the modification of Gupta based on Murty would require common and routine software programming. Ex.1002 ¶77.

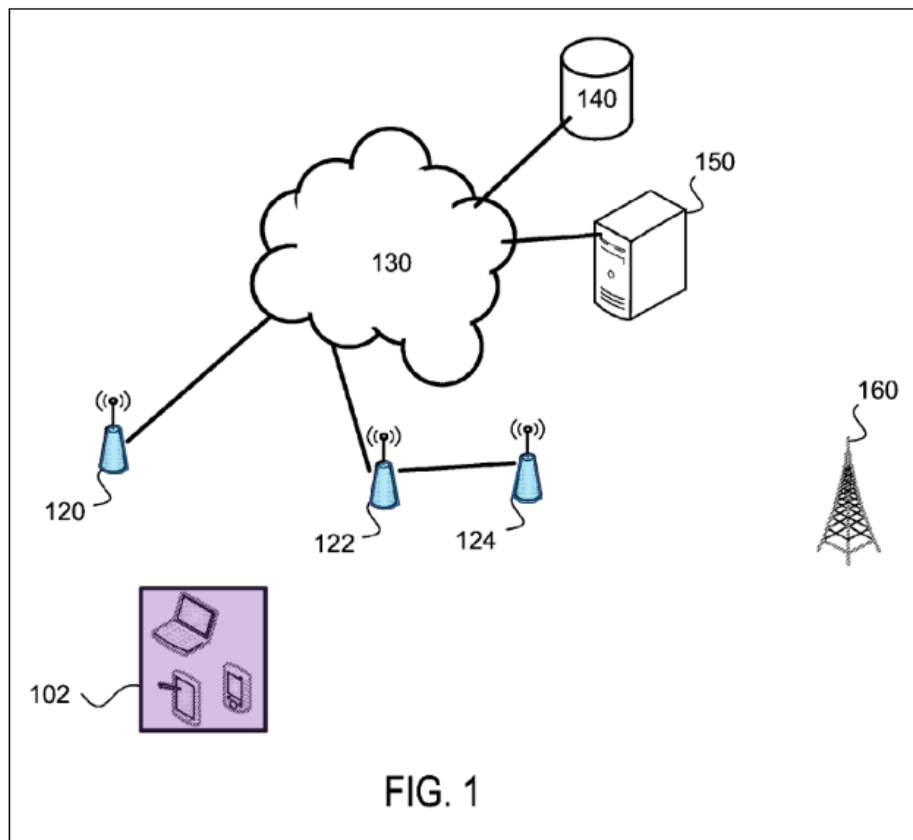
2. Independent Claims 1 and 22

Because independent claims 1 and 22 are largely duplicative of one another, Petitioner addresses those claims together herein. Petitioner has also applied this approach herein to dependent claims that are largely the same.

- (a) *Preamble: “A computer-implemented method for roaming implementation in a wireless mesh network formed with one or more mesh points, the method comprising:”*

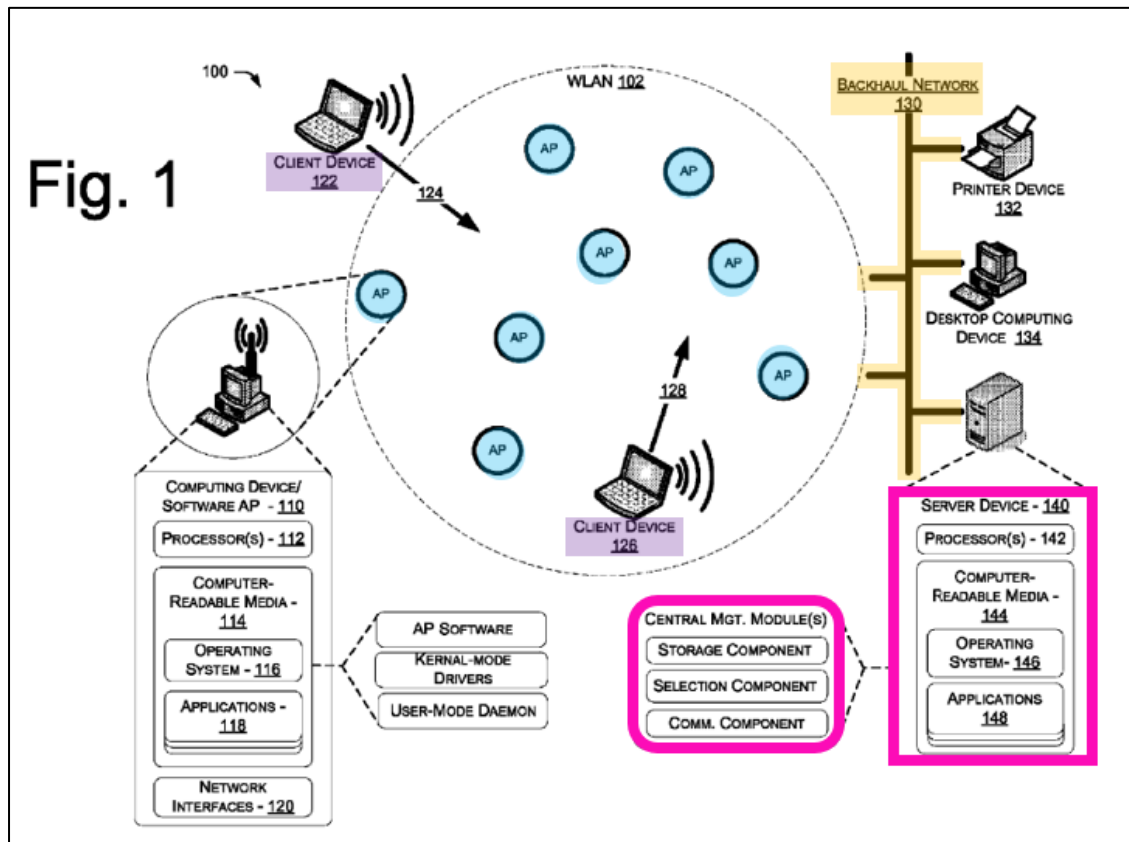
To the extent the preamble is limiting, Gupta discloses or renders it obvious, alone or in combination with Murty. Ex.1002 ¶¶78-87.

Wireless mesh network - Gupta discloses a wireless mesh network, illustrated in Figure 1, formed with one or more “WiFi Access Points (APs)” (mesh points) (blue). Ex.1005, [0028]. As Gupta explains, such a network “[is] configured for APs *to mesh*” so that “the APs [can] share information directly or indirectly, with one another ...”. *Id.*, [0030], [0033].



Ex.1005, FIG. 1.

Murty also discloses wireless mesh networks and confirms they were well-known in the art. Ex.1002 ¶¶79-80; Ex.1006, 1:21-32 (“[W]ireless LANs (WLANs) are becoming increasingly popular ... These WLANs provide mobile client devices with wireless access from any location within range of one or more access points (AP) associated with the WLAN. In this way, mobile client devices can access a WLAN, and potentially one or more backhaul networks (wired and/or *wireless mesh*) ... without being physically connected to the network.”), 3:7-26, 6:58-61 (“System 100 [in Figure 1] also includes a backhaul network (typically wired and/or *wireless network mesh*) ... depicted here as backhaul network 130 [(tan)].”).



Ex.1006, FIG. 1.

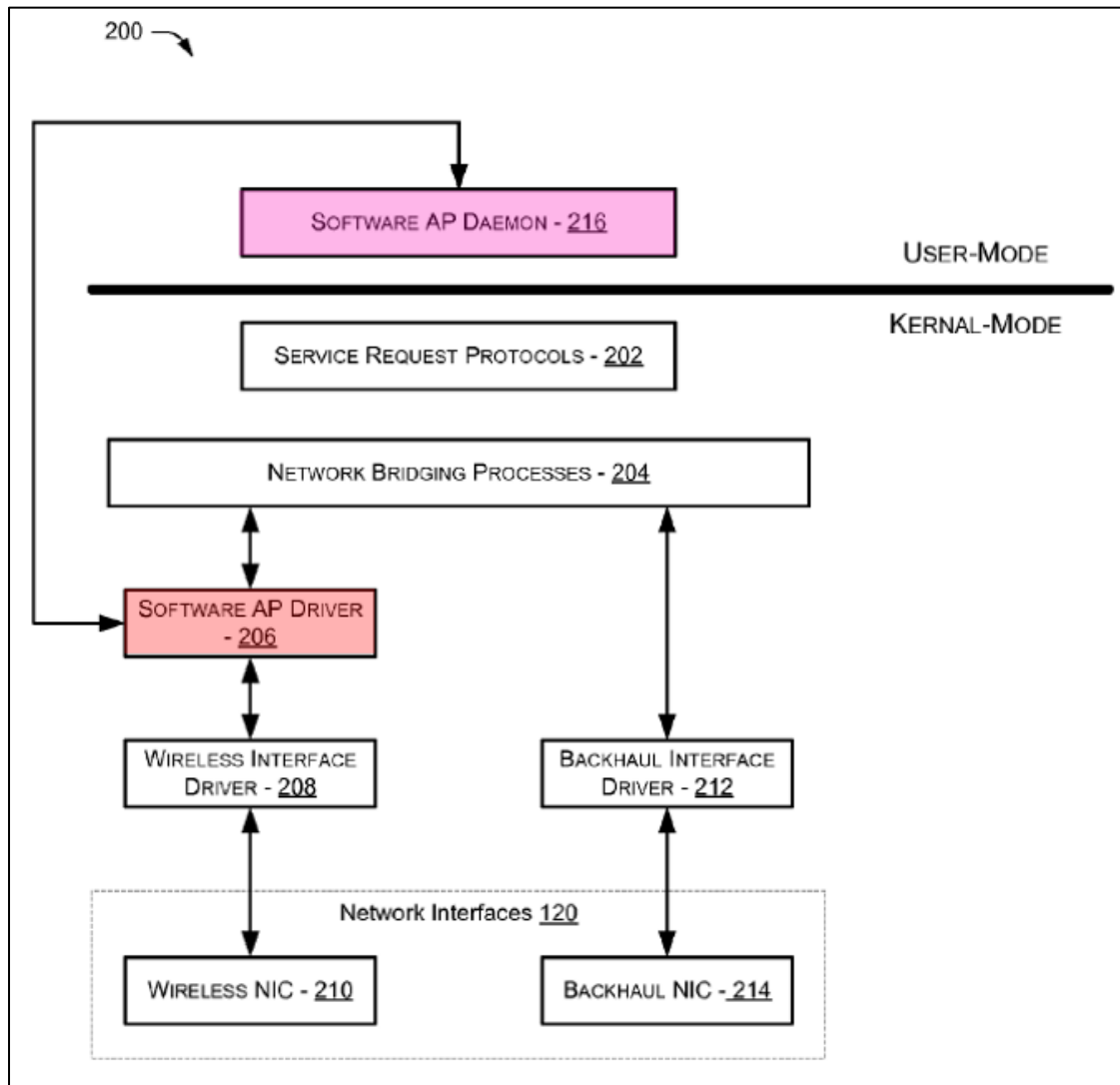
Computer-implemented method for roaming - Gupta discloses a computer-implemented method for roaming implementation (“redistribution of wireless clients”) in its wireless mesh network. Gupta teaches “[s]ystems and methods for instituting *redistribution of wireless clients* to improve service [with] ...**multiple APs acting in concert, and/or a central entity** ... *deciding that an associated client should be redistributed [(roam)] based on a connection metric*, wherein the decision is based on at least... [a] network metric and a threshold comparison ...”. Ex.1005, Abstract, [0004]. Gupta further teaches that redistribution (roaming) decisions can be made in a distributed or centralized manner, among others. *Id.*, [0052]. As an example of a distributed roaming architecture, Gupta explains that each AP can “make decisions locally” whether to redistribute (roam) its associated client devices. *Id.* Roaming decisions can also be made by “a central entity like a controller, or among the APs where one is designated as a controller, or a distributed controller where APs collectively control each other to make redistribution decisions.” *Id.* [0052].

Gupta further explains that its strategies to improve roaming (redistribution) of client devices across the wireless mesh network are implemented using computers, software and/or firmware. Ex.1005, [0096] (“features consistent with the present inventions may be implemented via ***computer-hardware, software*** and/or ***firmware.***”). Gupta further explains that there were many available computer-

implementation options, all of which were well-known. *Id.*, [0097]-[0098]; Ex.1002 ¶¶81-83.

In any event, a POSITA would have understood and found obvious that a computer-implementation is important to provide the flexibility to implement the different software-intensive roaming strategies discussed in Gupta. *See, e.g.*, Ex.1005, [0044]-[0048] (redistribution for load balancing). [0054]-[0061] (redistribution based on absolute or relative connection metric thresholds), [0062]-[0065] (redistribution based on probabilistic calculations that use “a mathematical function to return a calculated probability that the client should be redistributed or not”); Ex.1002, ¶84. A POSITA would have been motivated to consult Murty, which describes a software architecture for roaming implementation in a wireless mesh network, *i.e.*, a computer-implemented method, that “is intended to provide a significant degree of *control* and *flexibility* ...”. Ex.1006, 9:34-37; Ex.1002 ¶85. As Murty explains and as illustrated in Figure 2 below, “[n]etwork stack 200 enables AP functionality” in mesh points and includes “[s]oftware AP driver 206” (red) where “most of the AP functionality, such as *association*, authentication, rate control, *handoffs*, packet routing, and the like is implemented.” *Id.*, 8:29-9:3. The network stack also includes “software AP daemon 216” (magenta) responsible for “performing certain *association* and/or *handoff* procedures” and for “[p]eriodically reporting (to the central management module(s)) software AP-specific

information... [such as] an updated list of client devices currently associated with the software AP; the air-time utilization for each client device currently associated with the [AP] ...”. *Id.*, 9:55-10:9.



