

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. 10,278,179

Case IPR2023-TBD

DECLARATION OF ZHI DING, PH.D.

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I, Dr. Zhi Ding, declare as follows:

1. My name is Zhi Ding.
2. I have been retained as an expert witness on behalf of TP-Link Corporation Limited (“TP-Link” or “Petitioner”) for the above-captioned Petition for Inter Partes Review (“Petition”) of U.S. Patent No. 10,278,179 (the “’179 Patent”) (Ex. 1001). I am being compensated for my time in connection with this Petition at my standard consulting rate of \$820 per hour. My compensation is not affected by the outcome of this matter.
3. I have been asked to provide my opinions regarding whether claims 1-19 of the ’179 Patent (the “Challenged Claims”) are invalid as obvious to a person having ordinary skill in the art at the time of the alleged invention.
4. The ’179 Patent issued on April 30, 2019, from Application No. 15/287,711, filed on October 6, 2016, and claims priority to provisional applications No. 62/253,540, filed on November 10, 2015, and No. 62/336,503, filed on May 13, 2016.
5. I am not currently, and have not at any time in the past been, an employee of TP-Link. I have no financial interest in TP-Link.

I. BACKGROUND AND QUALIFICATIONS

6. I presently hold the title of Distinguished Professor in the Department of Electrical and Computer Engineering at the University of California, Davis. Since

my appointment on July 1, 2000, I have held the position of professor for the past 23 years at the present university and have served as a faculty member at several US universities for over 32 years. I am also a private technical consultant on various technologies related to information systems. I have more than three decades of research experience on a wide range of topics related data communications and signal processing.

7. I earned my Bachelor of Science degree in 1982 in wireless engineering from the Nanjing Institute of Technology (later renamed as Southeast University) in Nanjing, China. I earned my Master of Science degree in 1987 in electrical engineering from the University of Toronto in Toronto, Canada. I earned my Ph.D. in 1990 in electrical engineering from Cornell University in Ithaca, New York.

8. My responsibilities as a Professor at University of California, Davis, include classroom instruction on various topics of communication systems and signal analysis, as well as mentoring undergraduate students and supervising graduate students in their research and development efforts on various topics related to digital communications. I have directly supervised such research and development works ranging from signal detection to wireless networking. As the chief academic advisor, I have also directly supervised the completion of over 20 Masters theses and 30 Ph.D. dissertations on various topics related to digital communications. I have served full time as a faculty member at three major research universities in the

United States over the past 30 years, including Auburn University from 1990 to 1998, University of Iowa from 1999 to 2000, and University of California, Davis, from 2000 to present.

9. Since 1990, I have been selected as the principal investigator of multiple highly competitive federal and local research grants, including more than twenty major research projects supported by the National Science Foundation and two research projects funded by the U.S. Army Research Office. These competitive research projects focused on developing more efficient and effective digital communication transceivers, networks, and signal processing tools. I have also participated in several large-scale projects supported by the Defense Advanced Research Projects Agency (DARPA) with teams of researchers. I have applied for, and received support from, other federal, state, and industry sponsors.

10. I have published over 240 peer-reviewed research articles in premier international journals, in addition to over 250 refereed technical articles at top international conferences on communications and information technologies. According to Google Scholar, my published works have been cited by over 16,000 times by peers. I also authored two books on communications technologies. My most recent book, coauthored with B.P. Lathi, is entitled, “Modern Digital and Analog Communication Systems,” 5th edition, and was published by the Oxford University

Press in 2018. The 4th edition of this book (published in 2009) had been widely adopted as an introductory textbook to communication systems.

11. In addition to the over 490 published technical papers that have been cited over 16,000 times according to Google Scholar, I am also co-inventor of 4 issued U.S. patents on communication technologies.

12. I am a member of the Institute of Electrical and Electronics Engineers (IEEE) and was elevated to the grade of Fellow in January 2003 for contributions made in signal processing for communication. The IEEE is the world's largest professional society of engineers, with over 400,000 members in more than 160 countries. The IEEE has led the development of many standards for modern digital communications and networking, most notably, the IEEE 802 series of network standards. The IEEE Grade of Fellow is conferred by the Boards of Directors upon a person with an extraordinary record of accomplishments in any of the IEEE fields of interest. The total number selected in any one year does not exceed one-tenth of one percent of the total voting Institute membership.

13. I have served the IEEE in the following capacities:

- Chief Information Officer of the IEEE Communications Society from Jan. 2018 to present.
- Chief Marketing Officer of the IEEE Communications Society from Jan. 2020 to present.

- General Chair of the 2016 IEEE International Conference on Acoustics, Speech, and Signal Processing, the flagship conference of the IEEE Signal Processing Society.
- Chair of the Steering Committee for the IEEE Transactions on Wireless Communications from 2008 to 2010.
- Distinguished Lecturer of the IEEE Communications Society from January 2008 to December 2009.
- Technical Program Chair of the 2006 IEEE Globecom, one of two flagship annual IEEE Communication Society conferences.
- Distinguished Lecturer of the IEEE Circuits and Systems Society from 2004 to 2005.
- Associate Editor of the IEEE Transactions on Signal Processing from 1994 to 1997 and from 2001 to 2004.
- Member of the IEEE Statistical Signal and Array Processing for Communications Technical Committee from 1993 to 1998.
- Member of the IEEE Signal Processing for Communications Technical Committee from 1998 to 2004.

14. In 2012, I received the Wireless Communications Technical Committee Recognition Award from the IEEE Communications Society, an award given to a person with a high degree of visibility and contribution in the field of “Wireless and

Mobile Communications Theory, Systems, and Networks.” I received the 2020 Education Award from the IEEE Communications Society. According to the Society, this award “recognizes distinguished and significant contributions to education within the Society’s technical scope.”

15. I have also served as a technical consultant for the telecommunication industry. For example, in 1995 I consulted for Analog Devices, Inc., on the development of the first generation DOCSIS cable modem systems. I have also consulted for other companies, including Nortel Networks and NEC US Laboratories. I worked as a visiting faculty research fellow at NASA Glenn Research Center in 1992 and at U.S. Air Force Wright Laboratory in 1993. I have served on multiple review panels of the National Science Foundation to evaluate competitive research proposals in the field of communication. I have also reviewed a large number of research proposals at the request of the National Science and Engineering Research Council (NSERC) of Canada as an expert panelist from 2010 to 2013, and also at the request of the Research Grant Council (RGC) of Hong Kong as an external reviewer.

16. I have served as an expert witness or consulting expert on a number of matters related to intellectual property, mostly in the arena of telecommunications, including cellular communications, Wi-Fi technologies, Bluetooth, and optical

communications. For example, since 2007, I have been engaged to work on various litigations involving cellular, WiFi, Bluetooth, and optical communication networks.

17. Based on my above-described near three decades of experience in communications technologies, and the acceptance of my publications and professional recognition by societies in my field, I believe that I am qualified to be an expert in wireless communication systems, communication networks, and signal processing.

18. My qualifications and publications are set forth more fully in my curriculum vitae, attached.

II. MATERIALS AND OTHER INFORMATION CONSIDERED

19. In forming the opinions expressed in this Declaration, I relied upon my education and experience in the relevant field of the art and have considered the viewpoint of a person having ordinary skill in the art (POSITA) at the time of the alleged invention.

20. I have considered the materials referenced herein, including the '179 Patent (Ex. 1001), the file history of the '179 Patent (Ex. 1004), the Petition, and other documents listed in the Exhibit List of the Petition, including:

Description	Date of Public Availability
U.S. Patent 9,001,767 (“Gatewood”) (Ex. 1005)	Issued on April 7, 2015, from an application filed March 6, 2013.
U.S. Patent 7,366,120 (“Handforth”) (Ex. 1006)	Issued on April 29, 2008, from an application filed October 18, 2004.

Description	Date of Public Availability
U.S. Patent Application Publication No. 2008/0304485 (“Sinha”) (Ex. 1008)	Published on December 11, 2008, from an application filed June 6, 2007.
U.S. Patent Application Publication No. 2010/0322141 A1 (“Liu”) (Ex. 1009)	Published on December 23, 2010 from a PCT application filed March 11, 2008.
U.S. Patent Application Publication No. 2016/0192203 (“Gokturk”) (Ex. 1011)	Published on June 30, 2016, from an application filed December 23, 2015.
U.S. Patent Application Publication No. 2017/0238189 (“Nolan”) (Ex. 1012)	Published on August 17, 2017 from a PCT application filed March 27, 2015.
Microsoft Computer Dictionary, 5th Edition (2002) (Ex. 1014)	Published and publicly available no later than 2002.
Perahia and Stacey, <i>Next Generation Wireless LANs</i> , Cambridge Press (2008) (“Perahia”) (Ex. 1015)	Published and publicly available no later than October 27, 2008. <i>See</i> Ex. 1016.
U.S. Patent Application Publication No. 2010/0260146 (“Lu”) (Ex. 1020)	Published on October 14, 2010, from an application filed June 22, 2010.

21. The references listed above include prior art to the ’179 Patent which is entitled to a priority date not earlier than November 10, 2015.¹ Handforth, Sinha, and Liu (Exs. 1006, 1008, 1009) were not cited. Gatewood is cited art and is used in Ground III in combination with the Sinha non-cited art. I have also reviewed ITC Complaint Exhibit 22 (’179 Patent Infringement Claim Chart) (Ex. 1007), the Amended Joint Chart of Agreed and Disputed Claim Terms for Construction (Ex.

¹ I understand that Petitioner reserves the right to challenge the claimed priority date.

1017), Netgear's Opening Claim Construction Brief (Ex. 1018), and TP-Link's Initial Claim Construction Brief (Ex. 1019).

III. UNDERSTANDING OF PATENT LAW

22. I am not an attorney. For purposes of this declaration, I have been informed about certain aspects of the law that are relevant to my opinions. My understanding of the law is as listed below.

A. Claim Construction

23. I understand that in an IPR petition filed after November 13, 2018, a claim must be construed under the *Phillips* standard. Under that standard, words of a claim are given their plain and ordinary meaning as understood by a POSITA at the time of invention, in light of the specification and prosecution history, unless those sources show an intent to depart from such meaning, as well as pertinent evidence extrinsic to the patent.

B. Obviousness

24. I have been informed and understand that a patent claim can be considered to have been obvious to a POSITA at the time the application was filed. This means that, even if all of the requirements of a claim are not found in a single prior art reference, the claim is not patentable if the differences between the subject matter in the prior art and the subject matter in the claim would have been obvious to a POSITA at the time the application was filed.

25. I have been informed and understand that a determination of whether a claim would have been obvious should be based upon several factors, including, among others:

- the level of ordinary skill in the art at the time the application was filed;
- the scope and content of the prior art; and
- what differences, if any, existed between the claimed invention and the prior art.

26. I have been informed and understand that the teachings of two or more references may be combined in the same way as disclosed in the claims, if such a combination would have been obvious to a POSITA. In determining whether a combination based on either a single reference or multiple references would have been obvious, it is appropriate to consider at least the following factors:

- whether the teachings of the prior art references disclose known concepts combined in familiar ways, which, when combined, would yield predictable results;
- whether a POSITA could implement a predictable variation, and would see the benefit of doing so;
- whether the claimed elements represent one of a limited number of known design choices, and would have a reasonable expectation of success by a POSITA;
- whether a POSITA would have recognized a reason to combine known elements in the manner described in the claim;
- whether there is some teaching or suggestion in the prior art to make the modification or combination of elements claimed in the patent; and

- whether the innovation applies a known technique that had been used to improve a similar device or method in a similar way.

27. I understand that a POSITA has ordinary creativity, and is not an automaton.

28. I understand that in considering obviousness, it is important not to determine obviousness using the benefit of hindsight derived from the patent being considered.

29. I understand that prior art to the '179 Patent includes patents and printed publications in the relevant art that predate the Priority Date of the '179 Patent.

30. I understand that certain factors—often called “secondary considerations”—may support or rebut an assertion of obviousness of a claim. I understand that such secondary considerations include, among other things, commercial success of the alleged invention, skepticism of those having ordinary skill in the art at the time of the alleged invention, unexpected results of the alleged invention, any long-felt but unsolved need in the art that was satisfied by the alleged invention, the failure of others to make the alleged invention, praise of the alleged invention by those having ordinary skill in the art, and copying of the alleged invention by others in the field.

31. I further understand that there must be a nexus—a connection—between any such secondary considerations and the alleged invention. I also

understand that contemporaneous and independent invention by others is a secondary consideration tending to show obviousness.

IV. SUMMARY OF OPINIONS

32. It is my opinion that claims 1, 2, 4-7, 11, 12, 14-16 are disclosed or, at a minimum, rendered obvious by Sinha alone or in view of Liu (Ground IA).

33. It is my opinion that claims 1-7, 11-16 are disclosed or, at a minimum, rendered obvious by Sinha alone or in view of Liu (Ground IB).

34. It is my opinion that claims 1-19 are disclosed or, at a minimum, rendered obvious by Sinha-Liu in further view of Handforth (Ground II).

35. It is my opinion that claims 1, 3-6, 11, and 13-16 are disclosed or, at a minimum, rendered obvious by Gatewood alone or in view of Sinha (Ground III).

36. It is my opinion that for purposes of this proceeding, the claim terms need not be construed to resolve the prior art issues presented in this Petition.

V. OVERVIEW OF THE TECHNOLOGY

37. The '179 Patent is directed at wireless technology and specifically to computer networking via wireless connections. Unlike wired connections, wireless networks provide convenience, flexibility, and mobility for computers to connect to a network. In wireless networks, wireless devices such as laptops and printers connect to the broader network through a wireless access device by using a standardized wireless protocol such as Bluetooth, or Wi-Fi which typically refer to

the IEEE 802.11 series of standards. Wireless access devices utilize a wireless connection between the wireless access device and a wireless device to transfer data. A network device connected to an external network is referred to as a “gateway,” while a wireless access device connected to an external network may be referred to as a “gateway wireless access device.”

38. The area in which a wireless connection between the wireless device and the wireless access device (access point or AP) can be established and maintained is the wireless coverage area for the access device. Often, the area where a user wishes to use his or her wireless device is larger than the coverage area of the access device, but the signal strength and quality decrease with the distance of the wireless connection. Accordingly, users may add additional wireless access devices to their network, such as a WiFi extender, to increase the area where the user can maintain a strong wireless connection. WiFi extenders are typically similar to wireless access devices but do not include an integral router connected to the external network. A mesh network can form an extended network in which WiFi extenders rely on wireless backhaul to other wireless access devices for the gateway to connect to the external network. These specialized wireless access points (APs) are known as Mesh APs or MAPs.

39. A network is defined by its topology. A basic WiFi setup may have a single AP connected to a gateway or integrated with a gateway. A mesh network

would typically have a root AP (which itself is connected to a gateway or integrated with a gateway) and a number of secondary APs. In one mesh network configuration, these secondary APs may be wirelessly but directly connected to the root AP, forming a star topology network. In other configurations, some of the secondary APs may instead be connected indirectly but wirelessly to the root AP in a wireless daisy chain fashion by directly connecting to other secondary APs which are in turn either directly or indirectly connected to the root AP, forming a tree topology. In a star topology, the backhaul paths to an integrated root AP/gateway are single-hop communication paths. In a tree topology, the backhaul paths include indirect, multi-hop communication paths. A mesh network of a tree topology can form an extended network with large coverage to serve client wireless devices. The basic components of a mesh network include a gateway (which can be integrated with a root AP), secondary Mesh APs (non-root access nodes), backhaul connections (communication paths connecting APs), and client devices that are served by one or more APs.

40. To individual users (wireless devices), the quality of the wireless link/connection is important to his/her networking experience. Some link/channel quality parameters or indicators include received signal strength indicator (RSSI), received channel power indicator (RCPI), and hop-count from the client to the gateway. For example, the RSSI and RCPI provide signal strength information that

impacts link speed and/or packet loss rate. The stronger the RSSI/RCPI, the faster the connection speed, and/or the lower the packet loss rate. Similarly, the larger the hop count, the longer the link latency, and the higher the packet loss rate.

41. The performance of a network is critical to the clients. Important performance metrics should describe the user experience when in connection. Typical metrics include throughput, packet error/loss rates, connection speed, bandwidth efficiency, latency, and jitter. These metrics directly reflect and impact user experience, overall network capacity, and efficiency of resource usage.

42. One of the most important benefits of wireless networks is the ability to maintain good connectivity as a client wireless device moves from one location to another. Because the link quality with one mesh AP may deteriorate while the link quality with a different mesh AP improves, the decision to change the connection of a wireless client device from one AP to another AP allows the wireless client device to maintain strong link quality. This process is referred to as roaming. To achieve high-quality network performance, roaming relies on the measurement of channel qualities between a wireless client device and available APs in a mesh network. Roaming decisions based on channel or link quality measurement are vital to the effectiveness of mesh networks.

VI. THE '179 PATENT

43. The '179 Patent issued on April 30, 2019, from Application No. 15/287,711, filed on October 6, 2016, and claims priority to provisional applications No. 62/253,540, filed on November 10, 2015, and No. 62/336,503, filed on May 13, 2016.

A. Claims

44. The '179 Patent has 19 claims, including two independent claims numbered 1 and 11. Ex. 1001, 31:4-32:65. Claims 1-19 are the Challenged Claims.

45. Exemplary Claim 1 is reproduced below:

1. A computer-implemented method for implementing a dedicated backhaul in a wireless mesh network formed with one or more mesh points, the method being performed by a first mesh point and comprising:

establishing a forward wireless communication with a second mesh point;

establishing a backhaul communication, separate from the forward wireless communication, with the second mesh point,

wherein the forward wireless communication is established using a wireless communication technology using frequency bands selected from the group consisting of: a 2.4 GHz band, and a 5 GHz band, and

wherein the backhaul communication is established using a communication technology selected from the group consisting of: a power line based communication, a 2.4 GHz or 5 GHz radio frequency (RF) technology using a dedicated radio, and a sub-1GHz RF technology; and

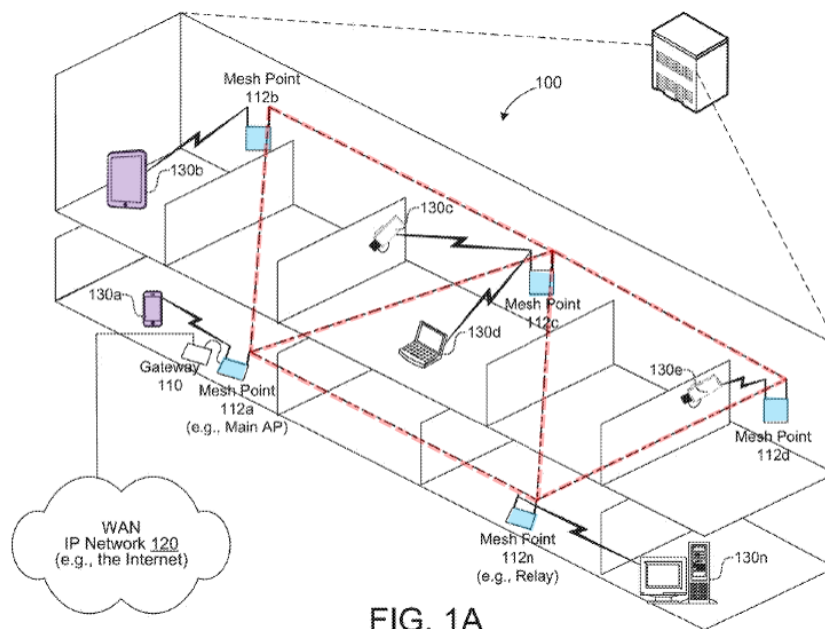
constructing a list of backhaul candidates, each backhaul candidate having a score indicative of an estimated quality of a potential link between the first mesh point and the second mesh point;

upon determining that a quality of service of the dedicated backhaul has dropped to below a predetermined threshold, establishing an alternative backhaul communication with the second mesh point using a backhaul candidate with the highest score on the list.

Ex. 1001, 31:5-31.

B. Background of the '179 Patent

46. The '179 Patent is directed to wireless mesh networks, which are wireless networks that deploy a multitude of mesh access points (MAPs) (blue) in a scattered manner to provide coverage over a large area. Ex.1001, 2:3-6.



Ex.1001, FIG. 1A.² In such a network, MAP-to-MAP communications (dotted line red) are referred to as backhaul communications, in contrast to fronthaul, client-facing communications between MAPs and client devices (purple). Ex.1018 (Patent Owner's claim construction brief), 31.

47. The '179 Patent claims to have invented the use of “dedicated” backhaul communications that are separate from client-facing communications and only serve “traffic between the mesh points.” Ex.1018, 31 (“The '179 and '698 Patents teach systems and methods for improving these wireless mesh networks by implementing a communication between mesh points, also known as a backhaul communication, that is dedicated to servicing data traffic between mesh points, also known as ‘back-end’ traffic. ... This backhaul communication, which the patents refer to as ‘dedicated,’ is separate from the communication the mesh points establish ‘for servicing data traffic from and to clients,’ also called ‘front-end’ traffic.”); Ex.1001, 27:5-21. In my opinion, and as the Petition demonstrates, dedicated backhaul communications were well-known before the claimed priority date of the '179 Patent, rendering the Challenged Claims unpatentable.

² I have added all colors and colored annotations unless otherwise noted.

VII. LEVEL OF ORDINARY SKILL IN THE ART

48. I understand that there are multiple factors relevant to determining the level of ordinary skill in the pertinent art, including the educational level of active workers in the field at the time of the alleged invention, the sophistication of the technology, the type of problems encountered in the art, and the prior art solutions to those problems.

49. In determining the characteristics of a hypothetical person of ordinary skill in the art of the '179 Patent at the time of the alleged invention, I considered several things, including the type of problems encountered in this field, and the rapidity with which innovations were made. I also considered the sophistication of the technology involved, and the educational background and experience of those actively working in the field, and the level of education that would be necessary to understand the '179 Patent. Finally, based on my own experience, I placed myself back in the relevant periods of time, and considered the state of the art and the level of skill of the engineers working in this field in those times.

50. It is my opinion that a POSITA at the time of the '179 Patent would have had a Bachelor's degree from an accredited program 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. Additional education might compensate for less experience, and vice-versa.

51. I also note that my opinions provided in this Declaration would not change in view of any minor modifications to this level of skill.

VIII. CLAIM CONSTRUCTION

52. I understand that Ex.1017 lists the parties' disputed constructions in the currently pending parallel ITC litigation. Ex.1017, Attachment A at 3-4 (disputed terms of the '179 Patent highlighted). I understand there are three disputed claim constructions.

53. I understand that the first claim construction dispute involves the claimed "forward wireless communication" (elements [1.1]/[11.1]) and separate "backhaul communication" (elements [1.2]/[11.2]). *Id.* at 3 (#7). I understand that Petitioner contends in the ITC that the claims of the '179 Patent should be held indefinite. For purposes of applying the prior art in this Petition, the prior art discloses those limitations under Patent Owner's claim interpretation, as well as under other possible interpretations of those claim terms. In this Petition, I have mapped the claimed "forward wireless communication" and "backhaul communication" to separate parts of the prior art's mesh-to-mesh "back-end" communication system (which is commonly referred to as backhaul), as described below.

