

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ARISTA NETWORKS, INC.,
Petitioner,

v.

WSOU INVESTMENTS, LLC d/b/a BRAZOS LICENSING AND
DEVELOPMENT,
Patent Owner.

IPR2022-00231
Patent 8,472,447 B2

Before THU A. DANG, BRIAN J. McNAMARA, and
JOHN A. HUDALLA, *Administrative Patent Judges*.

DANG, *Administrative Patent Judge*.

DECISION
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

A. *Background*

In response to a Petition (Paper 1, “Pet.”) filed by Arista Networks, Inc. (“Petitioner”), we instituted *inter partes* review of claims 1–6 and 12–17 (“the challenged claims”) of U.S. Patent No. 8,472,447 B2 (Ex. 1001, “the ’447 patent”). See Paper 8 (“Dec. Inst.”). During trial, WSOU Investments, LLC d/b/a Brazos Licensing and Development (“Patent Owner”) filed a Response (Paper 11 (“PO Resp.”)), to which Petitioner filed a Reply (Paper 18, “Pet. Reply”). In turn, Patent Owner filed a Sur-reply. Paper 20 (“PO Sur-reply”). An oral hearing was held with the parties on March 2, 2023. A transcript of the hearing has been entered into the record. Paper 25 (“Tr.”).

We have jurisdiction under 35 U.S.C. § 6. This Decision is a Final Written Decision under 35 U.S.C. § 318(a) as to the patentability of the claims on which we instituted trial. Based on the record before us, Petitioner has shown by a preponderance of the evidence that claims 1–6 and 12–17 of the ’447 patent are unpatentable.

B. *Related Proceedings*

The parties identify the ’447 patent as the subject of *WSOU Investments, LLC d/b/a Brazos Licensing and Development v. Arista Networks, Inc.*, Civil Action No. 6:20-cv-01083 (W.D. Tex. Nov. 25, 2020). Pet. 67; Paper 3, 2. Petitioner also indicates that Patent Owner previously filed a patent infringement action against Petitioner in *WSOU Investments, LLC d/b/a Brazos Licensing and Development v. Arista Networks, Inc.*, Civil Action No. 3:21-cv-08679 (N.D. Cal. Nov. 8, 2021). Pet. 67.

C. The '447 Patent

The '447 patent, titled “IP Multicast Snooping and Routing with Multi-Chassis Link Aggregation,” issued on June 25, 2013, from Application No. 13/010,382, filed on January 20, 2011. Ex. 1001, codes (54), (45), (21), (22).

The '447 patent relates to aggregation switches connected via a virtual fabric link (VFL) that are each active and able to perform IP multicast snooping, wherein the resulting IP multicast snooping information is maintained internally within each aggregation switch and shared substantially in real-time therebetween via the VFL. *Id.* at code (57). An illustration of handling multicast traffic is depicted in Figure 10 of the '447 patent, reproduced below:

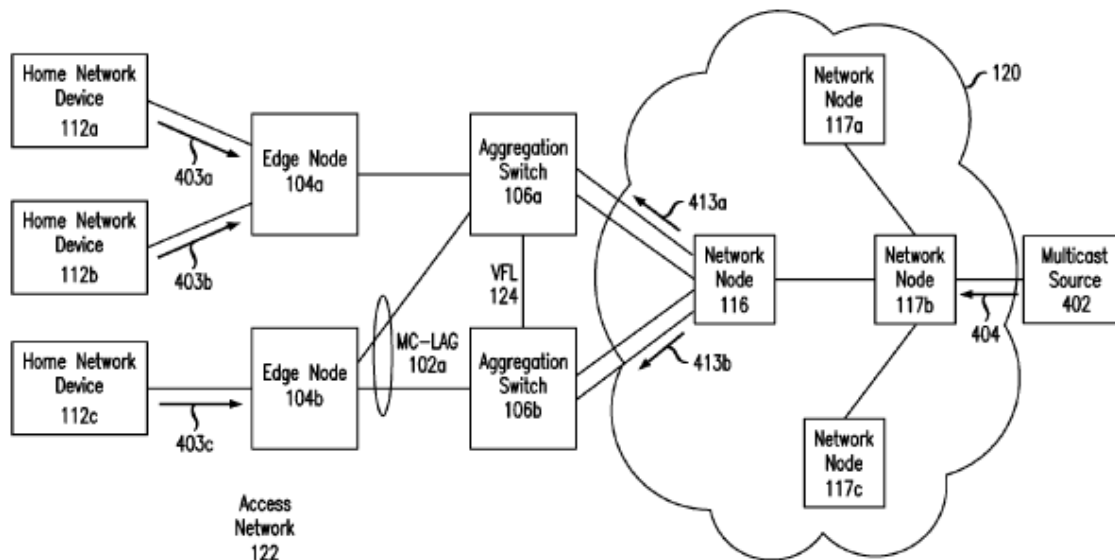


FIG. 10

Figure 10 is a schematic block diagram of a system for handling multicast traffic. *Id.* at 18:25–26. In the schematic block diagram of Figure 10, home network devices 112a–112c transmit respective membership reports 403a–403c to receive multicast traffic 404 from multicast source 402. *Id.*

at 18:26–30. Multicast source 402, in turn, transmits multicast traffic 404 to network nodes 117b, and multicast traffic 404 is routed through core network 120 until reaching network node 116 coupled to access network 122 having end devices 112a–112c that requested multicast traffic 404. *Id.* at 18:34–47. In order to enable aggregation switches 106a, 106b to properly forward multicast traffic 404, each of aggregation switches 106a, 106b is configured to perform IP multicast snooping. *Id.* at 18:48–49.

An illustration of sharing IP multicast snooping information is depicted in Figure 11 of the '447 patent, reproduced below:

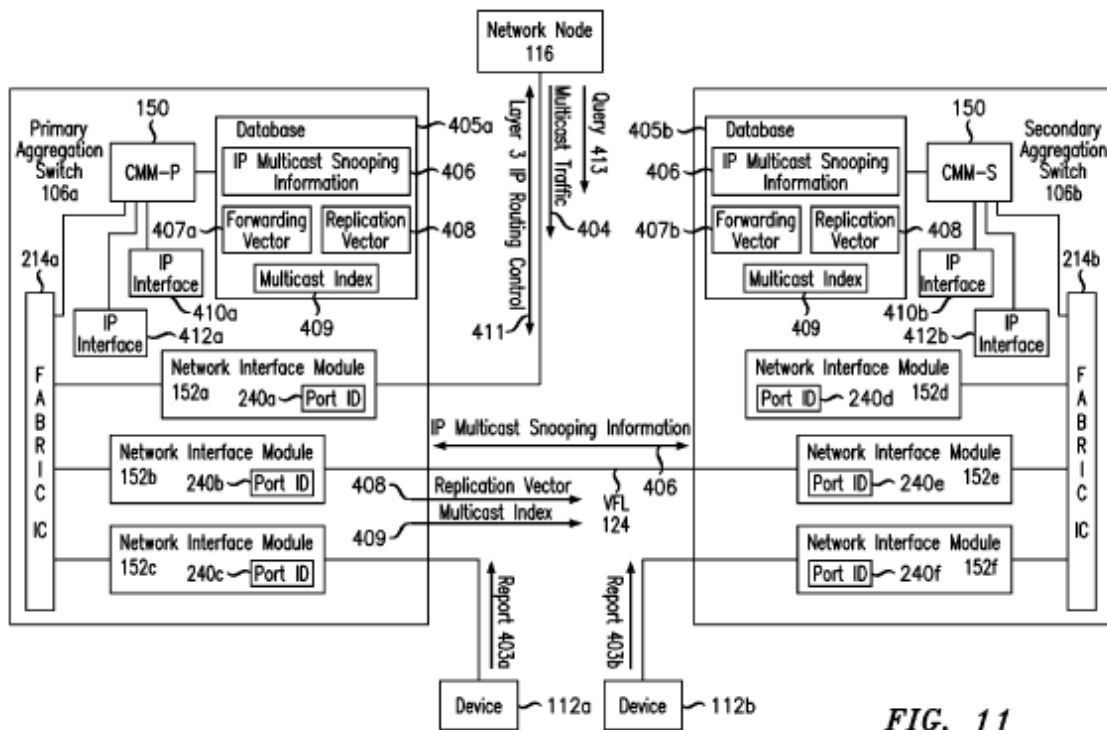


Figure 11 is a schematic block diagram illustrating the sharing of IP multicast snooping information between aggregation switches 106a, 106b. *Id.* at 19:11–13. As shown in Figure 11, aggregation switches 106a, 106b each include chassis management module (CMM) 150 and a plurality of network interface modules (NIM) 152. *Id.* at 19:13–20. Each CMM 150

runs a respective IP multicast snooping (IPMS) process and stores respective IP multicast snooping information 406 within respective databases 405a, 405b. *Id.* at 19:32–35.

