

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VERIZON BUSINESS NETWORK SERVICES INC.,
Petitioner,

v.

HUAWEI TECHNOLOGIES CO. LTD.,
Patent Owner.

IPR2020-01141
Patent 7,965,709 B2

Before TREVOR M. JEFFERSON, MICHELLE N. WORMMEESTER, and
KEVIN C. TROCK, *Administrative Patent Judges*.

WORMMEESTER, *Administrative Patent Judge*.

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

I. INTRODUCTION

Verizon Business Network Services Inc. (“Petitioner”) filed a Petition (Paper 3, “Pet.”) requesting *inter partes* review of claims 1, 4, 7, and 16 of U.S. Patent No. 7,965,709 B2 (Ex. 1001, “the ’709 patent”). Huawei Technologies Co. Ltd. (“Patent Owner”) filed a Preliminary Response (Paper 7). With our authorization (*see* Paper 9), Petitioner filed a Preliminary Reply (Paper 10) to Patent Owner’s Preliminary Response, and Patent Owner filed a Preliminary Sur-reply (Paper 11). Pursuant to 35 U.S.C. § 314, we instituted an *inter partes* review of all the challenged claims, namely, claims 1, 4, 7, and 16, based on all the grounds presented in the Petition. Paper 12 (“Inst. Dec.”). Thereafter, Patent Owner filed a Response (Paper 17, “PO Resp.”) to the Petition, Petitioner filed a Reply (Paper 21, “Pet. Reply”), and Patent Owner filed a Sur-reply (Paper 28, “PO Sur-reply”). On October 6, 2021, we conducted an oral hearing. A copy of the transcript (Paper 30, “Tr.”) is included in the record.

We have jurisdiction under 35 U.S.C. § 6(b). For the reasons that follow, we determine that Petitioner has shown by a preponderance of the evidence that claims 1, 4, 7, and 16 of the ’709 patent are unpatentable. This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a).

II. BACKGROUND

A. *Related Proceedings*

The parties identify one related federal district court case, *Huawei Technologies Co. v. Verizon Communications, Inc.*, Case No. 6:20-cv-00090 (W.D. Tex.). Pet. 7; Paper 4, 2.

Additionally, Petitioner filed a petition challenging claims 17, 18, 21, and 23 (not challenged in this proceeding) of the '709 patent in IPR2020-01143. Pet. 7; Paper 4, 2. In a separate decision, we denied instituting trial in that case. *Verizon Bus. Network Servs. Inc. v. Huawei Techs. Co.*, IPR2020-01143, Paper 12 (PTAB Jan. 14, 2021) (Decision Denying Institution of *Inter Partes* Review).

B. The '709 Patent

The '709 patent relates to network switching. Ex. 1001, 1:6. In particular, the '709 patent describes layer 2 bridge forwarding of Ethernet frames across virtual local area networks (VLANs). *Id.* at 1:6–15, 2:20–22. To illustrate, Figure 4 of the '709 patent is reproduced below.

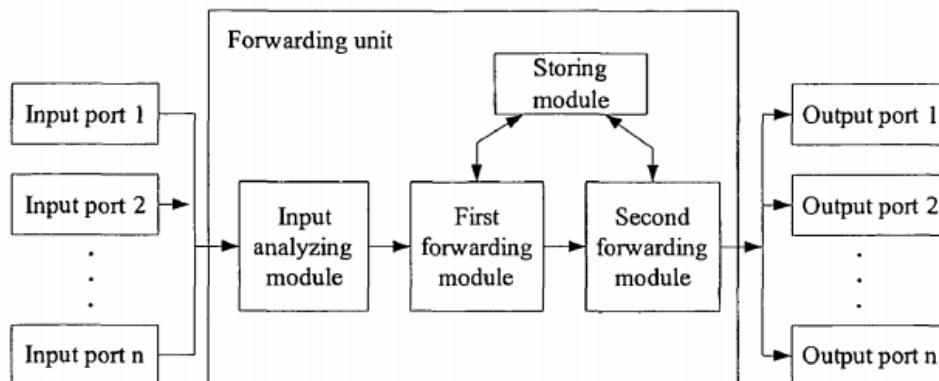


Fig.4

Figure 4 is a diagram of a cross-VLAN bridge forwarding apparatus according to one embodiment of the '709 patent. *Id.* at 3:50–52. The bridge forwarding apparatus includes at least one input port, a forwarding unit, and at least one output port. *Id.* at 8:57–67.

The input port receives a frame from a VLAN. *Id.* at 8:59–60.

The forwarding unit includes an input analyzing module, a first forwarding module, a second forwarding module, and a storage module. *Id.* at 9:1–18. The input analyzing module obtains the input VLAN identifier (VLAN ID) and the destination MAC (DMAC) address of the frame, and outputs the input VLAN ID and the DMAC address to a first forwarding module. *Id.* at 9:7–9, Fig. 4. The first forwarding module determines the virtual switching instance (VSI) that corresponds to the combination of the input port and the input VLAN ID, then searches the MAC address forwarding table corresponding to the VSI (using the DMAC address as a keyword) to obtain the output port and the output VLAN ID. *Id.* at 4:37–39, 7:16–18, 9:10–15. To do this, the first forwarding module uses information in the storage module, which stores the relationship between the combinations of the ports and the VLAN IDs with the VSIs, as well as the MAC address forwarding tables corresponding to each VSI. *Id.* at 9:2–6, Fig. 4. The search result of the first forwarding module is output to the second forwarding module, which transmits the frame to the output port according to the search result. *Id.* at 9:16–18, Fig. 4.

The output port transmits the frame to the destination VLAN. *Id.* at 8:66–67.

C. Illustrative Claim

Petitioner challenges claims 1, 4, 7, and 16 of the '709 patent. Claim 1 is independent and illustrative of the claims under challenge:

1. A forwarding method, comprising:
receiving, via an input port, a frame associated with a first virtual local area network (VLAN);

obtaining an input VLAN identifier (ID) representing the first VLAN and a destination media access control (MAC) address of the received frame;

determining a Virtual Switching Instance (VSI) corresponding to the combination of the input port and the input VLAN ID;

obtaining an output port and an output VLAN ID, wherein the output VLAN ID represents a second VLAN and wherein the output port and the output VLAN ID relate to the destination MAC address and the VSI; and

communicating the received frame and the output VLAN ID to the obtained output port, wherein the output VLAN ID is different from the input VLAN ID.

D. Asserted Grounds of Unpatentability

Petitioner challenges claims 1, 4, 7, and 16 of the '709 patent on the following two grounds of obviousness under 35 U.S.C. § 103.¹ Pet. 8, 20–58. We instituted *inter partes* review of both grounds. Inst. Dec. 46.

Claims Challenged	35 U.S.C. §	References
1, 4, 16	103	Carrie, ² Hawthorne ³
7	103	Carrie, Hawthorne, Dobbins ⁴

In support of its arguments, Petitioner relies on a Declaration of Dr. Samrat Bhattacharjee (Ex. 1003). Patent Owner submits with its Response a

¹ The Leahy-Smith America Invents Act (“AIA”) amended 35 U.S.C. § 103, effective March 16, 2013. See Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011). Because the application that issued as the '709 patent was filed before this date, the pre-AIA version of § 103 applies.

² Carrie, U.S. Patent No. 7,693,158 B1, issued Apr. 6, 2010 (Ex. 1005).

³ Hawthorne, U.S. Publ’n No. 2003/0152075 A1, published Aug. 14, 2003 (Ex. 1006).

⁴ Dobbins, U.S. Patent No. 6,711,171 B1, issued Mar. 23, 2004 (Ex. 1007).

Supplemental Declaration of Dr. Nathaniel J. Davis IV, Ph.D. (Ex. 2017).⁵
The transcripts of the depositions of Drs. Bhattacharjee and Davis are entered in the record as Exhibits 2018 and 1036, respectively.

III. ANALYSIS

A. Level of Ordinary Skill in the Art

We begin our analysis by addressing the level of ordinary skill in the art. Each of the parties has proposed a level of ordinary skill in the art. In particular, Petitioner proposes:

A person of ordinary skill in the art (“POSITA”) in October 2005 would have had a working knowledge of the network forwarding art that is pertinent to the ’709 Patent, including art describing Ethernet (layer 2) bridges and their functionality. A POSITA would have had a bachelor’s degree in computer science, computer engineering, or an equivalent, and two years of professional experience relating to network forwarding devices. Lack of professional experience can be remedied by additional education, and vice versa.

Pet. 13. Petitioner relies on the declaration testimony of Dr. Bhattacharjee. *Id.* (citing Ex. 1003 ¶¶ 26–30). On the other hand, Patent Owner proposes:

A person of ordinary skill in the art at the time of the ’709 patent (a “POSITA”) would have had at least a Bachelor’s or a Master’s degree in computer science, computer engineering, electrical and electronics engineering, telecommunications and networking, or some similar field of endeavor, along with three or more years of experience with networking technologies for the former (Bachelor’s degree holder) and two or more years’ of experience for the latter (Master’s degree holder), or the industry equivalent thereof, together with an understanding of switch and router

⁵ Patent Owner had submitted with its Preliminary Response a Declaration of Dr. Nathaniel J. Davis IV, Ph.D. (Ex. 2013), but does not rely on that declaration in its Response. *See generally* PO Resp.

system design. Additional education or work experience in a relevant field may substitute for one of the other aspects of the qualifications stated above.

PO Resp. 5. Patent Owner relies on the declaration testimony of Dr. Davis. *Id.* (citing Ex. 2017 ¶¶ 28–32).

Either proposal is consistent with the level of ordinary skill in the art reflected by the prior art. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001); *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995). On this record, the level of ordinary skill is neither in dispute nor dispositive of any challenge. For purposes of this Decision, we apply Patent Owner’s articulation.

B. Claim Construction

In this *inter partes* review proceeding, we construe claims of a patent using the same claim construction standard that would be used to construe the claims in a civil action under 35 U.S.C. 282(b). *See* 37 C.F.R. § 42.100(b) (2019). Applying that standard, we construe claims in accordance with their ordinary and customary meaning as would have been understood by one of ordinary skill in the art. *See id.*; *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–14 (Fed. Cir. 2005) (en banc). In so doing, we take into account the specification and prosecution history. *Phillips*, 415 F.3d at 1315–17.

Patent Owner proposes construing the claim term “Virtual Switching Instance (VSI)” as “a cross-VLAN bridge that binds a set of one or more virtual input ports {input port, input VLAN ID} to a virtual output port {output port, output VLAN ID}.” PO Resp. 6. Patent Owner’s proposed construction is consistent with the district court’s construction of the same

claim term in the related litigation. Ex. 2016, 2 (Claim Construction Order). Although Petitioner acknowledges that Patent Owner's proposed construction "matches" the district court's construction, Petitioner insists that "no construction is necessary." Pet. Reply 2. Petitioner adds that, "[i]n any event, the prior art renders this term obvious under any plain and ordinary construction, including the district court's." *Id.*

For purposes of this Decision, we conclude that no claim term requires express interpretation to resolve any controversy in this proceeding. *See Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

C. Obviousness over Carrie and Hawthorne

Petitioner asserts that claims 1, 4, and 16 of the '709 patent would have been obvious over Carrie and Hawthorne. Pet. 15, 20–49. Patent Owner opposes. PO Resp. 13–71. For the reasons explained below, we determine that Petitioner has demonstrated by a preponderance of the evidence that claims 1, 4, and 16 would have been obvious over Carrie and Hawthorne.

1. Overview of Asserted Prior Art

We start with an overview of the asserted prior art, Carrie and Hawthorne.

a. Carrie

Carrie describes “selectively processing VLAN traffic from different networks while allowing flexible VLAN identifier assignment.” Ex. 1005, 1:10–15. To illustrate, Figure 4 of Carrie is reproduced below.

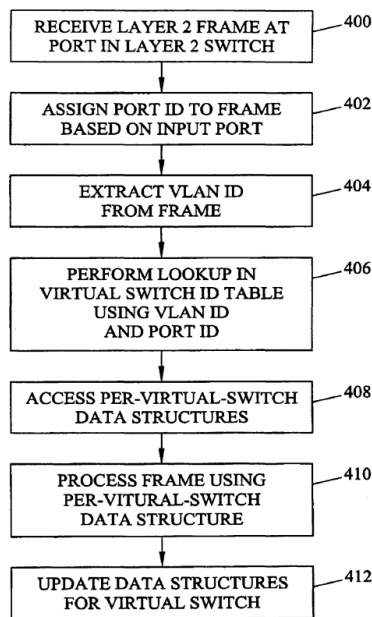


FIG. 4

Figure 4 is a flow chart of a method according to Carrie for assigning virtual switch identifiers based on port identifiers and VLAN identifiers, and selectively processing frames using these identifiers. *Id.* at 7:60–63.

Starting with step 400, a layer 2 frame with a VLAN identifier is received at a port of a layer 2 switch. *Id.* at 1:21–23, 7:64–65, Fig. 9 (frame 900 with VLAN ID). Next, at step 402, a port identifier is assigned to the frame. *Id.* at 7:65–66. Carrie notes that the port identifier may be added to the frame on entry into the switch. *Id.* at 4:26–28, 9:56–57, Fig. 9 (port identifier 902). At step 404, the VLAN identifier is extracted from the frame. *Id.* at 7:66–67. At step 406, a virtual switch identifier table is searched using the VLAN identifier and the port identifier combination to

determine a virtual switch identifier. *Id.* at 4:41–43, 7:67–8:2. The combination of port and VLAN identifiers is preferably unique. *Id.* at 4:50–51. The virtual switch identifier is then used to access a per-virtual-switch data structure at step 408, where the data structure may include a forwarding database. *Id.* at 4:43–45, 8:3–5. Thereafter, at step 410, the frame is processed according to the per-virtual-switch data structure. *Id.* at 8:5–6. For example, the frame may be forwarded to a node or nodes associated with the same virtual switch. *Id.* at 8:6–8. At step 412, the per-virtual-switch data structures are updated. *Id.* at 8:8–9.

b. Hawthorne

Hawthorne relates to forwarding traffic through a packet-based network using VLAN technology. Ex. 1006 ¶ 2. In particular, Hawthorne describes translating a VLAN ID of received VLAN traffic from an input VLAN ID to an output VLAN ID before transmitting the traffic from the network node. *Id.* ¶ 13. To illustrate, Figure 8 of Hawthorne is reproduced below.

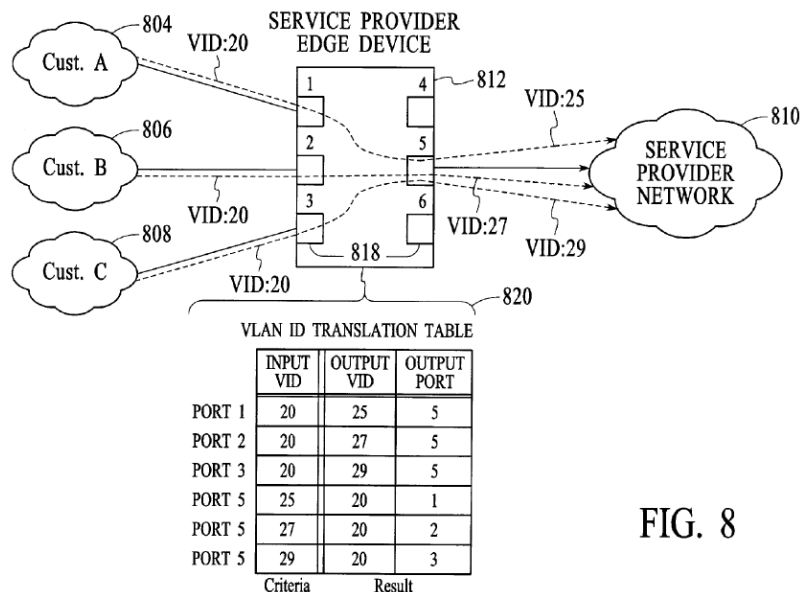


FIG. 8

Figure 8 shows an example application of VLAN ID translation according to Hawthorne, which ensures the uniqueness of VLAN traffic when the same VLAN ID is used for traffic at more than one port of a network node. *Id.* ¶ 65. For example, each of Customers A, B, and C may send traffic to the service provider edge device on VLAN ID 20, with the next hop for the traffic being to service provider network 810 via port interface 5 of the service provider edge device. *Id.* The VLAN ID translation rule at port interface 1 translates input VLAN ID 20 to output VLAN ID 25 and output port 5, the VLAN ID translation rule at port interface 2 translates input VLAN ID 20 to output VLAN ID 27 and output port 5, and the VLAN ID translation rule at port interface 3 translates input VLAN ID 20 to output VLAN ID 29 and output port 5. *Id.* Because the traffic from each input port interface is sent out of port interface 5 on different VLAN IDs, the traffic that is sent from port interface 5 can be differentiated within the service provider network based on VLAN ID alone. *Id.*

2. Independent Claim 1

We now turn to our discussion of the claims. Claim 1 is directed to a “forwarding method” that comprises five steps designated by Petitioner as steps 1.1, 1.2, 1.3, 1.4, and 1.5. Step 1.1 involves receiving a frame via an input port. Step 1.2 involves obtaining an input VLAN identifier and a destination MAC address of the received frame. Step 1.3 involves determining a virtual switching instance. Step 1.4 involves obtaining an output port and an output VLAN identifier. Step 1.5 involves communicating the received frame and the output VLAN identifier to the

output port. We address these steps in turn and then consider the parties' disputes as to claim 1.

a. Step 1.1: Receiving a Frame Via an Input Port

Claim 1 recites “receiving, via an input port, a frame associated with a first virtual local area network (VLAN).” For this limitation, designated by Petitioner as step 1.1, Petitioner provides an annotated version of Figure 1 of Carrie, which is reproduced below. Pet. 32.

