

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

U.S. Patent No. 9,560,177

**DECLARATION OF MARK CROVELLA, PH.D. IN SUPPORT OF
PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 9,560,177**

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I, Mark Crovella, Ph.D., declare as follows:

1. I make this declaration based upon my own personal knowledge and, if called upon to testify, would testify competently to the matters stated herein.

2. I have been asked by the petitioners to provide technical assistance in connection with the *inter partes* review of U.S. Patent No. 9,560,177 (which I will refer to as the “’177 Patent”). This declaration is a statement of my opinions on issues related to the patentability of claims 1-20 (which I will refer to as the “challenged claims”) of the ’177 Patent.

3. My compensation is not based on the content of my opinions or the resolution of this matter. I have no financial interest in the outcome of this proceeding.

I. BACKGROUND AND QUALIFICATIONS

4. In formulating my opinions expressed in this declaration, I have relied on my knowledge, training, and experience in the relevant field, which I will summarize briefly. Additional details are provided in my curriculum vitae, which I understand has been marked as Exhibit 1004.

5. I am a Professor in the Department of Computer Science at Boston University. From 2013 to 2018, I served as Chair of the Department. Since 2020, I also have been a Professor in the Faculty of Computing and Data Sciences, and I serve as the Chair of Academic Affairs there.

6. I earned an undergraduate degree in Biology from Cornell University, which I received in 1982. I received a master's degree in Computer Science from the University of Buffalo in 1989. I received a Ph.D. in Computer Science from the University of Rochester in 1994. The subject of my Ph.D. thesis was "Performance Predication and Tuning of Parallel Programs."

7. From 1982 to 1984, I worked as a computer programmer for the State of Colorado. From 1984 to 1994, I was employed at Calspan Corporation, a research and development firm in Buffalo, NY, where I rose to the level of Senior Computer Scientist. My work at Calspan focused on development of experimental software and large-scale simulation software in support of contracts between Calspan and the U.S. Department of Defense.

8. In 1994, I joined the faculty of Boston University, initially as an Assistant Professor of Computer Science. I was promoted to the rank of Associate Professor in 2000 and became a full Professor in 2006. I served as Chair of the Department from 2013 to 2018.

9. I have been pursuing research in the area of computer networking since 1994. I have conducted research in a variety of areas related to the Internet and the World Wide Web. Among other areas, I have studied the efficient design of Web servers and content distribution systems; I have studied the statistical properties of Internet traffic; and I have made extensive measurements of Internet

infrastructure and the behavior of Internet protocols.

10. For many years, I have taught a number of courses that have covered topics relevant to the '177 Patent, including a class called "Computer Networking." In that class, I teach the students about network routing and switching technology (past and present) and other technologies relevant to the challenged patent.

11. From 2007 to 2009, I was the Chair of ACM SIGCOMM (the Special Interest Group in Computer Communication), the main professional organization for scientists in the field of computer networking. I have been elected a Fellow of the IEEE and also of the ACM.

12. I am co-author of Internet Measurement: Infrastructure, Traffic, and Applications (Wiley Press, 2006), which is the first book written on the subject. I am the author of over two hundred research papers; according to Google Scholar, my work has been cited by over 30,000 other publications. Also, according to Google Scholar, as of May 2018, only 11 other researchers worldwide were more cited in the area of computer systems. I am a past editor of principal journals in the field of networking: Computer Communication Review, IEEE/ACM Transactions on Networking, Computer Networks, and IEEE Transactions on Computers.

13. I hold nine U.S. Patents derived from my Internet related research.

14. I also have considerable experience working with Web protocols and

distributed systems in industry. I co-founded a company that developed protocols for content delivery in the Web, which through a chain of acquisitions became part of Network Appliance, Inc. At Network Appliance, I served for two years as a Technical Director working on content distribution and Web caching systems.

15. I have also served as Chief Scientist for Guavus, Inc., a company founded by one of my Ph.D. students, that commercialized work that we did analyzing the properties of Internet traffic. Guavus was subsequently acquired and is now a division of Thales, Inc.

16. I am very familiar with the subject matter of the challenged patent. Based on my substantial academic and professional experiences, I consider myself an expert in the technology fields pertaining to the '177 Patent.

II. MATERIALS CONSIDERED

17. In preparation of this declaration, I have considered the materials discussed in this declaration, including for example the '177 Patent and its prosecution history. In particular, I have reviewed and considered the following documents, among others, in connection with my analysis:

- EX1001: The '177 Patent;
- EX1002: The prosecution history of U.S. Patent Application No. 15/072,558, which led to the issuance of the '177 Patent;
- EX1005: U.S. Patent No. 6,526,052 ("Rijhsinghani");

- EX1006: Request for Comments 5474, “A Framework for Packet Selection and Reporting” (“RFC-5474”);
- EX1007: U.S. Patent Application Publication No. 2008/0031141 (“Lean”);
- EX1008: Kurose and Ross, “Computer Networking: A Top-Down Approach” (4th ed. 2008) (“Computer Networking”);
- EX1009: OpenFlow Switch Specification (version 1.0.0);
- EX1010: Request for Comments 1701, “Generic Routing Encapsulation (GRE)”;
- EX1011: Request for Comments 2784, “Generic Routing Encapsulation (GRE)”;
- EX1012: Request for Comments 2026, “The Internet Standards Process – Revision 3”;
- EX1013: RFC Editor – Publication Process;
- EX1014: U.S. Patent No. 6,956,854;
- EX1015: U.S. Patent No. 7,389,359;
- EX1016: U.S. Patent No. 7,660,259;
- EX1017: U.S. Patent No. 8,724,638;
- EX1018: U.S. Patent No. 8,125,920;
- EX1019: U.S. Patent No. 7,626,938;

- EX1020: U.S. Patent No. 6,041,042;
- EX1021: U.S. Patent Application Publication No. 2004/0003094;
- EX1022: McKeown, “Fast Switched Backplane for a Gigabit Switched Router,” Business Communications Review (Dec. 1997);
- EX1023: Partridge, et al, “A 50-Gb/s IP Router,” IEEE/ACM Transactions on Networking (June 1998);
- EX1024: Claffy, et al., “Application of Sampling Methodologies to Network Traffic Characteristics,” ACM SIGCOMM Computer Communication Review, vol. 23, issue 4 (1993);
- EX1025: Duffield and Grossglauser, “Trajectory Sampling for Direct Traffic Observation,” IEEE/AMC Transactions on Networking, vol. 9, no. 3 (2001);
- EX1026: History of Packet Sampling @ sFlow.org;
- EX1027: NetFlow Configuration Guide, Cisco IOS, Release 12.2SX;
- EX1028: Experiences with Widespread Packet Sampling;
- EX1029: Complaint for Patent Infringement; and
- EX1030: Cloud Byte’s Preliminary Infringement Contentions with attached Exhibit 6.
- EX1034: Cloud Byte’s Disclosure of Proposed Claim Constructions and Extrinsic Evidence with attached Exhibit A

- EX1035: Internet Archive Declaration of Mina Ching for RFC-5474

18. My analysis and opinions are further based on my education, training, experience, and knowledge in the relevant field.

III. RELEVANT LEGAL STANDARDS

19. I am not an attorney. For the purposes of this declaration, I have been informed by counsel for the petitioners about certain aspects of the law that are relevant to forming my opinions. My understanding of the relevant law is as follows.

A. Prior Art

20. I understand that for an invention claimed in a patent to be found patentable, it must be (among other things) new and not obvious based on what was known before the invention was made.

21. I understand that the information used to evaluate whether a claimed invention was new and not obvious when made is generally referred to as “prior art.” I understand that prior art includes all patents and printed publications that existed before the earliest filing date of the patent. This includes foreign language material. I also understand that a patent is prior art if it was filed before the effective filing date of the claimed invention and that a printed publication is prior art if it was publicly available before the effective filing date.

22. I understand that in this *inter partes* review proceeding, the petitioners

have the burden of proving that the challenged claims are unpatentable in light of the prior art by a preponderance of the evidence. I understand that a preponderance of the evidence is evidence sufficient to show that a fact is more likely true than not true.

23. I understand that patent claims in an *inter partes* review are interpreted by applying the same standard that applies in district court litigation. After the claims are construed, they are then compared to the prior art.

24. I understand that in this *inter partes* review proceeding, the prior art that may be used to evaluate whether the challenged claims are new and not obvious is limited to patents and printed publications. My analysis, which is set out in detail below, compares the challenged claims to patents and printed publications that I have been informed constitute prior art to the claims.

B. Person of Ordinary Skill in the Art

25. I understand that my assessment of the challenged claims and the teachings of the prior art as well as my analysis and opinions herein must be undertaken from the perspective of what would have been known or understood by a person having ordinary skill in the art, reading the challenged patent on its priority date and in light of the specification and file history of the patent. I may refer to such a person as a “POSITA.”

26. I further understand that in determining the level of ordinary skill in

the art, I may consider factors including:

- (a) the type of problems encountered in the art or field of invention,
- (b) prior art solutions to those problems,
- (c) the rapidity with which innovations are made,
- (d) sophistication of the technology, and
- (e) the educational level of active workers in the field.

27. I understand that a person of ordinary skill in the art, or POSITA, is not a specific real individual but is instead a hypothetical individual having the qualities reflected by the factors above. This hypothetical person has knowledge of all prior art in the relevant field and takes from each reference what it would teach to a person having the skills of a POSITA.

C. Anticipation

28. I understand that a patent claim may be “anticipated” if each element of that claim is present either explicitly or inherently in a single prior art reference, and that the elements should be arranged in the prior art reference as in the claim. I understand that for a claimed limitation to be inherently present, the prior art reference need not expressly disclose the limitation so long as the claimed limitation necessarily flows from a disclosure in the reference.

D. Obviousness

29. I understand that prior art can render a patent claim unpatentable

where subject matter falling within the scope of the claim would have been “obvious” to a person of ordinary skill in the art. I understand that the following standards govern the determination of whether a patent claim is rendered obvious in light of the prior art. I have applied these standards in my evaluation of whether the challenged claims are obvious in light of the prior art.

30. I understand that a claimed invention is not patentable if it would have been obvious to a person of ordinary skill in the field of the invention at the time the claimed invention was made. Even if all the elements of a claim were not found in a single prior art reference, the claim is not patentable if the differences between the subject matter in the prior art and the subject matter in the claim would have been obvious to a POSITA at the time the application was filed. Prior art disclosing a method or device that falls within the scope of a claim can render that claim obvious even if other, different methods or devices might also fall within the scope of the claim.

31. I understand that a determination as to whether a claim would have been obvious should be based on four factors (though not necessarily in the following order): (i) the level of ordinary skill in the art at the time the application was filed; (ii) the scope and content of the prior art; (iii) the differences between the claimed invention and the prior art; and (iv) any “objective factors” indicating obviousness or non-obviousness that may exist in a particular case.

32. I understand that an obviousness analysis should not be based on hindsight but must be performed using the perspective of a person of ordinary skill in the relevant art as of the effective filing date of the patent claim.

33. I understand that secondary indicia of non-obviousness may include: (1) a long felt but unmet need in the prior art that was satisfied by the invention of the patent; (2) commercial success of processes covered by the patent; (3) unexpected results achieved by the invention; (4) praise of the invention by others skilled in the art; (5) taking of licenses under the patent by others; (6) deliberate copying of the invention; (7) failure of others to find a solution to the long felt need; and (8) skepticism by experts. I also understand that there must be a relationship between any such secondary considerations and the claimed invention. I further understand that contemporaneous and independent invention by others is a secondary consideration supporting an obviousness determination.

34. I understand that the teachings of two or more prior art references may be combined in the manner disclosed in a challenged claim if such a combination would have been obvious to one having ordinary skill in the art. In determining whether a combination would have been obvious, the following exemplary rationales may support a conclusion of obviousness:

- combining prior art elements according to known methods to yield predictable results;

- simple substitution of one known element for another to obtain predictable results;
- use of a known technique to improve similar devices (methods, or products) in the same way;
- applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;
- “obvious to try” – choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;
- known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art;
- some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention; and
- common sense.

35. I understand that the obviousness analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim but instead can take account of the ordinary innovation and experimentation in the relevant

field that does no more than yield predictable results.

36. I understand that, in assessing whether there was an apparent reason to modify or combine known elements as claimed, it may be necessary to look to interrelated teachings of multiple patents and printed publications, the effects of commercial demands, and the background knowledge of a person of ordinary skill in the art. I further understand that any motivation that would have applied to a person of ordinary skill in the art, including motivation from common sense or derived from the problem to be solved, is sufficient to explain why references would have been combined.

37. I understand that modifications and combinations suggested by common sense are important and should be considered. Common sense suggests that familiar items can have obvious uses beyond the particular application being described in a prior art reference, that if something can be done once it would be obvious to do it multiple times, and that in many cases a person of ordinary skill in the art can fit the teachings of multiple patents together in an obvious manner to address a particular problem. I also understand that the prior art does not need to be directed to solving the same problem that is addressed in the challenged patent claims.

38. I understand that a person of ordinary skill in the art is also a person of ordinary creativity. In many fields, it may be that there is little discussion of

obvious techniques, modifications, and combinations, and it may be the case that market demand, rather than scientific research or literature, will drive a new design. When there is market pressure or design need to solve a particular problem and there are a finite number of identified, predictable solutions, a person of ordinary skill in the art has a good reason to employ the known options. If this leads to the expected success, then it is likely the product of ordinary skill and common sense as opposed to patentable innovation. I understand that if a combination was obvious to try, that may show that it was obvious and therefore unpatentable. That a particular combination of prior art elements was obvious to try suggests that the combination was obvious even if no one made the combination.

IV. TECHNICAL ANALYSIS OF THE '177 PATENT

A. Overview of the Patent Specification

39. The '177 Patent is entitled “Network System and Network Flow Tracing Method.” EX1001, 1. The patent issued on January 31, 2017, and it claims priority to a Japanese patent application published on February 17, 2011. EX1001, 1. The patent “relates to a network system, and especially to a network flow tracing method in a network system.” EX1001, 1:14-16.

40. The patent specification describes a type of network “in which a node unit (user plane) is controlled from an external control unit (control plane).”

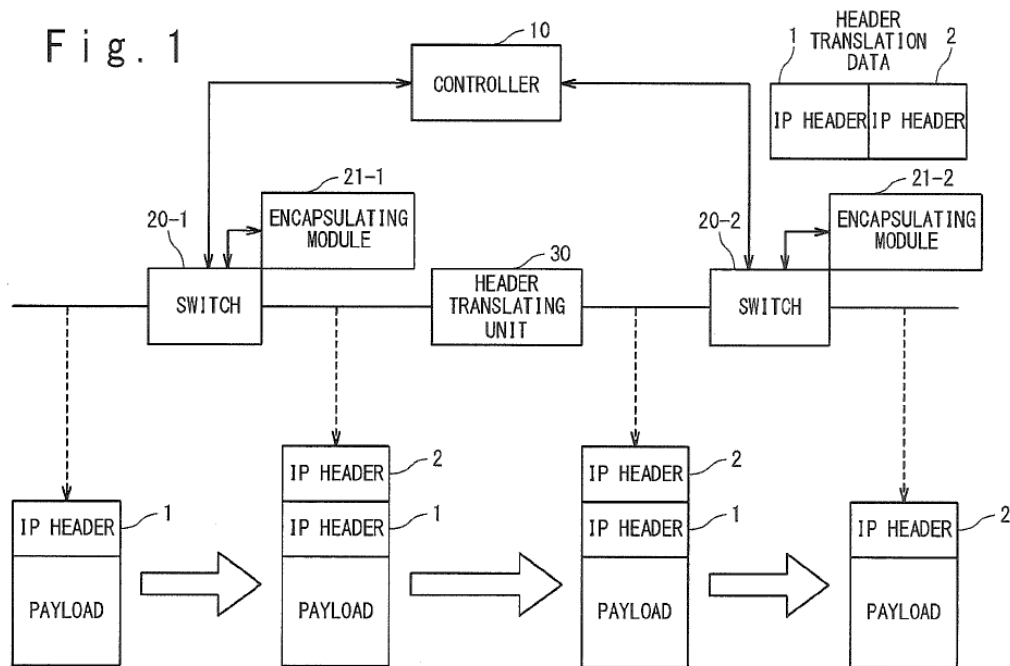
EX1001, 1:21-24. In such a network, a “controller...controls the conduct[] of switches...by operating flow tables of switches.” EX1001, 1:33-36. A “flow” is a series of packets processed similarly as they traverse the network. EX1001, 1:40-44, 2:13-16. “A flow table is a table which stores a flow entry defining a predetermined operation (action) to be carried out to the packets (communication data) which match a predetermined match condition (rule).” EX1001, 1:52-55. The “rule of the flow entry is defined” based on header information such as destination address, source address, destination port, and source port. EX1001, 1:56-60. The “action of the flow entry” can include outputting the packet to a particular port, discarding the packet, or rewriting the header. EX1001, 2:1-7. “By carrying out the monitoring and control of the traffic in a flow unit, the network can be controlled more flexibly than in a conventional network.” EX1001, 2:16-18.

41. The patent notes that certain network equipment “having a function of NAT (Network Address Translation) and NAPT (Network Address Port Translation) translate a packet header.” EX1001, 2:31-33. “Because the packet header has been translated when passing through such an equipment..., the flow after the passage is different from the flow before the passage.” EX1001, 2:37-40. This can prevent “monitoring and control for every flow....” EX1001, 2:41-43.

42. The ’177 Patent purports to address this problem by providing “a

network system and a network flow tracing method in which a packet is encapsulated by using the same header as a current header in a switch, and has two kinds of headers before translation and after the translation after passing through a network appliance.” EX1001, 3:22-27. According to the patent, “[i]n a flow-based network like the open flow network system, even when passed through [a] network appliance such as NAT or NAPT for translating the packet header, a corresponding relation between two flows before and after the passage can be grasped, and the tracing of the flow in end-to-end becomes possible.” EX1001, 4:8-13.

43. The patent describes exemplary embodiments of the present invention with reference to figures. For instance, Figure 1 is “a diagram showing a basic configuration example of a network system according to the present invention and change of a packet in the system....” EX1001, 4:17-19.



EX1001, Fig. 1. In the figure, “the network system according to the present invention includes a controller 10, switches 20” (i.e., switch 20-1 and switch 20-2), “and a header translating unit 30,” which could be a network appliance with NAT or NAPT functionality, for example. EX1001, 4:44-27. The figure illustrates a data packet as it is forwarded through switch 20-1, header translating unit 30, and switch 20-2.

44. The data packet is initially received by switch 20-1. At this point, the packet “has the structure of ‘the IP header 1-the payload’.” EX1001, 6:46-47. Switch 20-1 then “hands [the] inputted packet to the encapsulating module 21-1,” which “duplicates the IP header 1 of the packet..., encapsulates the packet with the same header as the IP header 1 and transfers the packet.” EX1001, 6:45-46, 6:48-

51. “Therefore, the packet transferred from the switch 20-1 has the structure of ‘the IP header 1-the IP header 1-the payload’.” EX1001, 6:52-54. I will note that the figure does not exactly track the description in the text because it shows IP header 2 and IP header 1 while the text describes the packet having IP header 1 and IP header 1.

45. “Next, the header translating unit 30 refers to the IP header 1 of the inputted packet [and] carries out the address translation processing to translate the IP header 1 into the IP header 2.” EX1001, 6:65-67. “In this way, the header translating unit 30 translates the IP header 1 of the inputted packet into the IP header 2 having a different value and transfers the packet.” EX1001, 7:6-8. At this point, “the transferred packet has the structure of ‘the IP header 2 – the IP header 1 – the payload’.” EX1001, 7:11-13. The packet is then received by switch 20-2.

46. “Next, the switch 20-2 hands [the] inputted packet to the encapsulating module 21-2.” EX1001, 7:24-25. If the encapsulating module 21-2 determines that “the inputted packet is an encapsulated packet” (as illustrated), it “refers to the IP header 2 and the IP header 1...and generates header translation data based on a pair (or set) of them and transmits it to the controller 10.” EX1001, 7:37-43. The “encapsulating module 21-2 removes the IP header 2 at the head of ‘the IP header 2-the IP header 1-the payload’ to decapsulate the inputted

encapsulated packet, and replaces ‘the IP header 1’ with ‘the IP header 2’....”

EX1001, 7:47-52. “In this way, the encapsulating module 21-2 removes the IP header 1 from the original packet and adds IP header 2 to the payload, and then transfers the packet.” EX1001, 7:53-55. At this point, “the configuration of the transferred packet is of ‘the IP header 2-the payload’.” EX1001, 7:55-57.

47. The ’177 Patent states that, by operating in the described manner, “the controller 10 can acquire the header translation data without improving the header translating unit 30, and trace the flow by using the data.” EX1001, 7:58-61.

B. Overview of the Prosecution History

48. The ’177 Patent issued based on Patent Application No. 15/072,558, which was filed on March 17, 2016. EX1002, 2-58. The application contained 20 claims, including 4 independent claims (i.e., application claims 1, 7, 13, and 19). EX1002, 29-33.

49. On April 11, 2016, the examiner issued an office action rejecting all claims. The examiner rejected the claims as unpatentable under 35 U.S.C. § 101 and for double patenting. EX1002, 88-94.

50. On August 9, 2016, the examiner conducted an interview with the applicant and apparently accepted the applicant’s rebuttal arguments regarding the rejection under 35 U.S.C. § 101. EX1002, 145, 149.

51. On August 11, 2016, the applicant filed a written response to the

examiner's rejection under 35 U.S.C. § 101 along with a terminal disclaimer to address the double patenting rejection. EX1002, 151-165.

52. One September 19, 2016, the examiner issued a notice of allowance. EX1002, 173-180.

53. The '177 Patent issued on January 31, 2017. EX1001, 1.

C. The Patent Claims

54. The '177 Patent contains 20 claims, including 4 independent claims (i.e., 1, 7, 13, and 19).

55. Claim 1 reads as follows:

[1pre] A switch apparatus, comprising:

[1a] a storage storing a table, the table including rules and actions corresponding to the rules; and

[1b] a controller comprising:

[1c] a memory storing instructions; and

[1d] a processor configured to execute the instructions to:

[1e] receive the rules and the actions from a control apparatus;

[1f] identify, based on the rules, a received packet;

[1g] duplicate a part of a header of the identified packet as an additional header when the identified packet comprises a target of encapsulation;

[1h] encapsulate the identified packet by the additional header; and

[1i] process, based on the actions, the identified packet.

I have separately numbered each limitation for ease of review in my analysis below.

56. The four independent claims are similar to each other. For instance, claim 1 and claim 7 are quite similar. Essentially, claim 1 recites a “switch apparatus” that receives instructions from a “control apparatus,” and claim 7 recites a “communication system” including a “control apparatus” configured to send instructions to a “switch apparatus” as recited in claim 1. The following table compares the language of independent claims 1 and 7, identifying differences in claim language with bold and underlining.

Claim 1	Claim 7
A <u>switch apparatus</u> , comprising:	A <u>communication system</u> , comprising:
	<u>a control apparatus configured to control a plurality of switch apparatuses; and</u>
	<u>a switch apparatus of the switch apparatuses comprising:</u>
a storage storing a table, the table including rules and actions corresponding to the rules; and	a storage storing a table, the table including rules and actions corresponding to the rules; and
a controller comprising:	a controller comprising:

Claim 1	Claim 7
a memory storing instructions; and	a memory storing instructions; and
a processor configured to execute the instructions to:	a processor configured to execute the instructions to:
receive the rules and the actions from a <u>control apparatus</u> ;	receive the rules and the actions from a <u>controller</u> ;
identify, based on the rules, a received packet;	identify, based on the rules, a received packet;
duplicate a part of a header of the identified packet as an additional header when the identified packet comprises a target of encapsulation;	duplicate a part of a header of the identified packet as an additional header when the identified packet comprises a target of encapsulation;
encapsulate the identified packet by the additional header; and	encapsulate the identified packet by the additional header; and
process, based on the actions, the identified packet.	process, based on the actions, the identified packet.

57. Claim 1 and claim 13 are also quite similar. Essentially, claim 13 recites a “communication method” including the functions performed by the “switch apparatus” of claim 1. The following table compares the language of independent claims 1 and 13, identifying differences in claim language with bold and underlining.

Claim 1	Claim 13
A <u>switch apparatus</u> , comprising:	A <u>communication method</u> , comprising:
<u>a storage storing a table, the table including rules and actions corresponding to the rules; and</u>	
<u>a controller comprising:</u>	
<u>a memory storing instructions; and</u>	
<u>a processor configured to execute the instructions to:</u>	
receive <u>the</u> rules and <u>the</u> actions from a <u>control apparatus</u> ;	receiv <u>ing</u> rules and actions from a <u>controller</u> ;
identify, based on the rules, a received packet;	identifi <u>ing</u> , based on the rules, a received packet;
duplicate a part of a header of the identified packet as an additional header when the identified packet comprises a target of encapsulation;	duplicat <u>ing</u> a part of a header of the identified packet as an additional header when the identified packet comprises a target of encapsulation;
encapsulate the identified packet by the additional header; and	encapsulat <u>ing</u> the identified packet by the additional header; and
process, based on the actions, the identified packet.	process <u>ing</u> , based on the actions, the identified packet.

58. Claim 13 and claim 19 are quite similar. The only difference is in the

preamble. Claim 19 recites a “program which when executed causes a switch” to perform the steps of the “communication method” recited in claim 13. The following table compares the language of independent claims 13 and 19, identifying differences in claim language with bold and underlining.

Claim 13	Claim 19
A <u>communication</u> method, comprising:	A <u>non-transitory recording medium</u> <u>recording a program which when executed causes a switch to perform</u> <u>a</u> method, <u>the method</u> comprising:
receiving rules and actions from a controller;	receiving rules and actions from a controller;
identifying, based on the rules, a received packet;	identifying, based on the rules, a received packet;
duplicating a part of a header of the identified packet as an additional header when the identified packet comprises a target of encapsulation;	duplicating a part of a header of the identified packet as an additional header when the identified packet comprises a target of encapsulation;
encapsulating the identified packet by the additional header; and	encapsulating the identified packet by the additional header; and
processing, based on the actions, the identified packet.	processing, based on the actions, the identified packet.

59. The dependent claims are also quite similar. The following table compares the language of dependent claims 2 and 8, identifying differences in

claim language with bold and underlining.

Claim 2	Claim 8
The <u>switch apparatus</u> according to claim <u>1</u> , wherein the processor is further configured to execute the instructions to	The <u>communication system</u> according to claim <u>7</u> , wherein the processor is further configured to execute the instructions to
send header information to the control apparatus when the identified packet comprises an encapsulated packet.	send header information to the control apparatus when the identified packet comprises an encapsulated packet.

60. The following table compares the language of dependent claims 2 and 14, identifying differences in claim language with bold and underlining.

Claim 2	Claim 14
The <u>switch apparatus</u> according to claim <u>1</u> , <u>wherein the processor is further configured to execute the instructions to</u>	The <u>communication method</u> according to claim <u>13</u> , further <u>comprising:</u>
send header information to <u>the control apparatus</u> when the identified packet comprises an encapsulated packet.	send <u>ing</u> header information to <u>a controller</u> when the identified packet comprises an encapsulated packet.

61. The following table compares the language of dependent claims 3 and 9, identifying differences in claim language with bold and underlining.