D. The Challenged Claims

Of the challenged claims, claims 1 and 15 are the independent claims. Claims 2–6 and 12–14 depend from claim 1. Claims 16–17 depend from claim 15. Claim 1 is illustrative and is reproduced below:

1. An aggregation switch in a multi-chassis system for performing Internet Protocol (IP) multicast snooping, comprising:

a plurality of virtual fabric link (VFL) ports coupled to a VFL, wherein the VFL is connected to a remote aggregation switch, wherein the remote aggregation switch is active and in a separate physical chassis;

a plurality of external ports coupled to at least one edge node and at least one network node,

a database maintaining IP multicast snooping information; and

a chassis management module for receiving the snooping information via at least the external ports, storing the snooping information within the database and sharing the snooping information substantially in real-time with the remote aggregation switch via the VFL,

wherein the chassis management module further builds respective forwarding vectors for multicast traffic flows received from the at least one network node via the external ports or the VFL ports based on the snooping information;

wherein the chassis management module further determines a multicast index for a received multicast traffic flow to set-up hardware paths for forwarding the received

multicast traffic flow to the external ports in a virtual local area network (VLAN) that requested the received multicast traffic flow via the at least one edge node, the multicast index being used globally between the aggregation switch and the remote aggregation switch.

Ex. 1001, 27:2–32.

E. Asserted Ground of Unpatentability

We instituted *inter partes* review of all challenged claims on all challenges in the Petition. Petitioner asserts that claims 1–6 and 12–17 of the '447 patent are unpatentable based on the following ground (Pet. 2):

Claim(s) Challenged	35 U.S.C. § ¹	Reference(s)/Basis
1–6, 12–17	103	Sane, ² Subramanian ³

Petitioner relies on the declaration of John R. Black, Jr., Ph.D. (Ex. 1003) in support of its unpatentability contentions.

II. ANALYSIS

A. Level of Ordinary Skill in the Art

In determining whether an invention would have been obvious at the time it was made, we consider the level of ordinary skill in the pertinent art at the time of the invention. *Graham v. John Deere Co.*, 383 U.S. 1, 17

¹ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. § 103, effective March 16, 2013. Because the application from which the '447 patent issued was filed before this date, the pre-AIA version of § 103 applies.

² US Patent No. 8,204,061 B1, issued June 19, 2012, filed July 23, 2009 (Ex. 1005, “Sane”).

³ US Patent No. 8,654,680 B2, issued February 18, 2014, filed July 20, 2010 (Ex. 1006, “Subramanian”).

(1966). In our analysis, various factors may be considered, including the “type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field.” *In re GPAC, Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (quotation marks omitted). Furthermore, the prior art itself can reflect the appropriate level of ordinary skill in the art. *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001).

Relying on the declaration of Dr. Black, Petitioner contends that a person of ordinary skill in the art (POSITA) related to the ’447 patent would have had “a B.S. in electrical engineering, computer engineering, computer science, or a related field,” and “4-6 years of industry experience designing or architecting network switch systems.” Pet. 11 (citing Ex. 1003 ¶ 64). Patent Owner does not propose any definition for a POSITA. PO Resp. 6.

We adopt and apply Petitioner’s definition of a POSITA at the time of the claimed invention because, based on the record, this proposal is consistent with the ’447 patent, the asserted prior art, and is supported by the testimony of Dr. Black. We note that the applied prior art comports with this level of skill. *See Okajima*, 261 F.3d at 1355.

B. Claim Construction

We construe each claim “in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. § 42.100(b). Under this standard, claim terms are generally given their plain and ordinary meaning as would have been understood by a POSITA at the time of the invention and in the context of the entire patent disclosure. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc).

Petitioner contends that it “has applied at least the plain and ordinary meaning and the construction entered by the District Court for ‘multicast index,’ which is ‘a unique identifier assigned to an ingressing multicast flow.’” Pet. 11–12 (citing Ex. 1010, 4). Petitioner also contends that it has applied the construction “agreed to by the parties in the co-pending district court litigation for ‘aggregation switch,’ which is ‘switch residing at the aggregation layer.’” *Id.* at 12 (citing Ex. 1011, 5). In its obviousness arguments, Petitioner further contends that claim limitation “database” should be interpreted as “an organized collection of data,” because the ’447 patent does not describe or claim any particular database such as a relation database, and the plain meaning according to multiple dictionary definitions encompasses this definition. *Id.* at 25.

Patent Owner does not propose a construction for any terms of the challenged claims. *See generally* PO Resp. However, Patent Owner contends that, because “Petitioner has applied **at least** the plain and ordinary meaning **and** the construction entered by the District Court for ‘multicast index,’” and “also applied the construction agreed to by the parties in the co-pending district court litigation for ‘aggregation switch.’” *Id.* at 6–7 (citing Pet. 12); *see also* PO Sur-reply 1. Patent Owner further contends that “[t]he Petition is unclear as to the required claim construction and what construction it actually applies.” PO Resp. 7. In its arguments addressing obviousness, Patent Owner does not take issue with the Petition’s proposed construction of “database.” *Id.* at 8–12 (citing Pet. 25); *see also* PO Sur-reply 1.

We determine that it is unnecessary to construe any claim term expressly to resolve the disputed issues before us. *See, e.g., Realtime Data,*

LLC v. Iancu, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

C. Principles of Law

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) objective evidence of nonobviousness.⁴ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

*C. Obviousness over Sane and Subramanian under
35 U.S.C. § 103*

Petitioner contends that claims 1–6 and 12–17 of the ’447 patent would have been obvious over Sane and Subramanian. Pet. 12–66; *see also* Pet. Reply 2–13. In response, Patent Owner contends Petitioner fails to prove any of the challenged claims would have been obvious over Sane and Subramanian. PO Resp. 6–18. In particular, Patent Owner contends that the asserted combinations fail to disclose key elements of claims 1 and 15. *Id.*

⁴ The present record does not include any objective evidence of nonobviousness.

at 7–18; *see also* PO Sur-reply 1–22. We summarize the asserted prior art below.

1. Sane

Sane, titled “Virtual Port Channel Switches with Distributed Control Planes,” is a U.S. patent directed to an apparatus that includes a multi-chassis trunk (MCT) port for connection to an MCT in communication with a switch, and a multi-chassis EtherChannel (MCEC) manager for creating an MCEC comprising links in communication with a network device and links connecting the switch to the network device. Ex. 1005, codes (54), (57). The MCEC manager transmits messages to the switch to synchronize state for the MCEC. *Id.* at code (57).

An illustration of Sane’s network topology is depicted in Figure 4, reproduced below:

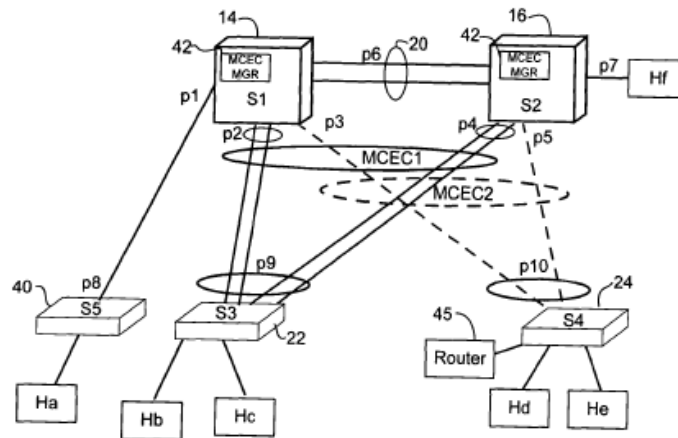


FIGURE 4

Figure 4 illustrates a network including MCEC (aggregation) switch 14 (S1) in communication with MCEC (aggregation) switch 16 (S2) via MCT 20, access switch 22 (S3), access switch 24 (S4), and access switch 40 (S5). *Id.* at 5:11–13. MCEC switch 16 (S2) is in communication

with MCEC switch 14 (S1), access switch 22 (S3), and access switch 24(S4). *Id.* at 5:13–15. Access switch 40 (S5) is connected to host Ha, access switch 22 (S3) is connected to host Hb and host Hc, access switch 24 (S4) is connected to host Hd and host He, and MCEC switch 16 (S2) is connected to host Hf. *Id.* at 5:15–18.

As shown in Figure 4, each MCEC switch 14, 16 (S1, S2) includes MCEC manager 42. *Id.* at 4:48–49. MCEC manager 42 provides a repository of MCEC configuration and running status, participates in port bringup sequences of the MCT as well as MCEC exchanges configuration information between MCEC switches, establishes peer link adjacency, and runs a heartbeat mechanism that checks communication between the two MCEC switches and ensures the correct state for MCEC links. *Id.* at 4:49–58.