Ex.1006, FIG. 2. As Dr. Ding explains, a POSITA would have found it obvious to try using such a software architecture to implement Gupta’s redistribution functionalities. Ex.1002 ¶¶86-87. A POSITA would have had a reasonable expectation of success given Murty’s detailed explanation of the architecture and its

use of routine software programming and because, as discussed above, the architecture is designed “to provide a *significant degree* of *control* and *flexibility*[.]” *Id.*; Ex.1006, 7:60-10:9. Additionally, as Dr. Ding explains, combination of Gupta and Murty as proposed is a combination of prior art elements according to known methods, and also application of a known technique to a known system ready for improvement, both to yield predictable results, namely improved roaming functionality. Ex.1002 ¶¶86-87.

- (b) *Elements [1.1]/[22.1]: “causing a wireless link to be established between a first mesh point and a client;”*

Gupta discloses this element or renders it obvious. Ex.1002 ¶¶88-90. As Gupta explains, “an access point (AP) [is] configured to allow a client to associate to it, and connect with a network.” Ex.1005, [0011], [0032]; *id.*, claim 1 (“A method for instituting redistribution of wireless clients to improve service, comprising: ... allowing a client to associate”). A POSITA would have understood and found obvious that by allowing the client to associate to it, the serving AP causes a wireless link to be established between itself (claimed first mesh point) and the client. Ex.1002 ¶90.

- (c) *Elements [1.2]/[22.2]: “without requiring that the established wireless link to be corrupted or lost, causing a second mesh point to measure a plurality of qualitative parameters indicative of a quality of a potential link between the second mesh point and the client;”*

Gupta discloses this element or renders it obvious, alone or in combination with Murty. Ex.1002, ¶¶91-99. As discussed under Section VII.A.2(a), Gupta discloses a computer-implemented method for roaming (“redistribution”) in a wireless mesh network. *See* Section VII.A.2(a). The purpose of redistribution is to identify a candidate AP (claimed second mesh point) that is expected to provide “improve[d] service” to the client device compared to the service currently provided by the first/serving AP connected to the client. Ex.1005, [0004] (“Systems and/or methods here include embodiments for instituting redistribution of wireless clients ***to improve service*** [and] deciding ... that an associated client should be redistributed ***based on a connection metric.***”). For example, as Gupta teaches, in a distributed decision-making architecture, the first/current AP compares connection metrics it receives from other candidate APs with its own connection metric measurements (“local information”) in order “to make decisions” whether to redistribute its associated client device(s). *Id.*, [0052] (“The AP itself could [] make decisions locally. ... The AP could receive ***information from other APs*** and use that information, ***in conjunction with local information***, to make [redistribution] decisions.”). Thus, as Gupta teaches and as would be well-understood, the first/current AP makes redistribution decisions based on connection metrics

measured by other APs (including the claimed second mesh point) and sent to the first/current AP (claimed first mesh point) while the first/current AP is still associated with the client device—*i.e.*, without requiring that the established wireless link to be corrupted or lost, as claimed. Ex.1002 ¶¶92-94. Gupta also teaches other redistribution decision-making architectures, such as a centralized architecture using a central controller. *Id.* Regardless, the redistribution decision-making entity “make[s] redistribution decisions based on [connection metric] information from *one or more APs*[,]” including from the claimed second mesh point. *Id.*

Claimed “plurality of qualitative parameters” – As Gupta teaches, a candidate AP (including the claimed second mesh point) is caused by system software to measure a *plurality* of qualitative parameters indicative of a quality of service of a potential link between it and the client. Ex.1005, [0033] (“Service to a client could be any kind of metric including but not limited to *signal-to-noise ratio (SNR)*, downlink *throughput* (e.g. Mbit/s), or direct or indirect *received signal strength indication (RSSI)* metrics which can be extrapolated to service levels indications *which are indicative of the user’s quality of experience* on the wireless local area network (WLAN). Examples of such metrics may include *measured*/projected/theoretical *throughput*, ... *phy rate*, and/or *latency*. In [mesh]

networks ... another possible metric may include the ***number of hops*** from one AP to a root node ...”).

As a specific example, Gupta teaches that the decision to redistribute a client device may be based on “achievable throughput,” which is “***the throughput metric between a client and an AP*** ...” as required by the claim. *Id.*, [0054]-[0055]. Gupta explains that the throughput metric “between” a client and a candidate AP can be derived from a plurality of parameters indicative of a quality of a potential link between that AP and the client and measured by the candidate AP, such as “***received signal strength indication (RSSI)***, number of clients, ***airtime utilization***, and ***physical layer data rate*** [and] [o]ther factors that may be available at an AP for estimation [such as]... interference seen by an AP (e.g. phy error), packet error rates, etc.” *Id.*, [0054], [0055]-[0056] (“***the throughput metric between a client and an AP*** may be affected by any number of factors or combination of factors... [such as] contention for the shared medium, interference, transmit power, receive sensitivity, ... [many of which] depend on the characteristics and location of ***the specific client*** or class of clients.”); *see also id.*, [0059] (“[A]n AP may be configured to monitor ***multiple inputs*** including for example, received signal strength indication (RSSI), contention, and/or goodput ...”). Ex.1002, ¶¶95-96.

In addition, Gupta-Murty renders obvious this element. Ex.1002, ¶¶97-99. A POSITA would have been motivated to consult Murty because, like Gupta, Murty

teaches using a throughput metric in making roaming decisions and, moreover, teaches how to estimate such a metric from link quality parameters: “With respect to determining whether to handoff the client device to another AP, this can be accomplished by evaluating whether another AP will be able to provide the client device that has moved with an *enhanced throughput capacity* (which, in at least some embodiments, is the product of an AP’s *free air time* and *average expected data rate*).” Ex.1006, 20:50-55, 17:64-18:8, 15:36-43. As Dr. Ding explains, a POSITA would have been motivated to use Murty’s method of estimating throughput in Gupta’s system because it involves simple calculations (*e.g.*, a product) using parameters (*e.g.*, airtime and data rate) already collected in Gupta’s system. Ex.1002, ¶97. Such a combination would be combination of prior art elements according to known methods, and also application of a known technique to a known system ready for improvement, both to yield predictable results. Further, because the combination involves routine software implementation, there is also a reasonable likelihood of success in the proposed combination. *Id.* Murty’s use of a central controller to make roaming decisions is also entirely consistent with Gupta. Ex.1002 ¶99.

Murty also explains that an AP’s free airtime (“FreeAirTime” and/or the related “AirTimeUsed”) and expected data rate (“ExpectedRate”) are among the plurality of qualitative parameters that are measured by the current AP (claimed first

mesh point) and each candidate AP (including the claimed second mesh point)—while the client device is still connected to the current AP—and sent to the network’s central controller to make roaming decisions. Ex.1006, 12:59-67 (“[T]he information collected (i.e., received) centrally *from the APs* is utilized to select a preferable AP.”), 18:23-31 (“Information associated with the AirTimeUsed is *provided by each AP* to the central controller.”), 18:45-67 (ExpectedRate calculated “in situ” in each AP based on measured RSSI and data rate); Ex.1002 ¶98.

- (d) *Elements [1.3]/[22.3]: “causing the plurality of qualitative parameters indicative of the quality of the potential link to be transmitted to a controlling entity of the wireless mesh network;”*

Gupta discloses this element or renders it obvious, alone or in combination with Murty. Ex.1002, ¶¶100-107.

Claimed “controlling entity” - Gupta describes various embodiments of a controlling entity responsible for making redistribution (roaming) decisions. Ex.1005, [0052]. As an example, in a distributed architecture, each AP is a controlling entity that “make decisions locally” whether to redistribute (roam) its associated client devices. *Id.* (“The AP itself could be pre-loaded with threshold information, and make [redistribution] decisions locally.”). Roaming decisions can also be made by “a central entity like a controller, or among the APs where one is designated as a controller, or a distributed controller where APs collectively control each other to make redistribution decisions.” *Id.* The different embodiments of a

“controlling entity” described in Gupta are all consistent with the ’242 Patent. Ex.1001, 15:36-41 (“the controlling entity may be centralized..., distributed among the mesh points ...”).

Transmission of “the plurality of qualitative parameters” - As Gupta teaches, the controlling entity makes redistribution decisions based on information that the candidate APs (such as the claimed second mesh point) transmit to it under control of software running in the controlling entity and/or candidate APs. Ex.1005, [0052], [0009] (“*input variables* of the associated client device *are monitored*” by the controlling entity such as “the AP, APs [working in concert], and the central entity”); Section VII.A.2.(a). For example, Gupta explains that a current/serving AP (claimed first mesh point and controlling entity) “receive[s] information *from other APs* and use that information, in conjunction with local information, to make [redistribution] decisions.” *Id.* More generally, “a system’s entity [(claimed controlling entity)] make[s] redistribution decisions based on information *from one or more APs* ...”. *Id.* Moreover, as discussed above, Gupta teaches that the information measured by each candidate AP (including the claimed second mesh point) and sent to the controlling entity (such as the first/current AP or a central controller) includes a plurality of qualitative parameters indicative of the quality of the potential link between the candidate AP and the client device, such as “*received signal strength indication (RSSI)*, number of clients, *airtime utilization*, and

physical layer data rate [as well as other parameters such as]... interference seen by an AP (e.g. phy error), packet error rates, etc.” *Id.*, [0054]-[0056], [0033]; Ex.1002, ¶¶103-05.

In addition, Gupta-Murty renders obvious this element. Ex.1002, ¶¶106-07. As discussed above, a POSITA would have been motivated to use Murty’s architecture and method of obtaining and using connection metrics in Gupta’s system. *See* Section VII.A.2.(a)-(c). Indeed, Murty teaches using the same connection metrics discussed in Gupta—the throughput capacity of APs—in making roaming decisions. Ex.1006, 20:50-55. Murty more precisely explains that an AP’s throughput capacity can be defined as “the product of [the] AP’s *free air time* and *average expected data rate*.” *Id.* And, as Murty teaches, an AP’s free airtime information and expected data rate are among the plurality of qualitative parameters that are measured by each candidate AP and sent to the network’s central controller to make roaming decisions. *See* Section VII.A.2.(c); Ex.1006, 12:49-50 (“AP information is collected and monitored centrally by the central controller(s).”). Murty’s use of a central controller to make roaming decisions is also entirely consistent with Gupta. Ex.1002, ¶107.

- (e) *Elements [1.4]/[22.4]: “comparing, by the controlling entity, the quality of the potential link between the second mesh point and the client against a quality of the established wireless link between the first mesh point and the client;”*

Gupta discloses this element or renders it obvious, alone or in combination with Murty. Ex.1002 ¶¶108-14. As Gupta teaches, the purpose of redistribution (roaming) is to identify a candidate AP (claimed second mesh point) that is expected to provide “improve[d] service” to the client device compared to the service provided by the AP currently connected to the client. Indeed, Gupta describes “[s]ystems and/or methods ... for instituting redistribution of wireless clients *to improve service* [and] deciding ... that an associated client should be redistributed *based on a connection metric.*” Ex.1005, [0004]. Gupta explains that its “pro-active” redistribution strategy results in “*better service, or better connection metrics* ... faster for the client, than if it were allowed to make decisions on its own.” *Id.*, [0042]-[0043], [0035]. As Dr. Ding explains, a POSITA would have understood and found obvious that—consistent with Gupta’s pro-active strategy to redistribute (roam) client to a candidate AP (claimed second mesh point) that is expected to provide “*better service, or better connection metrics*” than the current AP (claimed first mesh point)—Gupta’s controlling entity compares the quality of the potential link between the second mesh point and the client against a quality of the established wireless link between the first mesh point and the client. Ex.1002, ¶109. Indeed, Gupta teaches that the serving AP “receive[s] information from *other APs* and use

that information, **in conjunction with** local information, to make [pro-active redistribution] decisions.” Ex.1005, [0052]. In fact, as Gupta teaches, Gupta’s controlling entity performs such connection metric comparison in the context of follow-on redistribution (roaming) decisions:

Following an AP-initiated forced or persuaded redistribution, a client may associate to a new AP. The new AP can continue to monitor any of various connection metrics ... of the client to the newly associated AP. ... [T]he APs can share the newly redistributed client connection metrics on the new AP, allowing a comparison to the original distribution connection metrics from the old AP. The **comparison of connection metrics** may involve a central entity such as a controller, ... or an exchange of estimated throughput metrics among the neighboring APs where the client redistributed [(roamed)]. If it is determined that the connection metrics are **not improved** on the new AP, the APs or controller may attempt to **redistribute** the client to another AP, or back to the original AP.

Ex.1005, [0095]. A POSITA would have understood and found it obvious that Gupta’s controlling entity (*e.g.*, an AP or a central controller) performs the same “**comparison of connection metrics**” in making any roaming decision, including a decision to roam client from the current AP (claimed first mesh point) to a candidate AP (claimed second mesh point)—in which case the controlling entity compares the quality (connection metrics) of the potential link between the second mesh point and

the client against a quality (connection metrics) of the established wireless link between the first mesh point and the client, as claimed. Ex.1002 ¶¶110-11.

In addition, Gupta-Murty renders obvious this element. Ex.1002, ¶¶112-14. A POSITA would have been motivated to combine Gupta and Murty as discussed above. *See* Sections VII.A.1, VII.A.2.(a)-(d). Consistent with Gupta’s teachings, Murty explains that “for a client device to be considered... [to] benefit from being handed off, there should be an available candidate AP (for the client device to be handed off to) that is capable of providing the client device with ***an improved throughput capacity*** (i.e., a candidate AP should allow the client device to pump more data).” Ex.1006, 19:38-44. Significantly, as Murty teaches, Murty’s central controller determines whether a candidate AP is expected to provide improved throughput capacity by ***comparing*** the candidate AP’s expected throughput capacity to the throughput capacity provided by the currently associated AP:

[I]n the context of the exemplary association policy above, [the throughput capacity which is] the product of the free air time (FreeAirTime) and the expected data rate (ExpectedRate) of the candidate AP ***should be greater than*** that being made available by the AP that is already associated with the client device. In at least some embodiments, a client device handoff could be considered inappropriate ***unless the throughput capacity available to the client device (on the candidate AP) could be improved by a***

certain fraction (*e.g.*, 20%). This would minimize handoffs due to small fluctuations in loads and/or interference levels.