Claim 3	Claim 9
The <u>switch apparatus</u> according to claim <u>2</u> , wherein the header information includes the additional header.	The <u>communication system</u> according to claim <u>8</u> , wherein the header information includes the additional header.

62. The following table compares the language of dependent claims 3 and 15, identifying differences in claim language with bold and underlining.

Claim 3	Claim 15
The <u>switch apparatus</u> according to claim <u>2</u> , wherein the header information includes the additional header.	The <u>communication method</u> according to claim <u>14</u> , wherein the header information includes the additional header.

63. The following table compares the language of dependent claims 4 and 10, identifying differences in claim language with bold and underlining.

Claim 4	Claim 10
The <u>switch apparatus</u> according to claim <u>3</u> , wherein the processor is further configured to	The <u>communication system</u> according to claim <u>9</u> , wherein the processor is further configured to
execute further instructions to decapsulate the encapsulated packet.	execute further instructions to decapsulate the encapsulated packet.

64. The following table compares the language of dependent claims 4 and 16, identifying differences in claim language with bold and underlining.

Claim 4	Claim 16
The <u>switch apparatus</u> according to claim <u>3</u> , <u>wherein the processor is</u> further <u>configured to</u>	The <u>communication method</u> according to claim <u>15</u> , further <u>comprising:</u>
execute further instructions to decapsulate the encapsulated packet.	executing further instructions to decapsulate the encapsulated packet.

65. The following table compares the language of dependent claims 5 and 11, identifying differences in claim language with bold and underlining.

Claim 5	Claim 11
The <u>switch apparatus</u> according to claim <u>1</u> , wherein the processor is further configured to execute the instructions for	The <u>communication system</u> according to claim <u>7</u> , wherein the processor is further configured to execute the instructions for
translation of first header data of a head of the received packet into second header data.	translation of <u>the</u> first header data of a head of the received packet into the second header data.

66. The following table compares the language of dependent claims 5 and 17, identifying differences in claim language with bold and underlining.

Claim 5	Claim 17
The <u>switch apparatus</u> according to claim <u>1</u> , <u>wherein the processor is</u> further <u>configured to execute the</u>	The <u>communication method</u> according to claim <u>14</u> , further <u>comprising:</u>

Claim 5	Claim 17
<u>instructions for</u>	
translation <u>on of</u> first header data of a head of the received packet into second header data.	translating <u>ng</u> first header data of a head of the received packet into second header data.

67. The following table compares the language of dependent claims 6 and 12, identifying differences in claim language with bold and underlining.

Claim 6	Claim 12
The <u>switch apparatus</u> according to claim <u>5</u> , wherein the instructions to encapsulate the identified packet includes	The <u>communication system</u> according to claim <u>11</u> , wherein the instructions to encapsulate the identified packet includes
notifying the controller of <u>the</u> first header data before the translation and the second header data after the translation.	notifying the controller of first header data before the translation and second header data after the translation.

68. The following table compares the language of dependent claims 6 and 18, identifying differences in claim language with bold and underlining.

Claim 6	Claim 18
The <u>switch apparatus</u> according to claim <u>5</u> , <u>wherein the instructions to encapsulate the identified packet</u>	The <u>communication method</u> according to claim <u>17</u> , <u>further comprising:</u>

Claim 6	Claim 18
<u>includes</u>	
notifying the controller of the first header data before the translation <u>on</u> and the second header data after the translation <u>on</u> .	notifying the controller of the first header data before the translating <u>ng</u> and the second header data after the translating <u>ng</u> .

69. As shown in the following table comparing claim language (identifying differences in claim language with bold and underlining), claim 20 recites the same limitations as recited in claims 14 and 15.

Claims 14 and 15	Claim 20
[14] The <u>communication method</u> according to claim <u>13</u> , further comprising:	The <u>non-transitory recording medium</u> , according to claim <u>19</u> , <u>the method</u> further comprising:
sending header information to <u>a</u> controller when the identified packet comprises an encapsulated packet.	sending header information to <u>the</u> controller when the identified packet comprises an encapsulated packet,
[15] <u>The communication method according to claim 14,</u>	
wherein the header information includes the additional header.	wherein the header information includes the additional header.

D. Person of Ordinary Skill in the Art

70. As discussed above, I have been informed and understand that the

level of ordinary skill in the relevant art at the time of the claimed invention is relevant to inquiries such as the meaning of claim terms, the meaning of disclosures in prior art references, and the reasons that a person of ordinary skill in the art might have combined the teachings of certain prior art references.

71. In my opinion, a person of ordinary skill in the art with regard to the '177 Patent would have had an undergraduate degree (or equivalent) in electrical engineering, computer science, or a comparable subject and approximately two to three years of additional academic or professional work experience in a technical field with exposure to computer networking and switching and routing technology. A higher level of education could substitute for less industry experience and more industry experience could substitute for the specific level of education. In any event, such a person would have been knowledgeable about then-existing network switching and routing technologies and techniques.

72. In reaching my opinion about the level of ordinary skill in the art, I have considered the types of problems, and techniques for addressing them, discussed in the '177 Patent and in the prior art references cited on its face. The problems and technical solutions discussed in the '177 Patent and the prior art cited on the face of the patent support my opinion regarding the level of ordinary skill in the art.

73. For example, the patent discusses the problem of routing data packets through a network and presumes a level of background understanding. For example, in a section entitled “Background Art,” the ’177 Patent discusses the concept of a network in which the control plane and user plane are separated and identifies OpenFlow networks as an example. EX1001, 1:21-44. The patent refers to a number of network communications protocols, including TCP/IP and Ethernet, as well as the concept of a MAC address, IP address, and the basic operation of network switches. EX1001, 1:45-2:23. The patent also identifies NAT and NAPT functionality. EX1001, 2:31-36. The “Background Art” section suggests that a person of ordinary skill in the art reading the specification would be familiar with these various concepts, which supports my opinion regarding the level and type of experience such a person would have.

74. As a further example, the specification refers to “headers from layer 2 to layer 4” without further explanation (EX1001, 3:27-28) suggesting that a person of ordinary skill in the art would be familiar with the concept of a protocol stack.

75. Additionally, from my work in academia and industry in the 2000s and into the 2010s, I am familiar with the rapidity with which innovations were being made in the art and the education level of active works in the relevant field. Thus, my personal experience also informs and supports my opinion regarding the level of ordinary skill in the art.

76. In view of my educational background, as well as my decades of academic and professional experience (as discussed above), I was a person of more than the ordinary level of skill in the art in the 2011-2012 timeframe. Although my qualifications and experience exceed those of the hypothetical person of ordinary skill in the art defined above, my analysis and opinions regarding the '177 Patent have been based on the perspective of a person of ordinary skill in the art in 2011.

77. To the extent that a person of ordinary skill in the art may be defined slightly differently than I define it above, or the qualifications have minor substantive differences, I would still be at least a person of ordinary skill in the art based on my academic and industry background described in this declaration. I have considered whether my opinions expressed in this declaration would change if the level of ordinary skill in the art were varied by a few years or varied somewhat with respect to subject matter. My opinions would not change in light of such minor variations.

E. Claim Construction

78. I have been advised and understand that patent claims in an *inter partes* review are interpreted by applying the same standard that applies in federal district court proceedings, which I understand is referred to as the *Phillips* standard.

79. I understand that under the *Phillips* standard, claim terms are typically

given their ordinary and customary meaning as would have been understood by a POSITA at the time of the invention based on the language of the claims, the patent specification, and the prosecution history. I understand that these sources of evidence are often referred to as “intrinsic evidence” or the “intrinsic record” of the patent. I understand that under the *Phillips* standard, extrinsic evidence such as expert or inventor testimony, dictionary definitions, and prior art publications can also be considered but are given less weight than the intrinsic evidence.

80. I have been asked to provide my opinion regarding the meaning of the following terms to a person of ordinary skill in the art at the time of the '177 Patent. I do not contend that the following constructions are complete constructions of these terms for any other purpose, including for issues that may be raised in related litigation.

81. For all claim terms not addressed here, I have used the plain and ordinary meaning to a POSITA.

**1. “encapsulate”/“encapsulating”/“encapsulation”/
“decapsulate”**

82. Claim 1 recites a “switch apparatus” that is configured to “duplicate a part of a header of the identified packet as an additional header when the identified packet comprises a target of encapsulation” and to “encapsulate the identified packet by the additional header....” EX1001, 12:34-39. Claim 7 recites the same limitations. EX1001, 13:1-5. Claim 13 and 19 recite virtually identical limitations

of “duplicating a part of a header of the identified packet as an additional header when the identified packet comprises a target of encapsulation” and “encapsulating the identified packet by the additional header....” EX1001, 13:30-34, 14:25-29. A person of ordinary skill in the art would understand the terms “encapsulate,” “encapsulating,” and “encapsulation,” as used in the challenged claims, to refer to appending an additional header to a data packet.

83. The concept of “encapsulation” was well known before the '177 Patent. For example, the figure below from Computer Networking “illustrates the important concept of encapsulation.” EX1008, 77.

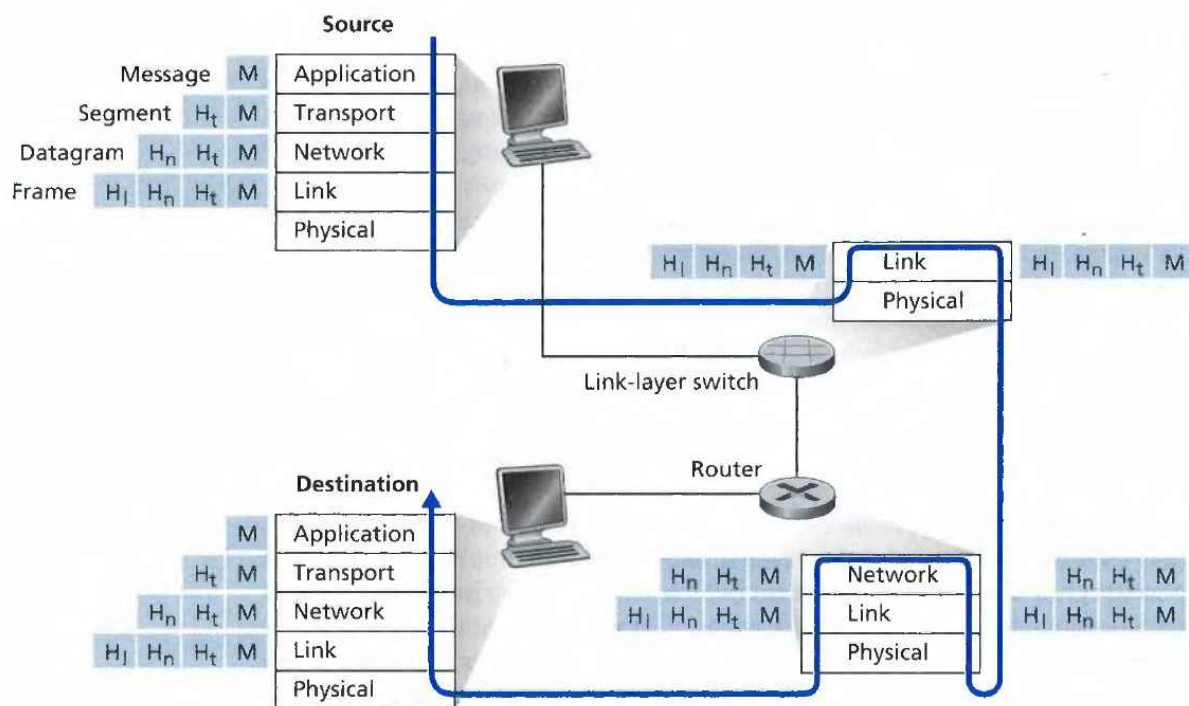


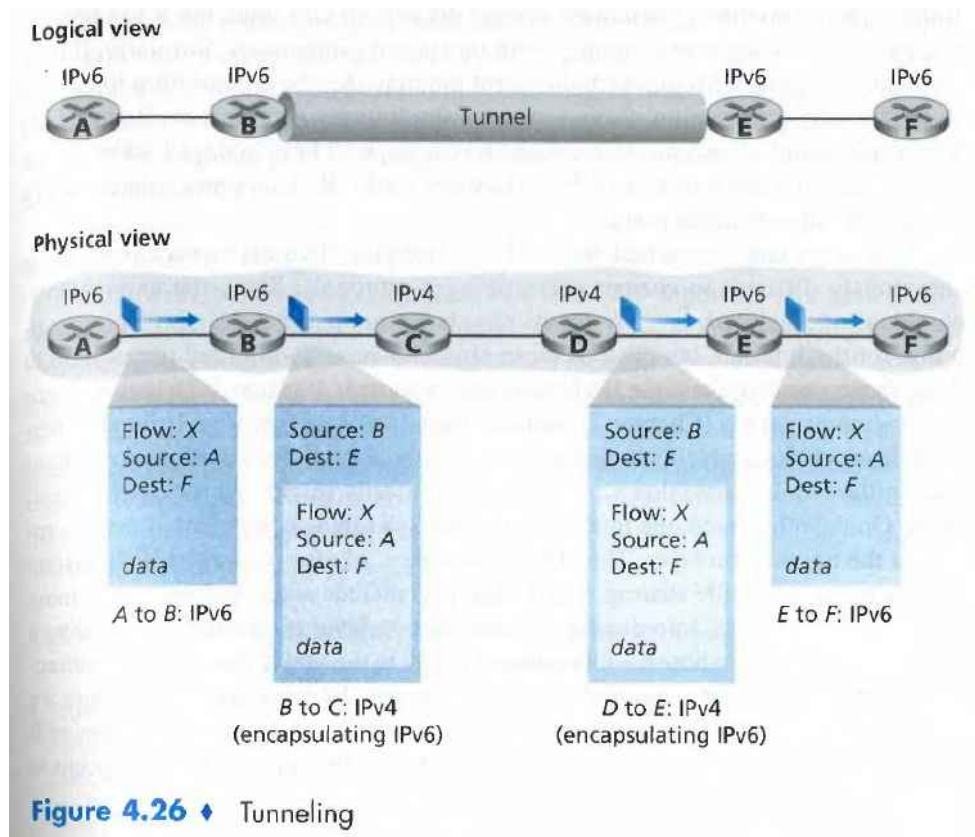
Figure 1.20 ♦ Hosts, routers, and link-layer switches; each contains a different set of layers, reflecting their differences in functionality.

EX1008, 77. The figure “shows the physical path that data takes down a sending

end system's protocol stack, up and down the protocol stacks of an intervening link-layer switch and router, and then up the protocol stack at the receiving end system.” EX1008, 76. Regarding encapsulation, the figure shows an application-layer message (M) sent by the sending host (in the upper-left corner of the figure) and that, “[i]n the simplest case, the transport layer takes the message and appends additional information (so-called transport-layer header information, H_t in Figure 1.20) that will be used by the receiver-side transport layer.” EX1008, 77. “The transport layer segment thus encapsulates the application-layer message.” EX1008, 77. “The transport layer then passes the segment to the network layer, which adds network-layer header information (H_n in Figure 1.20) such as source and destination end system addresses, creating a network-layer datagram.” EX1008, 77. “The datagram is then passed to the link layer, which (of course!) will add its own link-layer header information and create a link-layer frame.” EX1008, 77. “[A]t each layer, a packet has two types of fields: header fields and a payload field” and the “payload is typically a packet from the layer above.” EX1008, 77-78.

84. The concept of “tunneling” also employed encapsulation before the '177 Patent. Tunneling can be used to send a packet of one network protocol through a network employing a different protocol. For example, the following figure from Computer Networking illustrates IPv6 (Internet Protocol version 6)

packets being sent through a “tunnel” of IPv4 (Internet Protocol versions 4) routers.



EX1008, 148. “With tunneling, the IPv6 node on the sending side of the tunnel (for example, B) takes the *entire* IPv6 datagram and puts it in the data (payload) field of an IPv4 datagram,” which “is then addressed to the IPv6 node on the receiving side of the tunnel (for example, E) and sent to the first node in the tunnel (for example, C).” EX1008, 147-148. “The intervening IPv4 routers in the tunnel route this IPv4 datagram among themselves, just as they would any other datagram, blissfully unaware that the IPv4 datagram itself contains a complete IPv6 datagram.” EX1008, 148. “The IPv6 node on the receiving side of the tunnel

eventually receives the IPv4 datagram (it is the destination of the IPv4 datagram!), determines that the IPv4 datagram contains an IPv6 datagram, extracts the IPv6 datagram, and then routes the IPv6 datagram exactly as it would if it had received the IPv6 datagram from a directly connected IPv6 neighbor.” EX1008, 148.

85. The '177 Patent uses the terms “encapsulate,” “encapsulating,” and “encapsulation” in their plain and ordinary sense. For example, the specification states that “[t]he encapsulating module 21-1 duplicates the IP header 1 of the packet as set from the controller 10” and “encapsulates the packet with the same header as the IP header 1....” EX1001, 6:48-51. The packet then “has the structure of ‘the IP header 1-the IP header 1-the payload’.” EX1001, 6:52-54. The specification further states that “[i]n this case, ‘the IP header 1’ at the head of ‘the IP header 1-the IP header 1-the payload’ is the IP header of the encapsulated packet, and the remaining part of ‘the IP header 1-the payload’ (original packet) is a payload of the encapsulated packet.” EX1001, 6:55-59.

86. Similarly, the specification states that “[t]he encapsulating module 21-1 receives a packet” and the “configuration of the reception packet is of ‘the IP header 1-the payload’.” EX1001, 8:41-43. If the packet is an “encapsulation target, the encapsulating module 21-1 refers to the IP header 1, duplicates the IP header 1 and carries out encapsulation by using the same IP header 1” such that “the configuration of the packet is of ‘the IP header 1-IP header 1-the payload’.”

EX1001, 8:49-53. Again, the packet is encapsulated by adding an additional header to the received packet.

87. The patent provides a similar description with reference to Figure 4. The specification states the received “packet PKT0 has the header H0 and the payload P0” and “is presented as being ‘the packet PKT0=(H0, P0)’.” EX1001, 10:8-10. “When receiving the packet PKT0, the switch S0 refers to header H0 to duplicate the same header H0, and encapsulates the packet PKT0 to generate the packet PKT1.” EX1001, 10:11-13. “[B]ecause the packet PKT1 has the header H0 and the payload (H0, P0), the packet PKT1 is represented as ‘the packet PKT1=(H0,(H0,P0))’.” EX1001, 10:14-17.

88. The patent also states “that as for the encapsulation of the packet, for example, a method such as GRE (Generic Routing Encapsulation) shown in RFC1701 and RFC2784 may be used.” EX1001, 6:50-63. As a person of ordinary skill in the art would have known, GRE “specifies a protocol for performing encapsulation of an arbitrary network layer protocol over another arbitrary network layer protocol.” EX1010, 1; EX1011, 1. It involves adding a delivery header and GRE header to encapsulate a packet. EX1010, 2; EX1011, 2.

89. Thus, a person of ordinary skill in the art would have understood that the terms “encapsulate,” “encapsulating,” and “encapsulation,” based on their plain meaning to such a person, are used in the challenged claims to refer to appending

an additional header to the received data packet.

90. For similar reasons, a POSITA would understand the phrase “decapsulate the encapsulated packet” in claims 4, 10, and 16 to mean removing the additional header that was appended to the received data packet.

2. “[duplicate/duplicating] a part of a header of the identified packet as an additional header”

91. Claim 1 recites a “switch apparatus” that is configured to “duplicate a part of a header of the identified packet as an additional header when the identified packet comprises a target of encapsulation...” EX1001, 12:34-36. Claim 7 recites the same limitation. EX1001, 13:1-3. Claims 13 and 19 recite the virtually identical limitation of “duplicating a part of a header of the identified packet as an additional header.” EX1001, 13:30-32, 14:25-27. In my opinion, this claim limitation means that when a packet is identified as a target for encapsulation (i.e., when it will have an additional header added), a part of the existing header is duplicated to use as a portion of the new header that will be used to encapsulate the packet. I do not believe that a person of ordinary skill in the art would understand the claim language to require that the new header (i.e., “additional header”) must be composed solely of the duplicated “part of a header.”

92. The '177 Patent specification uses the term “header” to loosely describe information in the header of a data packet. For instance, the specification states that “the controller 10 previously sets ‘duplicating the IP header of the

packet in a predetermined flow, encapsulating a packet with the same header as the IP header, and transferring the encapsulated packet' to the encapsulating module 21-1 of the switch 20-1." EX1001, 6:20-24. It then clarifies, however, that the reference to "'the IP header' may be read as 'a part or all of data which can function as a rule of the flow entry'." EX1001, 6:28-30. Similarly, the specification states that "'the IP header (or header)' in the above description of the present invention is read as 'a part or whole of data for a rule of a flow entry'." EX1001, 8:34-36; see also 3:28-30 ("Specifically, the above-mentioned header is read as 'all or a part of data for a rule of a flow entry'."). The specification states that the "rule of the flow entry is defined based on various combinations of all or some of a destination address, a source address, a destination port, and a source port, which are contained in a header field of each protocol hierarchy of the packet, and is identifiable." EX1001, 1:56-60. Thus, the specification uses the term "header" to refer to certain fields in a data packet's header, such as source address and destination address, rather than the entire header including every field specified to define a particular type of data packet header.

93. Further, a person of ordinary skill in the art would know that in practice it is not feasible to duplicate a portion of a data packet's header and use it as the entire outer header encapsulating that same packet. For example, a packet header generally includes a checksum field, which is essentially a hash of the

packet payload. The specification cites the GRE (Generic Routing Encapsulation) protocol, which includes such a header field. Because the original packet header becomes part of the payload when the GRE header is added (i.e., the payload is changed), the checksum field in the outer header will necessarily be different than the checksum field in the original header. If the original checksum field based on the original payload were used as the checksum field in the new outer header, a network device would reject the packet because the checksum field in the outer header would not match a checksum of the payload (including the encapsulated packet).

94. Thus, a person of ordinary skill in the art would understand that the phrase “[duplicate/duplicating] a part of a header of the identified packet as an additional header,” as used in the challenged claims, means duplicating part of the packet header for use as part of a new header.

V. PRIOR ART REFERENCES

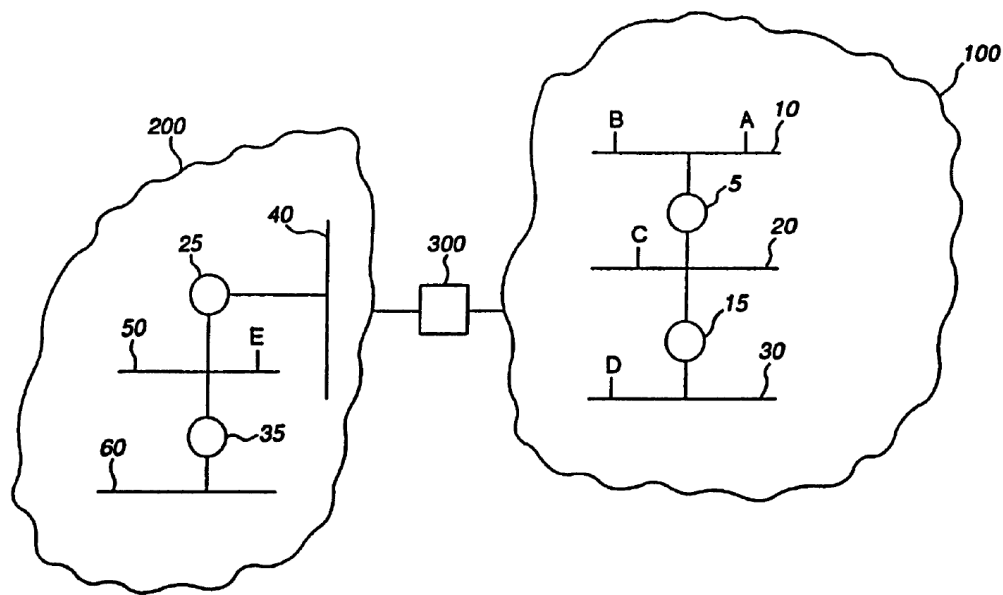
95. I am informed that each of the following references constitutes prior art to the '177 Patent.

A. Rijhsinghani (EX1005)

96. Rijhsinghani is a U.S. patent that was filed on December 23, 1998 and is entitled “Virtual Local Area Networks Having Rules of Precedence.”
EX1005, 1.

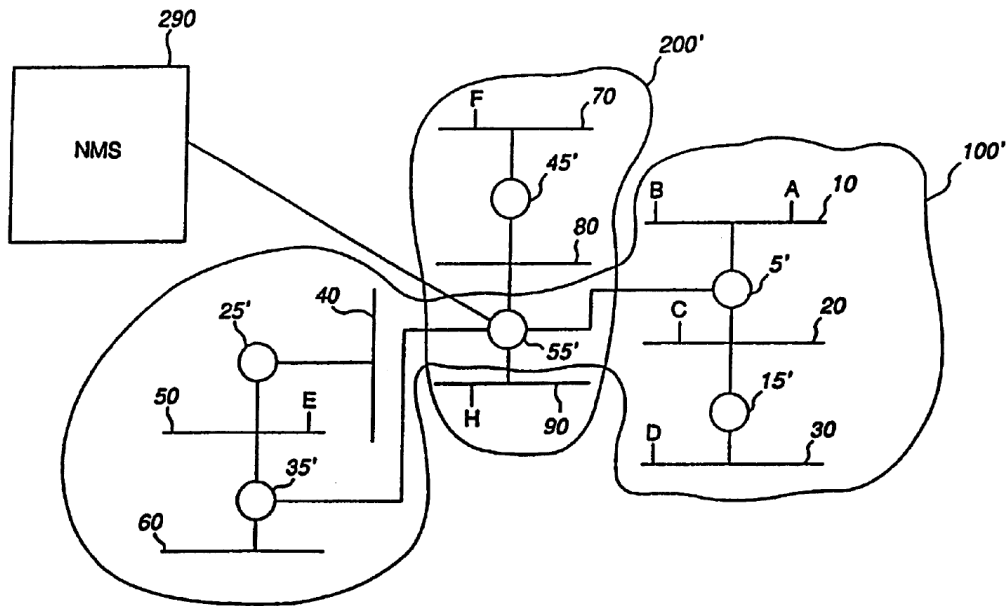
97. Rijhsinghani discloses “[a] switch for use in a communications system having multiple local area networks interconnected by multiple switches so as to be configurable into different types of virtual local area networks....” EX1005, 1 (Abstract). The switch “detects a communication from the local area network and identifies a virtual local area network over which the communication is to be transmitted based upon rules of precedence for different types of virtual local area networks.” EX1005, 1 (Abstract). “The communication is appended with a VLAN tag representing the identified virtual local area network so as to form a VLAN communication that is directed to the second communication port for transmission over the identified virtual local area network.” EX1005, 1 (Abstract).

98. Rijhsinghani begins by describing an exemplary local area network, or LAN, “used to facilitate communications between a number of users.” EX1005, 1:14-15. Figure 1 in Rijhsinghani illustrates “an exemplary interconnected bridged LAN system.” EX1005, 1:20-21.



EX1005, Fig. 1. The figure illustrates bridged LAN 100 and bridged LAN 200 connected by router 300. EX1005, 1:23-25. Each bridged LAN includes several individual LANs, identified by the numbers 10, 20, 30, 40, 50, and 60, connected by bridges numbered 5, 15, 25, and 35. EX1005, 1:21-23. Users (e.g., A, B, C, etc.) can communicate over the various network connections.

