

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ARISTA NETWORKS, INC.,

Petitioner,

- vs. -

CORRIGENT CORPORATION,

Patent Owner.

Case IPR2023-00839

U.S. Patent No. 9,118,602

**DECLARATION OF PAUL MIN, PH.D.
IN SUPPORT OF PETITION FOR *INTER PARTES*
REVIEW OF U.S. PATENT NO. 9,118,602**

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Exhibit No.	Description
1001	U.S. Patent No. 9,118,602 (the '602 Patent)
1002	Prosecution History of the '602 Patent
1003	Expert Declaration of Dr. Paul Min
1004	Curriculum Vitae for Dr. Paul Min
1005	RESERVED
1006	U.S. Patent No. 7,466,697 ("Raz")
1007	U.S. Patent No. 7,277,386 ("Ferguson")
1008	Request for Comments 3031, <i>Multiprotocol Label Switching Architecture</i> , Rosen, E. et al., January 2001 ("RFC 3031")
1009	Nadeau, Thomas D., <i>Multi-Protocol Label Switching, MPLS Network Management</i> , 2003
1010	Request for Comments 3209, <i>RSVP-TE: Extensions to RSVP for LSP Tunnels</i> , Awduche, D. et al., December 2001 ("RFC 3209")
1011	RESERVED
1012	RESERVED
1013	RESERVED
1014	RESERVED
1015	Complaint, Docket No. 1 in <i>Corrigent Corp. v. Arista Networks, Inc.</i> , Case No. 1:22-cv-497 (D. Del.)
1016	Docket Report for <i>Corrigent Corp. v. Arista Networks, Inc.</i> , Case No. 1:22-cv-497 (D. Del.) as of January 2, 2023
1017	RESERVED
1018	U.S. Patent No. 6,499,061 ("Benayoun")
1019	U.S. Patent No. 7,606,235 ("Ayyangar")
1020	Request for Comments 1583, <i>OSPF Version 2</i> , Moy, J. et al., March 1994 ("RFC 1583")
1021	U.S. Patent No. 8,312,145 ("Rabie")

Exhibit No.	Description
1022	<i>Corrigent Corp. v. Dell Technologies et al.</i> , No. 1:22-cv-00496 (D. Del.) Docket
1023	<i>Corrigent Corp. v. Cisco Systems, Inc.</i> , No. 6:22-cv-00396 (W.D. Tex.) Docket
1024	<i>Cisco Systems, Inc. v. Corrigent Corp.</i> , IPR2023-00447, Paper 1 (Jan. 10, 2023)
1025	Yan, Peter Y., Soo Kim, Kyeong, and Min, Paul S., <i>Multi-Channel Deflection Crossbar (MCDL): A VLSI Optimized Architecture for Multi-Channel ATM Switching</i> , 1997
1026	U.S. Patent No. 5,440,549 (“Min”)
1027	U.S. Patent No. 6,128,292 (“Kim”)
1028	Declaration of Dr. Samrat Bhattacharjee, dated January 10, 2023
1029	Claim Construction Order, Docket No. 69 in <i>Corrigent Corp. v. Cisco Systems, Inc.</i> , Case No. 6:22-cv-396 (W.D. Tex.)
1030	District of Delaware Statistics (Docket Navigator)
1031	Western District of Texas Statistics (Docket Navigator)

I, Paul Min, Ph.D., hereby declare as follows:

I. INTRODUCTION AND QUALIFICATIONS

1. I have been retained on behalf of Arista Networks, Inc. (“Arista”) to provide my technical review, analysis, insights, and opinions concerning the validity of the claims of U.S. Patent No. 9,118,602 (EX1001; “the ’602 Patent”) entitled “Tunnel Provisioning with Link Aggregation.” I understand that the patent is assigned to Corrigent Corporation (“Corrigent”).

2. I received a B.S. degree in Electrical Engineering in 1982, an M.S. degree in Electrical Engineering in 1984, and a Ph.D. degree in Electrical Engineering in 1987 from the University of Michigan in Ann Arbor. I received several academic honors, including my B.S. degree with honors, a best graduate student award and a best teaching assistant award during my M.S. study, and a best paper award from a major international conference for reporting results from my Ph.D. thesis.

3. After receiving my Ph.D., I worked at Bellcore in New Jersey from August 1987 until August 1990. At Bellcore, I was responsible for evolving the public switched telephone network (PSTN) into a multi-services voice and data network that incorporated packet switches, optical technologies, and wireless technologies, which included the deployment of the Synchronous Optical Network (SONET) as part of the digital backbone networks.

4. In September 1990, I joined the faculty at Washington University in St. Louis. In July 1996, I was promoted to an Associate Professor of Electrical Engineering with tenure. I am currently a Senior Professor at Washington University in the Department of Electrical and Systems Engineering. I have also served as the Chair of the Graduate Curriculum (2000-2002) and the Chair of the Undergraduate Curriculum (2011-2014) for the Department of Electrical and Systems Engineering.

5. At Washington University, I have conducted research in communication, computing, and related electronic hardware and software. I have received several grants from the U.S. Federal Agencies, including the National Science Foundation and the Defense Advanced Research Project Agency, and numerous contracts from companies and organizations around the world. I have researched a variety of communication, computing, and electronic technologies, including wireless communication, broadband communication, transmission and switching, integrated circuit design, software application and protocol design, and system prototype. I have an extensive background and experience in each of these technologies. Specifically related to the technology matters in this proceeding, I developed several packet switches and routers that can address the speed and processing mismatch between the optical transport networks and the switching infrastructure in data communication.

6. As a faculty member at Washington University, I have taught several courses in electronics, communication, and computing at both the undergraduate and graduate levels. For example, I have taught electronic circuits (Washington University ESE 232), communication theory (Washington University ESE 471), transmission and multiplexing (Washington University ESE 571), and signaling and control of communication networks (Washington University ESE 572).

7. I have supervised numerous graduate and undergraduate students, many of whom received a doctoral degree under my guidance. The doctoral theses that I have supervised relate to wireless communication, broadband communication, transmission and switching, integrated circuit design, software application and protocol design, and system prototype. My students and I have published a number of peer-reviewed articles on transmission and switching, electronic circuit and integrated circuit design, resource allocation, scheduling, modulation, mobility management, switching and transmission, and multiplexing. Several of these articles received accolades in the field. For example, in 2011, we received a best paper award in 3G WCDMA-related mobility and resource management at the prestigious Mobility 2011 international conference.

8. In addition to my responsibilities as a university faculty member, I have founded two companies. In May 1997, I founded MinMax Technologies, Inc., a fabless semiconductor company that developed switch fabric integrated circuit chips

for the Internet. In March 1999, I founded Erlang Technology, Inc., a fabless semiconductor company that focused on the design and development of integrated circuit chips and software for the Internet. One of Erlang's products received a best product of the year award in 2004 from a major trade journal for the electronics industry. In these companies, I have designed several circuits and software protocols, including switch fabric, network processor, and high speed interface devices with transmission media, a key technology aspect of this litigation.

9. Outside my own start-up companies, I have also served in various technology and business advisor roles for other companies and organizations around the world. I was the main technical author for one of two winning proposals to the Korean government for CDMA wireless service licenses (1996). I was responsible for designing a commercial scale IS-95 CDMA cellular network, which I understand to be one of the earliest such networks deployed in the world. I worked with numerous engineers and scientists around the world to implement this commercial-scale cellular network before IS-95 CDMA was widely accepted. This provided me with extensive insight into various components of CDMA technology, which extensively use various transmission technologies incorporating packet framing techniques. I have also been involved in a semiconductor company that specializes in semiconductor memories such as flash EEPROMs as a board member and as a technical advisor (2007-2011).

10. I am a member of and have been actively involved in several professional organizations. For example, I have served as the Chair of the Saint Louis Section of the IEEE with more than 3,000 members (2014), and a member of the Eta Kappa Nu Honor Society for electrical engineers. I have also been an Ambassador of the McDonnell International Scholars Academy (2007-2013).

11. In my 30+ years of experience with telecommunications technology, I have acquired significant knowledge about telecommunications systems industry standards, standard setting organizations such as Bellcore, IEEE, ATM Forum, IETF, ITU, 3GPP, and the rules and document policies that those organizations have in place to develop industry standards.

12. I am a named inventor on eleven U.S. patents, many of which focus on algorithm and device designs. I have extensively published technical papers in international conferences and journals, technical memoranda and reports, and given a number of seminars and invited talks. I have organized several international conferences and served as an international journal editor.

13. I attach as Exhibit 1004 my curriculum vitae, which includes a more detailed list of my qualifications. My work on this case is being billed at a rate of \$500 per hour, with reimbursement for actual expenses. I have no direct financial interest in the dispute between the Arista and Corrigent, and my compensation is not contingent upon the outcome of this *Inter Partes* review.

II. UNDERSTANDING OF THE GOVERNING LAW

A. Invalidity by Obviousness

14. I understand that obviousness is analyzed from the perspective of a person of ordinary skill in the art (“POSITA”) at the time of the alleged invention. I also understand that a POSITA is presumed to have been aware of all pertinent prior art at the time of the alleged invention.

15. I understand that an obviousness analysis involves comparing a claim to the prior art to determine whether the claimed invention as a whole would have been obvious to a POSITA in view of the prior art, and in light of the general knowledge in the art at the time the invention was made. I also understand that the invention may be deemed obvious when a POSITA would have reached the claimed invention through routine experimentation.

16. I understand that obviousness can be established by combining or modifying the disclosures of the prior art to achieve the claimed invention. It is also my understanding that where there is a reason to modify or combine the prior art to achieve the claimed invention, there must also be a reasonable expectation of success in so doing to render the claimed invention obvious. I understand that the reason to combine prior art references can come from a variety of sources, not just the prior art itself or the specific problem the patentee was trying to solve. I also understand that the references themselves need not provide a specific hint or suggestion of the

alteration needed to arrive at the claimed invention; the analysis may include recourse to logic, judgment, and common sense available to a POSITA.

17. I understand that when there is some recognized reason to solve a problem, and there are a finite number of identified, predictable solutions, a POSITA has good reason to pursue the known options within his or her technical grasp. If such an approach leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. In such a circumstance, when a patent simply arranges old elements with each performing the same function it had been known to perform and yields no more than one would expect from such an arrangement, the combination is obvious.

18. I understand that when considering the obviousness of an invention, one should also consider whether there are any objective indicia that support the non-obviousness of the invention. I further understand that objective indicia of non-obviousness include failure of others, copying, unexpected results, information that “teaches away” from the claimed subject matter, perception in the industry, commercial success, and long-felt but unmet need. I also understand that in order for objective indicia of non-obviousness to be applicable, the indicia must have some sort of nexus to the subject matter in the claim that was not known in the art. I understand that this nexus includes a factual connection between the patentable subject matter of the claim and the objective indicia alleged. I also understand that

an independently made invention that is made within a comparatively short period of time is evidence that the claimed invention was the product of ordinary skill.

19. Finally, I understand that patent examiners at the U.S. Patent and Trademark Office (“USPTO”) rely upon certain exemplary rationales in reviewing patent applications to understand whether the subject matter of the claims is obvious. I understand that the following is the list of exemplary rationales relied upon by patent examiners at the USPTO:

- (A) Combining prior art elements according to known methods to yield predictable results;
- (B) Simple substitution of one known element for another to obtain predictable results;
- (C) Use of a known technique to improve similar devices (methods, or products) in the same way;
- (D) Applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;
- (E) “Obvious to try” – Choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;
- (F) 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; and

- (G) 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.

B. Interpreting Claims Before the Patent Office

20. I understand that *Inter Partes* Review is a proceeding before the United States Patent & Trademark Office (“USPTO”) for evaluating the validity of issued patent claims. I understand that, in an *Inter Partes* Review, a claim term is interpreted in a manner consistent with the standard used in patent litigation, as set forth in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (*en banc*). That standard generally construes the claims according to their “ordinary and customary” meaning in view of the claim language, specification, and file history, and where applicable, relevant other evidence.

21. I understand that a patent’s “specification” includes all the figures, discussion, and claims within the patent. I understand that the USPTO will look to the specification and prosecution history to see if there is a definition for a given claim term, and if not, will apply the ordinary and customary meaning from the perspective of a POSITA at the time in which the alleged invention was made.

C. Materials Relied on in Forming My Opinions

22. In forming the opinions expressed in this declaration, I have relied on my own knowledge, experience, and expertise, as well as the knowledge of a POSITA in the relevant timeframe. In addition, I have reviewed and relied upon all documents referenced in this declaration and the following list of materials:

- U.S. Patent No. 9,118,602 (“the ’602 Patent”) (EX1001);
- Prosecution History of the ’602 Patent (EX1002);
- U.S. Patent No. 7,466,697 (“Raz”) (EX1006);
- U.S. Patent No. 7,277,386 (“Ferguson”) (EX1007);
- Request for Comments 3031, *Multiprotocol Label Switching Architecture*, Rosen, E. et al., Jan. 2001 (“RFC 3031”) (EX1008);
- Nadeau, Thomas D., *Multi-Protocol Label Switching, MPLS Network Management*, 2003 (EX1009);
- Request for Comments 3209, *RSVP-TE: Extensions to RSVP for LSP Tunnels*, Awduche, D. et al., Dec. 2001 (“RFC 3209”) (EX1010);
- U.S. Patent No. 6,499,061 (“Benayoun”) (EX1018);
- U.S. Patent No. 7,606,235 (“Ayyangar”) (EX1019);
- Request for Comments 1583, *OSPF Version 2*, Moy, J. et al., Mar. 1994 (“RFC 1583”) (EX1020);
- U.S. Patent No. 8,312,145 (“Rabie”) (EX1021);
- Yan, Peter Y., Soo Kim, Kyeong, and Min, Paul S., *Multi-Channel Deflection Crossbar (MCDC): A VLSI Optimized Architecture for Multi-Channel ATM Switching*, 1997 (EX1025);
- U.S. Patent No. 5,440,549 (EX1026); and
- U.S. Patent No. 6,128,292 (EX1027).

III. BACKGROUND DISCUSSION COMPUTER NETWORKING TECHNOLOGY

23. To better understand my opinions on the validity of the claims of the '602 Patent, I provide below some background on computer networking with a particular focus on multi-protocol label switching ("MPLS") and link aggregation protocol ("LAG"). The concepts discussed in this section were well known and widely used well prior to the May 6, 2005 priority date for the '602 Patent.

A. Multi-Protocol Label Switching ("MPLS")

24. The transmission of packets across "packet switched networks" or "PSNs" is a key method of communicating information in computer networks, such as "wide area networks" ("WANs") and "local area networks" ("LANs"). EX1018, 1:15-17. "In most of these PSNs, each node is used as a switching node after the route for a flow of data from a source node to a destination node has been established by routers located at each node." EX1018, 1:18-21. "The assignment of a particular packet to a particular flow of data is done only once as that packet enters the network." EX1018, 1:21-23. "The flow to which the packet is assigned is associated with a short fixed length value known as a label." EX1018, 1:23-24. "When a packet is forwarded to the next switching node, the label is sent along with it." EX1018, 1:25-26. "At subsequent nodes, the label is used as an index into a table which specifies the next node in the flow such that a corresponding new label can be assigned." EX1018, 1:26-29.

25. One technique for using a label in the transmission of information is called Multi-protocol Label Switching (“MPLS”). MPLS makes use of a label “to enable reservation of resources for packet flows from a source device to a destination device.” EX1019, 1:25-27. In MPLS, “a source device can request a path through a network, i.e., a Label Switched Path (LSP).” EX1019, 1:27-30. “An LSP defines one or more distinct, dedicated, and guaranteed paths through the network to carry MPLS packets from a source to a destination.” EX1019, 1:30-33. “An LSP identifier associated with a particular LSP is affixed to packets that travel through the network via the LSP.” EX1019, 1:33-34. “A given LSP may define one or more paths between the source and destination, and each path may be used to carry MPLS network traffic associated with the LSP.” EX1019, 1:35-37. A POSITA would have understood an LSP to refer to “a defined set of one or more paths associated with a common flow of MPLS traffic.” EX1019, 1:37-41. Further, a POSITA would have known that an LSP “may also be viewed as an MPLS tunnel having one or more paths.” EX1019, 1:41-42. A POSITA would have understood that a “network tunnel” is a path through which packets can flow across the devices in a network.

B. Link Aggregation Groups (“LAG”)

26. “In some environments, two network devices may be connected by multiple physical interconnects.” EX1007, 1:21-22. “For example, two network routers may be connected by multiple Ethernet links.” EX1007, 1:22-24. “Similarly,

multiple physical interconnects may couple other devices, e.g., two switches, a switch and a server, two routers, a switch and an end user station, and the like.” EX1007, 1:24-26.

27. “The term ‘link aggregation’ refers to a technique by which the multiple physical interconnects are logically associated and treated as a single, aggregated link.” EX1007, 1:27-30. The IEEE 802.3ad Working Group has developed a standard for implementing link aggregation. EX1007, 1:30-32. An advantage of link aggregation, also referred to as a “link aggregation group” or “LAG,” is that it provides “for increased link availability and bandwidth between the two devices.” EX1007, 1:32-34. “For example, bandwidth can be increased in linear increments, e.g., by adding individual interconnects to increase the bandwidth between the two devices.” EX1007, 1:34-36. “In addition, the multiple physical interconnects provide a degree of redundancy in that a failure in a single physical interconnect no longer inhibits direct traffic flow between the two devices.” EX1007, 1:36-40. “With link aggregation, traffic on a failed physical interconnect can be redirected to one of the other physical interconnects in the aggregated link.” EX1007, 1:40-42.

28. Closely related to the concept of the link aggregation is the concept of multi channel switching. Multi channel switching is a switching method that allows a group of physical ports in a switch to be aggregated to form a channel group. The links attached to the physical ports belonging to a channel group form a channel

group, over which can flow a data traffic that requires a bit rate that is higher than what one physical port in the switch could handle. During the 1990s, I worked on the multi channel switching techniques, as indicated a number of my publications on this topic and patents issued to my name. See my CV (EX1004), and also my publications, (e.g., EX1025), and patents (EX1026, EX1027) relating to this concept.

IV. OVERVIEW OF THE '602 PATENT

A. Specification of the '602 Patent

29. The methods and systems described in the '602 Patent relate “generally to communication networks, and particularly to methods and systems for performing link aggregation in tunneled networks.” EX1001, 1:19-21. As any POSITA would have known at the time the application for the '602 Patent was filed, MPLS was a popular “method[] for efficient transportation of data packets over connectionless networks, such as Internet Protocol (IP) networks.” EX1001, 1:26-29. In MPLS, information packets flow along a label-switched path (“LSP”) as label-switching routers (“LSRs”) pass them through a network. EX1001, 1:34-56. “The flow of packets along a label-switched path (LSP) under MPLS is completely specified by the label applied at the ingress node of the path.” EX1001, 1:40-42. According to the '602 Patent, this means that “an LSP can be viewed as a tunnel through the network.” EX1001, 1:42-43.

30. Further, the '602 Patent discusses the well-known concept of link aggregation ("LAG") defining it as a "technique by which a group of parallel physical links between two endpoints in a data network can be joined together into a single logical link." EX1001, 2:2-4. These groups of physical links are commonly referred to as "LAG groups." EX1001, 2:4-5. "Traffic transmitted between the endpoints is distributed among the physical links in a manner that is transparent to the clients that send and receive the traffic." EX1001, 2:5-7. For ethernet networks, link aggregation protocol has a defined "sub-layer, which interfaces between the standard Media Access Control (MAC) layer functions of the physical links in a link aggregation group and the MAC clients that transmit and receive traffic over the aggregated links." EX1001, 2:12-17.

31. The specification of the '602 Patent describes "[e]mbodiments of the present invention [that] provide tunnel provisioning with link aggregation." EX1001, 2:29-30. More specifically, one aspect of the '602 Patent discloses a "method for assigning and utilizing an Ethernet physical data port in an Ethernet Link Aggregation Group (LAG) in a Multi-Protocol Label Switching (MPLS) network" (the "First Method"). EX1001, 2:31-34. Figure 1A of the '602 Patent (reproduced and annotated below) schematically illustrates an MPLS communication network such as the one disclosed in the First Method:

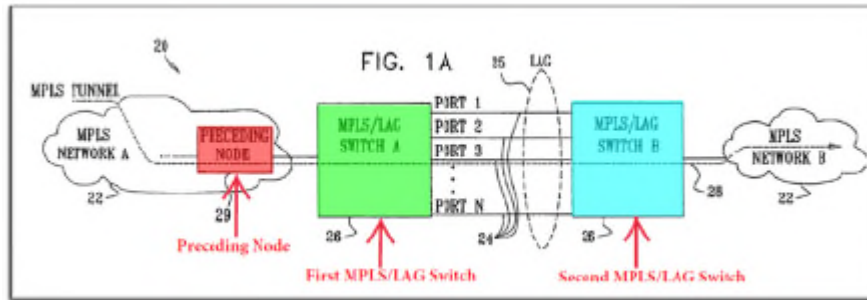


Figure 1A of the '602 Patent (Annotated)

EX1001, Figure 1A.

32. The First Method “includes the steps of, selecting, by a first MPLS/LAG switch [highlighted above in green], from a plurality of physical data ports in said first MPLS/LAG switch, a single physical tunnel port which meets a bandwidth requirement of a network tunnel, wherein said single physical tunnel port has a port serial number.” EX1001, 2:34-39. The single physical tunnel port is then assigned by the first MPLS/LAG switch to the network tunnel. EX1001, 2:39-41. The first MPLS/LAG switch then prepares a “data packet label by which said single physical tunnel port may be identified.” EX1001, 2:41-43. When the first MPLS/LAG switch receives “a data packet including said data packet label,” the MPLS/LAG switch performs a “switching” of the “data packet to said single physical tunnel port according to said serial port number.” EX1001, 2:44-47. This sends the data packet to a second MPLS/LAG switch (highlighted above in blue) via the “physical tunnel port.” EX1001, 2:47-49.

33. As another aspect, the '602 Patent also discloses “a method for tagging a packet for transport through an Ethernet physical data port in an Ethernet Link Aggregation Group (LAG) located downstream from a preceding node [highlighted above in red] in a Multi-Protocol Label Switching (MPLS) network tunnel employing Resource Reservation Protocol Traffic Engineering (RSVP-TE) tunnel provisioning” (the “Second Method”). EX1001, 2:50-54. RSVP-TE is “the well-known Resource Reservation Protocol (“RSVP”), allowing the establishment of explicitly-routed LSPs using RSVP as a signaling protocol.” EX1001, 1:50-52. In RSVP-TE, an “admission control” decision module is “used during reservation setup to determine whether a node has sufficient available resources to supply the requested quality of service.” EX1001, 1:57-60. Consequently, this means that the “admission control module is used in RSVP-TE for setting up MPLS tunnels.” EX1001, 1:60-61.

34. The Second Method “includes the steps of sending downstream to an MPLS/LAG switch, by the preceding node, an RSVP-TE PATH message.” EX1001, 2:55-58. The RSVP-TE PATH message sent to the MPLS/LAG switch includes “a LABEL_REQUEST object requesting a network tunnel, and a bandwidth requirement.” EX1001, 2:59-60. The “preceding node” receives “a packet label sent by the MPLS/LAG switch” that contains “a serial number of a single physical tunnel port in the MPLS/LAG switch.” EX1001, 2:61-63. When the “single physical tunnel

port meets the bandwidth requirement,” the “preceding node” attaches “said data packet label to a data packet.” EX1001, 2:64-66. The data packet, with the data packet label, “is intended to be forwarded via the single physical tunnel port” and sent “downstream to the MPLS/LAG switch” by the “preceding node.” EX1001, 2:66-3:3.