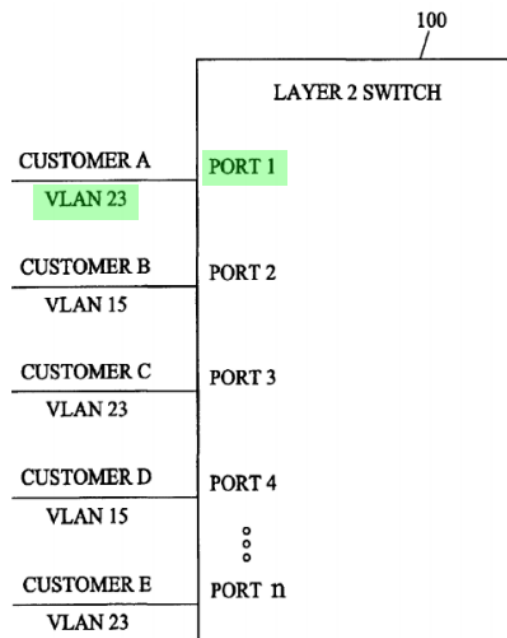


Figure 1 of Carrie, as annotated by Petitioner, is a block diagram of a layer 2 network and a layer 2 switch. See Ex. 1005, 3:51–53. The layer 2 switch has multiple ports, where each port is assigned a port identifier. *Id.* at 4:22–26, Fig. 1. Petitioner directs us to where Carrie teaches that “a layer 2 frame is received at a port of a layer 2 switch.” *Id.* at 7:64–65 (cited by Pet. 31). The layer 2 frame includes a VLAN identifier. *Id.* at 1:21–23; see also *id.* at 7:66–67 (“[T]he VLAN identifier is extracted from the layer 2 frame.”) (cited by Pet. 31). Networks assign VLAN identifiers to their layer 2 traffic.

Id. at 1:31–35. In Figure 1, for example, Customer A uses VLAN identifier 23 on port 1. *Id.* at 4:33–38 (cited by Pet. 31–32).

Based on Petitioner’s argument and evidence, we are persuaded that Carrie teaches the recited limitation of step 1.1. Patent Owner does not challenge Petitioner’s analysis for this limitation. *See generally* PO Resp.

b. Step 1.2: Obtaining an Input VLAN Identifier and a Destination MAC Address

Claim 1 further recites “obtaining an input VLAN identifier (ID) representing the first VLAN and a destination media access control (MAC) address of the received frame.” For this limitation, designated by Petitioner as step 1.2, Petitioner directs us to where Carrie teaches that “the VLAN identifier is extracted from the layer 2 frame.” Ex. 1005, 7:64–67 (quoted by Pet. 33). As additional support, Petitioner directs us to the flow chart in Figure 4 of Carrie, which illustrates the step “EXTRACT VLAN ID FROM FRAME.” *Id.* at Fig. 4 (step 404) (cited by Pet. 33).

Petitioner also directs us to Figure 9 of Carrie, which shows that “[f]orwarding database 910 . . . receives as input the MAC destination address” and a virtual switch ID. Ex. 1005, 10:14–15, Fig. 9 (cited by Pet. 33–34). Carrie teaches that “[u]sing the virtual switch ID in combination with the MAC destination address allows the portion of forwarding database 910 that is specific to the virtual switch to be selected.” *Id.* at 10:16–18 (cited by Pet. 33). The output of forwarding database 910 may be an output port or a flood list. *Id.* at 10:23–24. We note Carrie’s teaching that “portions of the hardware illustrated in FIG. 9 may also be used to implement the processing steps illustrated in . . . FIG[. 4.” *Id.*

at 9:49–54; *see also id.* at 6:39–42 (stating with respect to Figure 3, “[i]f a forwarding database entry for the received MAC destination address does not exist, the frame is flooded only onto ports associated with the same virtual switch”); *id.* at 8:5–8 (stating with respect to Figure 4, “[i]n step 410, the frame is processed using the per-virtual-switch data structure,” where, “[f]or example, the frame may be forwarded or flooded to a node or nodes associated with the same virtual switch”).

Based on Petitioner’s argument and evidence, we are persuaded that Carrie teaches the recited limitation of step 1.2. Patent Owner does not challenge Petitioner’s analysis for this limitation. *See generally* PO Resp.

c. Step 1.3: Determining a Virtual Switching Instance (VSI)

Claim 1 further recites “determining a Virtual Switching Instance (VSI) corresponding to the combination of the input port and the input VLAN ID.” For this limitation, designated by Petitioner as step 1.3, Petitioner contends that Carrie’s “switch maintains a plurality of virtual switches, where each virtual switch is a virtual switch instance identified by a virtual switch identifier.” Pet. 34. As support, Petitioner directs us to where Carrie teaches that “when a layer 2 frame is received, [a] virtual switch identifier is determined and used to access the forwarding data for that virtual switch.” Ex. 1005, 6:37–39 (cited by Pet. 34–35). Specifically, the frame’s “VLAN identifier and the port identifier are used to determine [the] virtual switch identifier.” *Id.* at 2:65–3:2 (cited by Pet. 35); *see also id.* at code (57) (“[A] layer 2 switch includes a virtual switch identifier data structure that associates a VLAN identifier extracted from a layer 2 frame and a port identifier corresponding to a port on which a frame is received

with a virtual switch identifier.”) (cited by Pet. 35); *id.* at 5:37–40 (stating that “the VLAN identifiers and the corresponding port identifiers are provisioned in [a] virtual switch ID table,” where “each unique combination of VLAN identifier and port identifier may be assigned to a virtual switch”) (cited by Pet. 35). Carrie additionally teaches that the MAC destination address and “the virtual switch ID[are] input into forwarding database 910” to “allow[] the portion of forwarding database 910 that is specific to the virtual switch to be selected,” and that “[t]he output of forwarding database 910 may be an output port, a flood list, or a multicast list.” *Id.* at 10:13–18, 23–24 (cited by Pet. 36–37). According to Petitioner, Carrie’s “virtual switch identifier identifies a *virtual switching instance* as claimed.” Pet. 37. Petitioner relies on the declaration testimony of Dr. Bhattacharjee. *Id.* at 34–37 (citing Ex. 1003 ¶¶ 135–136, 138–139).

Based on Petitioner’s argument and evidence, we are persuaded that Carrie teaches the limitation of step 1.3. Patent Owner, however, challenges certain aspects of Petitioner’s analysis regarding the recited “Virtual Switching Instance (VSI).” See PO Resp. 69–71. We address the parties’ dispute in further detail below. See *infra* Part III.B.2.f.i.

d. Step 1.4: Obtaining an Output Port and an Output VLAN Identifier

Claim 1 further recites “obtaining an output port and an output VLAN ID, wherein the output VLAN ID represents a second VLAN and wherein the output port and the output VLAN ID relate to the destination MAC address and the VSI.” For this limitation, designated by Petitioner as step 1.4, Petitioner relies on both Carrie and Hawthorne.

With respect to obtaining an output port, Petitioner directs us to where Carrie teaches:

The output of multiplexer 908, **which is the virtual switch ID**, is input into forwarding database 910. Forwarding database 910 also receives as input the MAC destination address. **Using the virtual switch ID in combination with the MAC destination address** allows the portion of forwarding database 910 that is specific to the virtual switch to be selected. . . . **The output of forwarding database 910 may be an output port**, a flood list, or a multicast list, depending on the output of the lookup.

Pet. 37–38 (quoting Ex. 1005, 10:13–25). According to Petitioner, this teaching in Carrie discloses obtaining an output port based on the virtual switch ID and the destination MAC address. *Id.* at 38 (Petitioner’s annotated Figure 9 of Carrie).

With respect to obtaining an output VLAN ID, Petitioner turns to Hawthorne. Specifically, Petitioner directs us to where Hawthorne teaches “translating [an] input VLAN ID to an output VLAN ID,” where the input VLAN ID identifies traffic received at a network node as belonging to a first VLAN, and the output VLAN ID identifies the traffic leaving the network node as belonging to a second VLAN. Ex. 1006 ¶ 15 (cited by Pet. 38). Petitioner also directs us to where Hawthorne describes “VLAN ID translation rules [that] specify the desired relationships between input VLAN IDs and output VLAN IDs.” *Id.* ¶ 57 (cited by Pet. 39). For example, “VLAN ID translation rules [may] specify an input port and VLAN ID pair that translate to an output port and VLAN ID pair.” *Id.* Hawthorne notes that the “VLAN ID translation rules may include additional criteria,” including “a DA MAC” (i.e., destination address MAC address). *Id.* ¶¶ 54, 57.

Petitioner contends that it would have been obvious to an ordinarily skilled artisan to “utilize Hawthorne’s teachings regarding its improved VLAN translation technique in combination with Carrie’s system—for example, in order to differentiate customer traffic forwarded to a service provider network.” Pet. 24; *see also id.* at 27–28 (“This expanded solution would have differentiated VLAN traffic from different networks not only within Carrie’s layer 2 switch but also when forwarding such traffic to a service provider connected to a single output port.”). As support, Petitioner asserts that Carrie “allows its switch to segregate customers’ VLAN traffic from different networks even if the customers utilize the same VLAN IDs” but “does not explicitly address the problematic situation in which traffic from two different networks with the same VLAN ID is forwarded to the *same output port*—for example, an output port connected to a service provider serving both networks.” *Id.* at 25–26. Petitioner further asserts that Hawthorne’s “VLAN translation technique allows ‘the uniqueness of each customer’s VLAN traffic [to be] maintained at the output port interface’” so that “‘different customers connected to different ports of a service provider edge device [] 812 [may] independently use the same VLAN IDs to send traffic’ to a single service provider network 810.” *Id.* at 26 (citing Ex. 1006 ¶ 65).

To illustrate, Petitioner provides an annotated version of Figure 8 of Hawthorne, which is reproduced below. *Id.* at 27.

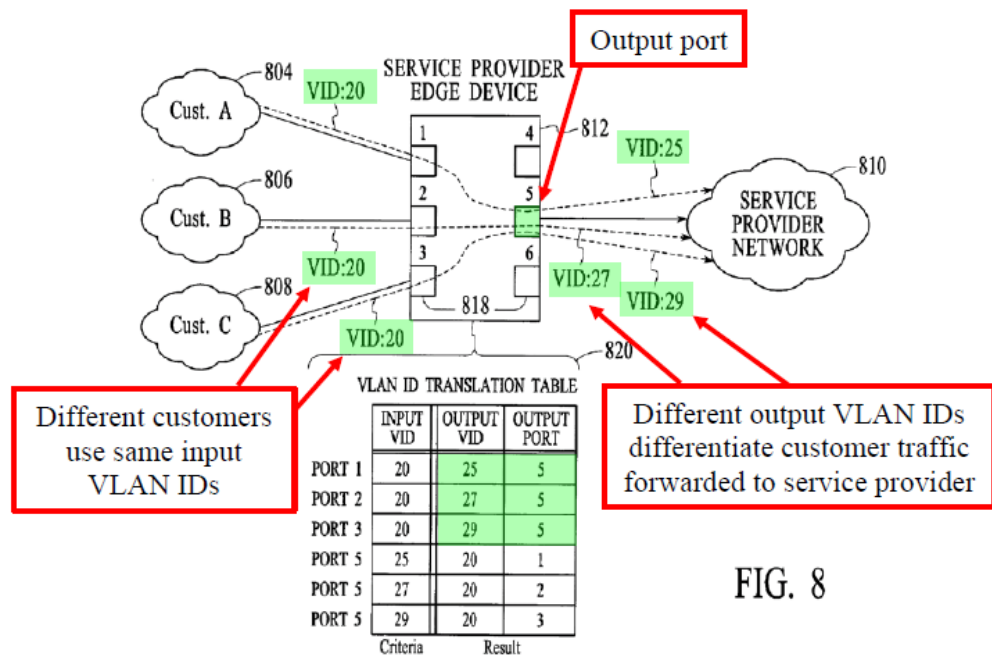


FIG. 8

Figure 8 of Hawthorne, as annotated by Petitioner, “depicts an example application of VLAN ID translation that ensures the uniqueness of VLAN traffic when the same VLAN ID is used for traffic at more than one port of the network node.” See Ex. 1006 ¶ 32. According to Petitioner, an ordinarily skilled artisan would have “modif[ied] Carrie’s layer 2 switch such that it translated an input VLAN ID of a received frame into an output VLAN ID, in the manner taught by Hawthorne,” in order to “augment Carrie’s virtual switch solution with Hawthorne’s known VLAN translation technique to create a more complete solution to the problem of different customer networks using the same VLAN ID.” Pet. 27. Petitioner adds that, “[a]s an aspect of this combination, it would have been obvious that Carrie’s output VLAN ID would relate to a particular virtual switch because the same variables that are used to select the output VLAN ID are also used to select the virtual switch identifier for that particular virtual switch—*i.e.*, input port and input VLAN ID.” *Id.* at 40–41. Petitioner relies on the declaration

testimony of Dr. Bhattacharjee. *Id.* at 24–31, 40–41 (citing Ex. 1003 ¶¶ 118–122, 124–128, 144).

Based on Petitioner’s argument and evidence, we are persuaded that the proposed combination of Carrie and Hawthorne teaches the recited limitation of step 1.4. We also are persuaded that Petitioner’s proffered reasoning for modifying Carrie’s system to include Hawthorne’s VLAN ID translation, namely, to provide “a more complete solution to the problem of different customer networks using the same VLAN ID,” is sufficient to support the legal conclusion of obviousness. *See In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) (“[T]here must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.”). Specifically, we are persuaded that Petitioner’s proposed combination would provide for differentiating traffic from different customer networks that is forwarded to the same output port, even where the different customer networks use the same VLAN ID. *See* Ex. 1006 ¶ 65 (“Because the VLAN traffic from each input port interface is sent out port interface 5 on different VLAN IDs, the traffic that is sent from port interface 5 can be differentiated within the service provider network based on VLAN ID alone.”) (cited by Pet. 26).

Patent Owner challenges certain aspects of Petitioner’s analysis regarding the rationale for combining Carrie and Hawthorne. *See* PO Resp. 13–69. We address the parties’ disputes in further detail below. *See infra* Parts III.B.2.f.ii–v.

e. Step 1.5: Communicating the Received Frame and the Output VLAN Identifier to the Output Port

Lastly, claim 1 recites “communicating the received frame and the output VLAN ID to the obtained output port, wherein the output VLAN ID is different from the input VLAN ID.” For this limitation, Petitioner directs us to where Carrie describes a switch fabric that “switches frames between input and output ports.” Ex. 1005, 5:20–21, Fig. 2 (cited by Pet. 41–42). Petitioner also directs us to where Hawthorne teaches that an “L2 forwarding engine attaches the translated VLAN ID to the traffic and forwards the traffic to the output port.” Ex. 1006 ¶ 60 (quoted by Pet. 42) (emphasis by Petitioner omitted). Hawthorne teaches that the translated (or output) VLAN ID is different than the input VLAN ID. Ex. 1006, code (57), ¶ 43, Fig. 2 (cited by Pet. 43). According to Petitioner, “it would have been obvious to a POSITA that Carrie’s switch—when modified in view of Hawthorne to determine an output VLAN ID—would have sent the determined output VLAN ID to the output port so that the frame may be tagged before transmission.” Pet. 42–43.

Based on Petitioner’s argument and evidence, we are persuaded that the proposed combination of Carrie and Hawthorne teaches the recited limitation of step 1.5. Patent Owner does not challenge Petitioner’s analysis for this limitation. *See generally* PO Resp.

f. Patent Owner’s Arguments

As noted above, Patent Owner makes several arguments. In particular, Patent Owner challenges Petitioner’s showing that its proposed combination of Carrie and Hawthorne teaches the recited Virtual Switching

Instance (VSI). Patent Owner also challenges Petitioner’s rationale for combining Carrie and Hawthorne. Patent Owner argues specifically that the proposed combination alters Carrie’s principle of operation, renders Carrie’s solution inoperable for its intended purpose, fails to provide a more complete solution, and fails to differentiate traffic from different security domains within the same entity. We address Patent Owner’s arguments in turn.

i. Virtual Switching Instance (VSI)

Patent Owner challenges Petitioner’s showing for the recited Virtual Switching Instance, arguing that, “at a minimum, determining a VSI involves determining a cross-VLAN bridge that includes both a set of one or more virtual **input** ports and a virtual **output** port,” and that Petitioner’s “analysis of Element [1.3] . . . failed to address these minimum requirements.” PO Resp. 69–70. Patent Owner bases this argument on its proposed construction of a VSI, namely, “a cross-VLAN bridge that binds a set of one or more virtual input ports {input port, input VLAN ID} to a virtual output port {output port, output VLAN ID}.” *See id.* at 6. Patent Owner specifically notes that Petitioner’s “mapping of the VSI in Element [1.3] . . . relies solely on Carrie, which maps **input** ports and **input** VLAN IDs to virtual switches.” *Id.* at 70; *see also id.* at 71 (“[T]he only port-VLAN ID pairs associated with Carrie’s virtual switches are on the **input** side.”). According to Patent Owner, “Carrie’s virtual switches do not bind virtual input port(s) to ‘a virtual **output** port {output port, **output VLAN ID**}’ as required of the claimed VSIs, but instead provide per-virtual switch

forwarding tables that merely specify ‘output ports’ (and not output VLAN IDs) on a per-virtual switch basis.” *Id.* at 71.