99. Rijhsinghani identifies some problems with bridged LANs of the type illustrated in Figure 1 and notes that virtual LANs (or VLANs) had “recently been developed to address the deficiencies in interconnected bridged LAN systems....” EX1005, 1:61-63. Figure 2 illustrates an exemplary VLAN system. EX1005, 2:5-10.



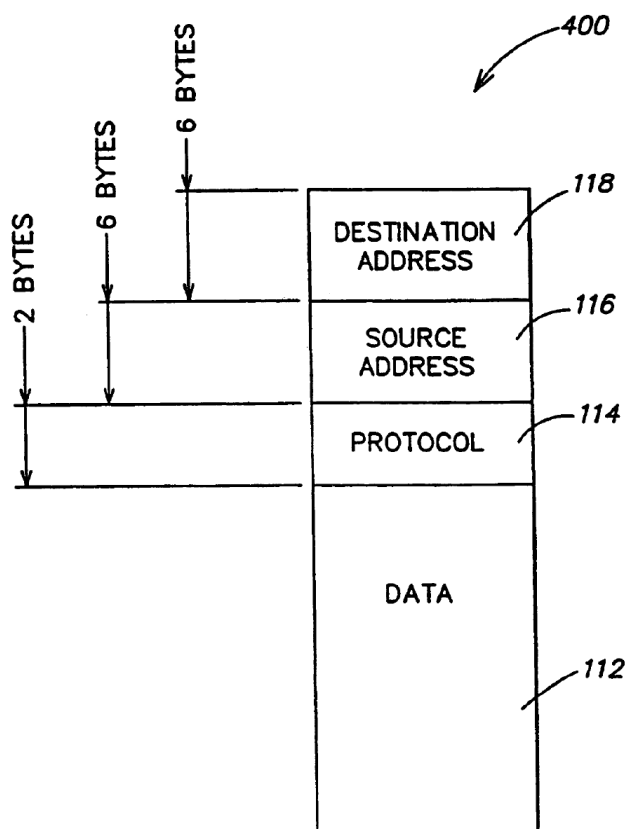
EX1005, Fig. 2. The figure illustrates individual LANs (10, 20, 30, 40, 50, 60, 70, 80, and 90) connected by switches (5', 15', 25', 35', 45', and 55'). EX1005, 2:8-10.

“A network management station (NMS) 290 controls the interconnection of the individual LANs such that LANs can be easily bridged to other LANs on a long term or short term basis without the need to rewire the network.” EX1005, 2:10-14.

100. In Figure 2, “the NMS 290 has configured two VLANs by instructing, e.g., programming, and thereby configuring the switches 5'-55' such that LANs 10-60 are bridged together by switches 5', 15', 55', [25' and] 35' to form VLAN 100' and LANs 70-90 are bridged together by switches 45' and 55' to form VLAN 200'.” EX1005, 2:14-19. Rijhsinghani explains that “switches 5'-55' are multi-ported and programmable by the NMS 290 such that the network can be

configured and reconfigured in any desired manner by simply changing the switch instructions.” EX1005, 2:20-26. “If it becomes desirable to change the network configuration, this is easily accomplished by issuing commands from NMS 290 to the applicable switches 5'-55'.” EX1005, 2:36-38.

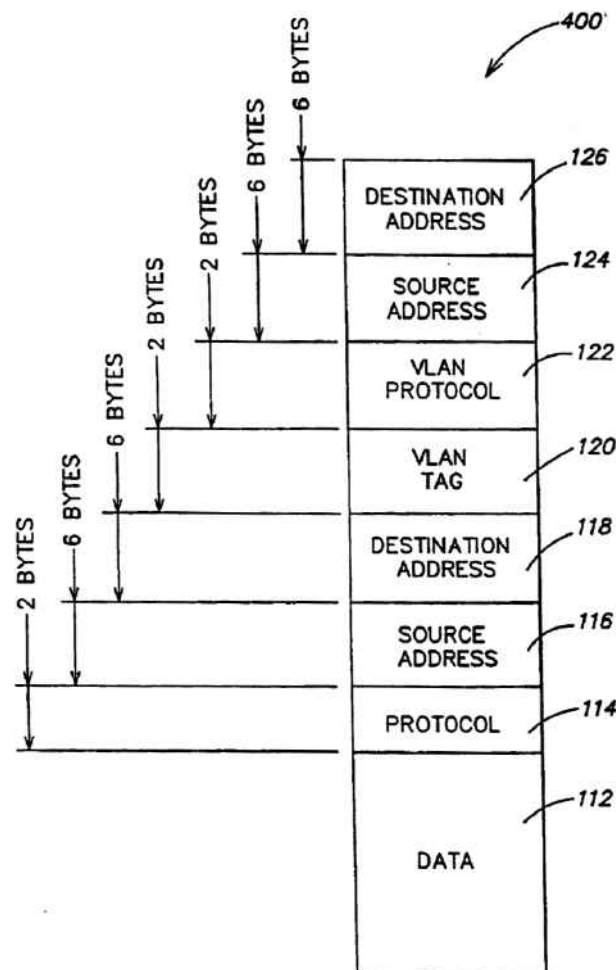
101. Rijhsinghani’s switches are configured to receive a packet and determine if it should be forwarded to a particular VLAN. Figure 3 illustrates “a communication packet 400” in a conventional LAN protocol of the type that would be received by one of Rijhsinghani’s switches. EX1005, 2:57-61.



EX1005, Fig. 3. Communication packet 400 “includes a destination address 118 having six bytes, a source address 116, and message data 112” as well as “an

indication of the applicable LAN protocol identifier 114.” EX1005, 2:57-61.

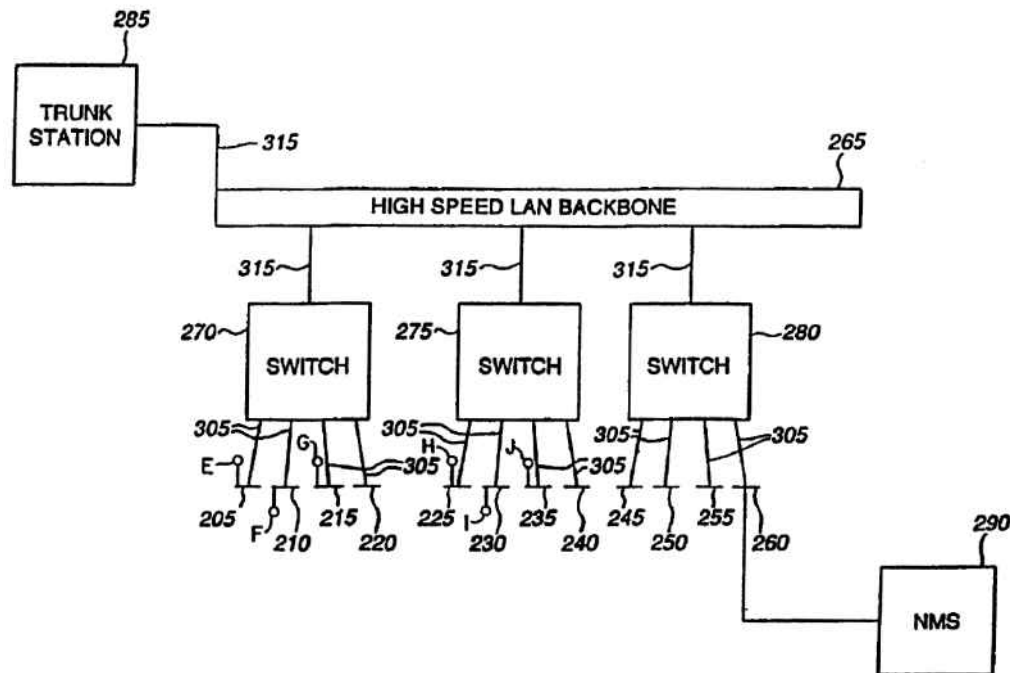
102. When a switch receives communication packet 400, it determines the appropriate VLAN (if any) and adds a VLAN header. Figure 4 illustrates “a VLAN communications packet 400’ which is similar to the LAN communication packet 400 depicted in FIG. 3, except that a VLAN header has been added to the packet.” EX1005, 3:22-25. “The VLAN header is added by the initial switch to which the message packet is directed.” EX1005, 3:25-26.



EX1005, Fig. 4. “The VLAN header, as shown, includes a destination address 126

which is the same address as the destination address 118, a source address 124 which is the same as source address 116, a protocol identifier 122, and a VLAN tag 120 identifying the applicable VLAN.” EX1005, 3:29-33.

103. Rijhsinghani’s Figure 5 illustrates “a schematic of a conventional VLAN system.” EX1005, 2:62.



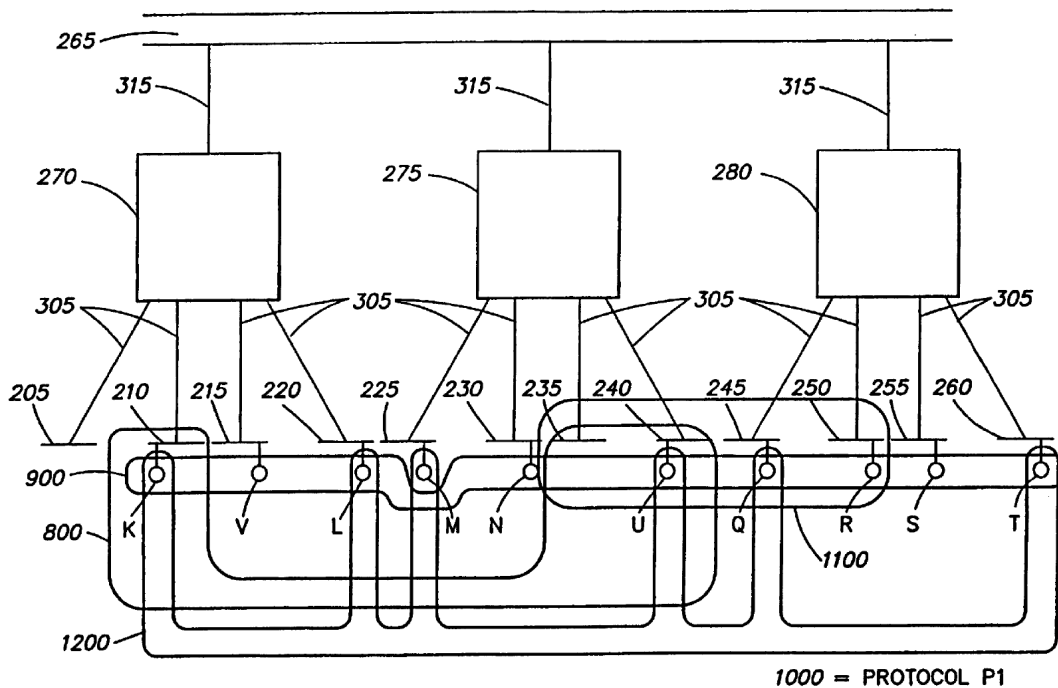
EX1005, Fig. 5. “The VLAN system includes LANs 205-260 which are connected by switches 270-280 to a high-speed LAN backbone or trunk 265.” EX1005, 2:63-65. The NMS 290 is “interconnected to the switches 270-280 via LAN 260,” and “trunk station 285 is connected to the high-speed LAN backbone 265 via a trunk port 315.” EX1005, 2:65-66, 3:2-3.

104. Rijhsinghani states that “[t]he NMS 290 of the system shown in

FIG. 5 is capable of configuring different types of VLANs as is understood by those skilled in the art.” EX1005, 4:1-3. “For example, VLANs may be port-based, address-based, protocol-based, port and protocol-based, or address and protocol-based.” EX1005, 4:3-5. To configure a VLAN, “the NMS instructs the appropriate switches to identify the VLAN for packets received at the switch.” EX1005, 4:5-8. “Identifying the appropriate VLAN for a packet enables the switch to transmit the packet over the appropriate VLAN.” EX1005, 4:8-10.

105. To establish a port-based VLAN, “the NMS configures the VLAN to include LANs connected at certain access ports 305 of certain switches” and “instructs each certain switch to identify the VLAN for a packet based upon the access port at which the packet is received.” EX1005, 4:11-14. “For an address-based VLAN, the NMS configures the VLAN to include certain addresses” so that “[i]f a switch is connected to a LAN at an access port 305 that includes one of the certain addresses, the NMS instructs the switch to identify the VLAN for a packet when received at the access port based upon the source address 116 included in the packet.” EX1005, 4:15-21. “For a protocol-based VLAN, the NMS 290 configures the VLAN...based upon the protocol identifier 114 included in the packet received at an access port 305.” EX1005, 4:22-28. The NMS 290 can also configure a VLAN based on a combination of port and protocol or a combination of address and protocol. EX1005, 4:29-37.

106. Rijhsinghani states that “[a]lthough it is known to configure different types of VLANs within a VLAN system based upon characteristics such as those previously described, problems arise in attempting to implement such systems.” EX1005, 5:41-45. For example, “under certain circumstances, overlap of VLANs may occur such as depicted” in Figure 6. EX1005, 5:45-47.



EX1005, Fig. 6. This figure “depicts a system with various LANs 205-206 configured into a number of different types of VLANs 800-1200 by the NMS 290 in a conventional manner.” EX1005, 4:38-40.

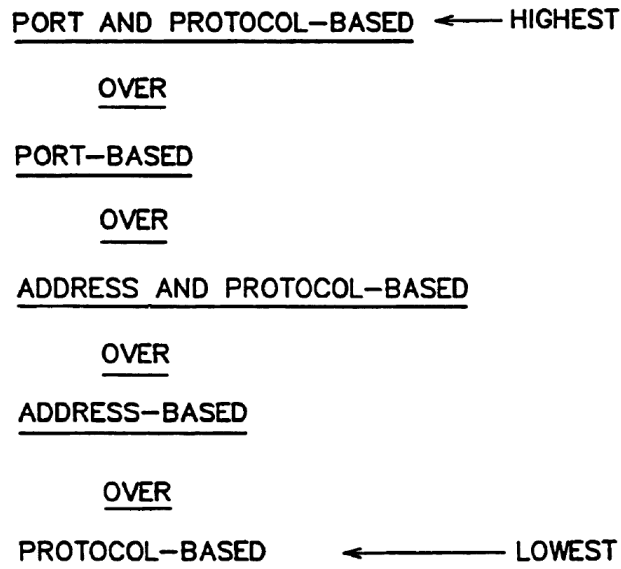
107. Rijhsinghani states that “[o]verlap occurs when a communication packet received at a switch can be identified with more than one VLAN.” EX1005, 5:47-49. For example, in the VLAN system of Figure 6, “when

switch 275 receives a communication with a protocol identifier for protocol P1 from LAN 235, it could choose to classify the communication in either VLAN 800, 1000, or 1100 because [275] will be programmed to consider the port, the protocol, and the port and protocol jointly.” EX1005, 5:65-6:3.

108. Rijhsinghani describes switches 270'-280' (illustrated in Figures 7, 8, and 9) that are each “programmed to utilize an order of precedence to identify with certainty the appropriate VLAN for transmission of the received communication.” EX1005, 9:47-50. In the disclosed embodiment, “each of the switches 270'-280' is programmed so as to operate to tag the communication with the VLAN header, i.e., the VLAN tag, representing the VLAN which is port and protocol-based over any other VLAN.” EX1005, 9:50-54. In other words, “if a communication received from one of the LANs is identified as potentially associated with a port and protocol-based or other type of VLAN, the switch will give precedence to the port and protocol-based VLAN over the other possible associated VLANs.” EX1005, 9:54-58.

109. Rijhsinghani's switches are also “programmed to give precedence to an identification of a possible association with a port-based VLAN over all other types of VLANs except port and protocol-based VLANs.” EX1005, 10:3-6. In other words, port and protocol-based VLANs will have the highest precedence followed next by port-based VLANs and so on. Figure 11 illustrates “the levels of

precedence” for the various types of VLANs. EX1005, 10:43-44.



EX1005, Fig. 11. Rijhsinghani’s switches use this “order of precedence” to identify the appropriate VLAN for a packet. EX1005, 11:41-45. This avoids the problem presented by a packet that could be assigned to more than one VLAN (i.e., “overlap”).

110. According to Rijhsinghani, the disclosed “invention provides rules of precedence for directing communications within different types of VLANs.” EX1005, 11:52-54. “Switches route communications to addressees, within a VLAN system capable of configuring multiple types of VLANs, based upon pre-defined rules of precedence and in a secure manner.” EX1005, 11:54-57.

B. RFC-5474 (EX1006)

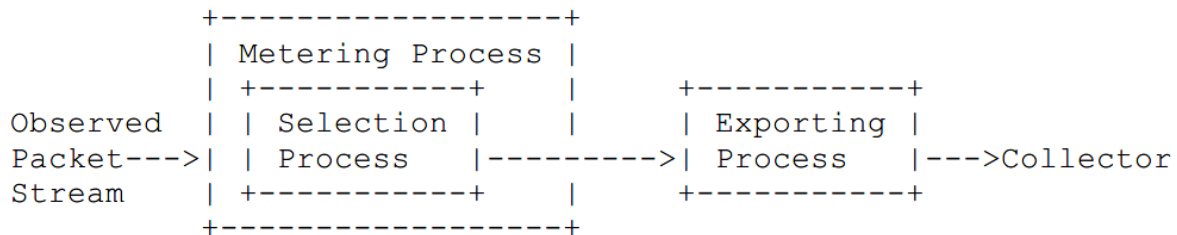
111. RFC-5474 is a Request for Comments (RFC) issued and published by

the Network Working Group of the Internet Engineering Task Force (IETF) in March 2009, entitled “A Framework for Packet Selection and Reporting” EX1006, 1. RFC-5474 “specifies a framework for the PSAMP (Packet SAMPling) protocol” including functions “to select packets from a stream according to a set of standardized Selectors, to form a stream of reports on the selected packets, and to export the reports to a Collector.” EX1006, 2.

112. A Request for Comments, or RFC, is essentially a technical standard or protocol used by networking professionals. RFCs are prepared and distributed under a formalized publication process overseen by the IETF. EX1012. I have personal experience working with and teaching about RFCs, including discussion of dozens of RFCs in my book *Internet Measurement*. I understand that once RFCs are published, the IETF does not make changes to any published RFC. The “Publication Process” webpage of the RFC Editor, which publishes RFCs on behalf of the IETF, states that “We DO NOT make changes to RFCs once they have been published. EX1013, 4. This is consistent with my personal experience going back well before RFC-5474 was published in 2009. Thus, it is my understanding, and I believe, that the RFC-5474 document available today through the RFC Editor website is the same as the version published in 2009.

113. RFC-5474 “describes the PSAMP framework for network elements to select subsets of packets by statistical and other methods, and to export a stream of

reports on the selected packets to a Collector.” EX1006, 4. The following figure illustrates “the sequence of the three processes (Selection, Metering, and Exporting) within the PSAMP device.” EX1006, 5.



EX1006, 5. RFC-5474 states that “[a] stream of packets is observed at an Observation Point.” EX1006, 5. “A Selection Process inspects each packet to determine whether or not it is to be selected for reporting.” EX1006, 5. “The Selection Process is part of the Metering Process, which constructs a report on each selected packet, using the Packet Content, and possibly other information....” EX1006, 5. Then, “[a]n Exporting Process sends the Packet Reports to a Collector, together with any subsidiary information needed for their interpretation.” EX1006, 5.

114. A POSITA would have been familiar with methods for sampling packets, such as PSAMP as disclosed in RFC-5474. I devoted a number of pages to describing such methods of packet sampling in *Internet Measurement*, including discussion of PSAMP.

115. Further, a POSITA in the late 2000s would have been familiar with RFCs, such as RFC-5474, and such a person would have known how to obtain

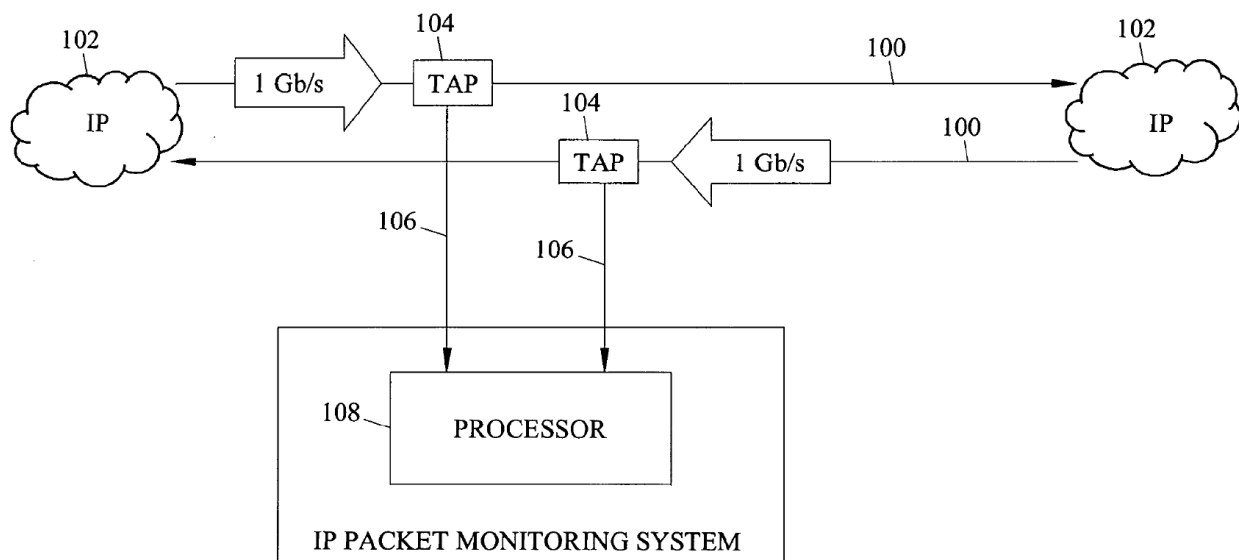
copies of RFCs from at least the IETF website or the IETF Editor website.

C. Lean (EX1007)

116. Lean is a U.S. patent application publication that was filed on August 1, 2007, and published on February 7, 2008. EX1007, 1. Lean is entitled “Methods, Systems, and Computer Program Products for Monitoring Tunneled Internet Protocol (IP) Traffic on a High Bandwidth IP Network.” EX1007, 1.

117. Lean describes “methods and systems for monitoring IP traffic on a high bandwidth IP network.” EX1007, [0002]. “More particularly, the subject matter described” in Lean “includes methods, systems, and computer program products for monitoring tunneled IP traffic on a high-bandwidth IP network.” EX1007, [0002].

118. Lean’s Figure 1 illustrates “conventional monitoring of traffic traversing a high bandwidth IP network.” EX1007, [0018]. “Each tap 104 passively copies all IP packets transmitted across Ethernet link 100 and sends the IP packet copy stream 106 to processor 108 for analysis.” EX1007, [0018].



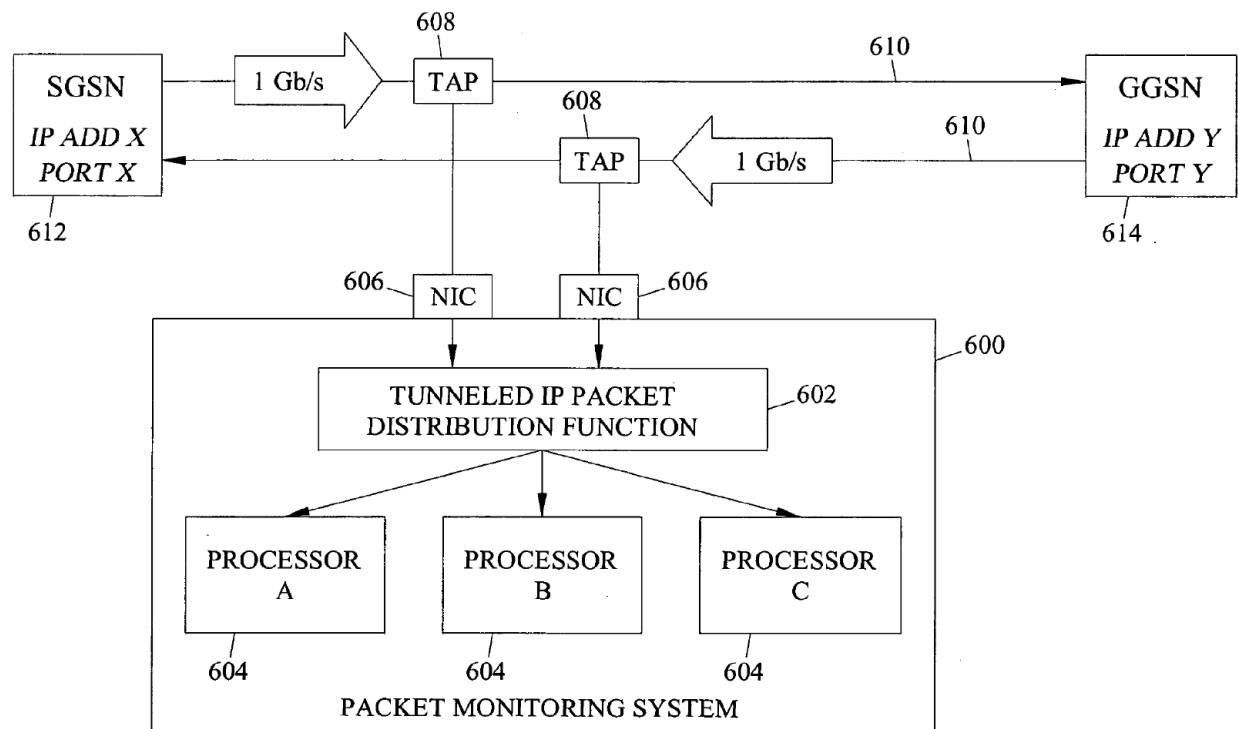
EX1007, Fig. 1. Lean’s Figure 2 illustrates a similar conventional network monitoring system in which the IP Packet Monitoring System includes multiple processors 204 for processing packets with different header information. EX1007, Fig. 2. As in the Figure 1 system, “TAPs 104 copy IP packets traversing high speed Ethernet connections 100.” EX1007, [0020]. They “forward the copied packets to IP header packet distribution function 202,” which “distributes the packets to one of the processors 204 based on IP and TCP or UDP header information in the packet.” EX1007, [0020].