35. Further, the '602 Patent discloses “an apparatus for assigning and utilizing an Ethernet physical data port in an Ethernet Link Aggregation Group (LAG) located downstream from a preceding node in a Multi-Protocol Label Switching (MPLS) network tunnel employing Resource Reservation Protocol Traffic Engineering (RSVP-TE) tunnel provisioning, the LAG having a first MPLS/LAG switch and a second MPLS/LAG switch.” EX1001, 3:4-11. Figure 1B of the '602 Patent (reproduced below) schematically illustrates an MPLS/LAG switch such as the one disclosed in the '602 Patent:

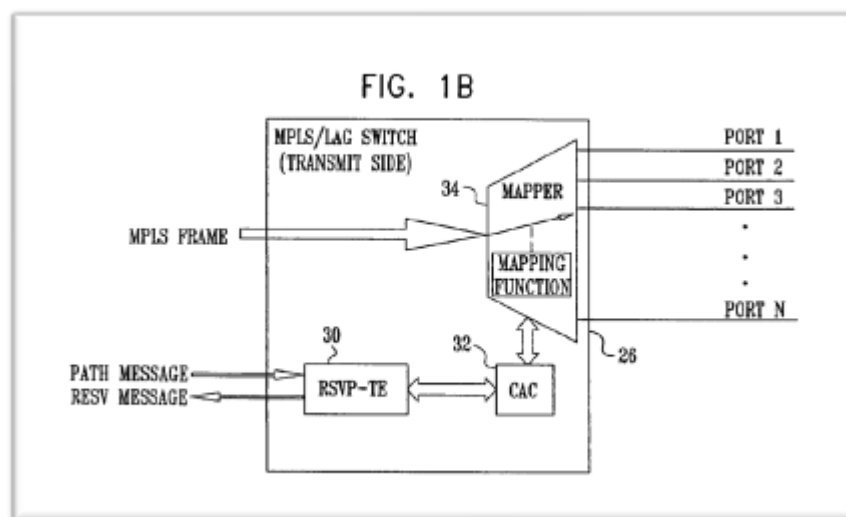


Figure 1B of the '602 Patent

EX1001, Figure 1B.

36. “The apparatus includes a processor, which is configured to receive a tunnel configuration request message from the preceding node” EX1001, 3:1113. The apparatus then makes “a selection from a plurality of physical data ports” in the first MPLS/LAG switch “of a single physical tunnel port which meets a bandwidth requirement of the network tunnel.” EX1001, 3:13-16. The “physical tunnel port has a port serial number.” EX1001, 3:16-17. The processor is also configured to “assign” the “single physical tunnel port to the network tunnel” and “prepare a data packet label, by which said single physical tunnel port may be identified.” EX1001, 3:17-20. The processor is further configured to “dedicate a sub-set of bits of” the “data packet label to encode” the “port serial number” of the “single physical tunnel port” and “publish” the “packet label upstream.” EX1001, 3:20-22.

37. “The apparatus includes a mapper configured to receive a data packet from an upstream node, detect [the] data packet label in [the] data packet, and if [the] data packet contains [the] data packet label, to direct the first MPLS/LAG switch to switch [the] data packet to [the] single physical tunnel port, and send [the] data packet to the second MPLS/LAG switch via [the] single physical tunnel port.” EX1001, 3:23-29.

38. Figure 3 of the '602 Patent (reproduced below) illustrates a method disclosed by the '602 Patent. EX1001, 5:64-7:32. “The method of [Figure 3] begins

when the preceding node asks to establish a part of tunnel 28 (having one or more hops) for sending MPLS packets to MPLS/LAG switch 26 A.” EX1001, 6:3-5. “The preceding node requests and then receives the MPLS label, which it will subsequently attach to all packets that are sent to MPLS/LAG switch 26 labeled A.” EX1001, 6:5-8. “The preceding node sends downstream an RSVP-TE PATH message augmented with a LABEL_REQUEST object, as defined by RSVP-TE, to MPLS/LAG switch A, at a label requesting step 60.” EX1001, 6:8-11. “The PATH message typically includes information regarding service properties that are requested for tunnel 28.” EX1001, 6:11-14. “The service properties may include a guaranteed bandwidth (sometimes denoted CIR—Committed Information Rate) and a peak bandwidth (sometimes denoted PIR—Peak Information Rate), as well as a requested CoS (Class of Service—a measure of packet priority).” EX1001, 6:14-19.

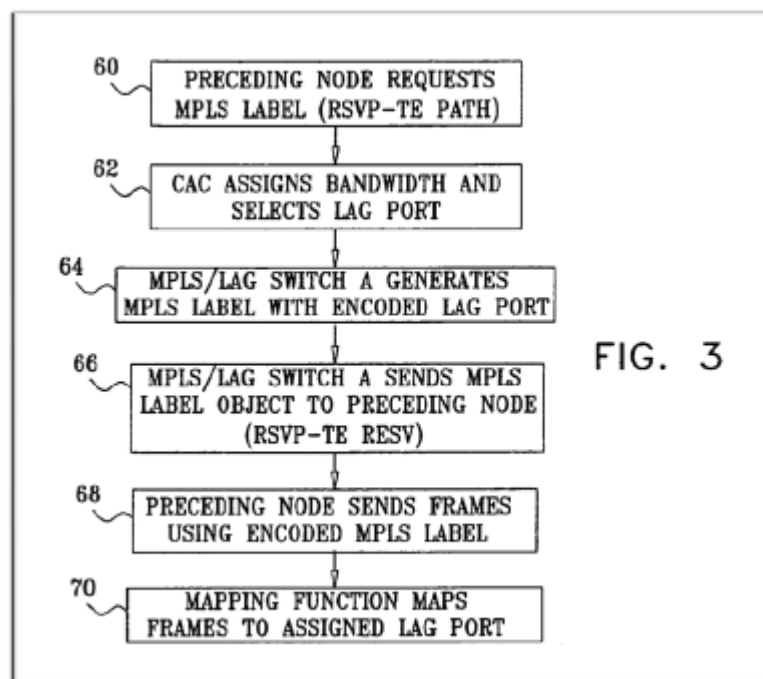


Figure 3 of the '602 Patent

39. “CAC processor 32 of switch A receives the PATH message and extracts the requested service properties.” EX1001, 6:20-21. “The CAC processor examines the available bandwidth of all ports 24 in LAG group 25 and selects a single physical port (‘the selected physical port’) on which to allocate bandwidth for MPLS tunnel 28, responsively to the requested service properties, at a port selection step 62.” EX1001, 6:21-26. “The selected physical port should be capable of providing sufficient peak and average bandwidths, as requested by the preceding node (and, originally, by the ingress node).” EX1001, 6:26-29.

40. “Regardless of the selection criterion used, the results of step 62 are that (1) a single physical port is explicitly selected and assigned to MPLS tunnel 28, and (2) sufficient bandwidth is allocated to tunnel 28, considering only the available bandwidth of the selected physical port, rather than the total available bandwidth of LAG group 25.” EX1001, 6:46-51. “All packets belonging to tunnel 28 will be switched through the same selected physical port, using the port coding technique described herein below.” EX1001, 6:51-53. “Having selected a physical port, RSVP-TE processor 30 of switch A now generates a suitable MPLS label, at a label generation step 64.” EX1001, 6:54-56. “The preceding node upstream of switch A will subsequently attach this MPLS label to all MPLS packets transmitted through tunnel 28 to switch A.” EX1001, 6:56-58. “The label is assigned, in conjunction

with the mapping function of mapper 34, so as to ensure that all MPLS packets carrying this label are switched through the physical port that was selected for this tunnel at step 62.” EX1001, 6:58-62. “For this purpose, RSVP-TE processor 30 of switch A dedicates a sub-set of the bits of MPLS label 52 to encode the serial number of the selected physical port.” EX1001, 6:62-65.

41. “RSVP-TE processor of switch 26 sends the generated MPLS label upstream to the preceding node, using an RSVP-TE RESV message augmented with a LABEL object, at a label sending step 66.” EX1001, 7:4-7. “At this stage, the part of tunnel 28 between the preceding node and switch A is provisioned and ready for use.” EX1001, 7:7-9. “The preceding node attaches the aforementioned MPLS label to all subsequent MPLS packets that it sends downstream through tunnel 28 to MPLS/LAG switch A, at a packet sending step 68.” EX1001, 7:912.

42. Figure 4 of the '602 Patent (reproduced below) illustrates another method disclosed by the '602 Patent. EX1001, 7:34-8:47. “Similar to the method shown in [Figure 3] above, the method begins with the preceding node in MPLS network A asking to establish a part of MPLS tunnel 28 for sending MPLS packets to switch A.” EX1001, 7:36-39. “The preceding node sends downstream an RSVP-TE PATH message, at a label requesting step 80, which is identical to label requesting step 60 of [Figure 3 above].” EX1001, 7:40-42. “CAC processor 32 of switch A receives the PATH message, extracts the requested service properties, and

selects a physical port out of group 25, at a port selection step 82.” “Step 82 is identical to port selection step 62 of [Figure 3] above.” EX1001, 7:42-46.

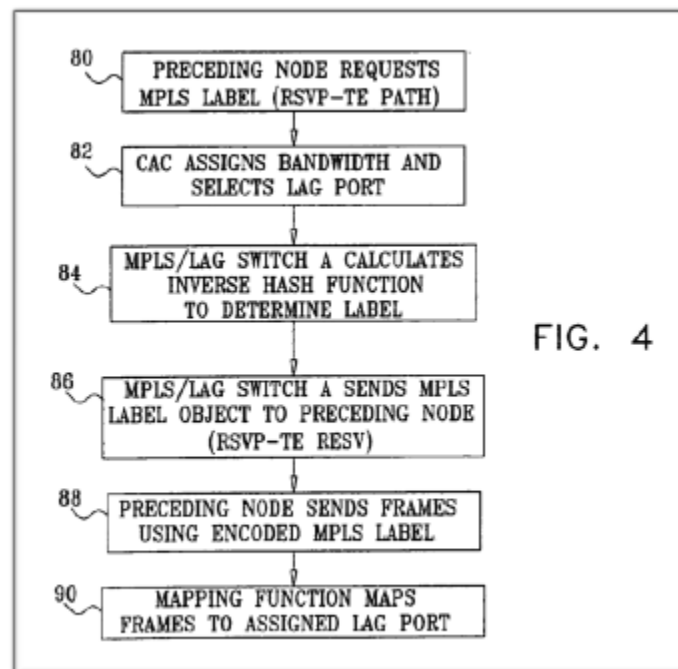


Figure 4 of the '602 Patent

43. In Figure 4, “RSVP-TE processor 30 of switch A takes the serial number of the selected physical port (selected at step 82) and generates MPLS label 52 by calculating an inverse of the hashing function, at an inverse calculation step 84.” EX1001, 7:66-8:3. “[T]he hashing function typically hashes the value of MPLS label 52 to determine the selected physical port, as the MPLS label uniquely identifies tunnel 28.” EX1001, 7:53-55. “Various hashing functions are known in the art, and any suitable hashing function may be used in mapper 34.” EX1001, 7:48-50.

44. “The purpose of [step 84] is to choose an MPLS label in a way that would cause the hashing function of mapper 34 to output the selected physical port (so that all subsequent packets carrying this label will be switched through this port).” EX1001, 8:3-7. “Having generated the MPLS label, RSVP-TE processor of switch A sends the MPLS label upstream to the preceding node, at a label sending step 86, which is identical to label sending step 66 of [Figure 3] above.” EX1001, 8:28-31. “At this stage, the part of tunnel 28 between the preceding node and switch A is provisioned and ready for use.” EX1001, 8:31-33. “The preceding node attaches the aforementioned MPLS label to all subsequent MPLS packets, belonging to tunnel 28, that are sent downstream to MPLS/LAG switch A, at a packet sending step 88.” EX1001, 8:33-36.

45. As discussed in the claim analysis below in Paragraphs 83-327, a POSITA would have been aware of prior art methods and systems that communicated performing link aggregation in tunneled networks.

B. The Claims of the '602 Patent

46. The '602 Patent includes 26 claims, and claims 1, 15, and 26 are independent claims. *See* EX1001, 9:23-12:36. Representative Claim 1 recites:

1. A method for assigning and utilizing an Ethernet physical data port in an Ethernet Link Aggregation Group (LAG) in a Multi-Protocol Label Switching (MPLS) network, the method comprising the steps of: assigning, by a first MPLS/LAG switch, a single physical tunnel port of a LAG to a network tunnel, wherein the single physical tunnel port of the LAG meets

a bandwidth requirement of the network tunnel, and wherein said single physical tunnel port of the LAG has a port serial number;

dedicating a sub-set of bits in a data packet label prepared by the first MPLS/LAG switch to encode said port serial number of said single physical tunnel port of the LAG into the data packet label;

sending, by said first MPLS/LAG switch, the data packet label, in which said port serial number of said single physical tunnel port is encoded, to a preceding node;

receiving from the preceding node, by said first MPLS/LAG switch, a data packet comprising said data packet label, in which said port serial number of said single physical tunnel port is encoded; and

sending said data packet from said first MPLS/LAG switch to a second MSPLS/LAG switch via said single physical tunnel port having the port serial number encoded in the data packet label.

EX1001, 9:23-47.

C. The Prosecution History of the '602 Patent

47. The application that resulted in the '602 Patent was U.S. Patent Application No. 13/969,520 ("the '520 Application"). EX1001. The '520 Application was filed with the USPTO on August 17, 2013. EX1001; EX1002 at 132. The '520 Application was filed as a continuation of Application No. 13/116,696 (now U.S. Patent No. 8,537,682), which is a continuation of Application No. 11/123,801 (now U.S. Patent No. 7,974,202). EX1001. Application No. 11/123,801 was filed on May 6, 2005. EX1001. I understand that this is the date to which the '520 Application claims its earliest priority.

48. The USPTO issued a Non-Final Rejection of the '520 Application on December 4, 2013. EX1002 at 48-77. The Non-Final Rejection stated that Claims

126 – all the originally filed claims – were rejected. EX1002 at 48. Among other rejections, the Examiner rejected Claims 1-2, 7, 9, 11, 13 and 14 under pre-AIA 35 U.S.C. § 103 as obvious over U.S. Patent App. Pub. No. 2005/0083928 (“Sivabalan”) in view of U.S. Patent App. Pub. No. 2005/0125490 (“Ramia”). EX1002 at 65-71. Further, Claims 3-6, 10 and 26 were rejected as obvious over Sivabalan in view of Ramia and further in view of an article titled “Link Bundling in MPLS Traffic Engineering” (“Kompella”). EX1002 at 71-73. In addition, Claim 8 was rejected as obvious over Sivabalan in view of Ramia and further in view of U.S. Patent App. Pub. No. 2004/0107285 (“Larson”). EX1002 at 73-74. Also, Claim 12 was rejected as obvious over Sivabalan in view of Ramia and further in view of U.S. Patent App. Pub. No. 2005/0090275 (“Wang”). EX1002 at 74-75.

49. The Applicant submitted a response to the Non-Final Office Action on March 4, 2014, with Claims 1, 15 and 26 being amended and new Claim 27 added.¹ EX1002 at 88-104. With respect to the obviousness rejections, the Applicant argued that Sivabalan makes use of RSVP, which the Applicant asserted “does not take physical link aggregation into account when reserving resources and treats aggregated parallel physical links only as a single logical link having the combined bandwidths of the separate physical links.” EX1002 at 97. “In the case of aggregated

¹ The Response also stated that “Claims 15-25 are being cancelled,” but that was an inaccurate statement. EX1002 at 96.

physical links, therefore, the prior-art RSVP provisioning will either assign the logical link, or an arbitrary single physical link.” EX1002 at 97. “In either of these cases, the resulting assignment may fail to operate properly; assigning the logical link to the network tunnel does not guarantee preservation of data packet arrival in order; and arbitrarily assigning a single physical link may conflict with previous assignments and may not provide sufficient bandwidth.” EX1002 at 97.

50. Further, the Applicant argued, “In a similar manner, IEEE Ethernet Link Aggregation standards usually only specify that data packets with the same header attributes (such as packets belonging to the same network tunnel) be assigned to the same physical link.” EX1002 at 97. “This, too, can fail to provide sufficient bandwidth.” EX1002 at 97. By contrast, the Applicant asserted that “[t]he subject matter now recited in claim 1 provides a method for overcoming the restrictions of the prior art, by supplementing RSVP to particularly assign a single physical Ethernet data port for network tunnel traffic to guarantee that the single physical Ethernet data port offers available bandwidth to support the traffic.” EX1002 at 97.

51. In addressing Claim 1, the Applicant also stated that “Sivabalan does not disclose ‘sending, by [a] first MPLS/LAG switch, a message comprising’ information about the primary or secondary component links ‘to a preceding node,’ as recited in claim 1.” EX1002 at 99. Applicant asserted that “[i]n fact, Sivabalan specifically emphasizes that ‘switchover of LSP traffic to the secondary component

link’ occurs with ‘no signaling to the head-end to implement the switch-over’ and that ‘[t]he secondary component link information is preconfigured into the label forwarding table entry for the LSP so that the switchover can occur very quickly.” EX1002 at 99-100. “Since Sivabalan’s switchover to the secondary component link very clearly occurs with no signaling to the head-end, there would have been no reason to send information about the primary or secondary links to a ‘preceding node,’ as recited in claim 1.” EX1002 at 100.

52. Moreover, Applicant asserted that “Ramia does not remedy Sivabalan’s shortcomings in this regard.” EX1002 at 100. Applicant acknowledged that Ramia does disclose “a device and method for handling MPLS labels” in which “[g]enerally, labels are determined by downstream nodes and distributed upstream.” EX1002 at 100. However, Applicant argued that “Ramia does not mention link aggregation groups, which is a focus of the subject matter of claim 1.” EX1002 at 100. Applicant asserted that the discussion of downstream nodes determining labels in Ramia was a “fairly-generic disclosure” that “would not have led a person of ordinary skill to implement the subject matter recited in claim 1.” EX1002 at 101.

53. Applicant also argued that dependent Claims 2-14 were allowable for the same reasons, irrespective of Kompella, Larson, or Wang. EX1002 at 101-102.

Lastly, the Response argued that since Claim 26 cited matter that was similar to the subject matter cited in Claim 1, Claim 26 was allowable. EX1002 at 101-102.

54. On June 5, 2014, the USPTO issued a Final Rejection that rejected claims 1-27 as obvious under 35 U.S.C. § 103. EX1002 at 113-129. Claims 1-2, 7, 9, 11, 13-15, 20 and 22-25 were rejected as being obvious over Sivabalan in view of Ramia. EX1002 at 115-121. Further, Claims 3-6, 10, 16-19, 21 and 26-27 were rejected as being obvious over Sivabalan in view of Ramia and further in view of Kompella. EX1002 at 121-124. Claims 8 and 12 were rejected again on the same grounds as in the Non-Final Rejection. EX1002 at 124-125. The Examiner addressed and disagreed with the Applicant's discussion of Sivabalan. EX1002 at 125-127. The Examiner stated that Sivabalan "discloses that RSVP is used to perform signaling procedures [refer paragraph 0049] and selects a physical link that has sufficient bandwidth to support a label switched path (LSP), i.e. a network tunnel, in accordance to MPLS [refer paragraph 0034]" EX1002 at 126. The Examiner further stated that "it is noted that Sivabalan discloses that the nodes of the network operate in a manner specified by various protocols, such as RSVP-TE for LSPs (i.e. tunneling) [refer paragraphs 0019-0026]." EX1002 at 126. "Furthermore, independent claim 1 does not claim supplementing RSVP to particularly assign physical Ethernet data port. However, in dependent claim 3, the prior art of record, Kompella, discloses the implementations of performing MPLS

with bundled links, i.e., the aggregated links, using RSVP for sending a path/REQUEST messages for setting up an LSP as would be disclosed in RSVP-TE extensions cited in RFC 4373 [refer Kompella; page 5 section 4.3] and operating without raising issue to securities for RSVP-TE specified in RFC 3209 [refer page 9 section 7].” EX1002 at 126. Finally, the Examiner concluded: “Given the suggestion of Sivabalan for supporting RSVP for signaling procedures and supporting various protocols, such as RSVP-TE for LSPs, in combination with Kompella for the explicit disclosure of implementing RSVP to identify resources needed for an LSP in an MPLS system when operating a link bundle, it would be clear that Sivabalan would be able to use RSVP to assign a single physical Ethernet data port, in this case an interface tied to a single component link in a link bundle, for network tunnel traffic that can offer a bandwidth to support traffic specified for an LSP or network tunnel.” EX1002 at 126-127.

55. The Applicant submitted a response to the Final Office Action Accompanied By Request For Continued Examination on September 5, 2014, with Claims 1, 15 and 26 being amended. EX1002 at 138-153. With respect to the obviousness rejection, Applicant stated that “Claim 1, for example, has been amended to introduce subject matter similar to the subject matter that ultimately led to the allowance of this application’s parent [the ‘682 Patent] and this application’s grandparent [the ‘202 Patent].” EX1002 at 148. The Applicant explained that the

Sivabalan and Ramia references had been relied upon by the Examiner during the prosecution of the applications that led to the ‘682 and ‘202 Patents. EX1002 at 149. The Applicant argued that “[i]n this application’s parent, the rejections based on Sivabalan and Ramia were overcome by amending claim 1 to indicate that preparing the data packet label included ‘dedicating a sub-set of bits of said data packet label to encode [a] port serial number of [a] single physical tunnel port,’ and to recite ‘sending, by [a] first MPLS/LAG switch, a message comprising said data packet label to a preceding node; [and] receiving, from the preceding node, by said first MPLS/LAG switch, a data packet comprising said data packet label.’” EX1002 at 148-149.

56. Further, the Applicant stated that “[i]n this application’s grandparent, the rejections based on Sivabalan and Ramia were overcome by amending claim 33 (which became claim 1 in [the ‘202 Patent]) to specify that ‘said single physical tunnel port has a port serial number,’ and that preparing the data packet label included ‘dedicating a sub-set of bits of said data packet label to encode said port serial number of said physical tunnel port.’” EX1002 at 149. Applicant argued that “[f]or at least reasons similar to those expressed in and/or deemed compelling in this application’s parent and grandparent, Sivabalan does not disclose or render obvious the subject matter now recited in claim 1. Moreover, Ramia does not remedy the shortcomings of Sivabalan in this regard.” EX1002 at 150.

57. Applicant asserted that Claims 2-7 and 9-26 were allowable for the same reasons as those discussed above for Claim 1. EX1002 at 150-152. With respect to Claim 27, Applicant stated that the Final Office Action did not provide an explanation of the basis of rejection, and Applicant asserted without further discussion that Claim 27 was not disclosed or rendered obvious Sivabalan, alone or in combination with either Ramia or Kompella. EX1002 at 151-152.

58. On April 17, 2015, the USPTO issued a Notice of Allowance for the '520 Application. EX1002 at 155-162. The Notice of Allowance stated that Claims 1-26 of the '520 Application were allowed but that Claim 27 was cancelled. EX1002 at 159-160. The '520 Application issued as the '602 Patent on August 25, 2015. EX1001.

D. The Priority Date of the '602 Patent

59. I understand that the earliest-filed patent application to which the '602 Patent claims priority (U.S. Patent Application No. 11/123,801) was filed on May 6, 2005. EX1001. I have therefore been asked for purposes of this declaration to analyze obviousness as of May 6, 2005.

V. STATE OF THE ART PRIOR TO THE '602 PATENT

A. The Person of Ordinary Skill in the Art

60. As discussed above, the claims of the '602 Patent are directed to a method and apparatus for assigning and utilizing an Ethernet physical data port in an Ethernet LAG in an MPLS network to transmit data. EX1001, Abstract, 1:1-2,

9:23-25. Based on this, it is my opinion that, as of May 6, 2005, a POSITA would have had a working knowledge of hardware and software for packet-switched networking, MPLS and LAG. A POSITA also would have had a bachelor's degree in electrical engineering, computer science, computer engineering, or an equivalent, and at least two years of professional experience. Further, it is my opinion that a person with additional education but less professional experience may still qualify as a POSITA, and a person with additional professional experience but less education may still qualify as a POSITA.

61. I believe that I would qualify as understanding the knowledge and skills of a POSITA as of May 6, 2005, and that I have a sufficient level of knowledge, experience, and expertise to provide an expert opinion in the field of the '602 Patent.

B. RFC 3209

62. RFC 3209 teaches a prior art Internet standards track protocol for the Internet community relating to “the use of RSVP (Resource Reservation Protocol), including all the necessary extensions, to establish label-switched paths (LSPs) in MPLS (Multi-Protocol Label Switching).” EX1010, Abstract. RFC 3209 discloses “several additional objects that extend RSVP, allowing the establishment of explicitly routed label switched paths using RSVP as a signaling protocol. The results is the instantiation of label-switched tunnels which can be automatically routed away from network failures, congestion, and bottlenecks.” EX1010, Abstract.