Ex.1006, 19:44-54; *id.*, 20:50-55 (throughput capacity is “the product of an AP’s free air time and average expected data rate.”). A POSITA would have found that Murty confirms Gupta’s teaching and, in any event, would have found it obvious to implement the same connection metric comparison in Gupta’s redistribution system. Ex.1002, ¶114. In particular, Murty’s connection metric comparison ensures that the expected connection metric gain exceeds a ***minimum specified, or select, level*** (*e.g.*, 20%) to minimize unnecessary handoffs and improve redistribution robustness, as further discussed below in Section VII.A.2(f) in connection with the claimed “select level.” *Id.* As Dr. Ding explains, a POSITA would have been motivated to use Murty’s comparison technique in Gupta’s system at least because it would be a combination of prior art elements according to known methods, and also application of a known technique to a known system ready for improvement, all with predictable results. *Id.* Further, because the comparison involves a routine software implementation that merely compares various numbers to one another, there is also a reasonable likelihood of success in the proposed combination. *Id.*

- (f) *Elements [1.5]/[22.5]: “upon determining that the quality of the potential link exceeds the quality of the established wireless link by a select level, causing the controlling entity to issue one or more instructions resulting in the client roaming from the first mesh point to the second mesh point; and”*

Gupta, alone or in combination with Murty, renders obvious this element.

Ex.1002, ¶¶115-22.

Claimed “one or more instructions” - As discussed above, Gupta teaches a controlling entity (such as the serving AP or a central controller) under software control redistributing (roaming) the client to a new candidate AP (claimed second mesh point) upon determining that the quality of the potential link between the candidate AP and the client *exceeds* the quality of the established wireless link between the current AP and the client so to provide “***better*** service, or ***better*** connection metrics” to the client. *See* Sections VII.A.2.(d)-(e), Ex.1005, [0042]-[0043], [0035]. And, as Gupta teaches, the controlling entity causes redistribution by issuing one or more instructions to the client, such as: “Deauth frame” (deauthentication) and/or “DisAssoc frame” (disassociation) for a legacy client that does not support intelligent roaming, discussed below in element [1.7], and “BSS Transition Management frame” for a client that supports intelligent roaming, discussed below in element [22.7]. *Id.*, [0067]; Sections VII.A.2.(h)-(i); Ex.1002, ¶¶116-17.

Claimed “select level” - In addition, as Gupta teaches, the controlling entity uses one or more thresholds above the current connect metrics (claimed select level)

in making a redistribution decision. Ex.1005, claim 1 (“A method for instituting redistribution of wireless clients to improve service ... wherein the decision is based on at least one of, a probability calculation, network metric and a ***threshold comparison***”); *id.*, [0021] (“The ***threshold comparison*** includes information received from ***another AP*** ...”), [0095] (“The ***comparison of connection metrics*** may involve ... ***multiple thresholds***” when “multiple connection metrics” are used).

As an example, in a distributed architecture, Gupta’s “AP itself could be pre-loaded with threshold information, and make [redistribution] decisions locally. ... The AP could receive information from other APs and use that information, ***in conjunction with*** local information, to make [redistribution] decisions.” Ex.1005, [0052]. A POSITA would have understood (and found it obvious) that Gupta’s AP uses the “pre-loaded [] threshold information” to determine whether a candidate AP offers a potential quality gain above the current link quality that is sufficient to warrant redistributing a client to the candidate AP—*i.e.*, whether the potential improvement in connection metrics exceeds the pre-loaded threshold (claimed select level). Ex.1002 ¶¶118-20.

A POSITA would also have found that the use of a “select level” in comparing connection metrics or link quality to be well-known and obvious as it was described in multiple prior art references, including Murty. *See, e.g.*, Ex.1006 (Murty), 19:49-54 (“a client device handoff [(roaming)] could be considered ***inappropriate*** unless

the throughput capacity available to the client device (on the candidate AP) *could be improved by a certain fraction (e.g., 20%)*. This would minimize handoffs due to small fluctuations in loads and/or interference levels.”); Ex.1008, [0040] (“when the throughput gain is not significant (e.g., not above a *predetermined threshold*), the first AP... may determine to not cause the re-association [(roaming)].”); Ex.1010, [0049] (roaming triggered “if the control device compares and obtains that STA signal strength reported by another AP is higher than signal strength of the AP currently associated with the STA [] by *a first threshold value (such as 2 dB)*.”); Ex.1002 ¶¶120-21.

In any event, Gupta-Murty renders obvious this element. Ex.1002 ¶122. A POSITA would have been motivated to combine the teachings of Murty with those of Gupta for multiple reasons, as discussed above. *See* Sections VII.A.1. VII.A.2.(a)-(e). Murty emphasizes the importance of using a *threshold* (claimed select level) in assessing any potential quality gain over the established link (*e.g., 20% minimum gain above the established link*) to “minimize handoffs due to small fluctuations in loads and/or interference levels.” Ex.1006, 19:49-54; *see also* Section VII.A.2.(e). A POSITA would have been motivated to use the same threshold-based comparison in Gupta’s redistribution system to achieve the same benefits. Ex.1002 ¶122. Thus, as Dr. Ding explains, a POSITA would have been motivated to use Murty’s comparison level in Gupta’s system at least because it would be a combination of

prior art elements according to known methods, and also application of a known technique to a known system ready for improvement, all with predictable results. Further, because the use of a comparison level involves a routine software implementation that merely compares various numbers to one another, there is also a reasonable likelihood of success in the proposed combination. *Id.*

(g) *Elements [1.6]/[22.6]: “determining whether the client supports intelligent roaming;”*

Gupta discloses or renders obvious this element. Ex.1002 ¶¶123-24. The ’242 Patent explains that a client device supports intelligent roaming if it supports the roaming commands described in the IEEE 802.11v/r standards, such as “the BSS Transition Management (BTM) [frames] for network assisted roaming, described in IEEE 802.11v standards[.]” Ex.1001, 22:34-39, 23:37-40. As Dr. Ding explains, the IEEE 802.11v/r standards require a client device to indicate whether it supports intelligent roaming by setting the “BSS Transition” bit to “1” in messages it sent to an AP. Ex.1002 ¶¶123-24; Ex.1011, 46-47, 264-265 (“STA that supports BSS transition management shall set the **BSS Transition** field of the Extended Capabilities information element to 1.”).

Table 7-35a—Capabilities field

Bit(s)	Information	Notes
19	BSS Transition	The STA sets the BSS Transition field to 1 when the MIB attribute dot11MgmtOptionBSSTransitionActivated is true, and sets it to 0 otherwise. See 11.22.6.

Ex.1011, Table 7-35a (excerpted), 47-48.

Gupta describes sending “BSS Transition Management frame” to “**802.11v-compliant clients**” and thus discloses or renders obvious this element because, as would be understood by a POSITA, an AP determines that a client is 802.11v-compliant by detecting that the client’s BSS Transition bit is set to “1.” Ex.1005, [0067], [0070]-[0074]; Ex.1002 ¶124.

(h) *Element [1.7]: “wherein, when the client does not support intelligent roaming, the one or more instructions include a deauthentication or a disassociation frame, with a reason code reflecting a roaming decision by the controlling entity.”*

Gupta discloses or renders obvious this element of claim 1. Ex.1002 ¶¶125-27. The ’242 Patent explains that a client device does not support intelligent roaming if it does not support the roaming commands described in IEEE 802.11v and 802.11r, in which case “the mesh network can force the client to roam by disconnecting the client (e.g., with Deauthentication and/or Disassociation management frames).” Ex.1001, 22:34-40.

As would be understood by a POSITA, an AP in Gupta's network determines that a client does not support intelligent roaming by detecting that its BSS Transition bit is not set to "1." Ex.1002 ¶125; Ex.1011, 46-47, 264-265. In that case, Gupta teaches the same way to force-disconnect the client and force it to roam to another AP as the '242 Patent. Ex.1002 ¶¶126-27. Indeed, Gupta teaches sending "DeAuth frame" (Deauthentication management frame) and/or "DisAssoc frame" (Disassociation management frame) to "explicitly disconnect[]" the client, just like in the '242 Patent. Ex.1005, [0066]-[0067], claim 14 ("The method of claim 1 wherein the disconnect message includes at least one of, a DeAuth frame, and a DisAssoc frame.").

Deauthentication and disassociation frames are management frames specified in the 802.11 prior art standards and include a "reason code" field reflecting the roaming decision. *See, e.g.*, Ex.1012 (802.11-2012), at 442 ("[The] Reason Code field is used to indicate the reason that an unsolicited notification management frame of type Disassociation, Deauthentication, ... was generated."). For example, a reason code 5 indicates that the reason for disassociation is because "AP is unable to handle all currently associated STAs." *Id.*, Table 8-36 - Reason codes. A reason code 5 would at least be consistent with redistribution for load balancing reasons, discussed in Gupta. Ex.1005, [0044]-[0048]; Ex.1002, ¶127.

Table 8-36—Reason codes

Reason code	Name	Meaning
0		Reserved
1		Unspecified reason
2		Previous authentication no longer valid
3		Deauthenticated because sending STA is leaving (or has left) IBSS or ESS
4		Disassociated due to inactivity
5		Disassociated because AP is unable to handle all currently associated STAs

Ex.1012, Table 8-36 (excerpted), 442-44. A reason code is issued when a roaming decision is made, and therefore reflects the roaming decision. Ex.1002, ¶127.

- (i) *Element [22.7]: “wherein, when the client supports intelligent roaming, the one or more instructions include a roaming directive and an identifier of the second mesh point.”*

Gupta discloses or renders obvious this element of claim 22. Ex.1002 ¶¶128-29. As Gupta teaches, when the client supports intelligent roaming (“802.11v-compliant clients”), the current AP sends it a BTM request (“BSS Transition Management frame”) “to **redirect** [the client] to find another AP with which to associate.” Ex.1005, [0067]-[0068], [0070]. Gupta further teaches including “**a list of candidate APs**” in the BTM request, to “**trigger** [] the client to disassociate from its currently associated AP, and associate with some other of the potential alternative candidates” on the list. *Id.*, [0072]. Gupta’s use of a BTM request to trigger client roaming satisfies the claimed “one or more instructions” (BTM request) that “include a roaming directive” (the BTM request is a roaming directive) and “an

identifier of the second mesh point” (an AP in the list of candidate APs). Gupta’s teaching is consistent with the ’242 Patent, which describes the exact same mechanism to direct an 802.11v-compliant client to roam to a target AP—by sending the client a BTM request that includes the target AP in a list of candidate APs. Ex.1001, 23:37-54. The ’242 Patent does not teach any other way to trigger roaming of an 802.11v-compliant client device. *Id.*; Ex.1002 ¶129.

3. Dependent Claims 2 and 23

- (a) *“The method of claim [1/22], wherein each mesh point in the wireless mesh network is capable of acting as the controlling entity.”*

Gupta discloses this element. Ex.1002 ¶130. Gupta discloses a distributed architecture in which each AP is capable of acting as the controlling entity to make redistribution decisions for its associated clients locally. Ex.1005, [0052] (“The AP itself could be pre-loaded with threshold information, and make [redistribution] decisions locally.”), [0066], [0068].

4. Dependent Claims 3, 24

- (a) *“The method of claim [1/22], wherein a mesh point in the wireless mesh network is designated as the controlling entity.”*

Gupta discloses this element or renders it obvious. Ex.1002 ¶131. Gupta teaches embodiments in which, among the mesh points of the wireless mesh network, “one is designated as a controller.” Ex.1005, [0052].

5. Dependent Claims 4, 25

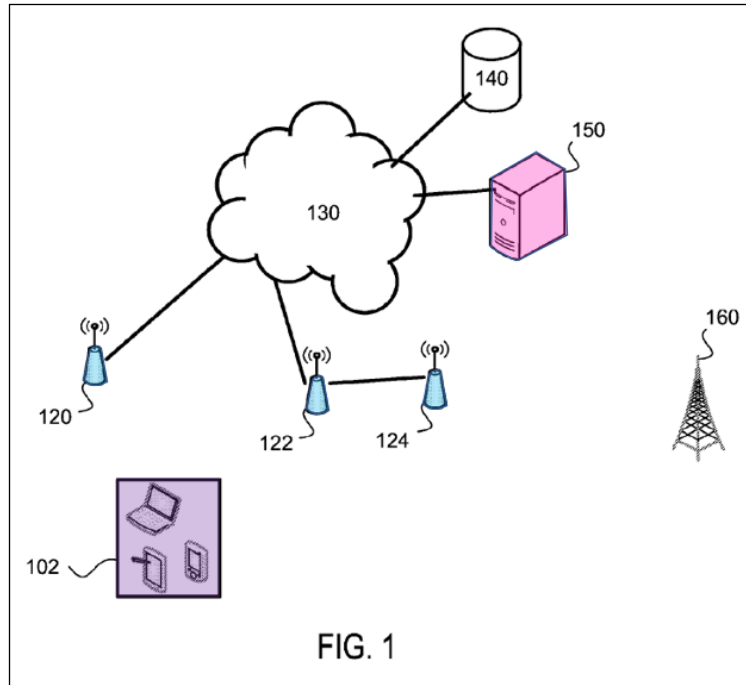
- (a) *“The method of claim [1/22], wherein the controlling entity is the first mesh point.”*

Gupta discloses this element or renders it obvious. Ex.1002 ¶132. Gupta teaches a distributed architecture in which the controlling entity that makes redistribution decisions for a client device is the client’s serving AP (claimed first mesh point), as explained in Section VII.A.1.(d). Ex.1005, [0004], [0045], [0052] (*“The AP itself* could be pre-loaded with threshold information, and make [redistribution] decisions *locally.*”), [0066], [0068].