119. Lean describes a potential problem with conventional IP packet monitoring systems as in Figure 2. “One problem with using information associated with the network and transport layer information in a packet to segregate traffic for network monitoring purposes occurs when a packet is tunneled.” EX1007, [0026]. Lean explains that “[w]hen a packet is tunneled

across the network, the packet being tunneled is encapsulated in another packet to be transported across the network.” EX1007, [0026]; see also [0027]

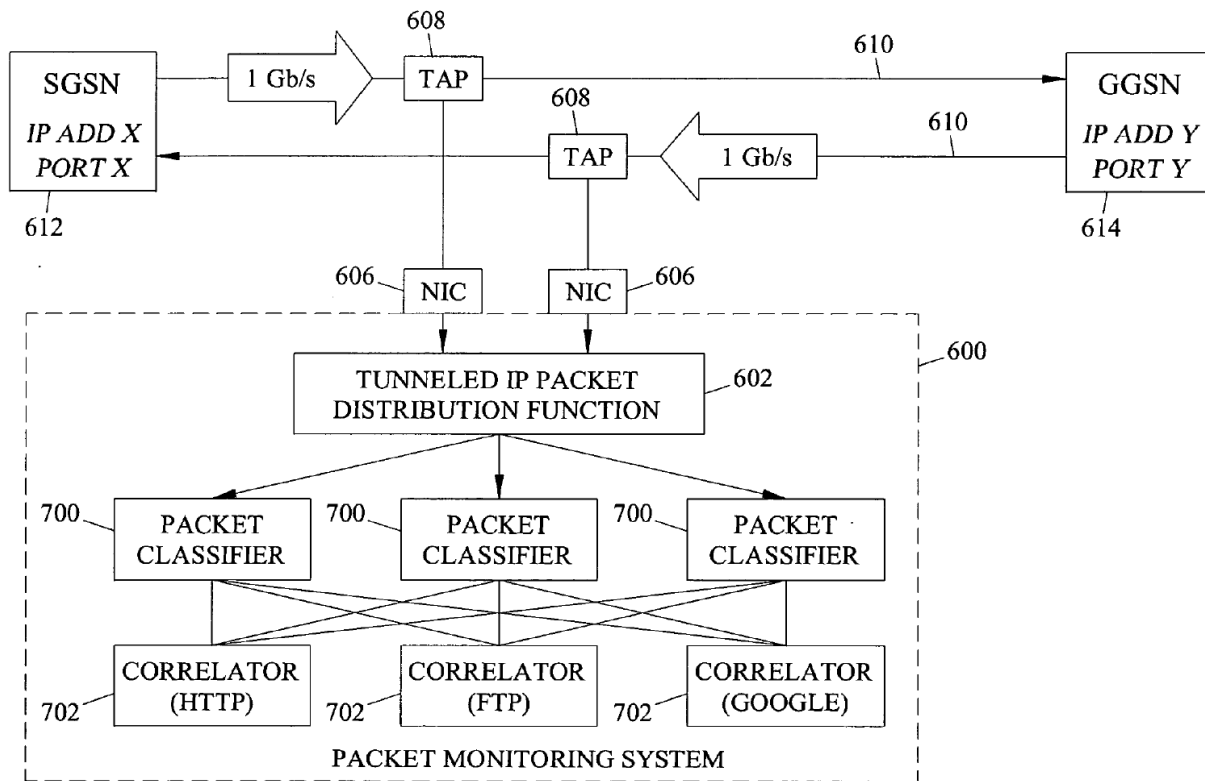
(“Encapsulating IP packet 404 carries tunneled IP packet 400 in its payload portion 402.”). In some scenarios, the outer header information will be the same for all tunneled packets, in which case the outer header information is not usable to segregate packets to different processors in the IP packet monitoring system. EX1007, [0026]-[0027].

120. Lean discloses several techniques for addressing the potential problem with segregating tunneled packets in the IP packet monitoring system. For example, Lean’s Figure 6 illustrates “an exemplary monitoring system for classifying and processing tunneled IP packets according to an embodiment” of Leans’ invention. EX1007, [0029].



EX1007, Fig. 6. In this embodiment, a “tunneled IP packet distribution function 602” is added to the IP packet monitoring system. EX1007, [0029]-[0032]. Rather than segregating packets based on address information in the outer header of the packet, tunneled IP packet distribution function 602 reads “tunneled protocol address information encapsulated in [the] payload portion of a received IP packet and may distribute the packets to one or more downstream applications for processing based on the tunneled protocol address information.” EX1007, [0029].

121. In the embodiment illustrated in Figure 7, “network monitoring system 600 includes a plurality of packet classifiers 700 for performing deep packet classification services for received packets.” EX1007, [0033].



EX1007, Fig. 7. Lean explains that “[d]eep packet classification services may include classifying packets based on classification criteria and/or rules.” EX1007, [0033]. In an embodiment, “each deep packet classifier 700 may classify packets based on application/presentation/session layer protocol information, such as HTTP information, FTP information, service provider identifiers, content provider identifiers, or other suitable application, presentation, or session layer information.” EX1007, [0033]. In the Figure 7 example, “correlators are included for the hypertext transfer protocol (HTTP), the file transfer protocol (FTP), and for packets originating from a common content provider, such as Google™.” EX1007, [0033]; see also [0034] (“The subject matter described herein is not

limited to correlating packets according to the protocols illustrated in FIG. 7.”).

D. Computer Networking (EX1008)

122. Computer Networking is the fourth edition of a book entitled “Computer Networking: A Top-Down Approach” authored by James F. Kurose and Keith W. Ross and published in 2008. The book was authored by experts in the field of computer networking. EX1008, 5 (“About the Authors”). It is the type of book that engineers and technicians working in the field, and students learning about the field, would reference to obtain an authoritative description of then-existing computer networking technology and techniques. I have personally reviewed and used multiple editions of Computer Networking starting with the first edition, and specifically including the fourth edition starting shortly after it was published in 2008. I considered it as a potential text for my course “Computer Networks” starting from its first edition. The book has been readily available for purchase since its publication. I was aware of this textbook in part because one of its authors (James Kurose) is a research collaborator of mine.

VI. THE CHALLENGED CLAIMS ARE RENDERED OBVIOUS BASED ON RIJHSINGHANI AS A PRIMARY PRIOR ART REFERENCE

123. It is my opinion that the challenged claims of the ’177 Patent are invalid as obvious in light of at least the prior art discussed below.

A. Rijhsinghani Renders Claims 1, 5-7, 11-13, and 19 Obvious

124. A person of ordinary skill in the art would have naturally considered

Rijhsinghani because it is in the same field of endeavor as the '177 Patent, namely network communications. EX1005, 1 (Abstract), 1:8-12, 6:26-35; EX1001, 1:14-16, 4:33-38. Further, both Rijhsinghani and the '177 Patent contemplate network switches configured to modify packet headers, including by duplicating header fields, to create a new header to be used for encapsulation. EX1005, 2:57-61, 3:23-45, Figs. 3 and 4; EX1001, 1 (Abstract), 3:22-27.

125. Rijhsinghani provides a sufficiently detailed description to permit a person of ordinary skill in the art to implement the aspects of Rijhsinghani's disclosure of VLANs and related switching techniques discussed below with regard to the challenged claims with a reasonable expectation of success and without undue experimentation. It would have been within the skill level of a person of ordinary skill in the art to implement Rijhsinghani's disclosed embodiments.

1. Independent Claim 1

a. [1pre] A switch apparatus, comprising:

126. Rijhsinghani discloses a *switch apparatus* as recited in the preamble of claim 1. (Note that for ease of reference I will use italics to indicate claim language throughout my analysis.)

127. For example, Rijhsinghani's Abstract discloses "[a] switch for use in a communications system having multiple local area networks interconnected by

multiple switches so as to be configurable into different types of virtual local area networks....” EX1005, 1 (Abstract), 11:54-57 (“Switches route communications to addressees, within a VLAN system capable of configuring multiple types of VLANs, based upon the predefined rules of precedence and in a secure manner.”), 12:34-35 (“wherein the network device is a switch”), 12:41-42 (same), 12:53-54 (same), 13:13-14 (same), 13:18-19 (same), 13:25-26 (same), 13:37-38 (same), 14:16-17 (same), 14:21-22 (same), 14:28-29 (same), 14:40-41 (same).

128. Rijhsinghani explains that “VLANs allow LANs to be bridged in virtually any desired manner, i.e., independent of physical topology, with switches operating at layer 2” meaning that “the switches are transparent to the user.” EX1005, 1:63-66; see also 2:8-26, 2:37-56, Fig. 2. Rijhsinghani illustrates a “conventional VLAN system” including switches 270, 275, and 280. EX1005, 2:62-65.

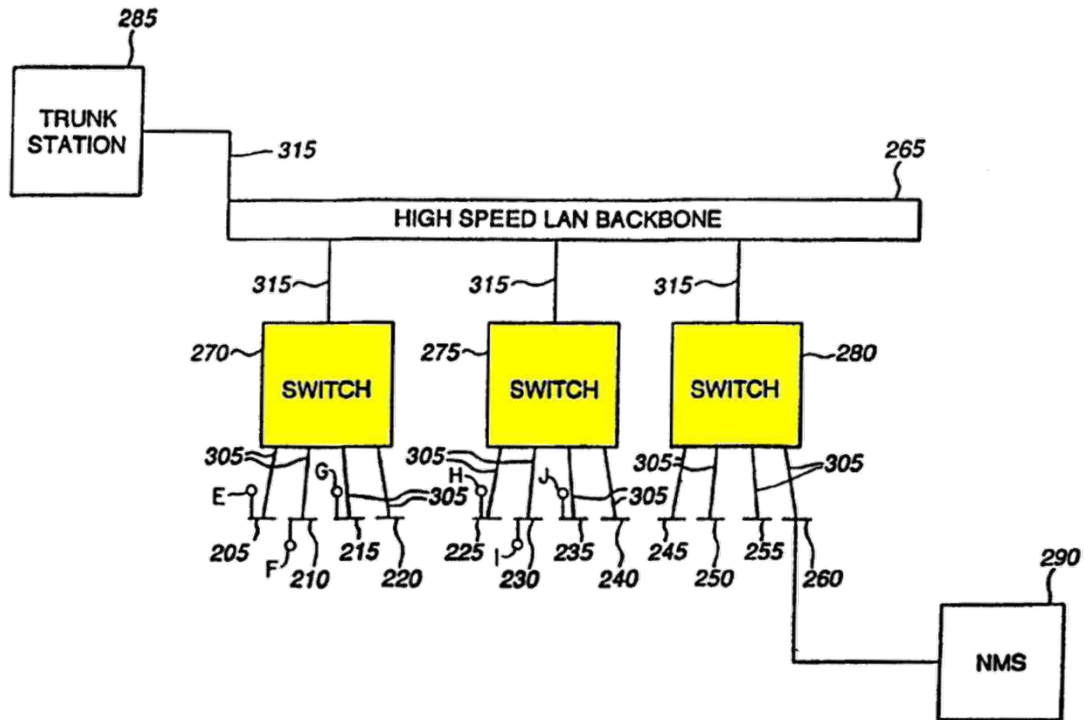


FIG. 5

EX1005, Fig. 5 (highlighted). “Each switch is capable of interconnecting a LAN connected via an access port 305 with another LAN connected via an access port 305.” EX1005, 3:8-10. “Each switch is also capable of interconnecting a LAN connected by an access port 305 with a LAN connected to another switch by an access port 305 via high-speed LAN backbone 265.” EX1005, 3:14-17. Each of switches 270, 275, and 280 constitutes a *switch apparatus* as recited in the claim.

129. Rijhsinghani’s Figure 7 illustrates “a VLAN system in accordance with the present invention.” EX1005, 7:33-34. As illustrated, “[t]he network includes multiple Local Area Networks (LANs) 205-260 interconnected by

multiple multi-ported reconfigurable switches 270', 275', and 280' all of which are connected by a high speed backbone LAN 265, often referred to as the trunk."

EX1005, 7:50-55.

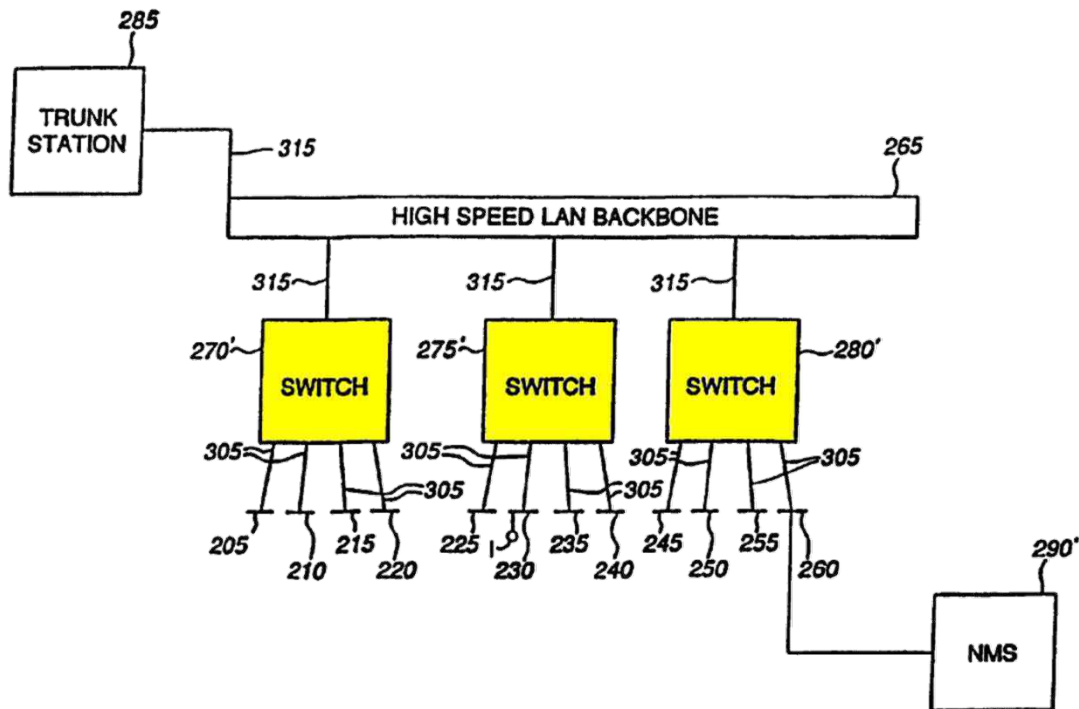


FIG. 7

EX1005, Fig. 7 (highlighted).

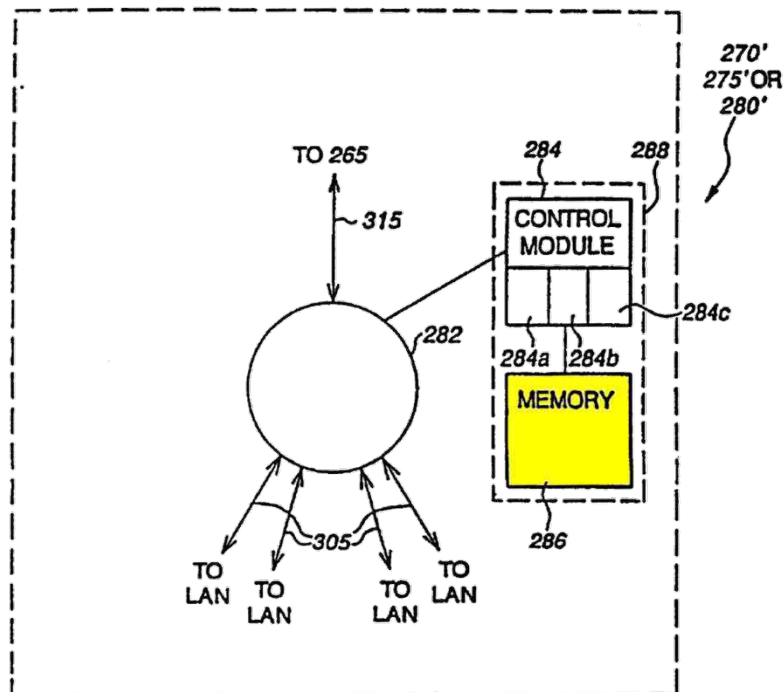
130. A person of ordinary skill in the art would have understood from Rijhsinghani's disclosure that switches 270', 275', and 280' operate in the same manner as the switches in the conventional VLAN system of Figure 5, except that the switches in the VLAN of Figure 7 implement Rijhsinghani's rules of precedence. Each of switches 270', 275', and 280' constitute a *switch apparatus* as recited in the preamble of claim 1.

131. Thus, Rijhsinghani discloses a *switch apparatus* as recited in the preamble of claim 1 and as explained further below.

b. [1a] a storage storing a table, the table including rules and actions corresponding to the rules; and

132. Rijhsinghani discloses this limitation of claim 1.

133. Each of Rijhsinghani's switches includes *a storage*. Figure 8 "depicts a switch which can be utilized in the VLAN system" described by Rijhsinghani. EX1005, 7:35-37. As illustrated, "each of the switches 270, 275, and 280 includes a control console 288 having a control module 284 and a memory 286 for storing and processing control and VLAN configuration instructions." EX1005, 8:6-9.



EX1005, Fig. 8 (highlighted). Each switch's memory 286 constitutes *a storage* as recited in claim 1.

134. Each memory 286 stores VLAN configuration instructions, which include *rules and actions corresponding to the rules*. As Rijhsinghani explains, “[t]he NMS 290’ is capable of configuring VLANs of differing types” (e.g., port-based, address-based, etc.) by instructing “the switches 270’-280’ as to the configuration of the different types of VLANs.” EX1005, 9:30-36. “Each of the switches 270’-280’ is programmed to consider the applicable characteristics of each communication received, via an access port, in order to determine the appropriate VLAN tag to add to the communication before transmission via the trunk port 315 to the high speed LAN backbone or trunk 265.” EX1005, 9:36-42. Thus, each switch “consider[s] the applicable characteristics of each communication received” (i.e., *rules*) to “determine the appropriate VLAN tag to add to the communication before transmission” (i.e., *actions corresponding to the rules*).

135. This description in Rijhsinghani is similar to the ’177 Patent’s description of *rules and actions*. The ’177 Patent states that “[a] flow table...stores a flow entry defining a predetermine operation (action) to be carried out to the packets (communication data) which match a predetermine match condition (rule).” EX1001, 1:52-55. The “rules” are based on communication characteristics of a received packet such as information in the packet header. EX1001, 1:56-67. The corresponding “action” can include forwarding the packet on a particular output port, discarding the packet, or rewriting the packet header.

EX1001, 2:1-9. While I understand that an appropriate obviousness analysis is based on a comparison of the prior art to the challenged claims—not the specification—the fact that the ’177 Patent specification uses the claim terms in a conventional manner that is the same as the instructions for configuring VLANs in Rijhsinghani supports my opinion that the prior art discloses the claimed *rules and actions corresponding to the rules* as claimed.

136. Rijhsinghani’s NMS 290 (or NMS 290’) “is capable of configuring different types of VLANs as is understood by those skilled in the art.” EX1005, 4:1-3. For example, the NMS can configure VLANs that are “port-based.” EX1005, 4:3-5. To do so, the NMS instructs certain switches “to identify the VLAN for a packet based upon the access port at which the packet is received.” EX1005, 4:11-14; see also 4:5-8 (“[T]he NMS instructs the appropriate switches to identify the VLAN for packets received at the switch.”). In this case, *rules* are based on the access port on which a packet is received. The switches use access port information (*rules*) to identify the appropriate VLAN so that a VLAN header can be added and the packet forwarded correctly (*actions corresponding to the rules*). EX1005, 4:8-10 (“Identifying the appropriate VLAN for a packet enables the switch to transmit the packet over the appropriate VLAN.”), 3:39-45 (“The switch determines, based upon instructions previously received from the NMS 290, that the LAN 205 falls within the applicable VLAN and, accordingly, adds the

appropriate VLAN header to the packet,” which “is then directed via trunk port 315 to the high-speed backbone LAN 265....”), 9:23-29 (“[A]ll communications between LANs within configured VLANs are forwarded to the appropriate addressee LAN...by identifying communications between LANs within configured VLANs and tagging the communications...with a VLAN header.”).

137. The NMS can configure VLANs that are “address-based.” EX1005, 4:3-5. To do so, “the NMS instructs the switch to identify the VLAN for a packet when received at the access port based upon the source address 116 included in the packet.” EX1005, 4:15-21; see also 4:5-8 (“[T]he NMS instructs the appropriate switches to identify the VLAN for packets received at the switch.”). In this case, *rules* are based on the packet’s source address. The switches use address information (*rules*) to identify the appropriate VLAN so that the VLAN header can be added and the packet forwarded correctly (*actions corresponding to the rules*). EX1005, 4:8-10, 3:39-45, 9:23-29.

138. The NMS can configure VLANs that are “protocol-based.” EX1005, 4:3-5. To do so, “[t]he NMS instructs the switches to identify the VLAN based upon the protocol identifier 114 included in the packet received at an access port 305.” EX1005, 4:22-28; see also 4:5-8 (“[T]he NMS instructs the appropriate switches to identify the VLAN for packets received at the switch.”). In this case, *rules* are based on the packet’s protocol identifier. The switches use protocol

information (*rules*) to identify the appropriate VLAN so that the VLAN header can be added and the packet forwarded correctly (*actions corresponding to the rules*). EX1005, 4:8-10, 3:39-45, 9:23-29.

139. The NMS can configure VLANs that are “port and protocol-based.” EX1005, 4:3-5. To do so, “the NMS 290 instructs the switches that include certain access ports to identify the VLAN for a packet based upon the access port at which the packet is received and the protocol identifier 114 included in the packet received.” EX1005, 4:29-33; see also 4:5-8 (“[T]he NMS instructs the appropriate switches to identify the VLAN for packets received at the switch.”). In this case, *rules* are based on the combination of access port information and protocol information. The switches use this information (*rules*) to identify the appropriate VLAN so that the VLAN header can be added and the packet forwarded correctly (*actions corresponding to the rules*). EX1005, 4:8-10, 3:39-45, 9:23-29.

140. The NMS can configure VLANs that are “address and protocol-based.” EX1005, 4:3-5. To do so, “the NMS 290 instructs the switches connected to certain addresses to identify the VLAN for the packet based on the source address 116 and the protocol identifier 114 included in the packet.” EX1005, 4:33-37; see also 4:5-8 (“[T]he NMS instructs the appropriate switches to identify the VLAN for packets received at the switch.”). In this case, *rules* are based on the combination of address information and protocol information. The switches use

this information (*rules*) to identify the appropriate VLAN so that the VLAN header can be added and the packet forwarded correctly (*actions corresponding to the rules*). EX1005, 4:8-10, 3:39-45, 9:23-29.

141. Rijhsinghani states that the “instructions” for configuring VLANs (*rules and actions corresponding to the rules*) “may be stored in the memory 286” (*a storage*) “and utilized by the switch control module 284 in determining which tag to add to a communication received at an access port 305.” EX1005, 9:42-45.

142. A POSITA would know that the instructions issued to switches to configure VLANs would be stored in *a table*, as claimed, because using a table data structure was (and is) the most common technique for switches to make packet routing decisions. Switches commonly used (and still use) information about a received packet to look up routing information in *a table* stored on the switch. See, e.g., EX1008, 95-97, 263-264; EX1009, 4-11; EX1014, 1 (Abstract), 1:38-61, 2:1-26, 2:44-51, 3:37-4:43, Figs. 1B, 2; EX1015, 2:25-60, 5:42-52, 7:34-48, 10:27-47, Fig. 1; EX1016, 1:17-30, 4:24-51, 6:19-43, Figs. 1, 3; EX1017, 1 (Abstract), 1:26-37, 2:66-3:37, 4:57-5:20, Fig. 2. This technique allows network administrators to configure or reconfigure VLANs, which Rijhsinghani discusses (EX1005, 2:10-14, 2:37-39), by simply updating routing information in tables on the switches.

143. Further, it would have been obvious to a POSITA to try implementing

Rijhsinghani's *rules* and *actions* on each switch in *a table* because it was one of a finite number of identified, predictable data structures to use for this purpose and could have been implemented by a POSITA with more than a reasonable expectation of success.

144. Thus, Rijhsinghani discloses to a POSITA *a storage* (memory 286) *storing a table, the table including rules and actions corresponding to the rules* (instructions configuring VLANs).

145. In addition, Rijhsinghani also discloses "rules of precedence" that apply when there is "overlap" such that a particular packet received by a switch could be assigned to multiple different VLANs. EX1005, 1 (Abstract), 5:47-49 ("Overlap occurs when a communication packet received at a switch can be identified with more than one VLAN."). In Rijhsinghani, "[a] switch control detects a communication from the local area network and identifies a virtual local area network over which the communication is to be transmitted based upon rules of precedence." EX1005, 1 (Abstract); see also 1:8-12 ("The present invention relates...particularly to communications systems having various types of virtual local area networks and established rules of precedence for matching a communication packet with a particular virtual local area network."), 9:47-50 ("Each of the switches 270'-280' is programmed to utilize an order of precedence to identify with certainty the appropriate VLAN for transmission of the received

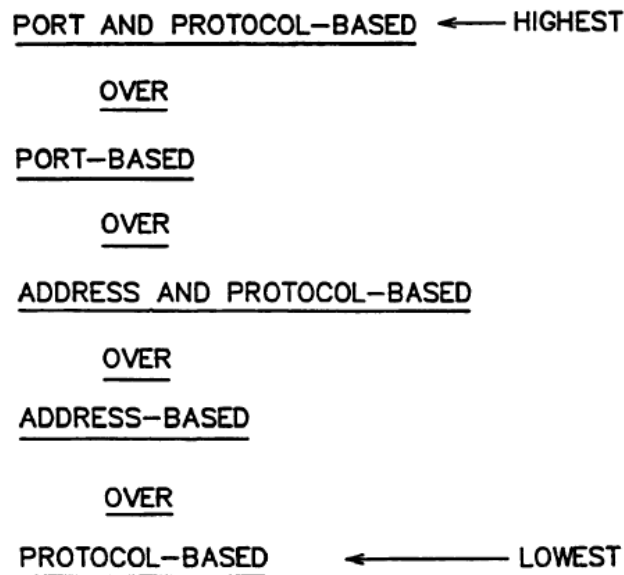
communication.”), 9:50-10:44.

146. Rijhsinghani’s “rules of precedence” constitute *rules and actions corresponding to the rules*. In this case, the *rules* include the information associating a packet with one or more types of VLANs and the *actions corresponding to the rules* involve assigning the packet to a particular VLAN, including when there is overlap and the packet could be assigned to more than one VLAN. EX1005, 6:25-35 (“[T]he present invention provides rules of precedence for directing communications within different types of VLANs, in order to provide for predictable and desirable network behavior when there are areas of the network in which there is overlap in VLAN configurations, and to allow conflict resolutions by switches in the VLAN system. Advantageously, switches are provided that route communications to addressees, within a VLAN system capable of configuring multiple types of VLANs, based upon predefined rules of precedence.”), 10:64-11:4 (“In step 1330, in the case of more than one VLAN match, the applicable switch 270’-280’ identifies which of the VLAN type matches has the highest priority based upon the order of precedence....”).

147. A person of ordinary skill in the art would understand that Rijhsinghani’s rules of precedence are stored in *a storage*, such as the switch’s memory 286, in *a table* as recited in the claim because such routing information was most commonly stored in tables stored on switches, as I explained above. See

paragraph 142.

148. Additionally, Figure 11 illustrates the rules of precedence in a manner that suggests a table data structure to a POSITA. The figure illustrates the order of precedence with port and protocol-based VLANs having the highest priority at the top, followed by port-based immediately below, etc. EX1005, 10:64-11:4.



EX1005, Fig. 11. This figure suggests a table data structure to a POSITA because a table is processed starting with the top row and moving down row by row until a match is found. A table data structure therefore naturally establishes an order of precedence with the first row having the highest priority (as in Figure 11), followed by each subsequent row in the table, and the lowest priority at the bottom (also as in Figure 11).

