

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

DELL TECHNOLOGIES INC. AND DELL INC.
Petitioners

v.

CLOUD BYTE LLC
Patent Owner

Case IPR2025-01284
Patent No. 9,900,249

PETITION FOR *INTER PARTES* REVIEW

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LIST OF EXHIBITS

Exhibit	Description
1001	The '249 Patent
1002	The prosecution history of U.S. Patent Application No. 14,244,701, which led to the issuance of the '249 Patent
1003	Declaration of Mark Crovella, Ph.D. in Support of <i>Inter Partes</i> Review of U.S. Patent No. 9,900,249
1004	<i>Curriculum vitae</i> for Mark Crovella, Ph.D.
1005	U.S. Patent Application Publication No. 2006/0227779 (“Shimizu”)
1006	Request for Comments 4271, “A Border Gateway Protocol 4 (BGP-4)” (“RFC-4271”)
1007	Request for Comments 791, “Internet Protocol” (“RFC-791”)
1008	Request for Comments 2026, “The Internet Standards Process – Revision 3” (“RFC-2026”)
1009	RFC Editor – Publication Process
1010	Kurose and Ross, “Computer Networking: A Top-Down Approach” (4th ed. 2008), excerpts
1011	Black, “TCP/IP and Related Protocols” (McGraw Hill, 1992)
1012	U.S. Patent No. 6,956,854
1013	U.S. Patent No. 8,724,638
1014	U.S. Patent No. 7,389,359
1015	U.S. Patent No. 7,660,259
1016	U.S. Patent No. 7,411,948
1017	U.S. Patent No. 5,274,631

Exhibit	Description
1018	U.S. Patent No. 7,417,990
1019	U.S. Patent No. 7,693,158
1020	U.S. Patent No. 5,889,777
1021	U.S. Patent No. 6,411,506
1022	U.S. Patent No. 6,950,895
1023	McKeown, “Fast Switched Backplane for a Gigabit Switched Router,” Business Communications Review (Dec. 1997)
1024	Partridge, et al, “A 50-Gb/s IP Router,” IEEE/ACM Transactions on Networking (June 1998)
1025	Complaint for Patent Infringement
1026	Cloud Byte’s Preliminary Infringement Contentions with attached Exhibit 10
1027	U.S. District Court – Judicial Caseload Profiles (March 2025)
1028	Assignment (U.S. Patent No. 9,900,249)
1029	Lex Machina (U.S. Patent No. 9,900,249)
1030	Internet Archive Declaration of Mina Ching for RFC-4271
1031	U.S. Patent No. 8,245,304
1032	U.S. Patent No. 7,894,848
1033	Cloud Byte’s Disclosure of Proposed Claim Constructions and Extrinsic Evidence with attached Exhibit A
1034	Declaration of Su Li

MANDATORY NOTICES UNDER 37 C.F.R. § 42.8

Real Party-in-Interest (37 C.F.R. § 42.8(b)(1))

The real parties-in-interest are petitioner Dell Technologies Inc. and Dell Inc. (“Petitioners”). No unnamed entity is funding, controlling, or directing this petition or has the ability to control or direct this petition or Petitioners’ participation in any resulting *inter partes* review. Petitioners understand based on public information that the challenged patent, U.S. Patent No. 9,900,249 (the “’249 Patent”), is owned by Cloud Byte LLC (“Patent Owner”).

Related Matters (37 C.F.R. § 42.8(b)(2))

Petitioners are aware of the following district court lawsuit involving the ’249 Patent: *Cloud Byte LLC v. Dell Technologies Inc. and Dell Inc.*, Case No. 2:24-cv-00637-JRG (E.D. Tex.).

Lead and Back-Up Counsel (37 C.F.R. § 42.8(b)(3))

Petitioners appoint James L. Day (Reg. No. 72,681) of Farella Braun + Martel LLP as lead counsel and appoint the following attorneys as back-up counsel: Daniel Callaway (Reg. No. 74,267) and Winston Liaw (Reg. No. 78,766) of Farella Braun + Martel LLP.

Service Information (37 C.F.R. § 42.8(b)(4))

Service of any documents to lead and back-up counsel can be made via hand-delivery to Farella Braun + Martel LLP, One Bush Street, Suite 900, San Francisco, California, 94104. Petitioners consent to electronic service to the

following email addresses: jday@fbm.com, dcallaway@fbm.com,
wliaw@fbm.com, and calendar@fbm.com.

I. INTRODUCTION

Dell Technologies Inc. and Dell Inc. (“Petitioners”) respectfully request *inter partes* review of claims 1-27 (the “challenged claims”) of U.S. Patent No. 9,900,249 (the “’249 Patent”) owned by Cloud Byte LLC (“Patent Owner”). Because this petition demonstrates a reasonable likelihood Petitioners will prevail on at least one—and indeed all—of the challenged claims, review should be instituted and the challenged claims canceled as unpatentable.

II. GROUNDS FOR STANDING

Petitioners certify pursuant to 37 C.F.R. § 42.104 that the ’249 Patent is available for *inter partes* review and that Petitioners are not barred or estopped from requesting review of the challenged claims on the grounds identified herein.

III. IDENTIFICATION OF CHALLENGE

Pursuant to 37 C.F.R. § 42.104(b), Petitioners request *inter partes* review of the challenged claims and further that the challenged claims be canceled as unpatentable for obviousness under 35 U.S.C. § 103¹ per the following grounds:

Grounds	Claims	Prior Art
1	1-27	Shimizu (EX1005)
2	1-27	Shimizu and RFC-4271 (EX1006)

¹ The pre-AIA version of Sections 102, 103, and 112 of the Patent Act apply.

Petitioners’ proposed constructions, the evidence relied upon, and the precise reasons why the challenged claims are unpatentable are provided in the following sections of the petition. A List of Exhibits identifying the specific evidence relied upon is provided above.

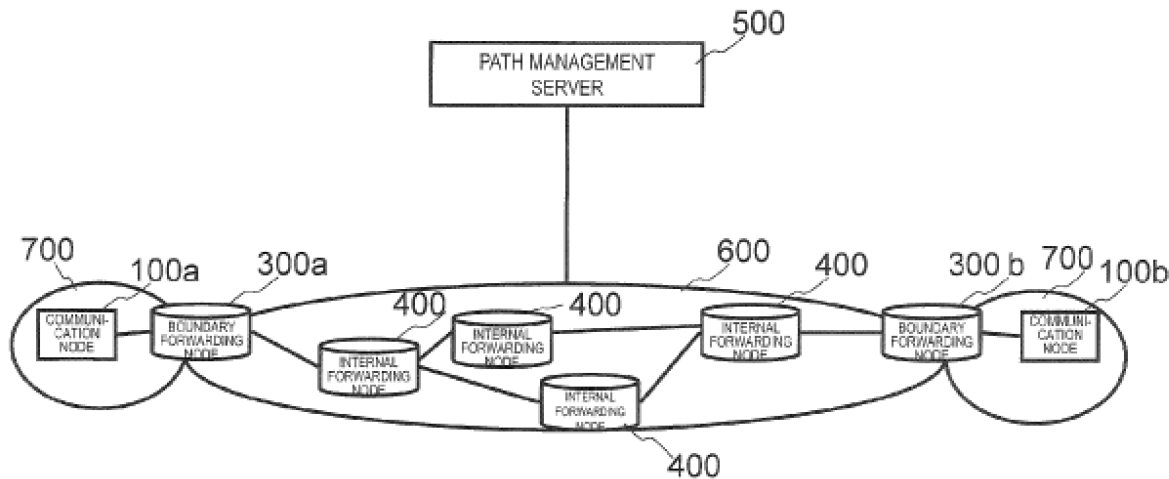
IV. THE CHALLENGED PATENT

A. Patent Specification

The ’249 Patent is entitled “Communication System, Forwarding Node, Path Management Server, Communication Method, and Program.” EX1001, 1. It describes “[a] packet forwarding node [that] includes a storage unit to store a packet forwarding table used for forwarding a packet based on an identifier which identifies a link between nodes on a packet forwarding path and a forwarding unit to receive an incoming packet including a plurality of the identifiers, and to forward the incoming packet based on an identifier corresponding to the packet forwarding node.” *Id.*, 1 (Abstract).

Figure 1 is a “diagram showing a communication system according to the first exemplary embodiment of the present invention.” EX1001, 6:62-64.

FIG. 1



'249 Patent, Fig. 1

The figure shows “data transfer network 600,” which “is a network for performing forwarding processing of a packet by a method of the present invention, and an external network 700,” which “is a network for performing packet forwarding processing by a method different from the network 600” (e.g., an IP network). *Id.*, 7:1-10. “The external network 700 is connected to the data transfer network 600 via the boundary forwarding nodes 300a and 300b.” *Id.*, 7:10-13.

When the boundary forwarding nodes 300a and 300b receive a packet from the communication nodes 100a or 100b, they “assign a header including forwarding path information...and in addition, forward the packet in question to an internal forwarding node 400 in the data transfer network 600 based on the forwarding path information in the header.” EX1001, 7:23-31. Once the packet

reaches the edge of data transfer network 600, “boundary forwarding nodes 300a and 300b remove the header from the received packet, and thereafter transmit the packet to communication nodes 100a and 100b of the external network 700.” *Id.*, 7:32-39.²

B. Prosecution History

The ’249 Patent issued based on Patent Application No. 14/244,701, which was filed April 3, 2014. EX1002, 2-101. The examiner rejected the application claims multiple times primarily based on U.S. Patent No. 7,522,603 (“Vasseur”). *Id.*, 157-161, 197-205, 351-357, 443-451. The applicant argued repeatedly, including in an Appeal Brief, that “[i]n Vasseur, a packet being used in MPLS (Multi-Protocol Label Switching), includes a **single label**,” while “[o]n the other hand, in the present application, a packet includes a **plurality of identifiers**.” *Id.*, 332 (emphasis in original); *see also id.*, 424, 514. The applicant also argued that “in MPLS of Vasseur, merely one identifier (label of MPLS) is included in one packet and so a plurality of identifiers are not included in one packet as in the

² The ’249 Patent essentially describes “source routing” through a private network. EX1003, ¶64. Source routing was a well-known technique specified in the Internet Protocol standard long before the ’249 Patent. *Id.*, ¶¶40-46 (background on source routing).

claimed invention....” *Id.*, 332-333 (emphasis in original); *see also id.*, 184, 424, 514.

After the Appeal Brief, the examiner continued examination and rejected the claims based on different prior art. EX1002, 633-665. Following several examiner interviews, the applicant amended the independent claims, adding additional limitations. *Id.*, 738, 744, 750-755. For example, the applicant amended application claim 1 to recite that the “forwarding unit” is configured to “determine a direction to forward the incoming packet,” “determine whether to forward to an external network,” “add the number of bytes to path/link information when the incoming packet is not forwarded to the external network,” and “remove path/link information header when the incoming packet is forwarded to the external network...” *Id.*, 750; *see also id.*, 751-755 (similar amendments).

On October 2, 2017, the examiner issued a Notice of Allowance. EX1002, 763-771. The applicant responded to the notice making several more claim amendments. *Id.*, 791-798. Following another interview, the examiner issued a Corrected Notice of Allowability including the applicant’s amendments and adding several more. *Id.*, 815-822. The ’249 Patent issued February 20, 2018.

EX1001, 1.

C. Patent Claims

The '249 Patent contains 27 claims, including 5 independent claims (i.e., 1, 6, 11, 16, 21). Claim 1 reads:

[1pre] A packet forwarding node, comprising:

[1a] a storage unit including a non-transitory computer readable medium configured to store a packet forwarding table used for forwarding a packet based on an identifier which identifies a link between nodes on a packet forwarding path; and

[1b] at least one processor configured to execute program instructions to provide a forwarding unit configured to:

[1c] receive an incoming packet including a plurality of the identifiers;

[1d] determine a direction to forward the incoming packet;

[1e] determine whether to forward to an external network;

[1f] add to path or link information when the incoming packet is not forwarded to the external network;

[1g] remove path or link information header when the incoming packet is forwarded to the external network; and

[1h] forward the incoming packet by using a path or link that corresponds to the identifier from among the plurality of the identifiers.

Claim language for all challenged claims appears in the attached Claim Appendix.

D. Person of Ordinary Skill in the Art

A POSITA would have had an undergraduate degree (or equivalent) in electrical engineering, computer science, or a comparable subject and approximately two to three years of academic or professional work experience in a technical field with exposure to computer networking and switching/routing technology. EX1003, ¶112. A higher level of education could substitute for less industry experience and more industry experience could substitute for the specific level of education. *Id.* In any event, a POSITA would have been knowledgeable about then-existing network switching and routing technologies and techniques. *Id.*

V. CLAIM CONSTRUCTION

The challenged claims should be construed under the *Phillips* standard. 37 C.F.R. § 42.100(b); *see generally Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). The Board, however, need only construe claims when necessary to resolve the underlying controversy. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed Cir. 2017). For purposes of this petition, Petitioners believe that no express constructions are necessary to determine that the asserted prior art discloses the limitations of the

challenged claims.³

VI. PRIOR ART REFERENCES

The '249 Patent is a continuation of an application filed July 5, 2011, which was a continuation of an international application filed September 13, 2010.

EX1001, 1-2. It claims priority to a Japanese application filed September 14, 2009. *Id.*, 1. Patent Owner does not assert an earlier priority date. EX1026, 11.⁴

The '249 Patent is a pre-AIA patent. *See* EX1002, 768 (examination under pre-AIA statutes).

A. Shimizu (EX1005)

Shimizu is a U.S. patent application published on October 12, 2006, entitled “Network Based Routing Scheme.” EX1005, 1. Shimizu constitutes prior art under at least Section 102(a), (b), and (e)(pre-AIA).

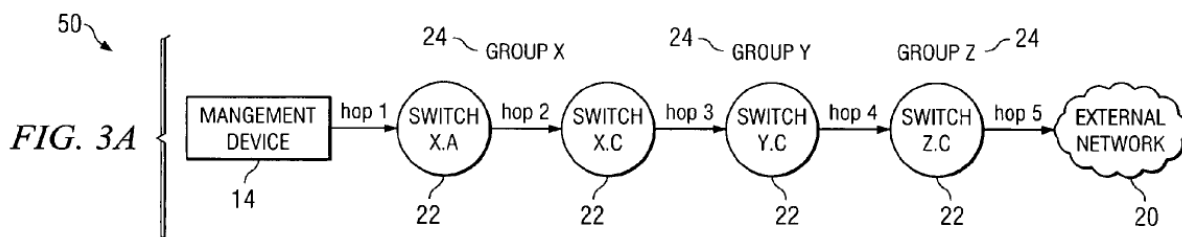
In Shimizu, “[a] network organization and routing scheme are provided.” EX1005, 1 (Abstract). The disclosed “techniques enable a network to control the

³ Petitioners reserve the right to present other claim construction arguments in the related district court litigation as relevant and necessary there.

⁴ For purposes of this petition, Petitioners take no position on the patent’s foreign priority claim. The references discussed herein qualify as invalidating prior art even if the '249 Patent is entitled to that earlier filing date.

paths that frames take through the network. A device transmitting a frame may add tags to the frame in order to define a particular path that the frame should take through the network. For example, the tags may indicate a link-by-link path between switches in the network.” *Id.*; see also *id.*, [0004] (“these techniques describe a routing scheme and network organization that enable a private network to control the path frames take through the private network”), [0006] (“these techniques may allow a device to specify a particular path that a frame should take th[r]ough a private network”), [0020] (“In operation, devices can control the path of frames through switch network 12 using tags in the frames.”).

Shimizu’s Figure 3A “illustrates the path 50 of a frame” through a switch network. EX1005, [0041]. As shown, “path 50 includes five different hops (1-5)” starting at management device 14, proceeding through four switches, and exiting to external network 20. *Id.*, [0042].

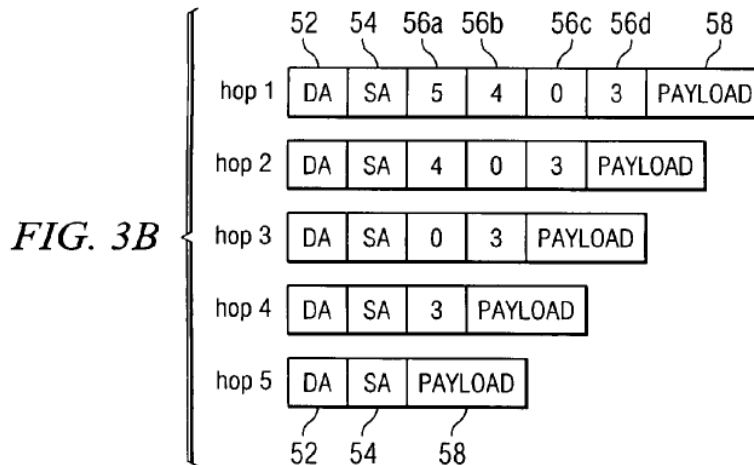


Shimizu, Fig. 3A

Shimizu describes using a plurality of tags in the frame header to dictate the sequence of hops (i.e., path) through the switch network. *Id.*, [0020]-[0027],

[0041]-[0050]; EX1003, ¶127.