54. In **Ground IA**, I have mapped the “backhaul communication” to back-end/backhaul path(s) dedicated for carrying control information (or that carry data and control information), and the “forward wireless communication” is mapped to different back-end path(s) dedicated for carrying data traffic. *See* Sections X.A.2(b)-(c). This claim mapping is consistent with the embodiment claimed in dependent claim 2. Ex.1001, claim 2 (“wherein the backhaul communication is dedicated for controlling packets.”). It is also consistent with the ’179 Patent’s description of “forwarding” client data traffic across a network, which uses a back-end/backhaul path to forward such data traffic from one mesh point to another. Ex.1001, 2:8-12 (“When a client device establishes connection with one of the mesh points, the mesh points can *forward* the traffic to the mesh point that is connected to the gateway ...”).

55. In **Ground IB**, I have mapped the “backhaul communication” to back-end/backhaul path(s) established in a frequency band dedicated for backhaul, and the “forward wireless communication” is mapped to different back-end path(s) established in a general-purpose frequency band used for both backhaul and client-facing communications. *See* Sections X.A.2(b)-(c). This claim mapping is consistent with Patent Owner’s claim construction position in the related parallel ITC litigation. Ex.1018, 38 (general-purpose, “client facing” radios “may also be

used to establish a communication, separate from the dedicated backhaul, between the mesh points.”).

56. In **Ground III**, I have mapped the “backhaul communication” to the primary back-end/backhaul path(s), and the “forward wireless communication” is mapped to different secondary back-end path(s) that are on active standby. *See* Sections X.D.1(b)-(c). This claim mapping is at least consistent with claim 3, which recites that a drop in the primary backhaul’s quality of service causes “redirecting backhaul traffic to the forward wireless communication.” Ex.1001, claim 3.

57. The second dispute involves the closed-form Markush groups recited in claim elements [1.3]/[11.3] and [1.4]/[11.4] directed to “forward wireless communication” and “backhaul communication.” Ex.1017, 3-4 (#8). Here, I have applied standard Markush law, which I understand to be Patent Owner’s construction as well. Ex.1017, 3-4 (#8); Ex.1018, 44 (“the claimed communications need only be established using *one* of the alternatives in the recited group.”) (emphasis in PO’s claim construction brief). I understand that, under standard Markush law, “selected from the group consisting of A, B or C” can be met by any one of the recited alternatives.

58. The third dispute involves the preamble of the independent claims 1/11. Ex.1017, 4 (#9). I understand the parties agree that the preamble is limiting. Under Petitioner’s proposed construction, the (first) mesh point recited in the preamble

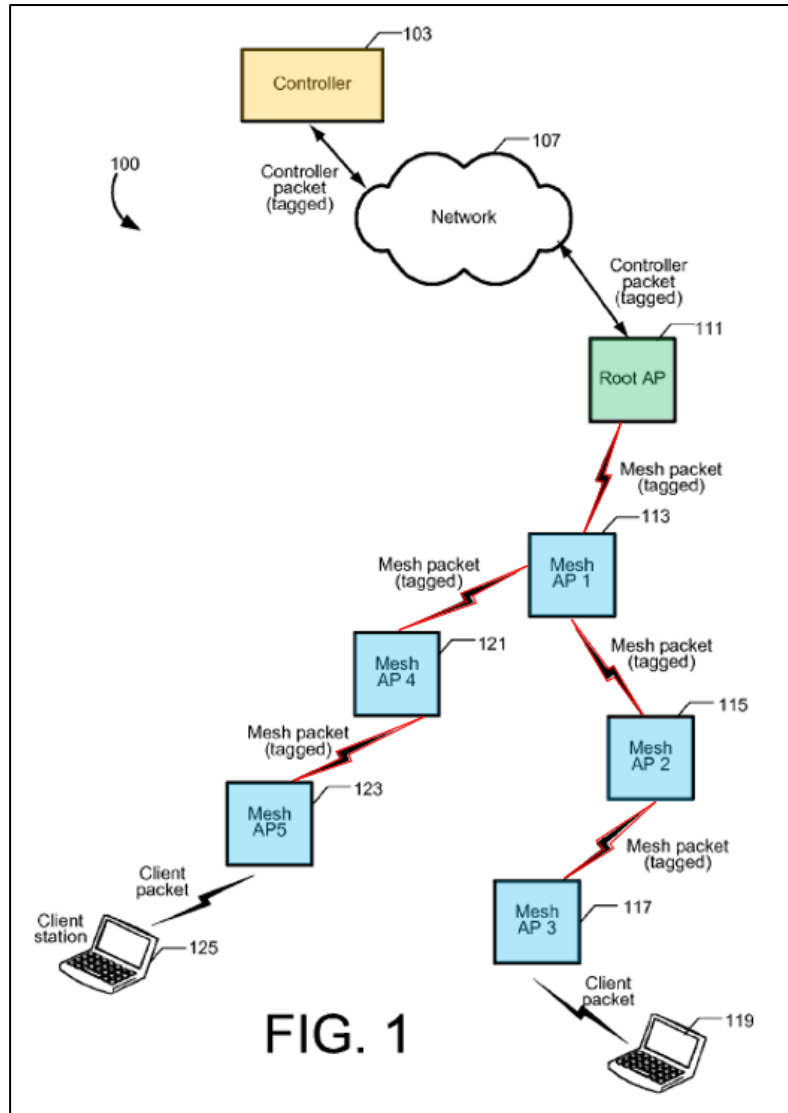
must perform each of the limitations recited in the claim. *Id.* PO's proposed construction allows other entities in the mesh network to perform some of the claimed limitations. *Id.*; Ex.1018, 46-47. As detailed in Section X, it is my opinion that the prior art satisfies the preamble under either party's construction.

59. Nothing in this section should be construed as expressing any opinion as to whether the claims constitute patentable subject matter under 35 U.S.C. § 101, or whether they satisfy the definiteness, enablement, best mode, or written description requirements under § 112.

IX. OVERVIEW OF THE PRIOR ART

A. Overview of Sinha

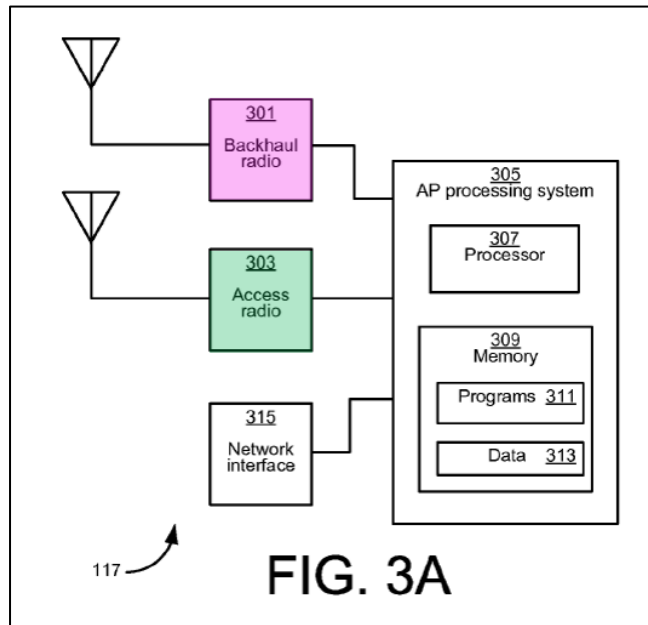
60. Sinha teaches a wireless mesh network, illustrated in Figure 1, in which a centralized controller (yellow) determines primary backhaul paths and secondary failover backhaul paths between access points of the network. Ex.1008, [0024] ("FIG. 1 shows a simple centrally controlled mesh network 100. A **wireless mesh network** includes a **backhaul topology** [(red)] to or from a root access point 111 [(green)] in a set of mesh nodes [(blue)].").



Ex.1008, FIG. 1.

61. As Sinha explains, the primary and secondary backhaul paths of the mesh network can all be carried over a frequency band (*e.g.*, 5 GHz band) dedicated for backhaul: “In the description herein all mesh nodes of the mesh network 100 are called mesh access points (mesh APs), and may be implemented by a dual radio wireless station [illustrated in Figure 3A] that includes a *first radio for the backhaul link* between mesh nodes, and a second [access] radio to provide [client-facing]

access point functionality. ... [I]n one embodiment, the **backhaul radio** [(magenta)] is an IEEE 802.11a conforming radio in the **5 GHz** range, and the second radio [(green)] is an IEEE 802.11g conforming radio in the **2.4 GHz** range.” *Id.*, [0025], [0047].



Ex.1008, FIG. 3A.

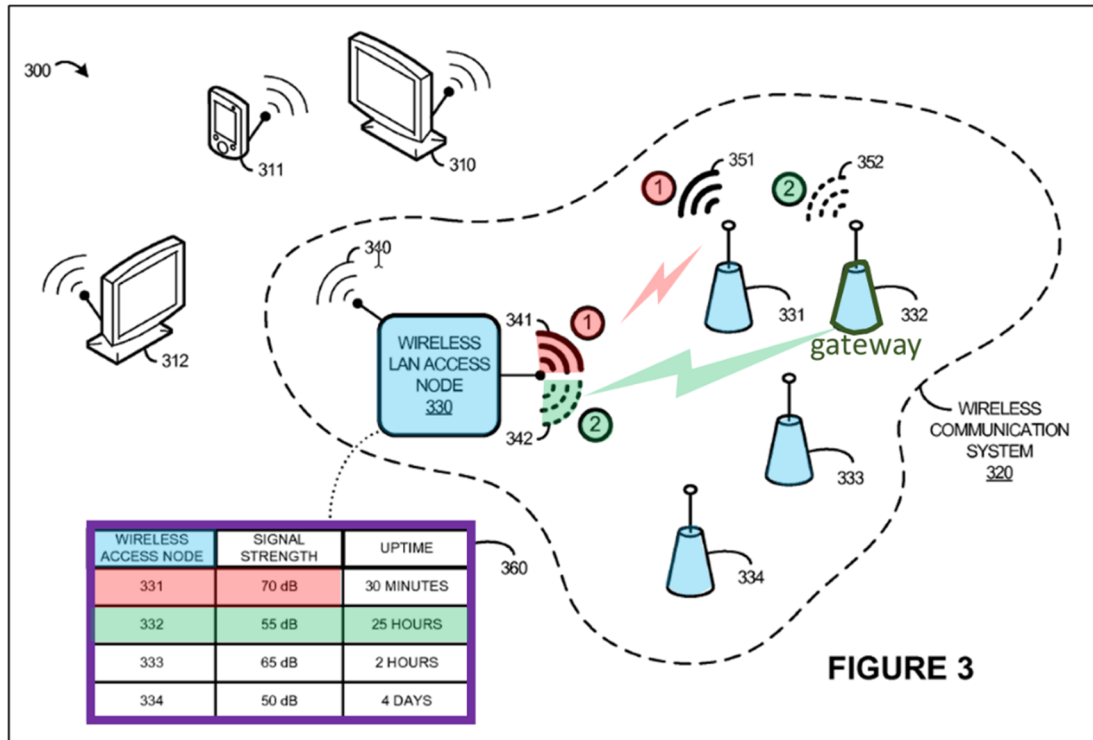
62. Sinha’s centralized controller (tan) is responsible for establishing all backhaul (MAP-to-MAP) paths in the mesh network, including separate “**control paths**” for control packets, and **data paths** for different classes of [client] data.” *Id.*, [0040]. In addition, the controller establishes secondary failover paths for each class of data or control traffic for redundancy reasons. *Id.*, [0053] (“[T]he centralized routing process [of the controller] is able to determine more than one route, with one route being the **primary route**, and the other paths being redundant, **secondary**

routes to use in the case that the first [primary] route fails. ... This provides a level of *redundancy*.”).

63. Sinha further teaches that the routes determined by the central controller are maintained in a “priority ordered list of routes.” *Id.*, [0058], [0103] (“Several routes may be calculated between two end points, and *ordered in order of preference*. At any one point in the mesh network, the *priority list* of next hops can have one or more next hops ordered by the order of preference.”).

B. Overview of Gatewood

64. Gatewood teaches forming redundant and dedicated backhaul paths between mesh access points (MAPs) (blue) of a wireless mesh network, such as the mesh network illustrated in Figure 3. Ex.1005, 3:45-53 (“FIG. 3 ... illustrat[es] communication system 300 ... [which] includes various user devices 310-312 and wireless local area network (WLAN) access nodes 330-334 ... [forming] a mesh wireless local area network.”).



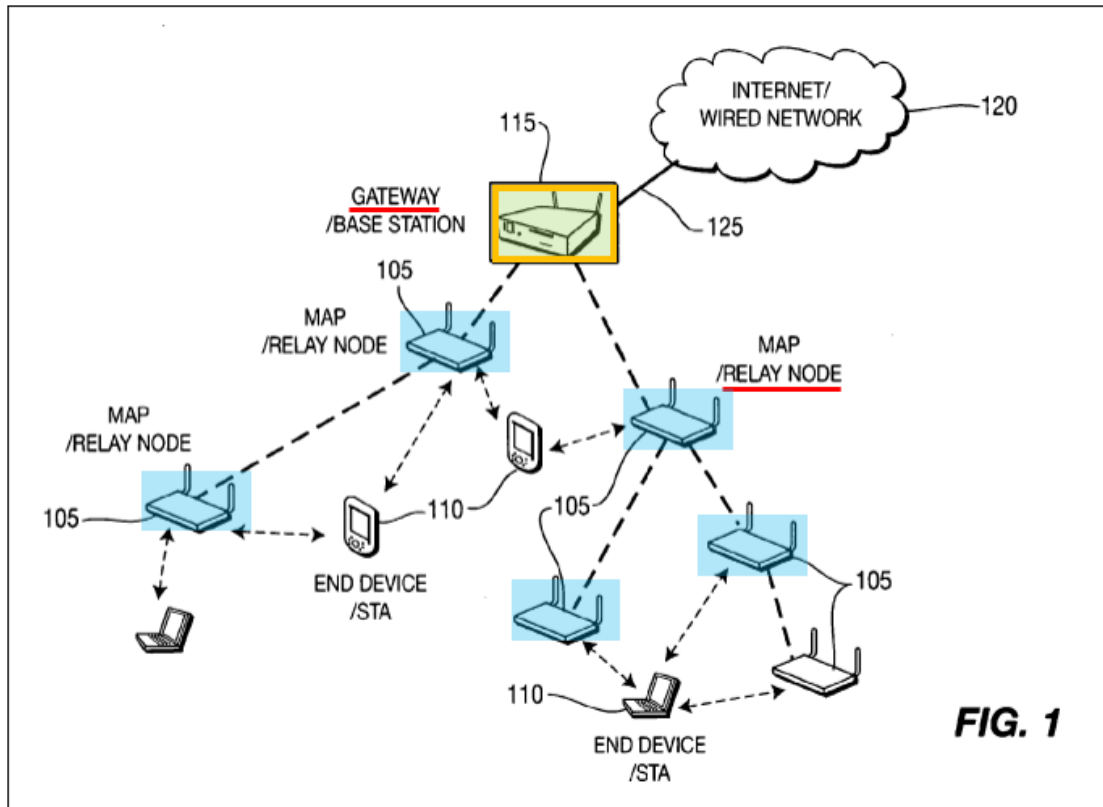
Ex.1005, FIG. 3.

65. As Gatewood teaches, MAPs communicate with one another over dedicated and redundant backhaul communication links established in the “5-GHz IEEE 802.11 frequency spectrum.” *Id.*, 6:48-56. For example, access node 330 (MAP.330) uses “first wireless backhaul link 341” (red) as its primary dedicated backhaul link, and also maintains a “second wireless backhaul link 342” (green) in an active backup state, both established in the 5-GHz band. *Id.*, 5:56-6:13, 6:1-13. Client-facing access communication (MAP.330-to-client) is over separate wireless links such as link 340 (140 in Figure 1) which “can be provided over at least 2.4, 3, 6, 5 and 60 GHz frequency bands[.]” *Id.*, 4:22-35, 9:55-65.

66. As Gatewood teaches and as shown in Figure 3, each MAP stores in its local table 360 (purple) a list of potential backhaul communication paths to other MAPs in the mesh network (column 1), together with their link quality parameters such as signal strength (column 2) and uptime information (column 3). *Id.*, 5:4-28.

C. Overview of Liu

67. Liu teaches a centralized control architecture of a wireless mesh network, illustrated in Figure 1, having a gateway (green/tan) and multiple MAPs (blue). As Liu teaches, a central controller integrated in the gateway is responsible for network-wide routing and determines all backhaul routing using a centralized routing process. Ex.1009, [0053] (“the mesh network has a centralized controller”), [0056] (“the central controller [is] resident in the gateway”), [0058] (“The ***central controller*** makes or periodically updates its decisions of the optimal STA-MAP association, ***backhaul routing***, and bandwidth allocation to each STA ...”).



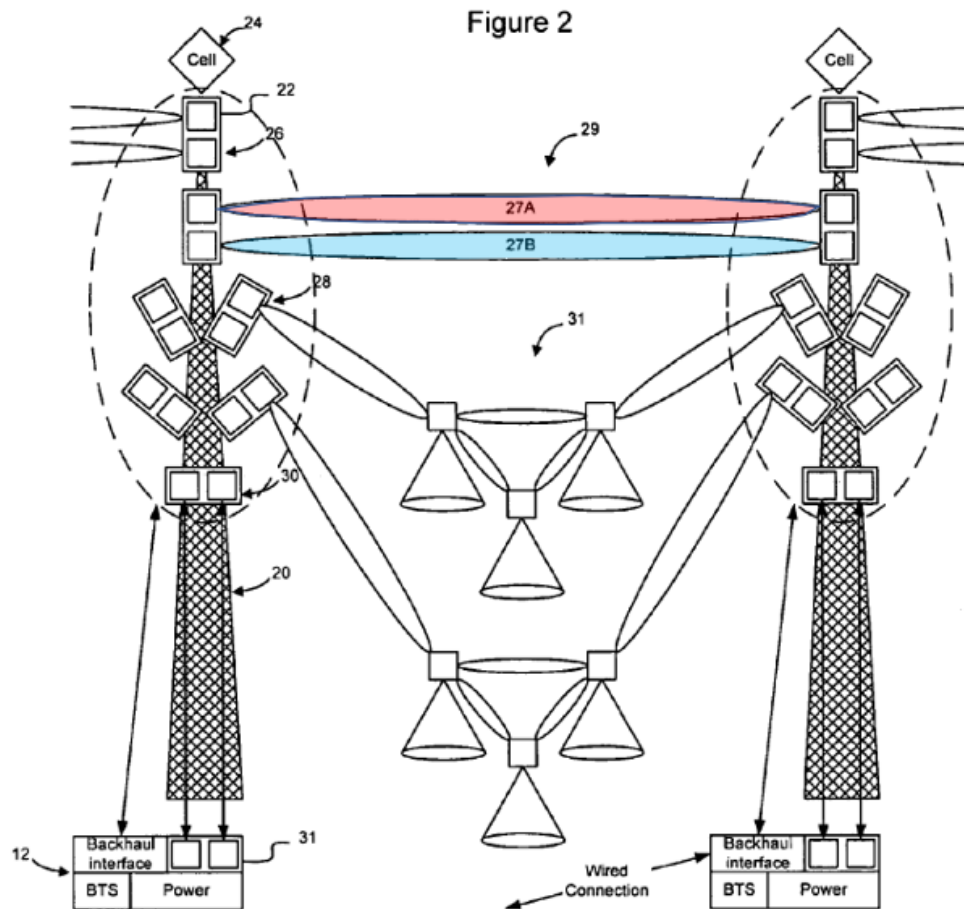
Ex.1009, FIG. 1.

D. Overview of Handforth

68. Handforth teaches forming multiple parallel redundant backhaul links between two network nodes of a wireless mesh network to provide higher throughput capacity through link aggregation, improved quality of service, and improved network fault tolerance. Ex.1006, 1:53-67, 4:67-5:2, 7:7-31. This is illustrated in Handforth's Figure 2, which depicts multiple redundant parallel wireless links, such as links 27A (red) and 27B (blue). *Id.*, 6:6-20.

69. The parallel links between two network nodes are treated as a single logical link that provide an "aggregate link capacity" with higher throughput than

possible by using a single link. *Id.*, 1:58-60, 6:64-67. The parallel links can also be configured to carry different classes of traffic for improved quality of service: “channel 27A may be reserved for high priority traffic ... while the other channel, e.g., channel 27B may be used to carry lower priority traffic.” *Id.*, 6:28-42.



Ex.1006, FIG. 2.

70. Handforth further teaches that the mesh network can aggregate wireless links that use different wireless communication technologies such as cellular, 802.16x, 802.11a operating at 5 GHz, and “other emerging or proposed standards,” such as 802.11n. *Id.*, 5:30-42.

X. SPECIFIC GROUNDS FOR PETITION

A. Ground IA: Claims 1, 2, 4-7, 11, 12, 14-16 Are Rendered Obvious by Sinha, Alone or In Combination With Liu

1. Reasons to Combine Sinha and Liu

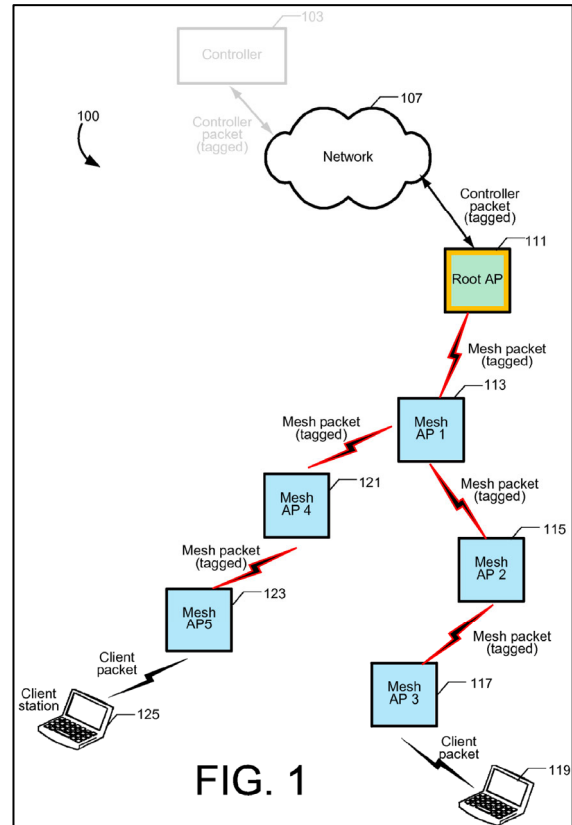
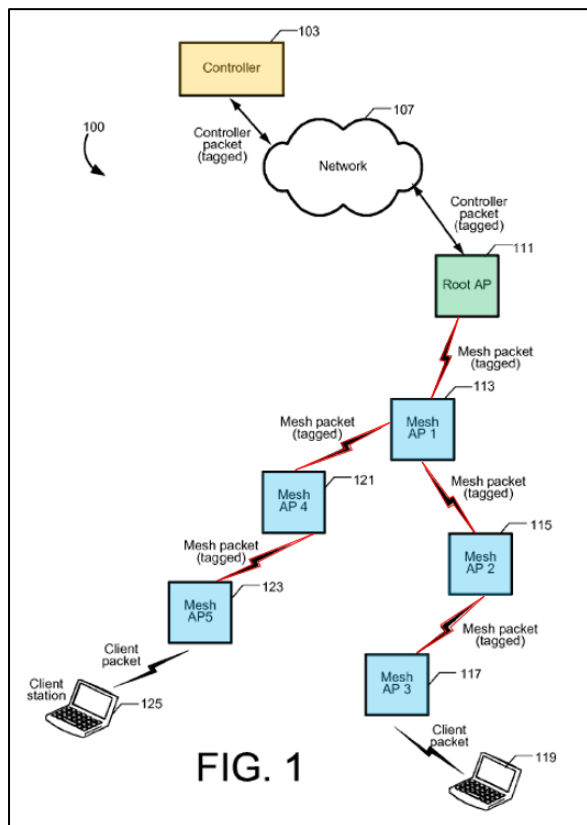
71. As I detail below, Sinha teaches both a “lightweight” MAP architecture and a non-lightweight (“not lightweight”) architecture. I used a non-lightweight architecture for claim mapping in Ground I.