Petitioner counters that Patent Owner’s “analysis is incomplete because it fails to consider the combination of Carrie and Hawthorne set forth in the Petition, including in element [1.4] where the claim actually recites ‘*output*’ limitations.” Pet. Reply 29. According to Petitioner, the district court’s construction of a VSI in the related litigation (which, as discussed above, is the same as Patent Owner’s proposed construction of a VSI) “implicates both elements [1.3] and [1.4] because it refers to both the input port side—recited in element [1.3]—and the output port side—recited in element [1.4].” *Id.* at 27–28. Petitioner contends that its “proposed combination of Carrie and Hawthorne renders obvious the ‘virtual output port’ of the district court’s construction that Patent Owner claims Carrie is lacking.” *Id.* at 29. As support, Petitioner asserts that “the Petition explains in detail how Carrie and Hawthorne together render obvious determining both an output port and an output VLAN ID.” *Id.* (citing Pet. 40–41).

Patent Owner responds that Petitioner “mapped element [1.3] based on Carrie alone, and Petitioner’s belated new theory premised on Hawthorne’s teachings for this claim element should be disregarded as untimely and prejudicial.” PO Sur-reply 25. Patent Owner adds that “this new theory is one that ‘could have been included in a properly-drafted petition, but was not.’” *Id.* at 25–26.

We disagree with Patent Owner. Petitioner correctly notes that step 1.3 requires a VSI that corresponds to an *input* port and an *input* VLAN ID, whereas step 1.4 requires that the VSI further relates to an *output* port and an *output* VLAN ID. As discussed above with respect to step 1.3,

Petitioner points us to where Carrie teaches that its frame's "VLAN identifier and the port identifier are used to determine [the] virtual switch identifier," which Petitioner contends "identifies a *virtual switching instance*." Pet. 35, 37; Ex. 1005, 2:65–3:2 (cited by Pet. 35). This portion of Petitioner's analysis relies on Carrie to show a VSI that corresponds to an *input* port and an *input* VLAN ID, as required by step 1.3.

As discussed above with respect to step 1.4, Petitioner relies still on Carrie to show the VSI further relates to an output port, directing us specifically to Carrie's teaching that "[u]sing the virtual switch ID in combination with the MAC destination address allows the portion of forwarding database 910 that is specific to the virtual switch to be selected," where "[t]he output of forwarding database 910 may be an output port." Pet. 37–38 (quoting Ex. 1005, 10:13–25) (emphases omitted). To show a VSI that relates to an output VLAN, however, Petitioner relies additionally on Hawthorne, directing us to Hawthorne's discussion of "VLAN ID translation rules [that] specify an input port and VLAN ID pair that translate to an output port and VLAN ID pair." Pet. 39; Ex. 1006 ¶ 57. Petitioner proposes combining the teachings from Carrie and Hawthorne to provide a VSI that relates to an output port and an output VLAN ID. Pet. 24–28. That is, this portion of Petitioner's analysis relies on both Carrie and Hawthorne to show a VSI that relates to an *output* port and an *output* VLAN ID, as required by step 1.4.

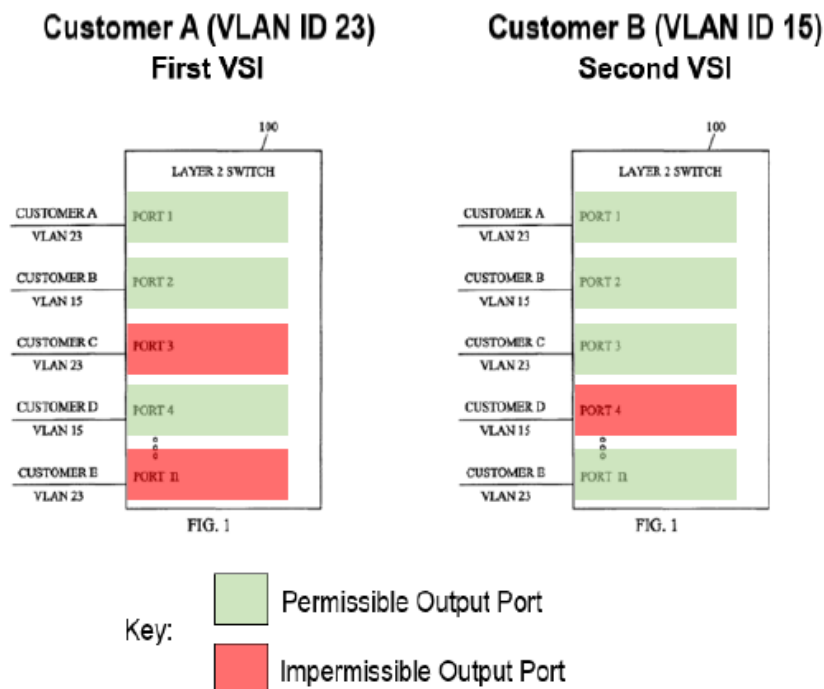
Considering Petitioner's analysis for the claimed VSI as a whole, we find that Petitioner relies on both Carrie and Hawthorne to show a VSI that corresponds to an input port and an input VLAN ID, and that further relates to an output port and an output VLAN ID, as required by steps 1.3 and 1.4.

The analysis is properly set forth in the Petition. *See* 35 U.S.C. § 312(a)(3) (a petition must identify, “with particularity, each claim challenged, the grounds on which the challenge to each claim is based, and the evidence that supports the grounds for the challenge to each claim”); 37 C.F.R. § 42.104(b) (a petition must identify “[h]ow the construed claim is unpatentable under the statutory grounds identified” and “where each element of the claim is found in the prior art,” and must explain the “relevance of the evidence to the challenge raised”); 37 C.F.R. § 42.22(a)(2) (a petition must include a “full statement of the reasons for the relief requested, including a detailed explanation of the significance of the evidence”); *see also* PO Resp. 13 (Patent Owner acknowledging that “the Petition relies on the alleged combination to map the prior art to at least Claim Element [1.4]”). Accordingly, Patent Owner’s arguments challenging Petitioner’s showing with respect to the claimed VSI are not persuasive.

ii. Altering Carrie’s Principle of Operation

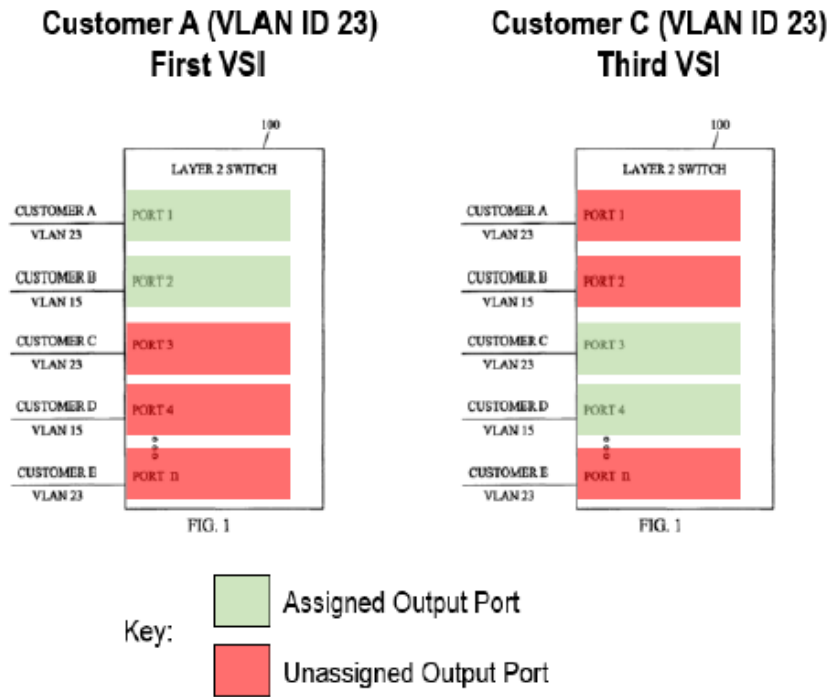
Patent Owner further argues that Petitioner’s “proposed modification of Carrie in view of Hawthorne fundamentally alters Carrie’s principle of operation,” which, according to Patent Owner, involves “virtual switches in an intra-VLAN bridge that assign mutually exclusive output ports to customers that share a same VLAN ID.” PO Resp. 14; *see also id.* at 28–29 (“The Petition’s proposed modification . . . is further deficient for fundamentally altering the principle by which ‘virtual switches enabled Carrie’s original system to differentiate customers and prevent traffic of customers who share the same VLAN ID from being sent over each other’s networks. . . . The key aspect of the virtual switches in Carrie’s original

solution that ensured traffic from one customer's VLAN would not be inadvertently flooded (or otherwise sent over) other customers' VLAN(s) was the unique sets of ports associated with different customers' virtual switches.”). Specifically, Patent Owner contends that “Hawthorne’s requirement for customers to access a common service provider network through a shared port is fundamentally at odds with Carrie’s operation as an intra-VLAN bridge.” *Id.* at 15 (emphasis and capitalizations omitted). To illustrate, Patent Owner provides a figure showing what Patent Owner considers to be Carrie’s principle of operation, which is reproduced below. PO Resp. 32 (citing Ex. 2007 ¶ 86).



Patent Owner’s figure illustrates scenarios adapted from Figure 1 of Carrie, and, according to Patent Owner, “identifies possible (permissible) ports in Customer A’s and B’s broadcast domain, assuming that the customers’ VLANs extend to each of those ports . . . and assuming that other customers with the same VLAN ID are not already associated with those ports.” *Id.*

at 33. To further illustrate, Patent Owner provides another figure, reproduced below. *Id.* at 33–34 (citing Ex. 2017 ¶ 87).



This figure shows that “Customers A and C (each with VLAN ID ‘23’) cannot *both* be associated with Ports 2 and 4,” as “the set of ports (e.g., broadcast domain) associated with each customer’s VSI must be mutually exclusive such that only one or the other of Customers A and C can be associated with each mutually permissible port.” *Id.* at 33.

Patent Owner asserts that “Hawthorne’s solution for interfacing customers to the common service provider involves switching customer traffic *out* of the customers’ own VLANs and onto distinct VLANs ***defined by the service provider*** (not the customers),” whereas “Carrie’s solution always forwards frames within the same VLAN.” *Id.* at 20, 21. Patent Owner points to Carrie’s teaching about the importance of “prevent[ing] frames intended for one VLAN from being sent over another VLAN.” *Id.* at 21–22 (quoting Ex. 1005, 5:44–47). Patent Owner also points to Figure 9

of Carrie showing “[t]he output of forwarding database 910 may be an output port, a flood list, or a multicast list,” and asserts that “[t]he notion of a translated VLAN ID is entirely absent from the output described here, or elsewhere in Carrie.” *Id.* at 22 (quoting Ex. 1005, 10:23–25). Patent Owner further points to Carrie’s claims and asserts that they “even explicitly emphasize the critical nature of the switch processing traffic ‘**without** modifying the VLAN identifier.’” *Id.* at 22 (quoting claim 1).

According to Patent Owner, “the root of Carrie’s ability to ‘prevent frames intended for one VLAN from being sent over another VLAN’ is found in the assignment of *mutually exclusive* ports to customers/VSIs that share a same VLAN ID—yet the Petition’s proposal destroys this root.” *Id.* at 30. Patent Owner alleges that “in the system resulting from the Petition’s proposed modification, Carrie’s virtual switches are no longer operable to differentiate customers’ VLAN traffic through mutually exclusive broadcast domains (e.g., output ports) associated with the VSIs of customers that share a same VLAN ID,” and that the proposed modification “demands an altogether different solution for differentiating customer traffic on the shared output port—namely, VLAN ID translation based on Hawthorne.” *Id.* at 35. Patent Owner contends that this is “a radical departure from Carrie’s intended operation,” where “the justification for the departure (i.e., to consolidate customer traffic at the edge of a service provider network) runs contrary to Carrie’s principal function as an intra-VLAN bridging device and . . . the proposed solution of a VLAN translation compromises Carrie’s security objectives and intended purpose by switching traffic outside of a customer’s own VLAN.” *Id.* at 35–36; *see also id.* at 15 (“[T]he Petition’s proposed modification . . . is based on Petitioner’s erroneous assumptions

about the nature of Carrie’s system . . . that disregard its principal function as a device for bridging traffic *within* VLANs and not an edge device for switching customer traffic to a service provider network through a common ingress port.”). Patent Owner notes specifically that “Carrie and Hawthorne provide materially different levels of security corresponding to their respective functions as an intra-VLAN bridging device and a service-provider edge device,” where “Carrie demands a high level of security that requires isolation of customer traffic and maintaining traffic within a customer’s own VLAN,” and “Hawthorne’s disclosure, by contrast, never once uses the term ‘security.’” *Id.* at 25–26.

Patent Owner adds that “Petitioner’s attempt to marry Carrie’s virtual switches with VLAN ID translation of Hawthorne’s edge device is premised on avoidable hindsight, not the reality of a POSITA starting from Carrie’s original solution and plainly stated avoidances.” *Id.* at 36–37; *see also id.* at 27 (“[T]he Petition fails to justify its underlying assumption that a POSITA—when starting from Carrie’s intra-VLAN bridging device that purposely precluded customers with the same VLAN ID from accessing a shared output port—would have sought to fundamentally depart from this principle of operation based on Hawthorne’s edge device.”). Patent Owner contends that Petitioner “assumed a POSITA would have found it obvious to incorporate VLAN ID translation rules within Carrie’s per-VSI forwarding databases despite there being no reason that such an implementation was worthy improvement,” as “other more straightforward methods of VLAN ID translation were available—like those expressly taught in Hawthorne—that would have been apt in the modified system where *all* customers communicate over the shared output port.” *Id.* at 37. According to Patent

Owner, “there is no need to use virtual switches to limit the universe of customers associated with the output port to those with mutually exclusive VLAN IDs,” and an ordinarily skilled artisan “would have recognized that the approach expressly described in Hawthorne of *directly* determining an output VLAN ID for traffic sent on the shared output port . . . would have been entirely suitable while avoiding the need to inject an intermediate step of first looking up a VSI, and separately evaluating data structures associated with the VSI to obtain output parameters.” *Id.*

Petitioner counters that “Carrie is concerned about the *unintended* mixing of customer traffic when multiple customers use the same VLAN ID,” and that Patent Owner incorrectly “concludes that Carrie’s goal is to prevent *all* cross-VLAN switching and VLAN translation, both unintended and intended.” Pet. Reply 4–5. As support, Petitioner points to Carrie’s teaching that “[w]hen layer 2 frames destined for network A arrive at a layer 2 switch, if a specific layer 2 forwarding table entry does not exist for the destination in network A, the frame intended for the destination in network A will be flooded to networks A and B,” and that “[f]looding traffic onto another user’s network is undesirable for security reasons and it also unnecessarily wastes network bandwidth.” *Id.* at 4 (quoting Ex. 1005, 1:36–40). Petitioner explains that “in this scenario layer 2 traffic ‘intended’ for one customer may be undesirably flooded onto another customer’s virtual network if it uses the same VLAN ID.” *Id.*

With respect to Patent Owner’s reliance on Carrie’s teaching that “[i]t is important to maintain separate forwarding databases and ARP^[6] caches to

⁶ In Carrie, “ARP” stands for “address resolution protocol.” Ex. 1005, 5:19.

prevent frames intended for one VLAN from being sent over another VLAN,” (see, e.g., PO Resp. 22 (citing Ex. 1005, 5:44–47)), Petitioner contends that Carrie’s teaching “is simply about preventing *unintended* cross-VLAN frame transmission (‘to prevent frames **intended** for one VLAN . . .’).” *Id.* at 5. Petitioner adds that Carrie’s teaching “does not describe the different concept of intentional VLAN translation, which involves modifying a single customer’s VLAN ID.” Pet. Reply 5. Petitioner also notes that “Carrie’s only reference to forwarding frames ‘without modifying a VLAN ID’ is in claim language *added* during prosecution—reaffirming that this concept is not a core principle of Carrie’s operation.” *Id.* at 5 n.1. Additionally, as to Patent Owner’s arguments about security, Petitioner reiterates its position that Carrie’s concern is “unintended mixing of customer traffic when two customers utilize the same VLAN ID (or IP address).” *Id.* at 7 (citing Ex. 1005, 6:1–16, 6:25–33, 6:57–7:13, 7:22–38). Petitioner relies on its declarant Dr. Bhattacharjee’s deposition testimony that “if a device **inadvertently** does anything, it is eventually going to be a security concern in these days.” *Id.* (citing Ex. 2018, 44:18–45:5).

Petitioner further argues that “Patent Owner . . . mischaracterizes Carrie’s switch as a[n] ‘intra-VLAN bridge’ meant only for ‘bridging traffic within VLANs and not an edge device for switching customer traffic to a service provider network through a common ingress port.’” Pet. Reply 7–8 (quoting PO Resp. 15). As support, Petitioner asserts that “Carrie is explicit that ‘the service provider . . . operates the layer 2 switch,’” and that Carrie’s solution addresses “how to separate the traffic of different customers that use the same VLANs *at the ingress and egress points of the service provider’s*

network.” *Id.* at 8–9 (quoting Ex. 1005, 4:28–32, 1:56–2:9); *see also id.* at 11–13.