For example, in some embodiments, “the frame is structured to include vector based tags” as illustrated in Figure 3B. EX1005, [0042].



Shimizu, Fig. 3B

The “vector based tag indicat[es] the next switch 22 in path 50.” *Id.*, [0043]. The illustrated tags 56 (i.e., 56a, 56b, 56c, 56d) direct the frame along path 50 illustrated in Figure 3A. *Id.*, [0041]-[0045]; EX1003, ¶128.

B. RFC-4271 (EX1006)

RFC-4271 is a Request for Comments published January 2006, entitled “A Border Gateway Protocol 4 (BGP-4).” EX1006, 1. A Request for Comments, or RFC, is essentially a technical standard or protocol used by networking professionals. EX1003, ¶41. RFCs are prepared and distributed under a formalized publication process overseen by the Internet standards governing body called the Internet Engineering Task Force (IETF). *Id.*; EX1008. RFC-4271

constitutes prior art under at least Section 102(a) and (b)(pre-AIA).

RFC-4271 “discusses the Border Gateway Protocol (BGP), which is an inter-Autonomous System routing protocol.” EX1006, 1; *see also* EX1003, ¶¶47-55 (explaining ASs and inter-AS routing). RFC-4271 explains “[t]he primary function of a BGP speaking system is to exchange network reachability information with other BGP systems.” EX1006, 1 “BGP-4 provides a set of mechanisms for supporting Classless Inter-Domain Routing (CIDR),” which “include support for advertising a set of destinations as an IP prefix, and eliminating the concept of network ‘class’ within BGP.” *Id.*, 1.

RFC-4271 was the specification for BGP-4 effective in 2009-2010. EX1003, ¶134. Petitioners submit EX1030, which is an archived version of RFC-4271 captured by the Internet Archive’s Wayback Machine on October 14, 2006 and identical to EX1006. EX1034, ¶¶2, 15. The Internet Archive is sufficient evidence of publication/authentication. *Valve Corp. v. Ironburg Inventions Ltd.*, 8 F.4th 1364, 1374 (Fed. Cir. 2021). It was readily available to “persons interested and ordinarily skilled in the subject or art exercising reasonable diligence [to] locate it.” *Medtronic v. Barry*, 891 F.3d 1368, 1380 (Fed. Cir. 2018); EX1003, ¶¶41, 134; EX1031 (prior art patent citing RFC-4271); EX1032 (same).

VII. GROUNDS OF UNPATENTABILITY

A. Ground 1: The Challenged Claims Are Rendered Obvious by Shimizu

Shimizu discloses and renders obvious every limitation of the challenged claims. Further, a POSITA naturally would have considered Shimizu because it is in the same field as the '249 Patent, namely network communications. EX1003, ¶136; EX1005, 1 (Abstract), [0002]; EX1001, 1 (Abstract), 1:9-15, 4:14-67.

Further, like the '249 Patent, Shimizu addresses the problem of controlling the path of data packets through a private network. EX1005, [0004], [0006]-[0007]; EX1001, 2:1-9, 5:1-10. Indeed, Shimizu and the '249 Patent address the problem in the same way by using source routing, i.e., by adding a series of identifiers, or tags, to the header of a data packet to dictate each hop along a path through the network. EX1003, ¶136.

Further, Shimizu identifies advantages of the disclosed routing techniques similar to those of the '249 Patent. EX1003, ¶137. Shimizu states that “[i]n certain embodiments, network routing tables maintain routing information based on switch/port identifiers,” which “enables smaller table sizes and simpler look-up mechanisms, since switches 22 in one group 24 need not maintain routing information for switches 22 in other groups 24.” EX1005, [0019]; *see also id.*, [0006] (“In some embodiments, appropriate routing can be enabled with smaller routing tables that require less memory in a switch.”). These benefits address the

same types of problems identified in the '249 Patent. EX1003, ¶137; EX1001, 3:20-4:20.

1. Claims 1 and 6⁵

a. [1pre/6pre] A packet forwarding node, comprising:

Shimizu discloses a *packet forwarding node*, as the preamble recites.

EX1003, ¶¶139, 225.⁶ In particular, Shimizu discloses a “[s]witch network 12 [that] includes switches 22....” EX1005, [0015]. “Switches 22 represent networking devices that route frames within networks and/or between different networks. According to particular embodiments, each switch 22 represents a network device with multiple ports capable of switching network traffic among the ports.” *Id.*, [0016]. Each switch 22 is a *packet forwarding node*. EX1003, ¶139.⁷

⁵ The challenged claims recite numerous duplicative or highly similar limitations. See EX1003, ¶¶91-110 (comparing language of similar claims). Certain claims are therefore considered together for ease of review.

⁶ For ease of reference, claim language is presented in italics

⁷ Shimizu describes routing “frames” through the network. See, e.g., EX1005, [0003] (“switches route frames between different network elements”). The term “frame” used in Shimizu is another name for a data packet. EX1003, ¶140. In particular, a “frame” is a data packet being transmitted through

Shimizu expressly describes switches in switch network 12 *forwarding* frames (*packet[s]*). For example, Shimizu states that “[s]witch Z.C may add an inbound tag before ***forwarding the frame*** on the port indicated by routing information maintained on switch Z.C, possibly ***forwarding the frame*** to switch Y.C.” EX1005, [0021]. Similarly, “[s]witch Y.C may ***forward the frame*** on the port indicated by its routing information....” *Id.*, [0021].⁸ Shimizu states that “[e]ach receiving switch 22 simply identifies the port(s) specified by the current outbound tag, removes the current outbound tag from the frame, and then ***forwards the frame*** on the specified port(s).” *Id.*, [0023]; *see also id.*, [0024], [0028] (“switches 22 may ***forward*** management messages based on type or other suitable factors”), [0037], [0058] (“Switch 22 determines, from the routing information, on which port the ***frame should be forwarded***....”). Each switch 22 in switch network 12 is a *packet forwarding node* as recited in the preamble. EX1003, ¶139, 225.

Layer 2 switches using, for example, the Ethernet protocol as disclosed in Shimizu. *Id.*, ¶140; EX1005, [0016]; EX1010, 75 (“In this book, we’ll refer to link-layer packets as frames.”), 77-78.

⁸ Emphasis is added unless otherwise indicated.

- b. [1a/6a] a storage unit including a non-transitory computer readable medium configured to store a packet forwarding table used for forwarding a packet based on an identifier which identifies [a link between nodes on/an interface of] a packet forwarding [path/node]; and

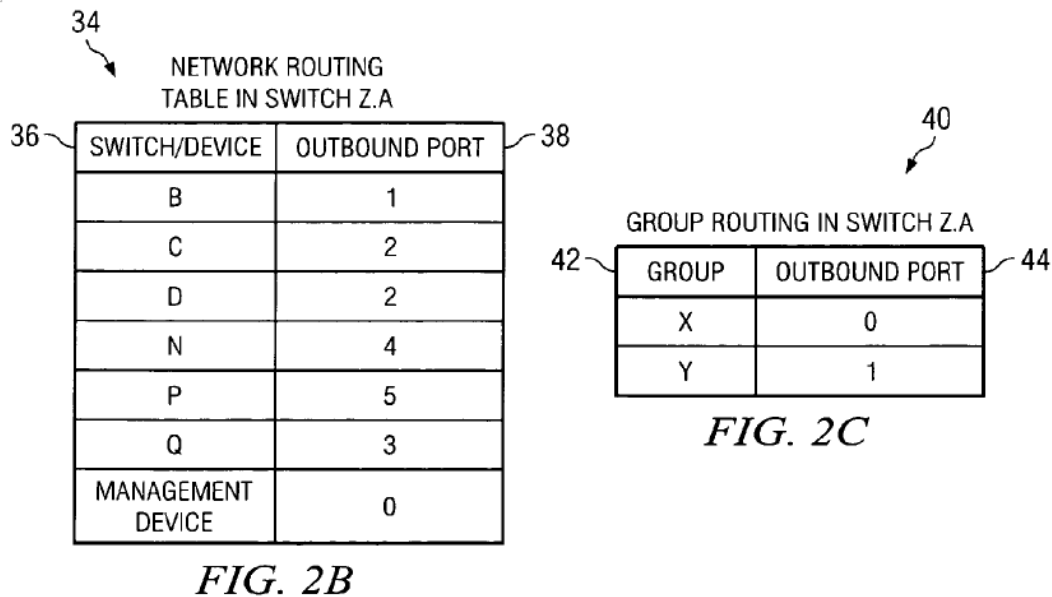
Shimizu discloses this limitation. EX1003, ¶¶143-163, 226-227.

In Shimizu, each switch 22 (*packet forwarding node*) has a *forwarding table*. EX1003, ¶144. Shimizu states that “network routing information is stored in network **routing tables**....” EX1005, [0019]. For example, Shimizu states: “In particular embodiments, switches within a private network are divided into groups, and a specific port of a specific one of the switches can be uniquely referenced by a tag that indicates a group, a switch, and a port identifier. This can permit switches within a group to maintain private **routing tables** defined for only other switches in the group. In some embodiments, appropriate routing can be enabled with smaller **routing tables** that require less memory in a switch.” *Id.*, [0006]; *see also id.*, [0019] (“The network **routing table** for each constituent switch 22 in a particular group 24 may only provide routing information for other switches 22 in that particular group 24.”).

A POSITA would understand that Shimizu’s “routing tables” are *forwarding tables* because they contain the information used by switches 22 to forward frames (*packet[s]*) from one switch to the next through the network. EX1003, ¶145. A POSITA would have used “routing table” and “forwarding table” interchangeably

in this context. *Id.* (citing EX1010, 95-97, 263-264; EX1012, 7:41-59; EX1013, 1 (Abstract), 1:26-37, 2:66-3:37, 6:5-20; EX1014, 2:25-60; EX1015, 1:17-2:44, 4:24-51, 6:19-43, Figs. 1, 3).

Shimizu illustrates two exemplary routing tables (each a *packet forwarding table*) in Figures 2B and 2C. EX1003, ¶146.



Shimizu, Figs. 2B and 2C

Figure 2B “illustrates one example of how routing information can be stored by switches 22. In the illustrated embodiment, switch Z.A stores routing information as a network routing table 34.” EX1005, [0035]. Shimizu’s network routing table 34 (in Figure 2B) is a *packet forwarding table*. EX1003, ¶146. Similarly, Figure 2C “illustrates an example of group routing information that may be stored and maintained by switch Z.A.” EX1005, [0039]. Shimizu states that “switch Z.A

maintains a table 40 providing routing information for group Y, as a whole, and group X, as a whole.” *Id.* Shimizu’s group routing table 40 (in Figure 2C) is also a *packet forwarding table*. EX1003, ¶146.

Shimizu’s *packet forwarding table[s]* are used for forwarding a packet as recited in 1a/6a. Figure 2A “illustrate[s] one of groups 24, group Z, employing a network based routing scheme....” EX1005, [0033].⁹

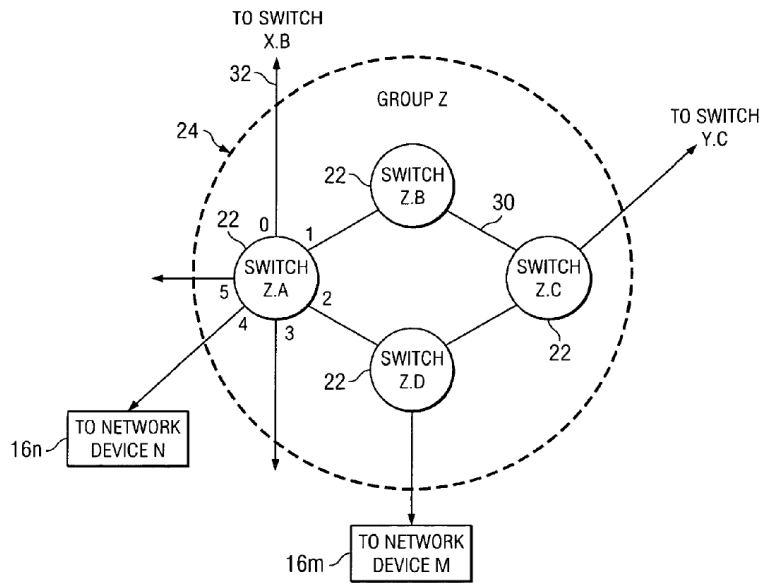


FIG. 2A

Shimizu, Fig. 2A

The sample routing tables in Figures 2B and 2C reside on switch Z.A in group Z. *Id.*, [0033]. Figure 2A illustrates “an embodiment of one of groups 24, group Z, and its constituent switches 22: switch Z.A, switch Z.B, switch Z.C, and switch

⁹ Figure 2A illustrates a portion of switch network 12 of Figure 1. EX1003, ¶147.

Z.D.” *Id.*, [0033]. “The constituent switches 22 are connected by intra-group links 30 and external links 32” where “[i]ntra-group links 30 connect constituent switches 22 to other constituent switches 22, and external links 32 connect constituent switches 22 to switches 22 in other groups 24 and network devices 16m,n” as well as to “a variety of networks, components, elements, or devices” outside the group such as “other network devices 16, management device 14, internet 18, and external network 20.” *Id.*, [0033].

As shown in Figure 2A, switch Z.A has six links “designated by ports 0 through 5.” EX1005, [0034]. “Network routing table 34 [in Figure 2B] includes a switch column 36 indicating a switch or device that should receive a frame, and an outbound port column 38 showing the corresponding outbound port on which a frame should be sent.” *Id.*, [0035]. Each outbound port on the switch designates a link between that switch and other switches and devices. *Id.*, [0034].

For example, if a frame arrives at switch Z.A with header information indicating it should be forwarded to switch Z.B, which is in the same group 24 (group Z), the switch would use network routing table 34 illustrated in Figure 2B (below left) to determine that the correct outbound port is port 1. EX1003, ¶150.

34 NETWORK ROUTING TABLE IN SWITCH Z.A

SWITCH/DEVICE	OUTBOUND PORT
B	1
C	2
D	2
N	4
P	5
Q	3
MANAGEMENT DEVICE	0

36 38

FIG. 2B

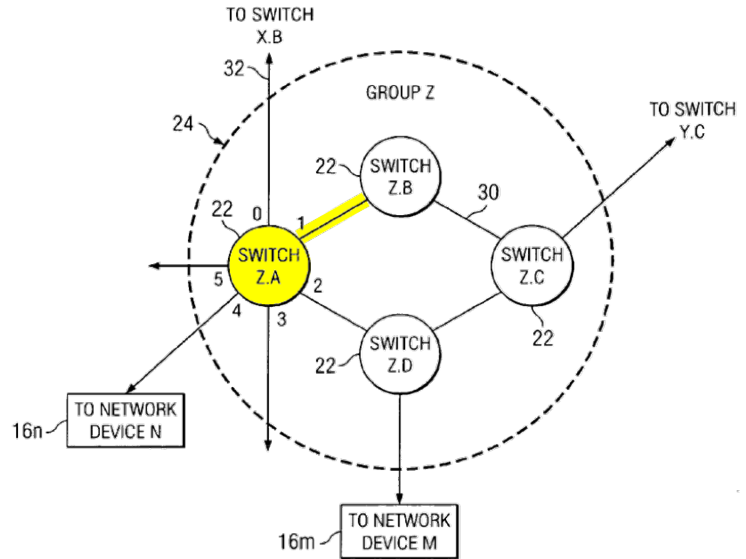


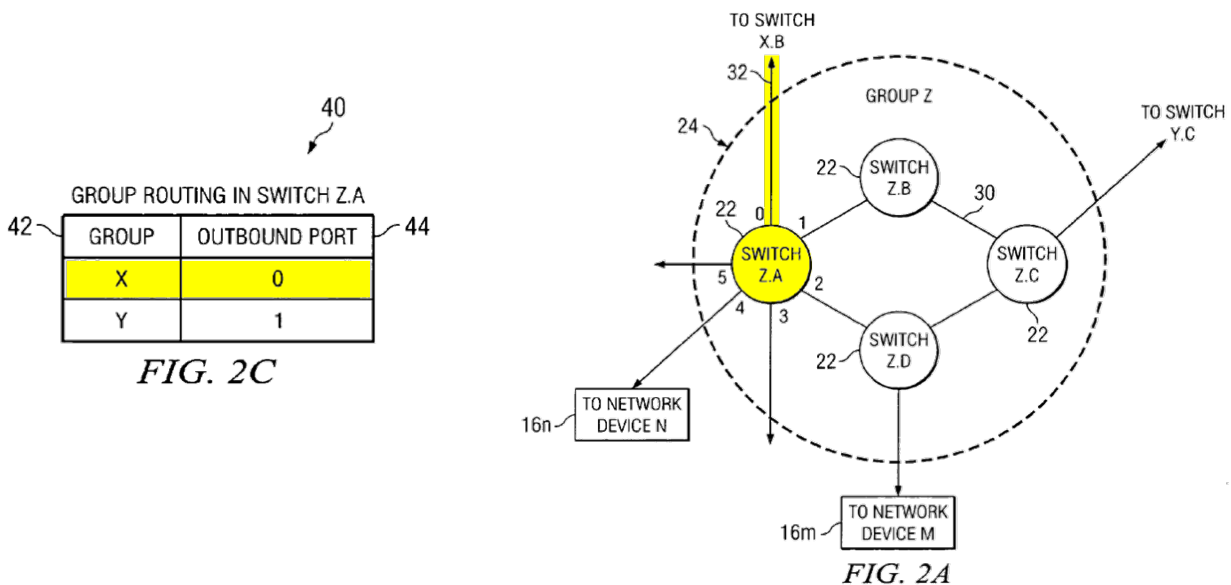
FIG. 2A

Shimizu, Fig. 2A and 2B (highlighted)

As shown in Figure 2A (above right), switch Z.A will transmit the frame using outbound port 1 forwarding it to switch Z.B. Thus, Shimizu’s *packet forwarding table* (network routing table 34) is *used for forwarding a packet* (frame) as recited in 1a/6a. EX1003, ¶150. Further, the routing table is *used for forwarding a packet based on an identifier* (switch/device value and/or outbound port value) *which identifies a link between nodes on a packet forwarding path* (link between switch Z.A and switch Z.B in this example). *Id.*, ¶150.