6. Dependent Claims 5 and 26

- (a) *“The method of claim [1/22], wherein the controlling entity is a server remote from the wireless mesh network.”*

Gupta discloses or renders obvious this element. Ex.1002 ¶¶133-34. Gupta discloses that the controlling entity (controller) can be a “central entity being in connection with a network” such as a server. Ex.1005, [0004]. As illustrated in Figure 1 and as Gupta teaches, APs (blue) are in communication with a remote “server 150” (red) which can operate as a “controller[.]” *Id.*, [0031]. Server 150 is remote from the wireless mesh network because it communicates with the mesh network formed by APs (blue) over another network 130 such as the Internet. *Id.*, [0030].



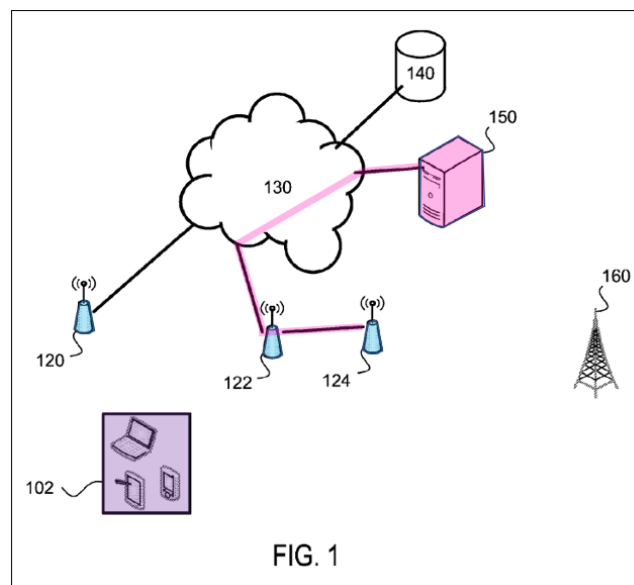
Ex.1005, FIG. 1.

7. Dependent Claims 6 and 27

- (a) *“The method of claim [1/22], further comprising: routing the one or more instructions to the first and second mesh points.”*

Gupta discloses or renders obvious this element. Ex.1002 ¶¶135-37. Gupta discloses that the controlling entity can be “a central entity [acting as] a controller, ... one [AP] designated as a controller, or a distributed controller where APs collectively control each other to make redistribution decisions.” Ex.1005, [0052]. Gupta further teaches that the controlling entity (“system’s entity”) *“send[s] commands to the appropriate APs to carry out the decisions.”* *Id.* A POSITA would have understood and found obvious that the “commands [sent] to the appropriate APs” include roaming instructions, such as “DeAuth frame, DisAssoc frame [(for

legacy clients)], and BSS Transition Management frame (for 802.11v-compliant clients)” (*id.*, [0067]) that the controlling entity sends—*i.e.*, routes—to the serving AP (claimed first mesh point) to be transmitted to the client to cause redistribution. Ex.1002 ¶136. Moreover, those instructions may be routed through the second mesh point (alternate AP) over the backhaul communication paths of the wireless mesh network. *Id.* To illustrate, in Figure 1 below, Gupta teaches that server 150 (magenta) can be the controlling entity, as discussed in Section VII.A.6. Gupta further teaches that the controlling entity may decide to roam the client device from current AP124 (claimed first mesh point) to alternate AP122 (claimed second mesh point). *Id.* To do so, server 150 sends roaming instructions to AP124 to be transmitted to the client device, and those instructions are routed over the magenta path passing through AP122. *Id.*



Ex.1005, FIG. 1.

8. Dependent Claims 7 and 28

(a) *Preamble: “The method of claim [1/22], further comprising:”*

Element [7.1]/[28.1]: “causing the first mesh point to measure the plurality of qualitative parameters indicative of the quality of the established wireless link between the first mesh point and the client; and”

Gupta-Murty renders obvious this element. Ex.1002 ¶¶138-39. As explained in Section VII.A.2(c), Gupta’s controlling entity under software control initiates redistribution (roaming) if the quality of service (connection metric) provided by the current AP (claimed first mesh point) to a client device is substantially poorer than what can be offered by another AP. *See* Section VII.A.2(c). To that end, the current AP (claimed first mesh point) measures a plurality of qualitative parameters indicative of the quality (connection metric) of the established wireless link between it and the client. *Id.*; Ex.1005, [0054] (“The connection metric, such as achievable throughput, could be derived from [multiple parameters such as]... received signal strength indication (RSSI), number of clients, airtime utilization, and physical layer data rate.”); Ex.1006, 20:55-55 (throughput capacity evaluation requires each AP to measure the “AP’s free air time and average expected data rate”).

(b) *Element [7.2]/[28.2]: “causing the plurality of qualitative parameters to be transmitted to the controlling entity of the wireless mesh network.”*

Gupta-Murty renders obvious this element. Ex.1002 ¶140. As taught by Gupta-Murty, the controlling entity causes the plurality of qualitative parameters measured by the current AP to be transmitted to the controlling entity so that they

can be monitored by the controlling entity. Ex.1005, [0009] (“input variables of the associated client device are monitored” by the controlling entity such as “the AP, APs [working in concert], and the central entity”); Ex.1006, 12:49-50 (“AP information is collected and monitored centrally by the central controller(s).”).

9. Dependent Claims 8 and 29

- (a) *“The method of claim [1/22], further comprising: constructing a list of roaming candidates, each roaming candidate having a score indicative of an estimated quality of a potential link between the client and a corresponding roaming candidate.”*

Gupta-Murty renders this claim obvious. Ex.1002 ¶¶141-45. Murty teaches forming an exemplary list of roaming candidates (AP_{list}) made of those APs that have strong received signal strength (RSSI) from a client device. Ex.1006, 17:44-45 (“ AP_{list} [is the list of those] APs that hear C [the client] within the 85th percentile of maximum RSSI.”). Murty explains that once “the group of APs are selected, each AP (‘candidate’) is assigned a single value (i.e., number)” —a score—that is “calculated by multiplying its ExpectedRate by its FreeAirtime[.]” *Id.*, 17:64-18:8. Murty further explains that “this **single value** [(score)] assigned to each AP (in the selected group) is intended to represent the **available throughput capacity** of that AP.” *Id.*, 18:8-10. Hence, this score is indicative of an estimated quality of a potential link between the client and a corresponding roaming candidate. Murty further explains that “[t]his single value can be used uniformly for comparing

various possible APs (‘candidates’) to identify (i.e., select) a ***preferable AP (having the highest single value)*** to associate with” the client device. *Id.*, 18:11-14.

A POSITA would have been motivated to combine Gupta with Murty and to implement Murty’s teachings of a candidate list in Gupta’s system. Ex.1002 ¶¶143-45. The use of such a candidate list would improve the speed and efficiency of Gupta’s redistribution decisions because, as Murty teaches, “the preferred AP is ***effectively selected*** as a function of the value [(score)]” associated with the list, which “can be updated over time such that another AP can [readily] be chosen in the future.” Ex.1006, 18:14-18. Constructing such a list would have been obvious to try with reasonable expectation of success because Gupta’s decision-making entity already collects all the information that is needed to implement Murty’s teachings (RSSI, data rate, airtime, throughput, etc), as discussed above, and implementation would merely involve routine software modifications, as Dr. Ding explains. *See* Section VII.A.2.(c); Ex.1002 ¶144. This implementation would also be a combination of prior art elements according to known methods, and also application of a known technique to a known system ready for improvement, all with predictable results, for the same reasons. *Id.* Gupta’s decision-making entity can readily use the collected information to form a rank-ordered list of candidate APs using a score reflecting a desired connection metric such achievable throughput, as taught in Murty. *Id.*

Gupta also teaches constructing “a list of candidate APs.” Ex.1005, [0072] (“[When] using a BTM exchange, the [current] AP could send the client a list of [candidate] APs to which it could associate. ... The *list of candidate APs* could then be used by the client to make a decision on which other AP to associate to.”). This “list of candidate APs” could be ordered “based on *any number of reasons*.” *Id.*, [0082]. A POSITA would have been motivated to consult Murty, which teaches specific algorithms to form and rank-order such a candidate list. Ex.1002 ¶145.

10. Dependent Claims 9 and 30

- (a) *“The method of claim [8/29], wherein the controlling entity is configured to select a roaming candidate with the highest score on the list of roaming candidates as the second mesh point.”*

Gupta-Murty renders obvious this element. Ex.1002 ¶146. As explained in Section VII.A.9, Murty’s central controller is configured “to identify (i.e., select) a *preferable AP (having the highest single value [(score)])* to associate with” the client device. Ex.1006, 18:11-14.

11. Dependent Claims 10 and 31

- (a) *“The method of claim [1/22], wherein one or more of the plurality of qualitative parameters are averaged over a select amount of packets.”*

Gupta discloses or renders obvious this element. Ex.1002 ¶¶147-50. Gupta teaches that “an AP may be configured to monitor multiple inputs including for example, received signal strength indication (RSSI), contention, and/or goodput” and that “[e]ach sample of a monitored input feature, can be *weighted* with a factor

such as airtime ***or number of frames***, corresponding to the duration or frequency of its observation.” Ex.1005, [0059].

A POSITA would have understood and found obvious that weighing samples of a parameter “over a number of frames” (claimed selected amount of packets) means forming a (weighted) average of such a parameter using a select number of present and past samples. Ex.1002 ¶¶148-50. Indeed, Gupta teaches using “***historical samples*** [to] affect ***current*** estimated connection metric calculations.” Ex.1005, [0060]-[0061]. Averaging a signal over multiple samples was in fact commonly done to reduce the effects of noise or random fluctuations in the data, and provide a more representative value for the signal. *See, e.g.*, Ex.1010 [0047] (APs “calculating ***an average value*** of the STA signal strength of the multiple probe messages [] received within a ***preset*** time”); Ex.1002 ¶150.

12. Dependent Claim 14

(a) *Preamble: “The method of claim 1, further comprising:”*

Element [14.1]: “determining whether the client supports intelligent roaming;”

See Section VII.A.2.(g).

(b) *Element [14.2]: “wherein, when the client supports intelligent roaming, the one or more instructions include a roaming directive and an identifier of the second mesh point.”*

See Section VII.A.2.(i).

13. Dependent Claims 15 and 35

- (a) *“The method of claim [1/22], wherein the one or more instructions are IEEE 802.11v, IEEE 802.11k and/or IEEE 802.11r compliant instructions.”*

Gupta discloses or renders obvious this element. Ex.1002 ¶153. As detailed in Section VII.A.2.(h)-(i), Gupta’s controlling entity transmits Deauthentication (“DeAuth”), Disassociation (“DisAssoc”), or 802.11v BTM frames to a client device, depending on whether the client supports intelligent roaming or not. Ex.1005, [0067]; Section VII.A.2.(h)-(i). A POSITA would understand and find obvious that these are IEEE-compliant instructions listed in the IEEE 802.11-2012 standard, which incorporates earlier 802.11v/k/r standards. Ex.1012, ix (listing 802.11v/k/r), 423 (Disassociation frame), 436 (Deauthentication frame), 781 (802.11v BTM frame).

14. Dependent Claims 18 and 20

- (a) *“The method of claim 1, wherein the one or more instructions include: roaming the client to another mesh point, roaming the client to another frequency band, roaming the client to another channel, or a combination thereof.”*

Gupta discloses roaming the client to another mesh point as discussed in Section VII.A.2 (claim 1), and thus discloses this element. Ex.1002 ¶154. Gupta also discloses roaming the client to another frequency band or a combination thereof. Ex.1005, [0046], [0075] (“[A]n AP associated to a client may determine ... that the client may be better served by a different AP or on a different band.”).

15. Dependent Claims 19 and 21

- (a) *“The method of claim 1, wherein the plurality of qualitative parameters include, in addition to an received signal strength indicator (RSSI) value: a potential or current transmission data rate, a potential or current packet aggregate size, a potential or current packet error rate (PER), a potential or current retry count, a potential or current available airtime, and/or a potential or current delay on the link.”*

Gupta discloses this element or renders it obvious, alone or in combination with Murty. Ex.1002 ¶¶155-56. As explained in Section VII.A.2.(c), each AP in Gupta’s network measures a plurality of qualitative parameters such as: “***received signal strength indication (RSSI)***, number of clients, ***airtime utilization*** [(1-claimed available airtime)], and ***physical layer data rate*** [(claimed transmission data rate)]... interference seen by an AP (e.g. phy error), ***packet error rates*** [(claimed PER)], etc.” Ex.1005, [0054].

Murty also teaches this element. Ex.1002 ¶156. As also explained in Section VII.A.2.(c), each AP in Murty’s network measures link quality parameters in addition to RSSI (*see* Ex.1006, 17:50), such as free airtime (claimed available airtime) and expected data rate (claimed transmission data rate). Ex.1006, 12:60-67, 18:23-43, 18:45-67.

B. Ground II: Claims 16, 17, 36, 37 Are Rendered Obvious by Gupta in Combination with Murty and Ganu

1. Dependent Claims 16 and 36

- (a) *“The method of claim [1/22], further comprising: delaying issuance of the one or more instructions if the client has active data traffic and/or if a quality of service (QoS) option is active.”*

Gupta-Murty renders obvious claim 1 as explained in Section VII.A.1.

Further, a POSITA would have been motivated to combine Gupta-Murty with Ganu, which discloses this additional element. Ex.1002 ¶¶157-64.