72. A “lightweight” architecture, in which a centralized controller separate from MAPs controls the operation of the MAPs of a wireless mesh network, is illustrated in Sinha’s Figure 1 (below left). Ex.1008, [0026]-[0027] (“The mesh APs [(MAPs)] may have AP functionality that is controlled by a controller 103 [(yellow)] that is coupled to the network ... Such APs are called *lightweight* APs, and *a protocol is used to exchange messages* between any AP ... and the controller, e.g., using a secure tunnel between the mesh AP and the controller 103.”).

73. Sinha also describes (but does not illustrate) a non-lightweight architecture whereby the controller is integrated in a MAP, eliminating the need for such controller-to-MAP protocol connection. *Id.*, [0131] (“Note that the description has been mostly for [lightweight] mesh APs that are controlled by a controller with which the mesh AP has a secure tunnel, e.g., an LWAPP/CAPWAP tunnel. ... [T]he invention is also applicable to mesh nodes that are not ‘*lightweight*’ but rather

include enough capability to ***not need an LWAPP or other protocol connection*** for a controller to function.”).

74. I have illustrated this architecture in the modified Sinha Figure 1 below right (hereinafter, Figure 1M), which depicts Sinha’s centralized controller 103 integrated in RootAP 111 (green with yellow border), consistent with Sinha’s teachings. In my opinion, a POSITA would understand and find obvious, however, that Sinha’s centralized controller could be integrated into any of Sinha’s MAPs.



Ex.1008, FIGS. 1 (left) and 1M (right).

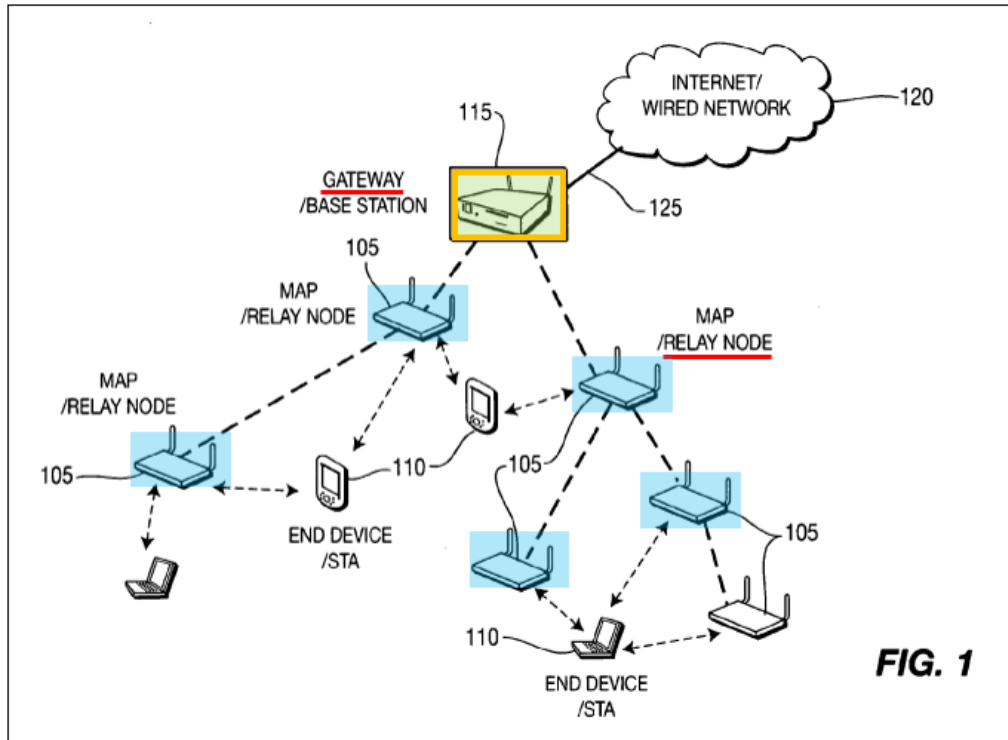
75. In my opinion, a POSITA would recognize and understand that a non-lightweight architecture that integrates the centralized controller in the network’s

RootAP (as illustrated in Figure 1M) advantageously reduces the number of network devices and connections, thereby reducing complexity and cost. As I have illustrated above, the “one-box” RootAP with integrated central controller in the Figure 1M at right replaces the “two-box” solution with centralized controller and separate RootAP connected through a secure tunnel in Figure 1 at left.

76. The architecture of Figure 1M with a centralized controller integrated in a RootAP or gateway was well-known and described in detail in Liu. Therefore, it is my opinion that Sinha in view of Liu (“Sinha-Liu”) also renders obvious the non-lightweight architecture illustrated in Figure 1M. In my opinion, a POSITA interested in integrating Sinha’s centralized controller in RootAP to reduce complexity and cost would have been motivated to consult Liu for this purpose. Liu discloses a wireless mesh network, illustrated in Figure 1 below, in which backhaul routing is controlled by a centralized controller integrated in a gateway (green/tan) of the network. Ex.1009, [0053] (“the mesh network has a centralized controller”), [0056] (“*the central controller [is] resident in the gateway*”).

77. Like Sinha’s centralized controller, Liu’s centralized controller is responsible for network-wide routing and determines all backhaul routing using a centralized routing process. *Id.*, [0051] (“The present invention is based on a *centralized method* to achieve joint optimization of association, *routing* and rate allocation ...”), [0058] (“The *central controller* makes or periodically updates its

decisions of the optimal STA-MAP association, **backhaul routing**, and bandwidth allocation to each STA ...”).



Ex.1009, FIG. 1.

78. Liu also describes in detail the architecture and functionalities of its gateway and resident centralized controller. *Id.*, [0059], [0062], Figures 6 and 9. In my opinion, a POSITA, having consulted Liu, would have understood that integrating a centralized controller into Sinha’s RootAP would have provided the benefits of higher integration and reduced communication complexity. Further, in my opinion, Liu’s disclosure provides a POSITA with detailed architectural and functional information on how to implement such an integrated centralized controller/RootAP. For example, Liu figures 6 and 9 describe the hardware

architecture of an integrated controller in a gateway or RootAP, as well as the flow of operations and interactions with other network devices and client devices. Thus, it is my opinion that modifying Sinha's architecture to include a centralized controller in Sinha's RootAP would have been obvious to try in view of Liu, and a POSITA would have had a reasonable expectation of success in doing so. Additionally, in my opinion, the use of Liu's centralized architecture with Sinha 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, both with predictable results.

2. Independent Claims 1 and 11³

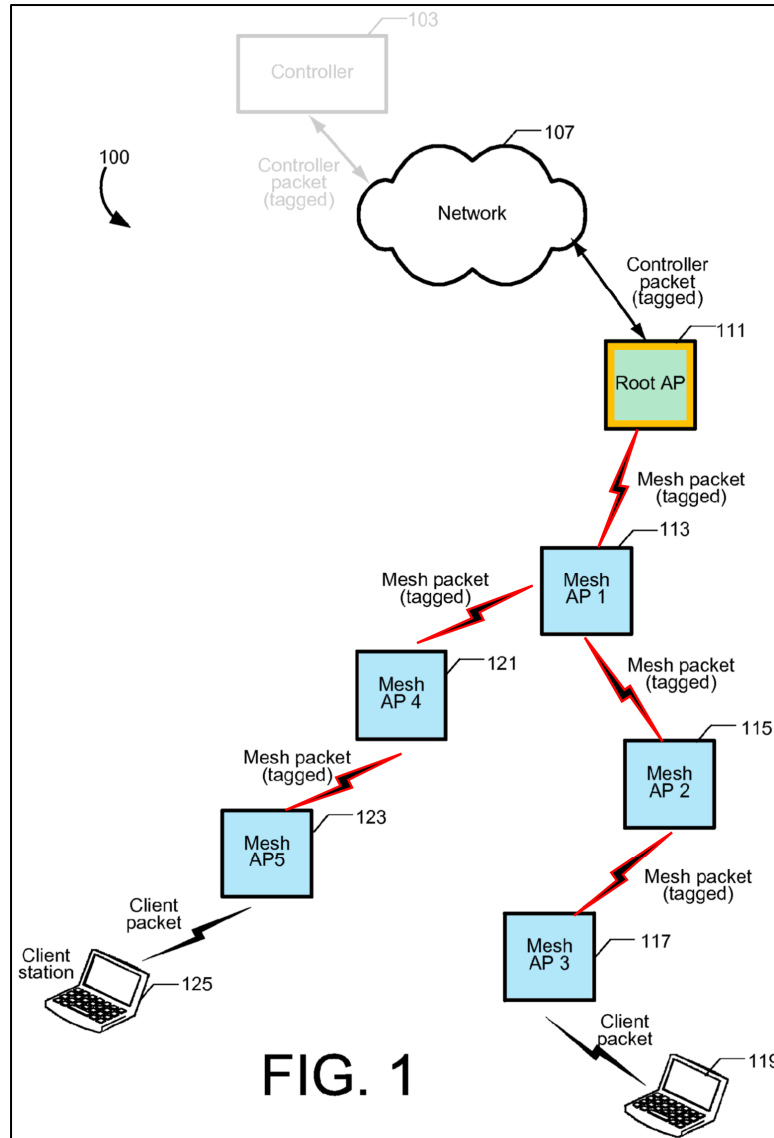
- a. **Claim 1 Preamble: "A computer-implemented method for implementing a dedicated backhaul in a wireless mesh network formed with one or more mesh points, the method being performed by a first mesh point and comprising:"**

Claim 11 Preamble: "A computing device comprising: one or more processors, that implements a mesh point in a wireless mesh network formed with a plurality of mesh points, the computing device being configured to perform a method comprising:"

³ Independent apparatus claim 11 and its dependent claims mirror independent method claim 1 and many of its dependent claims. I have addressed mirror claims together herein.

79. In my opinion, Sinha-Liu renders the preamble obvious. As I detail below and in Sections X.A.2(b)-(g), Sinha's RootAP (claimed first mesh point) performs each of the limitations of claims 1/11 and thus the preamble is satisfied under either party's construction. *See* Section VIII.

80. Sinha-Liu teaches wireless mesh networks, illustrated in Figure 1M, in which a central controller 103 integrated in the network's RootAP 111 (claimed first mesh point) (green/yellow) determines all backhaul communication paths between mesh access points (MAPs) (blue) using a centralized routing process. *See* Section X.A.1; Ex.1008, [0024] ("FIG. 1 shows a simple ***centrally controlled*** mesh network 100. A wireless mesh network includes a backhaul topology [(red)] to or from a root access point 111 to a set of mesh nodes."), [0035] ("Embodiments of the present invention include centralized routing, e.g., by a ***centralized routing process at the controller*** 103 [in RootAP 111].").



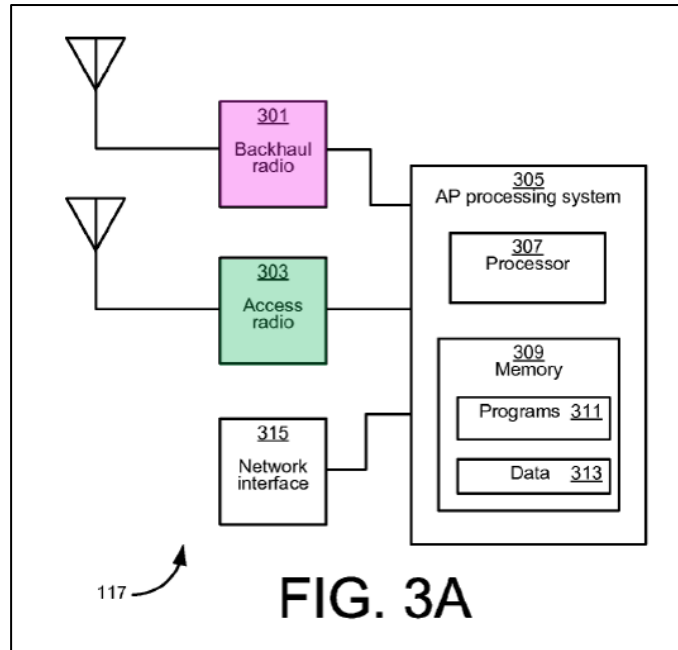
Ex.1008, FIG. 1M.

81. **Claimed Dedicated backhaul** - As Sinha teaches, “all mesh nodes of the mesh network 100 ... may be implemented by a dual radio wireless station that includes a *first radio for the backhaul link between mesh nodes*, and a second radio to provide access point functionality. ... [I]n one embodiment, *the backhaul radio* is an IEEE 802.11a conforming radio in the *5 GHz range*, and the second radio is an

IEEE 802.11g conforming radio in the 2.4 GHz range.”), [0047]. In this network, all backhaul communication paths are established in the 5-GHz band that is dedicated to servicing data traffic between mesh points (this band is not used for client-facing AP-to-client access communications), and therefore Sinha satisfies the claimed “dedicated backhaul.”

82. In my opinion, Sinha discloses the same dedicated backhaul that Patent Owner alleges to be the ’179 Patent’s core invention in Patent Owner’s claim construction brief at the ITC: “The ’179 and ’698 Patents teach systems and methods for improving these wireless mesh networks by implementing a communication between mesh points, also known as a backhaul communication, that is *dedicated* to servicing data traffic between mesh points, also known as ‘back-end’ traffic. ... This backhaul communication, *which the patents refer to as ‘dedicated,’* is separate from the communication the mesh points establish ‘for servicing data traffic from and to clients,’ also called ‘front-end’ traffic.” Ex.1018, 31.

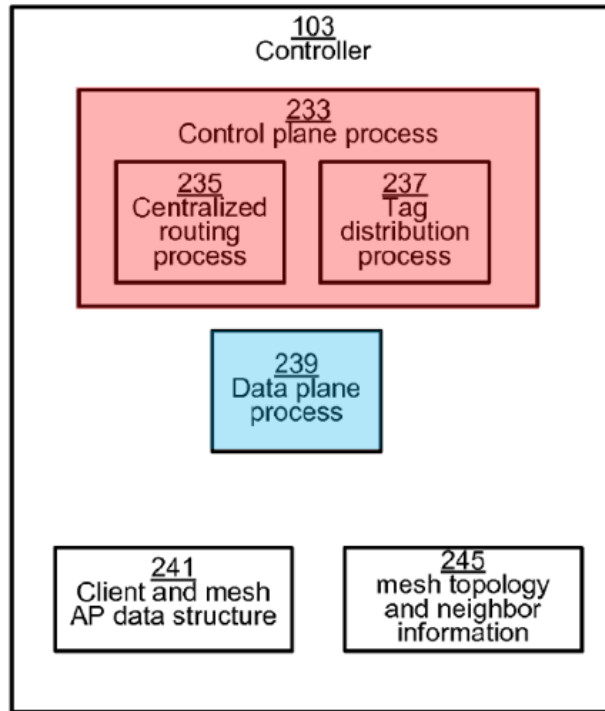
83. In more detail, Sinha teaches that each MAP (including the RootAP) of the mesh network can be implemented as a dual radio MAP, illustrated in Sinha’s Figure 3A below, having a 5-GHz “backhaul radio” (magenta) dedicated for backhaul communication, and a separate 2.4-GHz “access radio” (green) dedicated for client-facing access communication. Ex.1008, [0025].



Ex.1008, FIG. 3A.

84. **Claimed Computer-Implemented Method/Computing Device** –

Sinha’s centralized controller, illustrated in Figure 2B, is a computing device configured to perform centralized routing and packet forwarding, including all the claimed steps (claimed computer-implemented method). Ex.1008, [0043]-[0044] (“The controller 103 functionally includes a control plane process [(red)] and a data plane process [(blue)].”), [0045] (“The control plane process 233 includes the centralized routing process 235 and the tag distribution process 237... [that are] carried out by *one or [more] general purpose processors* that can carry out relatively complex operations, and the data plane process is carried out by *one or more special purpose processors* designed to carry out packet forwarding at a relatively fast rate ...”).



Ex.1008, FIG. 2B.

b. Elements [1.1]/[11.1]: “establishing a forward wireless communication with a second mesh point”

85. In my opinion, Sinha-Liu renders obvious this element. A backhaul path dedicated for carrying/forwarding client’s traffic data between RootAP (claimed first mesh point) and AP 117 (MAP3) (claimed second mesh point) in Figure 1/1M, which Sinha refers to as a ***data path***, is an example of the claimed forward wireless communication.

86. In my opinion, this mapping is consistent with the ’179 Patent’s description of “forwarding” client data traffic across a network, which uses a backhaul path for such data traffic. Ex.1001, 2:8-12 (“When a client device

establishes connection with one of the mesh points, the mesh points can **forward** the traffic to the mesh point that is connected to the gateway ...”).

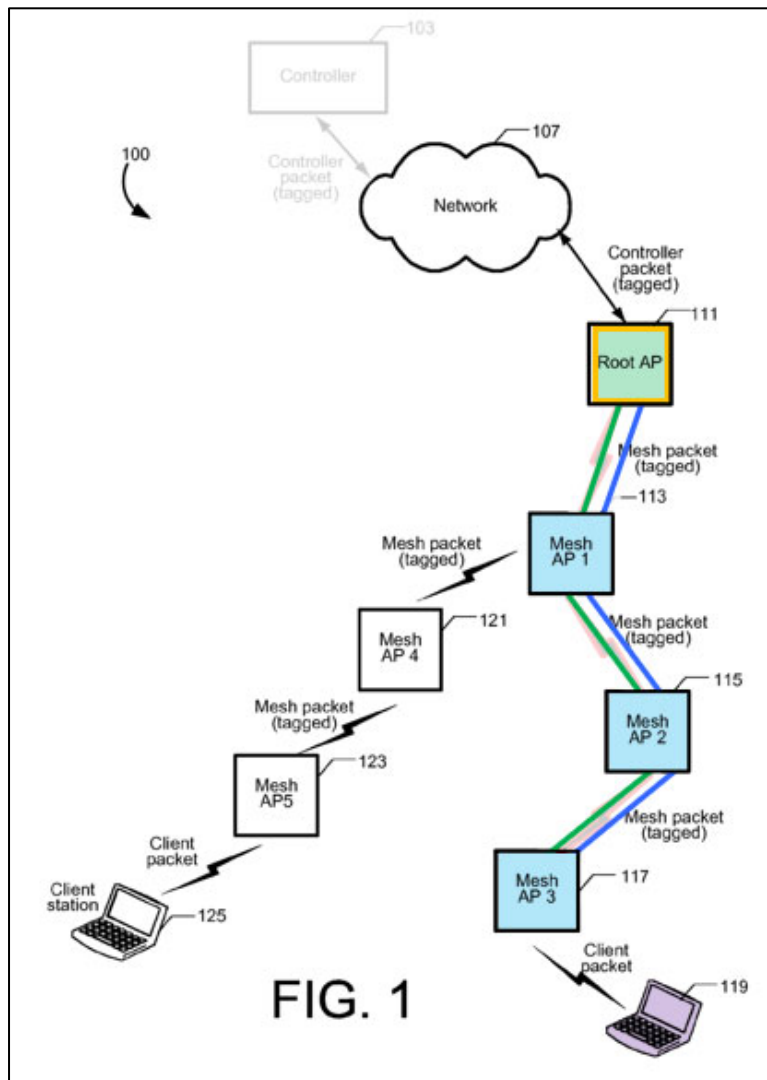
87. I note that Patent Owner’s discussion of “forward wireless communication” in its claim construction brief at the ITC further supports my mapping: “The name ‘forward wireless communication’ also reflects a functional aspect of communication ...: to provide the clients with ‘data packet **forwarding** to and from the gateway and the Internet.’ ’179 Patent, 27:5-21; *see also id.*, 29:60-63.” Ex.1018, 41-42 (emphasis in PO’s brief). In other words, according to Patent Owner, a forward wireless communication may be used to forward client data packets over a backhaul path.

88. As Sinha-Liu teaches, when a new client joins the wireless mesh network, the central controller in RootAP (claimed first mesh point) establishes one or more **data paths** over the backhaul to route/forward that client’s data traffic:

[T]he controller 103 [(in RootAP)] has information on what type of client is joining, e.g., whether a voice client, a data client, and what level of service the client has subscribed. From this information, and from information about the links between mesh APs in the mesh network, ***the controller 103 determines a path or paths for each class of traffic for client data to and from the new client***, where the “class” is defined by the type of client traffic, the level of subscribed traffic, and so forth.

Ex.1008, [0038].

89. I have annotated Figure 1M below to illustrate Sinha's teachings. Sinha's central controller establishes the **green** and **blue** data paths in Figure 1/1M to carry/forward two classes of data traffic—*e.g.*, high and low priority traffic, respectively. Ex.1008, [0060] (“[C]lient 119 [] has two classes of traffic, denoted Type1 and Type2 ...”).



Ex.1008, FIG. 1M.

90. Each data path that carries/forwards “a class of traffic for client data” (and each combination of such data paths) is an example of the claimed forward wireless communication. In an exemplary claim mapping, the **blue** data path carrying/forwarding low priority client data traffic between RootAP (claimed first mesh point) and MAP3 (claimed second mesh point) is mapped to the claimed forward wireless communication.

c. Elements [1.2] and [11.2]: “establishing a backhaul communication, separate from the forward wireless communication, with the second mesh point”

91. In my opinion, Sinha-Liu renders obvious this element. An example of a backhaul communication is a backhaul path dedicated for carrying control information, referred to in Sinha as a ***control path***, between RootAP (claimed first mesh point) and AP 117 (claimed second mesh point). This is consistent with dependent claims 2/12 of the '179 Patent which claim such a backhaul control path. Ex.1001, claim 2 (“wherein the backhaul communication is dedicated for controlling packets.”). Independent claims 1/11 are broader and the backhaul paths claimed in the independent claims can carry both data and control information. Below, I discuss an example of such backhaul path.