Shimizu explains that “network routing table 34 for switch Z.A only provides routing information for other switches 22 in group Z, devices connected to switch Z.A, and management device 14.” EX1005, [0036]. In contrast, group routing table 40, also stored on switch Z.A, specifies the outbound port for frames

destined for other groups. *Id.*, [0039] (“[S]witch Z.A maintains a table 40 providing routing information for group Y, as a whole, and group X, as a whole.”). Thus, as another example, if a frame arrives at switch Z.A with header information indicating that it should be forwarded to switch X.B, which is in a different group 24 (group X), switch Z.A would use group routing table 40 in Figure 2C (below left) to determine that the correct outbound port is port 0. EX1003, ¶152.



Shimizu, Figs. 2A and 2C (highlighted)

As shown in Figure 2A (above right), switch Z.A would transmit the frame using output port 0 thereby forwarding it to switch X.B. *Id.*, ¶152. Thus, Shimizu’s *packet forwarding table* (group routing table 40) is *used for forwarding a packet* (frame) as recited in 1a/6a. *Id.*, ¶152. Further, the routing table is *used for forwarding a packet based on an identifier* (group value and/or outbound port value) *which identifies a link between nodes on a packet forwarding path* (link

between switch Z.A and switch X.B in this example). *Id.*, ¶152.

Further, a POSITA would know that Shimizu’s routing tables (each a *packet forwarding table*) are stored on each switch 22 (*packet forwarding node*).

EX1003, ¶153. Switches store routing tables for use in routing network traffic. *Id.* Indeed, Shimizu states that switch 22 “stores” the routing tables. EX1005, [0035] (Figure 2B “illustrates one example of how routing information can be **stored by switches 22**. In the illustrated embodiment, **switch Z.A stores** routing information as a network routing table 34.”), [0019] (“One embodiment of selected routing information **stored by switches 22** is further explained below....”), [0036] (“Routing information is illustrated and described as being **stored in table 34....**”), [0038] (“routing information **stored in switches 22...**”), [0039], [0053], [0058].

Shimizu also discloses that routing tables are stored in “memory” in switches 22. EX1005, [0006] (“In some embodiments, appropriate routing can be enabled with smaller routing tables that require less **memory in a switch**.”), [0023], [0045], claim 9 (“**a memory** operable to maintain network routing information and standard routing information”). A POSITA would understand Shimizu’s “memory” in switches 22 to refer to a *non-transitory computer readable medium* such as RAM, SDRAM, or similar memory devices commonly used in switches before 2009. EX1003, ¶155 (citing EX1014; EX1015; EX1017; EX1018; EX1023; EX1024). Shimizu’s reference to “memory” could also indicate non-

volatile flash memory, NVRAM (Non-Volatile Random Access Memory), or similar devices, which would advantageously permit faster initial configuration and restart. EX1003, ¶156 (citing EX1016). Such “memory” also constitutes *a non-transitory computer readable medium*. *Id.*¹⁰ Thus, Shimizu discloses switches 22 including *a storage unit including a non-transitory computer readable medium configured to store a packet forwarding table* as recited in 1a/6a.

In addition to the explanation above, Shimizu’s discussion of Figures 3A-C further discloses that the routing tables are *used for forwarding a packet based on an identifier* as recited in the claims. EX1003, ¶159. As Shimizu explains, a “device transmitting a frame may add tags to the frame in order to define a particular path that the frame should take through the network. For example, the tags may indicate a link-by-link path between switches in the network.” EX1005, 1 (Abstract). Shimizu further states:

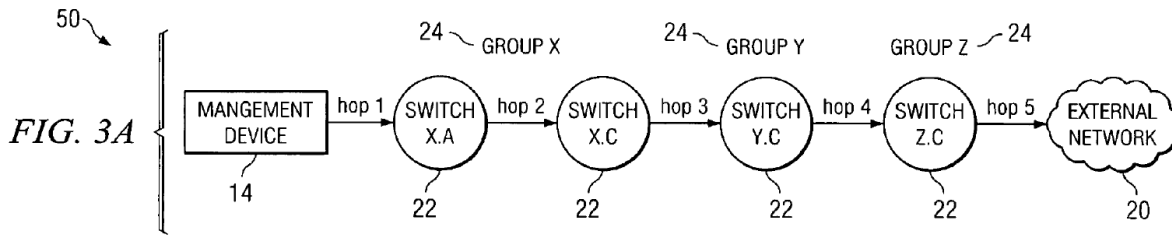
In the first mode of operation, a first tag in the frame is read. Whether the first tag’s switch identification corresponds to the switch is determined. If the switch identification does not correspond to the

¹⁰ The ’249 Patent describes using the same type of memory disclosed by Shimizu. EX1003, ¶157 (citing EX1001, 14:35-38 and EX1005, [0016]). Shimizu discloses *a storage unit including a non-transitory computer readable medium* in the same way that the ’249 Patent does.

switch, the routing information is accessed to determine the output port corresponding to the switch identification, and the frame is transmitted on the determined one of the ports. If the switch identification corresponds to the switch, the frame is transmitted on the port corresponding to the first tag's port identification.

Id., [0005]. Shimizu describes devices controlling the path of frames through the switch network using “tags” in the frames. *Id.*, [0020] (“In operation, devices can control the path of frames through switch network 12 using tags in the frames.”), [0043], [0056] (“In the illustrated embodiment, port ID based tags are used to control the path of frames through switch network 12.”). Thus, Shimizu describes a frame (*packet*) that is forwarded according to information in the “tag.” EX1003, ¶160. Shimizu's tags include the same types of information as in tables 34 and 40 (in Figures 2B and 2C), such as switch/device value, group value, and outbound port value. *Id.* The tags are another form of routing information and constitute *identifier[s]* for the same reasons. *Id.*

In addition, Shimizu's *identifier* used for forwarding the packet *identifies a link between nodes on a packet forwarding path* as recited in 1a. EX1003, ¶161. For example, Figure 3A below “illustrate[s] a path of an outbound frame....” (i.e., path 50). EX1005, [0041].



Shimizu, Fig. 3A

As illustrated, “path 50 includes five different hops (1-5).” *Id.*, [0042]. Shimizu states that “[i]n some embodiments, the frame is structured to include vector based tags. The structure of a frame with vector-based tags is shown in FIG. 3B for each hop (1-5) of path 50. In particular embodiments, the frame is structured to include port ID-based tags. The structure of a frame with port ID based tags is shown in FIG. 3C for each hop (1-5) of path 50.” *Id.*, [0042].

In Shimizu, each “hop” along path 50 is *a link between nodes on a packet forwarding path* specified by *identifiers* used to obtain forwarding information in the routing tables (*packet forwarding tables*). EX1003, ¶162. Thus, Shimizu discloses *a storage unit including a non-transitory computer readable medium configured to store a packet forwarding table used for forwarding a packet based on an identifier which identifies a link between nodes on a packet forwarding path* as recited in 1a. EX1003, ¶¶163.

The language in 6a is slightly different and refers to *an identifier* that *identifies an interface of a packet forwarding node*. EX1003, ¶91 (comparing

claims 1 and 6). As discussed above, Shimizu’s *identifier* specifies an outbound port on switch 22 for *forwarding a packet*. EX1005, [0034]. Each outbound port is *an interface of a packet forwarding node*—it is the interface between the switch and other network nodes (e.g., switches 22, management device 14, etc.) and external networks (e.g., internet 18, external network 20, etc.). EX1003, ¶227.

Thus, 6a is disclosed for the same reasons as 1a. *Id.*

c. [1b/6b] at least one processor configured to execute program instructions to provide a forwarding unit configured to

Shimizu discloses this limitation. EX1003, ¶¶164-168, 228. Shimizu states that “[s]witches 22 represent networking devices that route frames within networks and/or between different networks” and that “each switch 22 represents a network device with multiple ports capable of switching network traffic among the ports.” EX1005, [0016]. “For example, switches 22 may each represent a chip-based switching device capable of switching frames among multiple ports based on standard Ethernet protocols.” *Id.*, [0016]. A POSITA would have known Shimizu’s “chip-based switching device” means a switch with *at least one processor* used to perform Shimizu’s routing technique. EX1003, ¶165.

A POSITA would have known that by 2009 switches and other routing devices, as disclosed in Shimizu, included *at least one processor*. EX1003, ¶166 (citing EX1014; EX1015; EX1018; EX1023; EX1024). A POSITA would also

have known that switches and other routing devices used a *processor to execute program instructions* to provide forwarding functionality (*at least one processor configured to execute program instructions to provide a forwarding unit*). *Id.*, ¶166 (citing EX1014; EX1015; EX1019; EX1023; EX1024). Indeed, Shimizu recites a claim including “[l]ogic for routing frames, the logic encoded in media and operable when executed to” perform Shimizu’s routing techniques. EX1005, 9 (claim 16). A POSITA would understand Shimizu to disclose *program instructions* (logic) executed by *at least one processor* to provide Shimizu’s disclosed functionality. EX1003, ¶167. Thus, Shimizu discloses and suggests to a POSITA that switches 22 include *at least one processor*. *Id.*

d. [1c/6c] receive an incoming packet including a plurality of [the] identifiers

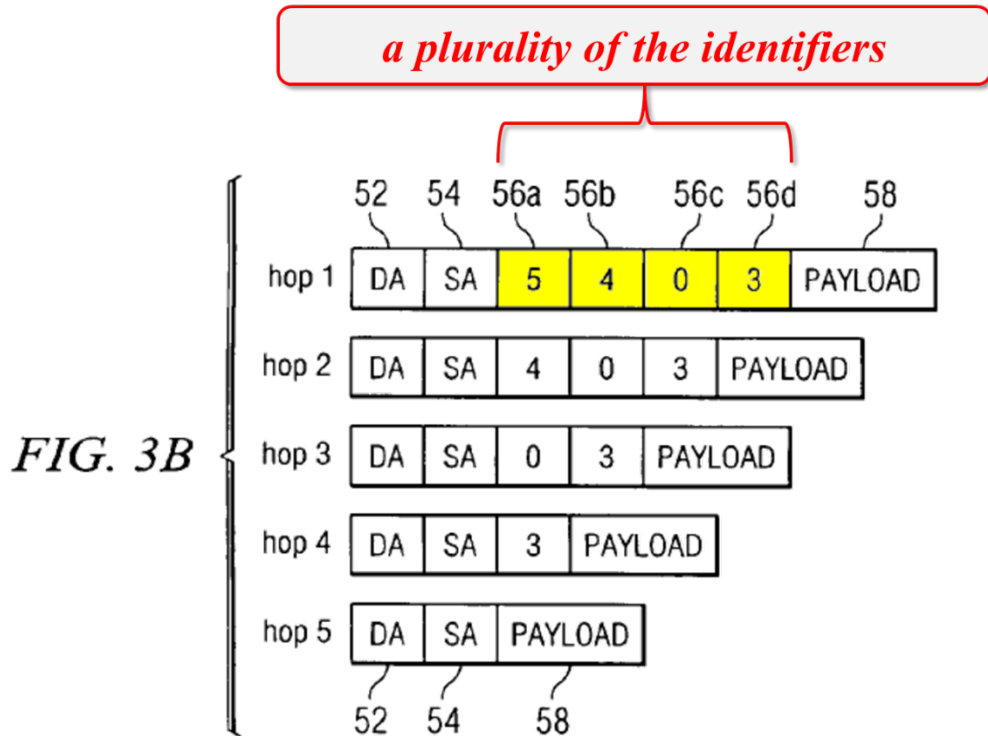
Shimizu discloses this limitation. EX1003, ¶¶169-174, 229.

Shimizu’s switches 22 *receive an incoming packet*. EX1003, ¶170. Shimizu states that the disclosed “method for routing frames comprises *receiving frames* using a group of ports of a switch.” EX1005, [0005]; *see also id.*, [0020] (“switch 22 will add an inbound tag only to *frames that switch 22 receives* from outside switch network 12”), [0021] (“each **switch 22 receiving an inbound frame**”), [0023] (“switch X.A may *receive a frame* with vector based outbound tags”; “[t]his frame would then be *received by switch Y.A*”), [0024], [0035], [0037], [0044], [0047]-[0050], [0053], [0056], Figs. 4, 5. Shimizu’s Figure 5 is “a

flowchart illustrating a method of processing ***a frame received at a switch*** in the switch network.” *Id.*, [0013], Fig. 5.

Further, Shimizu describes switches receiving *packet[s]* (frames) that *include a plurality of the identifiers* (tags). EX1003, ¶171. Shimizu states that “[e]ach frame includes a source address, a destination address, and a payload. At least some portion of the frames also include ***one or more tags***, where each tag specifies a group identification, a switch identification, and a port identification.” EX1005, [0005]; *see also id.*, [0020] (“In operation, devices can control the path of frames through switch network 12 ***using tags in the frames.***”), [0022] (“Outbound ***tags*** may be used to determine the particular path a frame should take through switch network 12.”).

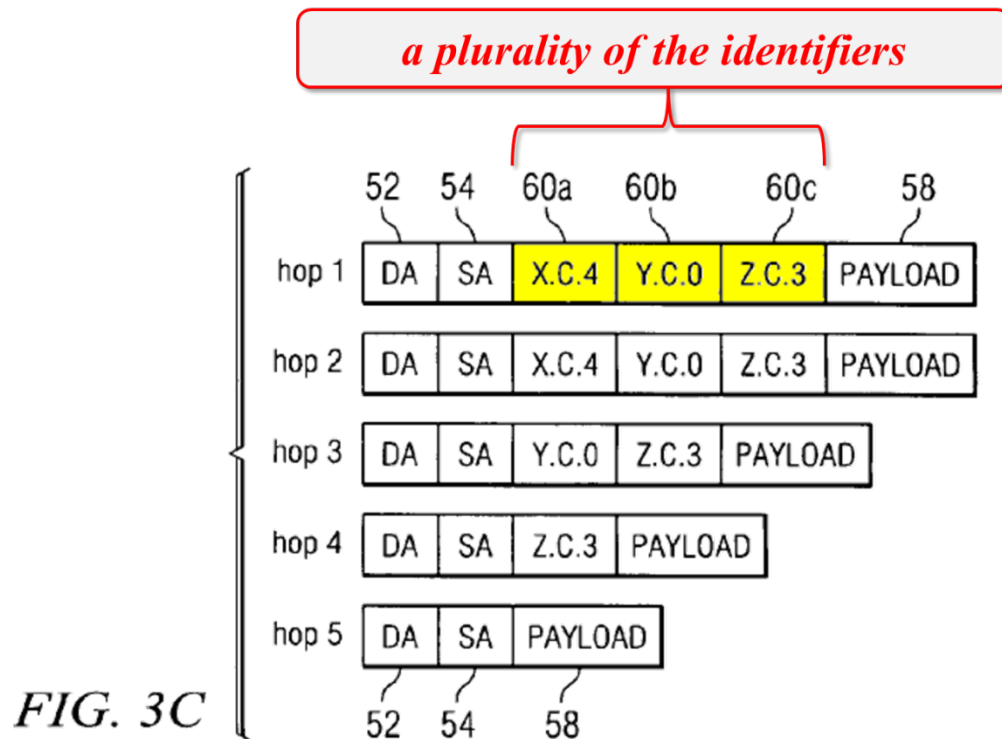
Shimizu’s Figure 3B illustrates the “structure of a frame with vector based tags....” EX1005, [0042]. The illustrated “frame is structured with a vector based tag indicating the next switch 22 in path 50” (of Figure 3A). *Id.*, [0043].