Ganu is directed to roaming in a wireless network in which “[the] network infrastructure needs to determine whether the client device should be steered to another radio and/or access point” when “the client device ... is in the midst of a ***delay-sensitive*** or disruption-sensitive transaction[.]” Ex.1007, 1:15-24. Examples of “delay-sensitive or disruption-sensitive application sessions” are active voice calls, video calls, “VoWiFi call sessions, audio and/or video media streams, or other ***real-time sessions*** [that] are sensitive to delays, jitters, packet losses, etc.” *Id.*, 3:17-19, 3:63-65. Ganu teaches that, when signal quality of a client degrades in the midst of delay-sensitive or disruption-sensitive applications, the network may decide to “allow the client device to be associated with the same radio [of the same AP] even though a better radio exists in the network that can provide better signals to the client.” *Id.*, 4:1-9. This “***Not Move Client Device***” strategy “minimize[es] the disruption of the ongoing session from roaming events.” *Id.*; Ex.1002, ¶¶158-61.

More specifically, Ganu teaches that “the flows or application sessions can [] be classified based on their quality-of-service (QoS) requirements as disruption-tolerant or disruption-intolerant. Based on knowledge of the expected flow durations and QoS requirements, appropriate steering decisions can be made.” *Id.*, 8:18-23. Ganu teaches several techniques to estimate the remaining duration of such an active session. *Id.*, 4:28-5-6 (“Estimation of Session Duration”). Ganu teaches delaying/refraining from causing the client to roam if the expected remaining duration of the client’s disruption-intolerant session is sufficiently short. *Id.*, 18:63-67 (“Responsive at least to the estimated remaining duration of the active session being less than a threshold value, the network device ***refrains from*** causing the client device to associate with [(roam to)] the second access point” while the client is in the midst of a disruption-intolerant application session).

A POSITA would have been motivated to combine Ganu with Gupta and Murty and implement Ganu’s roaming delay mechanism in Gupta-Murty’s network controller that manages client roaming to avoid severe disruption to clients. Ex.1002 ¶¶162-64. This is particularly the case for legacy clients that do not support intelligent roaming. *Id.* As discussed for prior art systems, the network controller will force such a legacy client to disconnect by sending the client a deauthentication and/or disassociation message. Ex.1002 ¶162; Gupta, [0066]-[0067]. The client cannot ignore such a message and must disconnect within a specified timeframe,

which could interrupt an ongoing voice or video call. *Id.* Moreover, the client “must complete a full communication handshake in accordance with IEEE 802.11X after being de-authenticated ... As such, the cost of interruption ... is quite high.” Ex.1007, 7:37-40; *id.*, 7:6-10 (“Disruption of service can be caused by the time it takes to de-authenticate a client device, and for the client device to scan for other available radios and associate with a new radio.”). Thus, without Ganu’s roaming delay mechanism, the cost of disruption to legacy clients is high. Ex.1002 ¶¶163-64. Implementing Ganu’s teachings in Gupta-Murty’s system would improve the system and reduce such disruption costs with predictable results. *Id.* It also would have been obvious to try with a reasonable likelihood of success because, as detailed in Ganu, its roaming delay mechanism can readily be implemented in a roaming network controller using routine software modifications. Ex.1007. 10:19-12:6.

2. Dependent Claims 17 and 37

- (a) *“The method of claim [16/36], wherein the QoS option requires a minimum service level for a type of the active data traffic.”*

Ganu renders this claim obvious in combination with Gupta-Murty. Ex.1002 ¶165. Ganu teaches that “the flows or application sessions can [] be classified based on their quality-of-service (QoS) requirements as disruption-tolerant or disruption-intolerant.” Ex.1007, 8:18-21. A “disruption-intolerant” requirement is an example of the claimed minimum service level. Ex.1002 ¶165.

C. Ground III: Claims 11 and 32 Are Rendered Obvious by Gupta in View of Murty and Perahia

- (a) *“The method of claim [1/22], further comprising: adjusting the plurality of qualitative parameters based on a modulation and coding scheme used in the established wireless link.”*

Gupta-Murty in combination with Perahia renders obvious claims 11 and 32.

Ex.1002 ¶¶166-70.

Gupta and Murty both teach that the qualitative parameters sent by the candidate/new AP to the controlling entity include expected data rate (ExpectedRate) (Murty) and/or physical layer data rate (Gupta) and free airtime (FreeAirtime) (Murty and Gupta). Ex.1002 ¶167; Section VII.A.2.(e). Murty further teaches calculating an expected throughput capacity of a candidate/new AP as the product of ExpectedRate multiplied by FreeAirtime. Ex.1006, 20:50-63. Murty further teaches that the network controller triggers client roaming if it finds a candidate AP that provides an expected throughput capacity that is 20% more than the existing throughput with the client associated with the current AP. *Id.*

A POSITA would understand and find obvious that the data rate in Gupta and Murty is a function of the modulation and coding scheme (“MCS”), and the achievable data rate is limited by the MCS capabilities of a client device. Ex.1002 ¶168; Ex.1009 (Perahia), table 7.12 at 213. As shown in the Perahia table below, the data rate (green arrow) increases as the MCS order increases from BPSK to 64-QAM and then to 256-QAM (blue arrow). *Id.* However, a client device might not support

all MCS schemes listed in this table. Ex.1002 ¶¶169-70. Notably, legacy devices that do not support 802.11ac would not implement 256-QAM (red box) and therefore would not operate at the corresponding high data rates (*e.g.*, 2,808 Mbps and 6,240 Mbps). Ex.1009, at 212. Instead, they can only operate up to around 1,000 Mbps, as shown in the table below. *Id.*, table 7.12 at 213; Ex.1002 ¶¶169-70. Thus, a candidate AP's data rate parameter well above 1,000 Mbps, if uncorrected, could cause unnecessary switching in situations where the client device cannot make use of that data rate because it does not implement 802.11ac 256-QAM. Ex.1002 ¶170. A POSITA would understand and find it obvious to adjust (*e.g.*, reduce) those data rates based on MCS actually supported by the client device, as taught in Perahia. *Id.* As Dr. Ding explains, such adjustment will increase the efficiency and efficacy of Gupta and Murty, and thus a POSITA would be motivated to use Perahia's teaching with Gupta and Murty as a combination of prior art elements according to known methods, and also application of a known technique to a known system ready for improvement, all with predictable results. *Id.* It would also be obvious to try with a reasonable expectation of success, because data-rate adjustment can be implemented with routine software. *Id.*

Table 7.12 Example calculations of MCS parameters

BW (MHz)	N_{SS}	Modulation	Rate (R)	N_{DBPS}	N_{CBPS}	N_{ES}	Data Rate (Mbps)	
							Normal GI	Short GI
20	1	BPSK	1/2	26	52	1	6.5	7.22
40	2	QPSK	1/2	216	432	1	54	60
80	3	QPSK	3/4	1053	1404	1	263.25	292.5
160, 80+80	4	16-QAM	1/2	3744	7488	2	936	1040
40	5	16-QAM	3/4	1620	2160	1	405	450
80	6	64-QAM	2/3	5616	8424	3	1404	1560
160, 80+80	7	64-QAM	3/4	14742	19656	7	3685.5	4095
40	8	64-QAM	5/6	4320	5184	2	1080	1200
80	8	256-QAM	3/4	11232	14976	6	2808	3120
160, 80+80	8	256-QAM	5/6	24960	29952	12	6240	6933.33

Ex.1009, table 7.12 at 213.

D. Ground IV: Claims 1, 12, 13, 22, 33, 34 Are Rendered Obvious by Murty in view of Tian

1. Reasons to Combine Murty and Tian

Murty teaches a software-based architecture for implementing network-initiated roaming of client devices in a wireless mesh network. *See* Section VII.D.2.(a). Murty does not discuss 802.11v intelligent roaming because Murty was filed in 2007, years before the IEEE 802.11v standards issued in 2011. Ex.1011, 1. Tian describes techniques to determine whether a client supports 802.11v intelligent roaming and the use of 802.11v standard messages to suggest such a client to roam. *See* Sections VII.D.2(f)-(g). A POSITA would have been motivated to combine the teachings of Murty and Tian so to upgrade Murty's network and provide support for intelligent roaming, as required in the IEEE 802.11v standards. Ex.1002 ¶¶171-74.

A POSITA would have found it obvious to try with reasonable expectation of success because Murty's roaming functionalities are implemented in software, and can be easily upgraded with additional capabilities. *Id.* Indeed, Murty teaches that its software architecture "is intended to provide a ***significant degree of control and flexibility*** to the user-level programs ... such as software AP daemon 216" which is responsible for roaming functionalities, including "association and/or handoff procedures" and the "reporting (to the central management module(s)) software AP-specific information." Ex.1006, 9:34-37, 9:55-10:9. Tian also describes maintaining a "record of re-association activities" for each client (client's historical roaming profile) to help select the appropriate re-association technique for that client in the future. *See* Sections VII.D.3-4. A POSITA would have been motivated to implement such a client roaming profile to improve Murty's system. Ex.1002 ¶¶172-74. A POSITA would have found that to be obvious to try with a reasonable expectation of success given Murty's flexible software-based architecture, discussed above. *Id.*

2. Independent Claims 1 and 22

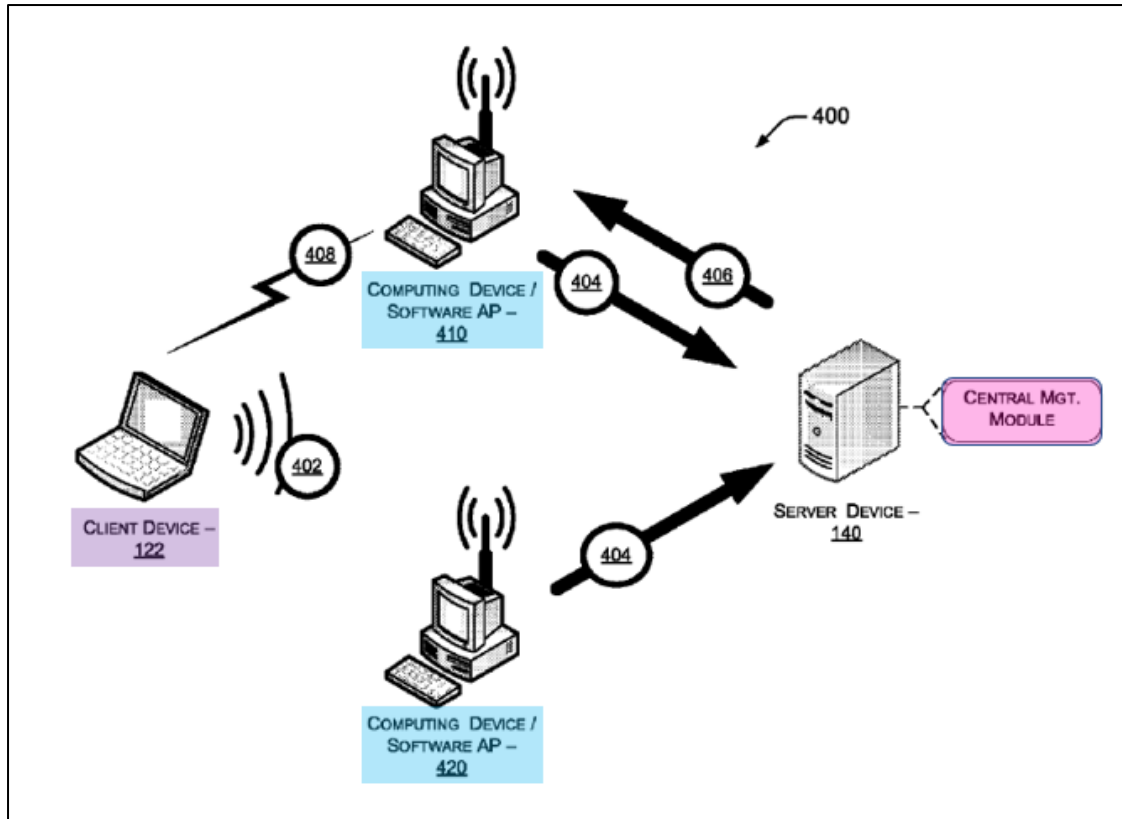
- (a) *Preamble: "A computer-implemented method for roaming implementation in a wireless mesh network formed with one or more mesh points, the method comprising:"*

To the extent the preamble is limiting, Murty discloses or renders it obvious, as discussed above in Ground I regarding the preamble of claim 1, and specifically regarding Murty's teachings. *See* Section VII.A.2(a); Ex.1002 ¶¶175-77.

- (b) *Elements [1.1]/[22.1]: “causing a wireless link to be established between a first mesh point and a client;”*

Murty discloses this element or renders it obvious. Ex.1002 ¶¶178-79. Murty’s Figure 4 below illustrates a wireless mesh network in which a central controller (magenta) centrally manages the associations between client devices (purple) and APs (blue). Ex.1006, 14:16-26. As Murty teaches, the figure illustrates that the central controller selects AP 410 (top) (blue) as the best AP to be associated with client device 122 (purple). *Id.*, 15:48-55. The controller then “sends a message to ... AP 410 ***instructing (i.e. directing) it***” to respond to the client’s next probe request “with a unicast probe response message ***thus initiating the association process.***”⁵ *Id.*, 15:51-64.

⁵ More specifically, the central controller instructs AP 410 “to add the MAC address for client device 122 to its ACL list [(access control list)].” Ex.1006, 15:51-55. This enables AP 410 to respond to the client’s probe request with a probe response because, in Murty’s system, an AP only responds to a client’s probe request if the client’s MAC address matches an entry in its ACL list. *Id.*, 15:17-24.



Ex.1006, FIG. 4. Thus, as illustrated in Figure 4, Murty’s central controller causes a wireless link to be established between a first mesh point (selected AP 410) and a client. Ex.1002 ¶¶178-79.

- (c) *Elements [1.2]/[22.2]: “without requiring that the established wireless link to be corrupted or lost, causing a second mesh point to measure a plurality of qualitative parameters indicative of a quality of a potential link between the second mesh point and the client;”*

Murty discloses or renders obvious this element, as discussed above in Ground I regarding the same claim elements [1.2]/[22.2], and specifically regarding Murty’s teachings. *See* Section VII.A.2(c); Ex.1002 ¶¶180-81.