Sane’s multicast flow including “multicast control plane [Internet Group Management Protocol] IGMP snooping” is described with reference to Figure 4, setting forth an example in which host Hb is interest in group G1 and router 45 behind access switch 24 (S4), and host Hb is then added to group G1. *Id.* at 6:30–35. The flow begins with host Hb sending an IGMP report to access switch 22 (S3), which in turn sends the IGMP report toward the router ports. *Id.* at 6:36–37. In this example, the load balancing algorithm picks the path towards MCEC switch 14 (S1) which in turn puts link p2 on its outgoing interface (oif) list for group G1 and forwards the IGMP report towards router port p3 leading to access switch 24 (S4). *Id.* at 6:38–43.

MCEC switch 14 (S1) also forwards a software IGMP synchronization message to its peer MCEC switch 16 (S2) that includes the

original MCEC report and MCEC port number MCEC1. *Id.* at 6:43–47. Once MCEC switch 16 (S2) receives the IGMP software update, it updates its multicast forwarding state (oif-list) for group G1, which includes local port p4 translated from port number MCEC1 from MCEC switch 14 (S1). *Id.* at 6:47–51. MCEC switch 16 (S2) acts on the software IGMP synchronization message similar to its IGMP snooping functionality, wherein, as part of IGMP snooping function, it also forwards the IGMP report toward the router port. *Id.* at 6:52–55. If host Hf, for example, sources multicast packets for group G1, MCEC switch 16 (S2)’s oif-list for group G1 includes local port p4 that leads to host Hb as well as port p5 that lead to access switch 24 (S4) and router 45. *Id.* at 6:65–7:1.

The forwarding of IGMP protocol packets is configured so that IGMP reports received at one MCEC switch are also forwarded to its peer MCEC switch. *Id.* at 7:3–5. In this way, the multicast forwarding state remains in sync on both the MCEC switches. *Id.* at 7:5–6.

Network device 80, such as an MCEC switch implementing the embodiments above, interfaces with physical media via a plurality of line cards. *Id.* at 10:7–8. As packets are received, processed, and forwarded by the network device, they are stored in a packet memory 88. *Id.*

2. Subramanian

Subramanian, titled “Packet Forwarding Using Multiple Stacked Chassis,” discloses a multiple physical switch/router chassis that operates without special stacking hardware or stacking channels. Ex. 1006, codes (54), (57). In particular, Subramanian relates to a single packet network device configured to perform both switching and routing, referred to as a “packet switch.” *Id.* at 1:22–26. A packet switch comprises a chassis with

an electrical backplane, wherein the packet switch accommodates line cards, switch fabric cards, and route processing managers (RPMs). *Id.* at 1:24–33.

RPMs control all aspects of the overall operation of the chassis. *Id.* at 2:66–67. Each RPM comprises three processors: a control processor which controls the overall operation of the switch, and two route processors which run different routing/switching protocols, communicate with external peers, and program the line cards to perform correct routing and switching. *Id.* at 3:5–10. In a stacked chassis, line card CPUs communicate with the stack master RPM to administer protocols, keep hardware tables synchronized, etc. *Id.* at 7:32–35.

The stack master RPM creates an inter-process communication (IPC) packet and adds an ethernet header identifying the final destination line card, a switch fabric header identifying the exact link aggregation group (LAG) stacking port on which the packet should be sent to the other chassis, and an ethernet header identifying the line card which has the corresponding port. *Id.* at 7:66–8:6. Once the IPC packet reaches the line card, the line card reads and strips the ethernet header and switch fabric headers, and the packet is then queued for egress out of the stacking port. *Id.* at 8:7–10.

In multicast operations, the multicast media access control (MAC) address is programmed into a table with a multicast group identification (MGID) for the group serving as the egress port, wherein each MGID is distributed to all line cards with a list of all ports on all chassis that belong to the group. *Id.* at 15:56–61. All line cards are informed of the MGID and egress processing index (EPI) for the entire multicast group, with a description of all ports on all chassis that are part of the group. *Id.* at 17:33–

35. Each line card programs a local flow table with the MGID and EPI, and programs the hardware MGID/EPI table with all ports in the local chassis, including the stacking port. *Id.* at 17:36–38. When a multicast packet is received at a port on a chassis, the destination multicast IP address causes the line card to perform a lookup on the flow table, which then returns the MGID/EPI at local port association. *Id.* at 17:40–43. The MGID/EPI indicates two ports located on the line card.

3. Analysis

Petitioner contends that “[t]he ’447 patent describes and claims known IP multicast snooping and [multi-chassis] MC-LAG using a global multicast index,” wherein Sane teaches “nearly all of the claim elements, with the exception of some implementation details that Sane leaves to the [POSITA]’s discretion—but which are also taught by Subramanian.”

Pet. 17. In particular, Petitioner contends that a POSITA implementing Sane “could have, and would have, implemented Sane’s multicast using Subramanian’s global MGID and EPI indexes.” *Id.* at 18. According to Petitioner, Sane’s MCEC switches synchronize their multicast processing and provide multicast forwarding of packets, and although Sane leaves the implementation details of this synchronization to the POSITA, Subramanian provides these details using “global MGID and EPI indexes” to provide synchronized multicast lookups for an MC-LAG like those found in Sane. *Id.*

In response, Patent Owner argues that Sane and Subramanian do not disclose “a database maintaining IP multicast snooping information,” recited in claims 1 and 15 (PO Resp. 7–12; PO Sur-reply 2–17), or “wherein the chassis management module further determines a multicast index for a

received multicast traffic flow,” recited in claims 1 and 15 (PO Resp. 12–18; PO Sur-reply 17–22).

Having reviewed Petitioner’s and Patent Owner’s contentions and supporting evidence in the complete record, we determine Petitioner has demonstrated by a preponderance of the evidence that the challenged claims would have been obvious over Sane in view of Subramanian. As an initial matter, we address in detail Petitioner’s contentions and Patent Owner’s arguments with respect to the limitations of independent claims 1 and 15.

a. Independent claims 1 and 15

- i. *Preamble – an “aggregation switch in a multi-chassis system,” “performing Internet Protocol (IP) multicast snooping” (claims 1 and 15).*

Petitioner contends that, “[t]o the extent it is limiting, the preamble is taught by Sane.” Pet. 18. In particular, Petitioner argues that the claimed “aggregation switch” is taught by either of Sane’s identical aggregation switches S1 or S2 (switches 14 and 16), which make up “an MC-LAG system that Sane alternatively refers to as a ‘Multi-Chassis EtherChannel (MCEC)’ or a ‘Virtual Port Channel (VPC).’” *Id.* (citing Ex. 1005, 1:5–10, 1:55–2:2, 2:49–53, 3:4–46, Fig. 1). Relying on Dr. Black’s testimony, Petitioner contends that Sane’s aggregation switches S1 and S2 residing at the aggregation layer are analogous to the aggregation switches in the ‘477 patent (*id.* at 19 (citing Ex. 1001, 1:61–62; Ex. 1005, 3:4–22, Fig. 1; Ex. 1003 ¶ 92)), and that the switches are in a multi-chassis system because “they make up a ‘Multi-Chassis Etherchannel,’ in which two switches in two separate chassis (S1 and S2) coordinate to behave as a single logical switch.” *Id.* (citing Ex. 1005, 3:30–61; Ex. 1003 ¶ 92).

Petitioner further contends that Sane teaches the claimed “snooping.” Pet. 19. Petitioner points out that the ’447 patent provides IGMP snooping as its claimed snooping, and contends that “Sane teaches the same thing.” *Id.* (citing Ex. 1001, 2:58–3:5, 18:51–59; Ex. 1005, 6:30–7:8 (“The multicast control plane (IGMP snooping) is also described as part of this flow”).

Although Patent Owner does not present arguments addressing the specific merits of Petitioner’s contentions with respect to the preambles (*see generally* PO Resp.; PO Sur-reply), the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

We find persuasive Dr. Black’s un rebutted testimony that Sane’s system provides a “aggregation switch” and “snooping” because it is consistent with the teachings of Sane. *See* Ex. 1003 ¶¶ 91–93. In particular, Sane discloses aggregation switches S1 and S2 residing at the aggregation layer (Ex. 1005, 3:4–22, Fig. 1). In Sane, in a “Multi-Chassis EtherChannel,” two switches in the two separate chassis (S1 and S2) coordinate to behave as a single logical switch. *Id.* at 3:30–61. Further, Sane discloses that switches S1 and S2 comprise IGMP snooping functionality. *Id.* at 6:30–7:8.

We agree with Dr. Black that “S1 and S2 are switches because they are expressly called aggregation switches and reside ‘at the aggregation layer.’” Ex. 1003 ¶ 91 (citing Ex. 1001, 1:61–62; Ex. 1005, 3:4–22, cl. 13, Fig. 1). Further, “S1 and S2 are part of a multichassis system because they form a ‘Multi-Chassis EtherChannel.’” *Id.* We also agree that “Sane teaches the same variety of IP multicast snooping used in the ’447 patent.” *Id.* ¶ 93 (citing Ex. 1001, 2:58–3:5, 18:51–59; Ex. 1005, 6:30–7:8). As Dr.