Shimizu, Fig. 3B (annotated)

For example, during hop 1, the frame contains four tags 56 (i.e., 56a, 56b, 56c, and 56d). *Id.*, [0044]. “Tags 56 operate [to] control the path of frames through switch network 12.” *Id.*, [0043]. Shimizu’s tags 56 constitute *a plurality of identifiers*. EX1003, ¶172.

Shimizu’s Figure 3C illustrates the “structure of a frame with port ID based tags....” EX1005, [0042]. The illustrated “frame is structured with a port ID based tag indicating the next group 24 in path 50” (of Figure 3A). *Id.*, [0046].



Shimizu, Fig. 3C (annotated)

For instance, during hop 1, the frame contains three tags 60 (i.e., 60a, 60b, and 60c). *Id.*, [0047]. “Tags 60 operate [to] control the path of frames through switch network 12.” *Id.*, [0046]. Shimizu’s tags 60 constitute *a plurality of identifiers*. EX1003, ¶173.

Thus, Shimizu’s switches 22 *receive an incoming packet including a plurality of the identifiers*. EX1003, ¶174.

e. [1d/6d] determine a direction to forward the incoming packet

Shimizu discloses this limitation. EX1003, ¶¶175-179, 230. Indeed, Shimizu expressly states that “[m]anagement device 14 may structure a frame so

that various switches 22 in switch network 12 ***know which particular direction to route the frame.***” EX1005, [0041]. Thus, Shimizu expressly discloses that switches 22 *determine a direction to forward the incoming packet.* EX1003, ¶176.

Further, Shimizu describes switches 22 distinguishing between “inbound” frames and “outbound” frames (*determine a direction*). EX1005, [0020] (“In some embodiments, two types of tags exist: inbound tags and outbound tags.”).

Inbound frames enter the switch network 12 from external network 20 or Internet 18 (i.e., from outside switch network 12). *Id.*, [0020]. Switches 22 add inbound tags to inbound frames. EX1005, [0021]. Outbound frames originate in the network (e.g., from management device 14), and “[o]utbound tags may be used to determine the particular path a frame should take through switch network 12.” *Id.*, [0022]. The outbound tags identify the next hop in the path through the network. *Id.*, [0023]-[0024]. Thus, switches 22 *determine a direction to forward the incoming packet* (as inbound or outbound) to correctly process the frame’s tags. EX1003, ¶177.

In addition, Shimizu discloses that switches 22 within switch network 12 “may provide for special handling of received management messages” to control routing them to the management device. EX1005, [0027]. In this example, switch 22 *determine[s] a direction to forward the incoming packet* toward (i.e., in the direction of) management device 14. EX1003, ¶178.

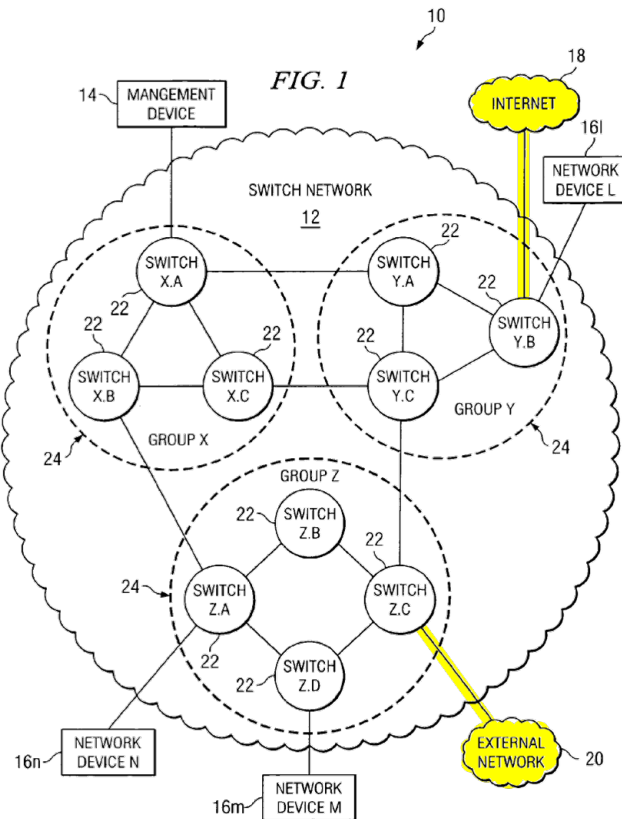
Thus, in several different ways, Shimizu discloses that switches 22 *determine a direction to forward the incoming packet*. EX1003, ¶179.

f. [1e/6e] determine whether to forward to an external network

Shimizu discloses this limitation. EX1003, ¶¶180-188, 231.

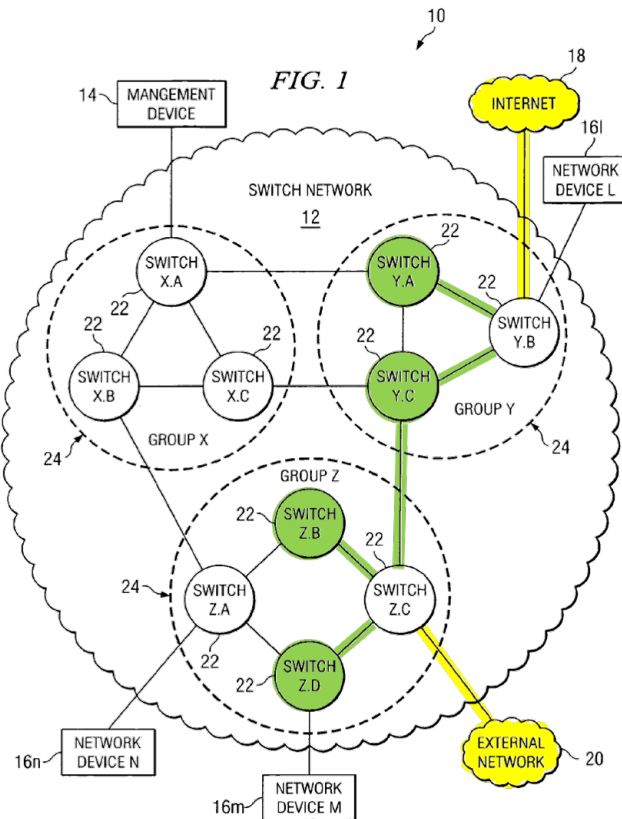
Shimizu expressly identifies *an external network*. EX1003, ¶181. For example, Figure 1 illustrates switch network 12 connected to “an internet 18, and an external network 20.” EX1005, [0014]. Each is *an external network* because they are outside (i.e., external to) switch network 12. EX1003, ¶181.

In Figure 1, switch Z.C is connected to external network 20 and switch Y.B is connected to internet 18, illustrated below. EX1003, ¶182.



Shimizu, Fig. 1 (highlighted)

Those same two switches (Z.C and Y.B) are also connected to other switches 22 within switch network 12, illustrated below. *Id.*, ¶182.

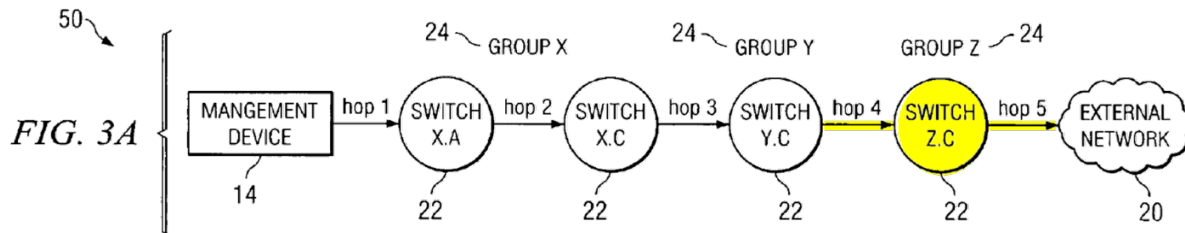


Shimizu, Fig. 1 (highlighted)

At least switches Z.C and Y.B distinguish between packets that are forwarded to an external network (internet 18 or external network 20) and a switch 22 within switch network 12. *Id.*, ¶182. Thus, as a POSITA would know, at least switches Z.C and Y.B *determine whether to forward to an external network* because those switches employing standard network protocols would need to process frames being forwarded to external networks differently than frames being forwarded to switches internal to the network. *Id.*, ¶182.

In addition, Shimizu describes “[o]utbound tags [that] may be used to **determine** the particular path a frame should take through switch network 12.”

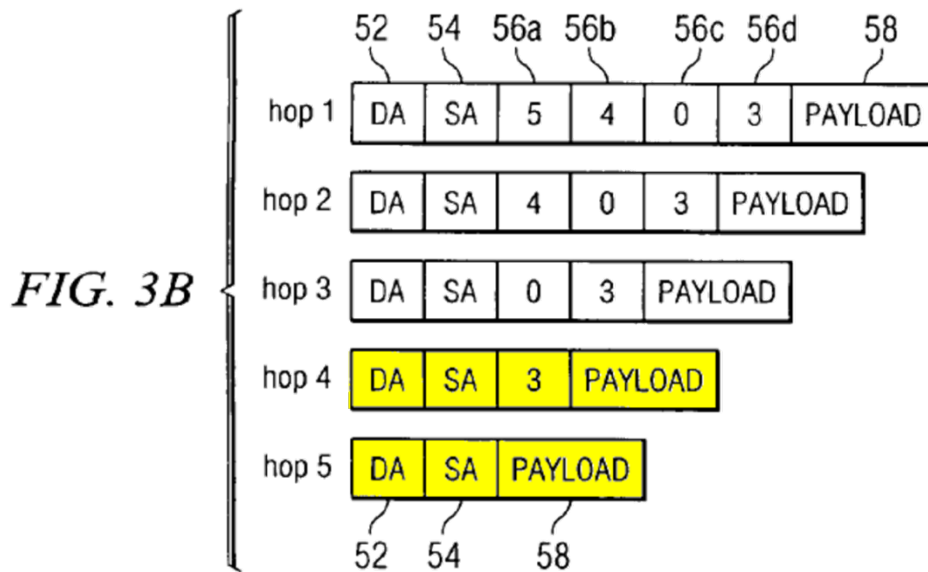
EX1005, [0022]. This includes determining a path to *an external network*. For example, Figure 3A illustrates path 50 of a frame through switch network 12 and then to external network 20. *Id.*, [0041].



Shimizu, Fig. 3A (highlighted)

In the illustrated example, switch Z.C receives the frame on hop 4 and forwards it to external network 20 on hop 5. EX1003, ¶185.

Figure 3B “shows the corresponding structure of a frame through the various hops (1-5) of path 50” where the frame employs vector-based tags. EX1005, [0043]. Switch Z.C receives the frame from hop 4 including tag 56d containing the value 3. *Id.*, [0044].



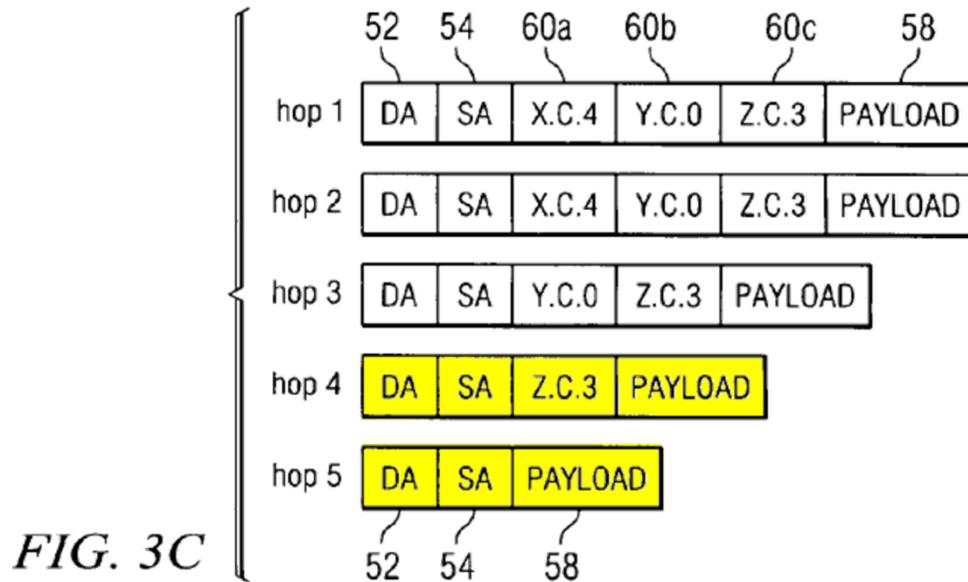
Shimizu, Fig. 3B (highlighted)

“Switch Z.C removes tag 56d from the frame and sends the frame out port 3, after which it is received by external network 20.” *Id.* Thus, the switch *determine[s]* *whether to forward to an external network* based on the relevant tag value.

EX1003, ¶186. In this example, switch Z.C determines that the frame should be forwarded to external network 20 because tag 56d has the value of 3 indicating the switch’s port connected to the external network. *Id.* If tag 56d had a different value, switch Z.C would make a different determination, e.g., that the frame should be forwarded to another switch 22 in switch network 12 (i.e., switch Y.C, Z.B, or Z.D in Figure 1). *Id.*

Figure 3C “shows the corresponding structure of a frame through the various hops (1-5) of path 50” where the frame employs port ID-based tags. EX1005,

[0046]. This time switch Z.C receives the frame from hop 4 including tag 60c with the value Z.C.3 (indicating group Z, switch C, port 3). *Id.*, [0050].



Shimizu, Fig. 3C (highlighted)

In this example, “[s]witch Z.C removes tag 60c and sends the frame on port 3...”

Id. “The frame, during hop 5 contains destination address 52, source address 54, and payload 58.” *Id.* “After hop 5, the frame is received by external network 20.”

Id. Thus, the switch *determine[s] whether to forward to an external network* based on the relevant tag value. EX1003, ¶187. In the illustrated example, switch Z.C determines that the frame should be forwarded to external network 20 because tag 60c has the value Z.C.3 indicating the switch’s port connected to the external network. *Id.* If tag 60c had a different value, switch Z.C would make a different determination, e.g., forwarding the frame to another switch 22 in switch network

12 (i.e., switch Y.C, Z.B, or Z.D in Figure 1). *Id.*

As a POSITA would have known, *an external network* (like network 20 or internet 18) is distinguished from switch network 12 because they use either different address spaces, separate routing instances, or both. EX1003, ¶183. This would require configuring the switch to determine that one or more specific ports are connected to an external network. *Id.*, ¶183. For example, Shimizu states that internet 18 “may be any group of networks connected together, such as a world wide collection of computers and computer networks that can use TCP/IP network protocols to facilitate data transmission and exchange” (EX1005, [0030]), which means a switch 22 connected to internet 18 is configured to receive a frame from another switch 22 in switch network 12 and forward it using a different protocol (e.g., TCP/IP) to internet 18. EX1003, ¶183. The switch 22 would not forward the frame using this protocol if the frame were being forwarded to another switch 22 in switch network 12. *Id.* Thus, the switch 22 *determine[s] whether to forward to an external network* or not. *Id.*

Shimizu also states that “external network 20 may include one or more networks such as a telecommunications network, a satellite network, a cable network, local area networks (LANs), wide area networks (WANs), public switched telephone networks, and/or any other appropriate networks.” EX1005, [0030]. Again, any switch 22 connected to one of these types of external networks

would receive a frame from another switch 22 in Shimizu’s switch network 12 and forward it using the appropriate protocol and format for whatever specific type of external network is to receive the frame. EX1003, ¶184. To ensure the frame is forwarded using the appropriate protocol for the external network, the switch 22 determines that in fact it is forwarding to such an external network. *Id.* Again, for this reason, switch 22 *determine[s] whether to forward to an external network* or not. *Id.* This would have been obvious to a POSITA based on Shimizu’s description. *Id.* (citing EX1005, [0030], [0031], [0033]).

g. **[1f/6f] add to path or link information when the incoming packet is not forwarded to the external network**

Shimizu discloses this limitation. EX1003, ¶¶189-193, 232.