- (d) *Elements [1.3]/[22.3]: “causing the plurality of qualitative parameters indicative of the quality of the potential link to be transmitted to a controlling entity of the wireless mesh network;”*

Murty discloses or renders obvious this element, as discussed above in Ground I regarding the same claim elements [1.3]/[22.3], and specifically regarding Murty’s teachings. *See* Section VII.A.2(d); Ex.1002 ¶182.

- (e) *Elements [1.4]/[22.4]: “comparing, by the controlling entity, the quality of the potential link between the second mesh point and the client against a quality of the established wireless link between the first mesh point and the client;”*

Murty discloses or renders obvious this element, as discussed above in Ground I regarding the same claim elements [1.4]/[22.4], and specifically regarding Murty’s teachings. *See* Section VII.A.2(e); Ex.1002 ¶¶183-85.

- (f) *Elements [1.5]/[22.5]: “upon determining that the quality of the potential link exceeds the quality of the established wireless link by a select level, causing the controlling entity to issue one or more instructions resulting in the client roaming from the first mesh point to the second mesh point; and”*

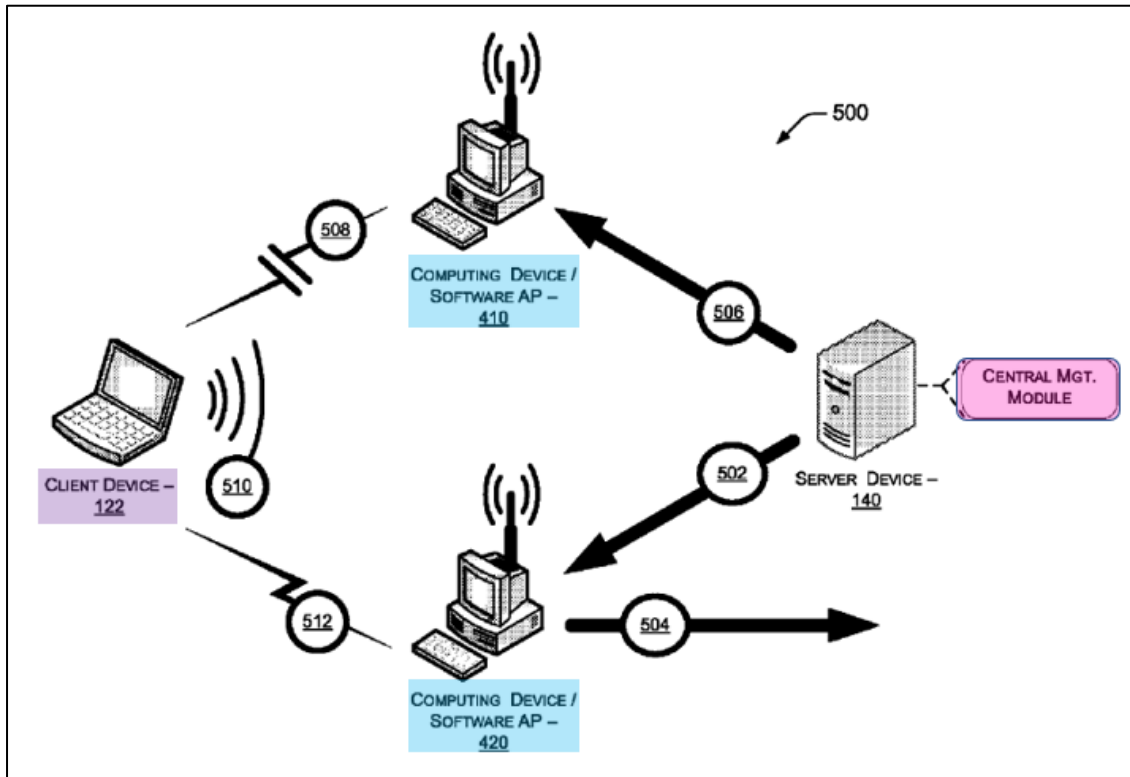
Murty discloses this element or renders it obvious. Ex.1002 ¶¶186-90.

Claimed “select level” - As discussed above in Sections VII.A.2(e) and VII.D.2(e), Murty’s central controller determines to roam the client device from the current AP (claimed first mesh point) to a candidate AP (claimed second mesh point) if the candidate AP’s expected throughput capacity (claimed quality of the potential link) exceeds the throughput capacity provided by the current AP (claimed quality of the established wireless link) “*by a defined threshold [(claimed select level)] (e.g., 20%)*”—that is, if the quality of the potential link is better than the quality of

the established link by a select level of 20%. Ex.1006, 20:16-21. Murty emphasizes the importance of using such a threshold (claimed select level) in assessing any potential quality gain to “minimize handoffs due to small fluctuations in loads and/or interference levels.” *Id.*, 19:49-54 (“[A] client device handoff could be considered inappropriate *unless the throughput capacity available to the client device (on the candidate AP) could be improved by a certain fraction (e.g., 20%).* This would minimize handoffs due to small fluctuations in loads and/or interference levels.”), 20:16-19; Ex.1002 ¶¶187-88.

Claimed “one or more instructions” - As Murty explains, upon determining that a candidate AP is capable of providing significantly improved throughput capacity (e.g., at least 20% improvement), the central controller issues instructions directing the chosen candidate AP “to associate with the client device” and directing the current AP “to disassociate from the client device.” *Id.*, 14:4-10, 15:48-51 (“Once the central management modules(s) has selected a ‘candidate’, it *directs* the candidate (via the software AP daemon ...) to associate with client device 122.”), 17:5-7 (“the central management module(s) *sends a message* to [the current AP] ...*instructing it* to send a *disassociate message* to client device 122.”). As illustrated in Figure 5, such instructions from the central controller (magenta) to APs (blue)—current AP 410 and candidate AP 420—result in the client 122 (purple) roaming

from the current AP (first mesh point) to the candidate AP (second mesh point), as claimed. *Id.*, 16:41-60, 17:5-10, 17:17-24; Ex.1002 ¶¶189-90.

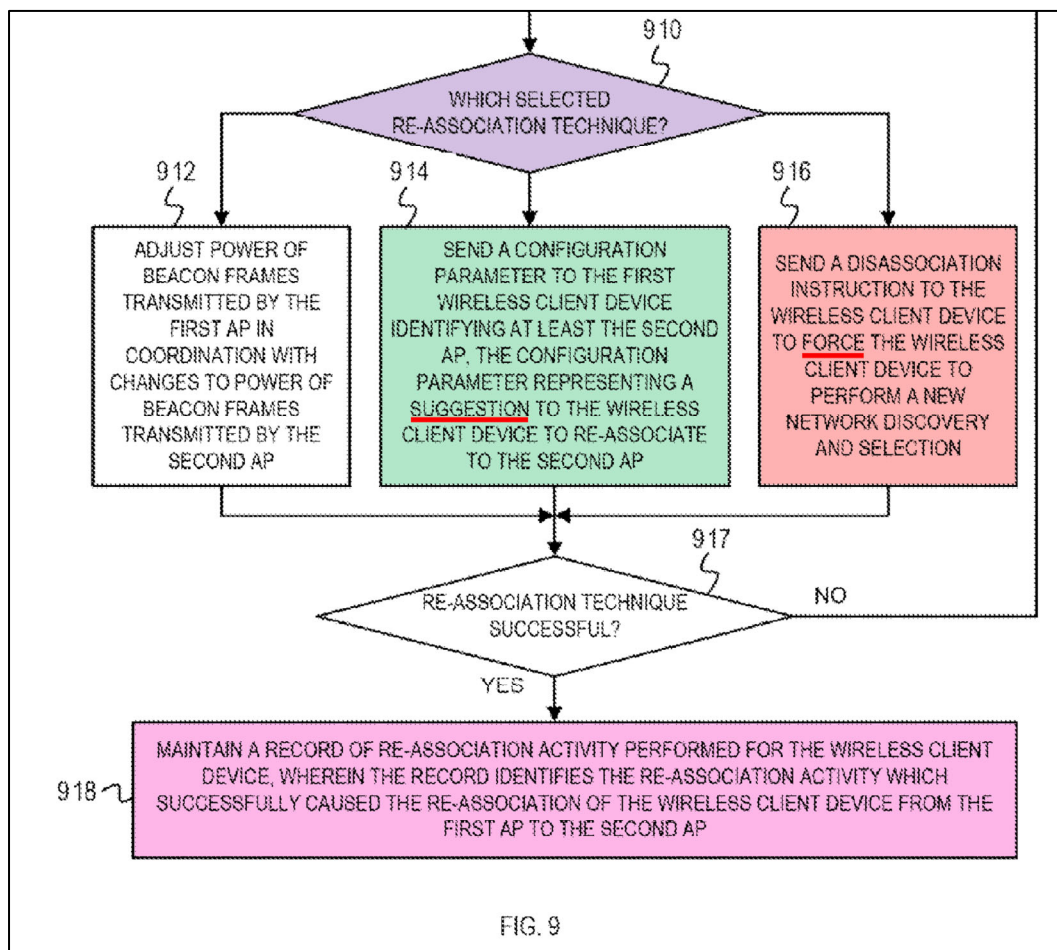


Ex.1006, FIG. 5.

(g) *Elements [1.6]/[22.6]: “determining whether the client supports intelligent roaming;”*

Murty-Tian renders this element obvious. Ex.1002 ¶¶191-92. As Tian teaches, APs “utilize the record of previous re-associations (see block 918 [(magenta in FIG. 9)] in the subsequent selection of re-association technique.” Ex.1008, [0078]. The record of previous re-associations allows “the access points [to] become aware of the *capabilities* of particular wireless client devices” (*id.*) and, in particular, whether the client supports 802.11v intelligent roaming. *Id.*, [0026] (discussing clients that

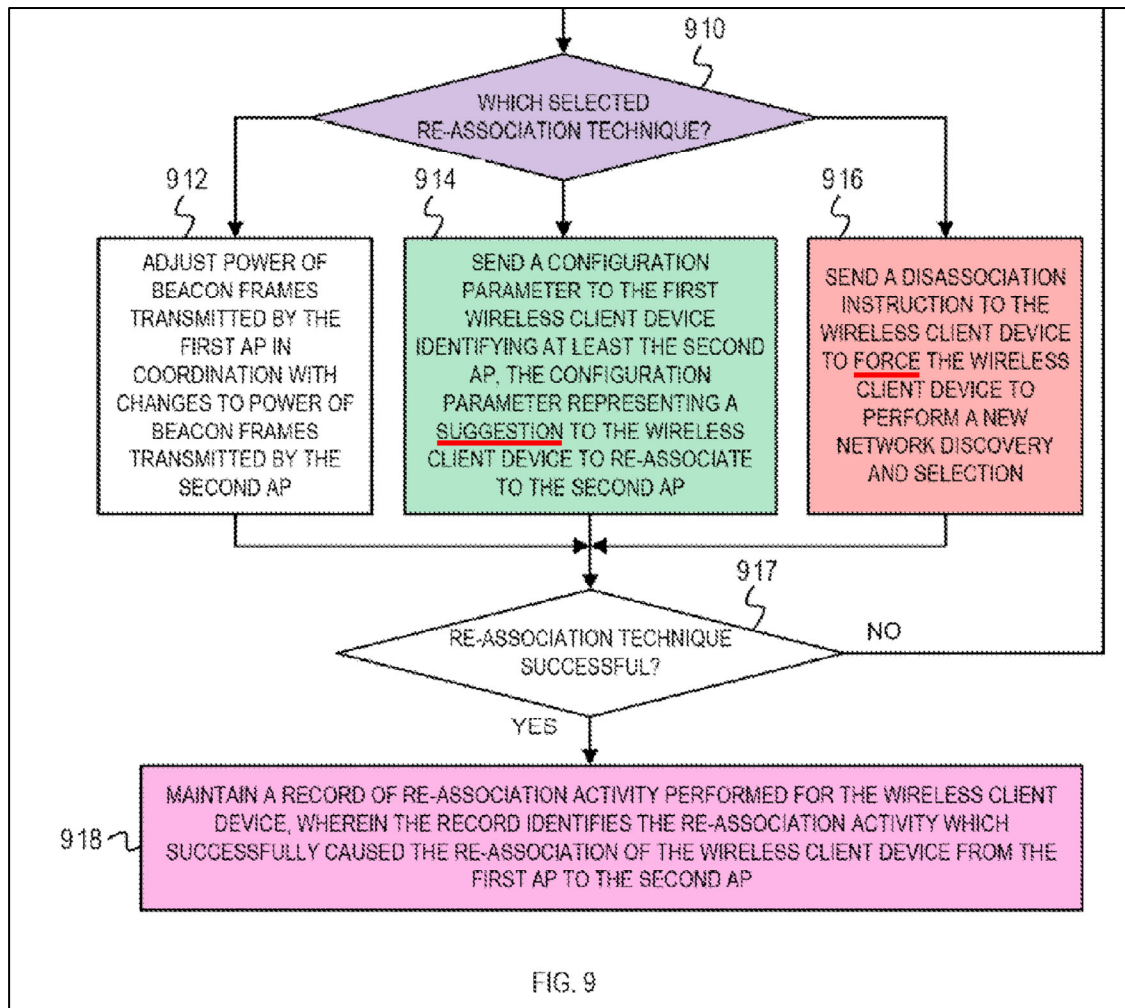
support 802.11v and legacy clients that do not), [0034] (discussing “legacy wireless client device” that do not understand “specific re-association commands”). Thus, Tian teaches determining whether the client supports intelligent roaming. As Tian explains in more detail, “[t]he APs may attempt different re-association techniques [(e.g., the techniques shown in blocks 912, 914, 916)] until identifying a re-association technique that successfully results in the re-association.” *Id.*, [0070]. The successful re-association technique can then be selected for use in a subsequent network-initiated roaming of the client, as shown at block 910 (purple). *Id.*



Ex.1008, FIG. 9 (excerpted).