Black explained, “IGMP snooping involves using the snooped IGMP packets and reports to obtain a map for multicast ports used for layer 2 multicast.” *Id.*

Based on the complete record presented, we determine that Petitioner has persuasively shown that Sane in view of Subramanian teaches an “aggregation switch in a multi-chassis system” for “performing Internet Protocol (IP) multicast snooping,” as recited in claims 1 and 15.⁵

- ii. *a “plurality of virtual fabric link (VFL) ports coupled to a VFL,” “the VLF is connected to a remote aggregation switch” (claim 1), wherein the “remote aggregation switch is active and in a separate physical chassis” (claims 1 and 15).*

Petitioner contends that Sane teaches that MCEC aggregation switches S1 and S2 are located in “separate physical chassis labeled 14 and 16.” Pet. 20 (citing Ex. 1005, 2:50–51, 3:4–52, Figs. 1, 4–10). Aggregation switches S1 and S2 are coupled ““via a multi-chassis trunk (MCT),’ i.e., the claimed virtual fabric link (VFL).” *Id.* (citing Ex. 1005, 1:55–2:2, 3:7–9, Figs. 1–10). Relying on Dr. Black’s testimony, Petitioner further contends that aggregation switches S1 and S2 are “remote” to each other because they are not in the same physical chassis. *Id.* (citing Ex. 1005, 1:55–2:2, 3:7–9, Figs. 1, 4–10; Ex. 1003 ¶ 94).

⁵ The issue of whether the preambles are limiting need not be resolved because, regardless of whether the preambles are limiting, Petitioner has sufficiently shown that the recitations of “aggregation switch in a multi-chassis system” and “performing Internet Protocol (IP) multicast snooping” in the preambles of claims 1 and 15 are taught by Sane in view of Subramanian. *See Realtime Data, LLC v. Iancu*, 912 F.3d at 1375.

Petitioner also contends that Sane’s aggregation switches S1 and S2 are “active,” as aggregation switches S1 and S2 “are redundant and all links are forwarding traffic.” Pet. 22–23 (citing Ex. 1005, 5:10–7:8, 8:39–46; Ex. 1003 ¶ 98).

Although Patent Owner does not present arguments in its Response addressing the specific merits of Petitioner’s contentions with respect to this claim limitation (*see generally* PO Resp.), the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378.

We find persuasive Dr. Black’s un rebutted testimony, which is consistent with the teachings of Sane. In particular, we agree that either switch S1 or switch S2 satisfies the limitation of an “remote aggregation switch” since S1 and S2 are separate physical switches in different chassis, with the remaining switch being the “aggregation switch.” *See* Ex. 1003 ¶¶ 94–98 (citing Ex. 1005, 3:4–52; Figs. 1, 4–10). We credit Dr. Black’s testimony that “[t]he switches are distinguished in Sane not by any difference in their characteristics and operation, but only by the particular connections and negotiated roles.” *Id.*

Based on the complete record presented, we are persuaded that Petitioner has demonstrated that Sane in view of Subramanian teaches a “plurality of virtual fabric link (VFL) ports coupled to a VFL,” wherein “the VFL is connected to a remote aggregation switch” as recited in claim 1, and that the “remote aggregation switch is active and in a separate physical chassis,” as recited in claims 1 and 15.

- iii. a plurality of “external ports coupled to at least one edge node and at last one network node” (claims 1 and 15).

Petitioner contends that Sane’s aggregation switches S1 and S2 “include a plurality of external ports coupled to edge (access) nodes and network (core) nodes.” Pet. 23 (citing Ex. 1005, Fig. 1). In particular, Petitioner contends that “[e]ach of aggregation switches S1 and S2 includes a plurality of external ports” (*id.* at 24 (citing Ex. 1005, 5:15–20, 4:51, 5:10–25, 5:51–54, 6:13–16, Fig. 3; Ex. 1003 ¶ 102; Ex. 1005, 2:3–11)), and that “[t]hese are external ports connected to external nodes such as the network core and edge nodes.” *Id.* (citing Ex. 1005, 4:51, 5:10–25, 5:51–54, 6:13–16; Ex. 1003 ¶ 102).

According to Petitioner, “MCEC switches 14, 16 are in communication with a core network 18 (Layer 3 (L3) network).” Pet. 24 (citing Ex. 1005, 3:4–7, 2:55–59, 5:15–18; Ex. 1003 ¶ 103). Further, Petitioner contends that MCEC switch “S1 is connected to [MCEC switches] S3 and S4 via ports p2 and P3, respectively,” MCEC switch “S2 is connected to [MCEC switches] S3 and S4 via ports p4 and P5, respectively,” and MCEC switches “S3 and S4 are edge nodes located on the edge layer and connect to hosts.” *Id.* at 24–25 (citing Ex. 1005, 3:23–30, 5:15–16, Figs. 1, 4; Ex. 1003 ¶ 103).

Although Patent Owner does not present arguments in its Response addressing the specific merits of Petitioner’s contentions with respect to this claim limitation (*see generally* PO Resp.), the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378.

We find persuasive Dr. Black’s un rebutted testimony, which is consistent with the teachings of Sane. In particular, we agree that a POSITA

would have understood that “Sane discloses core nodes when it discloses that ‘core network 18’ is a ‘Layer 3 (L3) network’—since a layer 3 network includes switches and routers capable of layer 3 processing, which are nodes.” Ex. 1003 ¶ 103. Accordingly, we are persuaded that Sane’s external ports, connected to the edge nodes, are also connected to at least one network node.

Based on the complete record presented, we are persuaded that Petitioner has demonstrated that Sane in view of Subramanian teaches a plurality of “external ports coupled to at least one edge node and at least one network node” as recited in claims 1 and 15.

iv. a “database maintaining IP multicast snooping information” (claim 1)

Petitioner contends that, in Sane, switches S1 and S2 obtain IP multicast snooping information, such as an IGMP packet or an IGMP report, intercepted *en route* to its intended recipient to determine where to send multicast packets. Pet. 26 (citing Ex. 1005, 6:30–7:8; Ex. 1003 ¶ 105). According to Petitioner, Sane teaches that packets such as the IGMP packets containing the IGMP reports “may be stored in packet memory 88 as they are processed for forwarding.” *Id.* (citing Ex. 1005, 10:7–12).

Furthermore, Petitioner contends that the MCEC manager in each of aggregation switches S1 and S2 provides a “repository” for such information, including “VPC⁶ related databases.” Pet. 27 (citing Ex. 1005,

⁶ Petitioner contends that “VPC (Virtual Port Channel) is synonym for MCEC.” Pet. 27 n.9 (citing Ex. 1005, 2:50–51). Patent Owner does not dispute Petitioner’s VPC/MCEC contention. *See generally* PO Resp.

4:48–64). Relying on the testimony of Dr. Black, Petitioner contends that a POSITA would have understood that Sane’s MCEC manager maintains the intercepted snooping in its VPC/MCEC related database. *Id.* (citing Ex. 1005, 3:12–16, 2:49–53; Ex. 1003 ¶¶ 105, 107). In particular, Petitioner refers to Dr. Black’s testimony that a POSITA would have known that “Sane intercepts and stores the snooping information in an organized collection of data, i.e., a database, as was commonplace at the time.” *Id.* (citing Ex. 1003 ¶ 105; Ex. 1018 (Sapkota, US No. 8,611,270 B1), 2:35–40 (“When the [access point] AP intercepts an IGMP packet . . . , the IP Multicast subscription information . . . [is] recorded by IGMP Snooping software into an IGMP snooping database”), 6:60–7:3).

Patent Owner argues that, although Petitioner identifies and relies on Sane’s IGMP packet or IGMP report as allegedly mapping to the required “multicast snooping information,” Petitioner “fails to show that Sane discloses or renders obvious **a database** maintaining IGMP packets or IGMP reports.” PO Resp. 7 (citing Pet. 26). In particular, Patent Owner contends that “nowhere in Sane is there any disclosure of collecting IGMP packets or reports,” wherein “the only discussion of IGMP packets, snooping, or reports in Sane only discloses forwarding a[n] IGMP report and nothing more.” *Id.* at 8 (citing Ex. 1005, 6:30–7:8) (emphasis omitted). Further, according to Patent Owner, there is no disclosure of “collecting IGMP reports or any kind of organization of IGMP reports.” *Id.* (emphasis omitted); *see also id.* at 10 (citing Ex. 1005, 1:67–2:14, 2:39–54, 3:12–16, 4:21–63, 6:30–7:9, 9:20–25) (same argument). According to Patent Owner, although Dr. Black testified that “databases were known in the art, . . . that is not sufficient” for a showing of obviousness. *Id.*

In its Sur-reply, Patent Owner acknowledges that Sane discloses that “[t]he MCEC manager also provides hardware state management and coordination with the peer switch to export VPC related databases.” PO Sur-reply 15 (citing Ex. 1005, 4:56–58). However, Patent Owner adds that “Sane does not expressly state that either an IGMP packet or an IGMP report are ever *stored* in an *exported* VPC related database, let alone either . . . is *maintained* in ‘a database’ located locally at the same aggregation switch.” *Id.* Thus, Patent Owner contends that Petitioner fails to “explain how merely snooping packets or forwarding/exporting packets onward constitutes ‘a database maintaining IP multicast snooping information.’” *Id.*

Patent Owner advanced similar arguments prior to institution that we found unavailing. *See* Dec. Inst. 18–20. On the complete record at trial, we determine that Petitioner has demonstrated by a preponderance of the evidence that Sane teaches a database maintaining IGMP packets or IGMP reports,” as recited in claim 1.