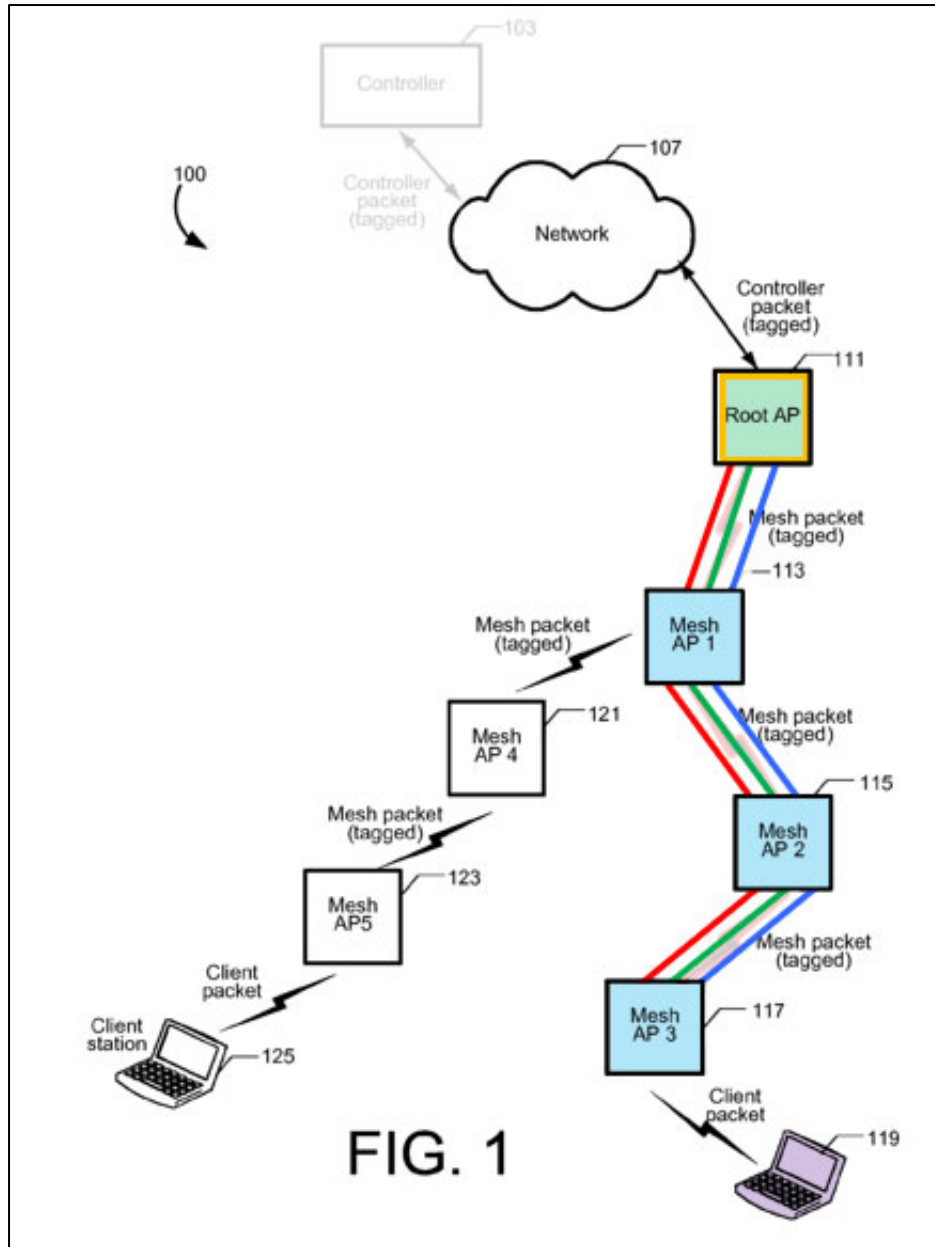
92. As Sinha teaches, the central controller resident in RootAP (claimed first mesh point) determines two types of backhaul communication paths through the mesh network: “***control paths*** for control packets, and ***data paths*** for different

classes of [client] data.” Ex.1008, [0040]. The control paths are established by the central controller when a new MAP, such as AP 117 (claimed second mesh point) joins the mesh network:

Referring to FIG. 1, when a mesh AP, e.g., mesh AP 117 joins the mesh network 100, via mesh AP 115 as the parent, a centralized routing process at *the controller 103 determines a control path for CAPWAP control packets between the controller 103 and the new mesh AP 117* both towards the new mesh AP 117—the downstream direction—and from the new mesh AP 117 to the controller 103—the upstream direction.

Ex.1008, [0036]. I discussed data paths in Section X.A.2(b) above.

93. Each MAP-to-MAP wireless connection shown in Sinha’s Figure 1/1M in fact comprises multiple paths/links dedicated for carrying control packets or data packets. Consistent with Sinha’s teachings, I have illustrated below a control path (**red**) dedicated for carrying control packets, and two separate data paths (**green** and **blue**) for carrying two classes of data traffic. Section X.A.2(b).



Ex.1008, FIG. 1M.

94. For purpose of claim mapping, Sinha's control path (**red**) is an example of the claimed backhaul communication, separate from the **blue** data path mapped to the claimed forward wireless communication. Indeed, as Sinha explains, the central controller can configure control path(s) and data path(s) as *separate paths*.

Ex.1008, [0040] (“These control and data paths need not be the same.”). In my opinion, the combination of Sinha’s **red** control path and **green** high priority data path is another example of the claimed backhaul communication that is also separate from the wireless forward communication (**blue**).

- d. **Elements [1.3]/[11.3]: “wherein the forward wireless communication is established using a wireless communication technology using frequency bands selected from the group consisting of: a 2.4 GHz band, and a 5 GHz band, and”**

95. In my opinion, Sinha-Liu renders obvious this element.

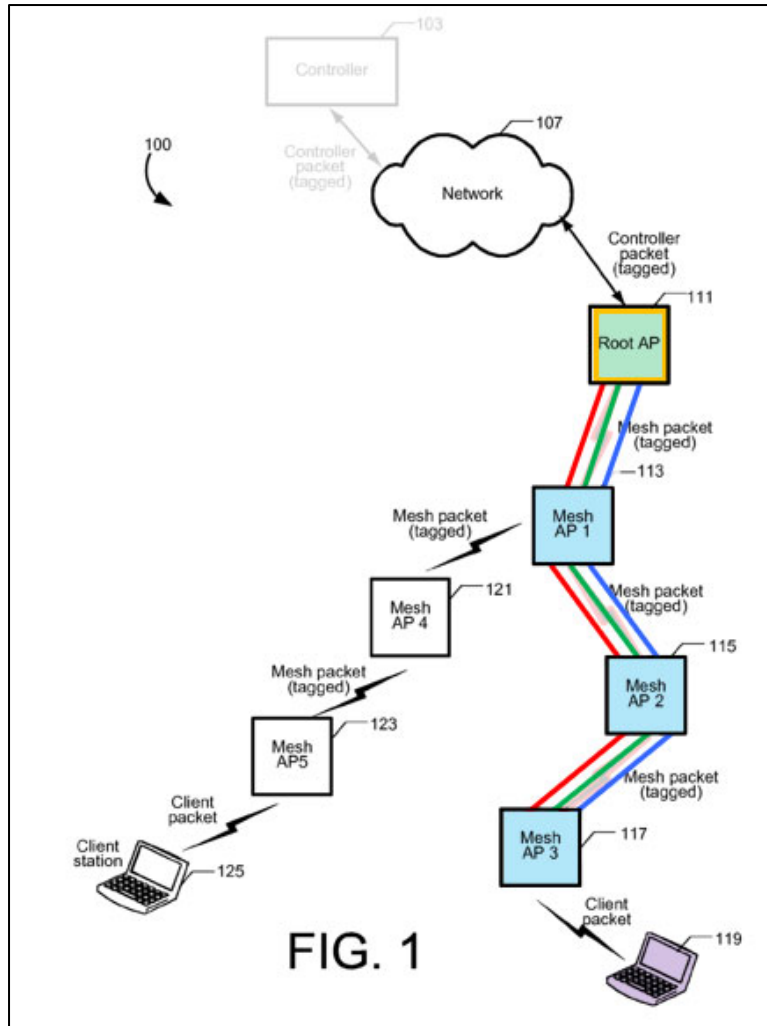
96. As I discussed above in Section X.A.2(b), the claimed forward wireless communication is mapped to one or more backhaul data paths, such as the **blue** data path for carrying low priority data. As Sinha teaches, all backhaul communications (data paths and control paths) are established in the 5-GHz band, which is one of the alternative frequency bands recited in the Markush group. Ex.1008, [0025] (“[A]ll mesh nodes of the mesh network 100 are called mesh access points (mesh APs), and may be implemented by a dual radio wireless station that includes a *first radio for the backhaul link* between mesh nodes, and a second radio to provide access point functionality. ... [I]n one embodiment, *the backhaul radio* is an IEEE 802.11a conforming radio in the *5 GHz range* ...”), [0047]-[0049].

- e. **Elements [1.4]/[11.4]: “wherein the backhaul communication is established using a communication technology selected from the group consisting of: a power line based communication, a 2.4 GHz or 5 GHz**

radio frequency (RF) technology using a dedicated radio, and a sub-1GHz RF technology; and”

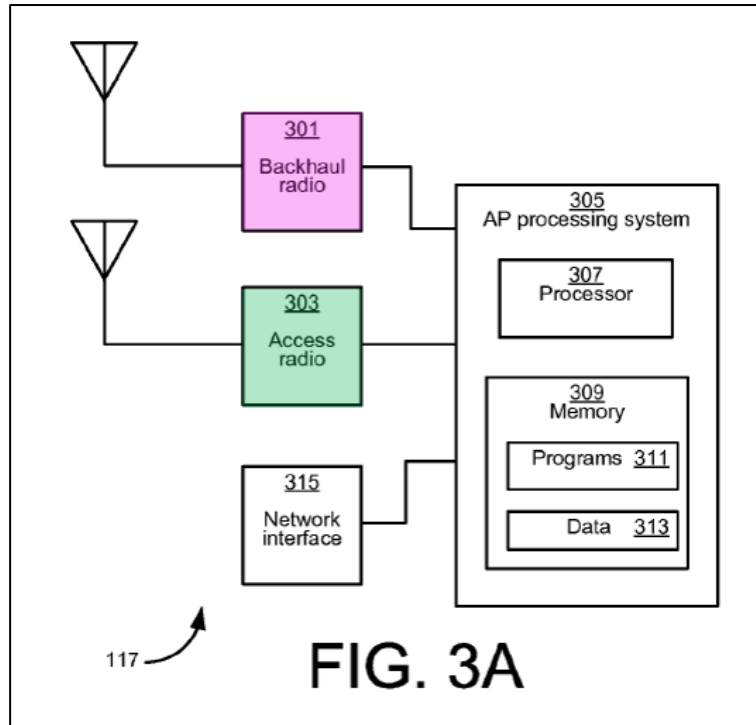
97. In my opinion, Sinha-Liu renders obvious this element.

98. As I discussed above under Section X.A.2(c), and as illustrated below, the claimed backhaul communication is mapped to the control path(s) (**red**) dedicated for carrying control packets between RootAP (claimed first mesh point) and MAP3 (claimed second mesh point). Alternatively, it is mapped to a combination of control and data paths (**red** and **green**), excluding those data paths (**blue**) mapped to the claimed forward wireless communication. See Section X.A.2(c).



Ex.1008, FIG. 1M.

99. As Sinha teaches, all backhaul communications (data paths and control paths) are established in the 5-GHz band using a 5-GHz dedicated radio, which is one of the alternatives recited in the Markush group. Ex.1008, [0025] (“[A]ll mesh nodes of the mesh network 100 are called mesh access points (mesh APs), and may be implemented by a dual radio wireless station that includes a *first radio for the backhaul link* between mesh nodes ... [I]n one embodiment, *the backhaul radio* is an IEEE 802.11a conforming radio in the *5 GHz range* ...”), [0047]-[0049].



Ex.1008, FIG. 3A.

- f. **Elements [1.5]/[11.5]: “constructing a list of backhaul candidates, each backhaul candidate having a score indicative of an estimated quality of a potential link between the first mesh point and the second mesh point”**

100. In my opinion, Sinha-Liu renders obvious this element. Sinha-Liu teaches that the central controller in RootAP (claimed first mesh point) constructs a “priority ordered list of [backhaul] routes” (claimed list of backhaul candidates) for each class of backhaul traffic between itself and any other AP of the mesh network, such as AP 117 (MAP3) (claimed second mesh point):

For *each class of service* and level of service, and for each direction, the centralized routing process 235 of the controller determines *one or more paths for packets to follow*. As a result, a

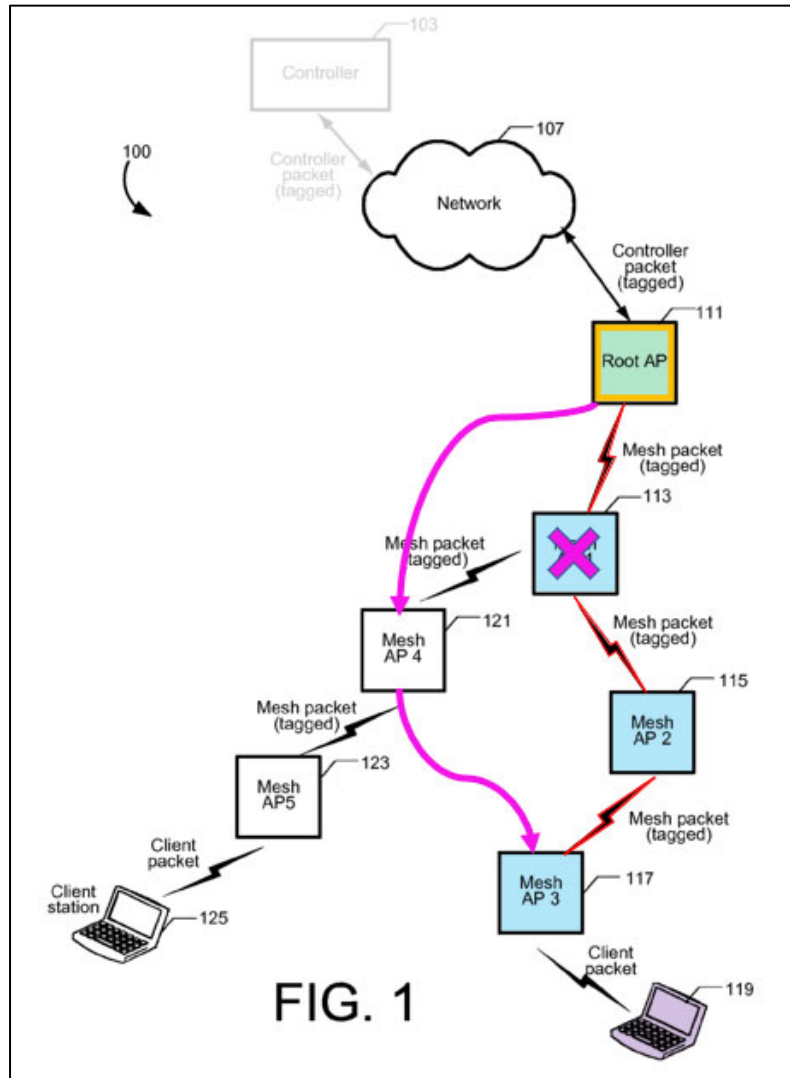
tag is assigned to each class and subscribed level of service and a **priority ordered list of routes** is assigned to each such tag. In one embodiment, the prioritized list of routes are **first for the level of service subscribed for**, and as backup, **for lesser levels** in case there is a break in the higher level of service subscribed for.

Ex.1008, [0058]; *id.*, [0053] (“the centralized routing process 235 is able to determine more than one route, with one route being the ***primary route***, and the other paths being redundant, ***secondary routes*** to use in case that the first route fails. ... This provides a level of redundancy.”); *id.*, [0103] (“Several routes may be calculated between two end points [(e.g., RootAP and MAP3)], and ***ordered*** in order of preference.”).

101. Each backhaul candidate in Sinha’s “priority ordered list of [backhaul] routes” has a priority order that reflects its level of service. In my opinion, this level of service, or the corresponding priority order, corresponds to the claimed “score indicative of an estimated quality of a potential link between the first mesh point and the second mesh point.”

102. I have annotated Figure 1M below to illustrate Sinha’s teachings. While the ***primary route*** between RootAP (claimed first mesh point) and MAP3 (claimed second mesh point) for a class of traffic is the RootAP-MAP1-MAP2-MAP3 route (red links) in Figure 1M, Sinha teaches that the central controller also determines and ranks additional fallback ***secondary routes***, such as the RootAP-MAP4-MAP3

route (magenta) that transits through MAP4 instead of MAP1, as further detailed below in Section X.A.2.(g). Another alternative backup route may be for example RootAP-MAP2-MAP3.



Ex.1008, FIG. 1M.

- g. **Elements [1.6]/[11.6]:** “upon determining that a quality of service of the dedicated backhaul has dropped to below a predetermined threshold, establishing an alternative backhaul communication with the second mesh point using a backhaul candidate with the highest score on the list.”

103. In my opinion, Sinha-Liu renders obvious this element.

104. **First**, Sinha discloses a 5-GHz band dedicated for backhaul, and the claimed forward wireless communication and backhaul communication are mapped to data and/or control paths that are all established in that band dedicated for backhaul and not used for client-facing access communications. Section X.A.2(c)-(d).

105. **Second**, as I discussed above in Section X.A.2.(f), Sinha's central controller constructs a "**priority ordered list of routes**" between RootAP 111 (claimed first mesh point) and another AP such as AP 117 (MAP3) (claimed second mesh point), for each class of traffic. Ex.1008, [0058].

106. As Sinha teaches, when the primary route (the route with the highest priority on the list) for a class of traffic fails, the route that has the highest priority (highest score) among the remaining backhaul candidates on the "priority ordered list of routes" is used as an alternative backhaul communication to route traffic to MAP3 (claimed second mesh point). Ex.1008, [0053] (the centralized controller "determine[s] more than one route, with one route being the **primary route**, and the other paths being **redundant, secondary routes** to use in the case that the first route fails.").

107. In more detail, Sinha explains that, to ensure that MAPs route traffic according to the "priority ordered list of routes" determined by the central controller,

the controller sends to each MAP a “list of at least one next hop arranged in a priority order” (also referred to as “next-hop list” or “priority-ordered list[] of next hop mesh APs”) for each class of traffic. Ex.1008, [0037], [0053], [0060], [0067].

108. Each MAP (including RootAP) stores its next-hop list(s) in a local “tag table” (illustrated in Figure 4) and uses them to perform next-hop routing for each class of traffic, consistent with the “priority-ordered list of routes.” *Id.*, [0037] (“The entries of the tag table include the tag, *the identity of the next hop, e.g., the next mesh AP in the path*, and class of traffic. The class of traffic for the control path is ‘control’ to indicate control packets.”). As illustrated in Figure 4, “List2 [(red)] and List 3 [(blue)] ... denote the *priority ordered lists of next hop mesh APs* for the Type1 [(red)] and Type2 [(blue)] class paths, respectively.” *Id.*, [0060].

	Tag	Next hop	Class	Source	Destination
402 {	T2	List2	Type1	Client 119	0
402' {	T2'	0			
403 {	T3	List 3	Type2	Client 119	0
403' {	T3'	0			

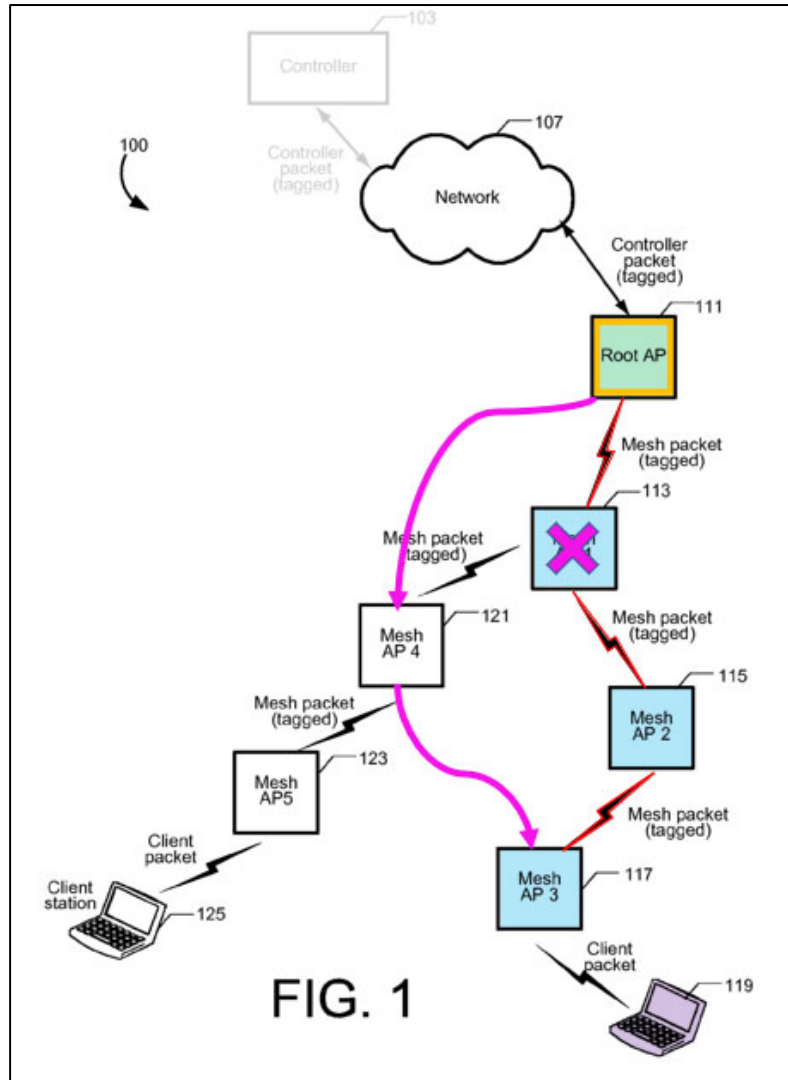
Ex.1008, FIG. 4 (excerpted).

109. In operation, “[i]f one path is not available, the *next priority next hop* is used, and the control plane process of the controller is sent information on the

broken next hop.” *Id.*, [0053]. In my opinion, Sinha’s use of “next priority next hop” to re-route traffic when the primary path becomes unavailable satisfies the claimed “using a backhaul candidate with the highest score on the list.”

110. I have annotated Figure 1M below to illustrate Sinha’s teachings. RootAP 111 (claimed first mesh point) may determine that the “priority-ordered list of routes” between it and MAP3 (claimed second mesh point) has two routes: (1) a primary route RootAP-MAP1-MAP2-MAP3 (red links in Figure 1M) and (2) a backup route RootAP-MAP4-MAP3 (magenta path). In this case, RootAP’s tag table (Figure 4) lists MAP1 and MAP4 as its next hops.

111. When RootAP detects that MAP1 or one of its links has failed (magenta “X”), it re-directs traffic intended for client device 119 (purple) to MAP4 (as illustrated in the alternate path highlighted in magenta)—instead of forwarding it to the failed MAP1—because its tag table identifies MAP4 as the “next priority next hop.”



Ex.1008, FIG. 1M.

112. In my opinion, a POSITA would have understood and found obvious that Sinha teaches detecting route failure upon determining that a quality of service of that route has dropped below a predetermined threshold. For example, an abnormally low data rate (or abnormally long delay) would be clear indication of route failure and Sinha describes monitoring both data rate and latency. It would have been obvious to compare data rate to a threshold corresponding to an abnormal,

unacceptable data rate to detect route failure. The same threshold comparison can be done with latency or other quality of service parameters as well to detect failure.

113. Indeed, as Sinha teaches, the controller and MAPs monitor the quality of service and link characteristics of the different paths/links of the mesh network. Ex.1008, [0039] (“the controller can determine or receive *link characteristics* including, but not limited to, one or more of *data rates*, noise level, *quality of service (QoS)*, class of service (CoS), time delays, and so forth, and, in this manner, the controller 103 can *centrally compute paths* for different classes of traffic.”).