RFC 3209 describes “routers that support both RSVP [1] and Multi-Protocol Label Switching [2] can associate labels with RSVP flows.” EX1010, Section 1.1. “The set of packets that are assigned the same label value by a specific node are said to belong to the same forwarding equivalence class (FEC) (see [2]), and effectively define the ‘RSVP flow.’ When traffic is mapped onto a label-switched path in this way, we call the LSP an ‘LSP Tunnel.’” EX1010, Section 1.1. RFC 3209 explains that “[w]hen labels are associated with traffic flows, it becomes possible for a router to identify the appropriate reservation state for a packet based on the packet’s label value.” EX1010, Section 1.1. To set up an LSP Tunnel, “[a] request to bind labels to a specific LSP tunnel is initiated by an ingress node through the RSVP Path message [which is] augmented with a LABEL_REQUEST object.” EX1010, Section 1.1. The Path message is propagated downstream from the ingress node to the tunnel’s endpoint, or destination, and it is during this propagation that “[r]outers along the path may use the setup to hold priorities. ... For instance, in the traffic engineering application, it is very useful to use the Path message as a means of verifying that bandwidth exists at a particular priority along an entire path before preempting any lower priority reservations.” EX1010, Section 2.2.

63. Path messages may be augmented with an explicit route object “[i]f the sender node has knowledge of a route that has high likelihood of meeting the tunnel’s QoS requirements, or that makes efficient use of network resources, or that satisfies

some policy criteria.” EX1010, Section 2.2. “To do this, the sender node adds an EXPLICIT_ROUTE object to the RSVP Path message, [which] specifies the route as a sequence of abstract nodes.” EX1010, Section 2.2. “The signaling protocol model supports the specification of an explicit path as a sequence of strict and loose routes, [which] significantly enhances the flexibility of path definitions.” EX1010, Section 1.1, Section 4.3.3.1. “A node [such as an intermediate node along the requested LSP, which would be a router such as an LSR] receiving a Path message containing an EXPLICIT_ROUTE object must determine the next hop for this path.” EX1010, Section 4.3.4.1. When the next hop is selected by the node, it propagates the Path message along the selected next hop to continue setup of the requested LSP. When the Path message reaches the tunnel’s endpoint, or destination, “[t]he destination node of a label-switched path responds to a LABEL_REQUEST by including a LABEL object in its response RSVP Resv message.” EX1010, Section 2.2. In particular, “[t]he Resv message is sent back upstream towards the sender, following the path state created by the Path message, in reverse order.” EX1010, Section 2.2. RFC 3209 explains how each node receiving the Resv from the next downstream node allocates a label to insert into the Resv message, which propagates upstream:

Each node that receives a Resv message containing a LABEL object uses that label for outgoing traffic associated with this LSP tunnel. If the node is not

the sender, it allocates a new label and places that label in the corresponding LABEL object of the Resv message which it sends upstream to the PHOP. The label sent upstream in the LABEL object is the label which this node will use to identify incoming traffic associated with this LSP tunnel. This label also serves as shorthand for the Filter Spec. The node can now update its "Incoming Label Map" (ILM), which is used to map incoming labeled packets to a "Next Hop Label Forwarding Entry" (NHLFE), see [2]. When the Resv message propagates upstream to the sender node, a label-switched path is effectively established.

EX1010, Section 2.2. When the node allocating the label receives a packet with that label fixed to it from upstream (such as from the sender node, or from another intermediate node which immediately precedes the node along the established LSP), the node uses the label to identify how to route the packet, and sends the packet to the assigned next hop. EX1010, Section 1.1 ("it becomes possible for a router to identify the appropriate reservation state for a packet based on the packet's label value."), Section 1.3 ("Label Switched Path[:] The path created by the concatenation of one or more label switched hops, allowing a packet to be forwarded by swapping labels from an MPLS node to another MPLS node. For a more precise definition see [2]."), Section 2.1.

C. Raz

64. Raz teaches a prior art system relating to “a link multiplexing mechanism utilizing path oriented forwarding.” EX1006, 1:6-8. Raz discloses an LSR provisioning a label-switched path (LSP) and in particular, assigning a subport to the LSP: “The CPU 16 in the LSR performs the conventional LSR functionality including the provisioning of LSPs. In particular, the CPU functions to perform the assignment of subports to LSPs in response to LSP setup requests.” EX1006, 7:65-8:1. As part of LSP setup, the LSR “executes a bandwidth allocation algorithm, described in more detail infra, that controls the allocation of bandwidth of each subport.” EX1006, 8:1-5. “The label is then sent to the requesting node or to a management entity to complete the LSP setup process. ...[T]he management entity is adapted to send the label to the upstream node in order for the upstream node to know how to label packets belonging to this LSP.” EX1006, 8:5-10. Raz describes that its subports make up an interface to a higher speed packet stream: “[a] subport forwarding and provisioning mechanism whereby a plurality of subports implemented using slower speed processors are used to perform the packet processing for a higher speed packet stream.” EX1006, Abstract, 1:66-2:3, 2:41-51, 6:24-27. Raz explains that the subports are “trunked” from the high-speed interface “the high speed interface (e.g., 10G) may be trunked into any number of individual subports.” EX1006, 7:14-15. Raz further explains that its subports may be defined as a Link Aggregation Group (LAG): “some commercially available layer 2 switches

can determine the destination port for a packet destined to a LAG, ... [which] can be used for ... defining its ports leading to the different subports as a single LAG.” EX1006, 9:9-15. “Outbound packets are assigned a subport based on their MPLS labels.” EX1006, Abstract, 2:9-10, 6:34-35. “Once assigned, the packets are forwarded to a particular subport.” EX1006, Abstract, 2:10-11, 6:35-36. “The output of all the subports is aggregated and combined into a single high speed packet stream and transmitted over the link.” EX1006, Abstract, 2:11-13, 6:36-38.

65. Further, “[i]nbound packets are received by [a] high speed PHY and forwarded to one of a plurality of subports.” EX1006, Abstract, 2:13-15, 6:3840. “The subport chosen is the one having the same subport index as the one through which the packet was sent out over at the transmitting node.” EX1006, Abstract, 2:15-16, 6:40-41. “Conventional layer 2 switches can also be used whereby reserved source MAC addresses are assigned to subports.” EX1006, Abstract. “The switch forwards the inbound packets to one of the subports in accordance with the packet’s source MAC address.” EX1006, Abstract. “The invention also comprises a mechanism for provisioning protection tunnels and a method for allocating subport bandwidth to subports.” EX1006, Abstract.

66. “To aid in understanding the invention, the example LSR shown [below in Figure 1] comprises a 10G interface that is composed of ten individual 1G packet streams.” EX1006, 7:7-9. “The ten subports are provided wherein each is adapted

to handle a 1G packet stream.” EX1006, 7:9-10. “The overall aggregate speed, however, is 10G.” EX1006, 7:10-11. “Due to the connection oriented approach of the MPLS protocol, the assignment of connections to subports can be done statically on an LSP basis.” EX1006, 7:11-14. “Note, that the high speed interface (e.g., 10G) may be trunked into any number of individual subports, e.g., 8, wherein 10 is used here by example only.” EX1006, 7:14-16.

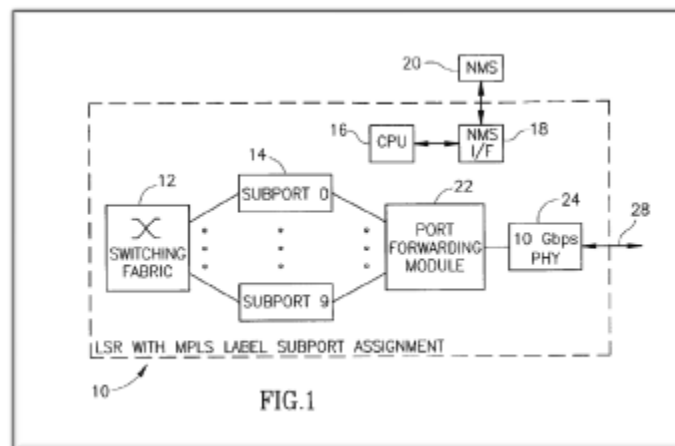


Figure 1 of Raz

67. “In accordance with the invention, the assignment of traffic to 1G subports is based on LSPs.” EX1006, 7:17-18. “Thus, the MPLS label is used in order to assign an incoming packet to one of the subports.” EX1006, 7:18-19. “The selected subport is the same for both sides of a 10G link.” EX1006, 7:20.

68. “As an example, consider two LSRs, LSR A and LSR B, each with 10 subports wherein each subport is mapped to an 8K range of labels.” EX1006, 7:30-32. “An LSP is to be provisioned from LSR A to LSR B.” EX1006, 7:32-33. “When the LSP is signaled or provisioned through management, the CAC in LSR B decides

to accept the LSP on subport 3 and thus assigns a label comprising an indication that subport 3 was selected.” EX1006, 7:33-36. “The label is communicated to LSR A which now knows that the output subport should be subport 3 (i.e. the same subport is provisioned).” EX1006, 7:36-38.

69. “When a packet for the provisioned LSP is received over a link connected to LSR A, it is forwarded to subport 3 and subsequently out over the 10G link to LSR B with the previously assigned label indicating subport 3.” EX1006, 7:39-42. “The port forwarding module in LSR B examines the label in the received packet and in response thereto forwards the packet to subport 3 for packet processing.” EX1006, 7:42-45.

70. In Raz, “[t]he invention also comprises a mechanism to improve the ability to handle wide connections.” EX1006, 10:60-61. “Wide connections are connections that require a relatively large amount of CIR bandwidth.” EX1006, 10:61-63. “For example, a connection of 500 Mbps, 700 Mbps or even a connection of 1 Gbps may need to be supported.” EX1006, 10:63-65. “There remains, however, the problem of fragmentation.” EX1006, 10:65-66. “Consider, for example, 300 Mbps of CIR bandwidth that is already allocated on each of the ten subports of a 10G port.” EX1006, 10:66-67. “In this case, a connection of 800 Mbps cannot be allocated on it even though the 10G port has 5600 M of free bandwidth.” EX1006, 11:1-2.

71. “The invention provides a scheme for allocating LSP bandwidth to subports that helps in solving the problem described above in a way that provides a tradeoff between leaving subports empty for wide LSPs and spreading traffic between subports for best utilizing the bandwidth of the link (e.g., for EIR traffic).” EX1006, 11:3-8. “The central idea is to leave one or more subports empty (i.e. no bandwidth used) in the event a wide connection is to be allocated.” EX1006, 11:8-10. “The allocated bandwidth, however, is still distributed among the subports in such a way that EIR traffic is supported.” EX1006, 11:10-12.

D. Ferguson

72. Ferguson teaches a prior art system relating to “distribution of traffic within computer networks.” EX1007, 1:6-7. “The invention is directed to techniques for distributing label switched packets, such as multiprotocol label switched (MPLS) packets, associated with a common label switched path (LSP).” EX1007, 1:57-60. “The techniques may, for example, be used to load balance label switched packets of an LSP across an aggregated link having two or more logically associated physical interconnects.” EX1007, 1:60-63. “In addition, the techniques may be used to distribute label switched packets of a common LSP across multiple data paths within a network device, such as a router.” EX1007, 1:63-66. “[T]he term path refers to any physical path for communicating data.” EX1007, 1:66-67. “In this manner, the

term encompasses both external physical interconnects between network devices, and internal data paths within an individual network device.” EX1007, 1:67-2:3.

73. “By distributing the MPLS packets across multiple data paths load balancing may be achieved, and the techniques may decrease packet latency through the network and the various communication devices.” EX1007, 2:54-57. “In addition, the techniques allow for the distribution of the MPLS traffic, while maintaining in-sequence delivery of packets of common data flows.” EX1007, 2:57-60. “In other words, those MPLS packets having common flow characteristics, such as MPLS packets having common source and destination addresses and ports, as well as the same communication protocol, may be distributed to the same physical interconnect in accordance with the techniques.” EX1007, 2:60-65.

74. “In another embodiment, a method comprises receiving a data unit from a network device, determining a type of communication protocol for the data unit, and selecting a label based on the type of communication protocol.” EX1007, 2:19-22. “The method further comprises pre-pending the selected label to the data unit to form a label switched packet in accordance with a label switching protocol, and forwarding the packet along a label switched path in accordance with the label.” EX1007, 2:22-26.

75. Figure 1 of Ferguson (shown below) “is a block diagram illustrating an example system 2 in which customer networks 4A, 4B (‘customer networks 4’) are

communicatively coupled via an intermediate provider network 6.” EX1007, 3:36-39. “Specifically, customer network 4A includes a customer edge (‘CE’) router 8A that is connected to a provider edge (‘PE’) router 10A via an aggregated link 12A.” EX1007, 3:39-41. “In other words, CE router 8A and PE router 10A communicate via two or more physical interconnects that are logically associated as an aggregated link.” EX1007, 3:42-44. “For example, CE router 8A and PE router 10A may communicate via two or more Ethernet links, Sonet links, or other physical interconnects.” EX1007, 3:44-47. “Similarly, customer network 4B includes a CE router 8B that is connected to a PE router 10B via an aggregated link 12B.” EX1007, 3:47-49. “PE routers 10 communicate network traffic from and to customer networks 4 in accordance with a label switching protocol, such as the Multiprotocol Label Switching (MPLS) protocol, via one or more label switched paths (LSPs) 14.” EX1007, 3:49-53. “For example, CE router 8A receives network traffic originating from devices within customer network 4A, and pre-pends MPLS labels to the network traffic to form outbound MPLS packets.” EX1007, 3:53-56. “CE router 8A communicates the outbound MPLS packets to PE router 10A via aggregated link 12A.” EX1007, 3:56-58.

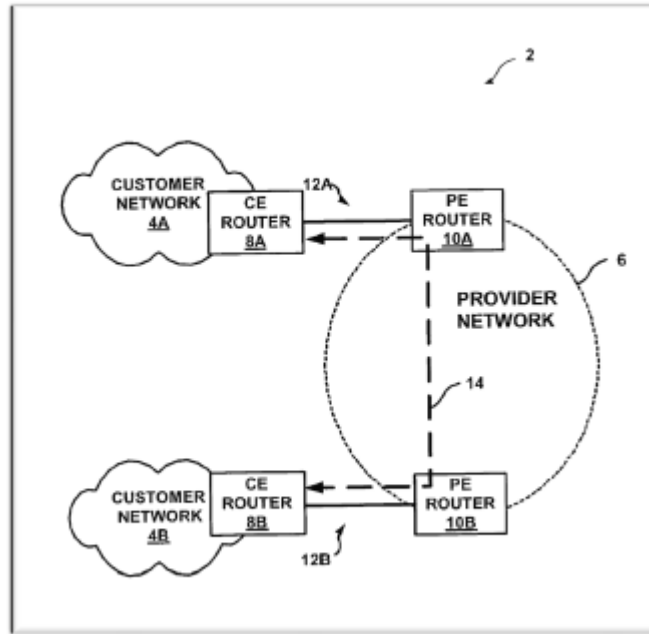


Figure 1 of Ferguson

76. “PE router 10A receives the MPLS packets, and forwards the MPLS packets to one or more intermediate routers (not shown) within provider network 6 for communication to PE router 10A via one of LSPs 14.” EX1007, 3:59-62. “PE router 10A may, for example, pre-pend additional MPLS labels to the traffic to form MPLS packets having multiple MPLS labels.” EX1007, 3:6264. “In this manner, each MPLS packet traversing provider network 6 via LSPs 14 may be guaranteed to carry two or more MPLS labels.” EX1007, 3:64-67.

77. “PE router 10B receives the MPLS packets from provider network 6, and forwards the MPLS packets to CE router 8B via aggregated link 12B.” EX1007, 4:1-3. “PE router 10B may, for example, remove one or more MPLS labels from each of the inbound packets, and distribute the packets across the physical

interconnects that are logically associated to form aggregated link 12B.” EX1007, 4:3-7. “Network traffic flows from customer network 4B to customer network 4A in similar manner.” EX1007, 4:7-8.

78. “In general, the devices of system 2, i.e., CE routers 8, PE routers 10, and intermediate routers (not shown) within provider network 6, utilize MPLS labels within pre-allocated ranges to convey protocol information for the payloads of the MPLS packets.” EX1007, 4:9-13. “In other words, the devices assign MPLS labels of the pre-allocated ranges to the MPLS packets based on the type of payloads carried by the MPLS packets.” EX1007, 4:13-16. “The devices may make use of this protocol information to facilitate distribution of the MPLS packets across multiple paths, e.g., multiple physical interconnects of an aggregated link.” EX1007, 4:16-19.

79. “Generally, the label typically carries an index into a forwarding table, e.g., a forwarding table maintained by each of CE routers 8 and PE routers 10, which specifies the next hop for the packet.” EX1007, 4:34-37. “In this manner, these devices do not need to examine the label switched packets and perform next-hop routing tasks.” EX1007, 4:37-39. “In other words, the label associates the packet with an LSP, and carries the information that determines which path a packet should take.” EX1007, 4:39-41. “Forwarding decisions can be made based on a field in the

packet or cell, i.e., the label, and the incoming interface, without requiring a route lookup.” EX1007, 4:41-44.

80. In Ferguson, “the devices of system 2 make use of the allocated ranges of MPLS labels to control the distribution of MPLS packets across multiple physical paths.” EX1007, 5:61-63. “Although the techniques have been described in reference to distribution of MPLS packets across parallel physical interconnects of an aggregated link, the techniques may be applied in a variety of environments.” EX1007, 5:63-67. “For example, the techniques may be readily applied to internal parallel data paths within a device.” EX1007, 5:67-6:2. “For example, the techniques may be used by a router to distribute packets across internal data paths that begin at the same input interface of the router and end at the same output interface of the router, but traverse through different internal, high-speed switch fabrics.” EX1007, 6:2-6. “A control unit for the router, for example, may implement the techniques to distribute received MPLS packets across multiple internal forwarding engines.” EX1007, 6:6-9.

81. Further, Ferguson explains that “[a]lthough the techniques are illustrated in reference to a router, the techniques may be readily applied to other network devices, such as switches, hubs, firewalls, gateways, proxy servers, and the like.” EX1007, 8:61-64. “In addition, the techniques may be applied to ‘edge’

devices that provide access to a large network, such as the Internet, or to high-speed ‘core’ devices within the network.” EX1007, 8:64-67.

VI. CLAIM CONSTRUCTION

82. For purposes of this declaration, it is my opinion that the terms in the claims of the ‘602 Patent do not require construction in order to evaluate the prior art discussed herein. Instead, in evaluating the prior art, I have applied the plain and ordinary meaning of the claim terms when read in light of the specification and prosecution history of the ‘602 Patent.

VII. GROUNDS OF INVALIDITY

A. Ground 1: Claims 1-26 of the ‘602 Patent are obvious over RFC 3209 in view of Raz.

83. It is my opinion that a POSITA would have found Claims 1-26 of the ‘602 Patent to be obvious over RFC 3209 in view of Raz and in further view of the knowledge of a POSITA.

84. It is further my opinion that a POSITA would have been motivated to apply various techniques and implementation details disclosed in Raz to the Multi-Protocol Label Switching (MPLS) network disclosed and suggested by RFC 3209 at least because (1) both references deal with the same purposes of preserving resources for setting up a label-switched path (LSP), and ensuring appropriate allocation of bandwidth to the path, as well as assisting the reroute of the path in the event of a failure, and (2) both references teach the same solution—using well known label

signaling protocols to perform downstream-on-demand label allocation after the downstream, intermediate node along the requested path performs selection of part of the path segment. Each of the functionalities described in Ground 1 would additionally be carried over into the combination of RFC 3209 with Raz and Ferguson in Ground 2.

85. Both RFC 3209 and Raz are directed to a system for setup and use of label-switched paths as network tunnels in an MPLS network. RFC 3209 “describes the use of RSVP (Resource Reservation Protocol), including all the necessary extensions, to establish label-switched paths (LSPs) in MPLS (Multi-Protocol Label Switching). Since the flow along an LSP is completely identified by the label applied at the ingress node of the path, these paths may be treated as tunnels.” EX1010, Abstract. Raz describes its proposed system as incorporating “a method of forwarding a high speed packet stream to a plurality of subports of lesser speed in a label switching network.” EX1006, 2:41-43. Raz situates its proposed system in the context of “Multiprotocol Label Switching (MPLS) based networks [which] are becoming increasingly popular especially in traffic engineering IP networks. MPLS uses a label switching model to switch data over a Label Switched Path (LSP).” EX1006, 1:22-25. Both RFC 3209 and Raz discuss the advantages of using traffic engineering applications of the underlying MPLS and label signaling in order to “allow the implementation of a variety of policies related to network performance

optimization. For example, LSP tunnels can be automatically or manually routed away from network failures.” EX1010, Section 1.1, Abstract (“[r]outers along the path may use the setup to **hold priorities**. ... For instance, in the traffic engineering application, it is very useful to use the Path message as a means of **verifying that bandwidth exists** at a particular priority **along an entire path**”); EX1006, 1:56-60, 11:3-12 (“**allocating LSP bandwidth** to subports”), 8:1-5 (as part of LSP setup, the LSR “executes a bandwidth allocation algorithm, described in more detail infra, that controls the allocation of bandwidth of each subport.”). A POSITA would have been motivated to combine RFC 3209 with Raz because in addition to being directed at the same problem and using the same solution, they analogously describe devices assigning network components to label-switched paths (LSPs) as network tunnels and allocating MPLS labels to advertise the assigned components. RFC 3209 explains how “each node that receives a Resv message” “allocates a new label...which it sends upstream” and in doing so, “a label-switched path is effectively established.” EX1010, Section 2.2. Raz describes a similar system in which a “LSR” (which is a type of node within MPLS network typology, also called a “switch”) provisions a label-switched path (LSP) and assigns a subport to the LSP: “The CPU 16 in the LSR performs the conventional LSR functionality including the provisioning of LSPs. In particular, the CPU functions to perform the assignment of subports to LSPs in response to LSP setup requests.” EX1006, 7:65-8:1.

86. As I discussed above, RFC 3209 discloses “several additional objects that extend RSVP, allowing the establishment of explicitly routed label switched paths using RSVP as a signaling protocol. The results is the instantiation of label-switched tunnels which can be automatically routed away from network failures, congestion, and bottlenecks.” EX1010, Abstract. RFC 3209 describes “routers that support both RSVP [1] and Multi-Protocol Label Switching [2] can associate labels with RSVP flows.” EX1010, Section 1.1. RFC 3209 explains that “[w]hen labels are associated with traffic flows, it becomes possible for a router to identify the appropriate reservation state for a packet based on the packet’s label value.” EX1010, Section 1.1. To set up an LSP Tunnel, “[a] request to bind labels to a specific LSP tunnel is initiated by an ingress node through the RSVP Path message [which is] augmented with a LABEL_REQUEST object.” EX1010, Section 1.1. The Path message is propagated downstream from the ingress node to the tunnel’s endpoint, or destination, and it is during this propagation that “[r]outers along the path may use the setup to hold priorities. ... For instance, in the traffic engineering application, it is very useful to use the Path message as a means of verifying that bandwidth exists at a particular priority along an entire path before preempting any lower priority reservations.” EX1010, Section 2.2. “A node [such as an intermediate node along the requested LSP, which would be a router such as an LSR] receiving a Path message containing an EXPLICIT_ROUTE object must determine the next hop

for this path.” EX1010, Section 4.3.4.1. In particular, “[a] Resv message is sent back upstream towards the sender, following the path state created by the Path message, in reverse order.” EX1010, Section 2.2. RFC 3209 explains how “each node that receives a Resv message” “allocates a new label ... which it sends upstream” and in doing so, “a label-switched path is effectively established.” EX1010, Section 2.2. When the node allocating the label receives a packet with that label fixed to it from upstream (such as from the sender node, or from another intermediate node which immediately precedes the node along the established LSP), the node uses the label to identify how to route the packet, and forwards the packet to the assigned next hop. EX1010, Section 1.3 (“Label Switched Path[:] The path created by the concatenation of one or more label switched hops, allowing a packet to be forwarded by swapping labels from an MPLS node to another MPLS node. For a more precise definition see [2].”), Section 2.1.