Sane discloses that each MCEC switch S1 (14), S2 (16) includes MCEC manager 42, wherein MCEC manager 42 “provides repository of MCEC configuration and running status, . . . exchanges configuration information between MCEC switches, establishes peer link adjacency (enabling common VPC transport layer), and runs a heartbeat mechanism that checks communication between the two MCEC switches and ensures correct state for MCEC links.” Ex. 1005, 4:48–56; Fig. 4. Further, MCEC manager 42 “provides hardware state management and coordination with the peer switch to export VPC related databases.” *Id.* at 4:56–58.

In Sane’s IGMP snooping process with a path towards switch S1 (14), switch S1 forwards a software IGMP synchronization message to peer

switch S2 (16) including the original IGMP report. Ex. 1005, 6:30–46. Switch S2 receives the IGMP software update, and acts on the software synchronization message similar to its IGMP snooping functionality, wherein as part of its IGMP snooping functionality, it may forward the IGMP report towards the router port. *Id.* at 6:46–55.

Based on the complete record presented at trial, we are persuaded that the MCEC manager in each of aggregation switches S1 and S2 “provides a database for, as examples, IGMP packets containing IGMP reports, including the disclosed VPC/MCEC related databases.” Pet. Reply 4–8; *see also* Pet. 27. Petitioner’s contention is supported by Dr. Black’s testimony that a POSITA would have known that, as commonplace at the time of the ’447 patent, switches such as Sane’s aggregation switches S1 and S2 intercept and record snooping information in a database. Ex. 1003 ¶ 105. As Dr. Black testified, “storing snooped packets and/or their information in a database” as “common to virtually all IGMP snooping implementation.” *Id.* ¶ 57. We credit Dr. Black’s testimony, which is consistent with the teachings of Sane, that “[a] person of skill in the art would [have] underst[oo]d that snooping information is stored in the VPC[/MCEC] related database [of Sane] because it is VPC[/MCEC] related information that is synchronized between switches.” *Id.* ¶ 74. That is, we credit Dr. Black’s testimony that a POSITA “would [have] recognize[d] from Sane’s disclosure that IGMP snooping information is VPC related information because it is shared over the MCT as part of cording forwarding state,” and thus, the POSITA “would have understood that the MCEC manager maintains the IGMP snooping information related database.” *Id.* ¶ 105. Here, Dr. Black supported his testimony with a contemporaneous reference. *See* Ex. 1018,

2:35–40 (“When the AP intercepts an IGMP packet . . . , the IP Multicast subscription information . . . [is] recorded by IGMP Snooping software into an IGMP snooping database.”).

Although Patent Owner contends that Petitioner fails to explain “how merely snooping packets or forwarding/exporting packets onward constitutes ‘a database maintaining IP multicast snooping information’” (PO Sur-reply 15–16), as Dr. Black points out, “[i]t is undisputed that Sane’s aggregation switches perform IGMP snooping,” wherein the switches “copy or extract payload information” and “examin[e] packets” in addition to forwarding the packets. Ex. 1003 ¶¶ 40, 43. According to Dr. Black, a POSITA would have understood that “to maintain and efficiently access the ICMP snooping information (for example to update forwarding state, compose the software IGMP synchronization message, or store the message prior to transmission) the switches would store the information in a database.” *Id.* ¶ 105. We credit Dr. Black’s testimony, which is consistent with the teachings of Sane, that a POSITA would have understood that Sane’s MCEC manager maintains the intercepted snooping information in Sane’s VPC/MCEC related database. *Id.* ¶¶ 105, 107. As Petitioner explained during Oral Argument, Sane’s aggregation switches S1 and S2 “update[e] [the] forwarding state,” which is “IGMP snooping” and “not simply forwarding packets.” Tr. 19:11–18.

Petitioner alternatively cites Sane’s packet memory 88 for teaching the recited database (Pet. 26 (citing Ex. 1005, 10:7–12)), and Patent Owner puts forth arguments related to this alternative. *See* PO Resp. 9–11; PO Sur-reply 3–11. For example, Patent Owner argues that “‘maintaining’ must require something more than merely ‘storing’ or ‘sharing’ the recited ‘IP

multicast snooping information” in packet memory 88. PO Sur-reply 9. We need not address Petitioner’s contentions and Patent Owner’s arguments regarding Sane’s packet memory 88 because we are persuaded that Sane’s MCEC manager in each of aggregation switches S1 and S2 provides the database.

Accordingly, based on the complete record presented, we are persuaded that Petitioner has demonstrated that Sane and Subramanian teaches a “database maintaining IP multicast snooping information,” as recited in claim 1.

- v. *a “chassis management module” (claim 1); for “receiving the snooping information via at least the external ports,” “storing the snooping information within database,” and “sharing the snooping information substantially in real-time with [a] remote aggregation switch” via a “virtual fabric link (VFL)” (claims 1 and 15)*

Petitioner contends that Sane’s switches S1 and S2 each have an “MCEC manager” that “receives and stores IGMP snooping information,” and a “multicast control plane” that “receives and stores such information,” wherein each switch’s MCEC manager provides “part of that switch’s ‘control plane’ functionality, i.e., the claimed chassis management module (‘CMM’).” Pet. 28–29 (citing Ex. 1005, 1:67–2:14, 2:49–54, 3:12–16, 4:21–63, 6:30–7:9, 9:20–25; Ex. 1003 ¶¶ 109–110). According to Petitioner, the control plane for each of Sane’s aggregation switches S1 and S2 receives the claimed snooping information, “e.g., IGMP reports,” via external ports, and this snooping information is intercepted and read by aggregation switches S1 and S2 as part of their IGMP snooping functionality. *Id.* at 29 (citing Ex. 1005, 6:30–7:8; Ex. 1003 ¶ 111).

Furthermore, Petitioner contends that the MCEC manager in each of aggregation switches S1 and S2 provides a “repository” for such information, including “VPC related databases.” Pet. 27 (citing Ex. 1005, 4:48–64).

Petitioner then contends that Sane’s aggregation switches S1 and S2 also share this snooping information substantially in real-time with the remote aggregation switch via the VFL, “i.e., Sane’s MCT.” Pet. 29 (citing Ex. 1005, 6:30–7:8). Petitioner contends that, for example, Sane’s aggregation switch S1 shares snooping information with aggregation switch S2 by forwarding a “software IGMP synchronization message” to its peer MCEC switch S2 that includes “the original IGMP report and MCEC port number” via the MCT link. *Id.* at 29–30 (citing Ex. 1005, 6:44–59). According to Petitioner, Sane’s snooping and sharing of snooping information is performed “substantially in real-time so that ‘multicast forwarding state remains in sync on both of the MCEC switches.’” *Id.* (citing Ex. 1005, 6:30–7:8; Ex. 1003 ¶ 113).

Although Patent Owner does not present arguments in its Response addressing the specific merits of Petitioner’s contentions with respect to this claim limitation (*see generally* PO Resp.), the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378.

As discussed above in Section II(C)(3)(a)(iv), we find persuasive Petitioner’s reliance on Sane’s MCEC manager in switches S1, S2 and multicast control plane for teaching the receipt and storage of IGMP snooping information, wherein “the MCEC manager in each of aggregation switches S1 and S2 provides a repository for such information.” Pet. 27–29. We are persuaded that the MCEC manager in each of aggregation switches

S1, S2 provides a VPC/MCEC related database for IGMP packets containing IGMP reports. Pet. 27; Pet. Reply 4–8. We credit Dr. Black’s testimony, which is consistent with the teachings of Sane and is supported by a contemporaneous reference, that a POSITA would have known that switches such as Sane’s aggregation switches S1 and S2 intercept and record snooping information in a database. Ex. 1003 ¶ 105 (citing Ex. 1018, 2:35–40).