114. In addition, Sinha ranks candidate paths/routes based on comparing their quality of service: “In one embodiment, the prioritized list of routes are first for the level of service subscribed for, and as backup, for *lesser* levels in case there is a break in the *higher* level of service subscribed for.” Ex.1008, [0058]. A POSITA would have understood and found obvious that Sinha detects a “break” in a path/route by comparing its quality of service, such as data rate, to a “performance threshold [that] indicates an inoperative or disconnected state,” as was well-known in the art and described in Gatewood.⁴ Ex.1005, 6:18-26; *id.*, 6:26-29 (“[T]he performance criteria can include a *data transfer rate*, and the performance *threshold*

⁴ As I discuss below, the combination of Sinha and Gatewood also renders obvious this element. *See* Section X.D.1(g).

can include when the data transfer rate decreases below a *predetermined* data transfer rate.”).

3. Dependent Claims 2 and 12

- a. “[The method of claim 1/The device of claim 11], wherein the backhaul communication is dedicated for controlling packets.”

115. In my opinion, Sinha-Liu renders obvious this element. As I discussed above in Section X.A.2(c), Sinha-Liu’s central controller establishes control path(s) dedicated for controlling packets. Ex.1008, [0036] (“[W]hen a mesh AP, e.g., mesh AP 117 joins the mesh network ... a centralized routing process at the controller 103 determines a *control path for CAPWAP control packets* between the controller 103 and the new mesh AP 117 ...”). This control path dedicated for control packets is an example of the claimed backhaul communication dedicated for controlling packets.

4. Dependent Claims 4 and 14

- a. [The method of claim 1,/The device of claim 11, the method performed by the device] further comprising: upon determining whether a quality of service of the dedicated backhaul has dropped to below a predetermined threshold, establishing an alternative backhaul communication with the second mesh point; and redirecting backhaul traffic to the alternative backhaul communication.”

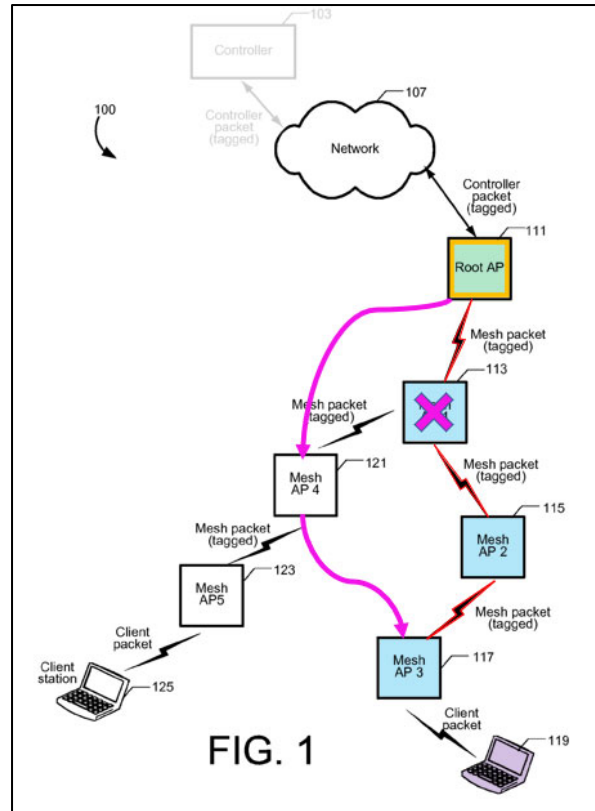
116. In my opinion, Sinha-Liu renders obvious this element.

117. **First**, Sinha discloses a 5-GHz band dedicated for backhaul. Section X.A.2(c)-(d).

118. **Second**, as I discussed above in Sections X.A.2.(f)-(g), for each class of traffic, Sinha’s central controller determines multiple backhaul paths/routes between the RootAP and any other AP, “with one route being the **primary route**, and the other paths being **redundant, secondary routes** to use in the case that the first route fails.” Ex.1008, [0053].

119. As Sinha teaches, when the primary route for a class of traffic—such as the RootAP-to-MAP1-to-MAP2-to-MAP3 route (red links) in Figure 1M—fails, backhaul traffic normally carried on that route is redirected to the alternative backhaul communication—such as the RootAP-to-MAP4-to-MAP3 route (magenta)—as illustrated below. Section X.A.2(g).

120. And, as I also discussed in Section X.A.2.(g), a POSITA would have understood and found obvious that the central controller detects that the primary route has failed—due for example to a failing wireless link of MAP1 (magenta “X”)—by determining that a quality of service of that route has dropped to below a predetermined threshold, e.g., the data rate has dropped to some unacceptably low level. *Id.*



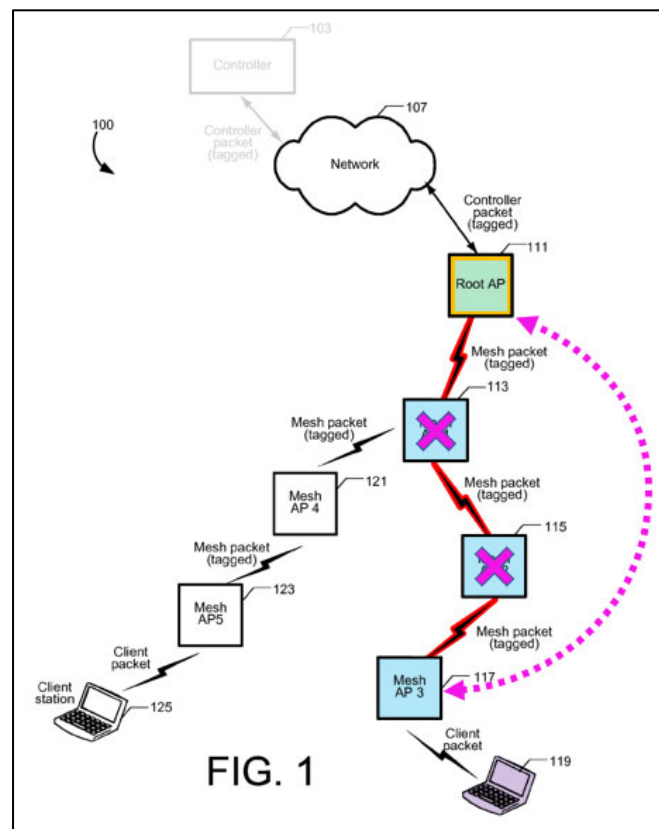
Ex.1008, FIG. 1M.

5. **Dependent Claims 5 and 15**

- a. “[The method of claim 4/The device of claim 14], wherein the alternative backhaul communication is a direct link that links to the second mesh point through no other mesh point.”

121. In my opinion, Sinha-Liu renders obvious this element. As Sinha teaches, for each class of traffic, the controller “determine[s] more than one route, with one route being the *primary route*, and the other paths being redundant, *secondary routes* to use in case that the [primary] route fails.” Ex.1008, [0053]. “This provides a level of *redundancy*.” *Id.* Thus, in my opinion and as illustrated in Figure 1M, a POSITA would have understood and found obvious that Sinha

teaches establishing a direct link (magenta dotted line) between RootAP and MAP3 as an alternative backhaul communication to provide “a level of redundancy” in case the primary route (red) failed due to failure of MAP1 and/or MAP2 (magenta “X”). This is possible because the connections are wireless, and thus the RootAP can directly connect to MAP3 over the air.

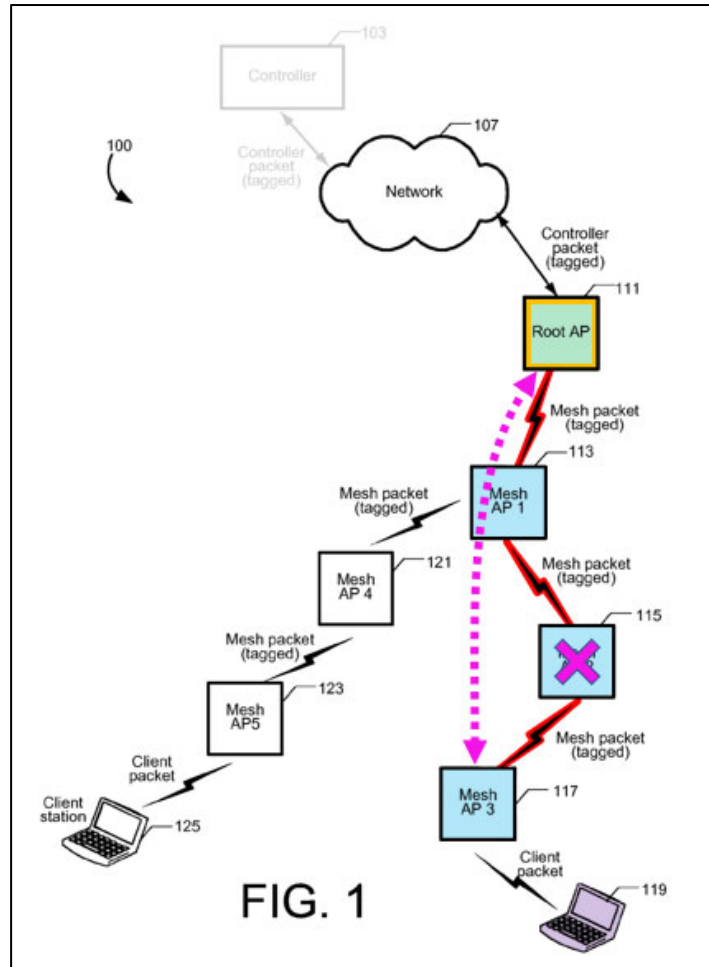


Ex.1008, FIG. 1M.

6. Dependent Claims 6 and 16

- a. “[The method of claim 4/The device of claim 14], wherein the alternative backhaul communication is an indirect link that links to the second mesh point through another mesh point.”

122. In my opinion, Sinha-Liu renders obvious this element. As Sinha teaches, the controller determines “redundant, ***secondary routes*** to use in case that the first [primary] route fails.” Ex.1008, [0053]. “This provides a level of ***redundancy***.” *Id.* Thus, as illustrated in Figure 1M, it is my opinion that a POSITA would have understood and found obvious that Sinha teaches establishing an indirect link (magenta dotted line) between RootAP and MAP3 as an alternative backhaul communication to provide “a level of redundancy” in case the primary route (red) failed due to failure of MAP2 (magenta “X”).



Ex.1008, FIG. 1M.

7. **Dependent Claim 7**

- a. **“The method of claim 1, wherein different backhauls are used for different clients.”**

123. In my opinion, Sinha-Liu renders obvious this element. Sinha teaches that different backhaul paths are established for different clients according for example to the client’s type and class of service:

[T]he controller 103 has information on ***what type of client is joining*** [the mesh network], e.g., whether a voice client, a data client, and what level of service the client has subscribed. From

this information, and from information about the links between mesh APs in the mesh network, *the controller 103 determines a path or paths for each class of traffic for client data to and from the new client*, where the “class” is defined by the type of client traffic, the level of subscribed traffic, and so forth.

Ex.1008, [0038], [0058]. Thus, different backhaul paths are used for different clients. For example, as Sinha teaches, a voice client A and a data client B will use different backhaul paths.

B. Ground IB: Claims 1-7 and 11-16 Are Rendered Obvious by Sinha, Alone or In Combination With Liu

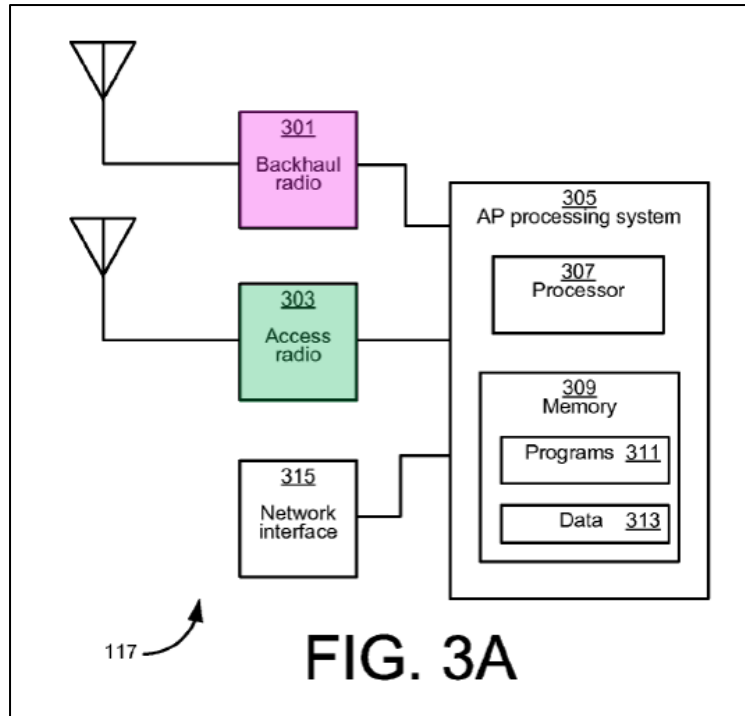
1. Reason for Ground IB

124. As I discussed above, I understand Petitioner contends in the ITC that the claims of the ’179 Patent should be held indefinite.

125. In Ground IA above, I have mapped “forward wireless communication” to one or more data paths dedicated to forwarding client data traffic in Sinha’s wireless mesh network. *See* Section X.A.2(b). My mapping is consistent with the ’179 Patent specification, and I note that Patent Owner’s description of “forward wireless communication” in its claim construction brief at the ITC shows that as well: “The name ‘forward wireless communication’ also reflects a functional aspect of communication ...: to provide the clients with ‘data packet *forwarding* to and from the gateway and the Internet.’ ’179 Patent, 27:5-21; *see also id.*, 29:60-63.” Ex.1018, 41-42 (emphasis in PO’s brief).

126. In the present Ground IB, I address a different potential interpretation of “forward wireless communication” from Patent Owner to mean a backhaul communication path established in a general-purpose frequency band—a band that is used both for backhaul communication and for client-facing access communication. I understand that, while Patent Owner proposes to construe “forward wireless communication” as a “client-facing wireless communication,” (Ex.1017, 3), Patent Owner maps the claimed “forward wireless communication” differently onto backhaul communications formed in general-purpose frequency bands (*e.g.*, the 2.4-GHz band) in its infringement claim charts. Ex.1007, 5-6.

127. As I discussed above under Ground IA, Sinha discloses wireless mesh networks that deploy dual-radio MAPs having a 5-GHz backhaul radio and a separate 2.4-GHz access radio, as shown in Figure 3A below.



Ex.1008, FIG. 3A. In such networks, the 5-GHz band is dedicated for back-end/backhaul (including the claimed “forward” and “backhaul” communications), and the 2.4-GHz band is used for client-to-AP access communication. Ex.1008, [0048]-[0049].

128. In my opinion, a POSITA would have understood and found obvious to use Sinha’s 2.4-GHz band to establish both backhaul and client-facing communications—making the 2.4-GHz band a *general-purpose* frequency band—while keeping the 5-GHz band dedicated for backhaul. Ground IB relies on wireless mesh networks having a 5-GHz frequency band frequency band dedicated for backhaul, and a 2.4-GHz general-purpose frequency band. No modification of the radio would be required because the radio is not concerned with whether data is

going to (or coming from) an end user device or another access point that use the band.

129. In my opinion, a POSITA would have understood and found obvious that such networks use the 2.4-GHz radio of a dual-radio MAP to establish both backhaul and client-facing communications, while keeping its 5-GHz “backhaul radio” dedicated for backhaul.

130. In my opinion, a POSITA would have been motivated to deploy such “repurposed” dual-radio MAPs in a mesh network to increase the amount of traffic that can be carried on backhaul paths beyond the capabilities (*e.g.*, maximum throughput) of the 5-GHz dedicated backhaul radio (red). Ex.1006 (Handforth), 6:64-7:18 (“The use of redundant channels in the backhaul network also enhances backhaul capabilities by providing for higher throughput in the backhaul ...”). Using such dual-radio MAP in a mesh network also enhances the resilience of the network because the 2.4-GHz general-purpose radio can be used to establish backhaul communication when the 5-GHz dedicated backhaul radio fails. Ex.1006, 6:64-7:18. Resilience (fault tolerance) is a key architectural consideration in Sinha. Ex.1008, [0053], [0058] (backup paths), [0109] (“Different embodiments of the invention also can be used to provide multiple redundant paths for mesh APs, leading to fault tolerance.”), [0119] (backup controller).

131. Furthermore, in my opinion, this repurposed use of dual radio MAP would also have been obvious to try with reasonable expectation of success because Sinha teaches that its network management method supports dual-radio MAPs having separate radios for backhaul and access communication, as well as single/general-purpose-radio MAPs in which “the same radio is used for access and backhaul communication.” Ex.1008, [0048]. The “repurposed” dual-radio MAP combines two embodiments discussed in the same paragraph in Sinha—Sinha’s dual-radio MAP and Sinha’s single/general-purpose-radio MAP. Basically, the 5-GHz radio of what I call the “repurposed” dual-radio MAP is used the same way taught in Sinha with regard to the dual-radio MAP embodiment described in detail in Sinha, and its 2.4-GHz radio is used the same way taught in Sinha with regard to the single-radio MAP embodiment.

2. Independent Claims 1 and 11

a. Preamble of Claims 1/11

132. *See* Section X.A.2(a).

b. Elements [1.1]/[11.1]: “establishing a forward wireless communication with a second mesh point”

133. In my opinion, Sinha-Liu renders obvious this element.

134. As I discussed above, Ground IB relies on Sinha’s wireless mesh network Figure 1M in which each MAP (including RootAP) is implemented using the “repurposed” dual-radio MAP, discussed above in Section X.B.1. Each

repurposed dual-radio MAP has a 5-GHz dedicated backhaul radio and a 2.4-GHz general-purpose radio. A backhaul path between RootAP (first mesh point) and MAP3 (second mesh point) that is established in the general-purpose 2.4-GHz band is the claimed forward wireless communication.

c. Elements [1.2]/[11.2]: “establishing a backhaul communication, separate from the forward wireless communication, with the second mesh point”

135. In my opinion, Sinha-Liu renders obvious this element.

136. As I discussed above, the claimed forward wireless communication is a backhaul path established in the general-purpose 2.4-GHz band. *See* Section X.B.2(b). In contrast, the claimed backhaul communication between RootAP (first mesh point) and MAP3 (second mesh point) is a backhaul path established in the 5-GHz band dedicated for backhaul. *See* Section X.B.2(c). These two paths are in different frequency bands and are separate.

d. Elements [1.3]/[11.3]: “wherein the forward wireless communication is established using a wireless communication technology using frequency bands selected from the group consisting of: a 2.4 GHz band, and a 5 GHz band, and”

137. In my opinion, Sinha-Liu renders obvious this element.

138. As I discussed above under Section X.B.2(b), the forward wireless communication between the first mesh point (RootAP) and the second mesh point

(MAP3) is a backhaul path established in the 2.4-GHz band (recited in the Markush group).

- e. **Elements [1.4]/[11.4]: “wherein the backhaul communication is established using a communication technology selected from the group consisting of: a power line based communication, a 2.4 GHz or 5 GHz radio frequency (RF) technology using a dedicated radio, and a sub-1GHz RF technology; and”**

139. In my opinion, Sinha-Liu renders obvious this element.

140. As I discussed above, the backhaul communication between the first mesh point (RootAP) and the second mesh point (MAP3) is established in the 5-GHz band using the 5-GHz dedicated “backhaul radio” (recited in the claimed Markush group). Ex.1008, [0049] (“[T]he backhaul radio 301 substantially conforms to the IEEE 802.11a standard, operating in the 5 Ghz band ...”); Section X.B.2(c).

- f. **Elements [1.5]/[11.5]**

141. *See* X.A.2(f).

- g. **Elements [1.6]/[11.6]**

142. *See* X.A.2(g).

3. Dependent Claims 2 and 12

143. *See* X.A.3.

4. Dependent Claims 3 and 13

- a. **“[The method of claim 1,/The device of claim 11, the method performed by the device] further comprising:**

upon determining that a quality of service of the backhaul communication has dropped to below a predetermined threshold, redirecting backhaul traffic to the forward wireless communication.”

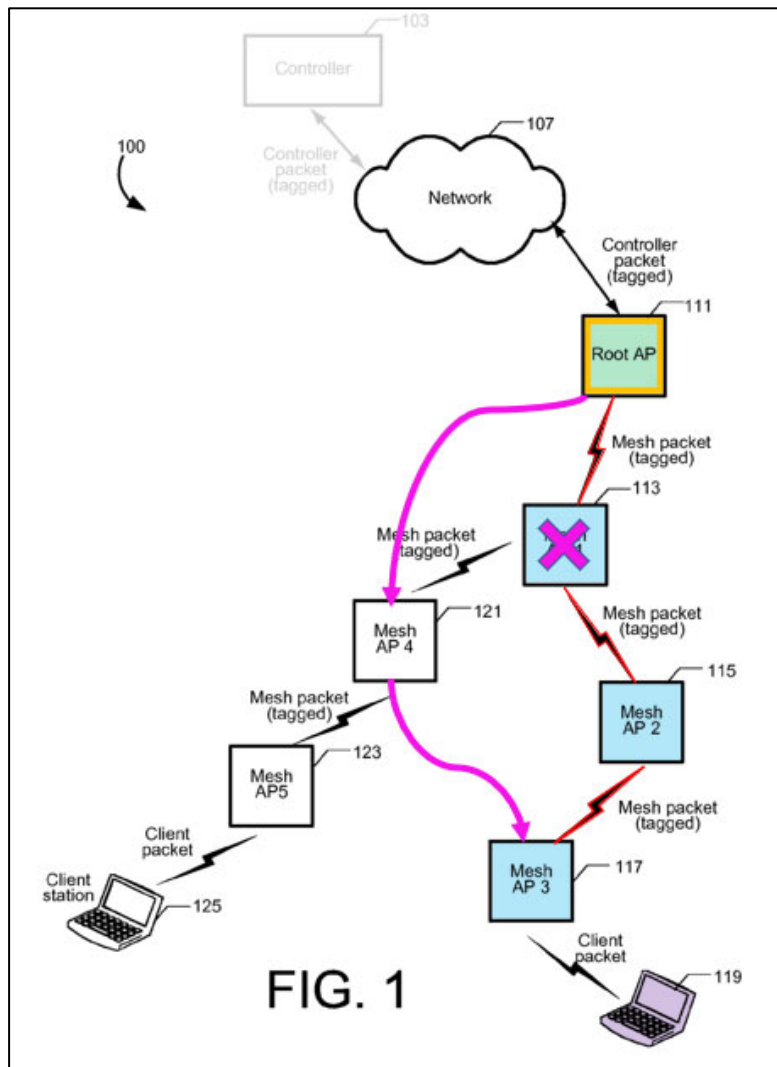
144. In my opinion, Sinha-Liu renders obvious this element. As I discussed above in Section X.A.2.(f), for each class of traffic, Sinha’s central controller determines multiple backhaul routes between the RootAP and any other AP, “with one route being the *primary route*, and the other paths being *redundant, secondary routes* to use in the case that the first route fails.” Ex.1008, [0053]; Section X.A.2.(f).