149. Further, it would have been obvious to a POSITA to try implementing

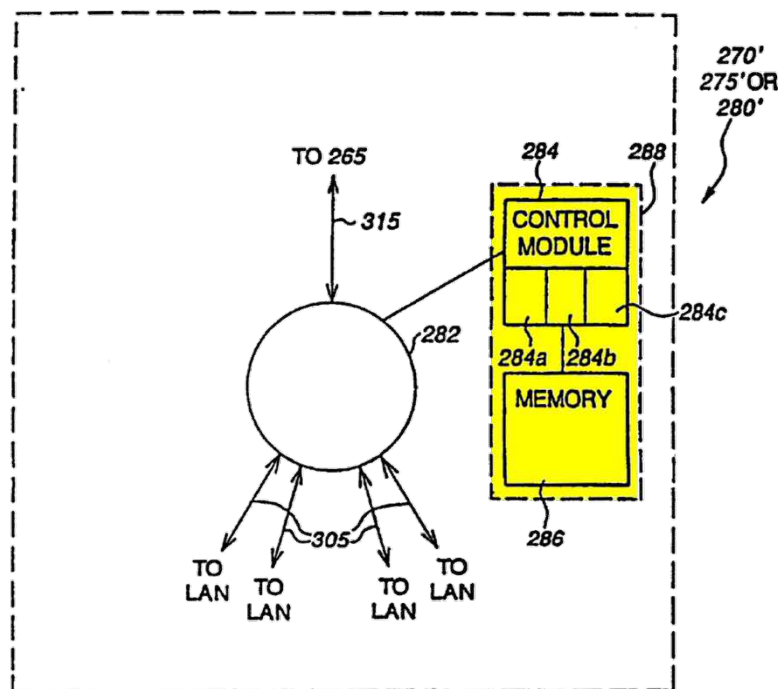
these *rules* and *actions* on Rijhsinghani's switch in *a table* because it was one of a finite number of identified, predictable data structures to use for this purpose and would have been implemented by a POSITA with more than a reasonable expectation of success.

150. Thus, Rijhsinghani discloses to a POSITA *a storage* (memory 286) *storing a table, the table including rules and actions corresponding to the rules* (rules of precedence).

c. [1b] a controller comprising:

151. Rijhsinghani discloses *a controller* as recited in claim 1.

152. Figure 8 illustrates Rijhsinghani's switch including control console 288, which constitutes *a controller* as recited in claim 1.



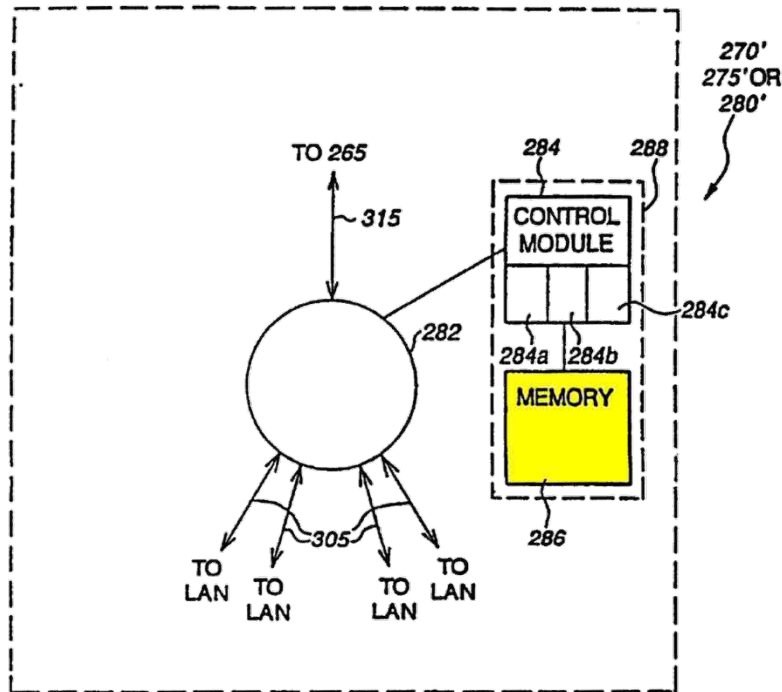
EX1005, Fig. 8 (highlighted). “[E]ach of the switches 270', 275' and 280' includes a control console 288 having a control module 284 and a memory 286 for storing and processing control and VLAN configuration instructions.” EX1005, 8:6-9.

153. Further the controller (console 288) includes *a memory storing instructions* and *a processor configured to execute the instructions* as I will explain below for limitations 1c-1i.

d. [1c] a memory storing instructions; and

154. Rijhsinghani discloses *a memory storing instructions* as recited in claim 1.

155. Figure 8 illustrates Rijhsinghani's switch including control console 288 (*a controller*) with memory 286, which constitutes *a memory storing instructions* as claimed. EX1005, 8:6-9.



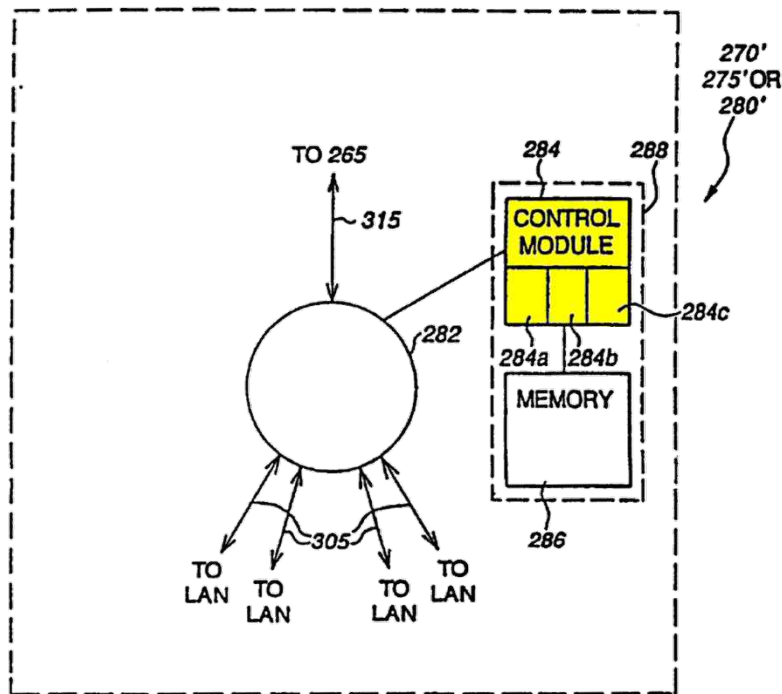
EX1005, Fig. 8 (highlighted). “[E]ach of the switches 270’, 275’ and 280’ includes a control console 288 having...a memory 286 for storing and processing control and VLAN configuration instructions.” EX1005, 8:6-9, see also 9:42-46 (“instructions may be stored in the memory 286 of the switch”).

156. I also identified memory 286 as *a storage storing a table, the table including rules and actions corresponding to the rules* in limitation 1a. A POSITA would know that switch memory could, and would, hold both instructions to be executed by a processor as well as routing and other types of tables. Thus, Rijhsinghani’s memory 286 is both *a storage* as recited in limitation 1a and *a memory* as recited in limitation 1c.

- e. [1d] a processor configured to execute the instructions to:

157. Rijhsinghani discloses *a processor configured to execute the instructions* as recited in claim 1.

158. Figure 8 illustrates Rijhsinghani's switch including control console 288 (*a controller*) with control module 284, which discloses *a processor* as claimed. EX1005, 8:6-11.



EX1005, Fig. 8 (highlighted).

159. “The control module 284 includes a controller 284a to control the switching device 282.” EX1005, 8:11-12. The control module 284 also includes “[a] detector 284b [that] detects a communication packet received from the backbone 265 via a trunk port 315 or from a LAN directly connected to the switch

via an access port 305.” EX1005, 8:12-15. “The control module 284 also includes a tagger 284c for tagging communications received via access port 305 for transmission from one member to another member of a configured VLAN by adding a VLAN header thereto.” EX1005, 8:60-63.

160. Based on Rijhsinghani’s description of control module 284, a person of ordinary skill in the art would know that control module 284 (including controller 284a, detector 284b, and tagger 284c) is software or firmware executed by *a processor* on the switch for “processing control and VLAN configuration instructions.” EX1005, 8:6-9. A POSITA would have known that switches such as Rijhsinghani’s included processors for executing instructions to process and route data packets. See, e.g., EX1015, 2:32-60, 4:19-36, 5:42-52, Fig. 1; EX1016, 1:45-58, 6:19-27; EX1008, 108; EX1022, 4-5, Fig. 2; EX1023, 3-4, Fig. 2.

161. Thus, Rijhsinghani discloses *a processor configured to execute the instructions* stored in memory 286. Further, the processor executes the instructions to perform the functions described in the following limitations of claim 1 as I will explain below.

f. [1e] receive the rules and the actions from a control apparatus;

162. Rijhsinghani discloses this limitation.

163. In Rijhsinghani, “[a] network management station (NMS) 290 controls the interconnection of the individual LANs such that LANs can be easily

bridged to other LANs on a long term or short term basis without the need to rewire the network.” EX1005, 2:10-14. As illustrated in Figure 2, “the NMS 290 has configured two VLANs by instructing, e.g., programming, and thereby configuring the switches 5'-55' such that LANs 10-60 are bridged together by switches 5', 15', 55', 35' to form VLAN 100' and LANs 70-90 are bridged together by switches 45' and 55' to form VLAN 200'.” EX1005, 2:14-19.

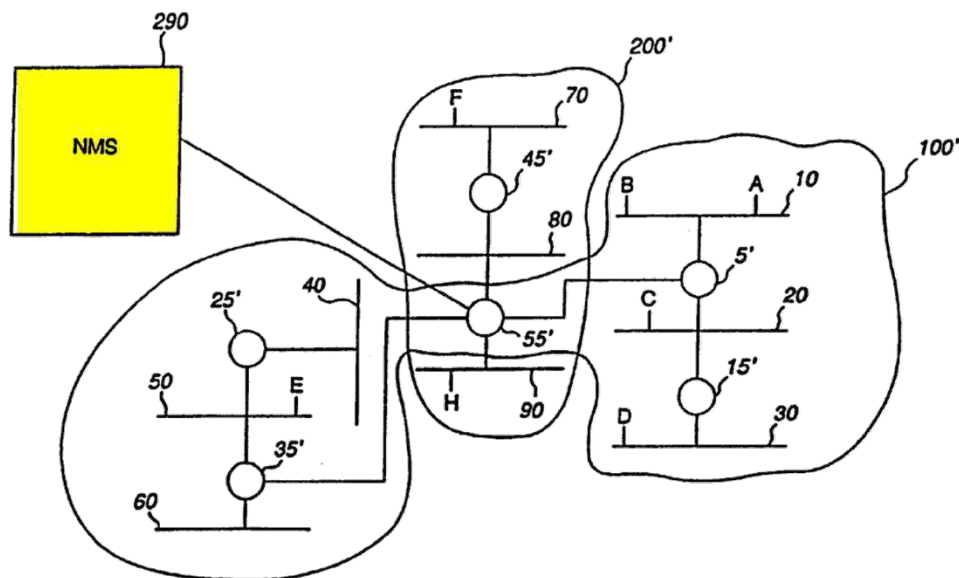


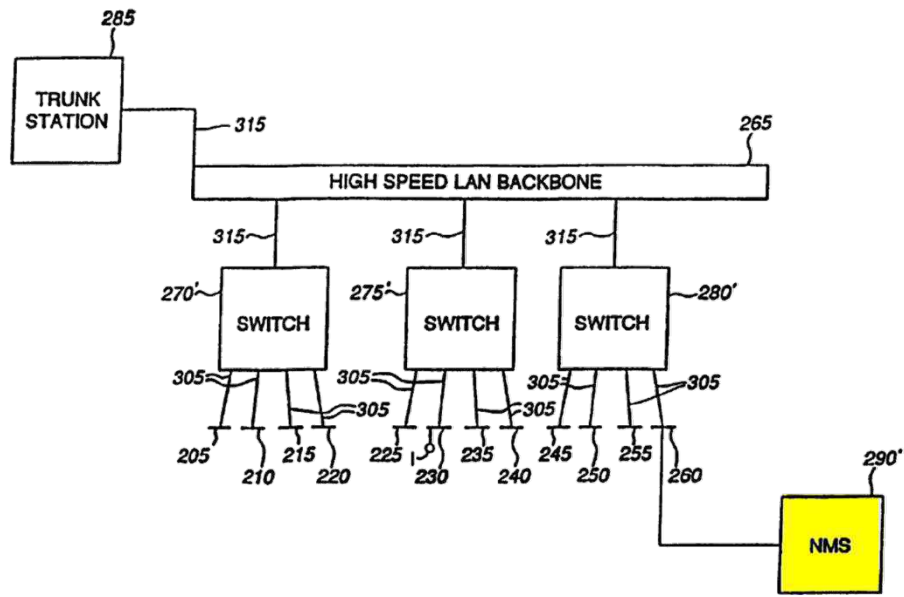
FIG. 2

EX1005, Fig. 2 (highlighted); see also Fig. 5. Thus, NMS 290 constitutes a *control apparatus* that controls the configuration of Rijhsinghani's switches among other things.

164. Further, Rijhsinghani's switches *receive the rules and the actions* from NMS 290 as claimed. Rijhsinghani states that “switches 5'-55' are multi-

ported and programmable by the NMS 290 such that the network can be configured and reconfigured in any desired manner by simply changing the switch instructions.” EX1005, 2:23-26. Rijhsinghani also states that “[i]f it becomes desirable to change the network configuration, this is easily accomplished by issuing commands from NMS 290 to the applicable switches 5'-55'.” EX1005, 2:36-39. Rijhsinghani describes, as an example based on Figure 2, that “if desired, user H could be easily added to VLAN 100' by simply reconfiguring VLAN 100' from the NMS 290. The NMS 290 issues an instruction to switch 55', instructing switch 55' to allow communications to flow between user A-D and E and user H via switch 55', i.e., to include LAN 90 in VLAN 100' and remove it from VLAN 200'.” EX1005, 2:39-46. Rijhsinghani explains that “the NMS 290 generates and transmits signals to instruct the switches 5'-55' to form the desired VLAN configurations.” EX1005, 2:53-56; see also 4:5-10. Thus, the switches *receive the rules and the actions from a control apparatus* (NMS 290).

165. In addition, Figure 7 illustrates “a VLAN system in accordance with the present invention.” EX1005, 7:33-34. Rijhsinghani states that “[a] network management station (NMS) 290', which may be a workstation having network management software loaded thereon, manages the network by configuring the network via the switches 270', 275' and 280' to form one or more virtual local area networks (VLANs).” EX1005, 7:58-63.



EX1005, Fig. 7 (highlighted). Like NMS 290 discussed above, NMS 290' constitutes *a control apparatus* as claimed.

166. Rijhsinghani states that switches 270', 275', and 280' include a control console 288 “for storing and processing control and VLAN configuration instructions,” which “may be...transmitted to the switch by the NMS 290'.”

EX1005, 8:6-11; see also 9:34-36 (“The NMS 290’ instructs the switches 270’-280’ as to the configurations of the different types of VLANs.”). Thus, in this disclosed embodiment too, Rijhsinghani’s switches *receive the rules and the actions from a control apparatus* (NMS 290’).

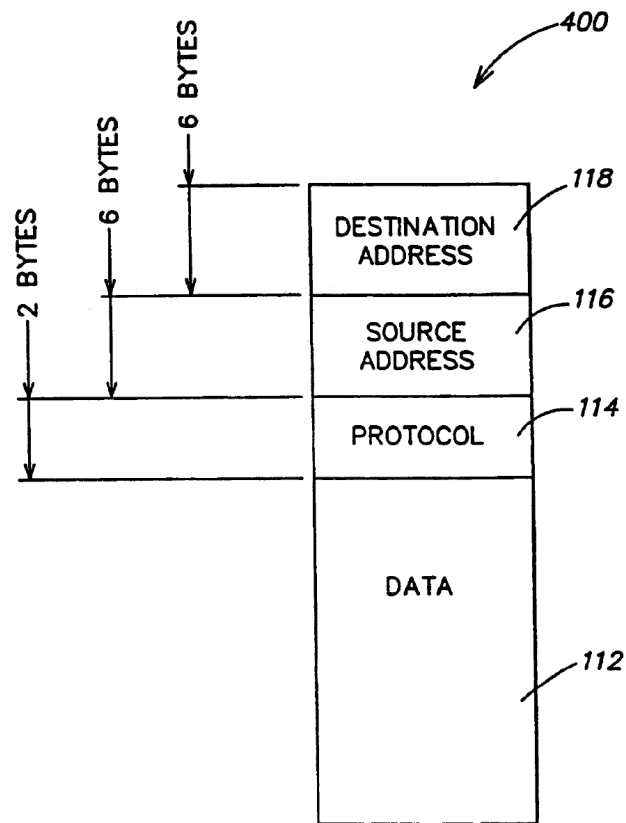
g. [1f] identify, based on the rules, a received packet;

167. Rijhsinghani discloses this limitation.

168. “When the NMS 290 configures a VLAN, the NMS instructs the appropriate switches to identify the VLAN for packets received at the switch.”

EX1005, 4:5-8. Figure 3 illustrates “a conventional LAN message packet.”

EX1005, 7:27. “In a conventional LAN protocol, a communication packet 400, as shown in FIG. 3, includes a destination address 118 having six bytes, a source address 116, and message data 112” as well as “an indication of the applicable LAN protocol identifier 114.” EX1005, 2:57-61.



EX1005, Fig. 3. In Rijhsinghani, “[a] switch control detects a communication [such as communication 400] from the local area network at the first port [of the switch] and identifies a virtual local area network over which the communication is

to be transmitted based upon rules of precedence for different types of virtual local area networks.” EX1005, 6:55-60. The packet illustrated in Figure 3 is *a received packet* (i.e., it is an example of a packet in the form received by a switch before a VLAN header has been added).

169. Further, Rijhsinghani discloses switches *identify[ing], based on the rules, a received packet*. For example, Rijhsinghani states that “[t]he switch determines, based upon instructions previously received from the NMS 290, that the LAN 205 falls within the applicable VLAN....” EX1005, 3:39-43; see also 4:5-10 (“When the NMS 290 configures a VLAN, the NMS instructs the appropriate switches to identify the VLAN for packets received at the switch. Identifying the appropriate VLAN for a packet enables the switch to transmit the packet over the appropriate VLAN.”). The “instructions previously received from the NMS 290” include the claimed *rules*, and the *received packet* is *identif[ied]* as associated with a particular VLAN based on those *rules* (i.e., instructions). EX1005, 7:1-4 (“Typically, the communication will include at least a source address and a protocol identifier, which the switch control detects, along with the port at which the communication is received, to identify the VLAN.”).

170. Rijhsinghani also states that “[e]ach of the switches 270'-280' is programmed to consider the applicable characteristics of each communication received, via an access port, in order to determine the appropriate VLAN tag to add

to the communication before transmission via the trunk port 315 to the high speed LAN backbone or trunk 265.” EX1005, 9:37-41. Thus, the switches “consider the applicable characteristics of each communication received” to *identify, based on the rules, a received packet* as one associated with a particular VLAN.

171. Additionally, “[e]ach of the switches 270'-280' is programmed to utilize an order of precedence to identify with certainty the appropriate VLAN for transmission of the received communication.” EX1005, 9:45-54. In this way too, the switches identify, based on *the rules*, a received packet as one associated with a particular VLAN. EX1005, 9:59-10:44 (providing specific examples with reference to Figure 9).

172. Figure 10 is a flow chart illustrating that the switches *identify, based on the rules, a received packet*. Figure 10 “summarizes the steps performed at each switch 270'-280' to correctly identify the appropriate VLAN for tagging a communication received from a LAN connected directly thereto by access port 305.” EX1005, 10:45-48. First, “in step 1300, the switch receives a communication, typically in the form of a packet, at an access port 305.” EX1005, 10:48-50.

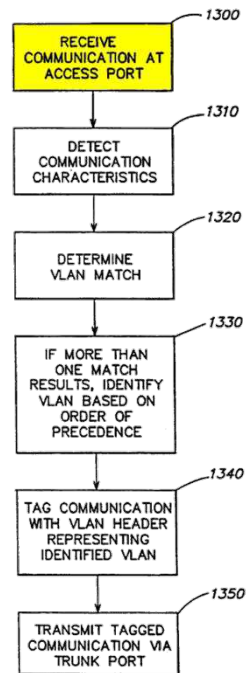


FIG. 10

EX1005, Fig. 10 (highlighted). Thus, the switch receives *a received packet*.

173. “In step 1310 the communication characteristics are detected by the detector 284b of the control module 288.” EX1005, 10:50-52.

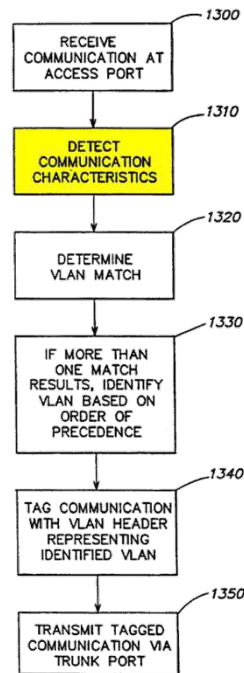


FIG. 10

EX1005, Fig. 10 (highlighted).

174. “In step 1320, the control module 288 [*a controller*], in accordance with the programmed instructions stored in the memory 286 [*rules and actions corresponding to the rules*], determines one or more VLAN matches, i.e. determines one or more VLANs with which the communication may be appropriately associated [*identify, based on the rules, a received packet*].”

EX1005, 10:55-59.

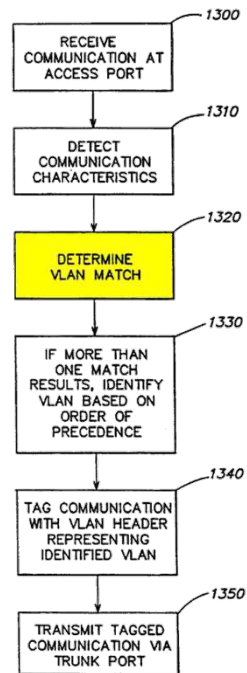


FIG. 10

EX1005, Fig. 10 (highlighted).

175. “In step 1330, in the case of more than one VLAN match, the applicable switch 270'-280' identifies which of the VLAN type matches has the highest priority based on the order of precedence....” EX1005, 10:64-11:4.

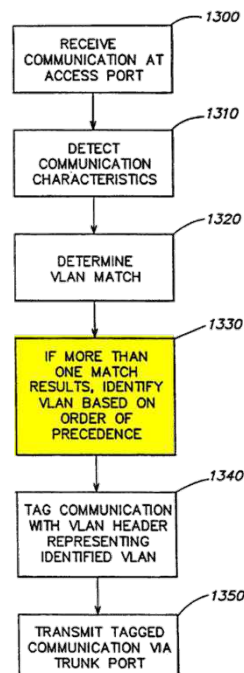


FIG. 10

EX1005, Fig. 10 (highlighted). This is a further disclosure that Rijhsinghani’s switches *identify...a received packet* by associating it with a particular VLAN *based on the rules* of precedence used to address overlap.

176. Further, Rijhsinghani’s switches also *identify, based on the rules, a received packet* by determining whether the packet is associated with any VLAN. EX1005, 8:16-18 (“Communications from the backbone 265 may or may not include a VLAN header....”). “For example, communications from a system user which is a member of the default group will not be tagged with a VLAN header by a switch connected via an access port 305 to the LAN on which the system user resides” where the “default group is a group of system users not within any VLAN.” EX1005, 8:18-23; see also 8:23-34, 3:62-63 (“The default group is a

group of system users or end stations not within any VLAN.”). Rijhsinghani states that “[f]or a communication packet sent by a system user within the default group, the initial switch to which the packet is directed determines that the system user does not fall within any VLAN, and consequently does not add a VLAN header.” EX1005, 3:63-67. Thus, for default group communications, the switch *identif[ies]...a received packet* as one that is not associated with a VLAN—and therefore does not have a VLAN header added—based on the communication’s characteristics (*based on the rules*).

177. Rijhsinghani also states that “where the sender and addressee are each members of a LAN connected to the same switch, there is no need to add a VLAN header to the communication before directing it to an output port 305.” EX1015, 9:13-16; see also 9:25-30. Again, in this case, the switch *identif[ies]...a received packet* as one that is not associated with a VLAN—and therefore does not need a VLAN header—based on the communication’s characteristics (*based on the rules*).

178. Thus, Rijhsinghani discloses in a number of different ways that the switches *identify, based on the rules, a received packet*.

h. [1g] duplicate a part of a header of the identified packet as an additional header when the identified packet comprises a target of encapsulation;

179. Rijhsinghani discloses this limitation.

180. Rijhsinghani’s Figure 4 illustrates “a VLAN communications packet

400' which is similar to the LAN communication packet 400 depicted in FIG. 3, except that a VLAN header has been added to the packet.” EX1005, 3:22-25. The source address and destination address used for the VLAN header are duplicates of the source address and destination address of the packet received by the switch.

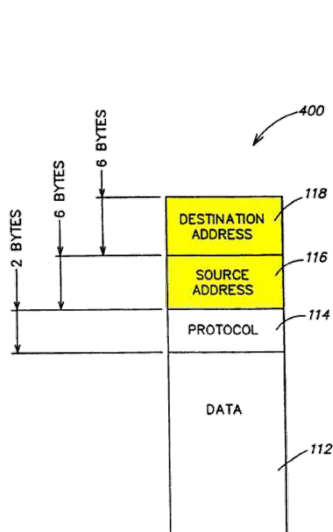


FIG. 3

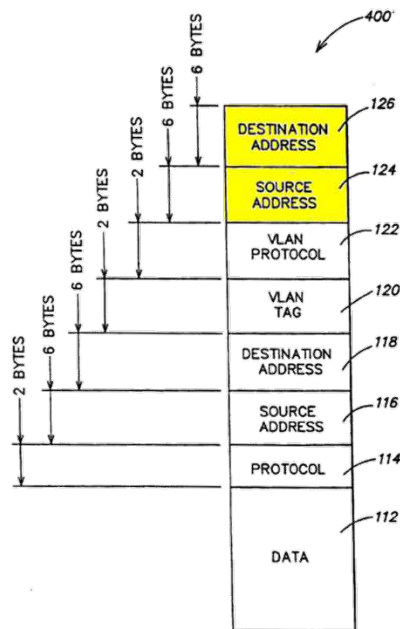


FIG. 4

EX1005, Figs. 3 and 4 (highlighted). Rijhsinghani expressly states that “[t]he VLAN header, as shown [in Figure 4], includes a destination address 126 which is the same address as the destination address 118 [and] source address 124 which is the same as source address 116....” EX1005, 3:29-33. Thus, Rijhsinghani’s switches *duplicate a part of a header of the identified packet* (source and destination address).

181. Further, the switches do so when the received packet is associated

with a VLAN and will have a VLAN header added to it. EX1005, 3:22-26 (“The VLAN header is added by the initial switch to which the message packet is directed.”), 3:26-29 (“The VLAN header identifies the resulting packet as a ‘VLAN’ or ‘tagged’ packet....”). As I discussed for limitation 1f, not all packets are associated with a VLAN. EX1005, 8:16-18. For instance, “communications from a system user which is a member of the default group will not be tagged with a VLAN header....” EX1005, 8:18-23; see also 3:62-67, 8:23-34. Similarly, “where the sender and addressee are each members of a LAN connected to the same switch, there is no need to add a VLAN header to the communication....” EX1005, 9:13-16; see also 9:25-30. Thus, the switch will *duplicate a part of a header of the identified packet...when the identified packet comprises a target of encapsulation* (i.e., when the packet will have an additional header added to it). See Section IV.E.1, above (construction of this claim language).