Additionally, Petitioner notes Patent Owner’s observation that “customers [in Carrie] with the same VLAN ID do not share output ports,” but contends that “this is not Carrie’s principle of operation, it’s Carrie’s *shortcoming*—the very shortcoming that would be remedied with Hawthorne’s VLAN translation technique.” *Id.* at 13–14. According to Petitioner, Patent Owner “mistakes an inconvenient *limitation* of Carrie as a purposeful feature,” and “Hawthorne’s VLAN translation technique solves this ‘known problem.’” *Id.* at 14–15.

As to “Patent Owner’s Fig. 1 analysis of Carrie’s permissible and impermissible output ports,” (see PO Resp. 31–33; *see also supra* pp. 25–26), Petitioner asserts that “[o]nce Carrie is modified to implement VLAN translation, as proposed in the Petition, none of the output ports shown in Fig. 1 are ‘impermissible[]’ . . . because any overlapping VLAN IDs would be translated prior to transmission.” *Id.* at 15. According to Petitioner, “adding Hawthorne’s VLAN translation technique to Carrie removes the shortcoming identified by Patent Owner and improves Carrie’s switch.” *Id.*

In its Sur-reply, Patent Owner reiterates “Carrie’s fundamental concern with isolating traffic in each customer’s own VLAN.” PO Sur-reply 3; *see also id.* at 9 (“Carrie’s device serves the specific function of an intra-VLAN bridge configured to bridge traffic across different ports **within** a customer’s own VLAN.”); *id.* at 12 n.1 (“[T]he incompatibilities between Carrie and Hawthorne did not stem merely from their different functions as an intra-VLAN bridge and edge device, but more specifically arose from differences between Carrie’s function as an intra-VLAN bridge and

Hawthorne’s unique solution for an edge device requiring customers to access the service provider network ***through a shared/single output port.***”); *id.* at 18 (“[T]he principle of operation underlying Carrie’s ability to distinguish traffic [when multiple customers use the same VLAN ID] is its provision of mutually exclusive output ports for the virtual switches associated with customers that share the same VLAN ID.”).

Referring to Carrie’s teaching that “[f]looding traffic onto another user’s network is undesirable for security reasons and it also unnecessarily wastes network bandwidth,” Patent Owner contends that Petitioner “fail[s] to appreciate that Carrie’s ‘security’ and ‘bandwidth’ concerns . . . are implicated ***every time traffic*** is switched ‘onto another user’s network’ (i.e., outside the customer’s own VLAN).” *Id.* at 4. Patent Owner asserts that “Petitioner also leaves unrebutted [Patent Owner’s declarant] Dr. Davis’s explanation that ‘[s]witching traffic outside a customer’s own VLAN, even if it can be differentiated from the traffic of other customers through VLAN translation or other means, still runs counter to Carrie’s specific security objectives and function as an intra-VLAN bridging device.’” *Id.* (quoting Ex. 2017 ¶ 98); *see also id.* at 7–8 (“Dr. Davis’s testimony forms the only testimony evidence on key issues specifically raised after institution, and especially on the key issues of how a POSITA would have interpreted Carrie.”). In support of Dr. Davis’s declaration testimony, Patent Owner points to Carrie’s teaching that “MAC address learning, ARP broadcasting, forwarding of spanning tree bridge protocol data units are preferably also limited to each virtual ***switch to prevent machine addresses in one network from being learned by another network.***” *Id.* at 5 (quoting Ex. 1005, 5:42–51). Patent Owner asserts that “Carrie’s express security objective of

preventing machine addresses in one network from being learned by another network transcends mere prevention of ‘**unintended** cross-VLAN frame transmission.’” *Id.*

Patent Owner adds that “customers expect VLAN traffic to be maintained within the **same** VLAN as the VLAN in which the frame originated, and therefore any action to switch a frame to another VLAN would be ‘unintended’ from the customer’s perspective.” *Id.* at 6. Patent Owner relies on Hawthorne’s teaching that “[a] **fundamental principal** [sic] of known VLAN technology is that the VLAN on which traffic enters a network node is the same as the VLAN on which the traffic exits the network node.” *Id.* (citing Ex. 1006 ¶ 7).

We disagree with Patent Owner. Carrie is directed to selectively processing VLAN traffic from different networks based on, for example, VLAN ID, port ID, or both, in order to provide for flexible VLAN ID assignment. Ex. 1005, 1:12–15, 2:4–9, 2:53–58, 2:62–65, 3:64–67, 4:1–4, 4:41–49, 5:3–15, 5:32–36, 7:57–63. To illustrate, Carrie explains:

In the example illustrated in FIG. 1, Customer A uses VLAN identifier 23 on port 1. Customer B uses VLAN identifier 15 on port 2. Thus, traffic from Customer A on port [1] will not be flooded to Customer B on port 2, since different VLAN identifiers are used. However, Customer C uses VLAN identifier 23 on port 3. Without the present invention or another VLAN mapping technique, layer 2 traffic from Customer A’s network would be flooded onto Customer C’s network and vice versa. However, according to the present invention, the port identifier is used in combination with the VLAN identifier to determine a virtual switch identifier. The virtual switch identifier is then used to select per-virtual-switch data structures, and the message is processed using the per-virtual switch data structures. As a result, traffic associated with different customers can be isolated,

even though the customers use the same VLAN ID and the customers are connected to the same layer 2 switch.

Ex. 1005, 4:41–49, Fig. 1. In the context of flooding, “when layer 2 traffic arrives at a switch and has a particular VLAN identifier, if a layer 2 forwarding database entry is not present in the forwarding table for the layer 2 traffic, the layer 2 traffic is only flooded onto ports of the switch associated with the same VLAN identifier.” *Id.* at 1:24–29. Carrie further explains that “each unique combination of VLAN identifier and port identifier may be assigned to a virtual switch,” where “separate message processing data structures are maintained for each virtual switch.” *Id.* at 5:37–40. The “message processing data structures may include layer 2 forwarding databases.” *Id.* at 5:42–44.

As Patent Owner points out, Carrie teaches that “[i]t is important to maintain separate forwarding databases . . . to prevent frames intended for one VLAN from being sent over another VLAN.” *Id.* at 5:44–47 (cited by PO Resp. 29). Although this teaching may suggest that the switch in Carrie is functioning as an intra-VLAN bridge, it does not necessarily limit Carrie’s switch functionality to intra-VLAN bridging. Carrie’s emphasis on “prevent[ing] frames intended for one VLAN from being sent over another VLAN” addresses the problem of “[f]looding traffic onto another user’s network” that was *not* intended to receive the traffic. *See* Ex. 1005, 1:41–43, 5:44–47. To illustrate, Carrie provides an example scenario:

[N]etwork A may assign the VLAN identifier 23 to its layer 2 traffic. Network B may also assign the VLAN identifier 23 to its layer 2 traffic. When layer 2 frames *destined for network A* arrive at a layer 2 switch, if a specific layer 2 forwarding table entry does not exist for the destination in network A, the frame

intended for the destination in network A will be flooded to networks A and B.

Id. at 1:34–40 (emphases added). Patent Owner is correct that Carrie further explains such “[f]looding . . . is undesirable for security reasons and it also unnecessarily wastes network bandwidth.” *Id.* at 1:41–43 (cited by PO Resp. 25). This says nothing, however, about altering the principle of selectively processing VLAN traffic from different networks based on the combination of the VLAN ID and the port ID to provide for flexible VLAN ID assignment, where cross-VLAN switching *is* intended.

Contrary to Patent Owner’s position that Carrie’s principle of operation is “assign[ing] mutually exclusive output ports to customers that share a same VLAN ID” (see PO Resp. 14), Carrie contemplates that “customers can share ports,” though cautions that “the combination of port and VLAN identifier is preferably unique” (see Ex. 1005, 4:49–50). Using Hawthorne’s VLAN ID translation would ensure that the combination of port and VLAN identifier is unique. To illustrate, Hawthorne provides a different example scenario:

[C]ustomers B and C 106 and 108 want to forward traffic through the Service Provider Edge Device 112 to the Service Provider Network 110 using the same VLAN ID (i.e., VLAN ID 20) as the VLAN ID that is being used by Customer A 104. If the traffic from all three of the customers is output on the same port of the Service Provider Edge Device with the same VLAN ID, the customer-specific traffic cannot be differentiated within the Service Provider Network based on VLAN ID alone and as a result additional packet processing must be performed within the service provider network to prevent different customers from seeing each other’s traffic.

Ex. 1006 ¶ 9, Fig. 1. Hawthorne teaches that its “VLAN ID translation rules specify an input port and VLAN ID pair that translate to an output port and

VLAN ID pair” such that “the uniqueness of VLAN IDs can be established on a per-port basis.” *Id.* ¶ 57. In other words, Hawthorne’s VLAN ID translation technique allows for “traffic from each input port interface [to be] sent out [shared] port interface 5 on different VLAN IDs” and then to be “differentiated within the service provider network based on VLAN ID alone,” thereby “prevent[ing] different customers from seeing each other’s traffic.” *Id.* ¶¶ 9, 65, Fig. 8. Thus, combining Carrie and Hawthorne as proposed by Petitioner would provide for a switch with expanded switching functionality that operates on the principle of selectively processing VLAN traffic (for example, applying VLAN ID translation rules) from different networks (for example, Hawthorne’s Customers A, B, and C in the above example scenario) based on the combination of the VLAN ID and the port ID (Hawthorne teaches specifying VLAN ID translation rules between input port and VLAN ID pairs and output port and VLAN ID pairs) in order to provide for flexible VLAN ID assignment (Hawthorne’s Customers A, B, and C may use the same VLAN ID despite also sharing the same output port because they will not be able to see each other’s traffic after VLAN ID translation). Patent Owner does not point to persuasive evidence showing that adding Hawthorne’s VLAN ID translation feature to Carrie’s switch would alter the principle of selectively processing VLAN traffic from different networks based on the combination of the VLAN ID and the port ID in order to provide for flexible VLAN ID assignment.

Moreover, using Hawthorne’s VLAN ID translation would increase security by preventing different customers from seeing each other’s traffic in the context of intentional cross-VLAN switching (*see* Ex. 1006 ¶¶ 9, 65), consistent with Carrie’s goal of ensuring that “traffic associated with

different customers can be isolated, even though the customers use the same VLAN ID and the customers are connected to the same layer 2 switch” (see Ex. 1005, 4:46–49). It is of no moment that Hawthorne “never once uses the term ‘security.’” See PO Resp. 26.

We note Patent Owner’s contention that “Carrie’s express security objective of preventing machine addresses in one network from being learned by another network transcends mere prevention of ‘*unintended*’ cross-VLAN frame transmission.” PO Sur-reply 5; *see also* Tr. 22:7–16 (“So anytime that a customer’s packet is switched outside of their own VLAN, there are security concerns that arise in that context. Once you’re outside the customer’s own VLAN -- and here in Hawthorne, for example, they switch it onto a service provider’s VLAN -- the service provider may have any number of machines that are either associated with the service provider or third parties, so we don’t know exactly who might have access to that frame[.]”). Carrie teaches that “MAC address learning, ARP broadcasting, forwarding of spanning tree bridge protocol data units are preferably also limited to each virtual switch to prevent machine addresses in one network from being learned by another network.” Ex. 1005, 5:47–51. As Petitioner points out, “Carrie’s concern with these operations, however, is the same as with the flooding operation: unintended mixing of customer traffic when two customers utilize the same VLAN ID (or IP address).” Pet. Reply 7.

Regarding MAC address learning, for example, Carrie explains that “if customers use the *same VLAN identifiers*, . . . any layer 2 frame that is addressed to the learned MAC source address will be forwarded to that MAC source address even if the layer 2 frame is from a different network.”

Ex. 1005, 6:1–16. Similarly, in its discussion of “ARPing,” Carrie alludes to “conflicts between networks” that may arise, where “different networks use the same IP addresses.” *Id.* at 6:57–7:13. Additionally, with respect to spanning tree protocol, Carrie notes that “if VLAN conflicts occur, spanning tree data will be shared across networks.” *Id.* at 7:22–38.

Yet in the context of intentional cross-VLAN switching, Petitioner’s proposed combination of Carrie and Hawthorne does not implicate these security concerns. By using VLAN ID translation, Petitioner’s proposed combination provides *different VLAN identifiers* so that “the uniqueness of each customer’s VLAN traffic is maintained at the output port interface.” *See* Ex. 1006 ¶ 65. That means that the traffic sent from a shared port interface “can be differentiated within the service provider network based on VLAN ID alone.” *Id.* Thus, Petitioner’s proposed combination implements security features consistent with Carrie’s teachings.

Even if it were true that “[s]witching traffic outside a customer’s own VLAN, even if it can be differentiated from the traffic of other customers through VLAN translation,” would result in some loss of security, Patent Owner essentially alleges tradeoffs (*see* PO Sur-reply 4); but “[t]he fact that [a] motivating benefit comes at the expense of another benefit . . . should not nullify its use as a basis to modify the disclosure of one reference with the teachings of another.” *See Winner Int’l Royalty Corp. v. Wang*, 202 F.3d 1340, 1349 n.8 (Fed. Cir. 2000). The relative advantages (e.g., expanded switching functionality) and disadvantages (e.g., decrease in security) of adding Hawthorne’s VLAN ID translation feature to Carrie’s switch amount to a tradeoff, a decision well within the level of an ordinarily skilled artisan. Additionally, there is no persuasive showing in the record that Carrie’s

switch would not be able to tolerate some loss of security as a tradeoff for the benefit of added functionality. *See* Ex. 1005, 4:50–52 (“[T]he combination of port and VLAN identifier is *preferably* unique” (emphasis added)), 5:47–51 (“MAC address learning, ARP broadcasting, forwarding of spanning tree bridge protocol data units are *preferably* also limited to each virtual switch to prevent machine addresses in one network from being learned by another network.” (emphasis added)), 7:5–8 (“The present invention *preferably* maintains proxy ARP data on a per virtual switch basis to ensure that conflicts between networks do not occur if different networks use the same IP addresses.” (emphasis added)).

We recognize that Carrie’s claims recite “selectively processing the first layer 2 frame . . . without modifying the first VLAN identifier,” as Patent Owner points out. *See, e.g.,* Ex. 1005, claim 1. During prosecution of the application for Carrie, however, the applicant amended the claims to recite “without modifying the first VLAN identifier” in order to distinguish them over Hawthorne. Ex. 2014, 19–24, 26–29. The applicant argued that there is “no teaching or suggestion in Hawthorne of selectively processing a packet using a virtual switch without modifying the VLAN identifier of the packet,” and that, “[r]ather, Hawthorne teaches translating an input VLAN ID to an output VLAN ID on a per-port basis and replacing the input VLAN ID with the translated output VLAN ID.” *Id.* at 27–28. This argument does not support Patent Owner’s position that Hawthorne’s cross-VLAN switching is “at odds” with Carrie’s function as an intra-VLAN bridge. It simply indicates that Hawthorne’s edge device modifies the input VLAN identifier using VLAN ID translation, whereas Carrie’s switch does not modify the input VLAN identifier at all.

Moreover, claim 2 of Carrie, which depends from claim 1, recites “preventing the first layer 2 frame from being forwarded to the second network and preventing the second layer 2 frame from being forwarded to the first network.” Ex. 1005, claim 2. Patent Owner’s focus on Carrie’s switch as an intra-VLAN bridge ignores this aspect of Carrie’s claims. Our reviewing court has explained that “the presence of a dependent claim that adds a particular limitation gives rise to a presumption that the limitation in question is not present in the independent claim.” *Phillips*, 415 F.3d at 1315. Because claim 2 of Carrie is directed to preventing cross-VLAN switching, we find that claim 1 of Carrie encompasses cross-VLAN switching in addition to intra-VLAN bridging.

As to Patent Owner’s criticism about “incorporat[ing] VLAN ID translation rules within Carrie’s per-VSI forwarding databases,” where “other more straightforward methods of VLAN ID translation were available . . . that would have been apt in the modified system (PO Resp. 36–37), we note that “just because better alternatives exist in the prior art does not mean that an inferior combination is inapt for obviousness purposes.” See *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004); *In re Mouttet*, 686 F.3d 1322, 1334 (Fed. Cir. 2012). That is, “obviousness ‘does not require that the motivation be the *best* option, only that it be a *suitable* option from which the prior art did not teach away.’” *Bayer Pharma AG v. Watson Labs., Inc.*, 874 F.3d 1316, 1328 (Fed. Cir. 2017). Here, Petitioner argues that an ordinarily skilled artisan would have been motivated to add Hawthorne’s VLAN ID translation feature to Carrie’s switch to “create a more complete solution to the problem of different customer networks using the same VLAN ID,” or, in other words, to expand Carrie’s switch functionality by

adding cross-VLAN switching capability. Pet. 27. As discussed above, Carrie contemplates cross-VLAN switching capability. *Compare* Ex. 1005, claim 1, *with* Ex. 1005, claim 2 (further limiting claim 1 to include preventing cross-VLAN switching, where claim 1 does not recite preventing cross-VLAN switching). Carrie thus supports Petitioner’s proffered reasoning for combining Carrie and Hawthorne.