Shimizu describes adding tags (*identifiers*) to an inbound frame. EX1003, ¶190. In Shimizu, “[i]nbound tags may be used, for example, when a frame enters switch network 12 to ensure that responses to the frame are sent from switch network 12 on the same port that originally received the frame.” EX1005, [0020]. “When an inbound frame enters switch network 12 at a specific port, the receiving switch 22 may **add an inbound tag** indicating the group/switch/port that received the frame.” *Id.*; *see also id.*, [0006] (“Also, in particular embodiments, **a tag can be added** to a frame entering a private network to ensure that responses to the frame leave the private network on the exact same port.”). Additionally, “[i]n

particular embodiments, a receiving switch 22 ***adds an inbound tag*** that simply indicates the port on which the receiving switch 22 received the frame, and each subsequent switch 22 that receives the frame may ***add another inbound tag*** that indicates the port on which that switch 22 received the frame.” *Id.*, [0021].

Shimizu’s inbound frames (*packet[s]*) are those that originate from an external network and route through switch network 12. EX1003, ¶191. Therefore, inbound tags are added by switches 22 as they forward inbound frames to other switches 22 (i.e., *when the incoming packet is not forwarded to the external network*). *Id.*

In addition, Shimizu describes adding tags to “network management messages” routed to management device 14 in switch network 12. EX1003, ¶192. Shimizu states that “[i]n some embodiments, management device 14 receives network management messages from network devices 16, internet 18, external network 20, and/or switches 22.” EX1005, [0027]. “To control routing of management messages to management device 14, switches 22 within switch network 12 may provide for special handling of received management messages.” *Id.* “[O]ne or more of switches 22 ***add inbound tags*** to network management messages so that management device 14 knows the port the network management message entered switch network 12 and/or the precise route that each network management message took to reach the management device 14.” *Id.*; *see also id.*, [0054] (“[S]witch 22 determines whether switch 22 received the frame from an

external link in step 92. If so, switch 22 **adds a tag** to the frame specifying the input port on which switch 22 received the frame at step 94.”), claims 4, 12, 19. These tags are added by switches 22 as they forward the management message to other switches 22 in switch network 12 and ultimately to management device 14 (i.e., *when the incoming packet is not forwarded to the external network*).

EX1003, ¶192.

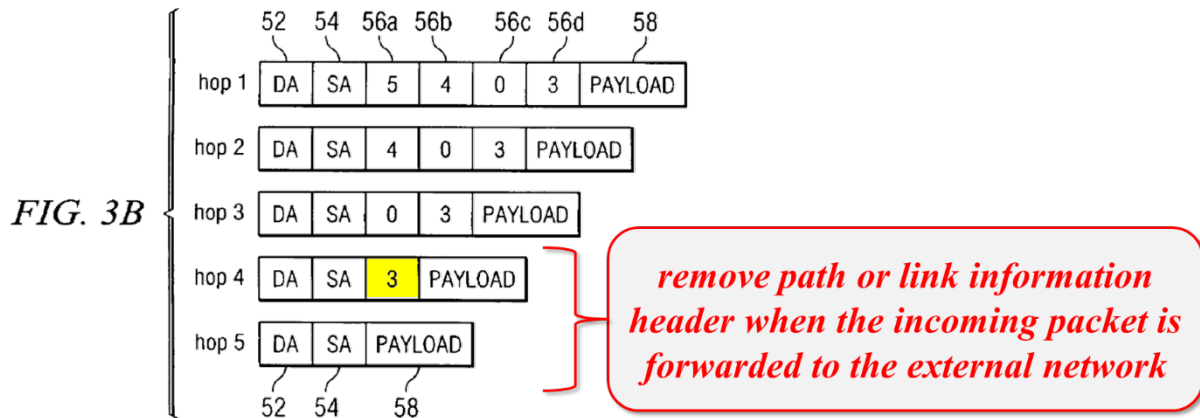
Thus, Shimizu’s switches 22 *add to path or link information (tags) when the incoming packet is not forwarded to the external network*. EX1003, ¶193.

h. [1g/6g] remove path or link information header when the incoming packet is forwarded to the external network[;/,] and

Shimizu discloses this limitation. EX1003, ¶¶194-197, 233. Shimizu discloses that when the switch 22 at the edge of switch network 12 forwards an outbound frame to an *external network* (e.g., external network 20 or internet 18), the switch removes the last outbound tag and thereby *remove[s] path or link information header when the incoming packet is forwarded to the external network*. *Id.*, ¶195.

For example, Shimizu states (regarding the frame illustrated in Figure 3B) that “[s]witch Z.C receives the frame and extracts the last tag 56: tag 56d” (i.e., value 3). EX1005, [0044]. As shown in the figure, “[s]witch Z.C **removes tag 56d** from the frame and sends the frame out port 3, after which it is received by

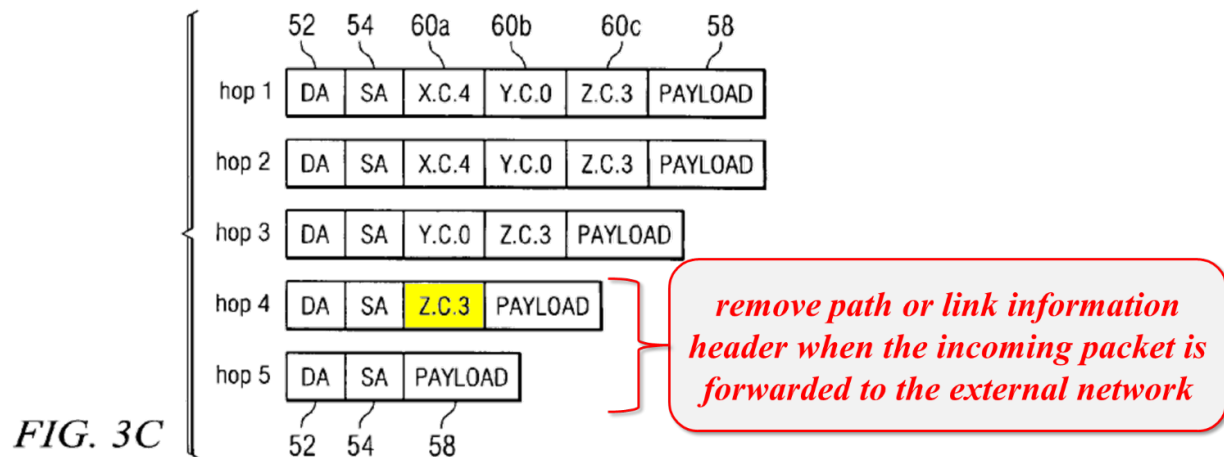
external network 20.” *Id.*



Shimizu, Fig. 3B (annotated)

In hop 4, the outbound frame includes tag 56d (value 3). EX1003, ¶196. The switch removes tag 56d (*remove path or link information header*) and then forwards the frame in hop 5 to external network 20 (*when the incoming packet is forwarded to the external network*). *Id.*

As another example, Shimizu states (regarding the frame illustrated in Figure 3C) that “[s]witch Z.C receives the frame and extracts tag 60c.” EX1005, [0050]. The switch “**removes tag 60c** and sends the frame on port 3...” *Id.* “After hop 5, the frame is received by external network 20.” *Id.*



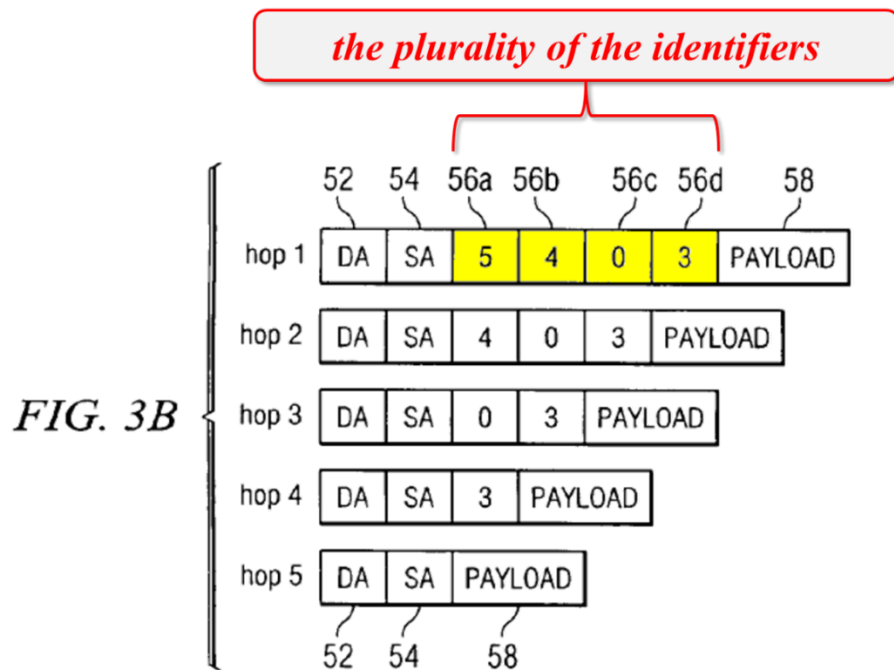
Shimizu, Fig. 3C (annotated)

In hop 4, the outbound frame includes tag 60c (value Z.C.3). EX1003, ¶197. The switch removes tag 60c (*remove path or link information header*) and forwards the frame in hop 5 to external network 20 (*when the incoming packet is forwarded to the external network*). *Id.*

- i. **[1h/6h] [to] forward the incoming packet by using a path or link that corresponds to the identifier from among the plurality of [the] identifiers.**

Shimizu discloses this limitation. EX1003, ¶¶198-205, 234. Shimizu states that “[i]n operation, devices can control the path of frames through switch network 12 using tags in the frames.” EX1005, [0020]. Each tag is an *identifier*, and the frame can contain multiple tags or a *plurality of the identifiers*. EX1003, ¶199. The switch uses each tag (*the identifier from among the plurality of the identifiers*) to transmit the frame (*forward the incoming packet*) as indicated by the tag (*by using a path or link that corresponds to the identifier*). *Id.*

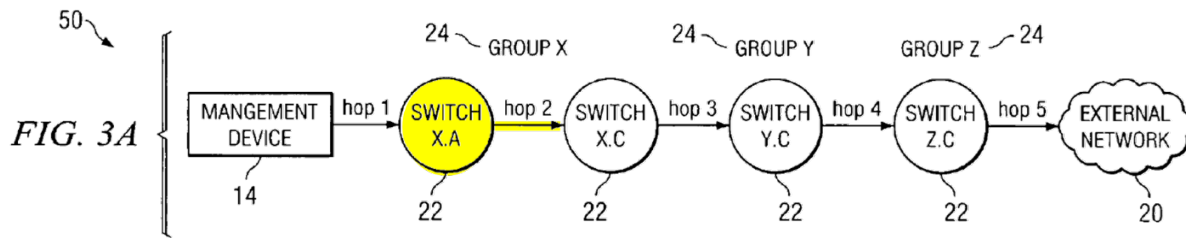
For example, Figure 3B illustrates the “structure of a frame through the various hops (1-5) of path 50” (shown in Figure 3A). EX1005, [0043]. The outbound frame “is structured with a vector based tag indicating the next switch 22 in path 50.” *Id.* “During hop 1, the frame contains destination address 52, source address 54, four tags 56, and payload 58.” *Id.*, [0044].



Shimizu, Fig. 3B (annotated)

The “four tags 56” constitute *the plurality of the identifiers*. EX1003, ¶200.

Further, the switches 22 use the four tags 56 to “control the path” of the frame through switch network 12. EX1005, [0043]. For example, in hop 1, “[s]witch X.A receives the frame and extracts tag 56a,” which has value 5. *Id.*, [0044]. “Because tag 56a contains the value 5, switch X.A sends the frame on port 5 after removing tag 56a from the frame” as shown in Figure 3A. *Id.*



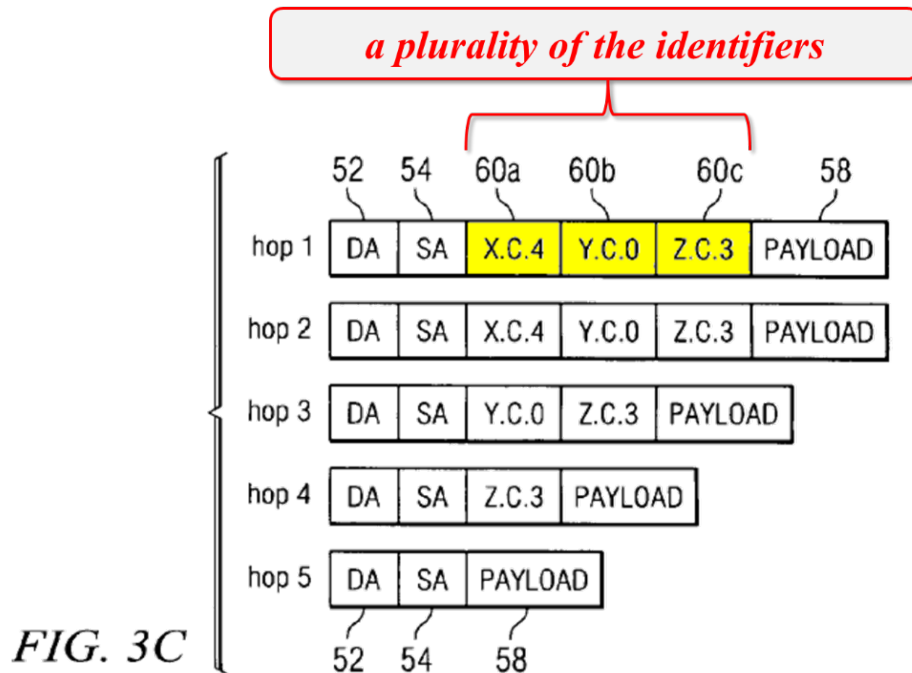
Shimizu, Fig. 3A (highlighted)

In the illustrated example, switch X.A *forward[s] the incoming packet* received on hop 1 *by using a path or link* (hop 2 from switch X.A to switch X.C) *that corresponds to the identifier* (tag 56a) *from among the plurality of the identifiers* (tags 56a, 56b, 56c, 56d). EX1003, ¶201.

In hop 2, “the frame contains destination address 52, source address 54, three tags 56, and payload 58.” EX1005, [0044]. “After hop 2, switch X.C receives the frame and extracts tag 56b” (*the identifier from among the plurality of the identifiers*). *Id.*; EX1003, ¶202. In Figure 3B, “tag 56b contains the value 4.” EX1005, [0044]. “Switch X.C removes tag 56b from the frame and sends the frame out port 4” over hop 3. *Id.* Thus, switch X.A *forward[s] the incoming packet* received on hop 2 *by using a path or link* (hop 3 from switch X.C to switch Y.C) *that corresponds to the identifier* (tag 56b) *from among the plurality of the identifiers* (tags 56b, 56c, 56d). EX1003, ¶202. The switches 22 forward the frame similarly over hops 4 and 5. EX1005, [0044].

Shimizu describes a similar technique for Figure 3C, which also illustrates the “structure of a frame through the various hops (1-5) of path 50” (shown in

Figure 3A). EX1005, [0046]. This outbound frame “is structured with a port ID based tag indicating the next group 24 in path 50.” *Id.* “During hop 1, the frame contains destination address 52, source address 54, three tags 60, and payload 58.” *Id.*, [0047].

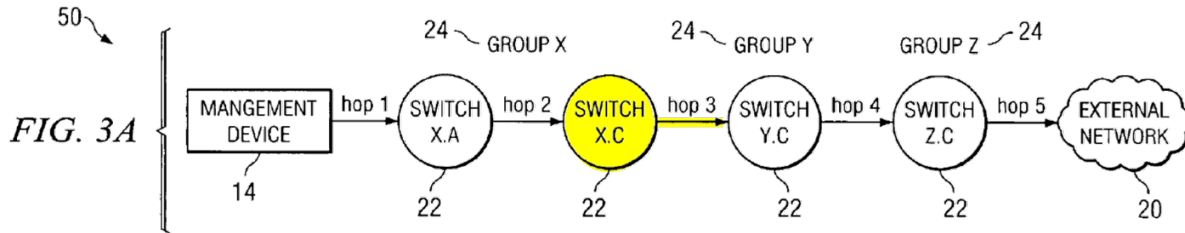


Shimizu, Fig. 3C (annotated)

The “three tags 60” constitute *the plurality of the identifiers*. EX1003, ¶203.