182. The switch will *duplicate a part of a header of the identified packet as an additional header* as claimed. As I discussed above, this claim limitation means that when a packet is identified as a target for encapsulation (i.e., when it will have an additional header added), the switch duplicates part of the existing header to use as part of the new header that will be used to encapsulate the packet. See Section IV.E.1, above (construction of this claim language). Rijhsinghani discloses exactly that by duplicating part of the header information in the received packet so that it

can be used as part of the VLAN header added to the packet.

183. As illustrated in Figures 3 and 4, the received packet's source address 116 and destination address 118 are duplicated for use in the VLAN header as source address 124 and destination address 126. EX1005, 3:29-33. The VLAN header constitutes the *additional header* recited in the claim.

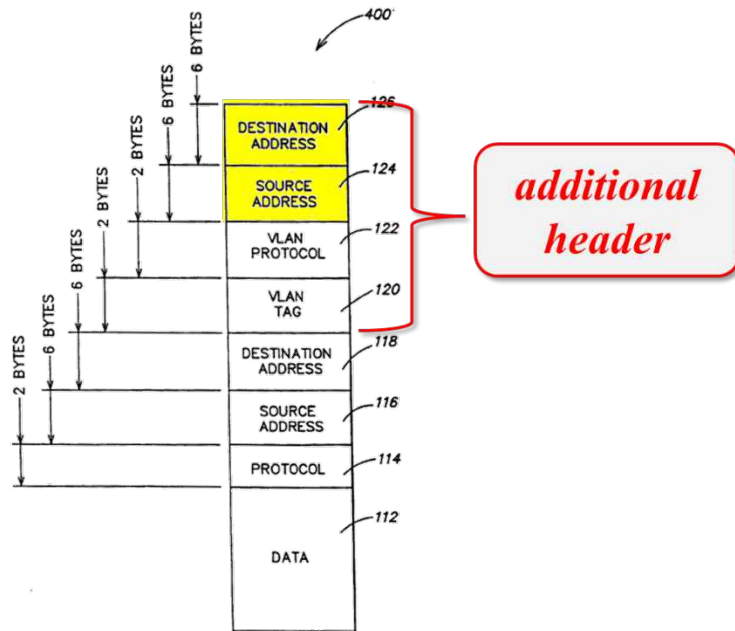


FIG. 4

EX1005, Fig. 4 (annotated); see also 3:29-34. Thus, the switch *duplicate[s] a part of a header of the identified packet* (source address and destination address) to use *as an additional header* (in the new VLAN header) *when the identified packet comprises a target of encapsulation* (when the packet will have a VLAN header added).

184. To the extent the Patent Owner may argue that the *additional header*

is limited to the duplicated information, then the source and destination addresses within the VLAN header would constitute such an *additional header*.

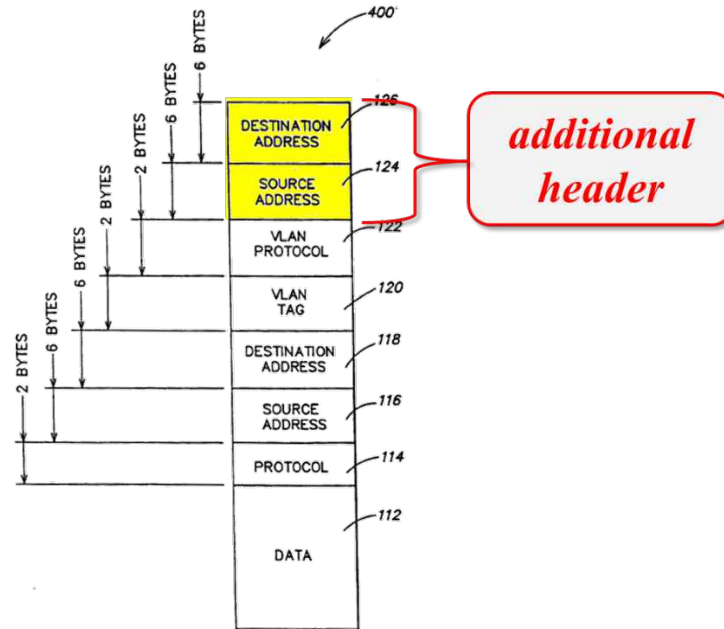


FIG. 4

EX1005, Figure 4 (annotated).

185. Thus, Rijhsinghani's switches *duplicate a part of a header of the identified packet as an additional header when the identified packet comprises a target of encapsulation* as recited in claim 1.

i. [1h] encapsulate the identified packet by the additional header; and

186. Rijhsinghani discloses this limitation.

187. Rijhsinghani's switches *encapsulate the identified packet by the additional header* by adding a VLAN header, which Rijhsinghani also refers to as a VLAN tag, to the packet. EX1005, 1 (Abstract) ("The communication is

appended with a VLAN tag representing the identified virtual local area network so as to form a VLAN communication....”), 3:23-27 (“The VLAN header is added by the initial switch to which the message packet is directed.”), 3:39-43, Figs. 3 and 4.

188. Rijhsinghani states that “[a]fter the VLAN has been identified, the switch control adds a VLAN tag representing the identified VLAN to form a VLAN communication.” EX1005, 7:4-7. In particular, the switch’s control module 284 includes “tagger 284c for tagging communications received via an access port 305 for transmission from one member to another member of a configured VLAN by adding a VLAN header thereto.” EX1005, 8:60-63; see also 9:17-22, 9:25-29 (“This is accomplished by identifying communications between LANs within configured VLANs and tagging the communications...with a VLAN header.”), 9:45-54, 9:59-10:44, 11:46-47.

189. The flow chart of Figure 10 shows that, after the packet is associated with one or more VLANs, “[i]n step 1340, the communication is tagged with the VLAN header representing the highest priority identified VLAN.” EX1005, 11:5-7.

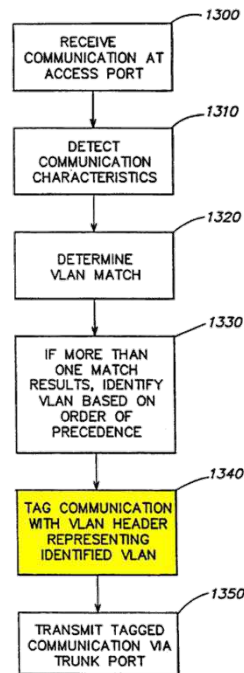


FIG. 10

EX1005, Fig. 10 (highlighted). This step constitutes *encapsulat[ing] the identified packet by the additional header* as claimed.

j. [1i] process, based on the actions, the identified packet.

190. Rijhsinghani discloses this limitation.

191. Rijhsinghani’s switches *process...the identified packet* by forwarding it, and they do so *based on the actions* because the packet is forwarded based on its association with a particular VLAN. Rijhsinghani states that, after the appropriate VLAN is identified and the VLAN header is added, “packet 400’ is then directed via trunk port 315 to the high-speed backbone LAN 265 and detected by switches 275 and 280.” EX1005, 3:39-45; see also 7:1-9 (“After the VLAN has been identified, the switch control adds a VLAN tag representing the identified VLAN

to form a VLAN communication. The switch control then directs the VLAN communication to the second communication port for transmission over the identified virtual local area network.”), 11:47-51 (“[T]he tagger 284c of switch 275’ tags the packet with the VLAN header representing VLAN 1100. Last, the switch 275’ transmits the tagged packet via the trunk port 315 onto the high-speed backbone 265 to be forwarded to system user at address V in the conventional manner.”).

192. The flow chart of Figure 10 shows that, after the packet is tagged with the VLAN header, “[i]n step 1350, the tagged communication is transmitted via the trunk port 315 from the switch and from there forwarded to the appropriate addressee or addressees in the conventional manner.” EX1005, 11:7-10.

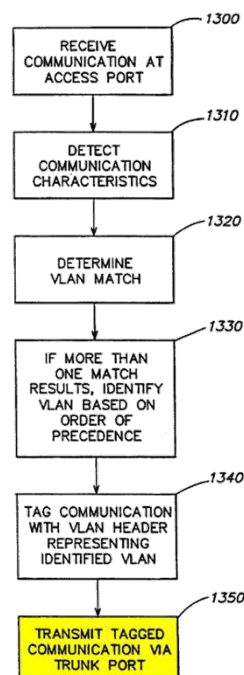


FIG. 10

EX1005, Fig. 10 (highlighted). This step constitutes *process[ing]*, based on the actions, the identified packet as claimed.

2. Dependent Claim 5: The switch apparatus according to claim 1, wherein the processor is further configured to execute the instructions for translation of first header data of a head of the received packet into second header data.

193. Rijhsinghani discloses the limitations of claim 1 for the reasons I explained for that claim. Rijhsinghani also discloses the additional limitation recited in claim 5.

194. As discussed in more detail for limitation 1d, Rijhsinghani's switches include control module 284 that is executed by *the processor*. See Section VI.A.1.e, above. Control module 284 includes detector 284b, which "detects a communication packet received from the backbone 265 via a trunk port 315 or from a LAN directly connected to the switch via an access port 305." EX1005, 8:12-15. "The control module 284 also includes a tagger 284c for tagging communications received via an access port 305 for transmission from one member to another member of a configured VLAN by adding a VLAN header thereto." EX1005, 8:60-63.

195. As discussed for limitation 1g, Rijhsinghani's switch (control module 284) creates the VLAN header using copies of the source address and destination address of the packet received by the switch (by detector 284b). See Section VI.A.1.h, above. Thus, Rijhsinghani's control module 284, executed by

the processor, performs a translation of first header data of a head of the received packet (including source and destination address from the received packet as in Figures 3 and 4) into second header data (VLAN header as in Figure 4), as recited in claim 5.

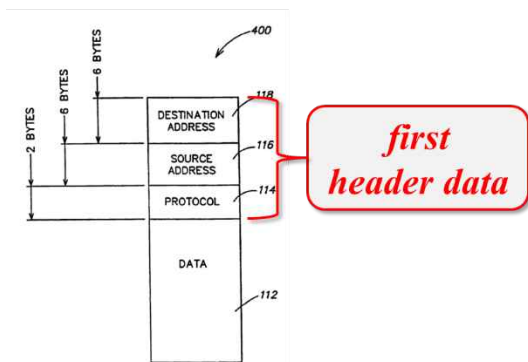


FIG. 3

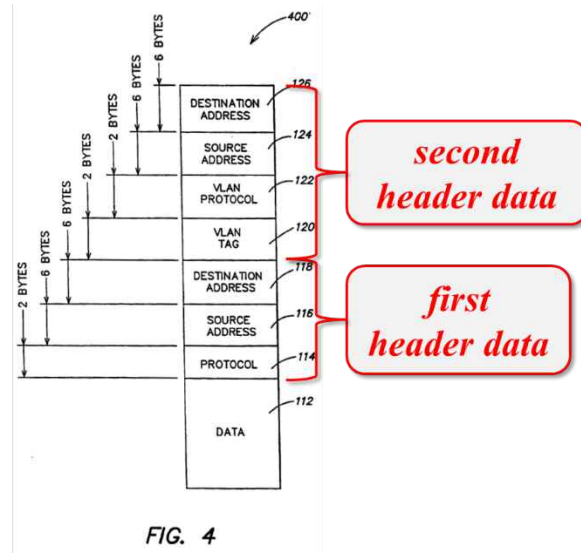


FIG. 4

EX1005, Fig. 3 and 4 (annotated).

3. **Dependent Claim 6:** The switch apparatus according to claim 5, wherein the instructions to encapsulate the identified packet includes notifying the controller of the first header data before the translation and the second header data after the translation.

196. Rijhsinghani discloses the limitations of claim 5 for the reasons I explained for that claim. Rijhsinghani also discloses the additional limitation recited in claim 6.

197. Claim 6 recites *notifying the controller* of the *first header data* and the *second header data*. The term *the controller* in claim 6 refers to the *controller*

recited in claim 1. In particular, limitation 1b recites *a controller* that is included in the claimed *switch apparatus*. As I discussed for limitation 1b, Rijhsinghani's control console 288 constitutes the *controller* of claim 1. See Section VI.A.1.c, above.

198. Rijhsinghani's control console 288 (*the controller*) includes detector 284b, which detects a received packet including its source address and destination address (*the first header data before the translation*). EX1005, 8:12-15. The control console 288 (*the controller*) also includes tagger 284c, which adds the VLAN header to the packet (*the second header data after the translation*). EX1005, 8:60-63. Thus, *the instructions to encapsulate the identified packet includes the detector 284b and tagger 284c notifying the controller (control console 288) of the first header data before the translation (source address and destination address of the received packet) and the second header data after the translation (VLAN header)*.

4. Independent Claim 7

a. A communication system, comprising:

199. Rijhsinghani discloses a *communication system*, as recited in the preamble of claim 7.

200. For example, Rijhsinghani's Abstract refers to a switch for use in "a communications system having multiple local area networks interconnected by

multiple switches so as to be configurable into different types of virtual local area networks....” EX1005, 1 (Abstract). In a section entitled “Field of the Invention,” Rijhsinghani states that “[t]he present invention relates generally to communications networks and more particularly to communications systems having various types of virtual local area networks and established rules of precedence for matching a communication packet with a particular virtual local area network.” EX1005, 1:8-12; see also 6:42-46 (“a switch is provided for use in a virtual communications system”), 7:10-12, 7:49-50 (“FIG. 7 depicts a virtual communications system or network in accordance with the present invention.”).

b. a control apparatus configured to control a plurality of switch apparatuses; and

201. Rijhsinghani discloses this limitation of claim 7.

202. As I discussed for limitation 1e, Rijhsinghani discloses a network management station (referred to as NMS 290 or NMS 290') that constitutes *a control apparatus*. See Section VI.A.1.f, above.

203. As illustrated in Figure 2, “the NMS 290 has configured two VLANs by instructing, e.g., programming, and thereby configuring the switches 5'-55' such that LANs 10-60 are bridged together by switches 5', 15', 55', 35' to form VLAN 100' and LANs 70-90 are bridged together by switches 45' and 55' to form VLAN 200'.” EX1005, 2:14-19.

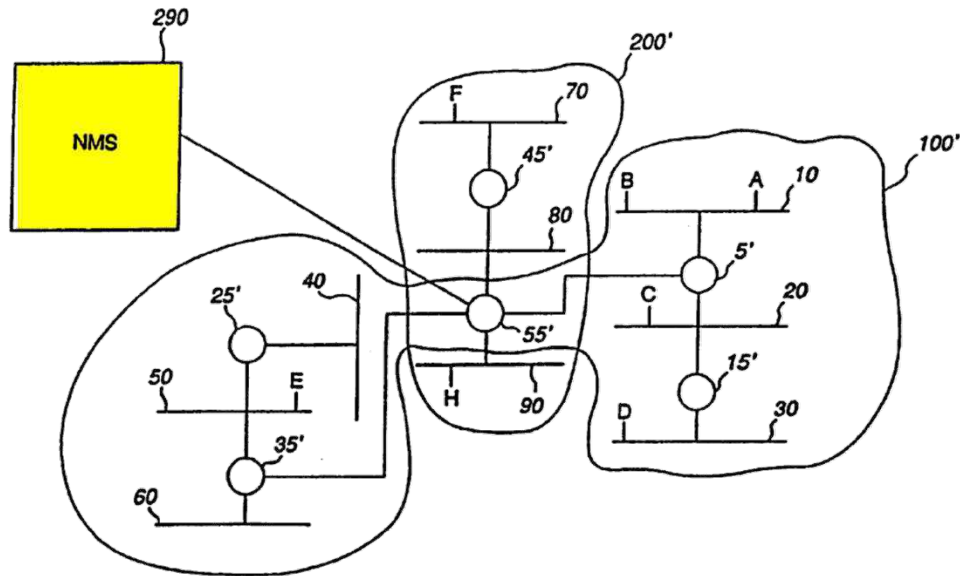


FIG. 2

EX1005, Fig. 2 (highlighted); see also Fig. 5. Thus, NMS 290 constitutes *a control apparatus configured to control a plurality of switch apparatuses*.

204. In addition, Figure 7 illustrates “[a] network management station (NMS) 290’, which may be a workstation having network management software loaded thereon, manages the network by configuring the network via the switches 270’, 275’ and 280’ to form one or more virtual local area network (VLANs).” EX1005, 7:58-63; see also 2:62-3:22, Fig. 5.

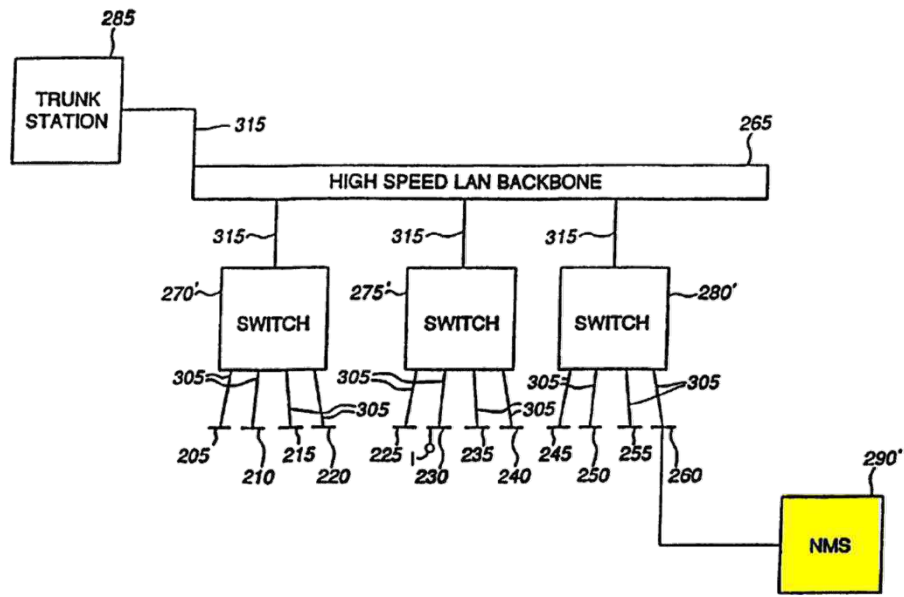


FIG. 7

EX1005, Fig. 7 (highlighted). Thus, NMS 290' constitutes *a control apparatus configured to control a plurality of switch apparatuses*.

c. a switch apparatus of the switch apparatuses comprising:

205. Rijhsinghani discloses this limitation of claim 7.

206. Rijhsinghani discloses *a switch apparatus* for all the reasons I discussed for claim 1, which recites *a switch apparatus*. See Section VI.A.1, above. For example, Rijhsinghani's Abstract discloses "[a] switch for use in a communications system having multiple local area networks interconnected by multiple switches so as to be configurable into different types of virtual local area networks...." EX1005, 1 (Abstract); see also 12:34-35 ("wherein the network device is a switch"), 12:41-42 (same), 12:53-54 (same), 13:13-14 (same), 13:18-19

(same), 13:25-26 (same), 13:37-38 (same), 14:16-17 (same), 14:21-22 (same), 14:28-29 (same), 14:40-41 (same).

207. Further, each switch is one of several that are controller by a network management station (*control apparatus*) such that each is *a switch apparatus of the switch apparatuses* (i.e., the *plurality of switch apparatuses* controlled by the *control apparatus*). For example, Figure 2 illustrates a network in which “the NMS 290 has configured two VLANs by instructing, e.g., programming, and thereby configuring the switches 5'-55' such that LANs 10-60 are bridged together by switches 5', 15', 55', 35' to form VLAN 100' and LANs 70-90 are bridged together by switches 45' and 55' to form VLAN 200'.” EX1005, 2:14-19.

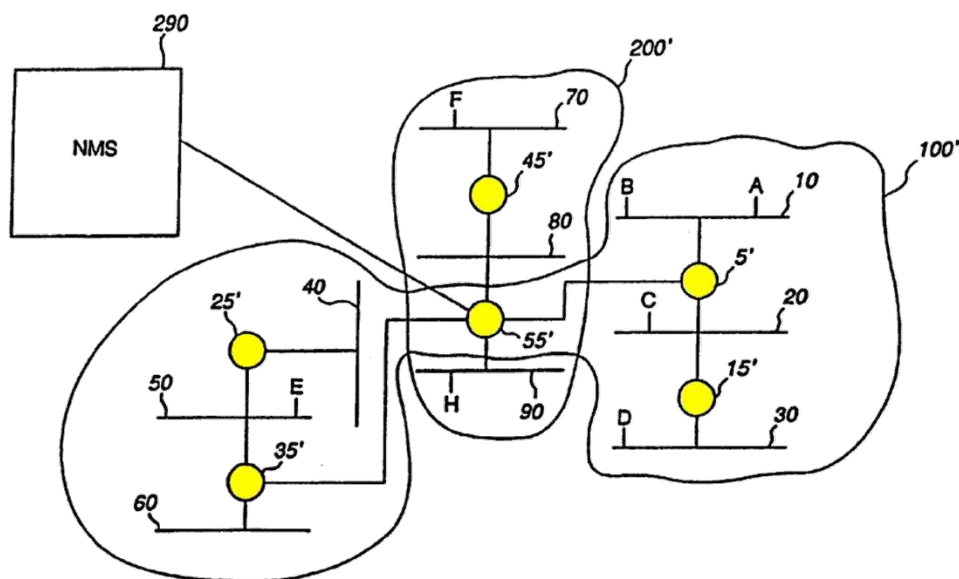


FIG. 2

EX1005, Fig. 2 (highlighted). Thus, each of switches 5'-55' constitutes *a switch*

apparatus of the switch apparatuses.

208. Figure 5 illustrates a “conventional VLAN system” including switches 270, 275, and 280. EX1005, 2:62-65. “An NMS 290 is interconnected to the switches 270-280 via LAN 260.” EX1005, 2:65-66. The NMS configures VLANs by instructing the switches to connect certain LANs. EX1005, 3:8-22.

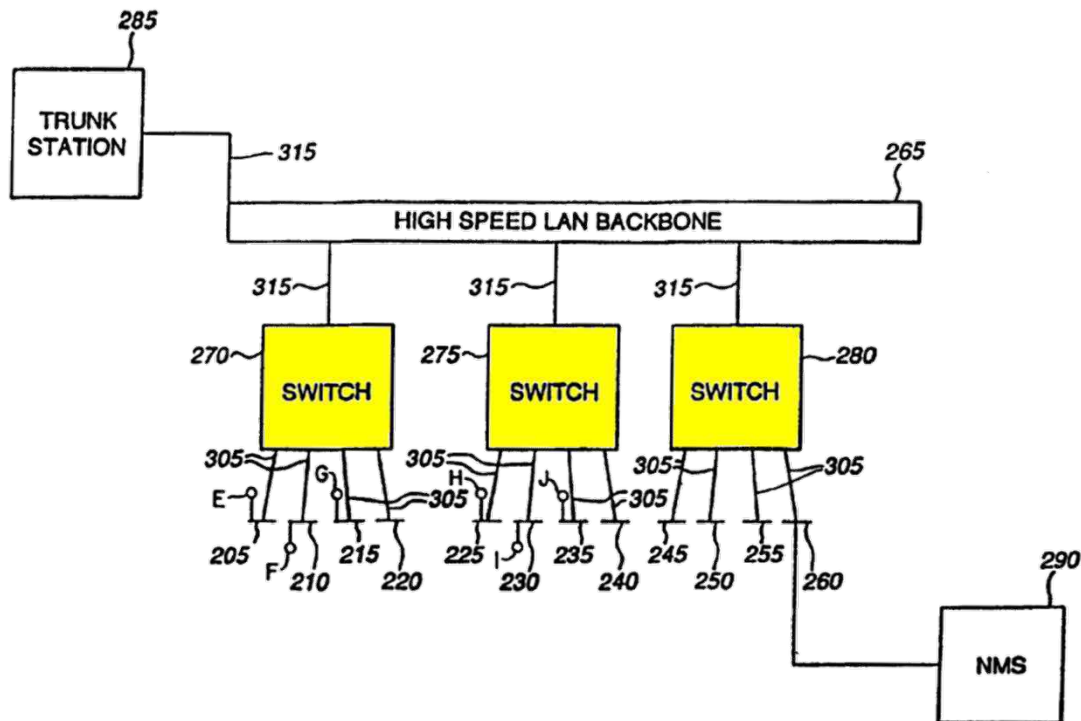


FIG. 5

EX1005, Fig. 5 (highlighted). Each of switches 270, 275, and 280 constitutes a *switch apparatus of the switch apparatuses.*

209. Similarly, Rijhsinghani’s Figure 7 illustrates a “network [that] includes multiple Local Area Networks (LANs) 205-260 interconnected by multiple multi-ported reconfigurable switches 270’, 275’, and 280’ all of which are

connected by a high speed backbone LAN 265, often referred to as the trunk.”

EX1005, 7:49-55.

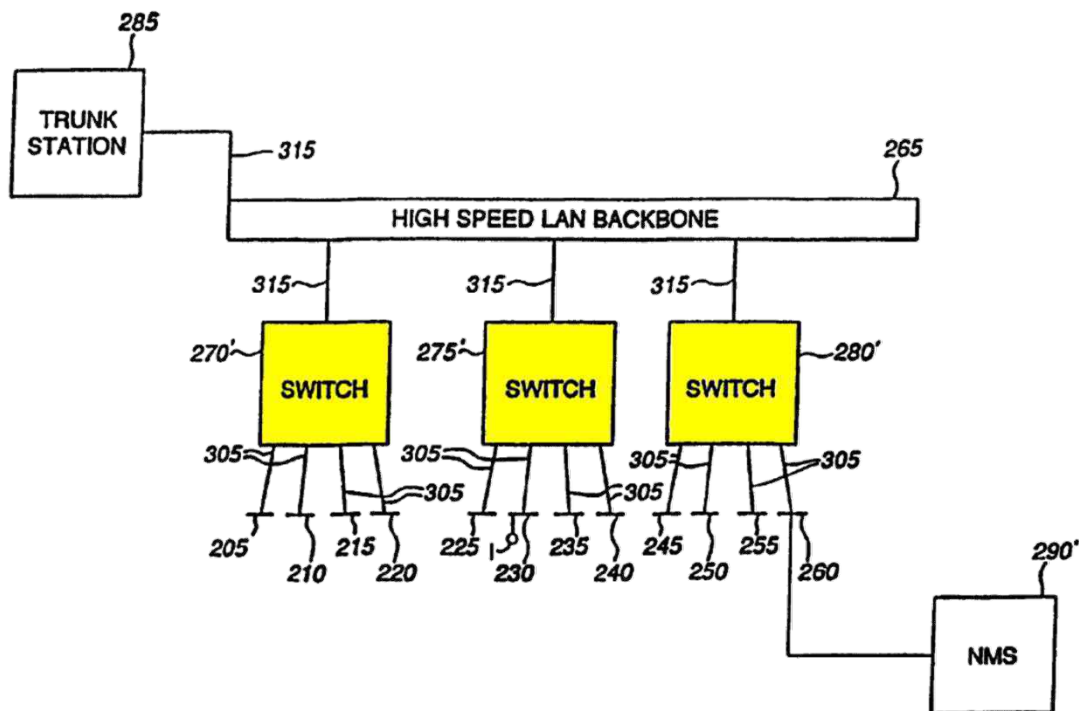


FIG. 7

EX1005, Fig. 7 (highlighted). Each of switches 270', 275', and 280' constitutes *a switch apparatus of the switch apparatuses*.