Hawthorne’s statement that “[a] fundamental princip[le] of known VLAN technology is that the VLAN on which traffic enters a network node is the same as the VLAN on which the traffic exits the network node” does not change the outcome of our analysis. *See* Ex. 1006 ¶ 7 (cited by PO Sur-reply 6). Hawthorne was published on August 14, 2003, months before Carrie’s filing date of December 22, 2003. Ex. 1005, code (22); Ex. 1006, code (43). Given Hawthorne’s disclosure of cross-VLAN switching, known VLAN technology at the time of Carrie’s filing date was not limited to intra-VLAN bridging. Indeed, during prosecution of the application for Carrie, the Examiner relied on Hawthorne as a basis for rejecting the claims. *E.g.*, Ex. 2014, 5 (Examiner citing Hawthorne’s disclosure regarding VLAN ID translation).

For the reasons given above, Patent Owner’s arguments on altering Carrie’s principle of operation do not adequately rebut Petitioner’s obviousness showing.

iii. Rendering Carrie’s Solution Inoperable for Its Intended Purpose

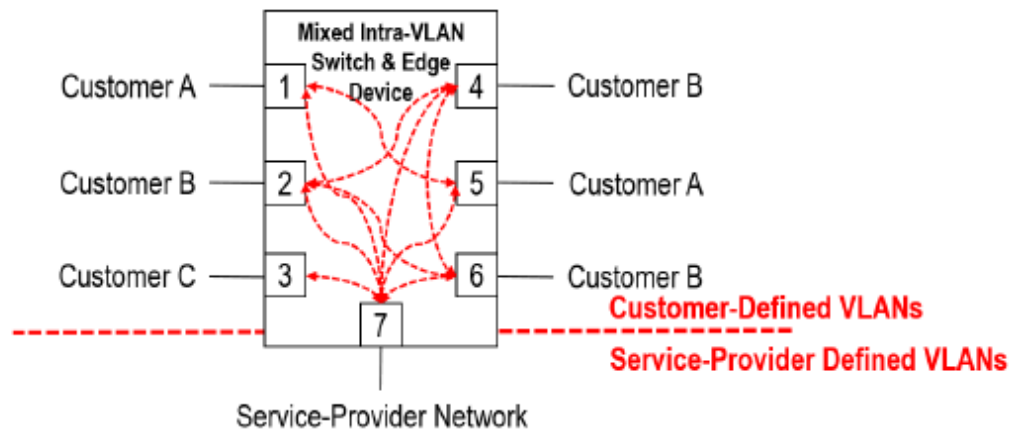
Patent Owner further argues that Petitioner’s “proposed modification of Carrie in view of Hawthorne renders Carrie’s original solution inoperable for its intended purpose.” PO Resp. 38. Patent Owner contends that Carrie

has “a clear purpose of isolating traffic within a customer’s own network (and, specifically, the customer’s own VLAN) during Layer 2 switching operations.” *Id.* at 39; *see also id.* at 41 (“Carrie’s design . . . purposely avoids switching traffic outside of a customer’s own VLAN.”); *id.* at 56 (“[T]he Petition’s proposed modification renders Carrie’s system inoperable for its intended purpose of isolating traffic within a customer’s own VLAN, and further undermines a range of security features described as part of Carrie’s original solution.”). As support, Patent Owner asserts that “Carrie explains in no uncertain terms that ‘[f]looding traffic *onto another user’s network* is *undesirable* for *security reasons* and it also unnecessarily *wastes network bandwidth*,’” and also that “Carrie explains that ‘[i]t is important to maintain separate forwarding databases and ARP caches *to prevent frames intended for one VLAN from being sent over another VLAN.*’” *Id.* at 39–40 (quoting Ex. 1005, 1:41–43, 5:44–47). According to Patent Owner, “[t]hese statements expressly show Carrie’s warning against switching traffic onto another user’s network, both for ‘security reasons’ and to avoid ‘wast[ing] network bandwidth.’” *Id.* at 40.

Patent Owner additionally asserts that Carrie’s claims “explicitly forbid modification of frame VLAN IDs (e.g., to switch the frame onto another VLAN).” *Id.* (citing Ex. 1005, claim 1). Patent Owner notes that “Hawthorne . . . explains in its background section that ‘[a] *fundamental principal* [sic] of known VLAN technology is that *the VLAN on which the traffic enters a network node is the same as the VLAN on which the traffic exits the network node*,’” and, according to Patent Owner, “Carrie’s repeated emphasis on not modifying VLAN IDs can thus be appreciated in the context of Carrie implementing an intra-VLAN bridge specifically

designed to abide by this ‘fundamental principle.’” *Id.* at 41–42 (quoting Ex. 1006 ¶ 7).

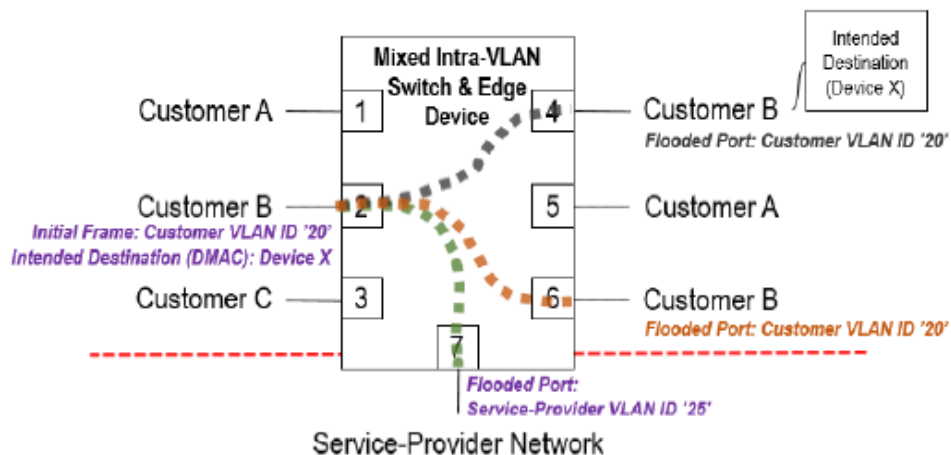
Turning to Petitioner’s proposed combination, Patent Owner asserts that “Hawthorne’s techniques directly contradict Carrie’s intended purpose each time the system resulting from the proposed combination switches a frame that arrived on a customer’s own VLAN to a different VLAN on the service provider’s network.” *Id.* at 45. To illustrate, Patent Owner provides a figure, which is reproduced below. *Id.* at 46 (citing Ex. 2017 ¶ 101).



Example Representation Of Petitioner’s Carrie-Hawthorne System

This figure shows what Patent Owner considers an exemplary embodiment of Petitioner’s proposed combination of Carrie and Hawthorne that “switches traffic from a customer’s VLAN to a service-provider’s VLAN each time the system forwards a frame from a customer network to the service-provider network over the shared output port.” Ex. 2017 ¶¶ 101–102 (cited by PO Resp. 45). Patent Owner insists that “switching traffic in this manner is unnecessary in light of Carrie’s function as an intra-VLAN bridging device, and contrary to Carrie’s intended purpose to isolate traffic within a customer’s own VLAN.” PO Resp. 47.

Patent Owner adds that “Petitioner’s combination also exhibits the problem of forwarding frames intended by the source to be maintained within the customer’s VLAN onto one or more different, service-provider defined VLANs.” *Id.* As support, Patent Owner asserts that “[s]ince the shared output port is associated with a customer’s virtual switch in the Carrie-Hawthorne system, the flooding/broadcast domain of each customer would logically encompass the shared output port and any other ports on which the customer connects.” *Id.* at 48. According to Patent Owner, “when the Layer 2 switch in the Carrie-Hawthorne system receives a frame from a customer that requires flooding, the switch would expectedly forward the frame on every port in the flooding/broadcast domain of the customer’s VSI—including the shared output port,” which means “flooded frame(s) would be sent outside the customer’s own VLAN in direct contradiction of Carrie’s intended purpose.” *Id.* at 48–49. Patent Owner further asserts that “[t]he tension between the Petition’s proposed combination and Carrie’s intended purpose is especially pronounced when a customer device addresses a frame to a destination within the customer’s own VLAN on a port other than the shared output port.” *Id.* at 49. To illustrate, Patent Owner provides another figure, reproduced below. *Id.* at 50 (citing Ex. 2017 ¶ 105).

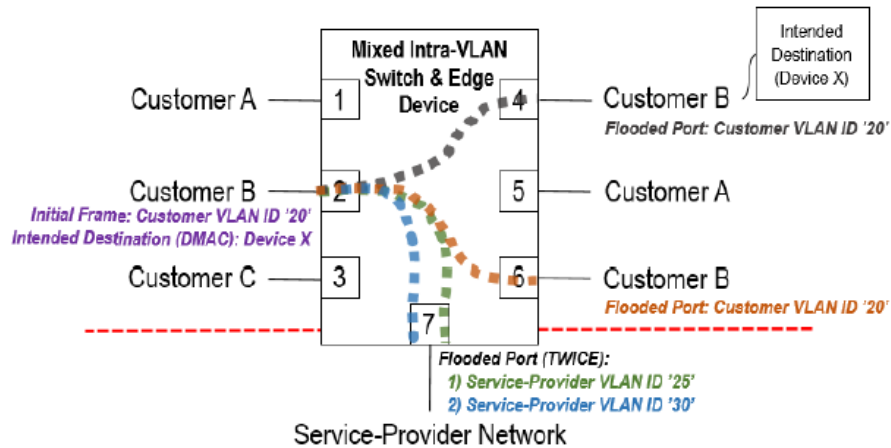


Carrie-Hawthorne: Flooding Onto Single Service-Provider VLAN

This figure shows what Patent Owner considers to be an exemplary embodiment of Petitioner’s proposed combination of Carrie and Hawthorne, where “flooding on the shared output port not only switches the frame outside of the customer’s own VLAN but does so with respect to traffic that was never intended for the service-provider network in the first place.” Ex. 2017 ¶ 105 (cited by PO Resp. 49).

Patent Owner contends that “the effects are exacerbated in circumstances where the proposed combination floods traffic on *multiple* service-provider VLANs,” as an ordinarily skilled artisan “would have expected flooding on multiple service-provider VLANs as a predictable result of the combination in circumstances where the service provider defines different VLAN IDs for the traffic of a given customer depending on the destination MAC address (DA MAC or DMAC) specified in a frame from that customer.” *Id.* at 50–51; *see also id.* at 51–52 (“By implementing the Carrie-Hawthorne system in accordance with Carrie’s approach of flooding all outputs associated with a virtual switch, it would be expected that the Carrie-Hawthorne system in this example would flood frames on all

ports associated with the virtual switch (including the shared output port to the service provider network) and all associated VLANs in the service provider network.”). To illustrate this additional flooding, Patent Owner provides yet another figure, reproduced below. *Id.* at 53 (citing Ex. 2017 ¶ 107).



Carrie-Hawthorne: Flooding Onto Multiple Service-Provider VLANs

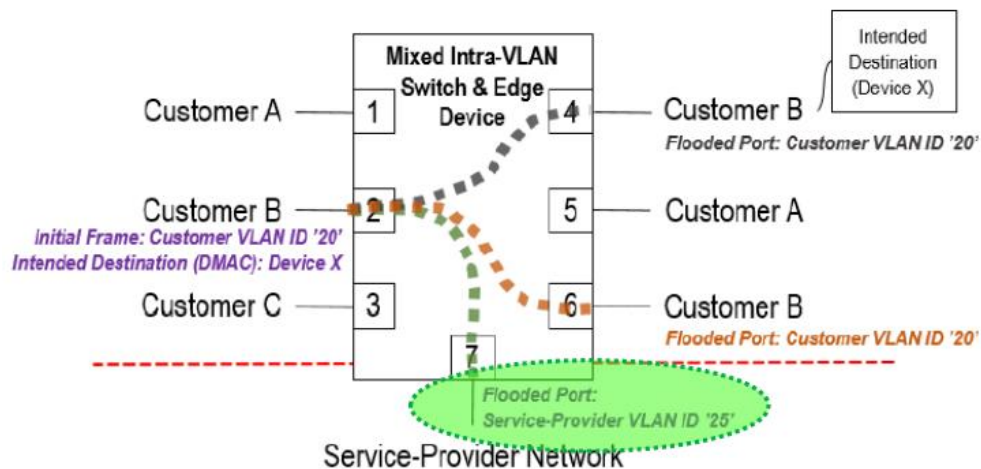
This figure shows what Patent Owner considers an exemplary embodiment of Petitioner’s proposed combination of Carrie and Hawthorne, where a frame is flooded “not only on the customer’s own VLAN but also on each of the service-provider defined VLANs associated with the customer.”

Ex. 2017 ¶ 107 (cited by PO Resp. 52–53). According to Patent Owner’s declarant Dr. Davis, “this would occur whether or not the frame was addressed to a device in the customer’s own VLAN or a device accessible in or through one of the service-provider defined VLANs.” *Id.*

Patent Owner adds that “Carrie’s concerns with switching traffic ‘onto another user’s network’ are not unique to flooding,” as “Carrie teaches that ‘MAC address learning, ARP broadcasting, forwarding of spanning tree bridge protocol data units are preferably also limited to each virtual switch *to prevent machine addresses in one network from being learned by*

another network.” PO Resp. 53 (quoting Ex. 1005, 5:47–51); *see also id.* at 54–55. Referring to our Institution Decision, Patent Owner contends that an ordinarily skilled artisan thus “would not have agreed with the notion that ‘using VLAN translation may increase security’ in Carrie’s system.” *Id.* at 55 (quoting Inst. Dec. 35–36). According to Patent Owner, “[w]hile differentiating customer traffic sent over a shared output port might increase security in an abstract sense . . . , it does not follow that a POSITA would have pursued this option in the context of Carrie’s intra-VLAN bridging device” because “the proposed modifications give rise to multiple additional/different security issues that directly touch on Carrie’s explicit design objectives and intended purpose.” *Id.*

Petitioner responds that “Carrie’s purpose is not to prevent all intended and unintended cross-VLAN traffic or VLAN translation—it is simply to distinguish the traffic of customers that use the same VLAN ID.” Pet. Reply 17. Petitioner contends that its “proposed combination preserves and enhances Carrie’s ability to distinguish traffic from multiple customers, even when traffic is switched to a shared output port for transmission over the service provider’s core network.” *Id.* According to Petitioner, “Patent Owner’s myopic focus on whether a frame is switched to a VLAN with a different VLAN ID entirely misses the point of Carrie,” which “is unconcerned with this type of switching because it is *intended*.” *Id.* at 18. Petitioner asserts that “[w]hen the Carrie-Hawthorne system forwards a frame to the service provider network with a translated VLAN ID, it does so intentionally.” *Id.* To illustrate, Petitioner provides an annotated version of one of Patent Owner’s figures, reproduced below. *Id.* at 20 (citing PO Resp. 50).



Carrie-Hawthorne: Flooding Onto Single Service-Provider VLAN

Patent Owner's figure, as annotated by Petitioner, shows that "the VLAN ID of Customer B's frame is intentionally translated from 20 to 25 to distinguish it from other customers' traffic (shown in green highlighting)." *Id.* at 19. Petitioner states, "If anything, Patent Owner's hypotheticals confirm the viability of the Carrie-Hawthorne system because they illustrate that even if multiple customers use the same VLAN ID, VLAN translation will distinguish their respective traffic when it is flooded onto a common output port—thereby satisfying Carrie's overarching concern." *Id.* at 20.

Petitioner adds that, "[t]o the extent Patent Owner further implies that the combination fails because a customer's frames are 'comingled' when switched onto a network 'shared by other customers,' any such concern is unfounded" because "Hawthorne is explicit that a customer's VLAN traffic is 'tunneled through' the service provider network using a translated VLAN ID, thereby 'ensur[ing] the uniqueness' of the traffic." *Id.* at 22 (quoting Ex. 1036, 25:7–9; Ex. 1006 ¶¶ 65, 70). To illustrate, Petitioner provides an annotated version of Figure 12 of Hawthorne, reproduced below. *Id.* at 23 (citing Ex. 1006, Fig. 12).