87. Raz describes a similar system in which a “LSR” (which is a type of node within MPLS network typology, also called a “switch”) provisions a label-switched path (LSP) and in particular, assigns a subport to the LSP: “The CPU 16 in the LSR performs the conventional LSR functionality including the provisioning of LSPs. In particular, the CPU functions to perform the assignment of subports to LSPs in response to LSP setup requests.” EX1006, 7:65-8:1. As part of LSP setup, the LSR “executes a bandwidth allocation algorithm, described in more detail infra,

that controls the allocation of bandwidth of each subport.” EX1006, 8:1-5. “The label is then sent to the requesting node or to a management entity to complete the LSP setup process. ...The management entity is adapted to send the label to the upstream node in order for the upstream node to know how to label packets belonging to this LSP.” EX1006, 8:5-10.

88. Raz discloses several techniques that a POSITA would recognize to improve RFC 3209’s MPLS network framework. First, Raz teaches that an LSP may be set up to pass through an aggregated set of links (e.g., a LAG), where one of the subports of the aggregated stream is assigned to the LSP during LSP setup to ensure that the bandwidth of all subports is efficiently allocated. EX1006, 7:65-8:5. Second, Raz teaches that the ports used by the path may be Ethernet ports allowing interconnection with standardized Ethernet equipment. EX1006, 14:42-44. Third, Raz teaches a beneficial implementation of MPLS labels such that the labels have dedicated a subset of bits to encode a serial number of the assigned subports of the LAG into the label—ensuring that when the LSR reads the label on incoming data packets, it knows which subport to send it to. EX1006, 9:41-48, 8:35-39. A POSITA would recognize this efficient approach to labeling would similarly be an efficient way to implement label creation in RFC 3209. EX1010, Section 4.1. Fourth, Raz teaches that the assigned subport meets the service property requirements needed to set up the LSP, such as the bandwidth requirement of the LSP, in order to properly

set up the LSP and ensure that bandwidth is reserved. EX1006, 7:7-16, 11:13-12:9. Fifth, Raz teaches dynamic rerouting of the LSP from the working path subport to a different, backup or protection path subport in the event of a network failure, and of returning to the working path if the fault is corrected, to ensure that the service on the established LSP through a LAG is not interrupted or otherwise dropped. EX1006, 5:20-28, 5:33-62. A POSITA would understand this technique would similarly improve the RFC 3209 disclosure.

89. In particular, RFC 3209 discloses or renders obvious the assignment of a physical interface to a network tunnel (i.e., an LSP operating as a network tunnel) in an MPLS network by an MPLS switch (i.e., an LSR) operating as the claimed “first” switch, where the physical interface is an outgoing interface connecting the LSR with another node on the next hop of the LSP. EX1010, Sections 1.1, 1.2, 2.2, 4.3.4.1. Raz discloses or renders obvious the assignment of a physical Ethernet LAG subport to a network tunnel (i.e., an LSP operating as a network tunnel) in an MPLS network by an MPLS/LAG switch (i.e., an LSR) operating as the claimed “first” switch, where the subport meets a bandwidth requirement of the network tunnel and has a port serial number. EX1006, 7:65-8:13, 8:22-29, 7:7-29. It would have been obvious to a POSITA for the outgoing interface of the LSR—which connects the LSR to another LSR—as rendered obvious by RFC 3209 to be a subport of a LAG (i.e., claimed “single physical tunnel port of a LAG”) as taught by Raz.

90. A POSITA would have understood that RFC 3209's system could have been improved by incorporating these aspects of Raz to ensure that LSPs, when they are set up, (1) can pass through aggregated links (such as LAG) and still employ traffic engineering functions of allocating bandwidth of the aggregated link to the LSP, and (2) support traffic engineering so that LSPs can handle high speed packet streams. RFC 3209 emphasizes that "[a]n advantage of using RSVP to establish LSP tunnels is that it enables the allocation of resources along the path. For example, bandwidth can be allocated to an LSP tunnel using standard RSVP reservations and Integrated Services service classes [4]." EX1010, Section 1.1. Raz similarly teaches "a method for allocating subport bandwidth to subports." EX1006, Abstract. Specifically, Raz teaches "a mechanism to improve the ability to handle wide connections, [specifically] a scheme for allocating LSP bandwidth to subports." EX1006, 10:60-11:8, Figure 5. As Raz describes, without bandwidth allocation between subports, "it may become difficult to allocate bandwidth for wide connections even though a sufficient amount of bandwidth is available [among the subports as a whole]." EX1006, 11:65-12:2.

91. Importantly, RFC 3209 discloses a framework for a type of signaling protocol to be utilized in MPLS network applications. RFC 3209 itself states: "Although traffic engineering (that is, performance optimization of operational networks) is expected to be an important application of this specification, the

extended RSVP protocol can be used in a much wider context.” EX1010, Section 1. Raz exemplifies one such traffic engineering application of that framework. EX1006, 1:22-39, 6:51-54 (“It is intended that the mechanism of the present invention be implemented in network devices such as routers (e.g., LSRs in MPLS networks) making up the nodes in a network and include edge nodes and intermediate nodes.”). Raz describes itself as an improvement to “link multiplexing mechanism utilizing path oriented forwarding” (EX1006, 1:6-8) which “are described in the context of an MPLS based network **employing any suitable routing** such as OSPF-TE and signaling **such as RSVP-TE signaling.**” EX1006, 6:46-50. Raz explicitly states that its described functionality is compatible with RSVP signaling protocol. EX1006, 5:10, 6:46-50. RFC 3209 is the Internet standards defining document which describes this signaling protocol and is titled “RSVP-TE: **Extensions to RSVP for LSP Tunnels.**” EX1010, Title. Raz’s teachings provide a clear application of RFC 3209’s framework by extending LSP path setup using MPLS to implement a node identifying and assigning a subport of an aggregated link to an LSP as the node’s outgoing interface, in view of RFC 3209’s rendering obvious the node’s assignment of its outgoing interface to the LSP. As such, it would have been well within a POSITA’s understanding and motivation to employ RFC 3209’s teachings of standard RSVP functionality in conjunction with Raz’s subport assignment functionality and related teachings.

a. **Claim 1**

[1.0] A method for assigning and utilizing an Ethernet physical data port in an Ethernet Link Aggregation Group (LAG) in a Multi-Protocol Label Switching (MPLS) network, the method comprising the steps of

92. It is my opinion that Element [1.0] is obvious over RFC 3209 in view of Raz. EX1001, 9:23-26.

93. RFC 3209 discloses or renders obvious a method for assigning and utilizing a physical data port in an MPLS network. As an initial matter, RFC 3209 discloses the communication of data packets in an MPLS network using label switched paths (LSPs), necessarily involving the use of physical data ports for transmission of packets along the LSP: “Section 2.9 of the MPLS architecture [2] defines a label distribution protocol as a set of procedures by which one Label Switched Router (LSR) informs another of the meaning of labels used to forward traffic between and through them. ... This document is a specification of extensions to RSVP for establishing label switched paths (LSPs) in MPLS networks.” EX1010, Section 1. RFC 3209 discloses that an LSP is “the path created by the concatenation of one or more label switched hops, allowing a packet to be forwarded by swapping labels from an MPLS node to another MPLS node.” EX1010, Section 1.2 (Terminology).

94. A POSITA would have known that physical interfaces (i.e., physical ports) connect nodes in an MPLS network, and that when a packet is forwarded from

node to node, it must travel through physical interfaces (i.e., the physical interfaces must be *utilized*) which are used to connect two adjacent physical nodes in an MPLS network. See EX1010, Section 1.1 (disclosing that a node (i.e., LSR) in the MPLS network may be “physical node.”). Not only are physical interfaces utilized, but they are also *assigned* as part of LSP setup—the path of a label-switched path (LSP) is assigned before the traffic is routed through it, and “the flow along an LSP is completely identified by the label applied [to the traffic] at the ingress node of the path.” EX1010, Abstract; see also EX1010, Section 1.1 (“the traffic that flows along a label-switched path is defined by the label applied at the ingress node of the LSP.”). A POSITA would have known that because the label defines the path to be taken by the traffic to which the label is applied, the entire route (including nodes and in particular links between those nodes) is assigned prior to traffic forwarding. A POSITA would have known further that ports—i.e., the path that a data packet takes from one node to another—may be assigned to LSPs and utilized when traffic actually traverses the “pre-determined” label-switched path. In order to know where to forward traffic, a transmitting node must know which interface to use, such as which interface connects it to the specified next node along the LSP.

95. As a particular example, RFC 3209 discloses that in the case of explicitly routed LSPs, “the paths taken by label-switched RSVP-MPLS flows can be pre-**determined**.” EX1010, Section 1.1 (emphasis added). LSP setup inherently

involves assignment of physical interfaces through which the traffic will be forwarded along a particular LSP, because the label tells the node where to forward the traffic and necessarily must identify an interface (i.e., a port) that the node will use to send the traffic to the next node. EX1010, Section 1.

96. To the extent not explicitly or inherently disclosed by RFC 3209, Raz discloses assigning and utilizing an Ethernet physical data port in an Ethernet link aggregation group (LAG) in an MPLS network. Specifically, Raz discloses the use of link aggregation to transport high speed Ethernet network traffic within an LSR in an MPLS network. Within the LSRs, individual packets from a high-speed Ethernet data stream are assigned to one of a plurality of subports for transportation through the LSR and then re-aggregated into the high-speed Ethernet data stream to be forwarded to the next node (next LSR) in the MPLS network:

There is thus provided in accordance with the invention a method of forwarding a high speed packet stream to a plurality of subports of lesser speed in a label switching network, the method comprising the steps of assigning outbound packets to one of a plurality of subports in accordance with the label associated with each outbound packet, forwarding each outbound packet to its assigned subport, **aggregating the output of a plurality of subports into a high speed packet stream** and forwarding

inbound packets from the high speed packet stream to a subport corresponding to the subport the inbound packet was originally sent out on.

EX1006, 2:41-51 (emphasis added). Figure 1 of Raz (shown below) provides an example of ten subports (Subport 0-Subport 9) used to implement link aggregation within an LSR in an MPLS network:

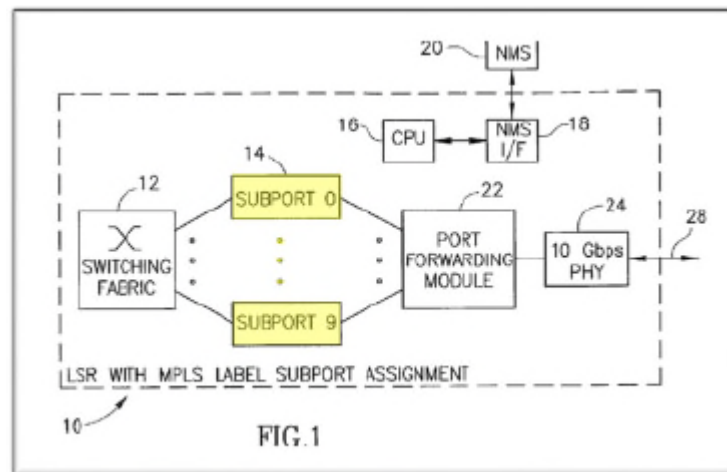


Figure 1 of Raz (Annotated)

The specification of Raz explains that the link aggregation is used to transport a high-speed packet stream through a plurality of subports of lesser speed within an LSR:

To aid in understanding the invention, the example LSR shown comprises a 10G interface that is composed of ten individual 1G packet streams. **The ten subports are provided wherein each is adapted to handle a 1G packet stream. The overall aggregate speed, however, is 10G.** Due to the connection oriented approach of the MPLS protocol, the assignment of

connections to subports can be done statically on an LSP basis. Note, that the high speed interface (e.g., 10G) may be trunked into any number of individual subports, e.g., 8, wherein 10 is used here by example only.

EX1006, 7:7-16 (emphasis added); see EX1006, 9:9-12 (disclosing that “some commercially available layer 2 switches can determine the destination port for a packet destined to a LAG (Link Aggregation Group) based on a CRC of the source MAC modulo (sic) the number of ports in the LAG. This can be used for spreading the packets to the subports by using the layer-2 switch as the port-forwarding module and defining its ports leading to the different subports as a single LAG.”), 14:19-22 (Claim 1), 15:32-35 (Claim 17), 16:41-53 (Claim 33), 17:62-18:7 (Claim 50), 18:39-42 (Claim 52), 19:3-7 (Claim 55).

97. Raz discloses the use of Ethernet physical data ports. EX1006, 2:52-67, 6:34-45; 2:28-32 (“Examples of applicable networks include, but are not limited to, Ethernet....”); 14:42-44 (Claim 7, “said high speed packet stream comprises a 10 Gigabit Ethernet (GE) stream.”).

98. While Raz discusses the utilization of subports in a LAG within an LSR to communicate high speed Ethernet packet streams in an MPLS network, it is my opinion that a POSITA would have found it obvious to implement the combination of RFC 3209 and Raz using Ethernet physical data ports of a LAG. The concept of using aggregation to communicate individual packets of a high speed Ethernet

packet stream through LAG subports in an LSR, as taught by Raz, also applies to communicating individual packets through interfaces operating as links between LSRs in an MPLS network, as taught by RFC 3209. A POSITA would have found it obvious to apply Raz's teaching of assigning a subport of an Ethernet LAG interface to the outgoing LSR interface which RFC 3209 renders obvious, because Ethernet was in widespread usage as of the priority date for the '602 Patent, and a POSITA would have found it desirable to use well-known and commercially accepted Ethernet link aggregation technology in implementing the inter-LSR link techniques in RFC 3209 and Raz. Further, Raz discloses that its invention could be implemented in Ethernet networks, and it identifies transmission speeds used by Ethernet networks (e.g., 1G and 10G). *Id.*, 1:16-19, 2:28-31, 4:52, 13:16-19, 14:42-44, 15:56-58. Thus, a POSITA would have understood that Raz discloses and suggests Ethernet subports in an Ethernet LAG.

99. In view of the above, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses and renders obvious Element [1.0].

[1.1] assigning, by a first MPLS/LAG switch, a single physical tunnel port of a LAG to a network tunnel, wherein the single physical tunnel port of the LAG meets a bandwidth requirement of the network tunnel, and wherein said single physical tunnel port of the LAG has a port serial number;

100. It is my opinion that Element [1.1] is obvious over RFC 3209 in view of Raz. EX1001, 9:27-32.

101. RFC 3209 discloses the setup of LSPs using traditional MPLS with the RSVP extension protocol for traffic engineering to create LSP tunnels:

This document describes the use of RSVP (Resource Reservation Protocol), including all the necessary extensions, to establish label-switched paths (LSPs) in MPLS (Multi-Protocol Label Switching). Since the flow along an LSP is completely identified by the label applied at the ingress node of the path, **these paths may be treated as tunnels. A key application of LSP tunnels is traffic engineering with MPLS** as specified in RFC 2702.

EX1010, Abstract (emphasis added).

Hosts and routers that support both RSVP [1] and Multi-Protocol Label Switching [2] can associate labels with RSVP flows. When MPLS and RSVP are combined, the definition of a flow can be made more flexible. Once a label switched path (LSP) is established, the traffic through the path is defined by the label applied at the ingress node of the LSP. The mapping of label to traffic can be accomplished using a number of different criteria. The set of packets that are assigned the same label value by a specific node are said to belong to the same forwarding equivalence class (FEC) (see [2]), and effectively define the “RSVP flow.” **When traffic is mapped onto a label-switched path in this way, we call the LSP an “LSP Tunnel”.** When labels are associated

with traffic flows, it becomes possible for a router to identify the appropriate reservation state for a packet based on the packet's label value.

EX1010, Section 1.1 (emphasis added). RFC 3209 alternates between the terms “node,” “router,” and “LSR,” which all refer to devices capable of performing MPLS and as such are MPLS switches. EX1010, Section 1 (“Label **Switched** Router (LSR)”), Section 4.2.2 (using the term “switch”).

102. RFC 3209 discloses or renders obvious assigning, by a node, the node's outgoing interface to a requested LSP tunnel. RFC 3209 describes LSP setup using the RSVP signaling protocol to establish explicitly routed paths through the MPLS network. EX1010, Abstract (“We propose several additional objects that extend RSVP, allowing the establishment of explicitly routed label switched paths using RSVP as a signaling protocol. The result is the instantiation of label-switched tunnels which can be automatically routed away from network failures, congestion, and bottlenecks.”). Explicitly routed paths involve propagation of a path request—that is, “[a] request to bind labels to a specific LSP tunnel is initiated by an ingress node”—that is supplemented with an Explicit Route Object (ERO). EX1010, Section 1.1. The path request with the ERO is forwarded from the LSP ingress node to the LSP destination by traversing one or more intermediate nodes along the route. EX1010, Section 1.1 Because the “EXPLICIT_ROUTE object specifies the route as a sequence of abstract nodes” (EX1010, Section 2.2)—where an “abstract node” is

“a group of nodes whose internal topology is opaque to the ingress node of the LSP” (EX1010, Section 1.1), each intermediate node along the route may make an independent forwarding decision (i.e., an independent *assignment* of network topology to the requested LSP): “A node receiving a Path message containing an EXPLICIT_ROUTE object must **determine the next hop for this path.** ... **[S]election of this next hop may involve a decision** from a set of feasible alternatives.” EX1010, Section 4.3.4.1 (emphasis added).

103. A POSITA would have understood and found it obvious from this disclosure that when a given node (i.e., a given LSR or switch) assigns the “next hop” to the requested LSP, this refers to the assignment of the next path segment along the LSP from the given node to an assigned next node which traffic belonging to that LSP will traverse after LSP setup is complete. For example, RFC 3209 discloses that “[f]urthermore, **multiple parallel LSP tunnels can be established between two nodes**, and traffic between the two nodes can be mapped onto the LSP tunnels according to local policy.” EX1010, Section 1 (emphasis added). A POSITA would have understood from this disclosure that in order to establish multiple parallel LSPs between two nodes, the node assigning the “next hop” for each of the parallel LSPs must have a way to differentiate traffic belonging to each of the LSPs. EX1010, Section 1.1. Such an assignment of the “next hop” to an LSP necessarily refers to the assignment of the outgoing physical interface (i.e., the physical port)

that connects the given node to the next node in the path. In other words, a given node selecting a path's "next hop" during LSP setup is in actuality selecting the link which the given node plans to use to forward traffic from itself to the selected next node when such traffic belonging to that LSP is received by the given node. This is because in a physical network, nodes are connected by physical links having physical interfaces (i.e., ports) on each end. These physical interfaces cannot be readily modified or swapped out to make physical connections with other nodes, so there is a one-to-one relationship between a node's outgoing interface and the node connected to that interface on the other end of the link. Further, RFC 3209 explains that the purpose of a node allocating a label is so the node can identify the tunnel that traffic carrying that label belongs to and importantly, where the node must send the traffic once received. EX1010, Section 2.2 ("The label sent upstream in the LABEL object is the label which this node will use to identify incoming traffic associated with this LSP tunnel. This label also serves as shorthand for the Filter Spec. The node can now update its "Incoming Label Map" (ILM), which is used to map incoming labeled packets to a "Next Hop Label Forwarding Entry" (NHLFE), see [2]." As disclosed by RFC 3031 (reference [2] referred in the previous disclosure), "[t]he 'Next Hop Label Forwarding Entry' (NHLFE) is used when forwarding a labeled packet. It contains the following information: 1. the packet's

next hop [and] and any other information needed to properly dispose of the packet.”
EX1008, Section 3.10.

104. Additionally, other Internet standards defining documents such as RFC 1583 confirm the relationship between assigning the “next hop” and assigning the outgoing interface by explaining that the “Next hop” is “The outgoing router interface to use when forwarding traffic to the destination.” EX1020, Section 11. While RFC 1583 primarily describes “Open Shortest Path First” (“OSPF”) routing protocols, it explains that in typical parlance, route lookup tables often contain a “next hop” field, which nodes use to look up how to route received traffic:

The routing table data structure contains all the information necessary to forward an IP data packet toward its destination. Each routing table entry describes the collection of best paths to a particular destination. When forwarding an IP data packet, the routing table entry providing the best match for the packet's IP destination is located. The matching **routing table entry then provides the next hop towards the packet’s destination.**

EX1020, Section 11 (emphasis added). Both MPLS and OSPF are traffic routing protocols and both may make use of route lookup tables—the difference is that in MPLS, a node may look at a data packet label and use the label value as an index into the route lookup table, while in OSPF, the data packet’s IP destination is used

as an index into the table. In both cases, route lookup tables convey the same information to the node, which is where the node needs to send the traffic.

105. In view of the foregoing, it is my opinion that RFC 3209 discloses or renders obvious the assignment of a physical interface to a network tunnel (i.e., an LSP operating as a network tunnel) in an MPLS network by an MPLS switch (i.e., an LSR) operating as the claimed “first” switch.

106. To the extent not disclosed or rendered obvious by RFC 3209, Raz discloses that the particular interface assigned to the network tunnel (i.e., an LSP operating as a network tunnel) may be a “single physical tunnel port of an Ethernet LAG” and that the switch (LSR) assigning the interface is a LAG switch. Raz discloses the assignment of one subport of a LAG to a network tunnel within an LSR to communicate individual packets within a high-speed packet stream:

The CPU 16 in the LSR performs the conventional LSR functionality including the provisioning of LSPs. **In particular, the CPU functions to perform the assignment of subports to LSPs in response to LSP setup requests.** The CPU executes a bandwidth allocation algorithm, described in more detail infra, that controls the allocation of bandwidth of each subport. **Once a subport is assigned, a label is generated so as to indicate the subport assignment.** The label is then sent to the requesting node or to a management entity to complete the LSP setup process. In case the label is sent

to a management entity, the management entity is adapted to send the label to the upstream node in order for the upstream node to know how to label packets belonging to this LSP. The LSR also comprises an NMS interface 18 for interfacing an external NMS 20 which is in communication with the network to the CPU 16.

EX1006, 7:65-8:13 (emphasis added); *see also* EX1006, 7:30-38 (providing example in which the assignment of subport 3 of a LAG to a network tunnel is performed by LSR B, which in this example corresponds to the claimed first MPLS/LAG switch), 7:11-14, 9:41-48. Further, Raz states that “[a] diagram illustrating an example LSR with label based **subport assignment** constructed in accordance with a first embodiment of the present invention is shown in [Figure] 1,” which is reproduced below. EX1006, 6:65-67; *see* 7:17-19 (“In accordance with the invention, the assignment of traffic to 1G subports is based on LSPs. Thus, the MPLS label is used in order to assign an incoming packet to **one of the subports.**”) (emphasis added); 9:4-15. Further, Raz discloses that the LAG subports are Ethernet subports: “Each of the one GE links make up the subports of the aggregate 10GE link,” where Raz defines GE as “Gigabit Ethernet.” EX1006, 8:22-29; *see* 4:52.

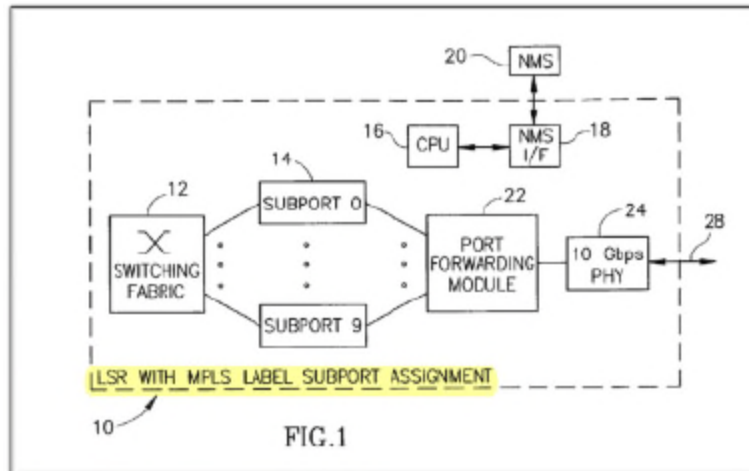


Figure 1 of Raz (Annotated)

107. Moreover, a POSITA would have understood that the assignment of the subport would be to a network tunnel formed by the LSP. EX1006, 3:1-15, 7:11-19, 7:65-8:13. It is disclosed in RFC 3209 and it would have been common knowledge to a POSITA as of the priority date that an LSP could be used to implement a network tunnel and that the set of packets that are using a particular MPLS label form a network tunnel. See EX1008, Section 3.27.3 (“It is possible to implement a tunnel as an LSP, and use label switching rather than network layer encapsulation to cause the packet to travel through the tunnel.”); EX1010, Abstract.