The switches use the three tags 60 to “control the path” of the frame through switch network 12. EX1005, [0046]. For example, in hop 2, “[s]witch X.C receives the frame and extracts tag 60a,” which has value X.C.4. *Id.*, [0048]. “Switch X.C first compares the group identification of tag 60a, ‘X,’ to its group identification” and “[f]inding there is a match, switch X.C then compares the

switch identification of tag 60a, ‘C,’ to its switch identification.” *Id.* “Because there is a match, switch X.C evaluates the port identification, which is 4.” *Id.* “Switch X.C first removes tag 60a, and then sends the frame on port 4 towards switch Y.C” over hop 3 in Figure 3A. *Id.*



Shimizu, Fig. 3A (highlighted)

In this example, switch X.C *forward[s] the incoming packet* received on hop 2 by *using a path or link* (hop 3 between switch X.C and switch Y.C) *that corresponds to the identifier* (tag 60a) *from among the plurality of the identifiers* (tags 60a, 60b, 6c). EX1003, ¶204. The switches 22 forward the frame similarly over each hop in path 50. EX1005, [0047]-[0050].

Thus, Shimizu’s switches 22 *forward the incoming packet by using a path or link that corresponds to the identifier from among the plurality of the identifiers* as recited in 1h/6h. EX1003, ¶205.

2. Claims 2-5 and 7-10

- a. Claims 2/7: The packet forwarding node according to claim [1/6], wherein the storage unit stores the table used for forwarding the packet based on the identifier which uniquely identifies the link within a predetermined domain.**

Shimizu discloses the additional limitation of claims 2 and 7. EX1003, ¶¶206-214, 235-236.

Shimizu discloses that *the storage unit stores the table used for forwarding the packet based on the identifier which...identifies the link* between nodes on a packet forwarding path as explained for 1a. See Section VII.A.1.b, above.

Shimizu also discloses that the identifier *uniquely identifies* the link as recited in claim 2. EX1003, ¶208. For example, Shimizu's Figure 2A illustrates the switches 22 in group Z. EX1005, [0033]. Shimizu explains that, as illustrated, "switch Z.A has six intra-group links 30 and external links 32, designated by ports 0 through 5." *Id.*, [0034]. Each port is connected to another switch or device, as shown:

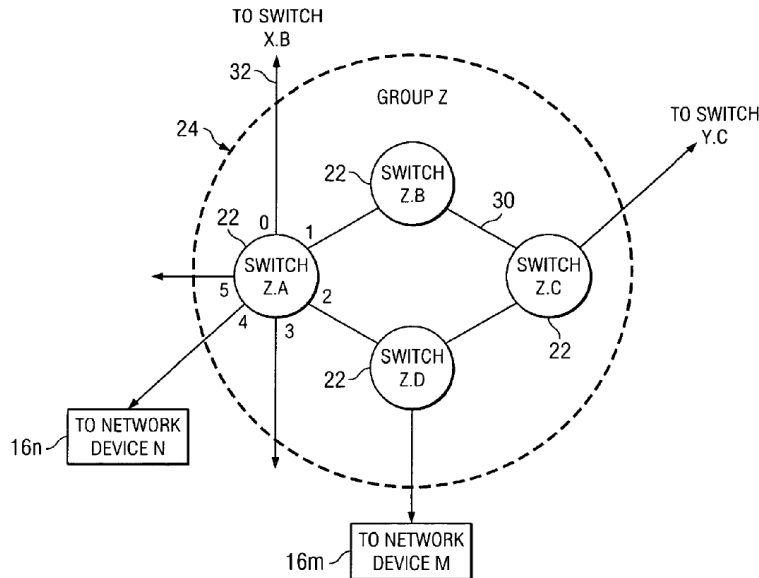


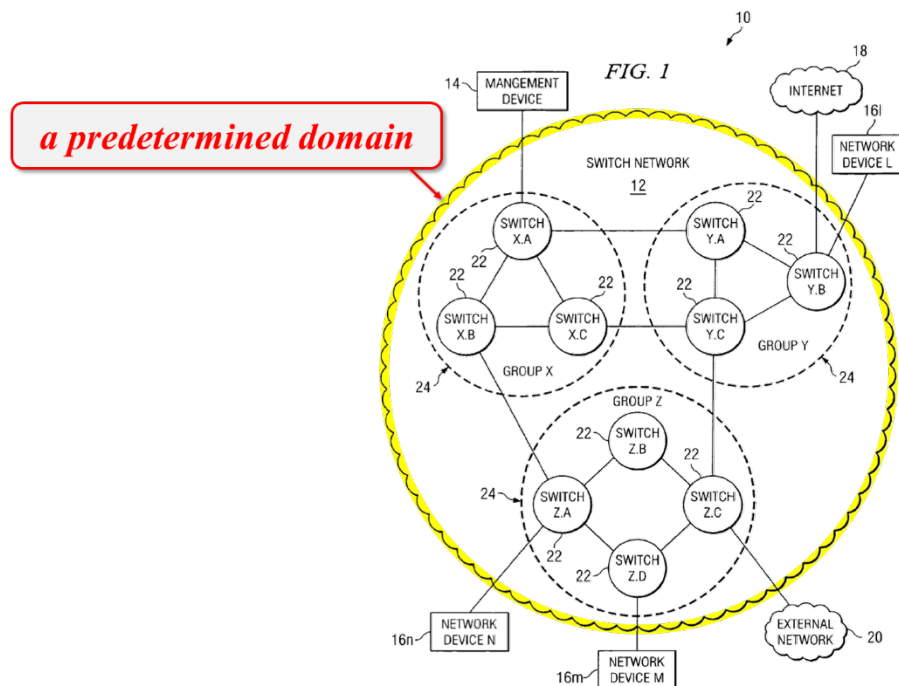
FIG. 2A

Shimizu, Fig. 2A

Thus, each *identifier* indicating the appropriate outbound port *uniquely identifies* the link between nodes on a packet-forwarding path. EX1003, ¶208.

Indeed, Shimizu states that switch network 12 “may be organized into one or more groups of switches, with each group and switch within a group having ***unique identifiers*** so that any given switch or port in the network may be referred to by a hierarchical identification, such as a group/switch/port identification.” EX1005, 1 (Abstract); *see also id.*, [0006] (“a specific port of a specific one of the switches can be ***uniquely referenced by a tag***”), [0018] (“each group 24 is assigned a ***unique identifier*** within switch network 12” and “each switch 22 in a particular group 24 is assigned a ***unique identifier*** within the particular group”), [0018], [0036].

Shimizu also discloses, in at least two different ways, that the identifier identifies *the link within a predetermined domain* as recited in claim 2. EX1003, ¶210. First, Shimizu discloses switch network 12, which is *a predetermined domain*. *Id.*, ¶211. “Switch network 12 includes switches 22 and represents any suitable collection of hardware, software, and controlling logic that interconnect switches 22 and elements coupled to switch network 12.” EX1005, [0015].

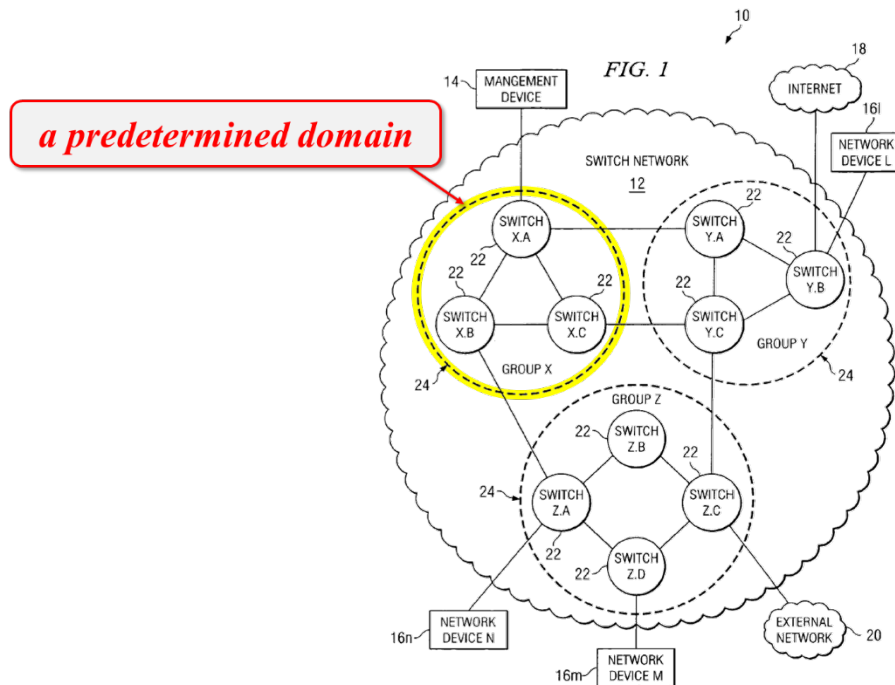


Shimizu, Fig. 1 (annotated)

Shimizu’s “switch network 12 is a private network that allows devices to specifically determine the path of a frame through the network.” *Id.*; *see also id.*, [0004] (“[T]hese techniques describe a routing scheme and network organization that enable a private network to control the path [of] frames take through the

private network”), [0006] (“[T]hese techniques may allow a device to specify a particular path that a frame should take th[r]ough a private network.”). Shimizu states that “within a private network, the switches can use private network routing protocols in place of Ethernet routing for selected network traffic.” *Id.* The private switch network 12 is connected to, but distinct from, internet 18 and external network 20 either of which may employ different routing techniques. *Id.*, [0030]. A POSITA would have recognized Shimizu’s private switch network 12 to be *a predetermined domain* set up and administered by a particular entity. EX1003, ¶213.

Second, Shimizu discloses groups 24 within switch network 12. Groups 24 are each *a predetermined domain*. EX1003, ¶214. Shimizu states that in some embodiments “switches within a private network are divided into groups, and a specific port of a specific one of the switches can be uniquely referenced by a tag that indicates a group, a switch, and a port identifier.” EX1005, [0006].



Shimizu, Fig. 1 (annotated)

“This can permit switches within a group to maintain private routing tables defined for only other switches in the group.” *Id.* A POSITA would have recognized that each of Shimizu’s groups 24 within private switch network 12 is *a predetermined domain* set up and administered by the entity responsible for private switch network 12. EX1003, ¶214.

- b. Claims 3/8: The packet forwarding node according to claim [1/6], wherein the storage unit stores the table used for forwarding the packet based on the identifier which uniquely identifies the link within a predetermined local domain.**

Shimizu discloses the additional limitation recited in claims 3 and 8.

EX1003, ¶¶215-219, 237-238.

Shimizu discloses that *the storage unit stores the table used for forwarding*

the packet based on the identifier which...identifies the link between nodes on a packet-forwarding path as explained for 1a. See Section VII.A.1.b, above. The identifier *uniquely identifies* the link as explained for claim 2. See Section VII.A.2.a, above. And Shimizu’s switch network 12 and each of groups 24 constitute a *predetermined...domain* as explained for claim 2. See Section VII.A.2.a, above.

In addition, Shimizu discloses that the identifier identifies *the link within a predetermined local domain* as recited in claim 3. EX1003, ¶217. Shimizu refers to switch network 12 as a “private” network. EX1005, [0004] (“[T]hese techniques describe a routing scheme and network organization that enable a **private network** to control the path frames take through the private network.”), [0006] (“[T]hese techniques may allow a device to specify a particular path that a frame should take th[r]ough **a private network**.”), [0015] (“In some embodiments, **switch network 12 is a private network** that allows devices to specifically determine the path of a frame through the network.”). Shimizu also discloses “private network routing protocols” for routing frames through the private network. *Id.*, [0006] (“[W]ithin a private network, the switches can use **private network routing protocols** in place of Ethernet routing for selected network traffic.”). A POSITA would have known that Shimizu’s private switch network 12 with private routing protocol would commonly be implemented as a *local* network

such as a LAN. EX1003, ¶219. Thus, Shimizu discloses to a POSITA that the identifier identifies *the link within a predetermined local domain. Id.*

- c. **Claims 4/9: The packet forwarding node according to claim [1/6], wherein the storage unit stores the table used for forwarding the packet based on the identifier which uniquely identifies the link within the packet forwarding node.**

Shimizu discloses the additional limitation of claims 4 and 9. EX1003, ¶¶220-222, 239-240.

Shimizu discloses that *the storage unit stores the table used for forwarding the packet based on the identifier which...identifies the link* between nodes on a packet-forwarding path as explained for 1a. See Section VII.A.1.b, above. The identifier *uniquely identifies* the link as explained for claim 2. See Section VII.A.2.a, above.

In addition, Shimizu discloses that the identifier identifies *the link within the packet forwarding node*. EX1003, ¶222. Shimizu describes switches 22 using an *identifier* to forward a frame using a particular outbound port on the switch as discussed for 1h. See Section VII.A.1.i, above. Thus, Shimizu discloses using an identifier to specify *the link within the packet forwarding node* (i.e., the link by which the frame is transferred from the inbound port to the outbound port of the switch). EX1003, ¶222.

- d. Claims 5/10: The packet forwarding node according to claim [1/6], wherein the storage unit stores the table used for forwarding the packet based on the identifier which unique[ly] identifies the link among the packet forwarding nodes.**

Shimizu discloses the additional limitation of claims 5 and 10. EX1003, ¶¶223-224, 241-242.

Shimizu discloses that *the storage unit stores the table used for forwarding the packet based on the identifier which...identifies the link* between nodes on a packet-forwarding path as explained for 1a. See Section VII.A.1.b, above. The identifier *unique[ly] identifies* the link as explained for claim 2. See Section VII.A.2.a, above.

The phrase in claim 5/10 reciting *the link among the packet forwarding nodes* is essentially the same as corresponding language in 1a. Compare EX1001, 30:18-19 (claim 1a: “identifies a link between nodes on a packet forwarding path”) with *id.*, 30:48-49, 31:15-16 (claim 5/10: “identifies the link among the packet forwarding nodes”); EX1003, ¶224. Thus, Shimizu discloses an identifier that identifies *the link among the packet forwarding nodes* as explained for 1a. See Section VII.A.1.b, above.

3. Claim 11

- a. A packet forwarding node, comprising:**

Claim 11’s preamble is identical to 1pre. EX1003, ¶92 (comparing claims 1 and 11). It is disclosed as discussed for 1pre. See Section VII.A.1.a, above.

b. a memory storing a program;

Shimizu discloses this limitation. EX1003, ¶¶244-245. As discussed for 1a, Shimizu's switches 22 contain memory devices such as RAM, SDRAM, NVRAM, or similar devices. See Section VII.A.1.b, above. Switches 22 also include at least one processor as explained for 1b. See Section VII.A.1.c, above. A POSITA would have known that the processor's fundamental purpose is executing program instructions stored in memory on the switch. EX1003, ¶245. A POSITA would also have known that Shimizu's routing techniques are performed by one or more processors on switches 22 executing program instructions stored in each switch's memory. *Id.* Thus, Shimizu discloses to a POSITA that each switch 22 (*packet forwarding node*) includes *memory storing a program* to perform Shimizu's routing techniques. *Id.*

c. at least one processor configured to execute the program to provide:

Shimizu discloses this limitation. EX1003, ¶¶246-247. As explained for the prior limitation of claim 11, Shimizu's switches 22 contain memory devices and at least one processor as discussed in more detail for 1a and 1b. See Sections VII.A.1.b and VII.A.1.c, above. A POSITA would have known that Shimizu's routing techniques are performed by one or more processors on switches 22 executing program instructions stored in the switch's memory. EX1003, ¶246. Thus, Shimizu discloses to a POSITA that each switch 22 (*packet forwarding*

node) includes *at least one processor configured to execute the program in memory to perform Shimizu’s routing techniques. Id.*, ¶246.

In addition, this limitation is virtually identical to 1b. EX1003, ¶92 (comparing claims 1 and 11). It is disclosed as discussed for 1b. See Section VII.A.1.c, above; EX1003, ¶247.

d. a communication unit configured to communicate with a server for receiving a plurality of identifiers, each of which identifies a link between nodes on a packet forwarding path; and

Shimizu discloses this limitation. EX1003, ¶¶248-251. Shimizu states that management device 14 can be used to configure switches 22 in switch network 12. EX1005, [0026]. A POSITA would understand that configuring the switches includes loading routing tables on them. EX1003, ¶249. The routing tables include *a plurality of identifiers, each of which identifies a link between nodes on a packet forwarding path* as explained for 1a and 1c. See Sections VII.A.1.b and VII.A.1.d, above. Thus, Shimizu’s management device 14 constitutes *a server sending a plurality of identifiers* to switches 22. EX1003, ¶249.