We are also persuaded by Petitioner’s contention that Sane’s aggregation switches S1 and S2 share snooping information substantially in real-time via Sane’s MCT. Pet. 29 (citing Ex. 1005, 6:30–7:8). That is, we agree that Sane’s aggregation switch S1 forwards a software IGMP synchronization message to its peer MCEC switch S2 that includes the original IGMP report and MCEC port number via the MCT link. *Id.* at 29–30; *see also* Ex. 1005, 6:44–59. We credit Dr. Black’s testimony, which is consistent with the teachings of Sane, that Sane’s snooping and sharing of snooping information is performed “substantially in real-time” so that “multicast forwarding state remains in sync on both of the MCEC switches.” Ex. 1003 ¶ 113 (citing Ex. 1005, 6:30–7:8).

Accordingly, based on the complete record presented, we are persuaded that Petitioner has demonstrated that Sane and Subramanian teaches “receiving the snooping information,” and “storing the snooping information within a database,” as recited in claims 1 and 15. We are also persuaded by Petitioner’s contention that that Sane’s “MCEC manager” for each of switches S1 and S2 provides “part of that switch’s ‘control plane’ functionality,” wherein the control plane for each of Sane’s aggregation switches S1 and S2 receives the claimed snooping information, and switches

S1 and S2 then share this snooping information substantially in real-time with the remote aggregation switch via the VFL, “i.e., Sane’s MCT.” Pet. 28–29. Having reviewed all of Petitioner’s assertions, as well as the supporting evidence, we also determine on this record that Petitioner has persuasively shown that the combination of Sane and Subramanian teaches a “chassis management module” as recited in claim 1, and “sharing the snooping information” via a VFL, as recited in claims 1 and 15.

- vi. *the chassis management module further “build[s] respective forwarding vectors for multicast traffic flows received from the at least one network node . . . based on the snooping information” (claims 1 and 15)*

Petitioner contends that Sane’s chassis management module “CMM,” i.e., control planes in each of switches S1 and S2, build their respective forwarding vectors, i.e., “outgoing interface lists, called ‘oif-lists,’” for multicast flows. Pet. 30 (citing Ex. 1005, 6:30–7:8). Specifically, Petitioner contends that the control planes in switches S1 and S2 use the snooping information (e.g., IGMP packets and reports) to determine the oif-list for a given multicast group for its switch. *Id.* at 31 (citing Ex. 1005, 6:30–52, 6:65–7:2; Ex. 1003 ¶¶ 114–115). According to Petitioner, Sane’s oif-lists are the claimed “forwarding vectors” because the oif-lists are lists of the ports out of which switches S1 and S2 will forward multicast traffic. *Id.* (citing Ex. 1005, 4:36–52). Petitioner contends that, in Sane, switches S1 and S2 update their oif-lists when snooping themselves and when receiving snooping information shared by the switch’s peer switch (e.g., shared by S2 with S1). *Id.* (citing Ex. 1005, 6:40–54; Ex. 1003 ¶ 115).

Further, Petitioner contends that Sane's switches S1 and S2 also add to their oif-lists the ports that lead to routers and/or ports that lead to hosts. Pet. 31 (citing Ex. 1005, 6:65–7:2; Ex. 1003 ¶ 117). Relying on the testimony of Dr. Black, Petitioner contends that the oif-list for Sane's exemplary multicast group G1 is the forwarding vector for multicast traffic flow from any originator of group G1 multicast traffic, including multicast traffic from a network node. *Id.* (citing Ex. 1003 ¶ 117).

Patent Owner does not present arguments in the PO Response addressing the specific merits of Petitioner's contentions with respect to the this claim limitation. *See generally* PO Resp. Nevertheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378.

Here, we agree with Petitioner that Sane's control planes in switches S1 and S2 use the snooping information (e.g., IGMP packets and reports) to determine the oif-list for a given multicast group for its switch. Pet. 31; *see also* Ex. 1005, 6:30–52, 6:65–7:2. That is, we agree with Petitioner's contention that Sane's oif-lists are the claimed “forwarding vectors” because the oif-lists are lists of the ports out of which switches S1 and S2 will forward multicast traffic. Pet. 31; *see also* Ex. 1005, 4:36–52.

Based on the complete record presented, we are persuaded that Petitioner has demonstrated that Sane in view of Subramanian teaches that the chassis management module further “build[s] respective forwarding vectors for multicast traffic flows received from the at least one network node . . . based on the snooping information,” as recited in claims 1 and 15.

- vii. *the chassis management module
“determin[es] a multicast index for a
received multicast traffic flow to set -up
hardware paths for forwarding the received
multicast traffic flow to the external ports
. . . that requested the received multicast
traffic flow via the at least one edge node,”
“the multicast index being used globally
between the aggregation switch and the
remote aggregation switch” (claims 1 and
15)*

Petitioner contends that Sane discloses that each of switch S1's and switch S2's control planes build forwarding vectors for multicast traffic flows, and that Subramanian “determines a multicast index for a received multicast traffic flow,” namely its MGID and EPI. Pet. 32–33. Relying on Dr. Black's supporting testimony, Petitioner contends that a POSITA implementing Sane would have used multicast indexes as taught by Subramanian. Pet. 32–33 (citing Ex. 1003 ¶¶ 120–121). According to Petitioner, Subramanian's MGID and EPI, alone or together are “multicast indexes” because “each is ‘a unique identifier assigned to a received (ingressing) multicast flow.’” *Id.* at 33. In particular, Petitioner contends that MGID is an index for an ingressing multicast flow that identifies the output ports for that flow in a given VLAN, and Subramanian uses its EPI with its MGID to identify the output ports for the ingressing multicast flow. *Id.* at 33–34 (citing Ex. 1006, 11:36–38, 13:22–25, 14:28–35, 14:67–15:3, 15:56–61, 17:33–59; Ex. 1003 ¶¶ 122–125).

Petitioner contends that Sane uses IGMP snooping to identify requests for multicast traffic flows coming from any location, including edge nodes,

and hardware paths (oif-lists) are then updated to set up a hardware path to a VLAN that requested access through the edge node. Pet. 35–36 (citing Ex. 1005, 6:65–7:2, Fig. 4; Ex. 1006 ¶ 127). According to Petitioner, Sane’s aggregation switches S1 and S2 each operates a control plane that performs IGMP snooping and determines which ports should be on the oif-list for particular multicast groups. *Id.* at 38 (citing Ex. 1005, 6:30–7:2; Ex. 1003 ¶ 132). Although Petitioner acknowledges that Sane does not expressly disclose “the lower-level implementation details” regarding how to set up the hardware paths for forwarding multicast flows within aggregation switches S1 and S2, Petitioner relies on Subramanian for disclosing “such a switching configuration.” *Id.* at 38–39. In particular, Petitioner contends that Subramanian provides details of how an ingressing packet is processed through hardware lookup tables, using its global multicast indexes MGID and EPI, to determine how to forward the packet within and between the switches to the correct egress ports—“the ports that would be defined by Sane’s oif-list in the multicast context.” *Id.* at 40 (citing Ex. 1006, 14:18–17:60; Ex. 1005, 6:30–7:2; Ex. 1003 ¶¶ 133, 136).

In addition, Petitioner contends that Sane teaches sharing IGMP snooping information so that the multicast forwarding state remains in sync on the MCEC switches. Pet. 42–43 (citing Ex. 1005, 7:5–6). Relying on Dr. Black’s supporting testimony, Petitioner contends that a POSITA would have recognized that Subramanian’s global MGID and EPI achieve Sane’s goals of synchronized multicast forwarding state. *Id.* at 43 (citing Ex. 1003 ¶ 141). That is, “[b]y providing each MCEC switch with a complete picture of the multicast groups as described in Subramanian, Sane’s switches efficiently synchronize their multicast forwarding state and avoid

unnecessary processing and congestion.” *Id.* (citing Ex. 1006, 5:21–31; Ex. 1003 ¶ 141).

According to Petitioner, Subramanian’s switches determine the MGID and EPI for a multicast traffic flow when they assign the MGID and EPI to the flow as part of programming their local hardware tables. Pet. 34 (citing Ex. 1006, 15:56–59, 17:36–38). Further, according to Petitioner, Subramanian’s switches determine the MGID and EPI for a received multicast packet by looking up the MGID and EPI for that packet. *Id.* (citing Ex. 1006, 15:56–59, 17:39–44). That is, Subramanian’s determined MGID and/or EPI are used to set up hardware paths for forwarding the received (ingressing) multicast traffic flow to the external ports in a VLAN. *Id.*

Petitioner then contends that, “[b]y providing each MCEC switch with a complete picture of the multicast groups as described in Subramanian, Sane’s switches efficiently synchronize their multicast forwarding state and avoid unnecessary processing and congestion.” Pet. 42–43. Dr. Black also provides supporting testimony that a POSITA would have recognized that Subramanian’s global MGID and EPI achieve Sane’s goals of synchronized multicast forwarding state. Ex. 1003 ¶ 141.