145. As I discussed above, in Sinha’s mesh networks that deploy the “repurposed” dual-radio MAPs, backhaul communications are established in both the 5-GHz band dedicated for backhaul and the general-purpose 2.4-GHz band. *See* Sections X.B.2(a)-(c). In my opinion, a POSITA would have understood and found obvious that at least some of Sinha’s redundant, secondary routes are established in the general-purpose 2.4-GHz band to improve resilience of the wireless mesh network. This allows backhaul traffic to be re-routed to the 2.4-GHz band if the 5-GHz band fails, consistent with Sinha’s teaching that secondary routes are used “in the case that the first route fails.” Ex.1008, [0053].

146. To illustrate, RootAP detects that MAP1’s wireless link(s) established in the 5-GHz band dedicated for backhaul (claimed backhaul communication) failed (magenta “X”) upon determining that a quality of service of the backhaul

communication dropped to below a predetermined threshold. *See* Section X.A.2.(g).

RootAP then redirects backhaul traffic to an alternate, secondary backhaul route established in the general-purpose 2.4-GHz band (claimed forward wireless communication), such as the RootAP-to-Mesh4-to-Mesh3 route (magenta). Section X.A.2(g).



Ex.1008, FIG. 1M.

5. Dependent Claims 4 and 14

147. *See* X.A.4.

6. Dependent Claims 5 and 15

148. *See* X.A.5.

7. Dependent Claims 6 and 16

149. *See* X.A.6.

8. Dependent Claim 7

150. *See* X.A.7.

C. Ground II: Claims 1-19 Are Rendered Obvious by Sinha In Combination With Liu And Handforth

1. Claims 1-7 and 11-16

151. Claim 1-7 and 11-16 are rendered obvious by Sinha in combination with Liu and Handforth for the reasons I discuss under X.B. In section X.B, I explained that a POSITA would have been motivated to use the 2.4-GHz band to also establish backhaul communications for reasons discussed in Handforth (increased throughput, additional fault tolerance using multiple communication technologies for the backhaul). Here, I explicitly combine Sinha-Liu with Handforth for the same reasons.

2. Dependent Claims 8 and 17

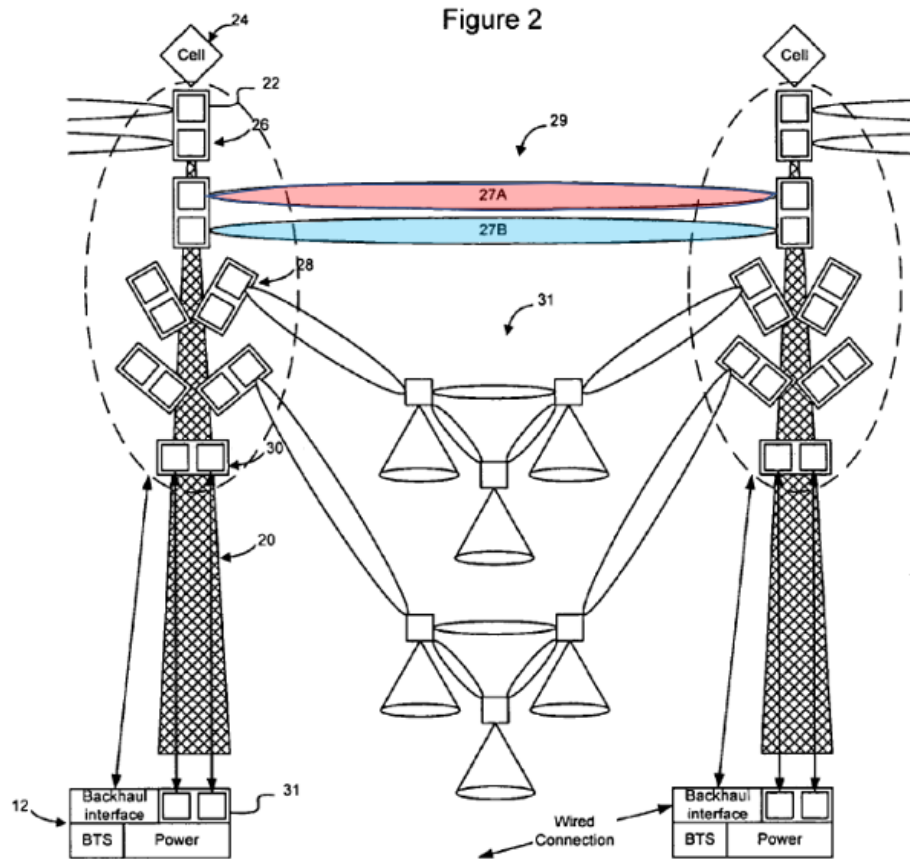
- a. “[The method of claim 1,/The device of claim 11, the method performed by the device] further comprising: measuring a plurality of qualitative parameters for the established backhaul communication; and causing the measured qualitative parameters to be transmitted to a controlling entity to facilitate a selection of a

communication technology used for a backhaul communication between each two mesh points in the wireless mesh network.”

152. In my opinion, Sinha-Liu renders obvious this element, alone or in combination with Handforth. As I discussed above, Sinha-Liu renders obvious a central controller integrated in RootAP 111 (first mesh point). Sinha further teaches that each “child mesh AP ... sends to the controller 103 information on its link to the parent, such that the *controller* [(claimed controlling entity)] can determine or *receive link characteristics* [(claimed plurality of quality parameters)] including, but not limited to, one or more of data rates, noise level, quality of service (QoS), class of service (CoS), time delays, and so forth, and, in this manner, the controller 103 can centrally *compute paths* for different classes of traffic.” Ex.1008, [0039]. The path selection involves a selection of a communication technology used for a backhaul communication because Sinha teaches that its wireless mesh networks can combine “other architectures/protocols” and operate in “other [] frequency ranges” corresponding to different communication technology variants of the 802.11 standard. *Id.*, [0127].

153. In addition, it is my opinion that Sinha-Liu in view of Handforth renders obvious this element. In my opinion, a POSITA interested in combining different wireless technologies to form a wireless mesh network would have been motivated to consult Handforth. Handforth teaches using different wireless technologies to

form redundant wireless channels linking nodes of a wireless mesh network. Ex.1006, 4:67-5:2, 1:57-60. This is illustrated in Handforth's Figure 2, which depicts multiple redundant wireless links connecting two network nodes, such as links 27A (red) and 27B (blue), that are formed using a variety of wireless technologies such as cellular, 802.16x, 802.11a operating at 5 GHz, and "other emerging or proposed standards," such as 802.11n. *Id.*, 5:30-42. And, like Sinha, Handforth teaches carrying different types of backhaul traffic over different links: "channel 27A may be reserved for ***high priority traffic*** ... while the other channel, e.g., channel 27B may be used to carry ***lower priority traffic***." *Id.*, 6:28-42, 1:53-56.



Ex.1006, FIG. 2.

154. Handforth explains how to scalably integrate the different communication technologies in a mesh network, by confining the differences in link technologies locally at the end points of such links. Ex.1006, 1:53-63, 4:63-67 (“By having independent links treated separately by the local BTSs [(APs)] but as a single unified link by other network elements, enhanced quality of service may be provided on the meshed backhaul network, ... [K]nowledge of the redundant link structure may be confined to the endpoints of the link, with the rest of the network treating the multiple redundant links as a single, logical, link.”).

155. In my opinion, a POSITA would have been motivated to implement Handforth's teachings in Sinha-Liu's network to integrate different communication technologies in a scalable way. Also, in my opinion, the combination of Sinha-Liu and Handforth 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 improving network throughput capacity in a scalable way.

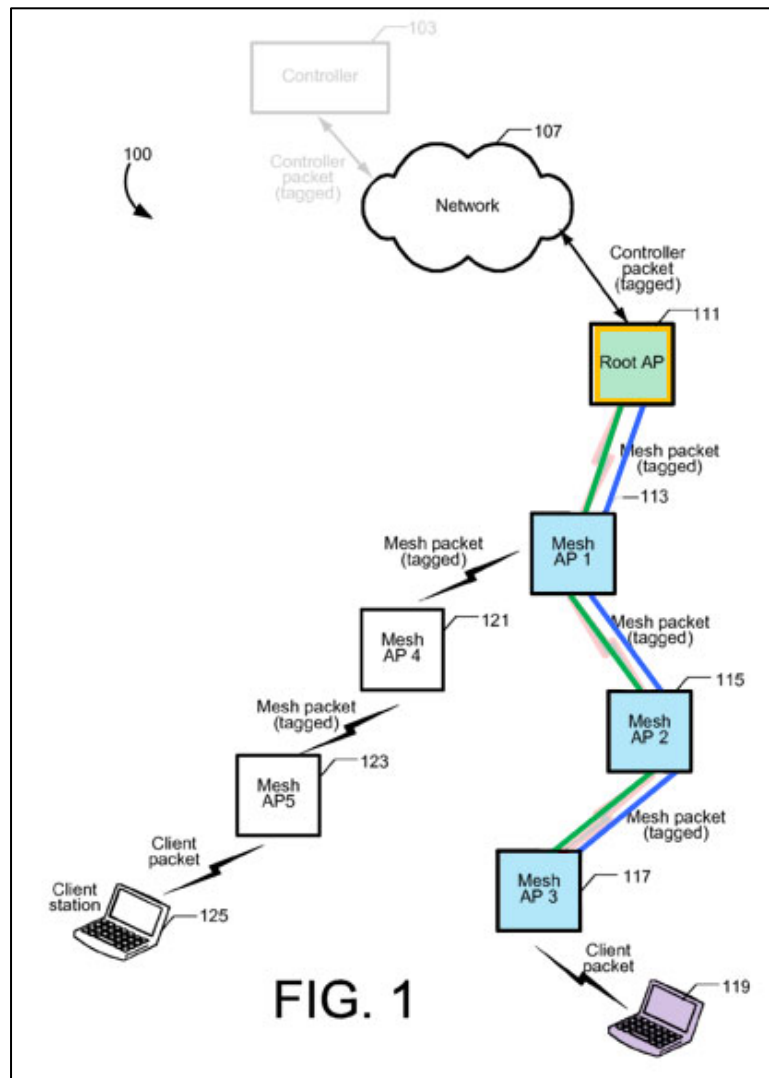
3. Dependent Claims 9 and 18

- a. “[The method of claim 1,/The device of claim 11, the method performed by the device] further comprising: **aggregating a plurality of backhaul links available on different communication technologies to create an aggregated backhaul communication.**”

156. In my opinion, Sinha-Liu renders obvious this element. Sinha-Liu teaches that the centralized controller “determines a path or paths *for each class of traffic* for client data ...”. Ex.1008, [0038], [0058]. As a result, “[an] AP can have *multiple tagged paths* back to the root mesh AP and controller *sorted by link metrics* ... [that] can be used ... for QoS/policy based routing.” *Id.*, [0109]. Thus, as taught by Sinha-Liu, multiple paths are used to carry backhaul traffic, thereby creating an aggregated backhaul communication.

157. In my opinion, each MAP-to-MAP wireless connection shown in Sinha's Figure 1/1M may in fact comprise multiple links for carrying different

classes of data traffic. I have annotated Figure 1M below to illustrate Sinha's teachings. The centralized controller establishes the **green** and **blue** data paths in Figure 1M to carry two classes of data traffic, *e.g.*, high ("Type1") and low ("Type2") priority traffic, respectively. Ex.1008, [0060] ("As an example, [] client 119 is a client that has two classes of traffic, denoted Type1 and Type2 ...").



Ex.1008, FIG. 1M.

158. In this example, the **green** and **blue** data paths for carrying two classes of data traffic create an aggregated backhaul communication for client 119's data traffic, as claimed. The different classes of traffic are merged (aggregated) at MAP3 before sending to client device 119 and/or at RootAP before sending to the Internet.

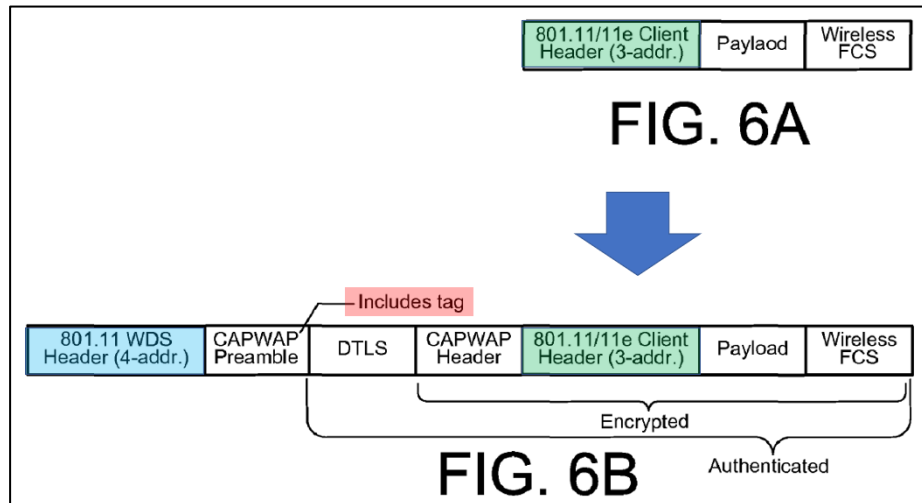
159. Sinha teaches forming the aggregated backhaul paths using different communication technologies. Ex.1008, [0127] (“While an embodiment has been described for operation in a mesh point with RF frequencies in the 5 GHz range and 2,4 GHz range ... other embodiments may be embodied in receivers and transceivers operating in other RF frequency ranges [and can] include IEEE 802.11 wireless LAN and links, wireless Ethernet, HIPERLAN 2, WIMAX, ...”). Thus, in my opinion, Sinha-Liu renders obvious this element. In my opinion, Sinha-Liu in combination with Handforth also renders obvious this element, as discussed above. *See* Section X.C.1.

4. Dependent Claims 10 and 19

- a. “[The method of claim 9/The device of claim 11], wherein the aggregated backhaul links are aggregated on a media access control (MAC) layer or a transport layer.”**

160. In my opinion, Sinha-Liu renders obvious this element. As Sinha teaches, “there is incentive to have routing be carried out at **layer-2** as much as possible” using “an extension of the IEEE 802.11 **MAC header**.” Ex.1008, [0002]. Layer-2 (also known as the data link layer) includes the MAC layer, “the lower of

two sublayers that make up the ISO/OSI data link layer ... [and] manages access to the physical network”. Ex.1014, 322. Consistent with that, as shown in Fig. 6A, client data packets received at the serving AP contain a MAC header (“802.11/11e Client Header”) (green). Ex.1008, [0067].



Ex.1008, FIGS. 6A/6B.

161. Each client packet is encapsulated in a mesh packet, illustrated in Figure 6B, for routing through the mesh network. *Id.*, [0074]. Each mesh packet includes a tag (red) indicative of a traffic class, and a network MAC header (“802.11 WDS Header”) (blue). *Id.*, [0074]. Because MAC headers are used in Sinha’s system to route backhaul traffic over multiple backhaul paths, in my opinion, the backhaul paths are aggregated on a MAC layer as claimed.

D. Ground III: Claims 1, 3-6, 11, and 13-16 Are Rendered Obvious by Gatewood In Combination With Sinha

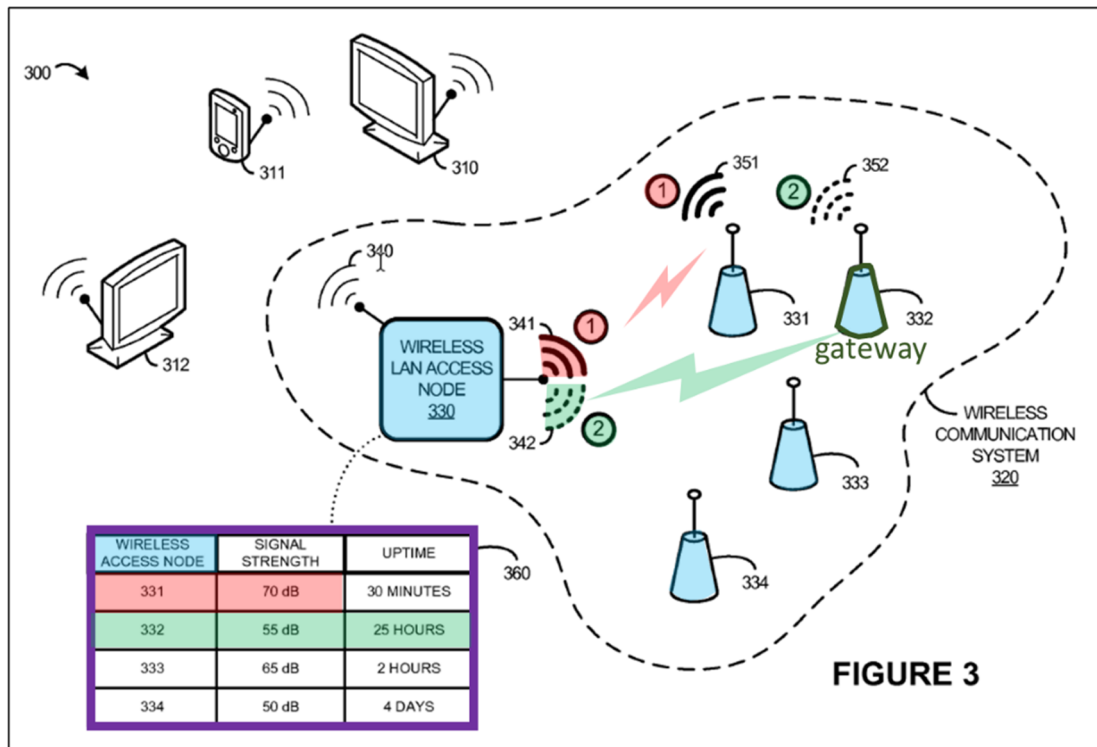
1. Independent Claims 1 and 11

- a. **Claim 1 Preamble: “A computer-implemented method for implementing a dedicated backhaul in a wireless mesh network formed with one or more mesh points, the method being performed by a first mesh point and comprising:”**

Claim 11 Preamble: “A computing device comprising: one or more processors, that implements a mesh point in a wireless mesh network formed with a plurality of mesh points, the computing device being configured to perform a method comprising:”

162. In my opinion, Gatewood in combination with Sinha renders the preamble obvious. As I detail below and in Sections X.C.2(b)-(g), Gatewood’s exemplary access node 330 (hereinafter, MAP.330) (claimed first mesh point) performs each of the limitations of claims 1/11. Thus, in my opinion, the preamble is satisfied under either party’s construction. *See* Section VIII.

163. Gatewood Figure 3 illustrates a wireless mesh network formed with multiple access nodes or mesh access points 330-334 (hereinafter, MAP.330, ... MAP.334) (blue). Ex.1005, 3:45-53 (“FIG. 3 ... illustrat[es] communication system 300 ... [which] includes various user devices 310-312 and wireless local area network (WLAN) access nodes 330-334 ... [forming] a *mesh wireless local area network*.”).



Ex.1005, FIG. 3.

164. The claims of the '179 Patent require that the first mesh point (MAP.330) establishes a “forward wireless communication” and a “backhaul communication” with a second mesh point. *See* Elements [1.1]/[11.1] and [1.2]/[11.2]. I have mapped the claimed second mesh point to a gateway of Gatewood’s wireless mesh network which, as Gatewood teaches, can be any of the access points of the mesh network.

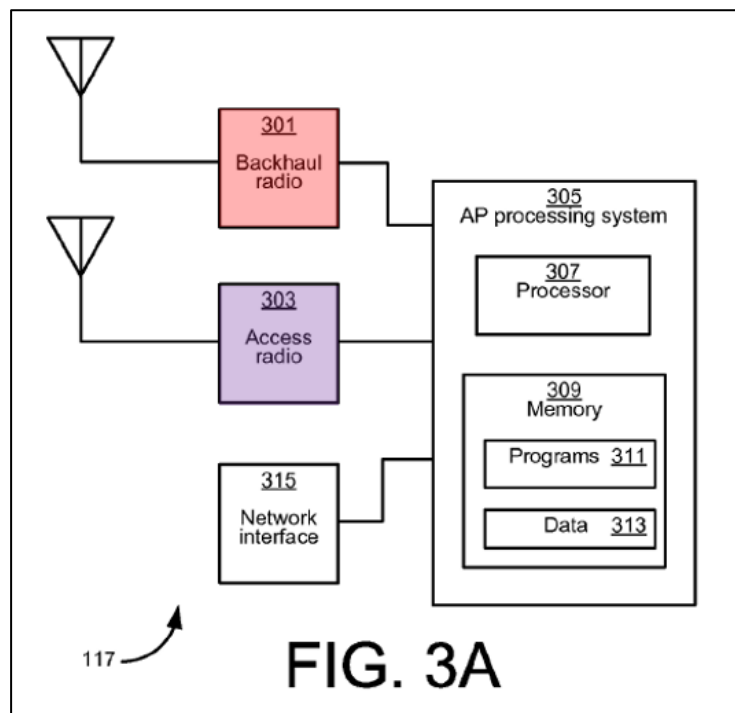
165. In Figure 3, I have outlined access node 332 (hereinafter, MAP.332) (blue) in dark green to illustrate that it is an exemplary gateway to another network such as the Internet, as Sinha teaches. Ex. 1005, 1:22-25 (“Access points can include router, **gateway**, or bridge functionality to connect user devices on the provided local

area networks to other networks and systems, such as the Internet or other packet networks.”), 3:58-4:3 (“WLAN access nodes 331-334 are also communicatively coupled to further networks, ... such as the Internet ... Although not shown in FIG. 3, each of WLAN access nodes 331-334 can have one or more additional wired or wireless links for communication with these further networks ...”). For purposes of claim mapping, MAP.332 is the claimed second mesh point.

166. **Claimed Dedicated Backhaul** – As Gatewood teaches, MAPs communicate with one another over dedicated and redundant backhaul communication links. For example, MAP.330 (claimed first mesh point) uses “first wireless backhaul link 341” (red) as its primary dedicated backhaul link, and also maintains a “second wireless backhaul link 342” (green) in an “active [backup] state”—with both links established in the “5-GHz IEEE 802.11 frequency spectrum.” Ex.1005, 5:56-6:13, 6:1-13, 6:48-56. Client-facing access communication (MAP-to-client) is over separate wireless links such as link 340 (140 in Figure 1) which “can be provided over at least 2.4, 3, 6, 5 and 60 GHz frequency bands[.]” *Id.*, 4:22-35, 9:55-65.

167. In my opinion, Gatewood in combination with Sinha (“Gatewood-Sinha”) also renders obvious the claimed dedicated backhaul. Sinha discloses wireless mesh networks in which each MAP is a dual radio MAP, illustrated in Sinha Figure 3A below, having a “backhaul radio” (red) dedicated for backhaul (MAP-to-

MAP) communication, and a separate “access radio” (purple) dedicated for access (MAP-to-client) communication. Ex.1008, [0047] (“FIG. 3A [illustrates] a mesh AP that includes two radios, *a first radio 301 for the backhaul* [(red)] ..., and a second radio 303 [(purple)] that is used as an *access radio* for data communication with clients associated with the mesh AP.”); *see also* Section X.A.1(f) regarding elements [1.4] and [11.4].



Ex.1008, FIG. 3A.

168. In my opinion, the use of dual radio MAPs of the type shown in Sinha Figure 3A is entirely consistent with Gatewood. Indeed, Gatewood explains that backhaul links (e.g., 341, 342) can be established over “the 5 GHz IEEE 802.11 frequency spectrum” while fronthaul communication with user devices can be

provided over other IEEE 802.11 frequency bands, such as the 2.4 Ghz band.
Ex.1005, 6:48-56, 9:55-62.