- d. a storage storing a table, the table including rules and actions corresponding to the rules; and**

210. This limitation of claim 7 is identical to the corresponding limitation in claim 1 (limitation 1a). See Paragraph 56, above (comparing claims 1 and 7). This limitation of claim 7 is disclosed for the reasons I discussed for limitation 1a. See Section VI.A.1.b, above.

e. a controller comprising:

211. This limitation of claim 7 is identical to the corresponding limitation in claim 1 (limitation 1b). See Paragraph 56, above (comparing claims 1 and 7). This limitation of claim 7 is disclosed for the reasons I discussed for limitation 1b. See Section VI.A.1.c, above.

f. a memory storing instructions; and

212. This limitation of claim 7 is identical to the corresponding limitation in claim 1 (limitation 1c). See Paragraph 56, above (comparing claims 1 and 7). This limitation of claim 7 is disclosed for the reasons I discussed for limitation 1c. See Section VI.A.1.d, above.

g. a processor configured to execute the instructions to:

213. This limitation of claim 7 is identical to the corresponding limitation in claim 1 (limitation 1d). See Paragraph 56, above (comparing claims 1 and 7). This limitation of claim 7 is disclosed for the reasons I discussed for limitation 1d. See Section VI.A.1.e, above.

h. receive the rules and the actions from a controller;

214. Rijhsinghani discloses this limitation of claim 7.

215. The reference to *a controller* in this limitation refers to an external controller, such as the *control apparatus* of claim 1 and the first limitation of claim 7, rather than the *controller* included in the *switch apparatus* as recited in a prior limitation of claim 7.

216. My reading of the term *a controller* in this limitation of claim 7 is supported by the claim language itself. For instance, this limitation refers to *a controller* rather than referring to “the controller,” which would indicate the controller previously recited in claim 7. Further, claim 7 recites a *switch apparatus* that is highly similar to the “switch apparatus” of claim 1 in which the corresponding limitation 1e recites that “the rules and the actions” are received from a “control apparatus.” A contrary reading of this limitation as referring to the same *controller* recited earlier in claim 7 would not make sense because it would require *a controller to receive the rules and actions* from itself.

217. The patent specification also supports my reading of this claim limitation because it refers to a “controller” as a separate network device apart from the “switches” that provides routing instructions to the switches. EX1001, 4:44-53, Fig. 1. The specification also states that the “controller” can be a “computer[] such as a PC (personal computer), appliance, a thin client terminal/server, a workstation, a mainframe, and a supercomputer...” EX1001, 5:16-19.

218. In addition, Patent Owner appears to read this claim limitation in the related litigation the same way I do (i.e., generally equating it with limitation 1e). EX1030, 80.

219. Based on my understanding that this limitation of claim 7 means that

the switch *receive[s] the rules and the actions from a controller* such as the *control apparatus*, it is equivalent in scope to limitation 1e and disclosed for the same reasons. See Section VI.A.1.f, above.

i. identify, based on the rules, a received packet;

220. This limitation of claim 7 is identical to the corresponding limitation in claim 1 (limitation 1f). See Paragraph 56, above (comparing claims 1 and 7). This limitation of claim 7 is disclosed for the reasons I discussed for limitation 1f. See Section VI.A.1.g, above.

j. duplicate a part of a header of the identified packet as an additional header when the identified packet comprises a target of encapsulation;

221. This limitation of claim 7 is identical to the corresponding limitation in claim 1 (limitation 1g). See Paragraph 56, above (comparing claims 1 and 7). This limitation of claim 7 is disclosed for the reasons I discussed for limitation 1g. See Section VI.A.1.h, above.

k. encapsulate the identified packet by the additional header; and

222. This limitation of claim 7 is identical to the corresponding limitation in claim 1 (limitation 1h). See Paragraph 56, above (comparing claims 1 and 7). This limitation of claim 7 is disclosed for the reasons I discussed for limitation 1h. See Section VI.A.1.i, above.

l. process, based on the actions, the identified packet.

223. This limitation of claim 7 is identical to the corresponding limitation in claim 1 (limitation 1i). See Paragraph 56, above (comparing claims 1 and 7). This limitation of claim 7 is disclosed for the reasons I discussed for limitation 1i. See Section VI.A.1.j, above.

5. Dependent Claim 11: The communication system according to claim 7, wherein the processor is further configured to execute the instructions for translation of the first header data of a head of the received packet into the second header data.

224. Rijhsinghani discloses the limitations of claim 7 for the reasons I explained for that claim. Rijhsinghani also discloses the additional limitation recited in claim 11.

225. The additional limitation recited in claim 11 is virtually identical to the limitation recited in claim 5. See Paragraph 65, above (comparing claims 5 and 11). Claim 11 is disclosed for the reasons I discussed for claim 5. See Section VI.A.2, above.

6. Dependent Claim 12: The communication system according to claim 11, wherein the instructions to encapsulate the identified packet includes notifying the controller of first header data before the translation and second header data after the translation.

226. Rijhsinghani discloses the limitations of claim 11 for the reasons I explained for that claim.

227. Claim 12 recites *notifying the controller*, which is ambiguous because

claim 7 (from which claim 12 indirectly depends) recites two different controllers. First, claim 7 recites *a switch apparatus of the switch apparatuses comprising...a controller* (i.e., *a controller* included in the *switch apparatus*). Second, claim 7 also recites that the *switch apparatus...receive[s] the rules and the actions from a controller*, which is an external controller such as the *control apparatus* as I explained for claim 7. See Section VI.A.4.h, above.

228. If I assume that *the controller* of claim 12 is the controller included in the switch apparatus, then claim 12 is similar in scope to claim 6. The language of claims 6 and 12 are virtually identical. See Paragraph 67, above (comparing claims 6 and 12). Because the reference to “the controller” in claim 6 is the controller included in the switch apparatus of claim 1, claim 12 is disclosed by Rijhsinghani for the reasons I discussed for claim 6 (based on the construction of *the controller* assumed in this paragraph). See Section VI.A.3, above. I will address claim 12 assuming the other construction in Sections VI.B.8 and VI.C.8, below.

7. Independent Claim 13

a. A communication method, comprising:

229. Rijhsinghani discloses a *communication method*, as recited in the preamble of claim 13, for at least the reasons I discussed for limitations 1e-1i. See Sections VI.A.1.f-VI.A.1.j, above; see also EX1005, 1 (Abstract), 1:8-12, 3:23-45,

4:1-37, 6:26-7:9.

b. receiving rules and actions from a controller;

230. This limitation of claim 13 is virtually identical to the corresponding limitation in claim 7. As in claim 7, the reference in claim 13 to *a controller* means an external controller, such as a “control apparatus,” for the reasons I explained for claim 7. See Section VI.A.4.h, above.

231. Claim 13 recites a *communication method* that is highly similar to the functions performed by the “switch apparatus” of claim 1 in which the corresponding limitation 1e recites that “the rules and the actions” are received from a “control apparatus.” The patent specification also supports my reading of this claim limitation because it refers to a “controller” as a separate network device apart from the “switches” that provides routing instructions to the switches.

EX1001, 4:44-53, Fig. 1. The specification also states that the “controller” can be a “computer[] such as a PC (personal computer), appliance, a thin client terminal/server, a workstation, a mainframe, and a supercomputer....” EX1001, 5:16-19. In light of the claim language and the patent specification, the reference in claim 13 to *a controller* means, or at least includes, an external controller such as a control apparatus. Patent Owner appears to read this claim limitation in the related litigation the same way I do (i.e., generally equating it with limitation 1e). EX1030, 84.

232. Based on my understanding that this limitation of claim 13 recites *receiving the rules and the actions from a controller*, which can be an external controller such as a control apparatus, it is similar to and at least as broad in scope as limitation 1e. Thus, it is disclosed for the same reasons I discussed for limitation 1e. See Section VI.A.1.f, above.

c. identifying, based on the rules, a received packet;

233. This limitation of claim 13 is virtually identical to the corresponding limitation in claim 1 (limitation 1f). See Paragraph 57, above (comparing claims 1 and 13). This limitation of claim 13 is disclosed for the reasons I discussed for limitation 1f. See Section VI.A.1.g, above.

d. duplicating a part of a header of the identified packet as an additional header when the identified packet comprises a target of encapsulation;

234. This limitation of claim 13 is virtually identical to the corresponding limitation in claim 1 (limitation 1g). See Paragraph 57, above (comparing claims 1 and 13). This limitation of claim 13 is disclosed for the reasons I discussed for limitation 1g. See Section VI.A.1.h, above.

e. encapsulating the identified packet by the additional header; and

235. This limitation of claim 13 is virtually identical to the corresponding limitation in claim 1 (limitation 1h). See Paragraph 57, above (comparing claims 1 and 13). This limitation of claim 13 is disclosed for the reasons I discussed for

limitation 1h. See Section VI.A.1.i, above.

f. processing, based on the actions, the identified packet.

236. This limitation of claim 13 is virtually identical to the corresponding limitation in claim 1 (limitation 1i). See Paragraph 57, above (comparing claims 1 and 13). This limitation of claim 13 is disclosed for the reasons I discussed for limitation 1i. See Section VI.A.1.j, above.

8. Independent Claim 19

a. A non-transitory recording medium recording a program which when executed causes a switch to perform a method, the method comprising:

237. Rijhsinghani discloses the preamble of claim 19 for at least the reasons I discussed for limitations 1c-1i. See Sections VI.A.1.d-VI.A.1.j, above.

238. In particular, Rijhsinghani discloses switches that include memory 286 (*[a] non-transitory recording medium recording a program*) as illustrated in Figure 8. See Section VI.A.1.d, above. “[E]ach of the switches 270’, 275’ and 280’ includes a control console 288 having...a memory 286 for storing and processing control and VLAN configuration instructions.” EX1005, 8:6-9, see also 9:42-46 (“instructions may be stored in the memory 286 of the switch”). A person of ordinary skill in the art would understand from Rijhsinghani’s reference to storing instructions in memory that the switches disclosed in Rijhsinghani would have non-transitory memory or storage in order to preserve the stored instructions when the switches are powered off or reset. A processor executes instructions

stored in the memory to perform each of the functions recited in limitations 1e to 1i, which mirror the steps recited in claim 19. See Sections VI.A.1.e-VI.A.1.j, above. Thus, Rijhsinghani discloses a *non-transitory recording medium recording a program which when executed causes a switch to perform a method* including the steps recited in claim 19.

b. receiving rules and actions from a controller;

239. This limitation of claim 19 is identical to the corresponding limitation in claim 13 and virtually identical to the corresponding limitation in claim 1 (limitation 1e). See Paragraph 57, above (comparing claims 1 and 13) and Paragraph 58, above (comparing claims 13 and 19). This limitation of claim 19 is disclosed for the reasons I discussed for claim 13 and limitation 1e. See Sections VI.A.7.b and VI.A.1.f, above.

c. identifying, based on the rules, a received packet;

240. This limitation of claim 19 is identical to the corresponding limitation in claim 13 and virtually identical to the corresponding limitation in claim 1 (limitation 1f). See Paragraph 57, above (comparing claims 1 and 13) and Paragraph 58, above (comparing claims 13 and 19). This limitation of claim 19 is disclosed for the reasons I discussed for claim 13 and limitation 1f. See Sections VI.A.7.c and VI.A.1.g, above.

d. duplicating a part of a header of the identified packet as an additional header when the identified packet comprises a target of encapsulation;

241. This limitation of claim 19 is identical to the corresponding limitation in claim 13 and virtually identical to the corresponding limitation in claim 1 (limitation 1g). See Paragraph 57, above (comparing claims 1 and 13) and Paragraph 58, above (comparing claims 13 and 19). This limitation of claim 19 is disclosed for the reasons I discussed for claim 13 and limitation 1g. See Sections VI.A.7.d and VI.A.1.h, above.

e. encapsulating the identified packet by the additional header; and

242. This limitation of claim 19 is identical to the corresponding limitation in claim 13 and virtually identical to the corresponding limitation in claim 1 (limitation 1h). See Paragraph 57, above (comparing claims 1 and 13) and Paragraph 58, above (comparing claims 13 and 19). This limitation of claim 19 is disclosed for the reasons I discussed for claim 13 and limitation 1h. See Sections VI.A.7.e and VI.A.1.i, above.

f. processing, based on the actions, the identified packet.

243. This limitation of claim 19 is identical to the corresponding limitation in claim 13 and virtually identical to the corresponding limitation in claim 1 (limitation 1i). See Paragraph 57, above (comparing claims 1 and 13) and Paragraph 58, above (comparing claims 13 and 19). This limitation of claim 19 is

disclosed for the reasons I discussed for claim 13 and limitation 1i. See Sections VI.A.7.f and VI.A.1.j, above.

B. The Combination of Rijhsinghani and RFC-5474 Renders Claims 2-4, 8-10, 12, 14-18, and 20 Obvious

244. Each of dependent claims 2-4, 8-10, 12, 14-18, and 20 include limitations regarding a switch apparatus sending header information to an external controller, as I will discuss in more detail below. (Note that I also addressed claim 12 above assuming a different construction of that claim.)

245. As discussed above, Rijhsinghani discloses communication systems in which a network management station (NMS) configures switches to implement virtual local area networks (VLANs). Rijhsinghani describes the external NMS sending instructions to the network switches but does not expressly discuss the switches sending information to the external NMS. However, RFC-5474 describing the PSAMP protocol discloses a well-known, prior art technique used by switches and other network devices to send header information to an external controller such as Rijhsinghani's NMS. Because a person of ordinary skill in the art would have been motivated to implement the PSAMP protocol in Rijhsinghani's network switches as discussed below, the combination of Rijhsinghani and RFC-5474 renders these claims obvious.

1. Motivation to Combine Rijhsinghani and RFC-5474

246. A person of ordinary skill in the art would have considered RFC-5474

because it is in the same field of endeavor as the '177 Patent and Rijhsinghani, namely network communications. EX1006, 2; EX1005, 1 (Abstract), 1:8-12, 6:26-35; EX1001, 1:14-16, 4:33-38. Indeed, RFCs were (and are) a primary source for understanding standardized techniques used in network communications, as a POSITA would have known. A POSITA implementing a communications network disclosed by Rijhsinghani would have naturally looked to RFC-5474 (and other RFCs) for standard network communications techniques that would permit interoperability within the network and with other networks. EX1006, 4 (“The motivation for the PSAMP standard comes from the need for measurement-based support for network management and control across multivendor domains.”); EX1018.

247. Rijhsinghani itself provides further motivation for a POSITA to consider RFC-5474. Rijhsinghani explains that “LAN network administrators generally attempt to connect together those users who frequently communicate with each other in bridged LANs.” EX1005, 1:45-47. “If, for example, in FIG. 1, user E and user A need to communicate frequently, it would be advantageous to interconnect LAN 10 and LAN 50 via a bridge rather than a router 300,” but “[t]his would require the rewiring of the system which is costly and may be impracticable under many circumstances, such as, if users A and E will only need to frequently communicate for a limited period of time.” EX1005, 1:53-60. In contrast, with a

virtual LAN (VLAN) system, as discussed in Rijhsinghani, “the bridging of LANs can be changed as desired without the need to rewire the network.” EX1005, 1:67-2:1. “A network management station (NMS) 290 controls the interconnection of the individual LANs such that LANs can be easily bridged to other LANs on a long term or short term basis without the need to rewire the network.” EX1005, 2:10-14. Thus, Rijhsinghani suggests and teaches that network administrators and designers were motivated to understand network traffic in order to configure or reconfigure network elements.

248. One common technique used by network administrators to configure and reconfigure networks including LANs and VLANs is called network traffic measurement or analysis. EX1025, 1 (“Traffic measurement is a critical component for the control and engineering of communication networks.”). Traffic management plays such a critical role in networking that I spent over 60 pages discussing it in my book *Internet Measurement*. Network traffic analysis is based on information provided by network nodes, such as switches and routers, about communications flowing through a network. By 2011, packet sampling techniques as disclosed by RFC-5474 were well known and in common use. For example, Hewlett-Packard introduced products with embedded packet sampling capability (HP Extended RMON) in 1993. EX1026; EX1028, 3. Indeed, sampling techniques had been in use since the early days of the Internet. EX1024; EX1025.

249. By 2011, a POSITA would have recognized the benefit of implementing switches compliant with the PSAMP protocol of RFC-5474. Such a person could have implemented Rijhsinghani's VLAN system using commercially available switches, which would have allowed network administrators to use Rijhsinghani's NMS with existing network traffic analysis tools to understand network traffic and to configure VLANs in the system as desired. EX1006, 29 ("Packet Sampling is ideally suited to determine the composition of the traffic across a network."); EX1027, 33-34. In fact, RFC-5474 states that the PSAMP framework requirements were "motivated by the dual aims of ubiquitous deployment and utility of the reports for applications." EX1006, 2.

250. In addition, a POSITA would recognize that implementing the PSAMP protocol in Rijhsinghani's network would aid in troubleshooting network problems. RFC-5474 states that "PSAMP Packet Reports can also be used to diagnose problems whose occurrence is evident from aggregate statistics, per interface utilization and packet loss statistics." EX1006, 30-31. Further, a POSITA would have understood that monitoring network traffic using PSAMP could be used to create summaries of network usage that could be used for billing and for capacity planning.

251. A POSITA could have implemented the PSAMP protocol of RFC-5474 in Rijhsinghani's network system without undue experimentation and

with a reasonable expectation of success. Packet sampling technology was well-known and routine well before the PSAMP protocol. EX1006, 26 (“Indeed, Sampling and Filtering operations are already realized in available equipment.”). The PSAMP protocol itself was intended to be “simple and inexpensive to implement.” EX1006, 26 (“In order for PSAMP to be supported across the entire spectrum of networking equipment, it must be simple and inexpensive to implement.”).

2. Dependent Claim 2: The switch apparatus according to claim 1, wherein the processor is further configured to execute the instructions to send header information to the control apparatus when the identified packet comprises an encapsulated packet.

252. Rijhsinghani discloses the limitations of claim 1 for the reasons I explained for that claim. The combination of Rijhsinghani and RFC-5474 discloses the additional limitation recited in claim 2.

253. In the combination of Rijhsinghani and RFC-5474, the *switch apparatus* disclosed by Rijhsinghani would be implemented to comply with the PSAMP protocol disclosed by RFC-5474. Such a *switch apparatus* is a “PSAMP Device” that selects packets and uses them to generate “Packet Reports” that are sent to a remote “Collector,” which would be located at Rijhsinghani’s network management station (*control apparatus*). EX1006, 5, 9. Each Packet Report must include “a basic report on the packet, i.e., some number of continuous bytes from

the start of the packet, including the packet header (which includes network layer and any encapsulation headers)....” EX1006, 19-20. Thus, in the combination, Rijhsinghani’s *switch apparatus* would be *configured...to send header information to the control apparatus* in compliance with the PSAMP protocol of RFC-5474.

254. Further, RFC-5474 describes a number of techniques for a PSAMP Device to select packets for reporting. EX1006, 15-17. One option is a technique called “Property Match Filtering” in which “a packet is selected if a specific field within the packet...equal(s) a predefined value.” EX1006, 14. RFC-5474 states: “Property match operations should be available for different protocol portions of the packet header” including “encapsulation headers....” EX1006, 15. The “encapsulation header” in Rijhsinghani’s VLAN communication packet is the VLAN header (as illustrated in Figure 4). Thus, Rijhsinghani’s switch apparatus employing property match filtering based on the VLAN header (encapsulation header) to select a packet for reporting—as taught by RFC-5474—would *send header information to the control apparatus when the identified packet comprises an encapsulated packet* as recited in claim 2.

3. Dependent Claim 3: The switch apparatus according to claim 2, wherein the header information includes the additional header.

255. The combination of Rijhsinghani and RFC-5474 discloses claim 2 for the reasons I explained for that claim. The combination of Rijhsinghani and

RFC-5474 also discloses the additional limitation recited in claim 3.

256. As I explained for claim 2, in the combination of Rijhsinghani and RFC-5474, the *switch apparatus* would be a PSAMP Device that selects packets and uses them to generate and send Packet Reports to Rijhsinghani's network management station (*control apparatus*). EX1006, 5, 9. Each Packet Report must include "a basic report on the packet, i.e., some number of continuous bytes from the start of the packet, including the packet header (which includes network layer and any encapsulation headers)...." EX1006, 19-20. In Rijhsinghani's VLAN communication packets (as illustrated in Figure 4), the "encapsulation header" referred to in RFC-5474 would be the VLAN header, which is or includes the *additional header* of claim 1 (limitation 1g). See Section VI.A.1.h, above. Because the Packet Report necessarily includes "any encapsulation headers," *the header information* sent by Rijhsinghani's switch *includes the additional header*.

4. Dependent Claim 4: The switch apparatus according to claim 3, wherein the processor is further configured to execute further instructions to decapsulate the encapsulated packet.

257. The combination of Rijhsinghani and RFC-5474 discloses claim 3 for the reasons I explained for that claim. The combination of Rijhsinghani and RFC-5474 also discloses the additional limitation recited in claim 4.

258. Rijhsinghani describes removing the VLAN header from VLAN communication packets (*decapsulat[ing] the encapsulated packet*). Rijhsinghani's

control module 284 includes “a tagger 284c for tagging communications received via an access port 305 for transmission from one member to another member of a configured VLAN by adding a VLAN header thereto.” EX1005, 8:60-63. In addition, “tagger 284c also removes the VLAN header from a communication received from the switch’s trunk port 315 that is to be forwarded to a member of a LAN connected to the switch by an access port.” EX1005, 8:63-67. “More particularly, the tagger 284c discards the tag by removing the VLAN header from the communication, prior to the communication being transmitted to the appropriate output port 305, i.e., prior to the controller 284a controlling the switching device 282 to transmit the communication from the trunk port 315 to the access port 305.” EX1005, 8:67-9:6; see also 3:50-54 (“The switch 275 accordingly removes the VLAN header and directs the packet, which now appears as packet 400 of FIG. 3, to LAN 230 over which the member I receives the message.”).

5. **Dependent Claim 8: The communication system according to claim 7, wherein the processor is further configured to execute the instructions to send header information to the control apparatus when the identified packet comprises an encapsulated packet.**

259. Rijhsinghani discloses the limitations of claim 7 for the reasons I explained for that claim. The combination of Rijhsinghani and RFC-5474 discloses the additional limitation recited in claim 8.

260. The additional limitation recited in claim 8 is identical to the limitation recited in claim 2. See Paragraph 59, above (comparing claims 2 and 8). Claim 8 is disclosed for the reasons I discussed for claim 2. See Section VI.B.2, above.

6. Dependent Claim 9: The communication system according to claim 8, wherein the header information includes the additional header.

261. The combination of Rijhsinghani and RFC-5474 discloses claim 8 for the reasons I explained for that claim. The combination of Rijhsinghani and RFC-5474 also discloses the additional limitation recited in claim 9.

262. The additional limitation recited in claim 9 is identical to the limitation recited in claim 3. See Paragraph 61, above (comparing claims 3 and 9). Claim 9 is disclosed for the reasons I discussed for claim 3. See Section VI.B.3, above.

7. Dependent Claim 10: The communication system according to claim 9, wherein the processor is further configured to execute further instructions to decapsulate the encapsulated packet.

263. The combination of Rijhsinghani and RFC-5474 discloses claim 9 for the reasons I explained for that claim. The combination of Rijhsinghani and RFC-5474 also discloses the additional limitation recited in claim 10.

264. The additional limitation recited in claim 10 is identical to the limitation recited in claim 4. See Paragraph 63, above (comparing claims 4

and 10). Claim 10 is disclosed for the reasons I discussed for claim 4. See Section VI.B.4, above.

8. Dependent Claim 12: The communication system according to claim 11, wherein the instructions to encapsulate the identified packet includes notifying the controller of first header data before the translation and second header data after the translation.

265. Rijhsinghani discloses the limitations of claim 11 for the reasons I explained for that claim.

266. As I discussed above in Section VI.A.6, claim 12's reference to *notifying the controller* is ambiguous because claim 7 (from which claim 12 indirectly depends) recites two different controllers. First, claim 7 recites *a switch apparatus of the switch apparatuses comprising...a controller* (i.e., a controller included in the *switch apparatus*). Second, claim 7 also recites that the *switch apparatus...receive[s] the rules and the actions from a controller*, which is an external controller such as the *control apparatus* as I explained for claim 7. See Section VI.A.4.h, above.

267. As I discussed for claim 5, Rijhsinghani's control module 284 translates *first header data before the translation* (including source and destination address in the received packet as in Figure 3 and Figure 4) into *second header data after the translation* (VLAN header as in Figure 4).

268. If I assume that *the controller* of claim 12 is located at an external

control apparatus—as opposed to in the switch—then claim 12 is similar in scope to claims 2 and 3. Those claims recite “send[ing] header information to the control apparatus when the identified packet comprises an encapsulation packet” (claim 2) and that “the header information includes the additional header” (claim 3).

269. According to RFC-5474, each Packet Report sent to the external controller includes “a basic report on the packet, i.e., some number of continuous bytes from the start of the packet, including the packet header (which includes network layer and any encapsulation headers)” (EX1006, 19-20), which therefore includes both *first header data before the translation and second header data after the translation*, as shown in the following annotation of Figure 4.

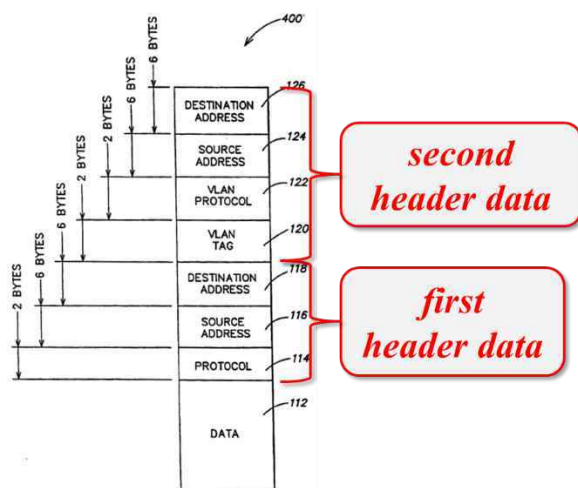


FIG. 4

EX1005, Fig. 4 (annotated).

270. For these reasons, and the reasons I explained for claims 2, 3, and 5, the combination of Rijhsinghani and RFC-5474 discloses claim 12 (based on the

construction of *the controller* assumed in this section). See Sections VI.B.2, VI.B.3, and VI.A.2, above.

9. Dependent Claim 14: The communication method according to claim 13, further comprising: sending header information to a controller when the identified packet comprises an encapsulated packet.

271. Rijhsinghani discloses the limitations of claim 13 for the reasons I explained for that claim. The combination of Rijhsinghani and RFC-5474 discloses the additional limitation recited in claim 14.

272. The additional limitation recited in claim 14 is similar to the limitation recited in claim 2. See Paragraph 60, above (comparing claims 2 and 14). The primary difference between the claims is that claim 2 recites sending header information “to the control apparatus” and claim 14 recites sending header information “to a controller.” For the reasons I explained for claim 7 and for claim 13, the reference in claim 14 to *a controller* means an external controller such as a control apparatus. See Sections VI.A.4.h and VI.A.7.b, above. Thus, claim 14 is similar in scope to claim 2 and is disclosed for the reasons I discussed for that claim. See Section VI.B.2, above.

10. Dependent Claim 15: The communication method according to claim 14, wherein the header information includes the additional header.