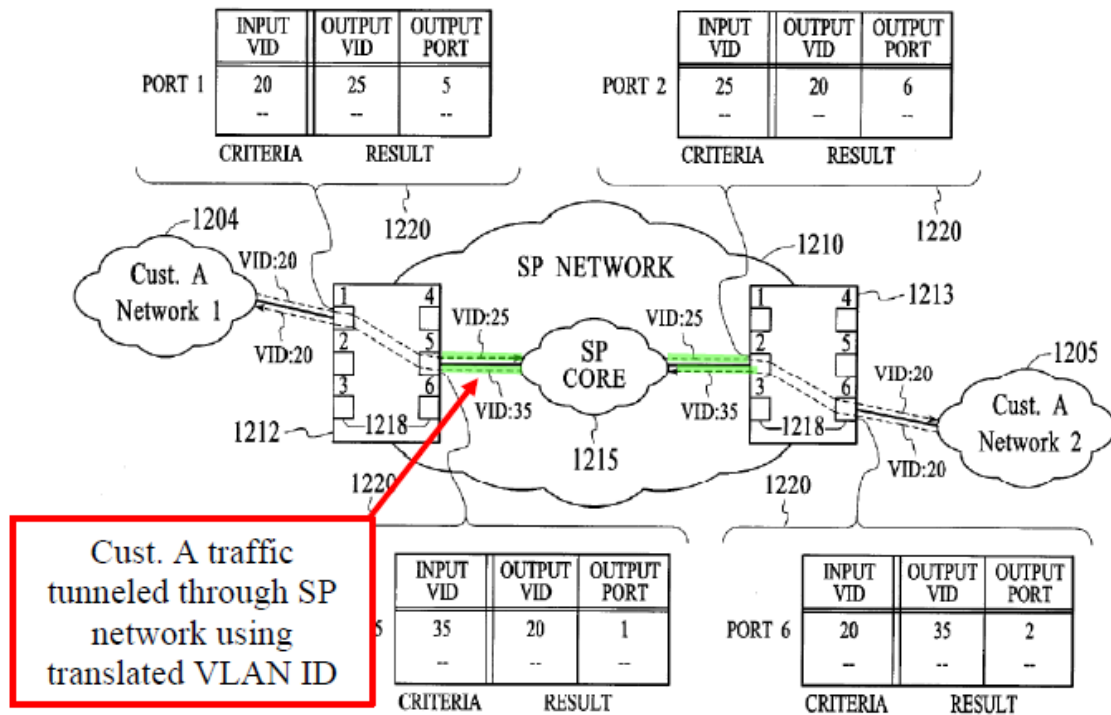


Figure 12 of Hawthorne, as annotated by Petitioner, shows an example of an end-to-end VLAN implementation using Hawthorne's VLAN ID translation techniques. See Ex. 1006 ¶¶ 36, 70.

In its Sur-reply, Patent Owner reiterates its position that “the intended purpose of Carrie’s switch was to provide a bridge that isolated each customer’s traffic within their respective VLAN.” PO Sur-reply 14. Patent Owner contends that, “[g]iven Carrie’s function as an ‘intra-VLAN bridge,’ the Petition fails to justify its assumption that a POSITA would have sought to implement Carrie’s intra-VLAN bridge in accordance with Hawthorne’s VLAN ID translation techniques to distinguish customer traffic on a shared output port.” *Id.* at 16. According to Patent Owner, “the problem addressed in Hawthorne of how to distinguish customer traffic on a shared output port would never even arise in the context of Carrie’s intra-VLAN bridge—especially since the function of Carrie’s bridge is not to connect customers

to a network or other resource on a single output port in the first instance.” *Id.* Patent Owner adds that the “application of Hawthorne-like VLAN ID translation to Carrie would compromise Carrie’s express security preferences” such that an ordinarily skilled artisan “would have rejected Petitioner’s proposed solution.” *Id.* at 17. Patent Owner relies on Dr. Davis’s declaration testimony, which, according to Patent Owner, “explain[s] that a POSITA would have accounted for Carrie’s explicit security objectives, and would have reserved any action to funnel customer traffic through a single network port to another switch within the larger network topology.” *Id.*

We disagree with Patent Owner. Carrie’s intended purpose is to provide for “selectively processing VLAN traffic from different networks while allowing flexible VLAN identifier assignment.” Ex. 1005, 1:12–15, 2:53–58, 3:33–36.⁷ Although one aspect of Carrie’s invention may be

⁷ See also Ex. 1005, 2:62–65 (“The present invention includes methods and systems for selectively processing virtual local area network traffic from different networks while allowing flexible VLAN identifier assignment.”); *id.* at 3:8–12 (“Assigning a port identifier to VLAN traffic and using the port identifier in combination with the VLAN identifier allows customers to flexibly assign VLAN identifiers without regard to VLAN identifiers assigned to other customers.”); *id.* at 4:28–32 (“[T]he port identifier may be used in combination with a VLAN identifier to allow customers to flexibly assign VLAN identifiers without regard to VLAN identifiers assigned to other customers of the service provider that operates the layer 2 switch.”); *id.* at 8:23–25, 9:18–21 (“[T]he present invention reduces the virtual switch ID lookup table size yet still provides flexibility in VLAN identifier assignment,” even though “[t]his decrease in lookup table size is at the expense of flexibility in VLAN identifier assignment.”); *id.* at 10:26–29 (“Thus, the present invention includes methods and systems that allow frames associated with different VLANs to be selectively processed while allowing flexible customer VLAN identifier assignment.”).

“isolating traffic within a customer’s own network,” it is not “a clear purpose.” See PO Resp. 39. As Petitioner points out, this aspect of Carrie’s invention addresses *unintended* cross-VLAN switching, which may give rise to security concerns where two or more customers use the same VLAN identifiers and the traffic is not intended to be shared between the customers. See Pet. Reply 17–18. Carrie explains:

One problem with using VLAN identifiers to control the distribution of layer 2 traffic occurs when different networks connected to the same layer 2 switch use the same VLAN identifiers. For example, network A may assign the VLAN identifier 23 to its layer 2 traffic. Network B may also assign the VLAN identifier 23 to its layer 2 traffic. When layer 2 frames *destined for network A* arrive at a layer 2 switch, if a specific layer 2 forwarding table entry does not exist for the destination in network A, the frame *intended for the destination in network A* will be flooded to networks A and B. Flooding traffic onto another user’s network is undesirable for security reasons and it also unnecessarily wastes network bandwidth.

Ex. 1005, 1:31–43, Fig. 1 (emphases added). To illustrate, Figure 1 of Carrie is reproduced below.

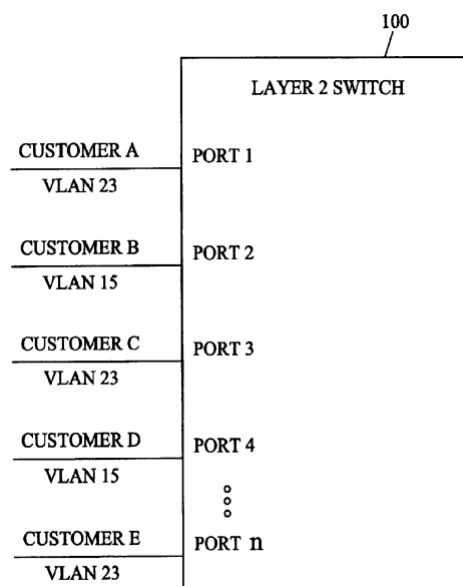


FIG. 1

Figure 1 is a block diagram of a layer 2 network and a layer 2 switch. *Id.* at 3:51–53. Here, Customer A uses VLAN ID 23 on port 1, and Customer C uses VLAN ID 23 on port 3. *Id.* at 4:33–35, 4:37–38. Isolating each customer’s traffic within the customer’s respective network in this case would give the customers flexibility to use the same VLAN identifier. For example, according to Carrie, “the port identifier is used in combination with the VLAN identifier to determine a virtual switch identifier,” which is “used to select per-virtual-switch data structures,” which are then used to process traffic such that the “traffic associated with different customers can be isolated, even though the customers use the same VLAN ID and the customers are connected to the same layer 2 switch.” *Id.* at 4:41–49. Carrie teaches that “separate messaging processing data structures are maintained for each virtual switch,” where the “message processing data structures may include layer 2 forwarding databases, ARP caches, and spanning tree data,” and that “[i]t is important to maintain separate forwarding databases and ARP caches to prevent frames *intended for one VLAN* from being sent over another VLAN.” *Id.* at 5:40–47 (emphasis added). Thus, isolating VLAN traffic within a network in Carrie is just a way to achieve the purpose of “selectively processing VLAN traffic from different networks while allowing flexible VLAN identifier assignment,” where cross-VLAN switching is *not* intended.

As Petitioner points out, Carrie is silent on “selectively processing VLAN traffic from different networks while allowing flexible VLAN identifier assignment,” where cross-VLAN switching is *intended*. See Pet. 25–26 (“Carrie’s solution does not explicitly address the problematic situation in which traffic from two different networks with the same VLAN

ID is forwarded to the *same output port*—for example, an output port connected to a service provider serving both networks.”); *see also* Ex. 1006 ¶ 9 (“If the traffic from all three of the customers is output on the same port of the Service Provider Edge Device with the same VLAN ID, the customer-specific traffic cannot be differentiated within the Service Provider Network based on VLAN ID alone and as a result additional packet processing must be performed within the service provider network to prevent different customers from seeing each other’s traffic.”). Adding Hawthorne’s VLAN ID translation feature to Carrie’s switch, as proposed by Petitioner, would provide a switch with *intended* cross-VLAN switching functionality while still allowing for flexible VLAN identifier assignment. *See* Pet. 27 (identifying the “motivat[ion] to augment Carrie’s virtual switch solution with Hawthorne’s known VLAN translation technique to create a more complete solution to the problem of different customer networks using the same VLAN ID”). Specifically, Hawthorne teaches that “different customers connected to different ports of a service provider edge device may . . . independently use the same VLAN IDs to send traffic to the service provider edge device.” Ex. 1006 ¶ 65. If the next hop for the VLAN traffic from each customer is to the service provider network via a shared port of the service provider edge device, then using Hawthorne’s VLAN ID translation feature would allow the VLAN traffic from each input port to be sent out a shared port on different VLAN IDs. *Id.* This is consistent with Carrie’s intended purpose of “selectively processing VLAN traffic from different networks while allowing flexible VLAN identifier assignment.”

Even if Carrie’s intended purpose were “isolating traffic within a customer’s own network,” as Patent Owner contends, adding Hawthorne’s

VLAN ID translation feature would not necessarily render Carrie's switch inoperable for its intended purpose. Petitioner's proposed combination of Carrie and Hawthorne provides a switch with both intra-VLAN bridging functionality and cross-VLAN switching functionality. With respect to intra-VLAN bridging, Carrie states:

Referring to FIG. 4, in step 400, a layer 2 frame is received at a port of a layer 2 switch. In step 402, a port identifier is assigned to the layer 2 frame. In step 404, the VLAN identifier is extracted from the layer 2 frame. In step 406, a lookup is performed in the virtual switch identifier table using the VLAN ID and the port ID combination. The virtual switch identifier is extracted and, in step 408, a per-virtual-switch data structure is accessed. Such data structures may include forwarding databases, ARP caches, etc. In step 410, the frame is processed using the per-virtual-switch data structure. For example, the frame may be *forwarded* or flooded to a node or nodes associated with the same virtual switch.

Ex. 1005, 7:64–8:8 (emphasis added). If Carrie's layer 2 switch were to have cross-VLAN functionality, the switch could still operate as an intra-VLAN bridge, where the frame described above in connection with Figure 4 would still be forwarded to the intended node. See Tr. 20:24–21:1 (Patent Owner's counsel acknowledging that for "[s]ome frames, if it knew it was going to forward a frame from port 2 to port 4, yes, it would work for a subset of frames"). Patent Owner does not adequately show why Carrie's switch could not operate as an intra-VLAN bridge while having cross-VLAN switching functionality. Moreover, as discussed above, Carrie appears to contemplate cross-VLAN switching capability. Compare Ex. 1005, claim 1, *with id.* at claim 2 (further limiting claim 1 to include preventing cross-VLAN switching, where claim 1 does not recite preventing cross-VLAN switching).

We note Patent Owner’s argument that Petitioner’s proposed combination of Carrie and Hawthorne gives rise to “security issues that directly touch on Carrie’s explicit design objectives and intended purpose.” PO Resp. 55. Regarding flooding, for example, where the forwarding database has no entry for a frame, Carrie explains that “if two service providers use the same VLAN identifier, frames intended for one service provider may be flooded onto the network of the other service provider.” Ex. 1005, 6:30–33. Carrie addresses “this difficulty by limiting such flooding to a per-virtual-switch basis,” so that “the frame is flooded only onto ports associated with the same virtual switch.” *Id.* at 6:34–42. According to Carrie, “security is increased” as a result. *Id.* at 6:42–44.

With respect to Petitioner’s proposed combination, Patent Owner contends that if the switch receives a frame that requires flooding, the switch would forward the frame on every port associated with the customer’s VSI, including the shared output port, even when the frame is addressed to a destination within the customer’s own VLAN on a port other than the shared output port. PO Resp. 48–49. Even if this were true, Hawthorne teaches that using its VLAN ID translation rules ensures “the uniqueness of each customer’s VLAN traffic is maintained at the output port interface.” Ex. 1006 ¶ 65. That is, “[b]ecause the VLAN traffic from each input port interface is sent out [the shared output] port interface . . . on different VLAN IDs, the traffic that is sent from [the shared output] port interface . . . can be differentiated within the service provider network based on VLAN ID alone.” *Id.* Such traffic differentiation helps “prevent VLAN traffic from being seen by the wrong customers.” *See id.* ¶ 9. Thus, Hawthorne

addresses Carrie's security concerns in the context of cross-VLAN switching.

We further note Patent Owner's argument that Carrie's claims "forbid" VLAN ID modification. See PO Resp. 40–42. As discussed above, the prosecution history for Carrie simply indicates that Hawthorne's edge device modifies the input VLAN ID using VLAN ID translation, whereas Carrie's switch does not modify the input VLAN ID at all. See Ex. 2014, 19–24, 26–29. Patent Owner does not point to persuasive evidence showing that Carrie *forbids* VLAN ID modification.

In view of the foregoing, Patent Owner's arguments on rendering Carrie's solution inoperable for its intended purpose do not adequately rebut Petitioner's obviousness showing.

iv. Failure to Provide a More Complete Solution

Patent Owner argues that Petitioner's proposed combination of Carrie and Hawthorne does not "provide a 'more complete' solution as alleged." PO Resp. 57. According to Patent Owner, "Carrie's original solution already allowed customers to flexibly select VLAN IDs," and "[t]he only relevant restriction to customers' selection of VLAN IDs is that customers with the same VLAN ID cannot connect to the same port if their traffic is to be distinguished." *Id.* Patent Owner acknowledges that the "additional functionality gained by [Petitioner's] proposed modification of Carrie in view of Hawthorne is the ability to distinguish customer traffic on a shared **output** port when customers use the same VLAN IDs to forward traffic to a service provider network," but contends that "two or more customers are still unable to present the same VLAN IDs at a shared **input** port if their

traffic is to be distinguished (since each customer's traffic would map to the same VSI based on their shared input port and shared VLAN ID).” *Id.*

Patent Owner further notes that the functionality gained nevertheless “was unnecessary in light of Carrie’s function (e.g., intra-VLAN bridging) and would have been avoided to the extent it required switching customer traffic onto a service provider defined VLAN (as taught by Hawthorne).” *Id.*

Patent Owner also contends that Petitioner “fails to explain why a POSITA would have sacrificed Carrie’s expressed principle to avoid switching traffic onto other VLANs merely to accommodate additional flexibility for customers to use a same VLAN ID on a shared port.” *Id.* at 58. Patent Owner asserts that “Carrie’s goal of providing flexible VLAN assignments is clearly subordinate to the higher-order concerns of differentiating customer traffic and isolating traffic within a customer’s own VLAN—a fact that is evident from Carrie’s teaching against customers sharing the same VLAN ID on a port.” *Id.* (citing Ex. 1005, 1:41–43, 4:49–52, 5:32–36, 8:66–9:3). According to Patent Owner, “Carrie could have condoned the practice of customer[’s] sharing a VLAN ID on a port in the interest of increased customer flexibility (and at the expense of isolating customer traffic from other customers), but Carrie purposely chose a different solution.” *Id.*

Patent Owner adds that Petitioner’s “application of Hawthorne’s VLAN ID translation to Carrie results in a system that is strikingly similar to an approach Carrie expressly critiqued in its background section.” *Id.* at 58–59. Specifically, Patent Owner directs us to where Carrie describes using virtual metropolitan area network (VMAN) identifiers in addition to VLAN identifiers to segregate traffic from different customers with the same VLAN

identifiers. *Id.* (citing Ex. 1005, 1:56–2:9). This involves adding a VMAN identifier to a frame upon entry into a service provider’s network, using the VMAN identifier to switch the traffic within the service provider’s network, and removing the VMAN identifier when the traffic leaves the service provider’s network. Ex. 1005, 1:59–63. Carrie explains that using VMAN identifiers “still does not solve the problem of flexible VLAN assignment” because “there must still be a way to segregate this traffic at the egress point of the layer 2 service provider’s network,” where “two customers use the same VLAN ID.” *Id.* at 1:63–2:1; *see also id.* at 2:6–9 (“[T]here still exists a need for a solution to how to separate the traffic of different customers that use the same VLAN IDs at the ingress and egress points of the service provider’s network.”). According to Patent Owner, Petitioner’s proposed combination of Carrie and Hawthorne similarly “adds a new identifier to a frame upon ingress to a service provider’s network, uses the new identifier to switch the traffic within the service provider’s network, and removes the identifier upon egress from the service provider’s network.” PO Resp. 59–60 (citing Pet. 24–31). Patent Owner further asserts that “the Carrie-Hawthorne system requires mechanisms for distributing unique translated VLAN IDs to customers and requires additional processing to segregate the traffic upon ingress and egress from the service provider network,” thereby “exhibit[ing] substantially the same defects as the approach expressly critiqued in Carrie, while still doing nothing to enable customers to freely connect to a single port with the same VLAN ID.” *Id.* at 60. Patent Owner contends that, “[u]nder these circumstances, a POSITA would not have found it obvious to modify Carrie in view of Hawthorne since it fails to

provide a ‘more complete solution to the problem of different customer networks using the same VLAN ID.’” *Id.*

With respect to Patent Owner’s argument that Petitioner’s proposed combination of Carrie and Hawthorne is deficient “because, even if Hawthorne’s VLAN translation distinguishes traffic on a shared *output* port, ‘two or more customers are still unable to present the same VLAN IDs at a shared *input* port if their traffic is to be distinguished,’” Petitioner responds that “[t]his is tantamount to arguing that a POSITA would not have improved Carrie’s switch with VLAN translation because VLAN translation does [not] solve *every* conceivable problem with Carrie’s switch.” Pet. Reply 23–24 (quoting PO Resp. 57). Petitioner further asserts that “the known advantages of VLAN translation would have been enough to motivate a POSITA to modify Carrie’s switch as proposed.” *Id.* at 24.