108. Further, as previously discussed with respect to Element [1.0], a POSITA would have understood that Raz’s subport within the LSR is a physical subport. Raz describes a series of 10 1G subports that collectively comprise a 10G interface of the LSR. EX1006, 7:7-29, 8:40-55, 9:29-40; 13:1-19. A POSITA would have understood that each of the 1G subports is implemented as a physical subport

on the LSR through which a 1G packet stream travels. Furthermore, to the extent not explicitly disclosed, a POSITA would have understood that an LSR implementing MPLS and using LAG is an MPLS/LAG switch. See EX1009 at 7 (“A label switching router is any router or switch that supports the forwarding of MPLS-encapsulated packets based solely on the incoming interface and the information in the shim header.”). Further, Raz explains that an LSR that supports MPLS can also implement a LAG. EX1006, 7:7-16.

109. RFC 3209 additionally discloses that the traffic engineering applications it describes with its RSVP signaling protocol include ensuring the LSP tunnel meets the bandwidth required to support the LSP’s traffic:

An advantage of using RSVP to establish LSP tunnels is that it enables the allocation of resources along the path. For example, **bandwidth can be allocated to an LSP tunnel using standard RSVP reservations** and Integrated Services service classes [4].

EX1010, Section 1.1 (emphasis added); see also Section 2.2 (“in the traffic engineering application, it is very useful to use the Path message as a means of **verifying that bandwidth exists at a particular priority along an entire path.**” (emphasis added)). A POSITA would have understood that an LSP tunnel’s “entire path” includes the nodes that the LSP traverses as well as the links between nodes and interfaces (i.e., ports) on each end of the links.

110. To the extent not disclosed in RFC 3209, Raz also explains that the assigned subport meets a bandwidth requirement of the LSP (i.e., the claimed network tunnel):

The invention provides a scheme for **allocating LSP bandwidth to subports** that helps in solving the problem described above in a way that provides a tradeoff between leaving subports empty for wide LSPs and spreading traffic between subports for best utilizing the bandwidth of the link (e.g., for EIR traffic). **The central idea is to leave one or more subports empty (i.e. no bandwidth used) in the event a wide connection is to be allocated.** The allocated bandwidth, however, is still distributed among the subports in such a way that EIR traffic is supported.

EX1006, 11:3-12 (emphasis added); see EX1006, 2:23-25 (“In addition, the invention comprises an algorithm for allocating subport bandwidth to LSPs.”), 7:22-26 (“it may be the case that **a different subport is the only subport (or the subport best suited) that can accept the LSP with the required bandwidth.**”) (emphasis added), 7:7-16, 11:13-12:9 (explaining that in bandwidth allocation, each subport is checked to see if the “requested bandwidth” for an LSP is lower than a threshold amount of bandwidth which itself is lower than the bandwidth capacity of each subport), see also Figure 5. Further, Claims 4-6, 20-22 and 37-39 of Raz require that each subport be “capable of handling” a traffic stream of a certain bandwidth.

EX1006, 14:33-41, 15:47-55, 16:65-17:6. The bandwidth allocation to subports of a LAG as taught by Raz would be used with the teachings of RFC 3209 in order to ensure that an LSP tunnel can support the requested traffic capacity.

111. In addition, Raz discloses that the assigned subport has a serial number. In discussing Figure 4, Raz explains that the MPLS label contains bits that “indicate the subport,” which a POSITA would have understood to mean that the subport has a serial number that is indicated by the bits:

Consider an LSP to be setup through LSR A to LSR C. When the LSP is signaled, the CAC in LSR C decides to provision the LSP on subport 1 and therefore assigns the label 0x22003. With reference to [Figure] 4, each label 140 comprises 20 bits or 5 nibbles where the first three bits indicate 1 of 8 line interface cards, **bits 16 to 13 indicate the subport** and bits 12 to 0 indicate the actual label. In this example, the label 0x22003 indicates line interface card 1, subport 1 and label 3.

EX1006, 9:41-48 (emphasis added) and Figure 4; *see* EX1006, Figure 1 (identifying subports numbered 0-9), 8:35-39 (“the LSR network device 48 comprises ... a plurality of subports 34, labeled subport 0 through subport 9”).

112. In particular, RFC 3209 discloses or renders obvious the assignment of a physical interface to a network tunnel (i.e., an LSP operating as a network tunnel) in an MPLS network by an MPLS switch (i.e., an LSR) operating as the claimed

“first” switch, where the physical interface is an outgoing interface connecting the LSR with another node on the next hop of the LSP. It is my opinion that Raz discloses or renders obvious the assignment of an interface to a network tunnel in an MPLS network by an MPLS/LAG switch (i.e., an LSR) operating as the claimed “first” switch, where the interface assigned is a physical Ethernet LAG subport, where the subport meets a bandwidth requirement of the network tunnel and has a port serial number. While Raz discloses a method of assigning a LAG subport within an LSR to the network tunnel, a POSITA would have understood that the same principles would also have been applied to the physical/outgoing interface of the LSR operating as the claimed “first” MPLS switch, as taught by RFC 3209. As discussed above, Raz teaches that a switching fabric within the LSR has subports and one of the subports with sufficient bandwidth to meet the requirements of an LSP (i.e., the network tunnel) is assigned to communicate packets from a high-speed data stream through the LSR’s switching fabric along the LSP passing through the LSR. The same principles would have applied to forwarding packets between MPLS/LAG switches in an MPLS network. A POSITA would have understood from RFC 3209 and Raz, and would have been motivated, to assign a single physical tunnel port of the MPLS/LAG switch to a network tunnel in order to provide a tunnel pathway from the switch to the LSP’s assigned next hop that can meet the bandwidth requirements “in the event a wide connection is to be allocated” for forwarding

packets in a high-speed packet stream. EX1006, 11:3-12; *see* EX1006, 2:23-25, 7:7-16, 7:22-26, 11:13-12:9, Figure 5. A POSITA would have been motivated to employ this same concept between nodes in an MPLS network as taught by RFC 3209 in order to improve the ability to communicate high speed packet streams that require increased bandwidth. At the time of the '602 Patent's priority date, a POSITA would have understood that bundled links may connect LSRs together. *See, e.g.*, EX1021, 6:58-63 (**"As is typical, each router includes a processor, some memory and a number of ports for connecting the links that allow communication between the routers 102. Five parallel links connect a router D 102D and a router E 102E and may be configured as a bundled link 106."**) (emphasis added), Abstract ("Traffic engineering and bandwidth management of bundled links may, at times, require the **selection of one of a plurality of component links in a bundled link.**") (emphasis added). It thus would have been obvious to a POSITA, given the teachings of RFC 3209 and Raz, for an LSR (i.e., claimed "first MPLS/LAG switch") to assign to an LSP tunnel (claimed "network tunnel") an outgoing interface (i.e., claimed "physical tunnel port") which is a subport of a LAG (i.e., claimed "single physical tunnel port of a LAG") connecting the LSR to another LSR.

113. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses and renders obvious Element [1.1].

[1.2] dedicating a sub-set of bits in a data packet label prepared by the first MPLS/LAG switch to encode said port serial number of said single physical tunnel port of the LAG into the data packet label;

114. It is my opinion that Element [1.2] is obvious over RFC 3209 in view of Raz. EX1001, 9:33-36.

115. RFC 3209 discloses or renders obvious the preparation of a data packet label by the LSR having assigned its outgoing interface to the LSP tunnel to encode an identifier for the interface into the data packet label. As previously explained, RFC 3209 discloses the use of RSVP signaling protocol to establish explicitly routed paths (LSP tunnels) through the MPLS network. EX1010, Abstract (“We propose several additional objects that extend RSVP, allowing the establishment of explicitly routed label switched paths using RSVP as a signaling protocol. The result is the instantiation of label-switched tunnels which can be automatically routed away from network failures, congestion, and bottlenecks.”). RFC 3209 explains that during LSP tunnel setup, a path request is propagated from an ingress node downstream (along the LSP data path) to a destination node, and it is in response to this request that each intermediate node assigns the path’s “next hop” and creates a label which it will use to identify traffic belonging to this LSP and determine where to forward such traffic:

The signaling protocol model uses downstream-on-demand label distribution.

A request to bind labels to a specific LSP tunnel is initiated by an ingress node through the RSVP Path message. For this purpose, the RSVP Path message is

augmented with a LABEL_REQUEST object. **Labels are allocated downstream and distributed (propagated upstream) by means of the RSVP Resv message.** For this purpose, the RSVP Resv message is extended with a special LABEL object.

EX1010, Section 1.1.

The destination node of a label-switched path responds to a LABEL_REQUEST by including a LABEL object in its response RSVP Resv message. The LABEL object is inserted in the filter spec list immediately following the filter spec to which it pertains.

The Resv message is sent back upstream towards the sender, following the path state created by the Path message, in reverse order. Note that if the path state was created by use of an ERO, then the Resv message will follow the reverse path of the ERO.

Each node that receives a Resv message containing a LABEL object uses that label for outgoing traffic associated with this LSP tunnel. **If the node is not the sender, it allocates a new label and places that label in the corresponding LABEL object of the Resv message** which it sends upstream to the PHOP [previous hop]. The label sent upstream in the LABEL object is the label which this node will use to identify incoming traffic associated with this LSP tunnel. This label also serves as shorthand for the Filter Spec. The

node can now update its "Incoming Label Map" (ILM), which is used to map incoming labeled packets to a "Next Hop Label Forwarding Entry" (NHLFE), see [2]. **When the Resv message propagates upstream to the sender node, a label-switched path is effectively established.**

EX1010, Section 2.2 (Operation of LSP Tunnels) (emphasis added). RFC 3209 further discloses that labels contain bits which encode information. EX1010, Section 4.1 ("The contents of a LABEL is a single label, encoded in 4 octets. Each generic MPLS label is an unsigned integer in the range 0 through 1048575."). RFC 3209 further discloses that the label must contain information sufficient for the LSR to identify the LSP to which a data packet having that label belongs, because "[t]he label sent upstream in the LABEL object is the label which this node will use to identify incoming traffic associated with this LSP tunnel." EX1010, Section 1.1. A POSITA would have understood from disclosure that "traffic belonging to the LSP tunnel is identified **solely on the basis of** packets arriving from the PHOP or 'previous hop' (see [1]) with **the particular label value(s) assigned by this node** to upstream senders to the session," where "**the label effectively defines the 'flow' through the LSP,**" that the label must contain information sufficient for the node to identify the pre-assigned next hop and corresponding outgoing interface (the physical tunnel port which was assigned in Element [1.1]). EX1010, Section 2.1. In view of the foregoing, it is my opinion that RFC 3209 discloses or renders obvious

that the LSR (claimed “first MPLS/LAG switch”) which assigned the interface (i.e., claimed “port”) dedicates a subset of bits in the label that the LSR prepares to encode said port serial number into the data packet label.

116. To the extent not disclosed or rendered obvious by RFC 3209, Raz discloses that the data packet label has dedicated a subset of bits to encode the subport serial number of a physical subport of the LAG into the label. The block quote from Raz set out below provides two examples of a subset of bits in a data packet label being dedicated to the identification of the subport of the LAG through which a packet would be sent. In the first example discussed in the block quote, LSR C (which corresponds to the claimed “first MPLS/LAG switch” in that example) dedicates “bits 16 to 13 [to] indicate the subport” (which is subport with serial number 1) of a LAG through which a packet should be sent from LSR B to LSR C in Figure 3 of Raz. In the second example, LSR B (which corresponds to the claimed “first MPLS/LAG switch” in that example) dedicates bits in the label provided to LSR A to indicate the subport (which is subport with serial number 0) of a LAG through which a packet should be sent from LSR A to LSR B in Figure 3.

Consider an LSP to be setup through LSR A to LSR C. When the LSP is signaled, the CAC in LSR C decides to provision the LSP on subport 1 and therefore assigns the label 0x22003. With reference to [Figure 4], each label 140 comprises 20 bits or 5 nibbles where the first three bits indicate 1 of 8 line

interface cards, **bits 16 to 13 indicate the subport** and bits 12 to 0 indicate the actual label. In this example, the label 0x22003 indicates line interface card 1, subport 1 and label 3.

The label generated by LSR C is communicated to LSR B which tells LSR B that the outbound subport (to LSR C) should be subport 1. **The CAC in LSR B determines that the best subport for receiving the LSP is on subport 0 on the inbound link and therefore assigns a label of 0x40005. This label indicates line interface card 2, subport 0 and label 5.** The label is communicated to LSR A who then knows by the output label that it is to assign the LSP to subport 0. The provisioned path indicating the LSR ports and subports is represented by the dotted line 53.

EX1006, 9:41-58, Figures 3-4. A POSITA would have understood that the inclusion of the bits in a data packet label by the LSR to indicate the subport through which a packet should be sent constitutes encoding the subport serial number in the label. As discussed above for Element [1.1], a serial number is a numerical identifier for the subport, and the series of bits in the label is a serial number that is encoded because it has been put into the label in a format in which it can be used to identify the subport.

117. As discussed above for Elements [1.0] and [1.1], it would have been within the knowledge of a POSITA to integrate the method disclosed by Raz in

MPLS/LAG switches of an MPLS network with the teachings of RFC 3209 in order to provide a tunnel pathway that can meet the bandwidth requirements “in the event a wide connection is to be allocated” for forwarding a high-speed packet stream. EX1006, 11:3-12; see EX1006, 2:23-25, 7:7-16, 7:22-26, 11:13-12:9, Figure 5. As such, a POSITA also would have been motivated to take the teaching of Raz of dedicating a subset of bits in an MPLS label to encode the serial number of a physical subport, and extend that to dedicating a subset of bits in an MPLS label to encode the serial number of the physical port of the MPLS/LAG switch to be used to forward packets through an LSP tunnel being set up using the well-known RSVP signaling protocol disclosed by RFC 3209 to facilitate the forwarding of high speed packet streams.

118. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses and renders obvious Element [1.2].

[1.3] sending, by said first MPLS/LAG switch, the data packet label, in which said port serial number of said single physical tunnel port is encoded, to a preceding node;

119. It is my opinion that Element [1.3] is obvious over RFC 3209 in view of Raz. EX1001, 9:37-39.

120. RFC 3209 discloses that the node (i.e., the LSR which corresponds to the claimed “first MPLS/LAG switch”) responsible for label creation sends the label that it allocated upstream to a preceding node. EX1010, Section 4.1.1.1 (“Once a

label is allocated, the node formats a new LABEL object. **The node then sends the new LABEL object as part of the Resv message to the previous hop.**") (emphasis added). This idea of a downstream node allocating a label for a data packet and sending the label upstream to a preceding node is typically referred to as "downstream" label distribution and is a core functionality of RSVP signaling protocol disclosed by RFC 3209:

The signaling protocol model uses downstream-on-demand label distribution. A request to bind labels to a specific LSP tunnel is initiated by an ingress node through the RSVP Path message. For this purpose, the RSVP Path message is augmented with a LABEL_REQUEST object. **Labels are allocated downstream and distributed (propagated upstream) by means of the RSVP Resv message.** For this purpose, the RSVP Resv message is extended with a special LABEL object.

EX1010, Section 1.1 (emphasis added).

121. As I discussed above for Element [1.2], Raz discloses dedicating a subset of bits in an MPLS label (i.e., a data packet label) to encode the serial number of a physical subport of the LAG into the label. Raz confirms that it employs the same downstream on demand label allocation as disclosed in RFC 3209:

Once a subport is assigned, a label is generated so as to indicate the subport assignment. The label is then sent to the requesting node or to a management

entity to complete the LSP setup process. In case the label is sent to a management entity, the management entity is adapted to **send the label to the upstream node in order for the upstream node to know how to label packets belonging to this LSP.**

EX1006, 8:4-10 (emphasis added); *see* EX1006, 9:49-58. The LSR that generates the label corresponds to the claimed MPLS/LAG switch, and it sends the label to the preceding node. Raz additionally discloses that its “LSPs may be setup using any suitable signaling protocol such as RSVP-TE.” EX1006, 1:36-39. Thus, a POSITA would have known, and would have been motivated, to employ downstream on demand label allocation as taught by RFC 3209 to specifically allocate the label which Raz teaches to include the encoding of the LAG subport serial number, and it would have been well within the POSITA’s ability to do so.

122. Further, as discussed above for Elements [1.0]-[1.2], it would have been within the knowledge of a POSITA to integrate the method disclosed by RFC 3209 with the MPLS/LAG switches of Raz in order to provide a tunnel pathway that can meet the bandwidth requirements “in the event a wide connection is to be allocated” for forwarding a high-speed packet stream. EX1006, 11:3-12; *see* EX1006, 2:23-25, 7:7-16, 7:22-26, 11:13-12:9, Figure 5. A POSITA also would have been motivated to take the teaching of Raz that the label encoding the serial number of the LAG subport is sent to a preceding node, and extend that to sending a label that encodes

the serial number of a physical port of an MPLS/LAG switch to a preceding node in an MPLS network to forward packets through an LSP tunnel being set up using the well-known RSVP signaling protocol disclosed by RFC 3209 to facilitate the forwarding of high speed packet streams.

123. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses and renders obvious Element [1.3].

[1.4] receiving from the preceding node, by said first MPLS/LAG switch, a data packet comprising said data packet label, in which said port serial number of said single physical tunnel port is encoded; and

124. It is my opinion that Element [1.4] is obvious over RFC 3209 in view of Raz. EX1001, 9:40-43.

125. RFC 3209 discloses receiving from the preceding node, by the LSR, a data packet comprising said data packet label. Specifically, RFC 3209 discloses data packets arriving from the previous hop of the LSP tunnel with the label value which was assigned by this LSR:

The semantics of these objects, from the perspective of a node along the label switched path, is that traffic belonging to the LSP tunnel is identified solely on the basis of **packets arriving from the PHOP or "previous hop"** (see [1]) **with the particular label value(s) assigned by this node** to upstream senders to the session.

EX1010, Section 2.1 (emphasis added), see Section 2.2 (“**The label sent upstream in the LABEL object is the label which this node will use to identify incoming traffic** associated with this LSP tunnel. This label also serves as shorthand for the Filter Spec. The node can now update its "Incoming Label Map" (ILM), which is used to **map incoming labeled packets to a "Next Hop Label Forwarding Entry" (NHLFE)**, see [2].”) (emphasis added).

126. To the extent not explicitly disclosed by RFC 3209, it is my opinion that Raz discloses receiving, from a preceding node, a data packet comprising the data packet label in which the port serial number of the physical LAG subport is encoded. Raz explains that an LSR receives a packet from a previous node in the LSP, wherein the packet has a data packet label indicating the physical tunnel subport over which the packet should be communicated:

When a packet for the provisioned LSP is **received** over a link connected to LSR A, it is forwarded to subport 3 and subsequently out over the 10G link to LSR B **with the previously assigned label indicating subport 3**. The port forwarding module in LSR B examines the label in the received packet and in response thereto forwards the packet to subport 3 for packet processing.

EX1006, 7:39-45 (emphasis added); see EX1006, 9:29-58, Figures 3-4. As discussed above for Element [1.2], the serial number for the physical tunnel subport is encoded within the data packet label. Raz further states that data packet label is sent to the

“upstream node” in its LSP “in order for the upstream node to know how to label packets belonging to this LSP.” EX1006, 8:7-10. This is consistent with the previously discussed and well-known teachings of RFC 3209 that data packets are labeled and forwarded along the established LSP with their label. In addition, Claim 1 of Raz recites “forwarding inbound packets transmitted by said upstream node and **received over said communications link by said downstream node to a subport in accordance with the label associated with said inbound packet.**” EX1006, 14:23-26 (emphasis added).

127. As discussed above for Elements [1.0]-[1.3], it would have been within the knowledge of a POSITA to integrate the method disclosed by RFC 3209 with MPLS/LAG switches of Raz in order to provide a tunnel pathway that can meet the bandwidth requirements “in the event a wide connection is to be allocated” for forwarding a high-speed packet stream. EX1006, 11:3-12; *see* EX1006, 2:23-25, 7:7-16, 7:22-26, 11:13-12:9, Figure 5. As such, a POSITA would have been motivated to treat labels containing encoding of an assigned LAG subport serial number as disclosed by Raz the same as labels disclosed in RFC 3209 to facilitate the transmission of packet streams using the well-known RSVP signaling protocol for label distribution and allocation.

128. Accordingly, it is my opinion that that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses and renders obvious Element [1.4].

[1.5] sending said data packet from said first MPLS/LAG switch to a second MPLS/LAG switch via said single physical tunnel port having the port serial number encoded in the data packet label.

129. It is my opinion that Element [1.5] is obvious over RFC 3209 in view of Raz. EX1001, 9:44-47.

130. It is my opinion that RFC 3209 discloses or renders obvious sending said data packet from said LSR (i.e., the claimed “first” MPLS switch) to a second LSR via the outgoing interface which was assigned by said LSR in Element [1.1] (i.e., the claimed “single physical tunnel port”). In particular and as previously explained, RFC 3209 discloses that each intermediate node (LSR or MPLS switch) assigns the “next hop” of an LSP tunnel during LSP setup, and a POSITA would have found it obvious that this assignment necessarily includes the assignment of the LSR’s outgoing interface (i.e., the physical tunnel port) which connects the LSR to the next LSR. See my earlier discussion at Element [1.1]. The particular assignment of a subport of a LAG to a network tunnel is further disclosed or rendered obvious by Raz, and as I previously discussed, the combination of these teachings would lead a POSITA to implement Raz’s LAG subport assignment disclosure to interfaces which connect an LSR to another LSR, as taught by RFC 3209. As I previously

explained, a POSITA would have understood from RFC 3209 and Raz’s disclosures that the assigned outgoing interface of a node selecting its “next hop” may be a subport of an aggregated, or trunked link. Additional background materials confirm that an interface connecting LSRs together may be a bundled, or trunked link. *See, e.g.,* EX1021, 6:58-63 (“**As is typical, each router includes** a processor, some memory and **a number of ports for connecting the links that allow communication between the routers 102. Five parallel links connect a router D 102D and a router E 102E and may be configured as a bundled link 106.**”) (emphasis added), Abstract (“Traffic engineering and bandwidth management of bundled links may, at times, require the **selection of one of a plurality of component links in a bundled link.**”) (emphasis added). It thus would have been obvious to a POSITA, given the teachings of RFC 3209 and Raz, for an LSR (i.e., claimed “first MPLS/LAG switch”) to assign to an LSP tunnel (claimed “network tunnel”) an outgoing interface (i.e., claimed “physical tunnel port”) which is a subport of a LAG (i.e., claimed “single physical tunnel port of a LAG”) connecting the LSR to another LSR.

131. RFC 3209 discloses forwarding a data packet received from the preceding node to another node (i.e., the LSR connected to it and the claimed “second” MPLS switch) via said previously assigned outgoing interface (i.e., said previously assigned LAG subport which is the claimed “physical tunnel port”). The

LSR which does the forwarding function is also the LSR which performed the “assigning” of its outgoing interface and the allocation of the label. EX1010, Section 4.1.1.1. Specifically, RFC 3209 discloses that a “Label Switched Path” is “**The path created by the concatenation of one or more label switched hops**, allowing a packet to be **forwarded** by swapping labels **from an MPLS node to another MPLS node**,” EX1010, Section 1.2. Furthermore, “[t]he node [which assigns the next hop and prepares the label] SHOULD be prepared to **forward packets carrying the assigned label** prior to sending the Resv message,” EX1010, Section 4.1.1.1. RFC 3209 is disclosing that when the MPLS node receives a data packet containing the label which the MPLS node allocated to this LSP tunnel, the MPLS node “forward[s] packets carrying the assigned label” to another MPLS node (the claimed “second MPL/LAG switch”).

132. RFC 3209 in view of Raz further renders obvious that the forwarding of the data packet is performed “via” assigned outgoing interface (i.e., the assigned LAG subport which was selected according to the teachings of Raz, and the claimed “single physical tunnel port”), because it is the LAG subport which Raz discloses is indicated in the data packet label.