- (h) *Element [1.7]: “wherein, when the client does not support intelligent roaming, the one or more instructions include a deauthentication or a disassociation frame, with a reason code reflecting a roaming decision by the controlling entity.”*

Murty-Tian renders obvious this element. Ex.1002 ¶¶193-95. As discussed above in Section VII.D.2(g), Tian teaches determining that the client does not support intelligent roaming based on the client’s prior roaming record, and a POSITA would be motivated to incorporate this teaching in Murty for the reasons described in Section VII.D.1 above. If the client does not support intelligent roaming, Tian teaches that an appropriate re-association technique is used at block 916 (red), whereby “a ***disassociation instruction*** is sent to the wireless client device to ***force*** the wireless client device to perform a new network discovery and selection.” Ex.1008, [0075]. “The ***disassociation instruction*** may instruct the wireless client device to disassociate from the first AP within a predefined time interval.” *Id.* Indeed, such client device would not support the 802.11v configuration message suggesting it to roam that is used at block 914. *Id.*, [0026].



Ex.1008, FIG. 9. Murty also discloses an AP sending “a disassociation message” to a client device. Ex.1006, 17:8-10. A POSITA would have understood that Tian’s and Murty’s “disassociation” instruction/message is the Disassociation frame specified in the prior art 802.11 standards, which includes a “reason code” field reflecting a roaming decision by the controlling entity. Ex.1002, ¶195; Ex.1012 (802.11-2012), at 442 (“[The] Reason Code field is used to indicate the reason that an unsolicited notification management frame of type Disassociation, Deauthentication, ... was generated.”); *id.*, Table 8-36 - Reason codes.

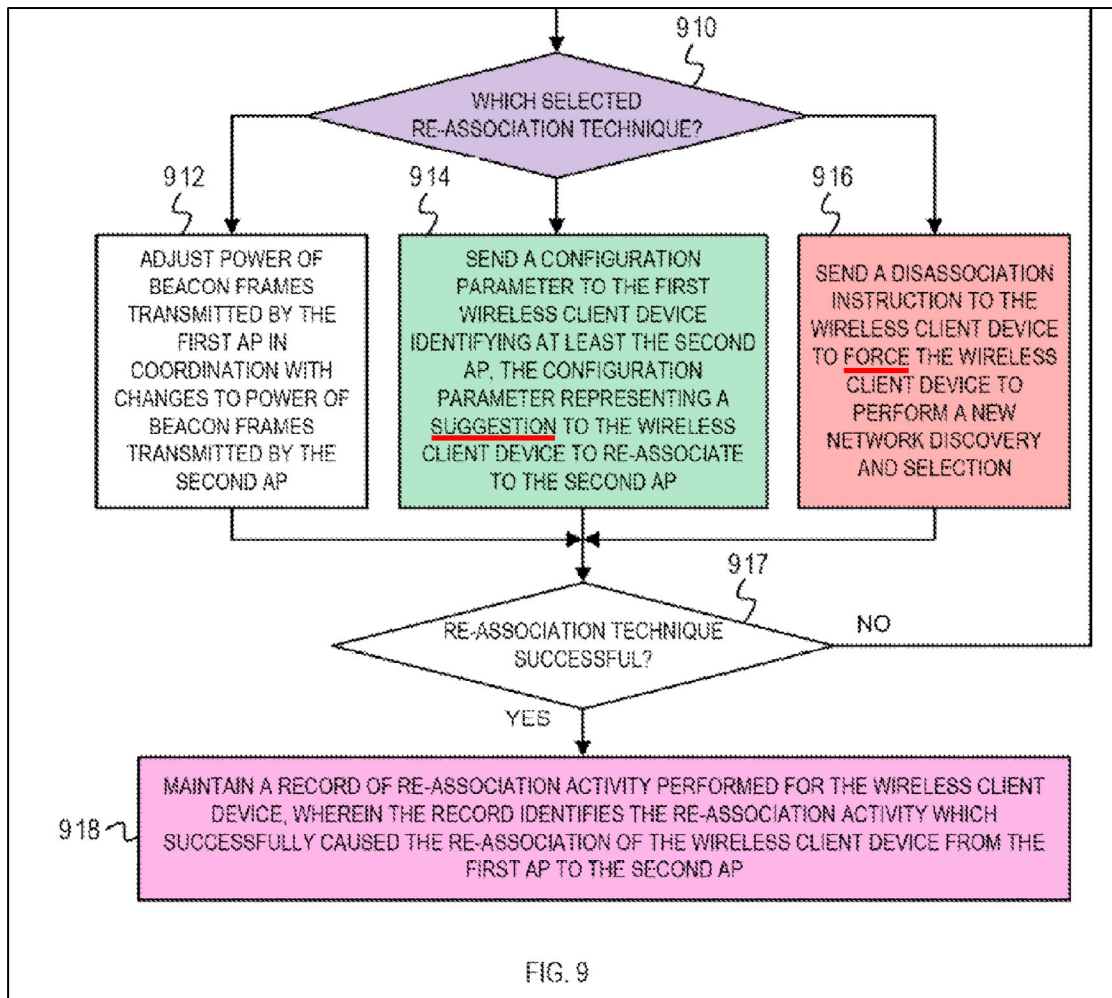
Table 8-36—Reason codes

Reason code	Name	Meaning
0		Reserved
1		Unspecified reason
2		Previous authentication no longer valid
3		Deauthenticated because sending STA is leaving (or has left) IBSS or ESS
4		Disassociated due to inactivity
5		Disassociated because AP is unable to handle all currently associated STAs

Ex.1012, Table 8-36 (excerpted), 442-44. A reason code is issued when a roaming decision is made, and therefore reflects the roaming decision. Ex.1002, ¶195.

- (i) *Element [22.7]: “wherein, when the client supports intelligent roaming, the one or more instructions include a roaming directive and an identifier of the second mesh point.”*

Murty-Tian renders obvious this element. Ex.1002 ¶¶196-98. As discussed above in Section VII.D.2(g), Tian teaches determining whether the client supports intelligent roaming based on the client’s prior roaming record. If the client supports intelligent roaming, Tian teaches that an appropriate re-association technique is used as shown at block 914 (green) of Figure 9, whereby “a configuration parameter [(message)] is sent to the ... client device identifying at least the second AP [(claimed second mesh point)], the configuration parameter representing *a suggestion* to the wireless client device to reselect and [re-]associate[] with the second AP.” Ex.1008, [0074].



Ex.1008, FIG. 9. A POSITA would have understood that Tian’s “configuration parameter representing a **suggestion**” corresponds to the BTM frame specified in the 802.11v intelligent roaming standards. *Id.*, [0003] (“The IEEE 802.11 standards may define a Basic Service Set (BSS) transmission management mechanism [(BTM frame)] to allow an AP to **suggest** that a wireless client device transition to a different AP.”). Tian further explains that “the configuration parameter may include an **explicit instruction** for the wireless client device to associate with the second AP if the wireless client device is capable of interpreting the explicit instruction.” *Id.*,

[0074]. Tian's configuration parameter message corresponds to the claimed "one or more instructions" ("configuration parameter") that "include a roaming directive" (an explicit instruction or a suggestion to roam) and "an identifier of the second mesh point" (second/candidate AP). Ex.1002 ¶¶197-98. A POSITA would have found it obvious to incorporate this teaching into Murty for the reasons described in Section VII.D.1 above.

3. Dependent Claims 12 and 33

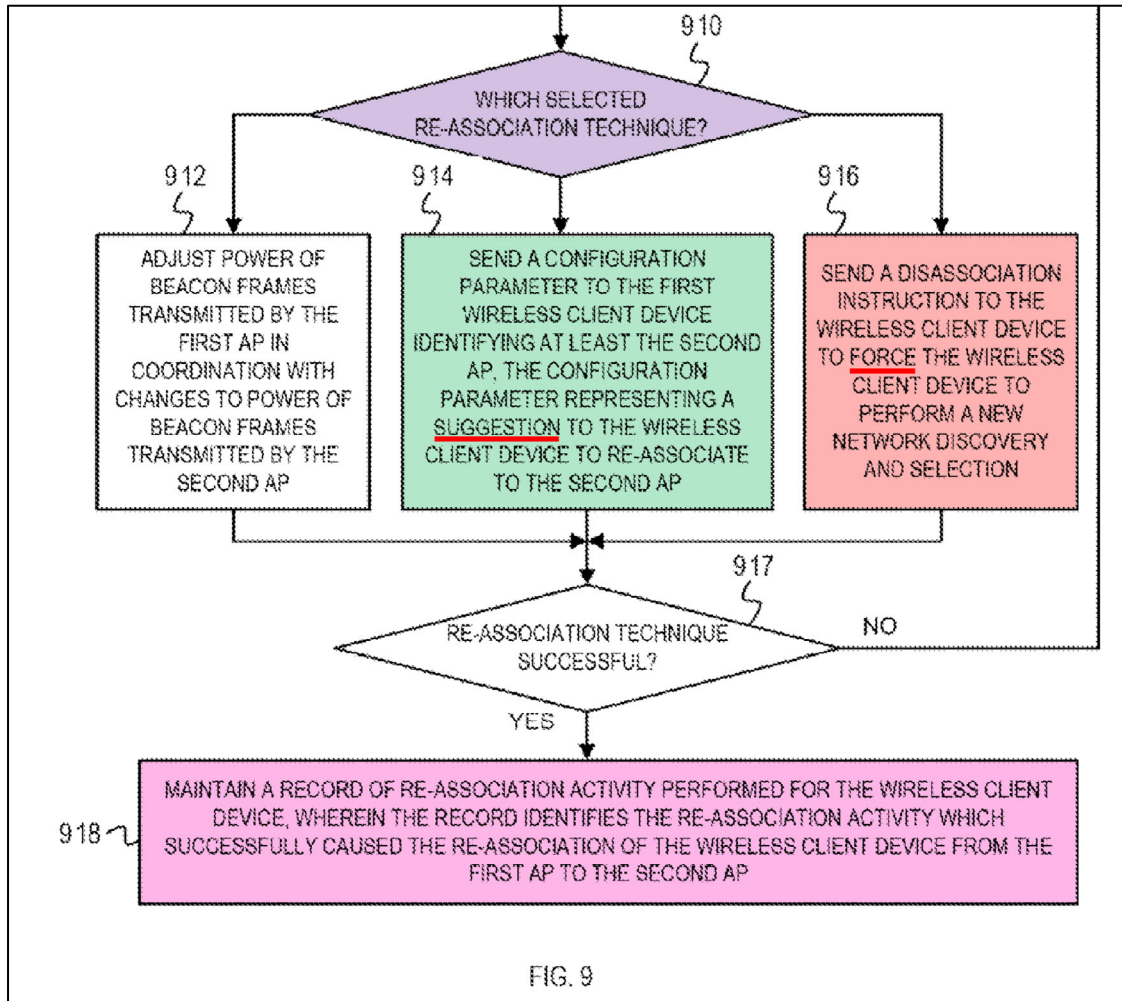
(a) *Preamble: "The method of claim [1/22], further comprising:"*

Elements [12.1]/[33.1]: "establishing a profile containing, for a select number of clients, a roaming capability and a roaming behavior of each client; and"

Murty-Tian renders obvious this element. Ex.1002, ¶¶199-201. The '242 Patent explains that "the mesh network can learn over time how different clients behave and can adjust its roaming instruction and behavior accordingly." Ex.1001, 23:9-11. Tian discloses the same. Ex.1002, ¶¶199-201. As shown at block 918 in Figure 9, Tian teaches establishing a profile containing a roaming capability and a roaming behavior for each client based on a "record of re-association activity performed for the wireless client device." Ex.1008, [0077]. For example, as discussed above in Sections VII.D.2.(h)-(g), if the client previously was successfully re-associated using the 802.11v configuration parameter message of block 914 (green), the "record of re-association" for that client would indicate that the client supports 802.11v intelligent roaming (claimed roaming capability). *Id.*, [0078]

(“Over several attempts and re-associations, the access points may become aware of the [roaming] *capabilities* of particular wireless client device. The [roaming] *capabilities* and associated delay of different re-association techniques may be considered when selecting a re-association technique for a particular wireless client device.”). As Tian also teaches, a client that supports 802.11v intelligent roaming may nonetheless “choose[s] to ignore the suggestion” carried in 802.11v BTM configuration parameter messages, in which case the re-association technique at block 914 (green) would still fail. *Id.*, [0003]. Tian’s “record of re-association activity” captures this roaming behavior as well. Ex.1002, ¶¶200-01. Thus, Tian’s “record of re-association activity” of a client device corresponds to the claimed client profile that contains the client’s roaming capability (*e.g.*, the client supports 802.11v intelligent roaming) and roaming behavior (*e.g.*, the client ignores 802.11v roaming suggestions). *Id.* As Dr. Ding explains, a POSITA would have been motivated to use Tian’s roaming profiles in Murty’s system to improve user’s experience and to improve re-association consistency and reliability. *Id.* As Dr. Ding further explains, a POSITA would have been motivated to use Tian’s roaming profiles in Murty’s system at least because it would be a combination of prior art elements according to known methods, and also application of a known technique to a known system ready for improvement, all with predictable results. *Id.* Further, because the implementation of roaming profiles involves routine software implementation of a