273. The combination of Rijhsinghani and RFC-5474 discloses claim 14 for the reasons I explained for that claim. The combination of Rijhsinghani and

RFC-5474 also discloses the additional limitation recited in claim 15.

274. The additional limitation recited in claim 15 is identical to the limitation recited in claim 3. See Paragraph 62, above (comparing claims 3 and 15). Claim 15 is disclosed for the reasons I discussed for claim 3. See Section VI.B.3, above.

11. Dependent Claim 16: The communication method according to claim 15, further comprising: executing further instructions to decapsulate the encapsulated packet.

275. The combination of Rijhsinghani and RFC-5474 discloses claim 15 for the reasons I explained for that claim. The combination of Rijhsinghani and RFC-5474 also discloses the additional limitation recited in claim 16.

276. The additional limitation recited in claim 16 is virtually identical to the limitation recited in claim 4. See Paragraph 64, above (comparing claims 4 and 16). Claim 16 is disclosed for the reasons I discussed for claim 4. See Section VI.B.4, above.

12. Dependent Claim 17: The communication method according to claim 14, further comprising: translating first header data of a head of the received packet into second header data.

277. The combination of Rijhsinghani and RFC-5474 discloses claim 14 for the reasons I explained for that claim. The combination of Rijhsinghani and RFC-5474 also discloses the additional limitation recited in claim 17.

278. The additional limitation recited in claim 17 is virtually identical to

the limitation recited in claim 5. See Paragraph 66, above (comparing claims 5 and 17). Claim 17 is disclosed for the reasons I discussed for claim 5. See Section VI.A.2, above.

13. Dependent Claim 18: The communication method according to claim 17, further comprising: notifying the controller of the first header data before the translating and the second header data after the translating.

279. The combination of Rijhsinghani and RFC-5474 discloses claim 17 for the reasons I explained for that claim. The combination of Rijhsinghani and RFC-5474 also discloses the additional limitation recited in claim 18.

280. The additional limitation recited in claim 18 is virtually identical to the limitation recited in claim 6. See Paragraph 68, above (comparing claims 6 and 18). Claim 18 is disclosed for the reasons I discussed for claim 6. See Section VI.A.3, above.

14. Dependent Claim 20: The non-transitory recording medium, according to claim 19, the method further comprising: sending header information to the controller when the identified packet comprises an encapsulated packet, wherein the header information includes the additional header.

281. Rijhsinghani discloses the limitations of claim 19 for the reasons I explained for that claim. The combination of Rijhsinghani and RFC-5474 discloses the additional limitations recited in claim 20.

282. The additional limitations recited in claim 20 are virtually identical to

the limitations recited in claims 14 and 15. See Paragraph 69, above (comparing claims 14 and 15 to claim 20). Claim 20 is disclosed for the reasons I discussed for claim 14 and claim 15. See Sections VI.B.9 and VI.B.10, above.

C. The Combination of Rijhsinghani and Lean Renders Claims 2-4, 8-10, 12, 14-18, and 20 Obvious

283. As I discussed above, each of dependent claims 2-4, 8-10, 12, 14-18, and 20 include limitations regarding a switch apparatus sending header information to an external controller. See Paragraph 244, above.

284. As I also discussed above, Rijhsinghani discloses communication systems in which a network management station (NMS) configures switches to implement virtual local area networks (VLANs). Rijhsinghani describes the external NMS sending instructions to the network switches but does not expressly discuss the switches sending information to the NMS. However, Lean discusses techniques for switches and other network devices to send copies of packets, including their header information, to an external controller such as Rijhsinghani's NMS. Because a person of ordinary skill in the art would have been motivated to implement Lean's techniques in Rijhsinghani's network switches, as discussed below, the combination of Rijhsinghani and Lean renders these claims obvious.

1. Motivation to Combine Rijhsinghani and Lean

285. A person of ordinary skill in the art would have considered Lean because it is in the same field of endeavor as the '177 Patent and Rijhsinghani,

namely network communications. EX1007, 1 (Abstract), [0002]; EX1005, 1 (Abstract), 1:8-12, 6:26-35; EX1001, 1:14-16, 4:33-38. Further, Lean contemplates monitoring tunneled network traffic in which packets have been encapsulated. EX1007, [0002], [0005], [0007]-[0008]. And both the '177 Patent and Rijhsinghani also involve transmission of encapsulated packets. EX1005, 3:23-34, Fig. 4; EX1001, 3:31-59, 6:48-54.

286. Rijhsinghani itself provides further motivation for a POSITA to consider Lean. As I discussed above, Rijhsinghani states that “LAN network administrators generally attempt to connect together those users who frequently communicate with each other in bridged LANs.” EX1005, 1:45-47. “If, for example, in FIG. 1, user E and user A need to communicate frequently, it would be advantageous to interconnect LAN 10 and LAN 50 via a bridge rather than a router 300,” but “[t]his would require the rewiring of the system which is costly and may be impracticable under many circumstances, such as, if users A and E will only need to frequently communicate for a limited period of time.” EX1005, 1:53-60. In contrast, with a VLAN system, as discussed in Rijhsinghani, “the bridging of LANs can be changed as desired without the need to rewire the network.” EX1005, 1:67-2:1. “A network management station (NMS) 290 controls the interconnection of the individual LANs such that LANs can be easily bridged to other LANs on a long term or short term basis without the need to rewire the

network.” EX1005, 2:10-14. Thus, Rijhsinghani suggests and teaches that network administrators and designers were motivated to understand network traffic in order to configure or reconfigure network elements.

287. As I discussed above, one common technique used by network administrators to configure and reconfigure networks including LANs and VLANs is called network traffic measurement or analysis. EX1025, 1 (“Traffic measurement is a critical component for the control and engineering of communication networks.”). Traffic management plays such a critical role in networking that I spent over 60 pages discussing it in my book *Internet Measurement*. Network traffic analysis is based on information provided by network nodes, such as switches and routers, about communications flowing through a network. By 2011, systems that passively copied packets traversing a network connection for external traffic analysis were common and would have been well-known to a POSITA. EX1019, 1:14-2:19, 2:55-67, 5:31-64, 8:5-11, Figs. 1-4; EX1020, 1 (Abstract), 1:13-2:10, 2:13-27, 3:14-33, Figs. 1-5; EX1021, 1 (Abstract), [0005]-[0019], Fig. 1-3.

288. Lean discusses several packet monitoring techniques that, when implemented in Rijhsinghani’s network system, would permit a network administrator to monitor network traffic in order to configure and reconfigure the LANs and VLANs in the network system.

289. For example, Lean discloses two embodiments of “conventional” packet monitoring systems illustrated in Figures 1 and 2. EX1007, [0018]-[0020]. In either conventional system, “taps 104” copy packets traversing the network and forward them to an external processor (Figure 1) or processors (Figure 2) for monitoring and analyzing the traffic. EX1007, [0003]-[0004], [0007], [0018]-[0020]. As Lean explains, “[e]ach tap 104 passively copies all IP packets transmitted across Ethernet link 100 and sends the IP packet copy stream 106 to processor 108 for analysis.” EX1007, [0018]. A POSITA would recognize that using either of the “conventional” monitoring technique disclosed by Lean could be implemented in Rijhsinghani’s network system so that network switches would passively copy packets and send them to the NMS for analysis. Such a combination would permit a network administrator to configure and reconfigure the LANs and VLANs in Rijhsinghani’s network system.

290. Lean describes taps or probes that copy packets being transmitted across the network. EX1007, [0018]-[0020]; see also [0031]. A POSITA would have known that the same disclosed functionality could be implemented in Rijhsinghani’s switches. Indeed, a POSITA would have recognized that locating the functionality for copying and forwarding packets in the network switches would have provided superior visibility to network traffic as opposed to a network appliance like a tap or probe. EX1026 (“In a switched environment, the most

effective place to monitor traffic is within the switch/router, where all the traffic will be seen. Traditional probes will only have a partial view of traffic.”).

291. Lean describes a potential problem with conventional network monitoring systems as illustrated in Figure 2. For instance, Lean states that “[o]ne problem with using information associated with the network and transport layer information in a packet to segregate traffic for network monitoring purposes occurs when a packet is tunneled.” EX1007, [0026]. In some circumstances, the “outer or encapsulating IP packet for each packet being transmitted in each direction...may include the same source and destination IP addresses,” in which case “segregation cannot be performed based on the outer header.” EX1007, [0026]. This potential problem would not dissuade a POSITA from implementing Lean’s prior art network monitoring functionality in Rijhsinghani’s network system because Rijhsinghani’s communication packets duplicate the source and destination addresses in the inner header and the outer header. Therefore, Lean’s prior art monitoring system (as in Figure 2) could segregate network packets using the source and destination address of the outer header in Rijhsinghani’s system as effectively as if it used the source and destination address of the inner header—because they are the same.

292. Lean also describes embodiments of the invention disclosed in the patent. Two inventive embodiments are illustrated in Figures 6 and 7. As in the

prior art systems, taps 608 “copy packets that traverse a high bandwidth IP network.” EX1007, [0031]. Lean’s invention involves how the copied packets are analyzed and used to segregate traffic at the external packet monitoring system. EX1007, [0029]-[0035], Figs. 6, 7. Thus, the packet copying functionality in Rijhsinghani’s switches would be the same, and Lean’s invention would involve modifications to Rijhsinghani’s external NMS.

293. A POSITA would have been motivated to implement Lean’s invention in Rijhsinghani’s network system for reasons stated in Lean. For instance, Lean states that an “advantage” of the disclosed invention is “increased IP traffic segregation granularity.” EX1007, [0038]. Lean’s invention permits “deep packet classification” based on packet information that may be at the “application, presentation, and session layer....” EX1007, [0033]; see also [0032]. Thus, implementing Lean’s invention in Rijhsinghani’s network system would allow network administrators to use Lean’s “deep packet classification” to segregate copied packets at a granular level thereby enhancing the traffic monitoring system.

294. A POSITA could have implemented Lean’s packet monitoring techniques in Rijhsinghani’s network system without undue experimentation and with a reasonable expectation of success. Techniques for copying and forwarding packets to an external analyzer, as in Lean, were well-known. EX1007, [0003]-

[0008]; EX1019; EX1020; EX1021. Based on Lean's disclosure, a POSITA could have modified Rijhsinghani's NMS to implement Lean's techniques for segregating packets based on various types of information in each packet as described by Lean without undue experimentation and with a reasonable expectation of success.

2. Claim 2: The switch apparatus according to claim 1, wherein the processor is further configured to execute the instructions to send header information to the control apparatus when the identified packet comprises an encapsulated packet.

295. Rijhsinghani discloses the limitations of claim 1 for the reasons I explained for that claim. The combination of Rijhsinghani and Lean discloses the additional limitation recited in claim 2.

296. In the combination of Rijhsinghani and Lean, the *switch apparatus* disclosed by Rijhsinghani would be modified to perform the functionality of the "tap" in Lean's prior art systems (e.g., Figures 1 and 2) or in Lean's inventive embodiments (e.g., Figures 6 and 7).

297. In Lean's prior art system of Figure 1, "tap 104 passively copies all IP packets...and sends the IP packet copy stream 106 to processor 108 for analysis." EX1007, [0018], Fig. 1. In the prior art system of Figure 2, taps 104 similarly "copy IP packets traversing high speed Ethernet connections 100" and "forward the copied packets to IP header packet distribution function 202" in the remote IP

packet monitoring system 200. EX1007, [0020], Fig. 2. In the disclosed embodiments of Lean's invention, taps 608 also copy packets traversing the network and send them for analysis on the remote packet monitoring system 600. EX1007, [0031], Figs. 6-7; see also claims 1(a), 2.

298. Thus, whether a network designer chose to implement one of Lean's prior art systems or one of Lean's inventive embodiments in Rijhsinghani's network system, Rijhsinghani's *switch apparatus* would be *configured to execute the instructions to send* copies of entire packets including *header information to the control apparatus* (Rijhsinghani's NMS) including *when the identified packet comprises an encapsulated packet* (Rijhsinghani's packet with VLAN header as in Figure 4). The combination of Rijhsinghani with any of Lean's prior art systems or inventive embodiments therefore discloses claim 2.

3. Claim 3: The switch apparatus according to claim 2, wherein the header information includes the additional header.

299. The combination of Rijhsinghani and Lean discloses claim 2 for the reasons I explained for that claim. The combination of Rijhsinghani and Lean also discloses the additional limitation recited in claim 3.

300. As I explained for claim 2, a network designer or administrator implementing Lean's prior art systems or inventive embodiments would modify Rijhsinghani's switches to copy and forward entire packets to the external NMS

(i.e., to perform the function of Lean’s taps) for traffic analysis. See Section VI.C.2, above. Because entire packets are copied and forwarded, *the header information* forwarded to the NMS would necessarily include *the additional header*.

4. Claim 4: The switch apparatus according to claim 3, wherein the processor is further configured to execute further instructions to decapsulate the encapsulated packet.

301. The combination of Rijhsinghani and Lean discloses claim 3 for the reasons I explained for that claim. The combination of Rijhsinghani and Lean also discloses the additional limitation recited in claim 4.

302. As I discussed above, Rijhsinghani describes removing the VLAN header from VLAN communication packets (*decapsulat[ing] the encapsulated packet*). See Section VI.B.4, above. Rijhsinghani’s control module 284 includes “a tagger 284c for tagging communications received via an access port 305 for transmission from one member to another member of a configured VLAN by adding a VLAN header thereto.” EX1005, 8:60-63. In addition, “tagger 284c also removes the VLAN header from a communication received from the switch’s trunk port 315 that is to be forwarded to a member of a LAN connected to the switch by an access port.” EX1005, 8:63-67. “More particularly, the tagger 284c discards the tag by removing the VLAN header from the communication, prior to the communication being transmitted to the appropriate output port 305, i.e., prior to

the controller 284a controlling the switching device 282 to transmit the communication from the trunk port 315 to the access port 305.” EX1005, 8:67-9:6; see also 3:50-54 (“The switch 275 accordingly removes the VLAN header and directs the packet, which now appears as packet 400 of FIG. 3, to LAN 230 over which the member I receives the message.”).

5. **Claim 8: The communication system according to claim 7, wherein the processor is further configured to execute the instructions to send header information to the control apparatus when the identified packet comprises an encapsulated packet.**

303. Rijhsinghani discloses the limitations of claim 7 for the reasons I explained for that claim. The combination of Rijhsinghani and Lean discloses the additional limitation recited in claim 8.

304. The additional limitation recited in claim 8 is identical to the limitation recited in claim 2. See Paragraph 59, above (comparing claims 2 and 8). Claim 8 is disclosed for the reasons I discussed for claim 2. See Section VI.C.2, above.

6. **Claim 9: The communication system according to claim 8, wherein the header information includes the additional header.**

305. The combination of Rijhsinghani and Lean discloses claim 8 for the reasons I explained for that claim. The combination of Rijhsinghani and Lean also discloses the additional limitation recited in claim 9.

306. The additional limitation recited in claim 9 is identical to the limitation recited in claim 3. See Paragraph 61, above (comparing claims 3 and 9). Claim 9 is disclosed for the reasons I discussed for claim 3. See Section VI.C.3, above.

7. Claim 10: The communication system according to claim 9, wherein the processor is further configured to execute further instructions to decapsulate the encapsulated packet.

307. The combination of Rijhsinghani and Lean discloses claim 9 for the reasons I explained for that claim. The combination of Rijhsinghani and Lean also discloses the additional limitation recited in claim 10.

308. The additional limitation recited in claim 10 is identical to the limitation recited in claim 4. See Paragraph 63, above (comparing claims 4 and 10). Claim 10 is disclosed for the reasons I discussed for claim 4. See Section VI.C.4, above.

8. Claim 12: The communication system according to claim 11, wherein the instructions to encapsulate the identified packet includes notifying the controller of first header data before the translation and second header data after the translation.

309. Rijhsinghani discloses the limitations of claim 11 for the reasons I explained for that claim.

310. As I discussed above in Section VI.A.6, claim 12's reference to *notifying the controller* is ambiguous because claim 7 (from which claim 12

indirectly depends) recites two different controllers. First, claim 7 recites *a switch apparatus of the switch apparatuses comprising...a controller* (i.e., a controller included in the *switch apparatus*). Second, claim 7 also recites that the *switch apparatus...receive[s] the rules and the actions from a controller*, which is an external controller such as the *control apparatus* as I explained for claim 7. See Section VI.A.4.h, above.

311. As I discussed for claim 5, Rijhsinghani's control module 284 translates *first header data before the translation* (including source and destination address in the received packet as in Figure 3 and Figure 4) into *second header data after the translation* (VLAN header as in Figure 4).

312. If I assume that *the controller* of claim 12 is located at an external control apparatus—as opposed to in the switch—then claim 12 is similar in scope to claims 2 and 3. Those claims recite “send[ing] header information to the control apparatus when the identified packet comprises an encapsulation packet” (claim 2) and that “the header information includes the additional header” (claim 3).

313. As I explained for claim 2, a network designer implementing Lean's prior art systems or inventive embodiments would modify Rijhsinghani's switches to copy and forward entire packets to the external NMS for traffic analysis. See Section VI.C.2, above. Because entire packets are copied and forwarded, the combination discloses *notifying the controller of first header data before the*

translation and second header data after the translation as shown in the notated version of Figure 4 below.

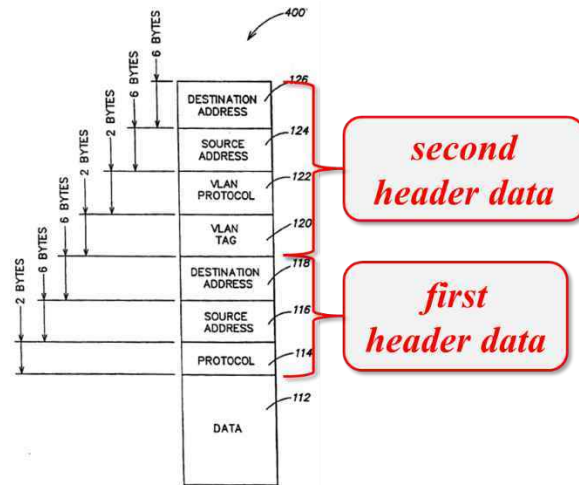


FIG. 4

EX1005, Fig. 4 (annotated).

314. For these reasons, and the reasons I explained for claims 2, 3, and 5, the combination of Rijhsinghani and Lean discloses claim 12 (based on the construction of *the controller* assumed in this section). See Sections VI.C.2, VI.C.3, and VI.A.2, above.

9. **Claim 14: The communication method according to claim 13, further comprising: sending header information to a controller when the identified packet comprises an encapsulated packet.**

315. Rijhsinghani discloses the limitations of claim 13 for the reasons I explained for that claim. The combination of Rijhsinghani and Lean discloses the additional limitation recited in claim 14.

316. The additional limitation recited in claim 14 is similar to the limitation

recited in claim 2. See Paragraph 60, above (comparing claims 2 and 14). The primary difference between the claims is that claim 2 recites sending header information “to the control apparatus” and claim 14 recites sending header information “to a controller.” As I explained for claim 7 and for claim 13, the reference in claim 13 to *a controller* means an external controller such as a control apparatus. See Sections VI.A.4.h and VI.A.7.b, above. Thus, claim 14, which depends from claim 13, is similar in scope to claim 2 and is disclosed for the reasons I discussed for that claim. See Section VI.C.2, above.

10. Claim 15: The communication method according to claim 14, wherein the header information includes the additional header.

317. The combination of Rijhsinghani and Lean discloses claim 14 for the reasons I explained for that claim. The combination of Rijhsinghani and Lean also discloses the additional limitation recited in claim 15.

318. The additional limitation recited in claim 15 is identical to the limitation recited in claim 3. See Paragraph 62, above (comparing claims 3 and 15). Claim 15 is disclosed for the reasons I discussed for claim 3. See Section VI.C.3, above.

11. Claim 16: The communication method according to claim 15, further comprising: executing further instructions to decapsulate the encapsulated packet.

319. The combination of Rijhsinghani and Lean discloses claim 15 for the

reasons I explained for that claim. The combination of Rijhsinghani and Lean also discloses the additional limitation recited in claim 16.

320. The additional limitation recited in claim 16 is virtually identical to the limitation recited in claim 4. See Paragraph 64, above (comparing claims 4 and 16). Claim 16 is disclosed for the reasons I discussed for claim 4. See Section VI.C.4, above.

12. Claim 17: The communication method according to claim 14, further comprising: translating first header data of a head of the received packet into second header data.

321. The combination of Rijhsinghani and Lean discloses claim 14 for the reasons I explained for that claim. The combination of Rijhsinghani and Lean also discloses the additional limitation recited in claim 17.

322. The additional limitation recited in claim 17 is virtually identical to the limitation recited in claim 5. See Paragraph 66, above (comparing claims 5 and 17). Claim 17 is disclosed for the reasons I discussed for claim 5. See Section VI.A.2, above.

13. Claim 18: The communication method according to claim 17, further comprising: notifying the controller of the first header data before the translating and the second header data after the translating.

323. The combination of Rijhsinghani and Lean discloses claim 17 for the reasons I explained for that claim. The combination of Rijhsinghani and Lean also discloses the additional limitation recited in claim 18.

324. The additional limitation recited in claim 18 is virtually identical to the limitation recited in claim 6. See Paragraph 68, above (comparing claims 6 and 18). Claim 18 is disclosed for the reasons I discussed for claim 6. See Section VI.A.3, above.

14. Claim 20: The non-transitory recording medium, according to claim 19, the method further comprising: sending header information to the controller when the identified packet comprises an encapsulated packet, wherein the header information includes the additional header.

325. Rijhsinghani discloses the limitations of claim 19 for the reasons I explained for that claim. The combination of Rijhsinghani and Lean discloses the additional limitations recited in claim 20.

326. The additional limitations recited in claim 20 are virtually identical to the limitations recited in claims 14 and 15. See Paragraph 69, above (comparing claims 14 and 15 to claim 20). Claim 20 is disclosed for the reasons I discussed for claim 14 and claim 15. See Sections VI.C.9 and VI.C.10, above.

VII. ADDING COMPUTER NETWORKING TO RIJHSINGHANI, RIJHSINGHANI AND RFC-5474, OR RIJHSINGHANI AND LEAN RENDERS ALL CHALLENGED CLAIMS OBVIOUS

327. To the extent the Patent Owner may argue that Rijhsinghani does not disclose *a table, the table including rules and actions corresponding to the rules* as recited in claim limitation 1a and the corresponding limitation in claim 7, it would have been obvious to implement Rijhsinghani's switches with table structures

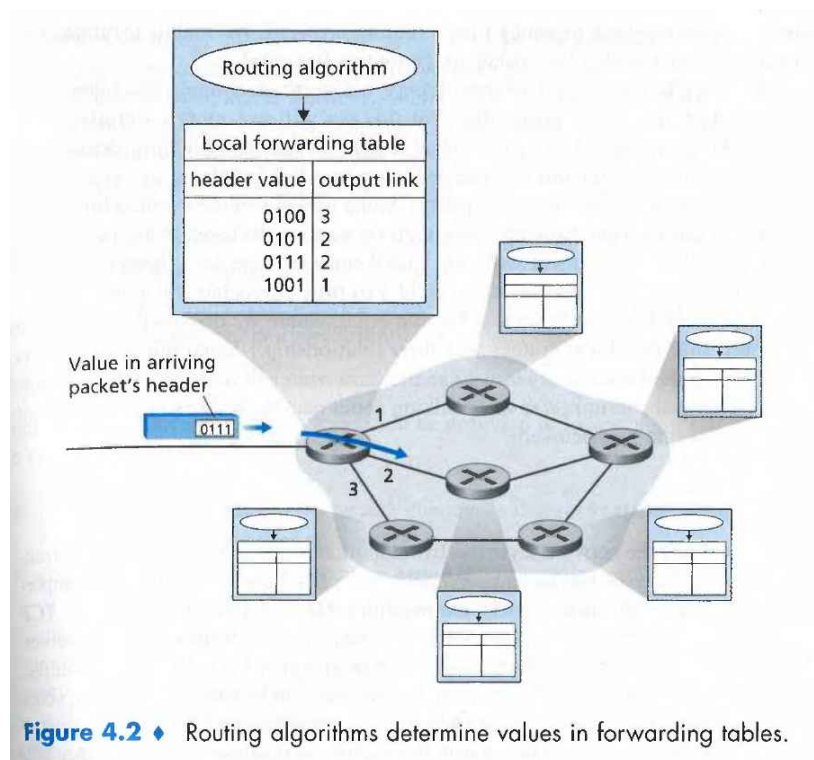
including rules and corresponding actions for processing packets as taught by any number of prior art references including Computer Networking (EX1008).

328. The use of a table to hold rules corresponding to packet forwarding actions would have been well known to a POSITA. As Computer Networking states:

Every router has a **forwarding table**. A router forwards a packet by examining the value of a field in the arriving packet's header, and then using this value to index into the router's forwarding table.

EX1008, 95 (emphasis in original); see also 110 ("Given the existence of a forwarding table, table lookup is conceptually simple—we just search through the forwarding table looking for the longest prefix match....").

329. Computer Networking includes the following figure illustrating an exemplary forwarding table.



EX1008, 96. In the illustrated example, the local forwarding table (*a table*) includes a column with header values (*rules*) used to look up values in a column identifying the output link for forwarding the particular packet (*actions corresponding to the rules*).

330. A POSITA seeking to understand and implement Rijhsinghani's VLAN system would have naturally looked to a textbook like Computer Networking, which describes and summarizes then-existing network technologies and techniques. EX1008, 8 ("The book is therefore appropriate for undergraduate courses and for first-year graduate courses. It should also be useful to practitioners in the telecommunications industry."). Rijhsinghani's disclosure is at a level of detail that presumes basic knowledge of networking technology and techniques.

To the extent a POSITA might need to supplement their basic understanding of networking, Computer Networking would be a natural and excellent resource.

331. Further, a POSITA could have implemented the table structures described in Computer Networking in Rijhsinghani's switches without undue experimentation and with a high likelihood of success. Indeed, Computer Networking describes then-existing technology and techniques for networking performed by commercially available switches and other network equipment. By implementing Rijhsinghani's VLAN system using commercially available equipment, would have meant that the switches would include forwarding tables as described in Computer Networking and as recited in the challenged claims.

VIII. SECONDARY CONSIDERATIONS

332. I have considered the impact of secondary considerations of obviousness, but I am not aware of any relevant information related to secondary considerations of obviousness that would impact my opinions at this time. To the extent the Patent Owner comes forward with any such information, I will consider it.

IX. AVAILABILITY FOR CROSS-EXAMINATION

333. In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be

subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during a time as mutually agreed between the parties.

X. RIGHT TO SUPPLEMENT

334. I reserve the right to supplement my opinions in the future to respond to any arguments that the Patent Owner raises. This declaration represents only those opinions that I have formed to date. I reserve the right to revise, supplement, and/or amend my opinions stated herein based on new information that becomes available to me and on my continuing analysis of the materials already provided.

XI. CONCLUSION

335. For the reasons discussed in this declaration, it is my opinion that the challenged claims of the '177 Patent are unpatentable in view of the prior art I have discussed above.

Acknowledgement of Oath

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1101 of Title 18 of the United States Code.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Mark Crovella". The signature is written in a cursive, flowing style.

Mark Crovella, Ph.D.

Dated: July 9, 2025