Patent Owner argues that the Petition “completely fails to show that Sane alone or in combination with Subramanian discloses ‘**the chassis management module** further determines a multicast index.’” PO Resp. 12. According to Patent Owner, although Petitioner relies on Sane’s “MCEC manager” or “control plane” as mapping to the claimed “chassis management module,” Subramanian does not disclose “where its MGID and

EPI are determined,” but rather “simply assumes and uses a pre-existing MGID and EPI.” *Id.* 12–13 (emphasis omitted).

Patent Owner contends that, in Subramanian, “all the operations involving the MGID or EPI in Subramanian is located at Subramanian’s ‘line card.’” PO Resp. 13–14. According to Patent Owner, the Petition and Dr. Black “implicitly place processing and any alleged ‘determining’ of the MGID and EPI in the hypothetical combination of Sane and Subramanian also in the ‘line cards.’” *Id.* at 14–15 (citing Pet. 38–39; Ex. 1003 ¶ 134). Patent Owner argues that the ’447 makes clear a line card is “*not* the same as the chassis management module.” *Id.* at 14.

Patent Owner is advancing similar arguments to those prior to institution that we found unavailing. *See* Dec. Inst. 24–27.

As Patent Owner acknowledges, Petitioner identifies and relies on Sane’s “MCEC manager” or “control plane” as mapping to the claimed “chassis management module” (PO Resp. 12; Pet. 30; *see also* Ex. 1005, 6:30–7:8), rather than Subramanian’s line cards. In particular, Petitioner contends that Sane’s aggregation switches S1 and S2 each operates a control plane that performs IGMP snooping and determines which ports should be on the oif-list for particular multicast groups. Pet. 38; *see* Ex. 1005, 6:30–7:2.

On the complete record at trial, we determine that Petitioner has demonstrated by a preponderance of the evidence Sane teaches that “the chassis management module further determines a multicast index,” as recited in claim 1. In particular, we agree with Petitioner’s reliance on Sane’s control plane as a “chassis management module” that performs IGMP snooping to determine which ports should be on the oif-list for

particular multicast groups, and Petitioner's reliance on Subramanian's MGID and EPI as the determined multicast index. Pet. 32, 38–39.

“The test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference. . . . Rather, the test is what the combined teachings of those references would have suggested to those of ordinary skill in the art.” *In re Keller*, 642 F.2d 413, 425 (CCPA 1981). Here, the question is not whether a POSITA would have performed the determining of MGIP or EPI at Subramanian's line card, but rather, what the combined teachings of Sane's use of control planes and Subramanian's use of MGID and EPI to determine the output ports would have suggested to a POSITA.

Petitioner relies on Sane for disclosing the use of its control plane to build forwarding vectors for multicast traffic flows, while Subramanian uses its EPI with its MGID to identify the output ports for the ingressing multicast flow. Pet. 32–34. Thus, although Patent Owner contends that “nothing in Subramanian discloses where its MGID and EPI are determined” (PO Resp. 12), Petitioner establishes that a POSITA would have found it obvious to modify to *Sane's control plane* for building forwarding vectors for multicast traffic flows *to include using Subramanian's MGID and EPI*, i.e., multicast indexes. Pet. 32–33 (emphasis added).

Although Patent Owner contends that the Petition and Dr. Black “implicitly place processing and any alleged ‘determining’ of the MGID and EPI in the hypothetical combination of Sane and Subramanian also in the ‘line cards’” (PO Resp. 14–15), Petitioner argues that in Petitioner's proposed combination, “Sane's control plane (i.e., the claimed chassis management module), first determines the MGID and EPI and **then** provides

them to the line cards.” Pet. Reply 9–10 (citing Pet. 32–36, 39–40, 42–43; Ex. 1003 ¶¶ 120, 132–137, 140–142; Dec. Inst. 22–25). In particular, Petitioner cites to Dr. Black’s testimony that “in L3 multicast, the MGID and EPI [are] **provided to** all line card on all chassis along with a list [of] all ports that are members of that multicast group,” while “in L2 multicast, the MGID is **distributed to** all line cards on all chassis with all ports that belong to the multicast group.” Pet. 9 (citing Ex. 1003 ¶ 125; Ex. 1006, 17:33–35, 15:58–61).

We agree with Petitioner that Sane discloses using IGMP snooping to identify requests for multicast traffic flows coming from an edge node, and oif-lists are then updated to set up a hardware path to a VLAN that requested access through the edge node. Pet. 35–36; *see also* Ex. 1005, 6:65–7:2, Fig. 4. In Sane, aggregation switches S1 and S2 each operates a control plane that performs IGMP snooping and determines which ports should be on the oif-list for particular multicast groups. *See* Ex. 1005, 6:30–7:2. We also agree with Petitioner that Subramanian discloses using its global multicast indexes MGID and EPI, to determine how to forward the packet within and between the switches to the correct egress ports. Pet. 40; *see also* Ex. 1006, 14:18–17:60. We credit Dr. Black’s testimony, which is consistent with the teachings of Sane and Subramanian, that Sane “provides detailed examples of embodiments that use received IGMP snooping information to determine the ports to receive a multicast packet” (Ex. 1003 ¶ 75 (citing Ex. 1005, 6:30–7:2)), and that although Sane does not “explain how multicast group and egress port information are programmed into hardware . . . Subramanian does provide such details” wherein “the use of a

multicast index would have been known to a person of ordinary skill in the art.” *Id.* ¶ 76.

We agree with Petitioner that, in the combination of Sane and Subramanian, “the control plane determines the global multicast index in conjunction with determining the claimed forwarding vector and distributes the index throughout the MCEC/VPC switches ‘to set-up hardware paths for forwarding the received multicast traffic flow to the external ports.’” Pet. Reply 8 (citing Ex. 1005, 6:30–7:8, 7:53–63; Ex. 1006, 10:18–28, 15:56–67, 17:26–38; Ex. 1003 ¶¶ 80–82, 116, 120, 123–127, 130–142). That is, we find Petitioner has persuasively established that a POSITA would have found it obvious to modify to Sane’s control plane for building forwarding vectors for multicast traffic flows to include using Subramanian’s MGID and EPI, i.e., multicast indexes. Pet. 32–33.

Accordingly, based on the complete record presented, we are persuaded that Petitioner has demonstrated that the combination of Sane and Subramanian teaches that the chassis management module “determin[es] a multicast index for a received multicast traffic flow to set-up hardware paths for forwarding the received multicast traffic flow to the external ports in a virtual local area network (VLAN) that requested the received multicast traffic flow via the at least one edge node,” wherein “the multicast index being used globally between the aggregation switch and the remote aggregation switch,” as recited in claims 1 and 15.

b. Dependent claims 2–6, 12–14, 16, and 17

Petitioner provides detailed explanations as to how Sane alone or in combination with Subramanian teaches the limitations recited in dependent claims 2–6, 12–14, 16, and 17. Pet. 47–66 (citing Ex. 1005, 1:55–64, 2:3–5,

3:4–22, 3:31–61, 4:16–36, 4:48–63, 5:10–25, 5:33–35, 5:63–65, 6:30–7:8, 9:15–30, 9:60–10:20, Figs. 1, 4; Ex. 1006, 1:31–33, 2:66–67, 4:3–8, 5:32–45, 6:2–52, 7:40–42, 7:48–8:40, 10:4–17, 10:58–62, 12:12–51, 13:11–15, 13:49–53, 18:54–56, Figs. 4–6, 8; Ex. 1003 ¶¶ 155–157, 159–160, 162–165, 167–169, 171–178, 181–183). Although Patent Owner does not present arguments in its Response addressing the specific merits of Petitioner’s contentions with respect to these claim limitations (*see generally* PO Resp.), the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378.

As to claim 2, Petitioner contends that “[e]ach of Sane’s control planes (CMM) in aggregation switches S1 and S2 share snooping information with the control plane in the other aggregation switch over the MCT (VFL).” Pet. 47 (citing Ex. 1005, 3:4–22 (describing switches S1 and S2 identically), 3:31–32, 3:46–61, 4:16–36, 4:48–63, 6:36–7:8, 9:15–30, 9:60–10:20; Ex. 1003 ¶ 155). According to Petitioner, while Sane does not explicitly describe doing so via an IPC channel, Subramanian does. *Id.* at 48. Specifically, Petitioner contends that Subramanian, like Sane, discloses peer switches C0 and C1 in separate chassis. *Id.* (citing Ex. 1006, 5:32–36, 6:2–14). According to Petitioner, Subramanian uses logical inter-process communication (IPC) channels for communications with the stack master RPM. *Id.* (citing Ex. 1006, 7:28–47 (“using InterProcess Communication (IPC) messages between peered tasks on each CPU”), 7:48–8:40; 4:3–8, 10:4–17, 10:58–62, 12:12–51, 13:11–15, 13:49–53, Figs. 4–6). Dr. Black provides supporting testimony that a POSITA would have been motivated “to combine Subramanian’s teaching of using an IPC channel for Sane’s disclosed communications over the MCT between MCEC switches S1 and

S2.” Ex. 1003 ¶ 157. According to Petitioner, a POSITA would thus have been motivated to use the IPC channel disclosed in Subramanian going over Sane’s VFL “because it was a well-known method of facilitating communications with a chassis management module that would lead to the predictable result of facilitating efficient communications in both single and multi-chassis configurations.” Pet. 49–50.