As to Patent Owner’s argument that Petitioner’s proposed combination is similar to the VMAN system that Carrie describes in its background section as inadequate, Petitioner contends that “their solutions are different.” *Id.* Specifically, Petitioner points out that “[t]he VMAN solution in the background ‘is to use a virtual metropolitan area network (VMAN) identifier *in addition* to VLAN identifiers to segregate traffic from different customers’ on the service provider network,” whereas “the solution proposed in the Petition uses only VLAN ID translation to segregate traffic and is therefore not the solution Carrie found lacking.” *Id.* at 24–25.

According to Petitioner, “the VMAN scenario in the background illustrates the need for traffic differentiation both within a layer 2 switch and on the service provider network,” and “[t]he proposed solution that uses Carrie’s

virtual switch technique combined with Hawthorne’s VLAN translation satisfies that need.” *Id.* at 25.

We agree with Petitioner. For an obviousness analysis, our reviewing court has instructed, “[T]he question is whether there is something in the prior art as a whole to suggest the *desirability*, and thus the obviousness, of making the combination,’ not whether there is something in the prior art as a whole to suggest that the combination is the *most desirable* combination available.” *Fulton*, 391 F.3d at 1200 (cited by Pet. Reply 24). Here, as Patent Owner points out, “Carrie’s original solution . . . allow[s] customers to flexibly select VLAN IDs,” however, “customers with the same VLAN ID cannot connect to the same port if their traffic is to be distinguished.” PO Resp. 57. Petitioner proposes to “augment Carrie’s virtual switch solution with Hawthorne’s known VLAN translation technique to create a more complete solution to the problem of different customer networks using the same VLAN ID.” Pet. 27. More specifically, Petitioner proposes adding Hawthorne’s VLAN ID translation feature to Carrie’s switch so that “traffic from two different networks with the same VLAN ID [can be] forwarded to the *same output port*—for example, an output port connected to a service provider serving both networks.” Pet. 25–26. Petitioner’s proposed combination would provide a switch with expanded functionality, namely, a switch with both intra-VLAN bridging functionality as well as cross-VLAN switching functionality. This is sufficient rationale for why an ordinarily skilled artisan would have combined Carrie and Hawthorne. *See Kahn*, 441 F.3d at 988 (“[T]here must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.”). Patent Owner even acknowledges that the “additional functionality gained by

[Petitioner's] proposed modification of Carrie in view of Hawthorne is the ability to distinguish customer traffic on a shared **output** port when customers use the same VLAN IDs to forward traffic to a service provider network.” PO Resp. 57. That “two or more customers are still unable to present the same VLAN IDs at a shared **input** port if their traffic is to be distinguished (since each customer's traffic would map to the same VSI based on their shared input port and shared VLAN ID)” does not sufficiently defeat Petitioner's obviousness showing. *See id.*

We note Patent Owner's contention that the functionality gained from Petitioner's proposed combination nevertheless is “unnecessary in light of Carrie's function (e.g., intra-VLAN bridging) and would have been avoided to the extent it required switching customer traffic onto a service provider defined VLAN (as taught by Hawthorne).” *Id.* This contention is unavailing. As discussed above, Carrie contemplates cross-VLAN switching. *Compare* Ex. 1005, claim 1, *with id.* at claim 2 (further limiting claim 1 to include preventing cross-VLAN switching, where claim 1 does not recite preventing cross-VLAN switching). Adding Hawthorne's VLAN ID translation feature to Carrie's switch provides for additional functionality, namely, cross-VLAN switching functionality. Hawthorne teaches that “different customers connected to different ports of a service provider edge device may . . . independently use the same VLAN IDs to send traffic to the service provider edge device.” Ex. 1006 ¶ 65. If the next hop for the traffic from each customer is to the service provider network via a shared port of the service provider edge device, then using Hawthorne's VLAN ID translation feature would allow the traffic from each input port to be sent out a shared port on different VLAN IDs, so that the traffic sent from

the shared port can be differentiated within the service provider network. *Id.* This provides for “a more complete solution to the problem of different customer networks using the same VLAN ID.” *See* Pet. 27.

We also note Patent Owner’s contention that “Carrie’s goal of providing flexible VLAN assignments is clearly subordinate to the higher-order concerns of differentiating customer traffic and isolating traffic within a customer’s own VLAN.” PO Resp. 58. According to Patent Owner, this “is evident from Carrie’s teaching against customers sharing the same VLAN ID on a port.” *Id.* We disagree. Patent Owner directs us to various passages in Carrie. For example, Patent Owner directs us to where Carrie states that “[f]looding traffic onto another user’s network is undesirable for security reasons and it also unnecessarily wastes network bandwidth.” *Id.* (citing Ex. 1005, 1:41–43). This statement is referring to the “problem with using VLAN identifiers to control the distribution of layer 2 traffic,” where “different networks connected to the same layer 2 switch use the same VLAN identifiers.” Ex. 1005, 1:31–34. Carrie suggests that “[o]ne solution to the problem of VLAN identifier assignment is to require different networks to use different VLAN identifiers,” but notes that “[w]hile assigning separate VLAN identifiers to separate networks prevents the flooding problems . . . , it unnecessarily limits the VLAN assignment capabilities of each network.” *Id.* at 1:44–49. Carrie’s express concern with resolving flooding problems at the expense of VLAN ID assignment flexibility undermines Patent Owner’s contention that Carrie is more concerned with differentiating customer traffic and isolating traffic within a customer’s own VLAN than providing flexible VLAN assignments.

Patent Owner further directs us to where Carrie teaches that “customers can share ports,” but “the combination of port and VLAN identifier is preferably unique.” PO Resp. 58 (citing Ex. 1005, 4:49–52). Patent Owner also directs us to where Carrie similarly teaches that “[b]ecause the present invention allows . . . customers to select VLAN identifiers independently of VLAN identifiers assigned to other customers, provided the customers are connected to different ports, the level 2 service provider does not constrain customer VLAN selection.” *Id.* (citing Ex. 1005, 5:32–36). Additionally, Patent Owner points to where Carrie explains that “Customers A and B can both use the ports in port set 1, because Customers A and B use different VLAN identifiers,” but “Customers A and C cannot use the same ports because Customers A and C use the same VLAN identifiers.” *Id.* (citing Ex. 1005, 8:66–9:3). Even if these cited passages in Carrie were to teach away from using the same VLAN ID on a port, Patent Owner’s contention in this regard is unavailing. Petitioner’s proposed combination of Carrie and Hawthorne does not call for using the same VLAN ID on a port; rather, it applies VLAN ID translation so that “VLAN traffic from each input port interface is sent out port interface 5 on *different VLAN IDs*.” See Ex. 1006 ¶ 65 (emphasis added).

Turning to Patent Owner’s argument that Petitioner’s proposed combination is similar to the VMAN system that Carrie considers inadequate, we note Carrie’s concern that the VMAN system does not address the “need for a solution to how to separate the traffic of different customers that use the same VLAN IDs at the ingress and egress points of the service provider’s network.” Ex. 1005, 2:4–9. More specifically, Carrie explains that “if two customers use the same VLAN ID, there must still be a

way to segregate this traffic at the egress point of the layer 2 service provider's network.” *Id.* at 1:65–2:1. By contrast, Petitioner's proposed combination addresses this need by using Carrie's combination of port and VLAN IDs so that “traffic associated with different customers can be isolated, even though customers use the same VLAN ID and . . . are connected to the same layer 2 switch,” and by using Hawthorne's VLAN ID translation technique so that “VLAN traffic from each input port interface is sent out port interface 5 on different VLAN IDs,” which means “the traffic that is sent from port interface 5 can be differentiated.” *See* Ex. 1005, 4:41–49; Ex. 1006 ¶ 65 (cited by Pet. 26); *see also* Ex. 1005, 2:65–3:8 (cited by Pet. 25). Thus, Patent Owner's comparison between Petitioner's proposed combination and the VMAN system is misplaced.

Patent Owner's arguments that Petitioner's proposed combination fails to provide a more complete solution do not adequately rebut Petitioner's obviousness showing.

v. Failure to Differentiate Traffic

Patent Owner argues that Petitioner's obviousness analysis is deficient because “the Carrie-Hawthorne system would *not* differentiate traffic in at least some circumstances that the Petitioner's own expert—Dr. Bhattacharjee—suggests would occur in typical implementations of the system.” PO Resp. 61. Specifically, Patent Owner directs us to Dr. Bhattacharjee's deposition testimony that “two different networks” could refer to “different customers, different entities, different commercial entities, ***different security domains within the same entity***, and so on.” *Id.* at 61–62 (quoting Ex. 2018, 59:21–60:19). According to Patent Owner, this means

that Petitioner assumes that its proposed “Carrie-Hawthorne combination would be capable of differentiating traffic from ‘different security domains within the same entity,’ which a POSITA would have understood to include a customer’s various physical LANs . . . that connect to different ports of a switch to operate a VLAN.” *Id.* at 62. Patent Owner contends that Petitioner’s proposed combination “would be unable to differentiate traffic between different physical networks in a customer’s VLAN,” however, because “when a virtual switch is associated with more than one port of a customer’s VLAN, Carrie’s system will nevertheless select the *same* per-virtual switch forwarding database to process traffic received on each of these ports—and thus the forwarding information *is not differentiated by port.*” *Id.* at 62, 64. Patent Owner relies on the declaration testimony of Dr. Davis. *Id.* at 65–67 (citing Ex. 2017 ¶¶ 124, 127). Patent Owner also relies on a figure from Dr. Davis’s initial declaration, which Patent Owner does not cite. *Compare* PO Resp. 66 (figure described as “Example Implementation of Data Structures Consistent With Petition’s And Dr. Bhatta[']charjee’s Description of Carrie-Hawthorne System”), *with* Ex. 2013 ¶ 79 (figure described as “Example Implementation of Data Structures Consistent With Petition’s And Dr. Bhatta[']charjee’s Description of Carrie-Hawthorne System”). Patent Owner concludes that “Petitioner’s proposed combination of Carrie and Hawthorne fails to achieve the functionality of differentiating network traffic on a shared output port in the manner alleged in the Petition.” *Id.* at 69; *see also id.* at 64 (“To the extent the Petition’s contention about the Carrie-Hawthorne combination being able to ‘differentiate[] VLAN traffic from different networks’ and ‘differentiat[e] VLAN traffic having the same input VLAN ID’ assumed an ability to

differentiate VLAN traffic from different physical networks of a customer within a VSI, this is false.”).

With respect to the scenario that Patent Owner describes, where “a virtual switch is associated with more than one port of a customer’s VLAN,” Petitioner counters that such “scenario is not possible in the proposed Carrie-Hawthorne system” because “Patent Owner’s allegedly problematic scenario corresponds to Carrie’s ‘port set’ embodiment of Figs. 5 and 6 in which multiple ports are associated with a port set and ‘each combination of port set and VLAN identifier is then assigned to a virtual switch,’” whereas Petitioner’s proposed “combination builds upon Fig. 4 of Carrie rather than Fig. 5—a distinction that caused Dr. Davis to withdraw the illustration that Patent Owner relies on for this argument.” Pet. Reply 25 (citing Ex. 1005, 4:1–4, 8:31–9:3). According to Petitioner, Figures 1–4 of Carrie describe an embodiment “in which ‘each *unique combination of VLAN identifier and port identifier* may be assigned to a virtual switch.” *Id.* at 26 (quoting Ex. 1005, 5:39–40). Petitioner asserts that “[i]n this embodiment, there is a one-to-one correspondence between a port/VLAN ID combination and a virtual switch instance,” and “[b]ecause the proposed Carrie-Hawthorne system is based upon this one-to-one embodiment, there would not be a ‘virtual switch [] associated with more than one port of a customer’s VLAN’ and no susceptibility to the hypothetical problem argued by Patent Owner.” *Id.* Petitioner adds that Dr. Davis “testified under re-direct examination by Patent Owner’s counsel that he has come to understand since preparing his initial declaration that Petitioner is relying upon . . . Carrie’s Fig. 4 rather than Fig. 5,” and “that this change in understanding ‘necessitated’ changes in his supplemental declaration, including the removal of the illustration

labeled ‘Example Implementation of Data Structures Consistent With Petition’s and Dr. Bhattacharjee’s Description of Carrie-Hawthorne System’ found on page 50 of his initial declaration.” *Id.* (citing Ex. 1036, 39:19–40:18); *see also id.* at 27 (citing Ex. 1036, 40:19–41:19).

In Response, Patent Owner contends that “the Petition cited multiple other embodiments from Carrie beyond just Figure 4,” which Patent Owner asserts it “detailed in [its] pre-institution Sur-Reply.” PO Sur-Reply 23 (citing Paper 11, 4–5). Patent Owner also contends that the “distinction between Figures 4 and 6 in Carrie relates simply to the method of looking up a customer’s virtual switch ID—e.g., whether the virtual switch ID is identified using an input ‘port’ (Figure 4) or an input ‘port set’ (Figure 6).” *Id.* at 24. Patent Owner asserts that “[r]egardless of the lookup method, however, virtual switch IDs are associated with customers, and the same customer would be identified by the same virtual switch ID on multiple ports.” *Id.* Additionally, Patent Owner contends that Petitioner “misreads the difference between Carrie’s Figures 4 and 5 embodiments,” as “[t]he distinction is not whether customers are assigned different VSIs on different ports, but instead whether the virtual switch is identified based on a combination of input port and VLAN ID of a frame (Figure 4) or by the input port or VLAN ID alone (Figure 5).” *Id.* at 25.

The parties’ dispute centers on whether Petitioner’s proposed combination addresses what Dr. Bhattacharjee characterizes as “the problematic situation in which traffic from two different networks with the same VLAN ID is forwarded to the same output port,” where “two different networks” refers specifically to different security domains within the same entity. The answer to this question is inconsequential to our analysis here.

Patent Owner is correct that Petitioner's declarant Dr. Bhattacharjee testified during his deposition that "two different networks" could refer to "different customers, different entities, different commercial entities, different security domains within the same entity, and so on." Ex. 2018, 59:21–60:19. Yet Patent Owner overlooks that Dr. Bhattacharjee provided this testimony in response to questioning on what he meant by "two different networks" when he stated in his declaration that "a POSITA would have recognized, however, that Carrie's solution does not explicitly address the problematic situation in which traffic from two different networks with the same VLAN ID is forwarded to the same output port." Ex. 2018, 59:21–60:19 (citing Ex. 1003 ¶ 120). Thus, Dr. Bhattacharjee's testimony on the meaning of "two different networks" simply shows that he is identifying a problem that Carrie's solution does not address, namely, the situation in which traffic from two different networks (including, for example, different security domains within the same entity) with the same VLAN ID is forwarded to the same output port. His testimony, by itself, does not show that Petitioner is assuming that its proposed combination of Carrie and Hawthorne would be capable of differentiating traffic specifically from different security domains within the same entity, as Patent Owner contends. See PO Resp. 62.

Indeed, Dr. Bhattacharjee relies on Hawthorne to illustrate the "problematic situation" that he identifies in his declaration. In particular, Hawthorne explains,

If the traffic from all three of the *customers* is output on the same port of the Service Provider Edge Device with the same VLAN ID, the customer-specific traffic cannot be differentiated within the Service Provider Network based on VLAN ID alone and as a result additional packet processing must be performed within the

service provider network to prevent different customers from seeing each other's traffic.

Ex. 1006 ¶ 9 (quoted by Ex. 1003 ¶ 120) (emphasis added). If anything, Dr. Bhattacharjee's reliance on Hawthorne in this regard shows that Petitioner's proposed combination is intended to address the problem where traffic from two different networks (including, for example, different *customers*) with the same VLAN ID is forwarded to the same output port. *See also* Ex. 1003 ¶ 121 ("Hawthorne provides a well-known and predictable solution to this problem Hawthorne explains that its VLAN translation technique allows 'the uniqueness of each *customer's* VLAN traffic [to be] maintained at the output port interface.'") (quoting Ex. 1006 ¶ 65) (emphasis added); Ex. 1006 ¶ 65 ("Because the VLAN traffic from each input port interface is sent out port interface 5 on different VLAN IDs, the traffic that is sent from port interface 5 can be differentiated within the service provider network based on VLAN ID alone."). As discussed above with respect to step 1.4, Petitioner explains that it would have been obvious to an ordinarily skilled artisan to "utilize Hawthorne's teachings regarding its improved VLAN translation technique in combination with Carrie's system—for example, in order to differentiate *customer* traffic forwarded to a service provider network." Pet. 24 (emphasis added). Patent Owner does not dispute that Petitioner's proposed combination would differentiate traffic where "different networks" refer to different customers.