169. In my opinion, the combination of Gatewood and Sinha 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 network and spectrum management.

170. **Claimed Computer-Implemented Method/Computing Device** – As Gatewood explains and as illustrated in Figure 5, access node 330 (claimed first mesh point) includes a processing system 520 and software 532 that operate to “select a first wireless backhaul link for communications of the wireless local area network based on signal strength, and [] a second wireless backhaul link as a backup for the first wireless backhaul link based on at least signal strengths and uptime information, among other operations.” Ex.1005, 8:12-21.

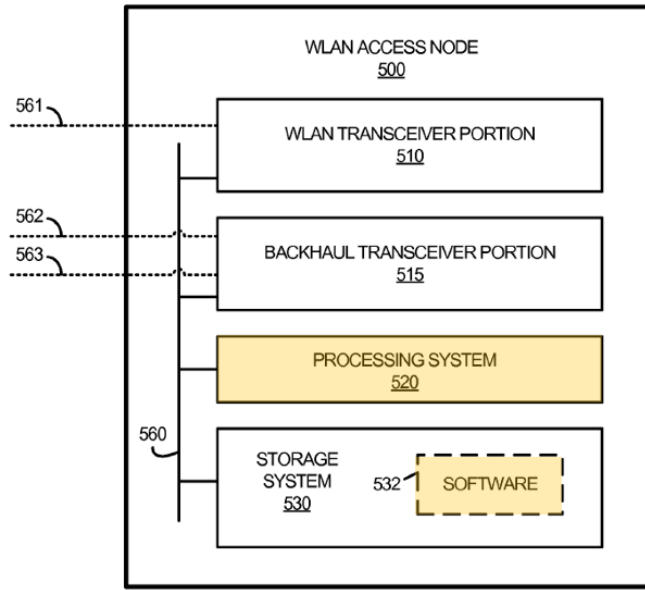


FIGURE 5

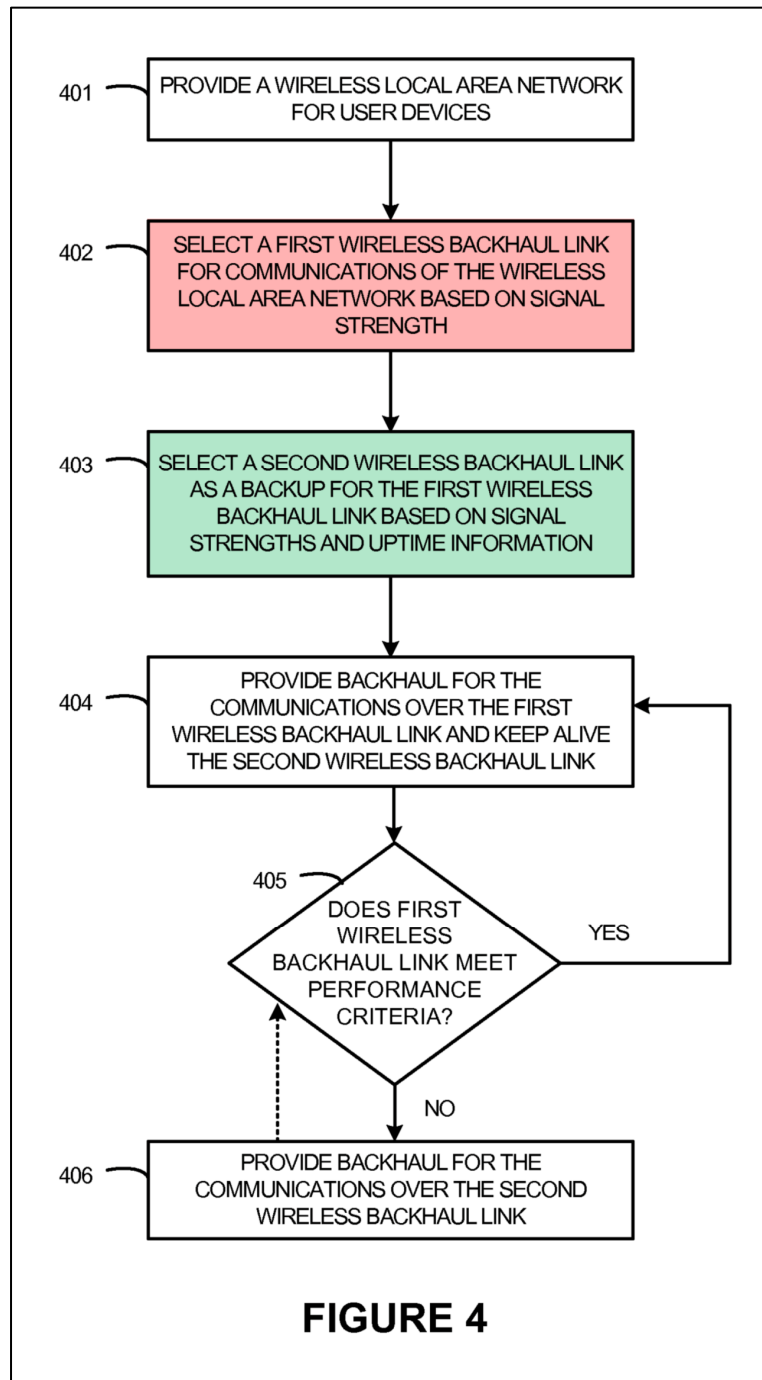
Ex.1005, FIG. 5; *id.*, 7:9-13 (“FIG. 5 is a block diagram illustrating WLAN access node 500, as an example of WLAN access node 120 found in FIG. 1 or WLAN access node 330 found in FIG. 3 ...”).

171. As Gatewood teaches, software 520 executes in processing system 520 and can include “operating system software, database software, [] application software ... firmware or [] machine-readable processing instructions executable by processing system 520.” *Id.*, 8:12-29.

b. Elements [1.1]/[11.1]: “establishing a forward wireless communication with a second mesh point”

172. In my opinion, Gatewood discloses or renders obvious this element. As shown at block 402 (red) in Figure 4, which is relevant to element [1.2] discussed in Section X.A.1(c) below, MAP.330 “selects [] *a first wireless backhaul link* ... based

on signal strength of wireless links provided by ones of WLAN access nodes 331-334 ... as measured or detected by WLAN access node 330 [(MAP.330)].” Ex.1005, 4:29-45.



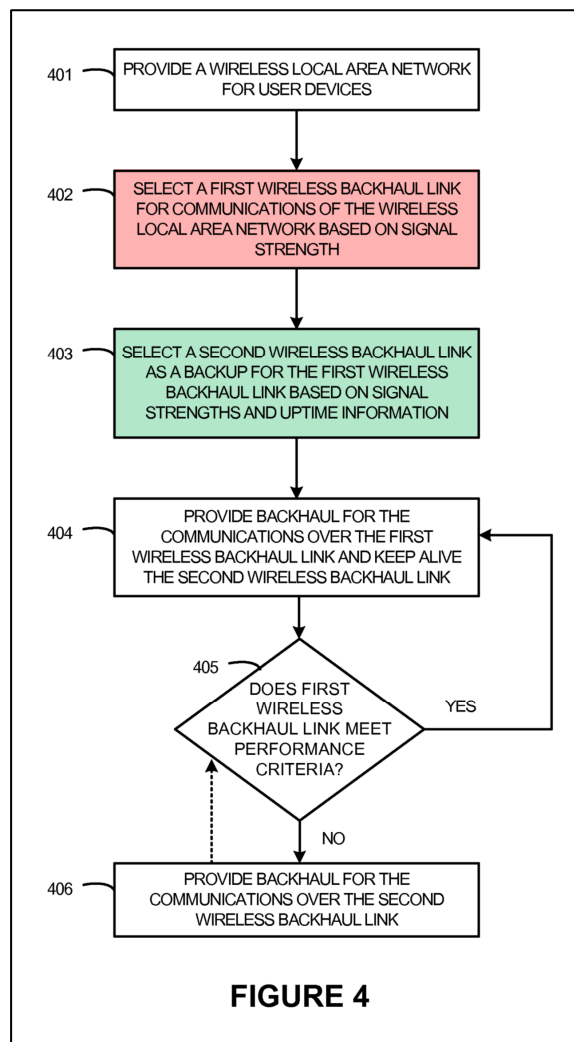
174. The *backup wireless backhaul link 342* (green) is an example of the claimed forward wireless communication. Thus, as Gatewood teaches, MAP.330 (claimed first mesh point) establishes a forward wireless communication—backup wireless backhaul link 342 (green)—with a second mesh point (MAP.332/gateway), as claimed.

175. Significantly, during prosecution, the examiner relied on the same mapping to find that Gatewood discloses “**establishing a forward wireless communication** (*read as second/backup wireless backhaul link in step 403 of fig. 4*) **with a second mesh point** (read as one of the other wireless access nodes).” Ex.1004, 142 (bolded language in original, italics added). Applicants did not at all challenge the examiner on this point. *See id.*, 170-172.

176. Patent Owner’s discussion of “forward wireless communication” in its claim construction brief at the ITC also supports my mapping: “The name ‘forward wireless communication’ also reflects a functional aspect of communication ...: to provide the clients with ‘data packet *forwarding* to and from the gateway and the Internet.’ ” 179 Patent, 27:5-21; *see also id.*, 29:60-63.” Ex.1018, 41-42 (emphasis in PO’s brief). Thus, a forward wireless communication may take place over a backhaul path, according to Petitioner.

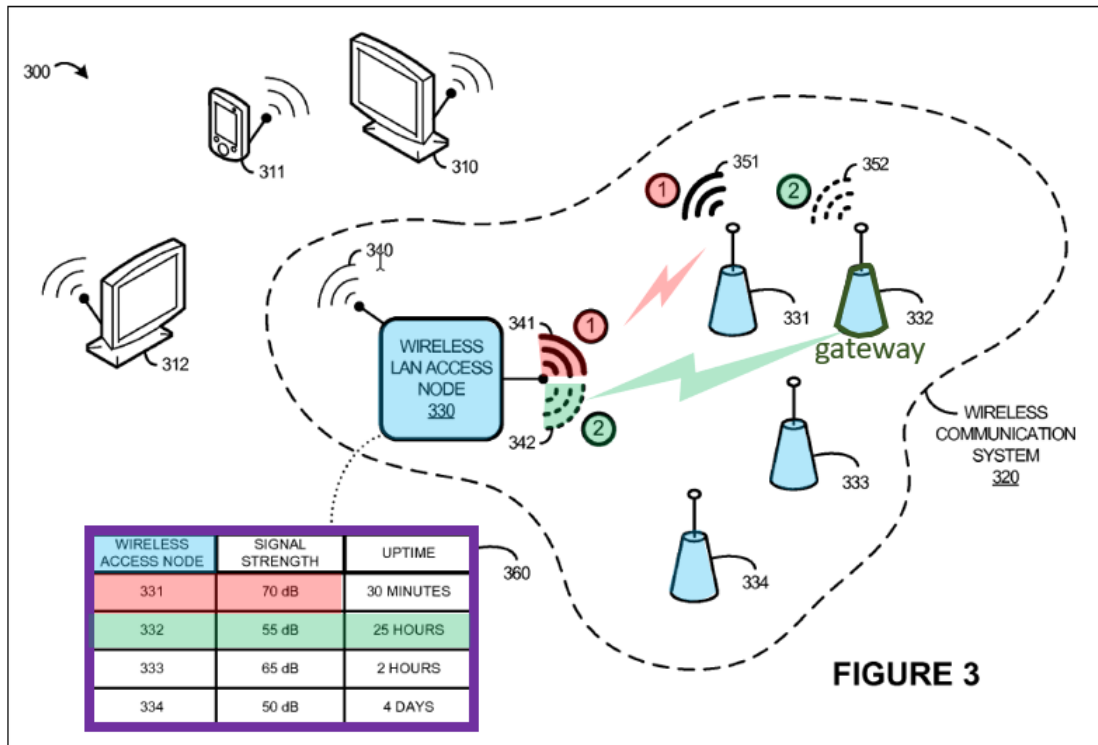
- c. **Elements [1.2]/[11.2]: “establishing a backhaul communication, separate from the forward wireless communication, with the second mesh point”**

177. In my opinion, Gatewood discloses or renders obvious this element. As shown at block 402 (red) in Figure 4, MAP.330 (claimed first mesh point) “selects [] *a first wireless backhaul link* ... based on signal strength of wireless links provided by ones of WLAN access nodes 331-334 ... as measured or detected by WLAN access node 330.” Ex.1005, 4:29-45. The *first wireless backhaul link* is the claimed backhaul communication.



Ex.1005, FIG. 4.

178. As illustrated in Figure 3 and as Gatewood explains, Gatewood’s *first wireless backhaul link 341* (claimed backhaul communication)—identified by “1” (red)—is separate from Gatewood’s *backup backhaul link 342* (claimed forward communication)—identified by “2” (green). *Id.*, 4:49-53.



Ex.1005, FIG. 3.

179. As I discussed above in Section X.C.1(a) and as Gatewood teaches, MAP.332 (claimed second mesh point) is an exemplary gateway providing access to the Internet. *Id.*, 3:58-66. The first backhaul link 341 (claimed backhaul communication) selected by MAP.330 (claimed first mesh point) is part of a 2-hop backhaul communication path (MAP.330-to-MAP.331-to-MAP.332) connecting

MAP.330 (claimed first mesh point) and the gateway/MAP.332 (claimed second mesh point), as claimed.

180. Moreover, while Figure 3 illustrates that the primary/first backhaul link and secondary/backup backhaul link connect MAP.330 to MAP.331 and MAP.332, respectively, Gatewood teaches that there are multiple candidate backhaul links between any two MAPs—such as between MAP.330 and MAP.332. Ex.1005, 10:23-31 (“Although **one main** wireless link for each of wireless links [] is shown in FIG. 1 [and in FIG. 3], it should be understood that [they] are merely illustrative [and] **further** wireless links can be shown ...”).

181. Thus, as Gatewood teaches, MAP.330 (first mesh point) can select a primary backhaul link (claimed backhaul communication) and a secondary/backup backhaul link (claimed forward wireless communication) that both terminate at **the same** MAP, such as MAP.332 (second mesh point).

182. In my opinion, establishing multiple redundant backhaul links between any two MAPs was in fact well-known and expressly taught in Sinha. Ex.1008, [0103] (“Several routes may be calculated between two end points, and ordered in order of preference.”); Ex.1006, 4:54-63 (“[T]he wireless links (W) in the meshed backhaul network may be dual redundant parallel links ... to form multiple parallel wireless channels between points on the network. These parallel links ... allow the simultaneous transmission of multiple signals between points on the network.”).

183. During prosecution, the examiner relied on the same mapping to find that Gatewood discloses “**establishing a backhaul communication** (*read as first wireless backhaul link in step 402 of fig. 4*) ...”. Ex.1004, 142 (bolded language in original, italics added). Applicants did not at all challenge the examiner on this point. *See id.*, 170-172.

- d. **Elements [1.3]/[11.3]: “wherein the forward wireless communication is established using a wireless communication technology using frequency bands selected from the group consisting of: a 2.4 GHz band, and a 5 GHz band, and”**

184. In my opinion, Gatewood discloses or renders obvious this element.

185. As Gatewood explains, the second wireless backhaul link 342 (forward wireless communication) may be established in the 5 GHz band (“5 GHz IEEE 802.11 frequency spectrum”) recited in the Markush group. Ex.1005, 6:48-56, 6:64-7:8 (“first wireless backhaul link 341 for the backhaul communication [] comprises a first IEEE 802.11 wireless link using a first wireless frequency spectrum, such as the **5 GHz IEEE 802.11 frequency spectrum**, and second wireless backhaul link 342 for the backhaul communication [] can comprise a second IEEE 802.11 wireless link using *the same* or similar first wireless frequency spectrum”).

- e. **Elements [1.4]/[11.4]: “wherein the backhaul communication is established using a communication technology selected from the group consisting of: a power line based communication, a 2.4 GHz or 5 GHz radio frequency (RF) technology using a dedicated radio, and a sub-1GHz RF technology; and”**

186. In my opinion, Gatewood in combination with Sinha renders obvious this element.

187. As Gatewood explains, the first wireless backhaul link 341 (backhaul communication) is established in the “5 GHz IEEE 802.11 frequency spectrum.” Ex.1005, 6:48-56, 6:64-7:8 (“first wireless backhaul link 341 for the backhaul communication [] comprises a first IEEE 802.11 wireless link using a first wireless frequency spectrum, such as *the 5 GHz IEEE 802.11 frequency spectrum*”).

188. In my opinion, a POSITA would have further understood and found obvious that the 5 GHz band can advantageously be dedicated for backhaul communication due to its higher bandwidth compared to the 2.4 GHz band, in which case the 5 GHz radio is a dedicated radio, as required by the claim.

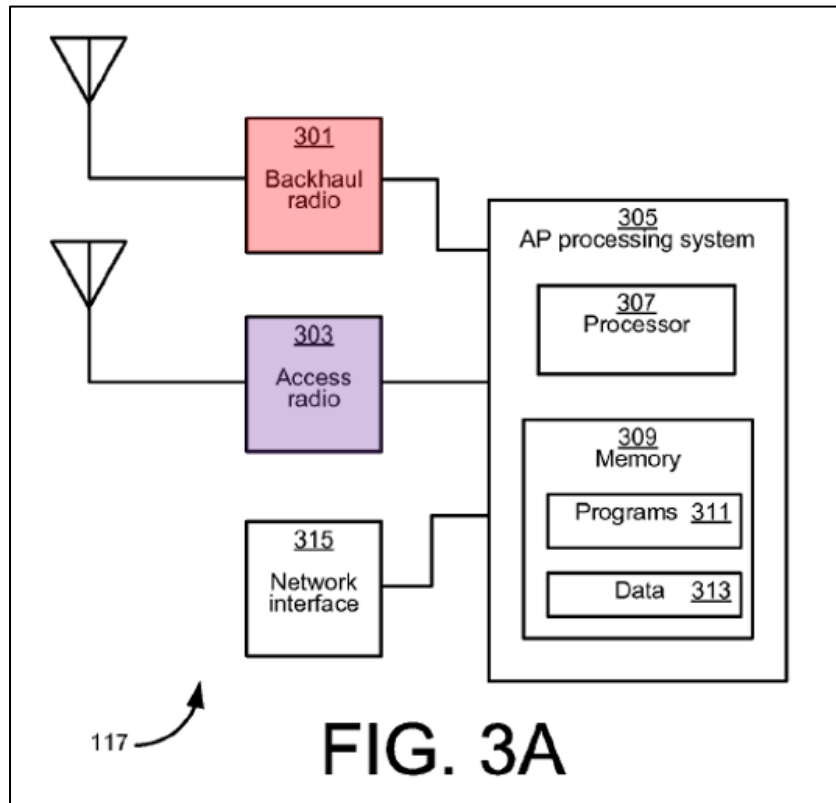
189. Sinha in fact describes the common use of a dedicated 5 GHz “backhaul radio” in mesh Wi-Fi network and access points:

[A]ll mesh nodes ... may be implemented by a dual radio wireless station that includes *a first radio for the backhaul link* between mesh nodes, and a second radio to provide access point functionality. ... [I]n one embodiment, *the backhaul radio* is an IEEE 802.11a conforming radio *in the 5 GHz range* ...

Ex.1008, [0025].

190. Sinha’s Figure 3A illustrates a MAP having a dedicated 5 GHz “backhaul radio” (red). *Id.*, [0047] (“FIG. 3A [illustrates] a mesh AP that includes

two radios, *a first radio 301 for the backhaul* [(red)] ... and a second radio 303 [(purple)] that is used as an access radio for data communication with clients associated with the mesh AP.”), [0049] (“*the backhaul radio 301* substantially conforms to the IEEE 802.11a standard, operating in *the 5 GHz band*”).



Ex.1008, FIG. 3A.

- f. Elements [1.5]/[11.5]: “constructing a list of backhaul candidates, each backhaul candidate having a score indicative of an estimated quality of a potential link between the first mesh point and the second mesh point”

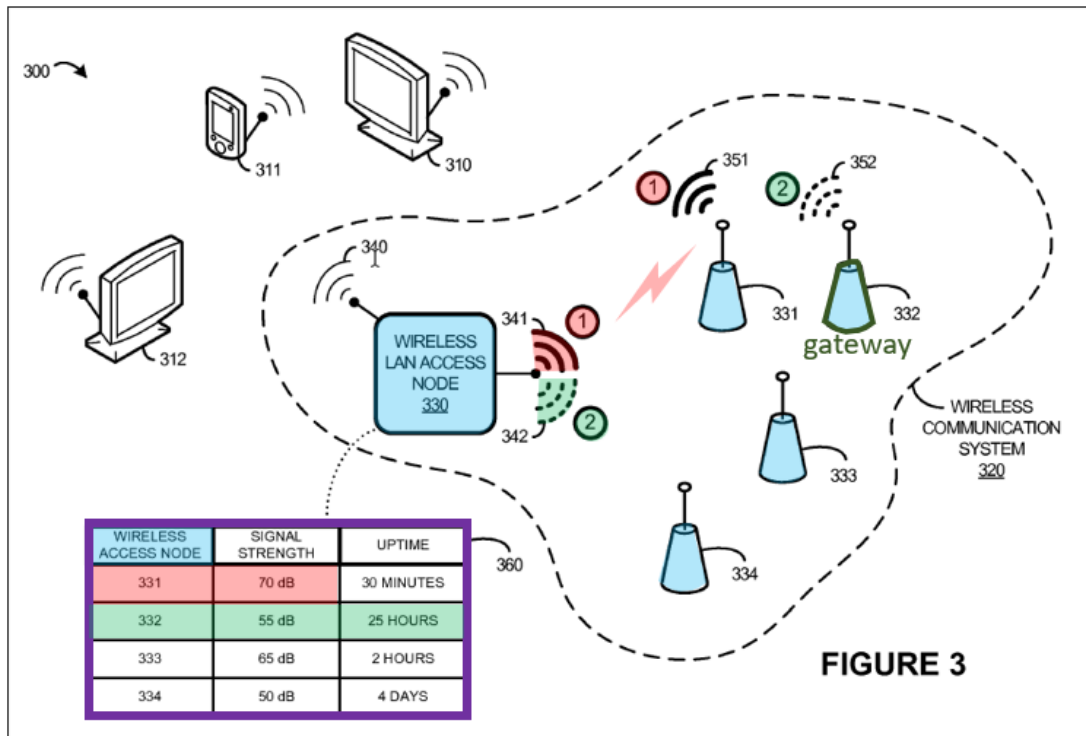
191. In my opinion, Gatewood in combination with Sinha renders obvious this element. As Gatewood explains, backhaul candidates are selected “based on at

least a signal strength and uptime information.” Ex.1005, 5:4-28. Gatewood further teaches constructing a list of backhaul candidates, such as the list stored in “data structure 360” of MAP.330 (claimed first mesh point). *Id.*

192. As illustrated in Figure 3 below, data structure 360 (purple) is a 3-column table that lists the candidate backhaul links between MAP.330 (claimed first mesh point) and other mesh points (column 1), together with their signal strength (column 2) and uptime (column 3). *Id.* Each candidate backhaul link on this list would allow MAP.330 to reach MAP.332 which, as illustrated in Figure 3 consistent with Gatewood’s teaching, is the gateway to the Internet. *Id.*, 1:29-32 (“[A] backhaul link can be employed to transport the communications of the wireless local area network to other networks, such as the Internet ...”). Thus, each candidate backhaul link on the list stored in “data structure 360” is a potential link that is part of a potential end-to-end backhaul communication path between MAP.330 (claimed first mesh point) and MAP.332 (claimed second mesh point and gateway).