Further, Shimizu’s “management device 14 and network devices 16 can transmit frames with outbound tags in order to define a desired frame path.” EX1005, [0022]. The outbound tags correspond to *a plurality of identifiers, each of which identifies a link between nodes on a packet forwarding path* as explained for 1c and 1h. See Sections VII.A.1.d and VII.A.1.i, above. Like management

device 14, a network device 16 can be *a server*. EX1005, [0029] (“Network devices 16 represent any device connectable to switch network 12. For example, network devices 16 may include personal computers, **servers**, file storage, network printers, and other network enabled devices.”). Thus, Shimizu’s management device 14 and network devices 16 disclose *a server sending a plurality of identifiers* to switches 22. EX1003, ¶250.

In addition, Shimizu’s disclosure of *a server sending a plurality of identifiers* to switches 22 informs a POSITA that Shimizu’s *packet forwarding node[s]* (switches 22) contain *a communication unit configured to communicate with a server for receiving a plurality of identifiers*. EX1003, ¶251. Switches 22 could not receive configuration and other information from management device 14 and network devices 16 without such *a communication unit*. *Id.*

e. a forwarding unit configured to:

This limitation is part of language in claim 11 that corresponds to 1b. EX1003, ¶92 (comparing claims 1 and 11). It is disclosed for reasons discussed for 1b. *See* Section VII.A.1.c, above; EX1003, ¶252.

f. receive an incoming packet including the plurality of the identifiers,

This limitation is virtually identical to 1c. EX1003, ¶92 (comparing claims 1 and 11). It is disclosed as discussed for 1c. *See* Section VII.A.1.d, above; EX1003, ¶253.

g. determine a direction to forward the incoming packet,

This limitation is identical to 1d. EX1003, ¶92 (comparing claims 1 and 11).

It is disclosed as discussed for 1d. *See* Section VII.A.1.e, above.

h. determine whether to forward to an external network,

This limitation is identical to 1e. EX1003, ¶92 (comparing claims 1 and 11).

It is disclosed as discussed for 1e. *See* Section VII.A.1.f, above.

i. add to path or link information when the incoming packet is not forwarded to the external network,

This limitation is identical to 1f. EX1003, ¶92 (comparing claims 1 and 11).

It is disclosed as discussed for 1f. *See* Section VII.A.1.g, above.

j. remove path or link information header when the incoming packet is forwarded to the external network, and

This limitation is identical to 1g. EX1003, ¶92 (comparing claims 1 and 11).

It is disclosed as discussed for 1g. *See* Section VII.A.1.h, above.

k. forward the incoming packet by using a path or link that corresponds to an identifier from among the plurality of identifiers.

This limitation is virtually identical to 1h. EX1003, ¶92 (comparing claims 1 and 11). It is disclosed as discussed for 1h. *See* Section VII.A.1.i, above; EX1003, ¶258.

4. Claim 16

a. A packet forwarding node, comprising:

Claim 16's preamble is identical to 1pre. EX1003, ¶93 (comparing claims 1

and 16). It is disclosed as discussed for 1pre. See Section VII.A.1.a, above.

- b. a communication unit configured to communicate with a server for receiving a plurality of identifiers, each of which identifies an interface of the packet forwarding node; and**

Shimizu discloses this limitation, which is similar to the “communication unit” limitation of claim 11. EX1003, ¶268. Shimizu discloses *a communication unit configured to communicate with a server for receiving a plurality of identifiers* for the reasons explained for the corresponding limitation of claim 11. See Section VII.A.3.d, above; EX1003, ¶268. The only difference is that claim 11 refers to an identifier that “identifies a link between nodes on a packet forwarding path,” while the identifier of this limitation of claim 16 *identifies an interface of the packet forwarding node*. As explained for 6a, Shimizu discloses identifiers that identify *an interface of the packet forwarding node* (as well as a link between nodes). See Section VII.A.1.b, above; EX1003, ¶268.

- c. at least one processor configured to execute program instructions to provide a forwarding unit configured to**

This limitation is identical to 1b. EX1003, ¶93 (comparing claims 1 and 16). It is disclosed as discussed for 1b. See Section VII.A.1.c, above.

- d. receive an incoming packet including a plurality of identifiers,**

This limitation is identical to 1c. EX1003, ¶93 (comparing claims 1 and 16). It is disclosed as discussed for 1c. See Section VII.A.1.d, above.

e. determine a direction to forward the incoming packet,

This limitation is identical to 1d. EX1003, ¶93 (comparing claims 1 and 16).

It is disclosed as discussed for 1d. See Section VII.A.1.e, above.

f. determine whether to forward to an external network,

This limitation is identical to 1e. EX1003, ¶93 (comparing claims 1 and 16).

It is disclosed as discussed for 1e. See Section VII.A.1.f, above.

g. add to path or link information when the incoming packet is not forwarded to the external network,

This limitation is identical to 1f. EX1003, ¶93 (comparing claims 1 and 16).

It is disclosed as discussed for 1f. See Section VII.A.1.g, above.

h. remove path or link information header when the incoming packet is forwarded to the external network, and

This limitation is identical to 1g. EX1003, ¶93 (comparing claims 1 and 16).

It is disclosed as discussed for 1g. See Section VII.A.1.h, above.

i. forward the incoming packet by using a path or link that corresponds to an identifier from among the plurality of identifiers.

This limitation is virtually identical to 1h. EX1003, ¶93 (comparing claims 1 and 11). It is disclosed as discussed for 1h. See Section VII.A.1.i, above; EX1003, ¶275.

5. Claims 12-15 and 17-20

a. Claims 12/17: The packet forwarding node according to claim [11/16], wherein the forwarding unit

forwards the packet based on the identifier which uniquely identifies the link within a predetermined domain.

Shimizu discloses the additional limitation of claims 12 and 17. EX1003, ¶¶259-260, 276-277. Shimizu discloses a *forwarding unit* that *forwards the packet based on the identifier which...identifies the link* between nodes on a packet-forwarding path as discussed for limitations 1b-1h. See Sections VII.A.1.c-VII.A.1.i, above. The identifier *uniquely identifies* the link as explained for claim 2. See Section VII.A.2.a, above. The identified *link* is also *within a predetermined domain* for the reasons discussed for claim 2, which recites the same phrase. See Section VII.A.2.a, above; EX1003, ¶97 (comparing claims 2 and 12).

b. Claims 13/18: The packet forwarding node according to claim [11/16], wherein the forwarding unit forwards the packet based on the identifier which uniquely identifies the link within a predetermined local domain.

Shimizu discloses the additional limitation of claims 13 and 18. EX1003, ¶¶261-262, 278-279. Shimizu discloses a *forwarding unit* that *forwards the packet based on the identifier which...identifies the link* between nodes on a packet-forwarding path as discussed for limitations 1b-1h. See Sections VII.A.1.c-VII.A.1.i, above. The identifier *uniquely identifies* the link as explained for claim 2. See Section VII.A.2.a, above. The identified *link* is *within a*

predetermined local domain for the reasons explained for claim 3, which recites the same phrase. See Section VII.A.2.b, above; EX1003, ¶99 (comparing claims 3 and 13).

- c. **Claims 14/19: The packet forwarding node according to claim [11/16], wherein the forwarding unit forwards the packet based on the identifier which uniquely identifies the link within the packet forwarding node.**

Shimizu discloses the additional limitation of claims 14 and 19. EX1003, ¶¶263-264, 280-281. Shimizu discloses a *forwarding unit* that *forwards the packet based on the identifier* as explained for 1b-1h. See Sections VII.A.1.c-VII.A.1.i, above. The *identifier...uniquely identifies the link within the packet forwarding node* for the reasons explained for claim 4, which recites the same phrase. See Section VII.A.2.c, above; EX1003, ¶102 (comparing claims 4 and 14).

- d. **Claims 15/20: The packet forwarding node according to claim [11/16], wherein the forwarding unit forwards the packet based on the identifier which uniquely identifies the link among the packet forwarding nodes.**

Shimizu discloses the additional limitation of claims 15 and 20. EX1003, ¶¶265-266, 282-283. Shimizu discloses a *forwarding unit* that *forwards the packet based on the identifier which...identifies the link* between nodes on a packet-forwarding path as explained for limitations 1b-1h. See Sections VII.A.1.c-VII.A.1.i, above. The *identifier uniquely identifies the link* as explained for

claim 2. *See* Section VII.A.2.a, above. The identified *link* is also *among the packet forwarding nodes* for the reasons explained for claim 5, which recites the same phrase. *See* Section VII.A.2.d, above; EX1003, ¶105 (comparing claims 5 and 15).

6. Claim 21

a. A server, comprising:

Shimizu discloses the preamble of claim 21. EX1003, ¶¶284-285. In particular, Shimizu explains that “[m]anagement device 14 may control the operation of switch network 12 and/or the interoperation between different switches 22 within switch network 12.” EX1005, [0026]. For instance, “management device 14 performs an initial configuration of switch network 12. The initial configuration separates switches 22 into groups 24, assigns a switch identification to each switch 22, assigns a group identification to each group 24, and distributes to each switch 22 the switch identification and the group identification corresponding to that particular switch 22.” *Id.* A POSITA would understand based on Shimizu’s description of the functions performed by management device 14 that it is a *server* computer. EX1003, ¶284. Further, Shimizu’s network device 16 can be a *server*. EX1005, [0029] (“network devices 16 may include personal computers, **servers**, file storage, network printers, and other network enabled devices”). Thus, Shimizu’s management device 14 and

network devices 16 disclose *[a] server*. EX1003, ¶284.

b. a memory storing a computer program;

A POSITA would have known that a server computer, as disclosed by Shimizu, includes *memory* (e.g., RAM, SDRAM, disk drive, etc.) and one of a server's most basic operations involves a processor executing *a computer program* stored in *memory*. EX1003, ¶286 (citing EX1020; EX1021; EX1022).

c. at least one processor configured to execute the computer program to provide:

A POSITA would have known that a server computer, as disclosed by Shimizu, includes *at least one processor* and one of a server's most basic operations involves a processor executing *a computer program*. EX1003, ¶287. A POSITA would also have known that the functions of Shimizu's management device 14 and network devices 16 (*server[s]*) require a processor in the device to *execute [a] computer program*. *Id.* (citing EX1020; EX1021; EX1022).

d. a first unit configured to determine a plurality of identifiers, each of which identifies a link between nodes on a packet forwarding path; and

Shimizu explains that management device 14 can be used to configure switches 22 in switch network 12. EX1005, [0026]. A POSITA would understand that this configuration includes loading routing tables on switches 22. *Id.*; EX1003, ¶288. The routing tables include *a plurality of identifiers, each of which identifies a link between nodes on a packet forwarding path* as explained for 1a

and 1c. *See* Sections VII.A.1.b and VII.A.1.d, above. Shimizu’s management device 14 constitutes a *server sending a plurality of identifiers* to switches 22.

EX1003, ¶288. A POSITA would have understood that for management device 14 to configure routing tables on switches 22, it would include *a first unit configured to determine a plurality of identifiers* (i.e., it would first determine the *plurality of identifiers* and then configure routing tables on switches 22 using those *identifiers*). *Id.*

In addition, Shimizu’s “management device 14 and network devices 16 can transmit frames with outbound tags in order to define a desired frame path.”

EX1005, [0022]. The outbound tags correspond to *a plurality of identifiers, each of which identifies a link between nodes on a packet forwarding path* as explained for 1c and 1h. *See* Sections VII.A.1.d and VII.A.1.i, above. Shimizu’s management device 14 and network devices 16 each disclose *a server sending a plurality of identifiers* to switches 22. EX1003, ¶289. A POSITA would understand that for such a device to send *a plurality of identifiers*, it would include *a first unit configured to determine a plurality of identifiers* (i.e., it would determine the *plurality of identifiers* to include as outbound tags in the frame). *Id.*

e. a second unit configured send information elements to a packet forwarding node which is capable of

Shimizu’s management device 14 configures the switches 22 in switch network 12. EX1005, [0026]. A POSITA would understand that this

configuration includes loading routing tables on the switches. *Id.*; EX1003, ¶290. The routing tables contain *information elements* including identifiers specifying links between nodes in the packet-forwarding path as explained for 1a. *See* Section VII.A.1.b, above. Thus, Shimizu’s management device 14 constitutes a server sending *information elements* to switches 22. EX1003, ¶290. A POSITA would have understood that for management device 14 to send *information elements* to switches 22, it would include *a second unit configured [to] send information elements to a packet forwarding node* (switch 22). *Id.*

In addition, Shimizu’s “management device 14 and network devices 16 can transmit frames with outbound tags in order to define a desired frame path.” EX1005, [0022]. The outbound tags are *information elements* corresponding to identifiers identifying a path through the network as explained for 1c and 1h. *See* Sections VII.A.1.d and VII.A.1.i, above. Shimizu’s management device 14 and network devices 16 each disclose *a server sending information elements* to switches 22. EX1003, ¶291. A POSITA would have understood that for such a device to send *information elements* to switches 22, it would include *a second unit configured [to] send information elements to a packet forwarding node* (switch 22). *Id.*

f. receiving an incoming packet including a plurality of identifiers,

This limitation is virtually identical to 1c. EX1003, ¶94 (comparing claims

1 and 21). It is disclosed as discussed for 1c. *See* Section VII.A.1.d, above;
EX1003, ¶293.

g. determining a direction to forward the incoming packet,

This limitation is virtually identical to 1d. EX1003, ¶94 (comparing claims 1 and 21). It is disclosed as discussed for 1d. *See* Section VII.A.1.e, above;
EX1003, ¶294.

h. determining whether to forward to an external network,

This limitation is virtually identical to 1e. EX1003, ¶94 (comparing claims 1 and 21). It is disclosed as discussed for 1e. *See* Section VII.A.1.f, above;
EX1003, ¶295.

i. adding to path or link information when the incoming packet is not forwarded to the external network,

This limitation is virtually identical to 1f. EX1003, ¶94 (comparing claims 1 and 21). It is disclosed as discussed for 1f. *See* Section VII.A.1.g, above;
EX1003, ¶296.

j. removing path or link information header when the incoming packet is forwarded to the external network, and

This limitation is virtually identical to 1g. EX1003, ¶94 (comparing claims 1 and 21). It is disclosed as discussed for 1g. *See* Section VII.A.1.h, above;
EX1003, ¶297.

- k. **forwarding the incoming packet by using a path or link, that corresponds to an identifier from among the plurality of identifiers.**

This limitation is virtually identical to 1h. EX1003, ¶94 (comparing claims 1 and 21). It is disclosed as discussed for 1h. See Section VII.A.1.i, above; EX1003, ¶298.

7. **Claims 22-27**

- a. **Claim 22: The packet forwarding node according to claim 1, wherein the storage unit stores the table used for forwarding the packet based on the identifier which identifies the link between adjacent nodes on a packet forwarding path.**

Shimizu discloses the additional limitation of claim 22. EX1003, ¶¶299-300. In particular, Shimizu discloses a *storage unit that stores the table used for forwarding the packet based on the identifier which identifies the link between...nodes on a packet forwarding path* for the reasons explained for 1a. See Section VII.A.1.b, above. Shimizu also discloses that the identified *link* is *between adjacent nodes* as recited in claim 22. For example, Figure 1 illustrates switch network 12 with links connecting *adjacent nodes* (switches 22). EX1003, ¶300. Similarly, Figure 2A illustrates a group 24 within switch network 12 showing links *between adjacent nodes* (switches 22). *Id.*

- b. **Claim 23: The packet forwarding node according to claim 6, wherein the storage unit stores the packet forwarding table used for forwarding the packet based on the identifier which identifies the link between adjacent nodes on a packet forwarding path.**

Shimizu discloses the additional limitation of claim 23. EX1003, ¶¶301-302. Shimizu discloses a *storage unit that stores the packet forwarding table used for forwarding the packet based on the identifier which identifies the link between...nodes on a packet forwarding path* for the reasons explained for 1a. See Section VII.A.1.b, above. Shimizu also discloses that the identified *link* is *between adjacent nodes* as discussed for claim 22. See Section VII.A.7.a, above; EX1003, ¶302 (comparing language of claims 22 and 23).