For the reasons given, Patent Owner's argument that Petitioner's proposed combination of Carrie and Hawthorne fails to differentiate traffic from different security domains within the same entity does not adequately rebut Petitioner's obviousness showing.

3. *Dependent Claim 4*

Claim 4 depends from claim 1. As discussed above, step 1.5 of claim 1 refers to “communicating the received frame and the output VLAN ID to the obtained output port.” Claim 4 limits step 1.5 to further comprise “adding the output VLAN ID to the received frame, or substituting the output VLAN ID for the input VLAN ID contained by the frame.” Noting the “disjunctive connector ‘or’” recited in claim 4, Petitioner contends that this limitation “covers several alternatives,” namely, the “adding” step and the “substituting” step. Pet. 46. According to Petitioner, a separate showing for each alternative is not required for unpatentability, as a “claim is unpatentable if any of the alternatives are within the scope of the prior art.” *Id.* We agree. See *Brown v. 3M*, 265 F.3d 1349, 1351 (Fed. Cir. 2001) (“When a claim covers several structures or compositions, either generically or as alternatives, the claim is deemed anticipated if any of the structures or compositions within the scope of the claim is known in the prior art.”) (cited by Pet. 46).

Thus, Petitioner focuses on the “adding” step of claim 4. For this limitation, Petitioner directs us to where Hawthorne teaches “obtaining the translated VLAN ID (the output VLAN ID) and the output port information from the table entry,” and then proceeding such that the “translated VLAN ID . . . is **attached to the traffic and the traffic is forwarded to the identified output port(s)**.” Pet. 44 (quoting Ex. 1006 ¶ 59). Petitioner also directs us to Hawthorne’s description of one embodiment, where incoming VLAN traffic is formatted as Ethernet packets, and, “after the . . . forwarding information (i.e., the translated VLAN ID and the output port(s)) is determined for the traffic, the traffic is formatted into pseudo-packets for

forwarding through the network node.” Ex. 1006 ¶ 63 (cited by Pet. 44–45). Each pseudo-packet includes an internal switch header that carries forwarding information, including the translated VLAN ID. *Id.* Petitioner contends that “it would have been obvious to a POSITA that Carrie’s switch—when modified in view of Hawthorne to determine an output VLAN ID—would have added the determined output VLAN ID to the received frame, for example via an internal switch header, and communicated them both to the output port so that the frame may be tagged before transmission.” Pet. 45. Petitioner relies specifically on “Carrie’s teaching of forwarding the received frame to the determined output port, in view of Hawthorne’s teachings of adding a translated VLAN ID to a received Ethernet frame.” *Id.* at 45–46.

Based on Petitioner’s argument and evidence, we are persuaded that the proposed combination of Carrie and Hawthorne teaches the recited “adding” step of claim 4. As Petitioner contends, it need not provide a separate showing for each alternative step recited in claim 4, namely, the “adding” step and the “substituting” step. Patent Owner does not challenge Petitioner’s analysis for claim 4. *See generally* PO Resp.

4. *Dependent Claim 16*

Claim 16 also depends from claim 1, and further recites “the first VLAN includes one or more VLANs on a same network port, or one or more VLANs on different ports of a same network, or one or more VLANs on different ports of more than one network.” Petitioner focuses on the first part of claim 16, which recites “the first VLAN includes one or more VLANs on a same network port.” *See* Pet. 47–49. According to Petitioner,

the remaining parts of claim 16 “recite optional alternatives to the alternative recited in [the first part]” and do not require a separate showing for unpatentability. *Id.* at 49 (noting that the different parts of claim 16 “begin with the disjunctive connector ‘or’”). We agree. See *Brown v. 3M*, 265 F.3d at 1351 (cited by Pet. 46).

For the limitation “the first VLAN includes one or more VLANs on a same network port,” Petitioner asserts that “Carrie teaches receiving a frame associated with a first VLAN at an input port of its switch.” *Id.* at 47. As support, Petitioner directs us to where Carrie teaches that “each layer 2 frame that arrives at a port of a layer 2 Switch is classified according to its VLAN identifier.” *Id.* (quoting Ex. 1005, 2:65–67). Petitioner further provides an annotated version of Figure 1 of Carrie, which is reproduced below.

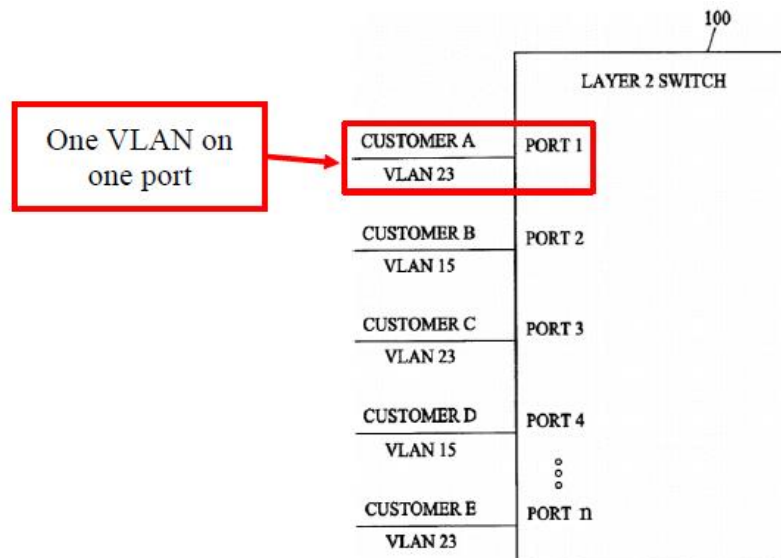


FIG. 1

Figure 1 of Carrie, as annotated by Petitioner, shows a layer 2 network and a layer 2 switch. See Ex. 1005, 3:51–53. Carrie explains, “In the example illustrated in FIG. 1, **Customer A uses VLAN identifier 23 on port 1.**” Pet. 47 (quoting Ex. 1005, 4:33–34). Petitioner contends that “the one

VLAN 23 on input port 1, as taught by Carrie, discloses ‘wherein the first VLAN includes one or more VLANs on a same network port,’ as recited in the claim.” *Id.* at 48. We note Petitioner’s showing in this regard corresponds to the aspect of the limitation reciting *one* VLAN on a network port.

Petitioner contends that Carrie also discloses the aspect of the limitation reciting *more* VLANs on a same network port “because [Carrie] teaches that each input port may receive frames from a plurality of ‘VLANs on the port.’” *Id.* (quoting Ex. 9:26–30). Petitioner further notes that Figure 11 of Hawthorne shows Customer A sending traffic via 4,096 VLANs to port 1 of a service provider edge device. *Id.* (citing Ex. 1006, Fig. 11).

Although Petitioner need not provide a separate showing for the remaining parts of claim 16, Petitioner nevertheless asserts that “Carrie illustrates in Fig. 1 multiple VLANs on different ports, which discloses ‘*one or more VLANs on different ports of a same network, or one or more VLANs on different ports of more than one network,*’ as recited in the claim.” *Id.* at 49.

Based on Petitioner’s argument and evidence, we are persuaded that the proposed combination of Carrie and Hawthorne teaches the recited limitation of claim 16. Patent Owner does not challenge Petitioner’s analysis for this claim. *See generally* PO Resp.

5. Summary

In view of the foregoing, we determine that Petitioner has demonstrated by a preponderance of the evidence that claims 1, 4, and 16 would have been obvious over Carrie and Hawthorne.

D. Obviousness over Carrie, Hawthorne, and Dobbins

Petitioner asserts that claim 7 of the '709 patent would have been obvious over Carrie, Hawthorne, and Dobbins. Pet. 15, 51–58. Patent Owner opposes. PO Resp. 72. For the reasons explained below, we determine that Petitioner has demonstrated by a preponderance of the evidence that claim 7 would have been obvious over Carrie, Hawthorne, and Dobbins.

We provided an overview of Carrie and Hawthorne above. *See supra* Part III.C.1. Before addressing the parties' arguments, we additionally provide an overview of Dobbins.

1. Overview of Dobbins

Dobbins relates to providing connection-oriented services for switched data communications networks. Ex. 1007, 1:19–24. For example, Dobbins describes a traffic service, which is responsible for creating, rerouting, and tearing down connections within the switching fabric. *Id.* at 16:44–45. The traffic service may be implemented by three types of switches, namely, an ingress switch, an egress switch, and an intermediate switch. *Id.* at 16:45–47. The ingress switch is attached to the source user, the egress switch is attached to the destination user, and any intermediate switch sits along the path. *Id.* at 16:50–56.

In describing the traffic service, Dobbins provides a general overview of the call origination process, which involves the ingress switch. *Id.* at 17:1–7. To illustrate, Figure 7 of Dobbins is reproduced below.

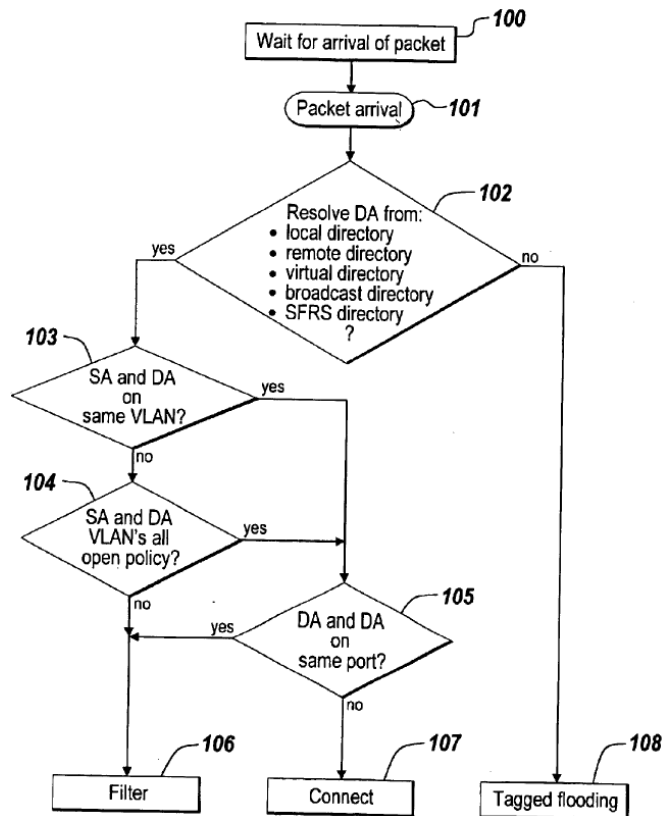


Fig. 7A

Figure 7 is a flowchart of a general call processing method that the ingress switch performs. *Id.* at 7:12–13. When the ingress switch receives a packet at step 101, it determines the source address and the destination address, and it notes the switch port at which it receives the packet. *Id.* at 17:7–10. Next, at step 102, the ingress switch resolves the destination MAC address. *Id.* at 17:10–24. At step 103, the ingress switch checks whether the source address and the destination address are on the same VLAN (i.e., whether they have the same VLAN ID). *Id.* at 17:25–28. If the source address and the destination address have the same VLAN ID, then the ingress switch

determines whether the source and the destination are on the same switch port at step 105. *Id.* at Fig. 7A. If the source and destination are not on the same port, then a connection is established at step 107; otherwise, the packet is filtered (i.e., dropped) at step 106. *Id.* at 17:34–39.

2. Dependent Claim 7

Claim 7 depends from claim 1 and recites the additional step of “abandoning the received frame prior to communicating, if it is determined that the output port is the same as the input port and the output VLAN ID is the same as the input VLAN ID.” For this limitation, Petitioner provides an annotated version of Figure 7A of Dobbins, which is reproduced below. Pet. 57.

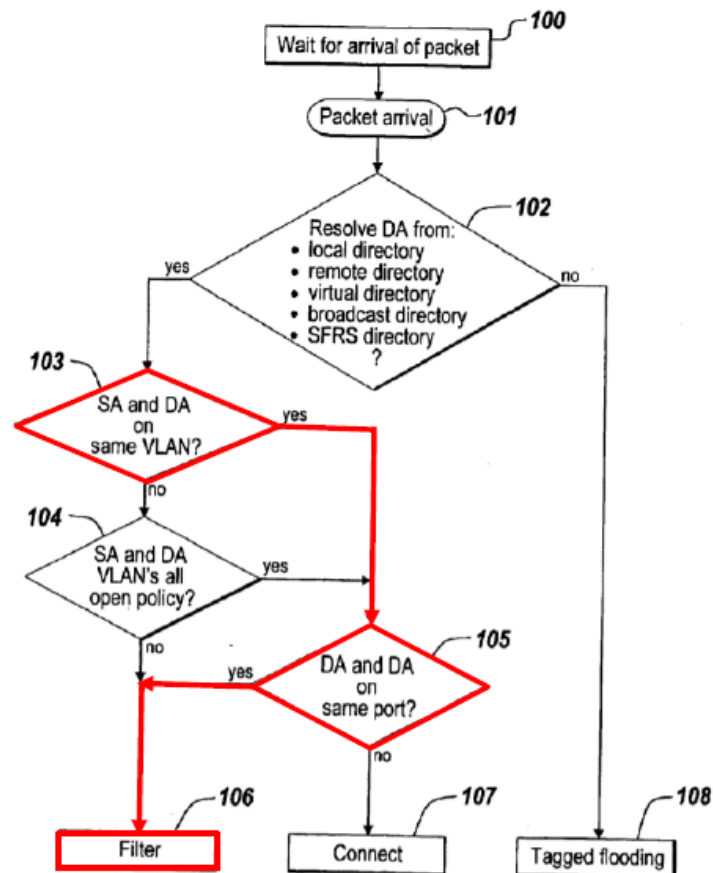


Figure 7, as annotated by Petitioner, is a flowchart of a general call processing method. *See* Ex. 1007, 7:12–13. Petitioner asserts that “Dobbins teaches that a received packet is ‘filtered’ or ‘dropped’ (*i.e.*, ‘*abandoning*’) if the ‘source and destination are on the same port’ and the source and destination addresses ‘have the same VLAN-ID.’” Pet. 56 (citing Ex. 1007, 17:34–39, Fig. 7A). Petitioner further contends that an ordinarily skilled artisan “would have found it obvious to utilize Dobbins[’] filtering technique in the context of Carrie’s forwarding method (as modified by Hawthorne) so that network bandwidth is efficiently utilized, for example by preventing looping.” *Id.* at 57–58; *see also id.* at 52 (“[A] well-known and conventional way to increase the network efficiency of a layer 2 switch was to prevent a frame being unnecessarily forwarded back to the port from which it was received—for example to prevent ‘looping.’”); *id.* at 51–55. Petitioner relies on the declaration testimony of Dr. Bhattacharjee. *Id.* at 51–55, 57–58 (citing Ex. 1003 ¶¶ 237–243, 247–248).

Patent Owner responds that “Dobbins is not relied upon to cure any of the deficiencies . . . with respect to the Carrie-Hawthorne combination” discussed above regarding claim 1, and that Petitioner’s asserted ground of obviousness over Carrie, Hawthorne, and Dobbins “is deficient” for the same reasons. PO Resp. 72. As discussed above, however, we are persuaded that Petitioner’s proposed combination of Carrie and Hawthorne teaches the recited limitations of claim 1. *See supra* Part III.C.2. We also are persuaded that Petitioner’s proffered reasoning for modifying Carrie’s system to include Hawthorne’s VLAN ID translation, namely, to provide “a more complete solution to the problem of different customer networks using the same VLAN ID,” is sufficient to support the legal conclusion of

obviousness. *See id.* Patent Owner does not otherwise challenge Petitioner's obviousness analysis for claim 7. *See generally* PO Resp.

Based on the record before us, we are persuaded that Petitioner's proposed combination of Carrie, Hawthorne, and Dobbins teaches the recited limitation of claim 7. We also are persuaded that Petitioner's proffered reasoning for modifying the proposed combination of Carrie and Hawthorne to include Dobbins' filtering technique, namely, to increase network efficiency, is sufficient to support the legal conclusion of obviousness.

3. Summary

In view of the foregoing, we determine that Petitioner has demonstrated by a preponderance of the evidence that claim 7 would have been obvious over Carrie, Hawthorne, and Dobbins.

IV. CONCLUSION⁸

We determine that Petitioner has demonstrated by a preponderance of the evidence that claims 1, 4, 7, and 16 of the '709 patent are unpatentable as follows.

⁸ 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 Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. § 42.8(a)(3), (b)(2).

Claims	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not shown Unpatentable
1, 4, 16	103	Carrie, Hawthorne	1, 4, 16	
7	103	Carrie, Hawthorne, Dobbins	7	
Overall Outcome			1, 4, 7, 16	

V. ORDER

In consideration of the foregoing, it is hereby

ORDERED that claims 1, 4, 7, and 16 of the '709 patent are held
unpatentable; and

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

IPR2020-01141
Patent 7,965,709 B2

PETITIONER:

Theodore Foster
David McCombs
Scott Jarratt
HAYNES & BOONE, LLP
ipr.theo.foster@haynesboone.com
david.mccombs.ipr@haynesboone.com
scott.jarratt.ipr@haynesboone.com

PATENT OWNER:

Michael Hawkins
Patrick Bisenius
Nicholas Stephens
Jennifer Huang
Kenneth Darby
Sangki Park
Thomas H. Reger II
Brian Strand
FISH & RICHARDSON P.C.
hawkins@fr.com
bisenius@fr.com
stephens@fr.com
jjh@fr.com
kdarby@fr.com
spark@fr.com
reger@fr.com