193. And, as Gatewood teaches, the signal strength and uptime information stored in “data structure 360” are both indicative of an estimated quality of a potential link between MAP.330 (claimed first mesh point) and MAP.332 (claimed second mesh point). Indeed, “[t]he uptime information can comprise a time period that a particular wireless link ... has met certain performance criteria, such as being operational, being functional, ... *having met a minimum performance threshold,*

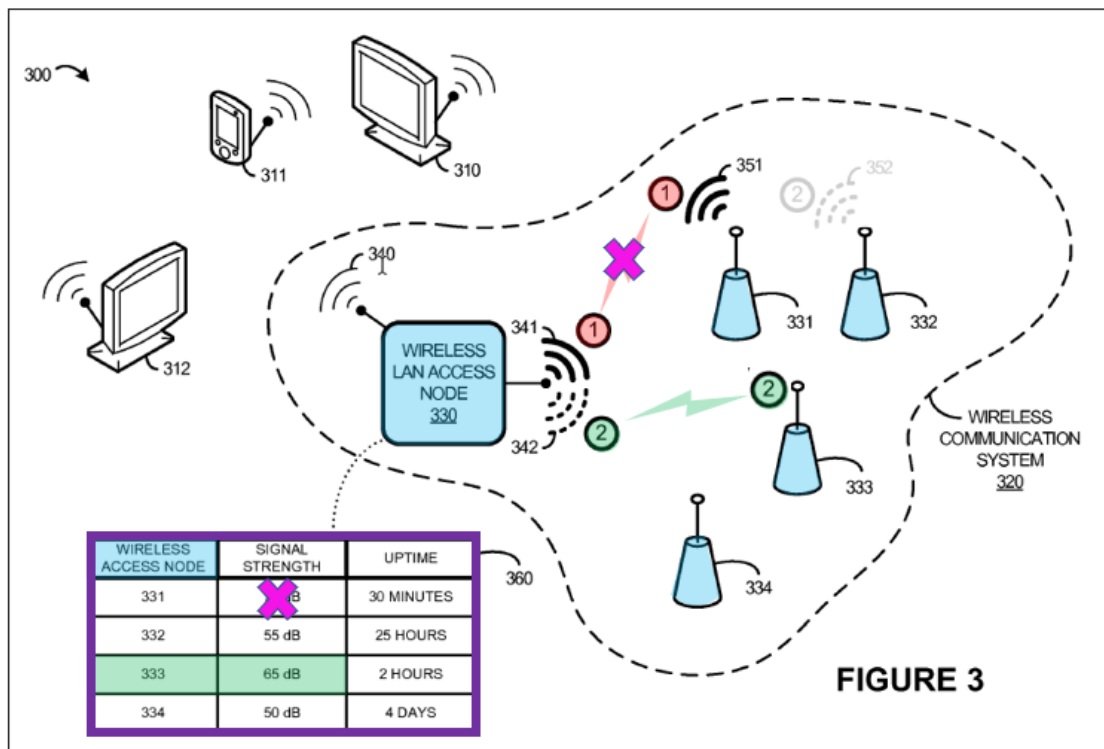
or not failed, among other *performance criteria*.” Ex.1005, 5:18-23; *id.*, 3:29-31 (“Uptime information can reflect a time period that the associated wireless link has been active and capable of carrying communications. For example, the uptime can be measured in minutes, hours, days, and the like, and *indicate how stable* the associated wireless link or wireless access node has been.”).



Ex.1005, FIG. 3.

194. Gatewood further teaches associating a score indicative of an estimated link quality with each backhaul candidate—this score is “[a] weighting calculation [] employed to balance signal strength and uptime considerations, such as giving an uptime measurement more weight in the selection process than a signal strength or vice versa.” *Id.*, 5:45-48.

195. As an example, by assigning zero weight to uptime, each candidate backhaul link has a score that simply reflects the signal strength of the link. *Id.*, 5:50-53. In that case, as Gatewood teaches and as I illustrated in modified Figure 3M below, MAP.330 would select the MAP.330-to-MAP.333 link (green) as the backup backhaul link because its signal strength—65 dB (green) in unmodified table 360 (purple)—is “the highest signal strength among WLAN access nodes 332-334.” *Id.*, 5:50-53 (“In other examples [where uptime is given zero weight], WLAN access node 333 is selected based on having ***the highest signal strength*** among WLAN access nodes 332-334.”).



Ex.1005, FIG. 3M.

196. In addition, in my opinion, Gatewood-Sinha renders this element obvious. As I discussed in Section X.A.2(f), Sinha teaches forming “a priority ordered list of routes” for “each class of service” in a wireless mesh network and, furthermore, discloses an efficient way to tag and route the different classes of traffic across the mesh network. Ex.1008, [0058].

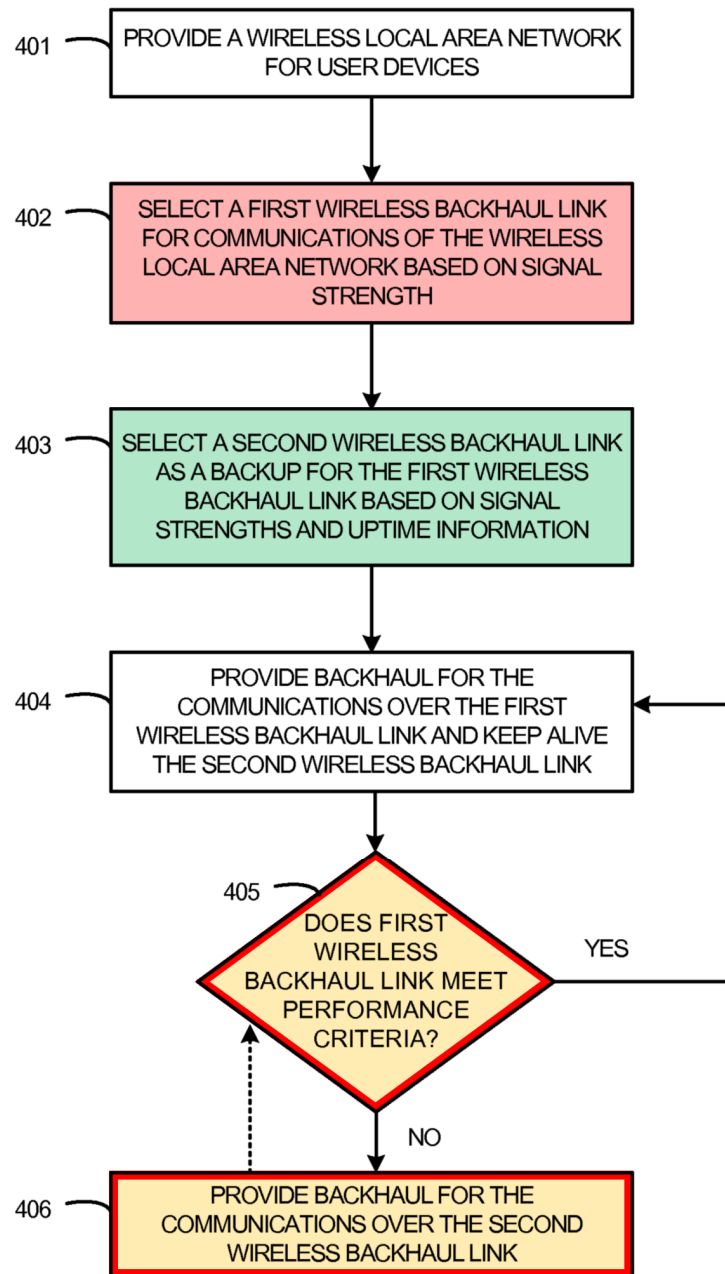
197. In my opinion, a POSITA would have been motivated to implement Sinha’s teachings in Gatewood’s network to further improve it, notably to provide the additional capability to handle multiple classes of traffic (important for multimedia applications) and to rapidly switch routes in the event of failure.

198. In my opinion, the combination of Gatewood and Sinha 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 traffic management and fast routing in a mesh network.

- g. Elements [1.6]/[11.6]: “upon determining that a quality of service of the dedicated backhaul has dropped to below a predetermined threshold, establishing an alternative backhaul communication with the second mesh point using a backhaul candidate with the highest score on the list.”**

199. In my opinion, Gatewood discloses this element and, alone or in view of Sinha, renders it obvious. As Gatewood teaches and as depicted at blocks 405 and 406 (tan) of Figure 4, “[w]hen first wireless backhaul link 341 [(claimed

dedicated backhaul)] ***does not meet one or more of the performance criteria*** (405), WLAN access node 330 provides (406) backhaul for the communications over second wireless backhaul link 342 [(claimed alternative backhaul communication)].” Ex.1005, 6:33-36. In my opinion, this mapping, in which the claimed alternative backhaul communication is the forward wireless communication path, is also consistent with claim 3, which claims “redirecting backhaul traffic to the forward wireless communication” under the same claimed condition. *See* Section X.D.2.



Ex.1005, FIG. 4.

200. In more detail, Gatewood explains that “WLAN access node 330 [(claimed first mesh point)] continues to monitor the performance criteria for first wireless backhaul link 341 when [it] is in use, such as monitoring for disconnected

states, ***performance below a performance threshold***, or other performance criteria.”

Id., 6:18-23. Gatewood discloses that “the performance criteria [(claimed quality of service)] can include a data transfer rate, and the performance threshold can include ***when the data transfer rate decreases below a predetermined data transfer value.***” *Id.*, 6:26-29.

201. As Gatewood further explains, upon determining that a quality of service (such as data transfer rate) of the first backhaul link 341 (claimed dedicated backhaul) has dropped below a predetermined threshold, “the communications associated with WLAN 340 [(client communications)] are backhauled [(established)] over second wireless backhaul link 342 (claimed alternative backhaul communication) because “second wireless backhaul link 342 acts as a backup to first wireless backhaul link 341.” *Id.*, 6:36-42.

202. In addition, in my opinion, the combination of Sinha and Gatewood renders this element obvious. As I discussed in Section X.A.2(g), Sinha teaches monitoring multiple network parameters such as “data rates, noise level, quality of service (QoS), class of service (CoS), time delays ...” to determine the primary and failover routing paths “for different classes of traffic.” Ex.1008, [0039].

203. In my opinion, a POSITA would have been motivated to implement Sinha’s teachings in Gatewood’s network to further improve it, notably to provide the additional capability to handle multiple classes of traffic (important for

multimedia applications) and to rapidly switch routes in the event of failure. *See* Section X.D.1(f).

204. Conversely, as discussed in Section X.A.2(g), it is my opinion that a POSITA would have been motivated to use Gatewood's performance threshold to detect failed or underperforming routes in Sinha. Indeed, Sinha applies the same strategy of determining and ranking primary and backup paths/routes based on quality of service as Gatewood, except that it does so for multiple classes of traffic. Ex.1008, [0058], [0052].

2. Dependent Claims 3 and 13

- a. **“[The method of claim 1/The device of claim 11] further comprising: upon determining that a quality of service of the backhaul communication has dropped to below a predetermined threshold, redirecting backhaul traffic to the forward wireless communication.”**

205. In my opinion, Gatewood discloses or renders obvious this element. As I discussed above under Section X.A.1(g) regarding element [1.6], Gatewood teaches redirecting traffic from a first wireless backhaul link to a backup wireless backhaul link (claimed forward wireless link) upon determining that a quality of service of the first backhaul link (claimed backhaul communication) has dropped to below a predetermined threshold. *See* Section X.A.1(g); Ex.1005, 6:33-42 (“When *first wireless backhaul link* 341 [(claimed backhaul communication)] *does not meet one or more of the performance criteria* (405), WLAN access node 330 provides

(406) backhaul for the communications over *second wireless backhaul link* 342 [(claimed forward wireless link)]. Since second wireless backhaul link 342 acts as a backup to first wireless backhaul link 341, the communications associated with WLAN 340 [(client communications)] are *backhauled [(redirected)] over second wireless backhaul link* 342 [(claimed forward wireless link)] when first wireless backhaul link 341 becomes unavailable, such as when first wireless backhaul link 341 does not meet the performance criteria.”); *id.*, 6:18-29 (“WLAN access node 330 [(claimed first mesh point)] monitors the performance criteria for first wireless backhaul link 341 [when it] is in use, such as monitoring for disconnected states, *performance below a performance threshold*, or other performance criteria. ... [For] example, the performance criteria can include a data transfer rate, and the *performance threshold* can include when the data transfer rate decreases below a *predetermined* data transfer value.”).

3. Dependent Claims 4 and 14

- a. [The method of claim 1,/The device of claim 11, the method performed by the device] further comprising: upon determining whether a quality of service of the dedicated backhaul has dropped to below a predetermined threshold, establishing an alternative backhaul communication with the second mesh point; and redirecting backhaul traffic to the alternative backhaul communication.”

206. In my opinion, Gatewood discloses or renders obvious this element. As I discussed above under Section X.C.1(g) regarding element [1.6], Gatewood

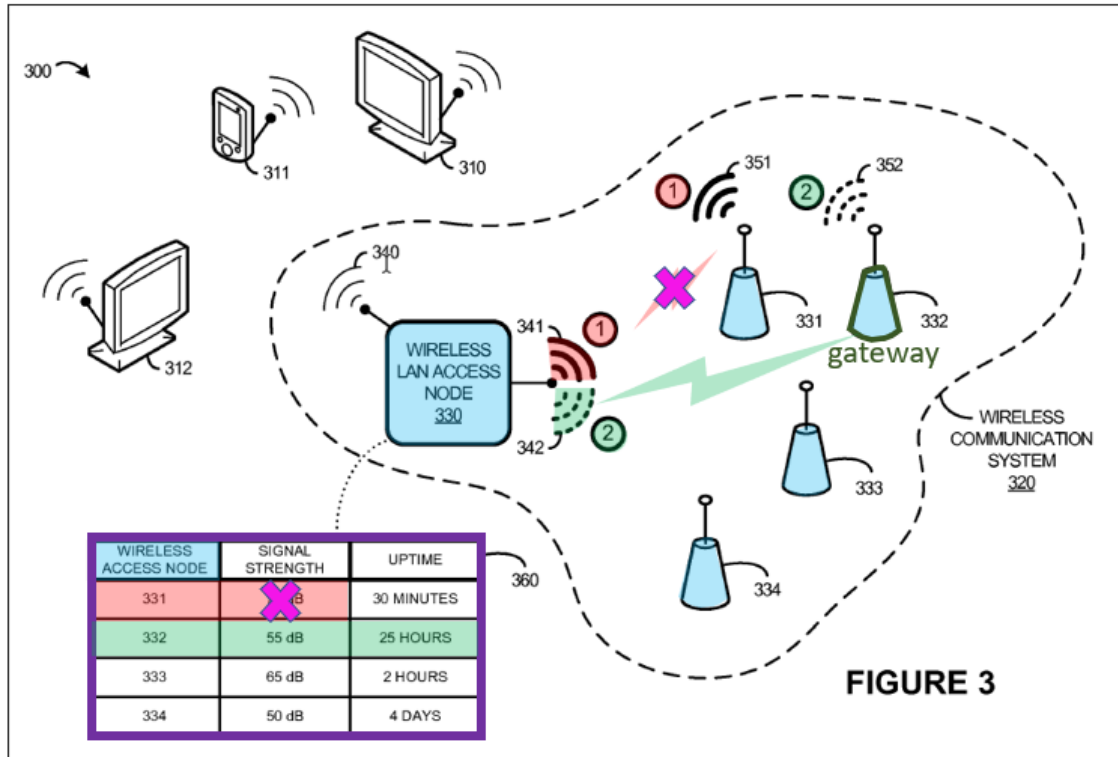
teaches redirecting traffic from a first wireless backhaul link (claimed dedicated backhaul) to a backup wireless backhaul link (claimed alternative backhaul communication) upon determining that a quality of service of the first backhaul link (claimed dedicated backhaul) has dropped to below a predetermined threshold. *See* Section X.C.1(g); *see also* Section X.C.2; Ex.1005, 6:33-42 (“Since second wireless backhaul link 342 [(claimed alternative backhaul communication)] acts as a **backup** to first wireless backhaul link 341 [(claimed dedicated backhaul)], the communications associated with WLAN 340 [(client communications)] are **backhauled [(redirected)] over second wireless backhaul link 342** when first wireless backhaul link 341 becomes unavailable, such as when first wireless backhaul link 341 **does not meet the performance criteria.**”); *id.*, 6:26-29 (“[T]he performance criteria can include a data transfer rate, and the **performance threshold** can include when the data transfer rate decreases below a **predetermined** data transfer value.”).

4. Dependent Claims 5 and 15

- a. “[The method of claim 4/The device of claim 14], wherein the alternative backhaul communication is a direct link that links to the second mesh point through no other mesh point.”**

207. In my opinion, Gatewood discloses or renders obvious this element. As shown in Figure 3, the second backhaul link 342 (green) (claimed alternative

backhaul communication) is a direct link that links MAP.330 (claimed first mesh point) to MAP.332 (claimed second mesh point) through no other mesh point.



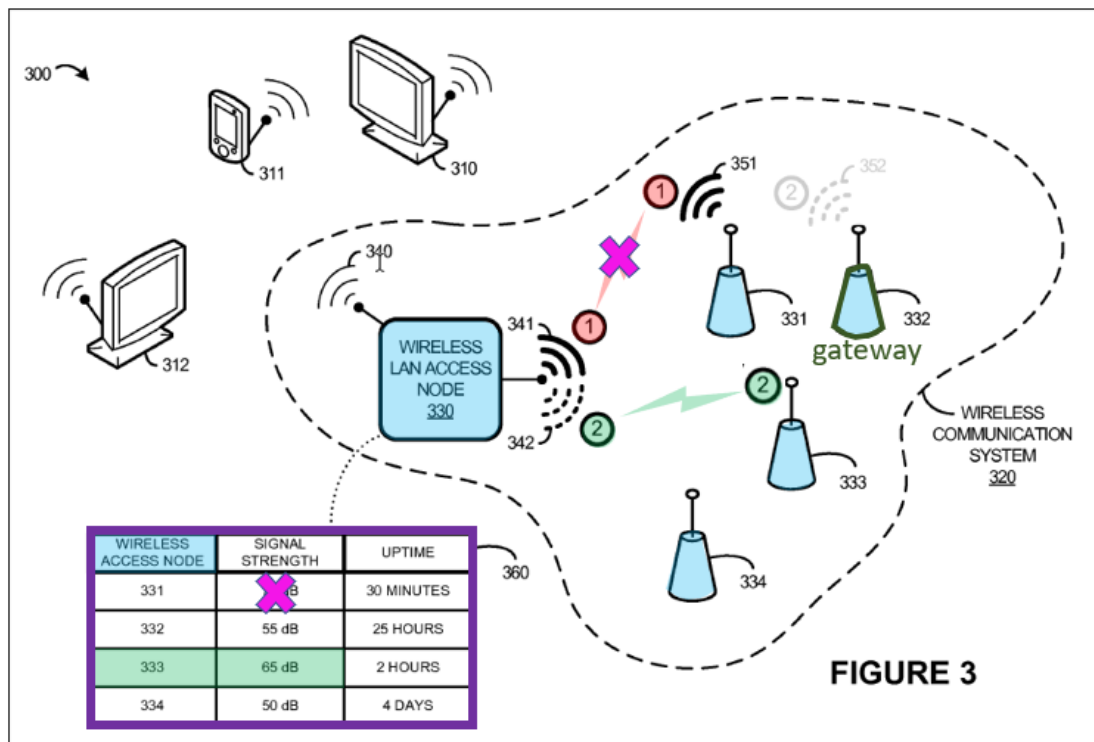
Ex.1005, FIG. 3.

5. Dependent Claims 6 and 16

- a. “[The method of claim 4/The device of claim 14], wherein the alternative backhaul communication is an indirect link that links to the second mesh point through another mesh point.”

208. In my opinion, Gatewood discloses or renders obvious this element. As I discussed above in Section X.C.1(f) and as illustrated in Figure 3M, the wireless backhaul link 342 (green) between MAP.330 (first mesh point) and MAP.333 (access node 333) is used as backup link (claimed alternative backhaul

communication) when signal strength is the criteria (score) used for selecting backup links. Ex.1005, 5:45-53 (“A weighting calculation [(score)] can be employed to balance signal strength and uptime consideration, such as giving an uptime measurement more weight in the [backup link] selection process than a signal strength or vice versa. ... In [certain] examples, WLAN access node 333 is selected based on having ***the highest signal strength*** among WLAN access nodes 332-334.”).



Ex.1005, Fig. 3M.

209. As shown in Figure 3M, the alternative backhaul path from MAP.330 (claimed first mesh point) to the gateway/MAP.332 (claimed second mesh point) is

an indirect, multiple-hop path that comprises the backup link 342 (green) between MAP.330 and MAP.333 as one of the hops.

XI. CUMULATIVENESS

210. In my opinion, the prior art references in this Petition are not cumulative of the references cited by the Examiner during prosecution of the '179 Patent. I note that Grounds IA/B and II are based on the Sinha, Liu and Handforth references, which were *not* cited or discussed during prosecution. Likewise, Ground III relies on the combination of Gatewood and Sinha that was *not* in front of the Examiner during prosecution.

211. The Notice of Allowability asserts that the prior art of record, including Gatewood, fails to disclose claim elements [1.4]/[11.4] (backhaul communication technology), [1.5]/[11.5] (constructing a list of backhaul candidates), and [1.6]/[11.6] (establishing an alternative backhaul communication). Ex.1004, 266.⁵

⁵ The Notice of Allowability issued following a telephone interview, which occurred after all claims were rejected as rendered obvious by Gatewood in combination with other art in a final Office Action. Ex.1004, 211-220 (10/04/2018 final Office Action), 268-269 (summary of 11/20/2018 interview). The record is not clear as to the reason the Examiner allowed the claims. For

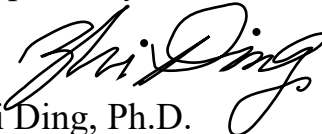
I have demonstrated here that Sinha clearly discloses them all, and that the combination of Gatewood and Sinha, which was **not** in front of the Examiner, also renders obvious these claim elements. *Id.*

XII. CONCLUSION

212. For the aforementioned reasons, in my opinion, to a person of ordinary skill in the art, the Challenged Claims of the '179 Patent are rendered obvious by the prior art.

Date: September 18, 2023

Respectfully submitted,


Zhi Ding, Ph.D.

example, the interview summary notes that to “expedite case prosecution, the Examiner suggested the applicant to roll up claim 8 into claims 1 and 12 to put the case in condition for allowance.” *Id.*, 269. But the Examiner **twice** rejected claim 8 as rendered obvious by Gatewood in combination with other art. Ex.1004, 146 (rejecting claim 8 as being unpatentable over Gatewood in view of Lu), 218 (rejecting claim 8 as being unpatentable over Gatewood in view of Gokturk and Nolan as applied to claim 1, and in further view of Lu).