133. To the extent not explicitly disclosed or rendered obvious by RFC 3209, given the teachings of Raz, a POSITA would have understood that the data packet received from the previous LSR would be sent to another LSR (which corresponds

to the claimed second MPLS/LAG switch) via the physical tunnel subport having the port serial number encoded in the data packet label. EX1006, 7:17-29, 9:29-58, Figures 3-4. Further, Claim 1 of Raz recites “forwarding inbound packets transmitted by said upstream node and received over said communications link by said downstream node to a subport in accordance with the label associated with said inbound packet.” Exhibit 1006, 14:23-26.

134. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses and renders obvious Element [1.5], and claim 1 as a whole is obvious over RFC 3209 in view of Raz.

b. Claim 2

[2] The method of claim 1, further comprising the step of receiving from a preceding node located upstream from said first MPLS/LAG switch, by said first MPLS/LAG switch, a request message requesting configuration of said network tunnel, the message further requesting said data packet label associated with said network tunnel.

135. It is my opinion that the element of Claim 2 is obvious over RFC 3209 in view of Raz. EX1001, 9:48-53.

136. RFC 3209 discloses that using RSVP signaling protocol to set up the LSP tunnel involves the propagation of a path request message downstream from ingress node to destination. Each intermediate node receives the forwarded path request from the previous node, the request message specifically including a request for a data packet label:

To create an LSP tunnel, the first MPLS node on the path -- that is, the sender node with respect to the path -- **creates an RSVP Path message** with a session type of LSP_TUNNEL_IPv4 or LSP_TUNNEL_IPv6 **and inserts a LABEL_REQUEST object into the Path message.** The LABEL_REQUEST object indicates that a label binding for this path is requested and also provides an indication of the network layer protocol that is to be carried over this path.

EX1010, Section 2.2 (emphasis added); Section 2.2 (“The LABEL_REQUEST object **requests intermediate routers and receiver nodes to provide a label binding** for the session.”) (emphasis added); Section 4.2.4 (discussing the common use of a LABEL_REQUEST object to establish an LSP tunnel when using RSVP-TE).

137. To the extent not explicitly disclosed by RFC 3209, Raz discloses that “the assignment of subports to LSPs” is performed “in response to LSP setup requests.” EX1006, 7:65-8:1. A POSITA would have understood that such requests would have come from a preceding node, because the preceding node needs the information requested in order to transmit the packet in accordance with the disclosed methods. Further, Raz explains that:

Once a subport is assigned, a label is generated so as to indicate the subport assignment. The label is then sent to the **requesting node** or to a management

entity to complete the LSP setup process. In case the label is sent to a management entity, the management entity is adapted to **send the label to the upstream node in order for the upstream node to know to label packets belonging to this LSP.**

EX1006, 8:4-10 (emphasis added). It is my opinion that a POSITA would have understood from this disclosure in RFC 3209 and Raz that a preceding or “requesting” node upstream from the MPLS/LAG switch (discussed above in the analysis of Claim 1) sends a request message requesting configuration of the network tunnel (i.e. the LSP) and requesting that the data packet label associated with the network tunnel be sent to the preceding node so that the preceding node knows the port of the MPLS/LAG switch to which the data packet should be routed through the network tunnel.

138. Accordingly, it is my opinion that RFC 3209 in view of Raz discloses and renders obvious the element of Claim 2.

c. Claim 3

[3] The method of claim 2, wherein said request message comprises an RSVP-TE PATH message augmented with a LABEL_REQUEST object.

139. It is my opinion that the element of Claim 3 is obvious over RFC 3209 in view of Raz and the knowledge of a POSITA. EX1001, 9:54-56.

140. RFC 3209 discloses that using RSVP signaling protocol to set up the LSP tunnel involves the propagation of a path request message downstream from

ingress node to destination. Each intermediate node receives the forwarded path request from the previous node, the request message specifically including a request for a data packet label:

To create an LSP tunnel, the first MPLS node on the path -- that is, the sender node with respect to the path -- **creates an RSVP Path message** with a session type of LSP_TUNNEL_IPv4 or LSP_TUNNEL_IPv6 **and inserts a LABEL_REQUEST object into the Path message.** The LABEL_REQUEST object indicates that a label binding for this path is requested and also provides an indication of the network layer protocol that is to be carried over this path.

141. EX1010, Section 2.2 (emphasis added); Section 2.2 (“The LABEL_REQUEST object **requests intermediate routers and receiver nodes to provide a label binding** for the session.” (emphasis added)), Section 4.2.4 (discussing the common use of a LABEL_REQUEST object to establish an LSP tunnel when using RSVP-TE). This functionality is consistent with Raz, which states: “the principles of the present invention are described in the context of an MPLS based network employing any suitable routing such as OSPF-TE and signaling such as **RSVP-TE signaling** or uses management-plane based provisioning instead or in addition thereto.” EX1006, 6:46-50 (emphasis added), 1:36-39 (“LSPs may be setup using any suitable signaling protocol such as RSVP-

TE or CR-LDP or using the management plane (e.g., NMS setting the relevant MIB items that create the LSPs.”), 5:10, 6:46-50.

142. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses and renders obvious the element of Claim 3.

d. Claim 4

[4] The method according to claim 3, wherein said request comprises an indication of a service property, and wherein said selecting comprises identifying a physical port in compliance with said service property.

143. It is my opinion that the element of Claim 4 is obvious over RFC 3209 in view of Raz and the knowledge of a POSITA. EX1001, 9:57-60. RFC 3209 discloses that a path setup request may include an indication of a service property, in particular a class of service in the form of an Integrated Services object and a bandwidth needed for the tunnel, both of which a POSITA would have considered to be service properties:

An advantage of using RSVP to establish LSP tunnels is that it enables the allocation of resources along the path. For example, **bandwidth can be allocated to an LSP tunnel using standard RSVP reservations and Integrated Services service classes [4].**

EX1010, Section 1.1 (emphasis added), Section 2.3 (“Service Classes – This document does not restrict the type of **Integrated Service requests for reservations.**”) (emphasis added), Section 2.6.

144. To the extent not explicitly disclosed in RFC 3209, a POSITA would have understood from the disclosure in Raz that it would have been obvious to include an indication of a service property in the request message received from the node preceding the MPLS/LAG switch, and select the subport for the tunnel that is in compliance with the service property. For example, Raz explains that its “invention provides a scheme for allocating LSP bandwidth to subports that helps in solving the problem described above in a way that provides a tradeoff between leaving subports empty for wide LSPs and spreading traffic between subports for best utilizing the bandwidth of the link (e.g., for [Excess Information Rate] traffic).” EX1006, 11:3-8. “The central idea is to leave one or more subports empty (i.e., no bandwidth used) in the event a wide connection is to be allocated.” EX1006, 11:8-10. A POSITA would have understood that Raz’s focus on allocation of bandwidth to accommodate “a wide connection” is another way of saying that the request message has an indication of a service property (i.e., the amount of bandwidth needed to accommodate the wide connection). Further, Raz provides an example of its system being used to provide a network tunnel for traffic requiring a Committed

Information Rate (“CIR”), which a POSITA would have understood to be a service property. EX1006, 10:60-11:2; *see* EX1006, 1:59-61, 4:40, 11:55-59, Figure 5.

145. Further, a POSITA would have understood from these disclosures in RFC 3209 and Raz that the assigned outgoing interface (of RFC 329) which corresponds to the selected subport (i.e., claimed “physical port”) of the MPLS/LAG switch is selected based on whether it can comply with the required service property—i.e. provide the bandwidth needed for the tunnel. EX1006, 10:60-11:12, 11:55-59. Specifically, Raz provides the example its system identifies and assigns a subport or port that has the bandwidth available to meet the required CIR, which is a service property. EX1006, 10:60-11:12. This functionality would have been carried over into the combination of RFC 3209 with Raz, in order for the selected subport (interface i.e., claimed “physical port”) to support the LSP tunnel as requested. EX1010, Section 1.1 (describing that one advantage of RSVP is the allocation of bandwidth to LSP tunnels, i.e., ensuring that the tunnel actually has the resources available to support the traffic flow belonging to that tunnel’s FEC).

146. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses and renders obvious the element of Claim 4.

e. Claim 5

[5] The method according to claim 4, wherein said service property comprises at least one of a guaranteed bandwidth; a peak bandwidth; and a class of service.

147. It is my opinion that the element of Claim 5 is obvious over RFC 3209 in view of Raz. EX1001, 9:61-63. As discussed above for Claim 4, RFC 3209 discloses that a path setup request may include an indication of a service property, in particular a class of service in the form of an Integrated Services object and a bandwidth needed for the tunnel:

An advantage of using RSVP to establish LSP tunnels is that it enables the allocation of resources along the path. For example, **bandwidth can be allocated to an LSP tunnel using standard RSVP reservations and Integrated Services service classes** [4].

EX1010, Section 1.1 (emphasis added), Section 2.3 (“Service Classes – This document does not restrict the type of **Integrated Service requests for reservations.**”) (emphasis added), Section 2.6. A POSITA would have understood from this disclosure that the LSP tunnel setup using RSVP includes reserving a bandwidth needed by the tunnel (i.e., a “guaranteed bandwidth” for the tunnel), as the allocation of bandwidth to the LSP tunnel is an advantage of using RSVP signaling protocol which ensures that the amount of bandwidth needed by the tunnel is *reserved* for the tunnel. EX1010, Section 2.2 (“It is very useful to use the Path

message as a means of verifying that bandwidth exists at a particular priority along an entire path.”).

148. To the extent not disclosed by RFC 3209, Raz discloses accommodation of “wide connections” that have a certain Committed Information Rate or CIR. EX1006, 10:60-11:2, 1:59-61, 4:40, 11:55-59, Figure 5. A POSITA would have understood that the CIR is a service property, and CIR is another way of saying a guaranteed bandwidth. Alternatively, it would have been within the knowledge of a POSITA, in view of the discussion of bandwidth allocation in Raz, that the service property being accommodated would have been any one of a guaranteed bandwidth, a peak bandwidth or a class of service. EX1006, 10:60-11:12, 1:59-61, 4:40, 11:55-59, Figure 5. This functionality would have been carried over into the combination of RFC 3209 with Raz.

149. Accordingly, it is my opinion that RFC 3209 in view of Raz discloses or renders obvious the element of Claim 5.

f. Claim 6

[6] The method according to claim 1, wherein said selecting comprises selecting a single physical tunnel port having a maximum available bandwidth of said plurality of physical data ports.

150. It is my opinion that the element of Claim 6 is obvious over RFC 3209 in view of Raz. EX1001, 9:64-67. Raz describes an embodiment of its method of allocating bandwidth to subports of a LAG in Figure 5 and explains that, in the

method, “the subport having the **most free bandwidth** is used.” EX1006, 11:13-59 (emphasis added), Figure 5. Moreover, it is my opinion that a POSITA would have understood to select the subport or port with the most available bandwidth to handle a high-speed packet stream requiring wide bandwidth. The selection of a subport having the maximum available bandwidth would have been a straightforward thing to do for a POSITA. Indeed, a POSITA would have understood from the following disclosure in Raz to select a single physical tunnel port having the necessary available bandwidth from among the plurality of available physical data ports of an MPLS/LAG switch:

The invention provides a scheme for allocating LSP bandwidth to subports that helps in solving the problem described above in a way that provides a tradeoff between leaving subports empty for wide LSPs and spreading traffic between subports for best utilizing the bandwidth of the link (e.g., for EIR traffic). The central idea is to **leave one or more subports empty (i.e. no bandwidth used) in the event a wide connection is to be allocated.**

EX1006, 11:3-10 (emphasis added). This functionality would have been carried over into the combination of RFC 3209 with Raz.

151. Accordingly, it is my opinion that RFC 3209 in view of Raz discloses or renders obvious the element of Claim 6.

g. Claim 7

[7] The method according to claim 1, wherein said selecting comprises selecting a port having a minimum available bandwidth of said plurality of physical data ports which is not less than said bandwidth requirement of the network tunnel.

152. It is my opinion that the element of Claim 7 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA. EX1001, 10:1-4. A POSITA would have understood from disclosures in Raz that certain subports are available and provide the bandwidth needed to forward packets in a high-speed data stream. The selection of a subport having a minimum available bandwidth which is not less than the bandwidth requirement of the network tunnel would have been a straightforward concept for a POSITA. Indeed, a POSITA would have understood that Raz discusses a situation where the minimum available bandwidth of each of its subports needs to be sufficient to handle the bandwidth of a wide connection. EX1006, 10:60-11:12. Raz then discloses that its system is arranged to address this situation. For example, the system in Raz may “leave one or more of the subports empty (i.e. no bandwidth used) in the event a wide connection is to be allocated,” which may involve selecting for the LSP a different subport having the minimum bandwidth available. EX1006, 11:8-10. Further, Raz explains its “bandwidth allocation method” in connection with Figure 5 to demonstrate how a subport is selected that has a minimum available bandwidth that is not less than the bandwidth required by the network tunnel (i.e., the LSP). EX1006, 11:13-59. As discussed above for Claim 1, a POSITA would have understood from this disclosure in Raz to

select a port of the MPLS/LAG switch that has a minimum available bandwidth that is not less than the bandwidth required by a network tunnel handling a high-speed packet stream. This functionality would have been carried over into the combination of RFC 3209 with Raz.

153. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses or renders obvious the element of Claim 7.

h. Claim 8

[8] The method according to claim 1, wherein said switching said data packet is according to a mapping function.

154. It is my opinion that the element of Claim 8 is obvious over RFC 3209 in view of Raz. EX1001, 10:5-6.

155. I note that Claim 8 is dependent on Claim 1, and Claim 8 refers to “said switching said data packet.” I understand that this language would generally be used to refer back to a switching of a data packet recited in Claim 1. However, Claim 1 does not specifically use the language of “switching” a data packet. As such, it is unclear what is meant when Claim 8 recites “said switching said data packet.”

156. Nonetheless, however that phrase would be interpreted, a POSITA would have understood that RFC 3209 renders obvious to switch data packets “according to a mapping function.” RFC 3209 discloses that “traffic is mapped onto a label-switched path,” and that “when labels are associated with traffic flows, it

becomes possible for a router to identify the appropriate reservation state for a packet based on the packet's label value." EX1010, Section 1.1. A POSITA would have understood this to mean that the label value is used by a router to identify the appropriate forward equivalence class (FEC) and corresponding routing instructions for that data packet according to a mapping of label to data flow. RFC 3209 further explains that the label, once assigned, is used by the router (node, or claimed "MPLS/LAG switch") in order to *map* incoming traffic to the appropriate next hop, or forwarding path, of the packet:

The label sent upstream in the LABEL object is the label which this node will use to identify incoming traffic associated with this LSP tunnel. This label also serves as shorthand for the Filter Spec. The node can now update its **"Incoming Label Map" (ILM), which is used to map incoming labeled packets to a "Next Hop Label Forwarding Entry" (NHLFE),** see [2].

EX1010, Section 2.2 (emphasis added), Section 1.2 ("Label Switched Path" is "The path created by the concatenation of one or more label switched hops, allowing a packet to be forwarded by swapping labels from an MPLS node to another MPLS node."). RFC 3209's disclosure of a node (i.e., claimed "MPLS/LAG switch") using the label "to map incoming labeled packets to a 'Next Hop Label Forwarding Entry'" is a mapping function which is used to switch the data packet to its next hop. EX1010, Section 2.2.

157. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses and renders obvious the element of Claim 8.

i. Claim 9

[9] The method according to claim 1, wherein said preparing comprises inserting into said data packet label a set of bits that identify said single physical tunnel port; and wherein said switching said data packet comprises extracting said set of bits to determine an identity of said single physical tunnel port.

158. It is my opinion that the element of Claim 9 is obvious over RFC 3209 in view of Raz for the same reasons as those discussed above for Elements [1.2] and [1.5]. EX1001, 10:7-12.

159. I note that Claim 9 is dependent on Claim 1, and Claim 9 refers to “said switching said data packet.” I understand that this language would generally be used to refer back to switching of a data packet recited in Claim 1. However, Claim 1 does not specifically use the language of “switching” a data packet. As such, it is unclear what is mean when Claim 8 recites “said switching said data packet.”

160. Nonetheless, however that phrase would be interpreted, a POSITA would have understood that Claim 9 is obvious over RFC 3209 in view of Raz. As explained above for Element [1.2], Raz discloses dedicating a subset of bits in MPLS label 140 (i.e., a data packet label) that identify a physical subport of the LAG:

Consider an LSP to be setup through LSR A to LSR C. When the LSP is signaled, the CAC in LSR C decides to provision the LSP on subport 1 and

therefore assigns the label 0x22003. With reference to [Figure], each label 140 comprises 20 bits or 5 nibbles where the first three bits indicate 1 of 8 line interface cards, **bits 16 to 13 indicate the subport** and bits 12 to 0 indicate the actual label. In this example, the label 0x22003 indicates line interface card 1, subport 1 and label 3.

EX1006, 9:41-58, Figure 4. In my opinion, a POSITA would consider this to be the same as inserting the bits into the data packet label.

161. Further, a POSITA would have understood from Raz to extract the bits from the label to identify the physical tunnel port onto which to switch the data packets from the high-speed packet stream. Raz explains that its system examines the data packet label to *determine* the physical tunnel subport over which the packet should be forwarded from one LSR to another:

When a packet for the provisioned LSP is received over a link connected to LSR A, it is forwarded to subport 3 and subsequently out over the 10G link to LSR B with the previously assigned label indicating subport 3. **The port forwarding module in LSR B examines the label in the received packet and in response thereto forwards the packet to subport 3 for packet processing.**

EX1006, 7:39-45 (emphasis added); see EX1006, 7:17-29, 9:29-58, Figures 3-4. As discussed above, a subset of bits in the data packet label identifies the physical tunnel

subport to be used for forwarding the data packet by the LSR which receives a data packet comprising that label. EX1006, 9:41-58, Figure 4. A POSITA would have understood from these disclosures that the bits within the data packet label are extracted to determine the identity of the single physical subport to use for the transmission of the high-speed packet stream.

162. Further, it is my opinion that it would have been within the knowledge of a POSITA to implement the method disclosed by Raz in MPLS/LAG switches of an MPLS network in order to provide a tunnel pathway that can meet the bandwidth requirements “in the event a wide connection is to be allocated” for forwarding a high speed packet stream. EX1006, 11:3-12; *see* EX1006, 2:23-25, 7:7-16, 7:22-26, 11:13-12:9, Figure 5. As such, a POSITA also would have been motivated to take the teaching of Raz of inserting a set of bits in MPLS label 140 and extracting bits from that label to identify a physical subport, and extend that to inserting a set of bits in an MPLS label and extracting bits from that label to identify the physical port of the MPLS/LAG switch to be used to forward packets through a network tunnel formed by the LSP. This functionality would have been carried over into the combination of RFC 3209 with Raz because RFC 3209 teaches that the label is used by the node to identify where to send the data packet. Raz’s functionality is an implementation enabling the node to use the label to identify the outgoing interface

from the contents of the label, in order to send the data packet to the assigned subport.

163. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses and renders obvious the element of Claim 9.

j. Claim 10

[10] The method according to claim 1, wherein said preparing comprises storing said data packet label along with an identifier of said single physical tunnel port in a memory, and wherein said switching said data packet comprises retrieving said identifier from said memory responsively to said data packet label.

164. It is my opinion that the element of Claim 10 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA. EX1001, 10:13-18. As discussed with respect to the element of Claim 8, RFC 3209 discloses that “traffic is mapped onto a label-switched path,” and that “when labels are associated with traffic flows, it becomes possible for a router to identify the appropriate reservation state for a packet based on the packet’s label value.” EX1010, Section 1.1. A POSITA would have understood this to mean that the label value is used by a router to identify the appropriate forward equivalence class (FEC) and corresponding routing instructions for that data packet according to a mapping of label to data flow. RFC 3209 further explains that the label, once assigned, is used by the router (node,

or claimed “MPLS/LAG switch”) in order to map incoming traffic to the appropriate next hop, or forwarding path, of the packet:

The label sent upstream in the LABEL object is the label which this node will use to identify incoming traffic associated with this LSP tunnel. **This label also serves as shorthand for the Filter Spec.** The node can now update its **"Incoming Label Map" (ILM), which is used to map incoming labeled packets to a "Next Hop Label Forwarding Entry" (NHLFE),** see [2].

EX1010, Section 2.2 (emphasis added). A POSITA would have understood that the node's ILM comprises a storage at the node of the label value along with the corresponding FEC and any information needed to forward the data packet to the next hop, which necessarily includes the identification of the outgoing interface on which the node will forward the data packet.

165. To the extent not explicitly disclosed, it is my opinion that a POSITA would have known to store the data packet label along with an identifier of the physical tunnel subport to be used to forward data packets in memory, which is a common element of computer network hardware. A POSITA would have understood that label switching commonly requires storing a label and the associated subport to enable forwarding of received packets. Further, it would have been understood that, when a data packet label was received, an identifier would be

retrieved from the memory so that it could be used to forward that data packet to the identified physical tunnel subport.

166. Further, it is my opinion that it would have been within the knowledge of a POSITA to implement the method disclosed by RFC 3209 with Raz's disclosures of MPLS/LAG switches in order to provide a tunnel pathway that can meet the bandwidth requirements "in the event a wide connection is to be allocated" for forwarding a high-speed packet stream. EX1006, 11:3-12; see EX1006, 2:23-25, 7:7-16, 7:22-26, 11:13-12:9, Figure 5. As such, a POSITA also would have been motivated to take the teaching of Raz relating to using a memory to identify a physical subport, and extend that to using a memory to identify the physical port of the MPLS/LAG switch to be used in RFC 3209's LSP tunnel setup and subsequent packet forwarding to forward packets through a network tunnel formed by the LSP tunnel.

167. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses and renders obvious the element of Claim 10.

k. Claim 11

[11] The method according to claim 1, further comprising the steps of selecting a backup port from among the plurality of physical data ports, different from said single physical tunnel port; and responsively to a service interruption of said single physical tunnel port, switching said data packet to said backup port and sending said data packet to said second MPLS/LAG switch via said backup port.

168. It is my opinion that the element of Claim 11 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA. EX1001, 10:19-25. RFC 3209 discloses that “the extended RSVP protocol [disclosed herein] ... supports smooth rerouting of LSPs.” EX1010, Section 1. RFC 3209 further discloses that “[o]ne of the requirements for Traffic Engineering is the capability to reroute an established TE tunnel under a number of conditions, [one condition being] when TE tunnel reroute is usually required is upon failure of a resource along the TE tunnel’s established path. Under some policies, it may also be necessary to return the TE tunnel to its original path when the failed resource becomes re-activated.” EX1010, Section 2.5 (emphasis added). A POSITA would understand that a “failure of a resource along the TE tunnel’s established path” is an interruption of service, such as by an interface assigned to the LSP, and that the “reroute” of the tunnel involves switching the data packets flowing through the tunnel to a different route (i.e., a different interface).

169. Additionally, Raz discloses the same uses of “rerouting” to change “the route of a traffic path” if there is a “fault on the working path,” and additionally discloses that the backup route comprises a backup subport selected from among the plurality of LAG subports:

Rerouting is defined as a procedure for **changing the route of a traffic path**.

Rerouting can serve as a recovery mechanism in which the broken path, the

recovery path or segments of these paths are created dynamically after **the detection of a fault on the working path**. In other words, rerouting can serve as a recovery mechanism in which the recovery path is not pre-established. Rerouting can also serve as an optimization mechanism in which path routes are dynamically changed to ones that are better suited for current network conditions.

EX1006, 5:20-28 (emphasis added). Further, Raz explains that “[t]he recovery path is the path by which traffic is restored after the occurrence of a fault, i.e., the path over which the traffic is directed by the recovery mechanism. The recovery path may be established by MPLS means. The terms backup path, alternative path and protection path are synonyms for a recovery path.” EX1006, 5:51-56, 10:12-56. Raz also discloses that “[a] switchover is the process of switching the traffic from the path that the traffic is flowing on onto one or more alternate path(s).” EX1006, 5:27-59. “This may involve moving traffic from a working path onto one or more recovery paths, or may involve moving traffic from a recovery path(s) on to a more optimal working path(s).” EX1006, 5:59-62. Raz further discloses that for a protection path, “protection bandwidth is defined as bandwidth on **a link reserved for protection purposes, e.g., ... recovery path**.” EX1006, 5:33-37 (emphasis added). Raz states that protection paths are “provisioned” with specific subports set for the protection

path, which a POSITA would consider to be the reservation of bandwidth along a backup subport. EX1006, 2:21-25.