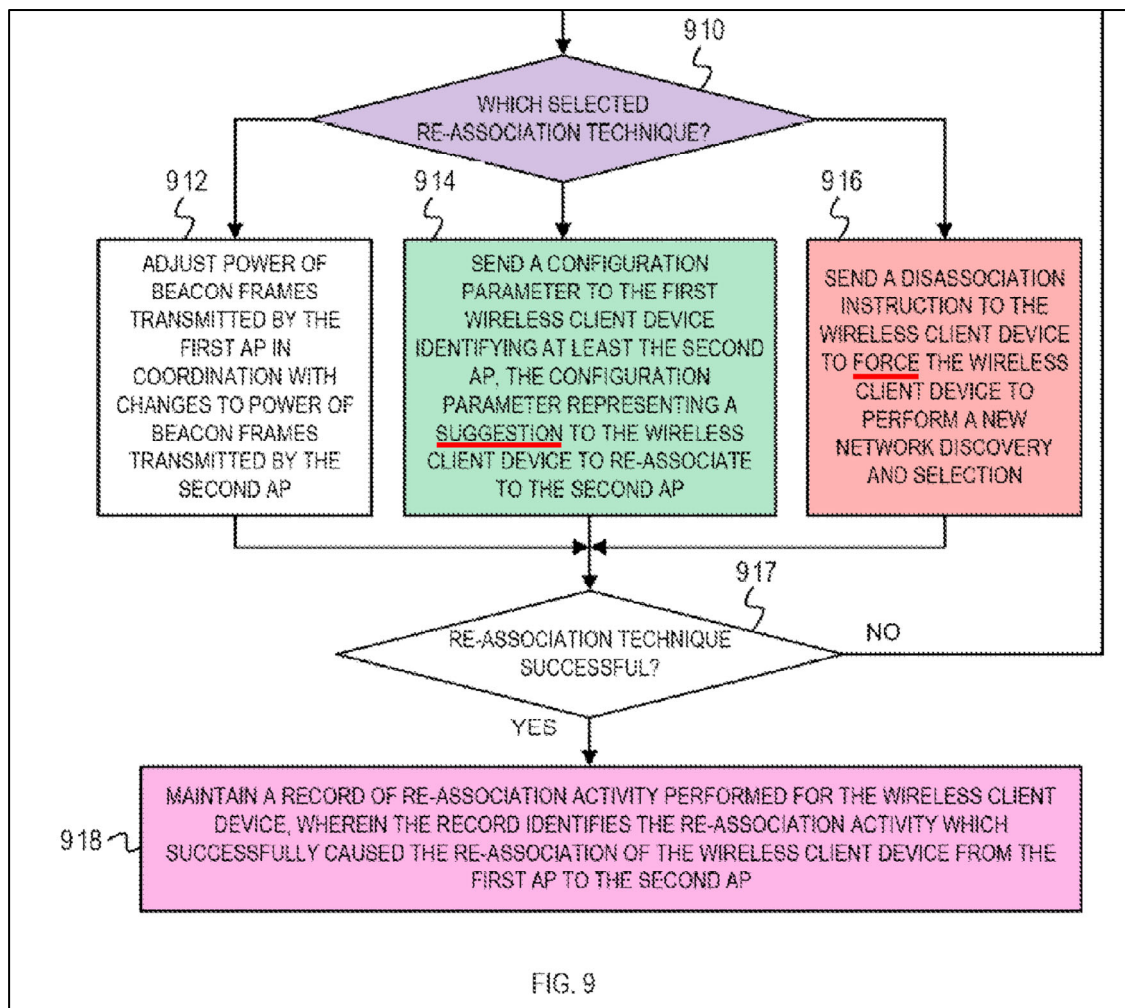
database of historical records, there is also a reasonable likelihood of success in the proposed combination. *Id.*



Ex.1008, FIG. 9.

(b) *Elements [12.2]/[33.2]: “selecting, for each client, the one or more instructions based on a profile of a corresponding client.”*

Murty-Tian renders this element obvious. Ex.1002, ¶¶202-04. As discussed above in Section VII.D.3(a), Tian discloses establishing a client’s roaming profile that is used to select an appropriate roaming technique, such as one of the techniques in blocks 912, 914 or 916 of Figure 9. *See* Section VII.D.3.(a).



Ex.1008, FIG. 9. As shown in Tian’s Figure 9, one or more instructions is selected accordingly. For example, if the client profile indicates that the client supports 802.11 intelligent roaming and has a history of following the roaming suggestions carried in 802.11v BTM messages, the current AP will send to the client BTM messages (“configuration parameter”) to initiate/suggest roaming, as shown at block 914 (green). Ex.1008, [0074]. If, on the other hand, the client profile indicates that the client does not support intelligent roaming, the current AP may send to the client a “disassociation instruction” as shown at block 916 (red), or may coordinate the

transmit power of beacon signals with other APs, as shown at block 912, to cause the client to choose to associate with another AP based on received signal strength of the beacon signals. *Id.*, [0075]. As Dr. Ding explains, a POSITA would have been motivated to use this teaching from Tian with Murty to improve user's experience and to improve roaming consistency and reliability, and the results of such a combination would be predictable and successful. Ex.1002 ¶204.

4. Dependent Claims 13 and 34

- (a) *“The method of claim [12/33], wherein the profile is established based on one or more unique identifiers of the client.”*

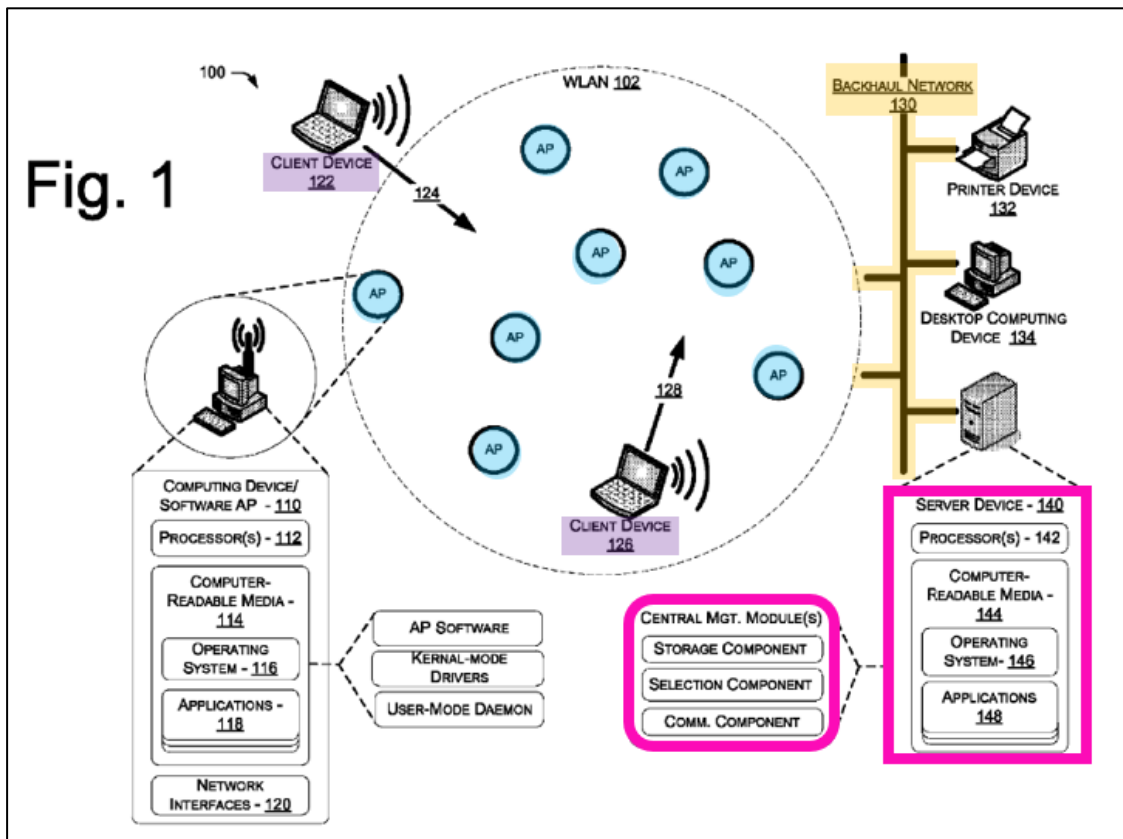
Tian discloses this element. Ex.1002, ¶205. As Tian teaches, “the record of re-association activity [(client profile)] may include a ***device identifier (e.g., MAC address)*** of the wireless client device ...” Ex.1008, [0077]. The MAC address is a unique identifier for the client device. Ex.1002, ¶205.

5. Dependent Claims 5, 8, 9, 19, 21, 26, 29, and 30

Murty discloses or renders obvious claims 8, 9, 19, 21, 29, and 30 for the same reasons discussed in those claims under Ground I, specifically regarding Murty's teachings. *See* Sections VII.A.9 (claims 8 and 29), VII.A.10 (claims 9 and 30), VII.A.15 (claims 19 and 21); Ex.1002, ¶206.

Murty also discloses or renders obvious claims 5 and 26, which recite: “The method of claim [1/22], wherein the controlling entity is a server remote from the wireless mesh network.” Ex.1002, ¶207. As Murty teaches, remote server 140

(magenta) is the controlling entity for the wireless mesh network: “server device 140 can be configured to collect information from each AP [(blue)] and *centrally manage* each AP with respect to each AP’s communication channel assignment, transmission power setting(s) and/or *client device-to-AP mapping* [(association/re-association)].” Ex.1006, 7:17-21, 10:22-25.



Ex.1006, FIG. 1.

VIII. THE BOARD SHOULD INSTITUTE IPR

The Board should decline to exercise its discretion to deny institution.

No Discretionary Denial under *Fintiv* - “The PTAB will not discretionarily deny petitions based on applying *Fintiv* to a parallel ITC proceeding.” Ex.1013, at

7. As explained below in Section IX.B, the only active parallel proceeding involving the '242 Patent is ITC Investigation No. 337-TA-1361.

No Discretionary Denial under §325(d) - The Board has consistently “held that a reference that ‘was neither applied against the claims nor discussed by the Examiner’ does not weigh in favor of exercising [] discretion under §325(d).” *Fasteners for Retail, Inc. v. RTC Indus., Inc.*, IPR2019-00994, Paper 9 at 7-11 (PTAB Nov. 5, 2019). Here, the prior art references relied on in this Petition (Gupta, Murty, Ganu, Perahia, and Tian) were not cited or discussed during prosecution.

IX. MANDATORY NOTICES

A. Real Party-In-Interest

TP-Link Corporation Limited, f/k/a/ TP-Link International Ltd., TP-Link Technologies Co., Ltd., TP-Link USA. Corp. and TP-Link Institute USA Corp. d/b/a TP-Link Research America Corp. are the real parties-in-interest.

B. Related Matters

The '242 Patent is the subject of an investigation in the International Trade Commission, Inv. No. 337-TA-1361, filed April 3, 2023 (“ITC Investigation”).

The '242 Patent is also subject of Civil Action No. 2:23-cv-2540 in the Central District of California (“District Court Case”), filed April 4, 2023. The District Court Case is stayed pending outcome of the ITC Investigation. Ex.1014.

C. Counsel and Service Information

Lead Counsel	Back-Up Counsel
Todd M. Friedman, P.C. (No. 42,559) todd.friedman@kirkland.com <u>Postal and Hand-Delivery Address:</u> KIRKLAND & ELLIS LLP 601 Lexington Avenue New York, NY 10022 Telephone: (212) 446-4800 Facsimile: (212) 446-4900	Bao Nguyen (No. 46,062) bao.nguyen@kirkland.com <u>Postal and Hand-Delivery Address:</u> KIRKLAND & ELLIS LLP 555 California Street San Francisco, CA 94194 Telephone: (415) 439-1425 Facsimile: (415) 439-1500

Individual attorney contact information is in the signature block below.

Petitioner concurrently submits a Power of Attorney, 37 C.F.R. § 42.10(b), and consents to electronic service directed to the following email address: TP-Link_ITC@kirkland.com.

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

Petitioner authorizes the Office to charge the filing fee and any other necessary fee to Deposit Account No. 506092. Review of 37 claims is requested. The undersigned further authorizes payment for any additional fees that may be due in connection with this Petition.

XI. CERTIFICATION OF GROUNDS FOR STANDING

Petitioner certifies pursuant to Rule 42.104(a) that the '242 Patent is available for IPR and that Petitioner is not barred or estopped from requesting an IPR of the Challenged Claims on the grounds identified in this Petition.

XII. CONCLUSION

Petitioner requests institution of an IPR and cancellation of the Challenged Claims.

Date: September 7, 2023

Respectfully submitted,

/s/ Todd M. Friedman

Todd M. Friedman, P.C.
Counsel for Petitioner
Reg. No. 42,559

CERTIFICATE OF COMPLIANCE

This Petition complies with the type-volume limitations as mandated in 37 C.F.R. § 42.24, totaling 13,962 words. Counsel has relied upon the word count feature provided by Microsoft Word.

/s/ Todd M. Friedman
Todd M. Friedman

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e), I certify that I caused to be served on September 7, 2023, a true and correct copy of the foregoing **Petition For *Inter Partes* Review Under 35 U.S.C. § 312 AND 37 C.F.R. § 42.104** by overnight carrier to the Patent Owner at the correspondence address of record for the Patent Owner's Attorneys as follows:

22918 – Perkins Coie LLP - PAO General
P.O. Box 1247
Seattle, WA 98111-1247
United States

A courtesy copy was also served via electronic mail on Patent Owner's counsel of record in the investigation before the International Trade Commission, Inv. No. 337-TA-1361.

Kevin C. Wheeler
Bert C. Reiser
Susan Y. Tull
LATHAM & WATKINS LLP
555 11th St. NW, Suite 1000
Washington, D.C. 20004-1304
Telephone: (202) 637-2200
Facsimile: (202) 637-2201

Patricia Young
Blake R. Davis
Allison Harms
Ben Alred
LATHAM & WATKINS LLP
140 Scott Drive
Menlo Park, CA 94025

Petition for *Inter Partes* Review of U.S. Patent No. 10,327,242 B2

Telephone: (650) 328-4600

Facsimile: (650) 463-2600

Email: netgearitc.lwteam@lw.com

/s/ Todd M. Friedman

Todd M. Friedman