- c. **Claims 24/25: The packet forwarding node according to claim [11/16], further comprising a storage unit that stores a table used for forwarding the packet based on an identifier which identifies the link between adjacent nodes on a packet forwarding path.**

Shimizu discloses the additional limitation of claims 24 and 25, which are essentially identical. EX1003, ¶¶303-304, ¶¶305-306. Shimizu discloses a *storage unit that stores a table used for forwarding the packet based on an identifier which identifies the link between...nodes on a packet forwarding path* for the reasons explained for 1a. See Section VII.A.1.b, above. Shimizu also discloses that the identified *link* is *between adjacent nodes* as discussed for claim 22. See Section VII.A.7.a, above; EX1003, ¶108 (comparing claims 22 and 24) and ¶109 (comparing claims 22 and 25).

- d. **Claim 26: The server according to claim 21,**

Shimizu discloses the limitations of claim 21. See Section VII.A.6, above.

Shimizu also discloses the additional limitations of claim 26. EX1003, ¶¶307-309.

- (i) **further comprising a storage unit to store a packet forwarding table used for forwarding the incoming packet based on the identifier which identifies the link between nodes on the packet forwarding path,**

This limitation is essentially the same as 1a. EX1003, ¶308. It is disclosed as discussed for 1a. See Section VII.A.1.b, above.

- (ii) **wherein the storage unit stores the table used for forwarding the packet based on the identifier which identifies a link between adjacent nodes on a packet forwarding path.**

Shimizu discloses a *storage unit that stores the table used for forwarding the packet based on the identifier which identifies a link between...nodes on a packet forwarding path* for the reasons explained for 1a. See Section VII.A.1.b, above.

Shimizu also discloses that the identified *link* is *between adjacent nodes* as discussed for claim 22. See Section VII.A.7.a, above.

- e. **Claim 27: The packet forwarding node according to claim 1, wherein when the forwarding unit receives the incoming packet including the identifier for the link connecting nodes on the packet forwarding path, the forwarding unit forwards the incoming packet based on the identifier included the received incoming packet from among the plurality of the identifiers.**

Shimizu discloses the additional limitation of claim 27. EX1003, ¶¶310-313.

Shimizu discloses that *the forwarding unit receives the incoming packet*

including the identifier for the link connecting nodes on the packet forwarding path for the reasons explained for 1a, 1b, and 1c. See Sections VII.A.1.b-VII.A.1.d, above. Shimizu also discloses that *the forwarding unit forwards the incoming packet based on the identifier included [in] the received incoming packet from among the plurality of the identifiers* as explained for 1h. See Section VII.A.1.i, above.

In addition, Shimizu discloses that *when the forwarding unit receives the incoming packet..., the forwarding unit forwards the incoming packet....* EX1003, ¶313. For example, Shimizu states:

[S]witch X.A may receive a frame with vector based outbound tags. The first tag identifies port 4. In order to transmit the frame to the appropriate next switch 22, switch X.A removes the first tag and sends the frame on port 4. This frame would then be received by switch Y.A, and switch Y.A repeats a similar process in order to transmit the frame to the appropriate next switch 22.

EX1005, [0023]. In this example, *when the forwarding unit of switch X.A receives the incoming packet (frame) including the identifier for the link connecting nodes on the packet forwarding path (vector based outbound tags), the forwarding unit forwards the incoming packet based on the identifier included [in] the received incoming packet from among the plurality of the identifiers (tag identifying port 4).* EX1003, ¶313.

B. Ground 2: The Challenged Claims Are Rendered Obvious by the Combination of Shimizu and RFC-4271

Every independent claim of the '249 Patent recites a *packet forwarding node* that *determin[es] whether to forward to an external network*. EX1001, 30:25 (claim 1), 30:60-61 (claim 6), 31:30-31 (claim 11), 31:65-66 (claim 16), 32:35-36 (claim 21). As discussed for 1e, Shimizu discloses this limitation and renders it obvious to a POSITA. *See* Section VII.A.1.f, above. In addition, Shimizu can be combined with the Border Gateway Protocol (BGP-4) standard described in RFC-4271 (EX1006), which expressly teaches configuring switches to determine whether a packet is being forwarded to an external network. EX1003, ¶¶314-322.

1. Motivation to Combine

A POSITA would have recognized that Shimizu's switch network 12 can be an autonomous system (AS) with routing functionality controlled by a single organization. EX1003, ¶316; *see also id.*, ¶¶47-55 (describing ASs and inter-AS routing). Shimizu's switch network 12 is connected to internet 18 and external network 20, which both are or include other ASs using different policies and protocols. *Id.*, ¶316. Shimizu's switch network 12 would employ an inter-AS routing protocol to communicate with these external networks. *Id.* (citing EX1005, [0030], [0033]).

By 2009, BGP4 was the standard inter-AS routing protocol for a switch network such as the one disclosed by Shimizu. EX1003, ¶317. As stated in

“Computer Networking,” which was published in 2008, “[t]he Border Gateway Protocol version 4, specified in RFC 4271...is the *de facto* standard inter-AS routing protocol in today’s Internet.” EX1010, 178; *see also id.*, 169 (“in the Internet all ASs run the same inter-AS routing protocol, called BGP4”). A POSITA would have recognized the benefit of employing BGP4 because it was the industry standard that permitted one AS to communicate with another. EX1003, ¶317. As “Computer Networking” stated, BGP was “an absolutely critical protocol for the Internet—in essence, it is the protocol that glues the whole thing together....” EX1010, 179. A POSITA would have been motivated to implement Shimizu’s switches 22 with the BGP4 protocol so that Shimizu’s switch network could communicate with internet 18 and external network 20 using the industry standard inter-AS routing protocol. EX1003, ¶317.

A POSITA would have known that the connections of Shimizu’s switch network 12 to internet 18 and external network 20 would be advantageously implemented using the BGP4 protocol of RFC-4271. EX1003, ¶318. A POSITA would have implemented BGP4 in Shimizu’s switch network 12 because it was a well-known industry standard. *Id.* A POSITA would have been aware of BGP4 and would likely have experience studying and working with it. *Id.* Indeed, by 2009, many switches would have come pre-configured to comply with BGP4 making its implementation simple for a POSITA. *Id.* Thus, a POSITA could have

implemented Shimizu’s switch network employing BGP4, as described in RFC-4271, without need for undue experimentation and with a reasonable expectation of success. *Id.*

2. Claim Limitation: [determine/determining] whether to forward to an external network

RFC-4271 describes how routing works in a network uses the BGP4 protocol. EX1006, 1; EX1003, ¶319. It shows that network nodes maintain knowledge of destinations accessible via external networks. EX1003, ¶319. The routing device, which RFC-4271 refers to as a “BGP speaker,” includes a Routing Information Base (RIB) that stores routing information consisting of three distinct parts. EX1006, 10.

RFC-4271 describes the three distinct parts of the Routing Information Base on the device as follows:

- a) Adj-RIBs-In: The Adj-RIBs-In stores routing information learned from inbound UPDATE messages that were received from other BGP speakers. Their contents represent routes that are available as input to the Decision Process.
- b) Loc-RIB: The Loc-RIB contains the local routing information the BGP speaker selected by applying its local policies to the routing information contained in its Adj-RIBs-In. These are the routes that will be used by the local BGP speaker. The next hop for each of these routes MUST be resolved via the local BGP speaker’s Routing Table.
- c) Adj-RIBs-Out: The Adj-RIBs-Out stores information the local

BGP speaker selected for advertisement to its peers. The routing information stored in the Adj-RIBs-Out will be carried in the local BGP speaker's UPDATE message and advertised to its peers.

EX1006, 10. RFC-4271 states that, “[i]n summary, the Adj-RIBs-In contains unprocessed routing information that has been advertised to the local BGP speaker by its peers; the Loc-RIB contains the routes that have been selected by the local BGP speaker's Decision Process; and the Adj-RIBs-Out organizes the routes for advertisement to specific peers (by means of the local speaker's UPDATE messages).” *Id.*, 10-11.

RFC-4271 further states that “[r]outing information that the BGP speaker uses to forward packets (or to construct the forwarding table used for packet forwarding) is maintained in the Routing Table. The Routing Table accumulates routes to directly connect networks, static routes, routes learned from the IGP protocols, and routes learned from BGP.” EX1006, 11.

When a routing device in a BGP-enabled network receives a packet whose destination address is part of an external network (i.e., a router that was learned from an inbound UPDATE message), the routing device distinguishes it from other packets not destined for an external network and uses BGP routing data to forward the packet toward the external network. EX1003, ¶322. When the routing device is an edge router (e.g., switch Z.C in Shimizu's switch network 12), the device forwards the packet over the link to the external network. *Id.* Thus, the

combination of Shimizu’s switch 22 and RFC-4271 (i.e., a BGP-enabled switch 22) would *determine whether to forward to an external network* as recited in the challenged claims. *Id.*

VIII. DISCRETIONARY DENIAL IS NOT WARRANTED

Pursuant to the Interim Processes for PTAB Workload Management Memorandum (March 26, 2025), any discretionary denial issues will be raised in a separate brief by Patent Owner. If Patent Owner files such a brief, Petitioners will respond in an opposition brief as provided in the Interim Processes for PTAB Workload Management Memorandum.

IX. CONCLUSION

Petitioners respectfully request institution of review and cancellation of the challenged claims.

Respectfully submitted,

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CLAIM APPENDIX

[1pre] A packet forwarding node, comprising:

[1a] a storage unit including a non-transitory computer readable medium configured to store a packet forwarding table used for forwarding a packet based on an identifier which identifies a link between nodes on a packet forwarding path; and

[1b] at least one processor configured to execute program instructions to provide a forwarding unit configured to:

[1c] receive an incoming packet including a plurality of the identifiers;

[1d] determine a direction to forward the incoming packet;

[1e] determine whether to forward to an external network;

[1f] add to path or link information when the incoming packet is not forwarded to the external network;

[1g] remove path or link information header when the incoming packet is forwarded to the external network; and

[1h] forward the incoming packet by using a path or link that corresponds to the identifier from among the plurality of the identifiers.

2. The packet forwarding node according to claim 1, wherein the storage unit stores the table used for forwarding the packet based on the identifier which uniquely identifies the link within a predetermined domain.

3. The packet forwarding node according to claim 1, wherein the storage unit stores the table used for forwarding the packet based on the identifier which uniquely identifies the link within a predetermined local domain.

4. The packet forwarding node according to claim I, wherein the storage unit stores the table used for forwarding the packet based on the identifier which uniquely identifies the link within the packet forwarding node.

5. The packet forwarding node according to claim 1, wherein the storage unit stores the table used for forwarding the packet based on the identifier which unique identifies the link among the packet forwarding nodes.

[6pre] A packet forwarding node, comprising:

[6a] a storage unit including a non-transitory computer readable medium configured to store a packet forwarding table used for forwarding a packet based on an identifier which identifies an interface of a packet forwarding node; and

[6b] at least one processor configured to execute program instructions to provide a forwarding unit configured to¹¹

[6c] receive an incoming packet including a plurality of identifiers,

[6d] determine a direction to forward the incoming packet,

[6e] determine whether to forward to an external network,

¹¹ The language of claim 6 is broken into separate limitations for ease of review.

[6f] add to path or link information when the incoming packet is not forwarded to the external network,

[6g] remove path or link information header when the incoming packet is forwarded to the external network, and

[6h] to forward the incoming packet by using a path or link that corresponds to the identifier from among the plurality of identifiers.

7. The packet forwarding node according to claim 6, wherein the storage unit stores the table used for forwarding the packet based on the identifier which uniquely identifies the link within a predetermined domain.

8. The packet forwarding node according to claim 6, wherein the storage unit stores the table used for forwarding the packet based on the identifier which uniquely identifies the link within a predetermined local domain.

9. The packet forwarding node according to claim 6, wherein the storage unit stores the table used for forwarding the packet based on the identifier which uniquely identifies the link within the packet forwarding node.

10. The packet forwarding node according to claim 6, wherein the storage unit stores the table used for forwarding the packet based on the identifier which uniquely identifies the link among the packet forwarding nodes.

11. A packet forwarding node, comprising:
a memory storing a program;

at least one processor configured to execute the program to provide:

a communication unit configured to communicate with a server for receiving a plurality of identifiers, each of which identifies a link between nodes on a packet forwarding path; and

a forwarding unit configured to:

receive an incoming packet including the plurality of the identifiers,

determine a direction to forward the incoming packet,

determine whether to forward to an external network,

add to path or link information when the incoming packet is not forwarded to the external network,

remove path or link information header when the incoming packet is forwarded to the external network, and

forward the incoming packet by using a path or link that corresponds to an identifier from among the plurality of identifiers.

12. The packet forwarding node according to claim 11, wherein the forwarding unit forwards the packet based on the identifier which uniquely identifies the link within a predetermined domain.

13. The packet forwarding node according to claim 11, wherein the forwarding unit forwards the packet based on the identifier which uniquely identifies the link within a predetermined local domain.

14. The packet forwarding node according to claim 11, wherein the forwarding unit forwards the packet based on the identifier which uniquely identifies the link within the packet forwarding node.

15. The packet forwarding node according to claim 11, wherein the forwarding unit forwards the packet based on the identifier which uniquely identifies the link among the packet forwarding nodes.

16. A packet forwarding node, comprising:

a communication unit configured to communicate with a server for receiving a plurality of identifiers, each of which identifies an interface of the packet forwarding node; and

at least one processor configured to execute program instructions to provide a forwarding unit configured to receive an incoming packet including a plurality of identifiers, determine a direction to forward the incoming packet, determine whether to forward to an external network, add to path or link information when the incoming packet is not forwarded to the external network, remove path or link information header when the incoming packet is forwarded to the external network, and forward the incoming packet by using a path or link that corresponds to an identifier from among the plurality of identifiers.

17. The packet forwarding node according to claim 16, wherein the forwarding unit forwards the packet based on the identifier which uniquely identifies the link within a predetermined domain.

18. The packet forwarding node according to claim 16, wherein the forwarding unit forwards the packet based on the identifier which uniquely identifies the link within a predetermined local domain.

19. The packet forwarding node according to claim 16, wherein the forwarding unit forwards the packet based on the identifier which uniquely identifies the link within the packet forwarding node.

20. The packet forwarding node according to claim 16, wherein the forwarding unit forwards the packet based on the identifier which uniquely identifies the link among the packet forwarding nodes.

21. A server, comprising:

a memory storing a computer program;

at least one processor configured to execute the computer program to provide:

a first unit configured to determine a plurality of identifiers, each of which identifies a link between nodes on a packet forwarding path; and

a second unit configured send information elements to a packet forwarding node which is capable of receiving an incoming packet including a plurality of identifiers, determining a direction to forward the incoming packet, determining whether to forward to an external network, adding to path or link information when the incoming packet is not forwarded to the external network, removing path or link information header when the incoming packet is forwarded to the external network, and forwarding the incoming packet by using a path or link, that corresponds to an identifier from among the plurality of identifiers.

22. The packet forwarding node according to claim 1, wherein the storage unit stores the table used for forwarding the packet based on

the identifier which identifies the link between adjacent nodes on a packet forwarding path.

23. The packet forwarding node according to claim 6, wherein the storage unit stores the packet forwarding table used for forwarding the packet based on the identifier which identifies the link between adjacent nodes on a packet forwarding path.

24. The packet forwarding node according to claim 11, further comprising a storage unit that stores a table used for forwarding the packet based on an identifier which identifies the link between adjacent nodes on a packet forwarding path.

25. The packet forwarding node according to claim 16, further comprising a storage unit that stores a table used for forwarding the packet based on an identifier which identifies the link between adjacent nodes on a packet forwarding path.

26. The server according to claim 21, further comprising a storage unit to store a packet forwarding table used for forwarding the incoming packet based on the identifier which identifies the link between nodes on the packet forwarding path,

wherein the storage unit stores the table used for forwarding the packet based on the identifier which identifies a link between adjacent nodes on a packet forwarding path.

27. The packet forwarding node according to claim 1, wherein when the forwarding unit receives the incoming packet including the identifier for the link connecting nodes on the packet forwarding path, the forwarding unit forwards the incoming packet based on the

identifier included the received incoming packet from among the plurality of the identifiers.

CERTIFICATE OF COMPLIANCE

This petition complies with the 14,000 word-count limit under 37 C.F.R. § 42.24(a)(1)(i). The petition contains 13,938 words, excluding the parts exempted by 37 C.F.R. § 42.24(a)(1) (i.e., table of contents, table of authorities, mandatory notices under § 42.8, certificate of service, word count certificate, and appendix of exhibits), as determined by the word count feature of Microsoft Word, which was used to prepare this petition.

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CERTIFICATE OF SERVICE

I hereby certify that on July 14, 2025, I caused a complete and entire copy of this Petition for *Inter Partes* Review and all supporting exhibits to be served by express mail, or means at least as fast and reliable as express mail, on the following counsel of record identified through the USPTO Patent Center.

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