170. A POSITA would have understood these disclosures in Raz to disclose selecting a backup port from among the plurality of physical data ports, different from said single physical tunnel port. A POSITA would have known that the backup or protection path subport is different from the primary physical tunnel subport because the purpose of rerouting and tunnel protection is to have the ability to send packets along an “alternate path” if the primary physical tunnel subport suffers a fault. EX1006, 5:20-28, 5:51-62, 10:12-56. These disclosures would have been carried over into the RFC 3209 and Raz combination such that the “recovery path” taught by RFC 3209 would be a selection and subsequent switching of data packets to a particular different subport from the plurality of LAG subports described by Raz.

171. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses or renders obvious the element of Claim 11.

I. Claim 12

[12] The method according to claim 11, further comprising the step of responsive to a restoral of said service interruption of said single physical tunnel port, reverting switching of said data packet from said backup port and sending said data packet to said second MPLS/LAG switch via said single physical tunnel port.

172. It is my opinion that the element of Claim 12 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA. EX1001, 10:26-31. In addition to the rerouting of traffic discussed above for Claim 11, RFC 3209 also discloses that “[o]ne of the requirements for Traffic Engineering is the capability to reroute an established TE tunnel under a number of conditions, [one condition being] when TE tunnel reroute is usually required is upon failure of a resource along the TE tunnel’s established path. **Under some policies, it may also be necessary to return the TE tunnel to its original path when the failed resource becomes re-activated.**” EX1010, Section 2.5 (emphasis added). A POSITA would have understood that a “failure of a resource along the TE tunnel’s established path” is an interruption of service, and that the “return” of the tunnel to its “original path” involves switching the data packets flowing through the tunnel back to the original path (i.e., the original interface). EX1010, Section 2.5.

173. To the extent not explicitly disclosed by RFC 3209, Raz also discloses a “revertive mode” that operates as “a recovery mode in which traffic is automatically switched back from the recovery path to the original working path upon the restoration of the working path to a fault-free condition.” EX1006, 5:64-67. Further, Raz explains that “[a] switchback is the process of returning the traffic from one or more recovery paths back to the working path(s).” EX1006, 5:62-63. As previously explained with respect to Claim 11, a POSITA would understand the

recovery and restoration disclosures in Raz to refer to the switching of data packets from a backup subport to the previously assigned subport utilized by the MPLS/LAG switch as part of the network tunnel. These disclosures would have been carried over into the RFC 3209 and Raz combination such that the “return[ing] the TE tunnel to its original path when the failed resource becomes re-activated” taught by RFC 3209 would be a subsequent switching of data packets back to the originally assigned subport from the plurality of LAG subports described by Raz.

174. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses and renders obvious the element of Claim 12.

m. Claim 13

[13] The method according to claim 1, wherein said first MPLS/LAG switch comprises a Label Switched Router (LSR).

175. It is my opinion that the element of Claim 13 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA. EX1001, 10:32-34. RFC 3209 describes and extends on “a label distribution protocol as a set of procedures by which one **Label Switched Router (LSR)** informs another of labels used to forward traffic between and through them.” EX1010, Section 1 (emphasis added). RFC 3209 describes that the LSR (which RFC 3209 alternately refers to as a “node” / “switch” or simply “router” operating in the MPLS network) which employs MPLS and the extensions to RSVP are capable of performing the method

described by the elements of Claim 1. EX1010, Section 1.1 (“Hosts and routers that support both RSVP [1] and Multi-Protocol Label Switching [2] can associate labels with RSVP flows.”). Raz likewise repeatedly discloses that the device used to switch high speed packet streams in a LAG in an MPLS environment according to the method of Claim 1 is an LSR, as shown below in Figure 1 of Raz, which easily enables a POSITA to implement the functionality of the LSR described by Raz into the method of MPLS LSP tunnels described by RFC 3209. *See* EX1006, 6:9-20, 6:63-8:13, 10:33-48, Figure 1, Figure 3.

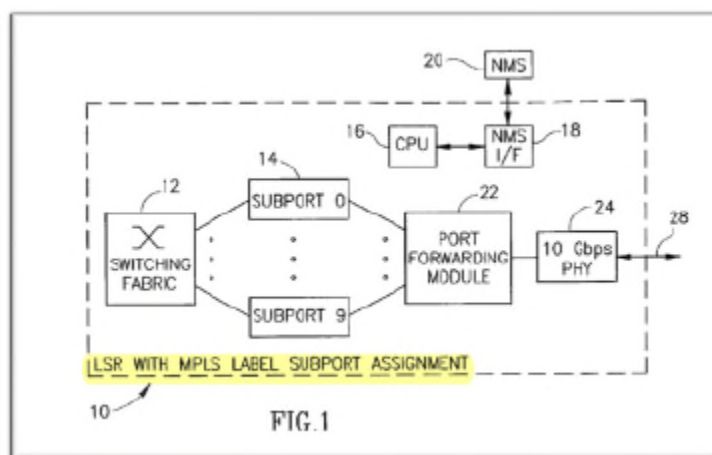


Figure 1 of Raz (Annotated)

176. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses or renders obvious the element of Claim 13.

n. Claim 14

[14] The method of claim 1, further comprising the step of designating by said first MPLS/LAG switch, the plurality of physical data ports in said first MPLS/LAG switch as a single logical port:

177. It is my opinion that the element of Claim 14 is obvious over RFC 3209 in view of Raz. EX1001, 10:37-40.

178. Raz discloses the use of link aggregation groups (LAG), which a POSITA would understand to be a single logical port whereby the aggregate output of each individual subport is equal to the total throughput of the logical port. Raz discloses a high-speed physical link composed of the aggregate of a plurality of subports. EX1006, Abstract, 7:7-16. In particular, Raz discloses that “some commercially available layer 2 switches can determine the destination port for a packet destined to a LAG (Link Aggregation Group) based on a CRC of the source MAC modulo (sic) the number of ports in the LAG. This can be used for spreading the packets to the subports by using the layer-2 switch as the port-forwarding module and **defining its ports leading to the different subports as a single LAG.**” EX1006, 9:9-15 (emphasis added). Further, Raz teaches that “[e]ach of the one GE **links make up the subports of the aggregate 10GE link.** The traffic directed to each one GE port is input to a packet processor (i.e. network processor) adapted to handle the one GE packet stream.” EX1006, 8:25-29 (emphasis added). A POSITA would have understood from these disclosures that a conventional switch (i.e., a conventional LSR such as the LSR taught by RFC 3209) could implement the multiple subports that Raz discloses to lead to a composite link as a link aggregation

group (i.e., claimed “logical port”). This functionality would have been carried over into the combination of RFC 3209 with Raz.

179. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses or renders obvious the element of Claim 14.

o. Claim 15

[15.0] An apparatus for assigning and utilizing an Ethernet physical data port in an Ethernet Link Aggregation Group (LAG) located downstream from a preceding node in a MultiProtocol Label Switching (MPLS) network tunnel employing Resource Reservation Protocol Traffic Engineering (RSVP-TE) tunnel provisioning, the LAG having a first MPLS/LAG switch and a second MPLS/LAG switch, the apparatus comprising:

180. It is my opinion that Element [15.0] is obvious over RFC 3209 in view of Raz. EX1001, 10:41-48. Element [15.0] is a preamble that covers substantially the same material as Element [1.0] of Claim 1. Accordingly, I incorporate my analysis for Element [1.0] from above into this Element, and this Element is obvious over RFC 3209 in view of Raz and the knowledge of a POSITA for the same reasons as those discussed for Element [1.0]. *See supra* VII.A.a.[1.0].

181. Element [15.0] additionally recites that the “Ethernet Link Aggregation Group (LAG) [is] located downstream from a preceding node,” “the LAG having a first MPLS/LAG switch and a second MPLS/LAG switch,” and where the MPLS network tunnel “employ[s] Resource Reservation Protocol Traffic Engineering (RSVP-TE) tunnel provisioning.” As I described previously with respect to Element

[1.0], RFC 3209 in combination with Raz renders obvious the use of Ethernet physical data ports of an Ethernet LAG to communicate high speed packet streams between LSRs (i.e., claimed “MPLS/LAG switch[es]”) in an MPLS network. A POSITA would have understood that when a LAG is used to communicate data packets from one MPLS switch to another MPLS switch, the LAG is connected to both MPLS switches via ports at either end of the LAG, which renders obvious the claim language “the LAG having a first MPLS/LAG switch and a second MPLS/LAG switch.” Additionally, as I explained with respect to Element [1.3], the LSR as described by RFC 3209 and Raz is located downstream from a preceding node along the LSP tunnel. Thus, the LAG which is connected to the claimed “first” MPLS switch is also located “downstream” from the claimed “preceding node.” RFC 3209 itself is an Internet standards defining document for the implementation of “RSVP-TE: Extensions to RSVP for LSP Tunnels,” and it consequently discloses the use of RSVP signaling protocol to set up LSP tunneling in an MPLS network. EX1010, Abstract, Section 1.1. RFC 3209 additionally discloses the use of an “apparatus” for implementing its system for setting up an LSP tunnel in an MPLS network in the form of nodes (i.e., LSRs) connected by physical links. EX1010, Abstract, Section 1.1.

182. To the extent not explicitly disclosed by RFC 3209, Raz discloses the use of an apparatus for implementing its system for communicating packets within

a high-speed packet stream. Specifically, Raz discloses that its system can be implemented using a processor, a FPGA, an ASIC, or a combination of those apparatuses. EX1006, 2:33-40, 7:54-8:13, 12:25-30, 12:57-31:1, 13:56-61. Further, as discussed above for Element [1.0], Raz explains that its apparatus can be used to communicate packets within an MPLS network. EX1006, Abstract, 1:40-55. Indeed, Figure 1 of Raz (shown below) demonstrates that the system of Raz is implemented in an MPLS network:

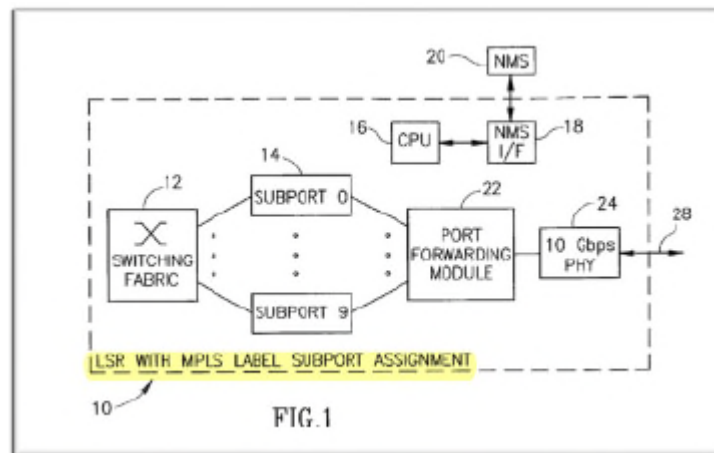


Figure 1 of Raz (Annotated)

183. In view of the above, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses and renders obvious Element [15.0].

[15.1] a processor, which is configured to:

184. It is my opinion that Element [15.1] is obvious over RFC 3209 in view of Raz. EX1001, 10:49.

185. To the extent not disclosed by RFC 3209, Raz discloses that its invention “is suited for implementation in hardware such as a network **processor** adapted to implement the mechanism of the present invention, software or a combination of hardware and software.” EX1006, 2:33-36 (emphasis added); see EX1006, 2:36-40, 3:39, 7:54-8:13, 12:2530, 12:57-31:1, 13:56-61. The use of a processor to perform various functionality as described in RFC 3209 and Raz would have been obvious to a POSITA.

186. In view of the above, it is my opinion that RFC 3209 in view of Raz discloses or renders obvious Element [15.1].

[15.2] assign a single physical tunnel port of a LAG to a network tunnel, wherein said single physical tunnel port meets a bandwidth requirement of the network tunnel, and wherein said single physical tunnel port has a port serial number.

187. It is my opinion that Element [15.2] is obvious over RFC 3209 in view of Raz. EX1001, 10:50-54.

188. Element [15.2] covers substantially the same material as Element [1.1] of Claim 1. Accordingly, I incorporate my analysis for Element [1.1] from above into this Element, and this Element is obvious over RFC 3209 in view of Raz and the knowledge of a POSITA for the same reasons as those discussed for Element [1.1]. See *supra* VII.A.a.[1.1].

189. In view of the above, it is my opinion that RFC in view of Raz in further view of the knowledge of a POSITA discloses and renders obvious Element [15.2].

[15.3] dedicate a sub-set of bits in a data packet label to encode said port serial number of said single physical tunnel port of the LAG into the data packet label;

190. It is my opinion that Element [15.3] is obvious over RFC 3209 in view of Raz. EX1001, 10:55-57.

191. Element [15.3] covers substantially the same material as Element [1.2] of Claim 1. Accordingly, I incorporate my analysis for Element [1.2] from above into this Element, and this Element is obvious over RFC 3209 in view of Raz and the knowledge of a POSITA for the same reasons as those discussed for Element [1.2]. *See supra* VII.A.a.[1.2].

192. In view of the above, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses and renders obvious Element [15.3].

[15.4] publish said packet label upstream;

193. It is my opinion that Element [15.4] is taught by Raz. EX1001, 10:58.

194. Element [15.4] covers substantially the same material as Element [1.3] of Claim 1. Specifically, a POSITA would have considered “sending ... the data packet label to a preceding node” (Element [1.3]) to cover substantially the same material as to “publish said data packet label upstream,” (Element [15.5]), because a POSITA would have understood that a preceding node is “upstream” with respect to the claimed first switch. See EX1010, Section 1.1 (“Labels are allocated

downstream and distributed (propagated upstream) by means of the RSVP Resv message.”). Accordingly, I incorporate my analysis for Element [1.3] from above into this Element, and this Element is obvious over RFC 3209 in view of Raz and the knowledge of a POSITA for the same reasons as those discussed for Element [1.3]. See *supra* VII.A.a.[1.3].

195. In view of the above, it is my opinion that RFC 3209 in view of Raz discloses or renders obvious Element [15.4].

[15.5] and a mapper, which is configured to:

196. It is my opinion that Element [15.5] is obvious over RFC 3209 in view of Raz. EX1001, 10:59.

197. A POSITA would have understood from Elements [15.6]-[15.8] that the purpose of the mapper is to receive a data packet, detect a data packet label within the data packet, and determine how to forward the data packet in accordance with the label. RFC 3209 discloses that its intermediate node (LSR) which corresponds to the claimed “first” switch performs the functions of receiving a data packet from an upstream node, detecting a data packet label, and determining how to forward the packet in accordance with the label. EX1010, Section 2.2, Section 4.1.1.1. RFC 3209 therefore renders obvious that this node (LSR) comprises the claimed “mapper” which performs these functions. See EX1010, Section 2.2 (discussing a node updating its “map” of incoming labels to next hop label forwarding entries for

evaluating incoming labels on data packets). A POSITA would have understood that intermediate nodes comprise a component which performs these functions and therefore corresponds to the claimed “mapper.” To the extent not disclosed by RFC 3209, Raz discloses that its apparatus can be implemented using a network processor, a FPGA, an ASIC or a combination of these. EX1006, 2:3-8, 2:33-40, 3:39, 6:27-29, 7:54-8:13, 12:25-30, 12:57-31, 13:56-61. A POSITA would have understood from this disclosure that the apparatus of Raz includes a mapper which performs the functions recited below in Elements [15.6]-[15.8]. Raz discloses a forwarding module that performs these functions and thus corresponds to the mapper recited in Element [15.5]. EX1006, 7:30-58; see EX1006, 9:29-58, Figures 3-4.

198. In view of the above, it is my opinion that RFC 3209 in view of Raz discloses or renders obvious Element [15.5].

[15.6] receive a data packet from an upstream node;

199. It is my opinion that Element [15.6] is obvious over RFC 3209 in view of Raz. EX1001, 10:60.

200. Element [15.6] covers substantially the same material as Element [1.4] of Claim 1. Accordingly, I incorporate my analysis for Element [1.4] from above into this Element, and this Element is obvious over RFC 3209 in view of Raz and the knowledge of a POSITA for the same reasons as those discussed for Element [1.4]. *See supra* VII.A.a.[1.4].

201. In view of the above, it is my opinion that RFC 3209 in view of Raz discloses or renders obvious Element [15.6].

[15.7] detect said data packet label in said data packet; and

202. It is my opinion that Element [15.7] is obvious over RFC 3209 in view of Raz. EX1001, 10:61.

203. RFC 3209 discloses that “[o]ne a label is allocated, the node formats a new LABEL object. The node then sends the new LABEL object as part of the Resv message to the previous hop. **The node SHOULD be prepared to forward packets carrying the assigned label prior to sending the Resv message.**” EX1010, Section 4.1.1.1 (emphasis added), Section 2.2 (“The label sent upstream in the LABEL object is the label which this node will use to identify incoming traffic associated with this LSP tunnel.”). A POSITA would understand from these teachings that in order for the node (LSR, or specifically the claimed “mapper” of the first switch) to use the label of an incoming packet to identify the traffic belonging to this LSP and use the label to forward the traffic, the node must detect and examine the label in the data packet. EX1010, Section 2.2.

204. To the extent not explicitly disclosed by RFC 3209, Raz teaches that when an LSR receives a data packet from an upstream node, the LSR detects the data packet label indicating the physical tunnel subport over which the packet should be communicated. EX1006, 7:39-45; *see* EX1006, 9:29-58, Figures 3-4. Claim 1 of

Raz recites that the LSR “forward[s] inbound packets transmitted by said upstream node and received over said communications link by said downstream node to a subport **in accordance with the label associated with said inbound packet,**” which would require the LSR to detect the data packet label in order to use it. Exhibit 1006, 14:23-26 (emphasis added). It is my opinion that a POSITA would have known from this disclosure that the data packet label in the data packet is detected by a mapper in Raz in order to forward the packet to a subport identified by the label, and that this functionality would have been carried over into the combination of Raz with RFC 3209.

205. In view of the above, it is my opinion that RFC 3209 in view of Raz discloses or renders obvious Element [15.7].

[15.8] if said data packet contains said data packet label, send said data packet to the second MPLS/LAG switch via said single physical tunnel port.

206. It is my opinion that Element [15.8] is obvious over RFC 3209 in view of Raz. EX1001, 10:62-64.

207. Element [15.8] covers substantially the same material as Element [1.5] of Claim 1, with the addition that it is performed by the “mapper” of Element [15.5] of Claim 15. Accordingly, I incorporate my analysis for Element [1.5] and Element [15.5] from above into this Element, and this Element is obvious over RFC 3209 in view of Raz and the knowledge of a POSITA for the same reasons as those discussed for Element [1.5] and Element [15.5]. *See supra* VII.A.a.[1.5]; VII.A.o.[15.5].

208. In view of the above, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses or renders obvious Element [15.8].

p. Claim 16

[16] The apparatus according to claim 15, wherein the processor is configured to make said selection in compliance with a service property.

209. It is my opinion that the element of Claim 16 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA. EX1001, 10:65-67. The element of Claim 16 covers substantially the same material as the element of Claim 4. Accordingly, I incorporate my analysis for Claim 4 from above into this Element, and this Element is obvious over RFC 3209 in view of Raz and the knowledge of a POSITA for the same reasons as those discussed for Claim 4. See *supra* VII.A.d.[4].

210. Accordingly, it is my opinion that RFC 3209 in view of Raz and the knowledge of a POSITA discloses and renders obvious the element of Claim 16.

q. Claim 17

[17] The apparatus according to claim 16, wherein said service property comprises at least one of the group consisting of a guaranteed bandwidth, a peak bandwidth, and a class of service.

211. It is my opinion that the element of Claim 17 is obvious over RFC 3209 in view of Raz. EX1001, 11:1-4. The element of Claim 17 covers substantially the same material as the element of Claim 5. Accordingly, I incorporate my analysis for

Claim 5 from above into this Element, and this Element is obvious over RFC 3209 in view of Raz and the knowledge of a POSITA for the same reasons as those discussed for Claim 5. *See supra* VII.A.e.[5].

212. Accordingly, it is my opinion that RFC 3209 in view of Raz discloses or renders obvious the element of Claim 17.

r. Claim 18

[18] The apparatus according to claim 17, wherein said processor is configured to make said selection of a port having a maximum available bandwidth of the plurality of ports.

213. It is my opinion that the element of Claim 18 is obvious over RFC 3209 in view of Raz. EX1001, 11:5-7. The element of Claim 18 covers substantially the same material as the element of Claim 6. Accordingly, I incorporate my analysis for Claim 6 from above into this Element, and this Element is obvious over RFC 3209 in view of Raz and the knowledge of a POSITA for the same reasons as those discussed for Claim 6. *See supra* VII.A.f.[6].

214. Accordingly, it is my opinion that RFC 3209 in view of Raz discloses or renders obvious the element of Claim 18.

s. Claim 19

[19] The apparatus according to claim 17, wherein said processor is configured to make said selection of a port having a minimum available bandwidth of the plurality of ports which is not less than said bandwidth requirement of the network tunnel.

215. It is my opinion that the element of Claim 19 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA. EX1001, 11:8-12. The element of Claim 19 covers substantially the same material as the element of Claim 7. Accordingly, I incorporate my analysis for Claim 7 from above into this Element, and this Element is obvious over RFC 3209 in view of Raz and the knowledge of a POSITA for the same reasons as those discussed for Claim 5. *See supra* VII.A.g.[7].

216. Accordingly, it is my opinion that RFC 3209 in view of Raz discloses or renders obvious the element of Claim 19.

t. Claim 20

[20] The apparatus according to claim 15, wherein said processor is configured to insert into said data packet label a set of bits which identify said single physical tunnel port; and wherein said mapper is configured to extract said set of bits to determine an identity of said single physical tunnel port.

217. It is my opinion that the element of Claim 20 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA. EX1001, 11:13-17. The element of Claim 20 covers substantially the same material as the element of Claim 9. Accordingly, I incorporate my analysis for Claim 9 from above into this Element, and this Element is obvious over RFC 3209 in view of Raz and the knowledge of a POSITA for the same reasons as those discussed for Claim 9. *See supra* VII.A.i.[9].

218. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses or renders obvious the element of Claim 20.

u. Claim 21

[21] The apparatus according to claim 15, further comprising a memory, and wherein said processor is configured to store said data packet label along with an identifier of said single physical tunnel port in said memory, and wherein said mapper is configured to retrieve said identifier from said memory responsively to said data packet label.

219. It is my opinion that the element of Claim 21 is obvious over Raz in view of the knowledge of a POSITA. EX1001, 11:18-23. The element of Claim 21 covers substantially the same material as the element of Claim 10. Accordingly, I incorporate my analysis for Claim 10 from above into this Element, and this Element is obvious over RFC 3209 in view of Raz and the knowledge of a POSITA for the same reasons as those discussed for Claim 10. *See supra* VII.A.j.[10].

220. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses or renders obvious the element of Claim 21.

v. Claim 22

[22] The apparatus according to claim 15, wherein said processor is further configured to select a backup port from among the plurality of physical data ports, different from said single physical tunnel port, and wherein said mapper is further configured, responsively to a service interruption of said single physical tunnel port, to direct the first MPLS/LAG switch to switch said data packet to said backup port, and send said data packet to the second MPLS/LAG switch via said backup port.

221. It is my opinion that the element of Claim 22 is obvious over Raz in view of the knowledge of a POSITA. EX1001, 11:24-32. The element of Claim 22 covers substantially the same material as the element of Claim 11. Accordingly, I incorporate my analysis for Claim 11 from above into this Element, and this Element is obvious over RFC 3209 in view of Raz and the knowledge of a POSITA for the same reasons as those discussed for Claim 11. *See supra* VII.A.k.[11].

222. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses or renders obvious the element of Claim 22.

w. Claim 23

[23] The apparatus according to claim 15, wherein said first MPLS/LAG switch comprises a Label Switched Router (LSR).