As to claim 3, Petitioner contends that “Sane’s snooping information includes group membership information for receiving multicast traffic flows, among other things.” Pet. 50 (citing Ex. 1005, 6:30–7:8). Relying on the testimony of Dr. Black, Petitioner contends that a POSITA also would have “underst[oo]d that the snooping information includes identifiers of multicast traffic flows (since the MCEC switches learn that the information is for group G1) and identifiers of neighboring multicast routers (since the MCEC switches learn whether host Ha, host Hf, and host Hb are interested in or are sourcing G1 multicast packets).” *Id.* at 51 (citing Ex. 1005, 6:32–35, 6:40–42, 6:65–7:2; Ex. 1003 ¶ 160).

As to claim 4, Petitioner contends that Sane’s ports p2–p5 on aggregation switches S1 and S2 are the recited external ports. Pet. 52 (citing Ex. 1005, 2:3–5, 3:33–37, 5:10–25, 5:33–35, 5:63–65, Fig. 4). Further, Petitioner contends that Sane’s external ports “are member ports of a multi-chassis link aggregation group (MC-LAG) connected to an edge node,” and that “switch S1 is connected to: edge node S3 using the external ports p2 and edge node S4 using external port p3.” *Id.* (citing Ex. 1005, 5:11–13, 5:14–20, Fig. 4). Petitioner also contends that “[s]witch S2 is connected to edge node S3 using port p4 and edge node S4 using external port p5.” *Id.*

According to Petitioner, Sane's MCECs "are an MC-LAG," ports p2 and p4 are "members of MCEC1 (an MC-LAG) connected to edge node S3," and ports p3 and p5 are "members of MCEC2 (another MC-LAG) connected to edge node S4." Pet. 53 (citing Ex. 1005, 1:55–64, 3:33–61, 5:10–23; Ex. 1003 ¶ 162). Petitioner also contends that Sane teaches "the remote aggregation switch includes one or more of the member ports of the MC-LAG" because "MCEC switch S2 (the remote aggregation switch) includes ports p4 and p5, which are members of MCEC1 and MCEC2, respectively," while "[s]witch S1 includes ports p2 and p3, which are members of MCEC1 and MCEC2, respectively." *Id.*

As to claim 5, Petitioner contends that Sane discloses that its CMM (control plane) "receives a portion of the snooping information from the remote aggregation switch via the VFL," and that Sane discloses "transmission from switch S1, over the MCT (VFL) between the chassis management modules of Sane's switches S1 and S2," of a "a software IGMP synchronization message to its peer MCEC switch 16 [S2]" that includes snooping information. Pet. 54–55 (citing Ex. 1005, 6:30–7:8; Ex. 1003 ¶ 164). According to Petitioner, Sane further discloses that "included in the shared snooping information is 'the original IGMP report and MCEC port number' for the MCEC port that originally received the snooping information." *Id.* at 55 (citing Ex. 1005, 6:45–47; Ex. 1003 ¶ 165). Petitioner contends that the MCEC port number, which is associated with the snooping information, "is remote hardware device information because it identifies the external port on the remote aggregation switch on which the snooping information was initially received," and "also identifies the remote

external port that received the snooping information on the remote aggregation switch.” *Id.* at 56 (citing Ex. 1005, 6:45–47; Ex. 1003 ¶ 165).

As to claim 6, Petitioner contends that, in Sane, “S1’s and S2’s CMMs determine whether the remote hardware device information identifies one of the member ports of the MC-LAG on the remote aggregation switch.” Pet. 57 (citing Ex. 1005, 3:4–30, 5:10–25, 6:49–51; Ex. 1003 ¶ 167).

According to Petitioner, “[w]hen this determination is made, . . . S1’s and S2’s CMMs determine a local member port of the MC-LAG on S1 or S2, respectively,” and “S1 and S2 also create the recited membership record for the portion of the snooping information.” *Id.* (citing Ex. 1005, 6:49–54; Ex. 1003 ¶¶ 168–169). Relying on Dr. Black’s supporting testimony, Petitioner contends that it would have been obvious “that Sane stores the membership record in a database” as it “was the common practice,” wherein the membership record “would include a ‘multicast address’ that corresponds to information in the IGMP snooping information” and the membership record and the IGMP snooping information “would have been stored together.” *Id.* at 58 (citing Ex. 1003 ¶ 169; Ex. 1023 (RFC 4605), 4, 7). Petitioner then contends that “Sane’s S2 uses the hardware device information to compute a forwarding vector.” *Id.* at 58–59 (citing Ex. 1005, 6:47–51, 6:55–64).

As to claim 12, Petitioner contends that “each of Subramanian’s chassis receives the MGID and the EPI (multicast indexes) and uses these indexes to ‘program[] the hardware MGID/EPI table with all ports in the local chassis’ (i.e., build forwarding vectors).” Pet. 59 (citing Ex. 1006, 17:26–38; Ex. 1003 ¶ 171). As to claim 13, Petitioner contends that “one of Sane’s aggregation switches S1 or S2 is designated as the ‘master switch’

(primary)—with special processing responsibilities—while the peer switch ‘is designated as a slave switch’ (secondary).” *Id.* at 60 (citing Ex. 1005, 7:9–22; Ex. 1003 ¶ 172). Further, Petitioner contends that “Subramanian teaches a stack master RPM (primary)—that communicates with line cards ‘to administer protocols, keep hardware tables synchronized, etc.’—while the other chassis becomes ‘the subordinate chassis’ with ‘the stack slave RPM SS.’” *Id.* (citing Ex. 1006, 5:12–24, 6:10–14, 6:61–66, 7:32–35; Ex. 1003 ¶ 173).

As to claim 14, Petitioner contends that “[t]he combination of Sane and Subramanian discloses all the elements . . . for the same reason as discussed above with respect to claim 13.” Pet. 61. According to Petitioner, “[c]laim 14 differs from claim 13 only in that the roles are reversed between the ‘aggregation switch’ of the preamble of claim 1, and the ‘remote aggregation switch,’” but “the result is the same because Sane’s switches S1 and S2 each operate in the same fashion, follow the same protocols, and maintain identical, independent distributed control planes.” *Id.* at 61–62 (citing Ex. 1005, 4:16–64; Ex. 1003 ¶ 176).

As to claim 16, Petitioner contends that “Sane teaches these elements for reasons as claims 4 and 5,” and additionally, Sane’s “remote aggregation switch’s member ports of the MC-LAG are connected to the edge node.” Pet. 64 (citing Ex. 1005, Fig. 4 (element 4)). As to claim 17, Petitioner contends that “[t]he Sane and Subramanian combination teaches these elements for the same reasons explained in claim 6.” *Id.* Additionally, Petitioner contends “Sane states in its IGMP snooping example that ‘[i]f host Ha is also interested in group G1, switch S2 adds the MCT as part of its oif-list,’” wherein a POSITA, “reading Sane and the disclosure describing

Figure 4 example, would [have] underst[oo]d that host Ha’s interest in group G1 would be communicated to switch S2 through, for example, the IGMP synchronization message.” *Id.* at 65 (citing Ex. 1005, 7:1–2, 3:12–18, 4:48–58, 6:36–53; Ex. 1003 ¶ 181). According to Petitioner, a POSITA “would also [have] recognize[d] that the fact that S2 expects to reach Ha through the MCT, indicates that the snooping information related to Ha was shared by S1 through the MCT.” *Id.* at 65–66 (citing Ex. 1005, 7:1–2; Ex. 1003 ¶¶ 181–183).

Based on the complete record presented, we are persuaded that Petitioner has demonstrated that the combination of Sane and Subramanian teaches the subject matter of dependent claims 2–6, 12–14, 16, and 17.

III. CONCLUSION⁷

For the foregoing reasons, we are persuaded on the record at hand that Petitioner has demonstrated by a preponderance of the evidence that the challenged claims of the ’447 patent are unpatentable.

⁷ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner’s attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. See 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent

In summary:

<u>Claims</u>	<u>35</u> <u>U.S.C. §</u>	<u>Reference(s)/Basis</u>	<u>Claims</u> <u>Shown</u> <u>Unpatentable</u>	<u>Claims</u> <u>Not Shown</u> <u>Unpatentable</u>
1–6, 12–17	103	Sane, Subramanian	1–6, 12–17	
<u>Overall</u> <u>Outcome</u>			1–6, 12–17	

IV. ORDER

For the reasons given, it is

ORDERED that, based on the preponderance of the evidence, claims 1–6 and 12–17 of the '447 patent have been shown to be unpatentable; and

FURTHER ORDERED that, because this is a final written decision. Parties to this proceeding seeking judicial review of our decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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