223. It is my opinion that the element of Claim 23 is obvious over Raz in view of the knowledge of a POSITA. EX1001, 11:33-35. The element of Claim 23 covers substantially the same material as the element of Claim 13. Accordingly, I incorporate my analysis for Claim 13 from above into this Element, and this Element is obvious over RFC 3209 in view of Raz and the knowledge of a POSITA for the same reasons as those discussed for Claim 13. *See supra* VII.A.l.[13].

224. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses or renders obvious the element of Claim 23.

x. Claim 24

[24] The apparatus according to claim 15, wherein said processor comprises a network processor.

225. It is my opinion that the element of Claim 24 is obvious over RFC 3209 in view of Raz. EX1001, 11:36-37. Raz states in multiple places that its invention could have been implemented on a network processor. EX1006, 1:65-2:8, 2:33-40, 6:24-33, 7:54-62, 11:24-29, 12:25-41, 12:51-53, 12:66-13:19, 13:56-61, 14:46-49, 15:59-62, 17:10-13. As I explained for element [15.1], this disclosure of a processor would be incorporated into the combination of Raz with RFC 3209. Accordingly, it is my opinion that RFC 3209 in view of Raz in view of the knowledge of a POSITA discloses or renders obvious Claim 24.

a. Claim 25

[25] The apparatus according to claim 15, wherein said plurality of physical data ports are selected from a single logical port.

226. It is my opinion that the element of Claim 25 is obvious over RFC 3209 in view of Raz. EX1001, 12:1-3. The element of Claim 25 covers substantially the same material as the element of Claim 14. Accordingly, I incorporate my analysis for Claim 14 from above into this Element, and this Element is obvious over RFC 3209 in view of Raz and the knowledge of a POSITA for the same reasons as those discussed for Claim 14. *See supra* VII.A.n.[14].

227. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses or renders obvious the element of Claim 25.

b. Claim 26

[26.0] A method for assigning and utilizing an Ethernet physical data port in an Ethernet Link Aggregation Group (LAG) in a Multi-Protocol Label Switching (MPLS) network, the method comprising the steps of

228. It is my opinion that Element [26.0] is obvious over RFC 3209 in view of Raz. EX1001, 12:4-7. Element [26.0] of Claim 26 is a preamble which covers substantially the same material as Element [1.0] of Claim 1. Accordingly, I incorporate my analysis for Element [1.0] from above into this Element, and this Element is obvious over RFC 3209 in view of Raz and the knowledge of a POSITA for the same reasons as those discussed for Element [1.0] of Claim 1. *See supra* VII.A.a.[1.0].

229. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses or renders obvious Element [1.0] of Claim 26.

[26.1] receiving from a preceding node located upstream from a first MPLS/LAG switch, at said first MPLS/LAG switch, a request message requesting configuration of a network tunnel, the message further requesting a data packet label associated with said network tunnel, said request message specifying a bandwidth requirement;

230. It is my opinion that Element [26.1] is obvious over RFC 3209 in view of Raz. EX1001, 12:8-13. Element [26.1] of Claim 26 covers substantially the same

material as the element of Claim 2, with the addition of a bandwidth requirement as in Element [1.1] of Claim 1. Accordingly, I incorporate my analysis for Claim 2 and for Element [1.1] of Claim 1 from above into this Element, and this Element is obvious over RFC 3209 in view of Raz and the knowledge of a POSITA for the same reasons as those discussed for the element of Claim 2 and element [1.1] of Claim 1. *See supra* VII.A.b.[2]; VII.A.a.[1.1].

231. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses or renders obvious Element [1.1] of Claim 26.

[26.2] assigning, at the first MPLS/LAG switch, a single physical tunnel port of a LAG to the network tunnel wherein the single physical tunnel port of the LAG, which meets the specified bandwidth requirement, wherein said single physical tunnel port of said LAG has a port serial number;

232. It is my opinion that Element [26.2] is obvious over RFC 3209 in view of Raz. EX1001, 12:14-19. Element [26.2] of Claim 26 covers substantially the same material as Element [1.1] of Claim 1. Accordingly, I incorporate my analysis for Element [1.1] from above into this Element, and this Element is obvious over RFC 3209 in view of Raz and the knowledge of a POSITA for the same reasons as those discussed for Element [1.1] of Claim 1. *See supra* VII.A.a.[1.1].

233. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses or renders obvious Element [26.2] of Claim 26.

[26.3] dedicating a sub-set of bits in a data packet label prepared by said first MPLS/LAG switch to encode said port serial number of said single physical tunnel port of the LAG into the data packet label;

234. It is my opinion that Element [26.3] is obvious over RFC 3209 in view of Raz. EX1001, 12:20-23. Element [26.3] of Claim 26 covers substantially the same material as Element [1.2] of Claim 1. Accordingly, I incorporate my analysis for Element [1.2] from above into this Element, and this Element is obvious over RFC 3209 in view of Raz and the knowledge of a POSITA for the same reasons as those discussed for Element [1.2] of Claim 1. *See supra* VII.A.a.[1.2].

235. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses or renders obvious Element [26.3] of Claim 26.

[26.4] sending, by said first MPLS/LAG switch, said data packet label, in which said port serial number of said single physical tunnel port is encoded, to the preceding node;

236. It is my opinion that Element [26.4] is obvious over RFC 3209 in view of Raz. EX1001, 12:24-26. Element [26.4] of Claim 26 covers substantially the same material as Element [1.3] of Claim 1. Accordingly, I incorporate my analysis for Element [1.3] from above into this Element, and this Element is obvious over RFC 3209 in view of Raz and the knowledge of a POSITA for the same reasons as those discussed for Element [1.3] of Claim 1. *See supra* VII.A.a.[1.3].

237. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses or renders obvious Element [26.4] of Claim 26.

[26.5] receiving from the preceding node, at said first MPLS/LAG switch, a data packet that includes said data packet label, in which said port serial number of said single physical tunnel port is encoded; and

238. It is my opinion that Element [26.5] is obvious over RFC 3209 in view of Raz. EX1001, 12:27-30. Element [26.5] of Claim 26 covers substantially the same material as Element [1.4] of Claim 1. Accordingly, I incorporate my analysis for Element [1.4] from above into this Element, and this Element is obvious over RFC 3209 in view of Raz and the knowledge of a POSITA for the same reasons as those discussed for Element [1.4] of Claim 1. *See supra* VII.A.a.[1.4].

239. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses or renders obvious Element [26.5] of Claim 26.

[26.6] sending said data packet from said first MPLS/LAG switch to a second MSPLS/LAG switch via said single physical tunnel port having the port serial number encoded in the data packet label.

240. It is my opinion that Element [26.6] is obvious over RFC 3209 in view of Raz. EX1001, 12:31-34. Element [26.6] of Claim 26 covers substantially the same material as Element [1.5] of Claim 1. Accordingly, I incorporate my analysis for Element [1.5] from above into this Element, and this Element is obvious over RFC

3209 in view of Raz and the knowledge of a POSITA for the same reasons as those discussed for Element [1.5] of Claim 1. *See supra* VII.A.a.[1.5].

241. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of the knowledge of a POSITA discloses or renders obvious Element [26.6] of Claim 26.

B. Ground 2: Claims 1-26 of the '602 Patent are obvious over RFC 3209 in view of Raz in further view of Ferguson.

242. It is further my opinion that a POSITA would have found Claims 1-26 of the '602 Patent to be obvious over RFC 3209 in view of Raz in further view of Ferguson and the knowledge of a POSITA.

243. Further, a POSITA would have been motivated to apply the teachings of Ferguson to the combination of RFC 3209 with Raz because this increases the availability of bandwidth needed to efficiently communicate high-speed packet streams via a LAG in an MPLS network. RFC 3209, Raz, and Ferguson are analogous art references that focus on solving the same problem. As an initial matter, each of RFC 3209, Raz, and Ferguson relate to the use of an MPLS network to communicate data packets. EX1010, Sections 1, 1.1, 1.2, 2.2; EX1006, 1:65-2:8, 2:26-31, 6:24-33, Figures 1 and 3-4; EX1007, 1:57-2:3, 2:22-26, 3:36-67, 8:10-12, Figures 2A-8. Both Raz and Ferguson extensively discuss the use of a LAG in an MPLS network to communicate the data packets. EX1006, 2:41-67, 6:34-45, 7:7-16, 14:19-22, Figure 1; EX1007, 1:21-26, 1:43-53, 3:36-4:19, 6:10-31, Figures 2A-

2C. Ferguson discloses the utilization of an Ethernet physical data port in a LAG to communicate MPLS packets between routers or switches in an MPLS network, which is the same subject matter as Raz. EX1007, 1:21-26, 1:43-53, 3:36-4:19, 6:10-31, Figures 2A-2C; EX1006, 1:65-2:8, 2:41-67, 6:34-45, 7:7-16, 14:6-26, 14:50-52, Figure 1.

244. Moreover, each of RFC 3209, Raz, and Ferguson are directed to solving the problem of ensuring enough bandwidth is available to communicate high speed packet streams through an MPLS network. EX1010, Section 1.1, Abstract; EX1006, 10:60-11:12, 14:33-41, 15:47-55, 17:1-9, Figure 5; EX1007, 1:28-42, 2:54-57, 4:55-60. Raz discusses allocating the bandwidth of subports within an LSR in order to handle high speed packet streams transiting the LSR. Raz explains that its “invention also comprises a mechanism to improve the ability to handle wide connections . . . that require a relatively large amount of CIR bandwidth.” Raz explains that “a connection of 500 Mbps, 700 Mbps or even a connection of 1 Gbps may need to be supported.” EX1006, 10:60-65. Raz discusses “the problem of fragmentation,” and it provides an example where “300 Mbps of CIR bandwidth [is] already allocated on each of the ten subports of a 10G port.” EX1006, 10:65-67. “In this case, a connection of 800 Mbps cannot be allocated on it even though the 10G port has 5600 M of free bandwidth.” EX1006, 11:1-2.

245. RFC 3209 explains that its framework allows the implementation of label-switched paths with traffic engineering, and that “in the traffic engineering application, it is very useful to use the Path message as a means of verifying that bandwidth exists at a particular priority along an entire path.” EX1010, Section 2.2. Raz explains that its “invention provides a scheme for allocating LSP bandwidth to subports that helps in solving the problem described above in a way that provides a tradeoff between leaving subports empty for wide LSPs and spreading traffic between subports for best utilizing the bandwidth of the link (e.g., for EIR traffic).” EX1006, 11:3-8. “The central idea is to leave one or more subports empty (i.e. no bandwidth used) in the event a wide connection is to be allocated.” EX1006, 11:8-10. “The allocated bandwidth, however, is still distributed among the subports in such a way that EIR traffic is supported.” EX1006, 11:10-12.

246. Ferguson similarly addresses the need to have bandwidth available for high-speed packet streams when implementing LAG to communicate data packets in an MPLS network. EX1007, 1:28-42, 2:54-57, 4:55-60. Ferguson explains that load balancing of MPLS packets in conventional systems “may not be able to achieve substantial distribution of the traffic among the paths, which may result in congestion on one data path and unused bandwidth on another.” EX1007, 4:55-59. “This may decrease the efficiency of the network and increase packet latency.” EX1007, 4:59-60. Ferguson, like RFC 3209 and Raz, focuses on improving the use

of bandwidth in an MPLS network. EX1007, 1:28-42, 2:54-57, 4:55-60. Further, like RFC 3209 and Raz, Ferguson explains that it can “use one or more fields directly from one or more of [the] MPLS labels” to select the path for communicating data packets. EX1007, 8:10-12. A POSITA thus would consider RFC 3209, Raz, and Ferguson to be analogous art references that address similar problems. As such, a POSITA would have understood from the disclosures in Ferguson that techniques for utilizing an Ethernet physical data port in a LAG to communicate data packets between routers or switches in an MPLS network are also applicable to the use of subports transmitting the data packets within the routers or switches, and vice versa. EX1007, 5:61-6:6. Thus, a POSITA would have understood that the techniques disclosed in Raz for using subports to transmit data packets within a router or switch would also have been applicable to an Ethernet physical data port in a LAG that communicates data packets between routers or switches in an MPLS network and readily implementable and compatible with Raz’s disclosures when each of Raz and Ferguson’s teachings are put into RFC 3209’s system framework.

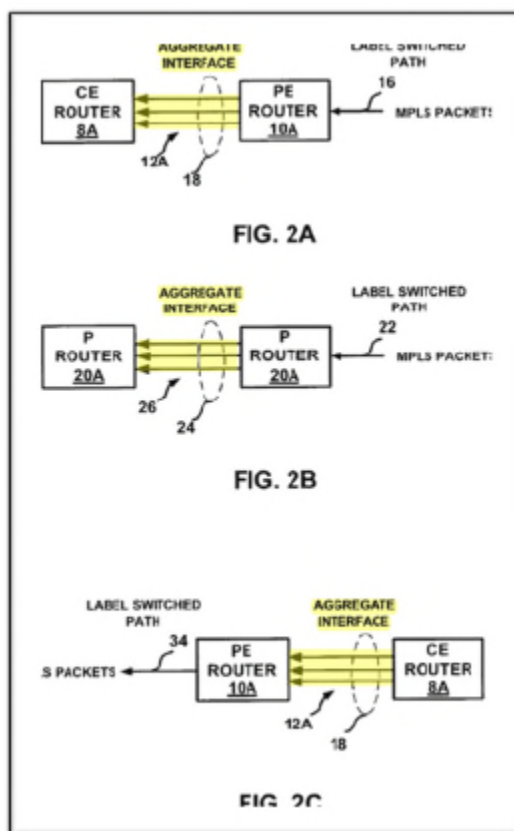
a. Claim 1

[1.0] A method for assigning and utilizing an Ethernet physical data port in an Ethernet Link Aggregation Group (LAG) in a Multi-Protocol Label Switching (MPLS) network, the method comprising the steps of:

247. It is my opinion that Element [1.0] is obvious over RFC 3209 in view of Raz and in further view of Ferguson.

248. With respect to Element [1.0], I provided my opinions about RFC 3209 and Raz above as part of Ground 1, and I incorporate that analysis here by reference.

249. Ferguson builds on that described functionality when it discloses the utilization of an Ethernet physical data port in a LAG in an MPLS network for the purpose of communicating high speed packet streams between routers (i.e., a type of “node” in network topology, such as an LSR). EX1007, 1:21-26, 1:43-53, 3:36-4:19, 6:10-31, Figures 2A-2C. As shown below in Figures 2A-2C of Ferguson, MPLS packets are communicated along a physical interconnect that is part of an “aggregate interface” between ports on two routers:



Figures 2A-2C of Ferguson (Annotated)

Further, Ferguson states that the physical interconnects may be Ethernet physical data ports (EX1007, 1:21-24, 1:43-53, 3:36-4:19, 5:4-24 (Table 1), 7:4-12) and that “the physical interconnects may couple other devices, e.g., **two switches**, a switch and a server, two routers, a switch and an end user station, and the like.” EX1007, 1:24-26 (emphasis added), 8:61-64.

250. Importantly, Ferguson explains to a POSITA that techniques used to communicate high speed data streams *within* a router or switch in an MPLS network can also be applied to communicating high speed data streams *between* two routers or *between* two switches in an MPLS network. EX1007, 5:61-6:6. Ferguson states that “[a]lthough [its] techniques have been described in reference to distribution of MPLS packets across parallel physical interconnects of an aggregated link, the techniques may be applied in a variety of environments.” EX1007, 5:63-67. “For example, the techniques may be readily applied to internal parallel data paths within a device.” EX1007, 5:67-6:2. “For example, the techniques may be used by a router [or switch] to distribute packets across internal data paths that begin at the same input interface of the router [or switch] and end at the same output interface of the router [or switch], but traverse through different internal, high-speed switch fabrics.” EX1007, 6:2-6. A POSITA would have understood from these statements that techniques used to communicate high speed data streams between routers or switches in an MPLS network can also be used to communicate high speed data

streams within a router or switch in an MPLS network, and vice versa. This is because packets are communicated the same way within a device as between devices. This knowledge would have motivated a POSITA to take the techniques used to communicate packets within the LSR of Raz and use them to communicate packets between LSRs or switches in the same MPLS network and apply them with Raz's techniques to the RSVP / MPLS system described by RFC 3209.

251. A POSITA would have understood from the disclosures in Ferguson that techniques for utilizing an Ethernet physical data port in a LAG to communicate data packets between routers or switches in an MPLS network are also applicable to the use of subports transmitting the data packets within the routers or switches, and vice versa. EX1007, 5:61-6:6. A POSITA would have known that the techniques disclosed in Raz for using subports to transmit data packets within a router or switch would also have been applicable to an Ethernet physical data port in a LAG that communicates data packets between routers or switches in an MPLS network, and that such techniques would be combined with the extensions to RSVP signaling described in RFC 3209. As such, the efficient use of bandwidth realized inside the LSR would also have been realized using the same techniques for communications between LSRs and would have been used with RFC 3209's system for the same reason.

252. In view of the above, it is my opinion that the combination of RFC 3209, Raz, and Ferguson discloses or renders obvious Element [1.0].

[1.1] assigning, by a first MPLS/LAG switch, a single physical tunnel port of a LAG to a network tunnel, wherein the single physical tunnel port of the LAG meets a bandwidth requirement of the network tunnel, and wherein said single physical tunnel port of the LAG has a port serial number;

253. It is my opinion that Element [1.1] is obvious over RFC 3209 in view of Raz and in further view of Ferguson.

254. With respect to Element [1.1], I provided my opinions about RFC 3209 and Raz above as part of Ground 1, and I incorporate that analysis here by reference.

255. Ferguson builds on that described functionality when it teaches a POSITA that the method of assigning a subport with appropriate bandwidth *within* the LSR that is disclosed in Raz could also be implemented *between* MPLS/LAG switches in an MPLS network, to the extent that it is not already obvious to a POSITA that the same aggregated links which connect interfaces within an LSR may also connect LSRs together. That is, to the extent that it was not already obvious from RFC 3209 and Raz, Ferguson discloses that the techniques in Raz for assigning a physical tunnel subport can also be implemented to assign a physical tunnel port to communicate packets along “physical interconnects” between “two switches” in an MPLS network. EX1007, 1:22-27, 1:57-66. In addition, Ferguson discloses that the physical interconnects between the two switches can be used as part of a LAG, to the extent the RFC 3209 and Raz combination does not already disclose or render

such LAG usage obvious. EX1007, 1:28-53, 2:44-47. As such, a POSITA would have understood the two switches implementing the techniques of Ferguson to be MPLS/LAG switches.

256. In addition, and as discussed above for Element [1.0], Ferguson teaches that the techniques used to reserve the bandwidth needed to communicate packets within a network device can also be applied to reserve the bandwidth needed to communicate packets between network devices in an MPLS network. A POSITA would have understood this to mean that the techniques which Raz teaches primarily to forward packets within a network device could also be applied to forward packets between network devices in an MPLS network. Specifically, the techniques disclosed in Raz for forwarding packets within an LSR in an MPLS network could also be applied when communicating packets from one MPLS/LAG switch to another MPLS/LAG switch. Indeed, a POSITA would have been motivated to apply the teachings of Ferguson to the combination of RFC 3209 and Raz because this increases the available bandwidth to communicate high speed packet streams.

257. Accordingly, it is my opinion that the combination of RFC 3209, Raz, and Ferguson discloses or renders obvious Element [1.1].

[1.2] dedicating a sub-set of bits in a data packet label prepared by the first MPLS/LAG switch to encode said port serial number of said single physical tunnel port of the LAG into the data packet label;

258. It is my opinion that Element [1.2] is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

[1.3] sending, by said first MPLS/LAG switch, the data packet label, in which said port serial number of said single physical tunnel port is encoded, to a preceding node;

259. It is my opinion that Element [1.3] is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

[1.4] receiving from the preceding node, by said first MPLS/LAG switch, a data packet comprising said data packet label, in which said port serial number of said single physical tunnel port is encoded; and

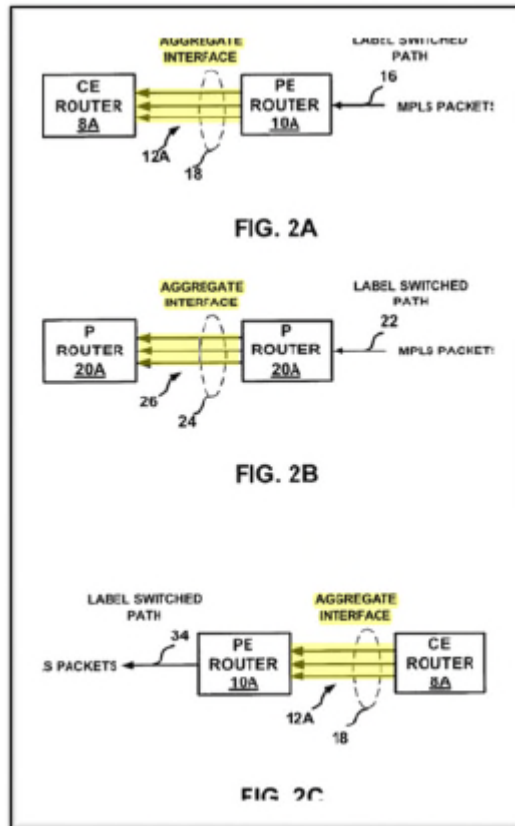
260. It is my opinion that Element [1.4] is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

[1.5] sending said data packet from said first MPLS/LAG switch to a second MPLS/LAG switch via said single physical tunnel port having the port serial number encoded in the data packet label.

261. It is my opinion that Element [1.5] is obvious over RFC 3209 in view of Raz and in further view of Ferguson.

262. With respect to Element [1.5], I provided my opinions about RFC 3209 and Raz above as part of Ground 1, and I incorporate that analysis here by reference. As I explained in Ground 1, it is my opinion that a POSITA would have found it obvious from RFC 3209 and Raz to send a data packet from a first MPLS/LAG switch to a second MSPLS/LAG switch via a single physical tunnel port having the port serial number encoded in the data packet label.

263. Moreover, for the reasons discussed above with respect to Elements [1.0]-[1.4], Ferguson discloses that the techniques which Raz teaches primarily to forward packets within a network device could also be applied to forward packets between network devices in an MPLS network, as shown below in Figures 2A-2C of Ferguson. Thus, Ferguson would have motivated a POSITA to treat packets communicated between MPLS/LAG switches in an MPLS network in the same way as packets communicated between LSRs in Raz.



Figures 2A-2C of Ferguson (Annotated)

264. Accordingly, it is my opinion that the combination of RFC 3209, Raz, and Ferguson discloses or renders obvious Element [1.5].

b. Claim 2

[2] The method of claim 1, further comprising the step of receiving from a preceding node located upstream from said first MPLS/LAG switch, by said first MPLS/LAG switch, a request message requesting configuration of said network tunnel, the message further requesting said data packet label associated with said network tunnel.

265. It is my opinion that the element of Claim 2 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons

as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

c. Claim 3

[3] The method of claim 2, wherein said request message comprises an RSVP-TE PATH message augmented with a LABEL_REQUEST object.

266. It is my opinion that the element of Claim 3 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

d. Claim 4

[4] The method according to claim 3, wherein said request comprises an indication of a service property, and wherein said selecting comprises identifying a physical port in compliance with said service property.

267. It is my opinion that the element of Claim 4 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

e. Claim 5

[5] The method according to claim 4, wherein said service property comprises at least one of a guaranteed bandwidth; a peak bandwidth; and a class of service.

268. It is my opinion that the element of Claim 5 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons

as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

f. Claim 6

[6] The method according to claim 1, wherein said selecting comprises selecting a single physical tunnel port having a maximum available bandwidth of said plurality of physical data ports.

269. It is my opinion that the element of Claim 6 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

g. Claim 7

[7] The method according to claim 1, wherein said selecting comprises selecting a port having a minimum available bandwidth of said plurality of physical data ports which is not less than said bandwidth requirement of the network tunnel.

270. It is my opinion that the element of Claim 7 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

h. Claim 8

[8] The method according to claim 1, wherein said switching said data packet is according to a mapping function.

271. It is my opinion that the element of Claim 8 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons

as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

i. Claim 9

[9] The method according to claim 1, wherein said preparing comprises inserting into said data packet label a set of bits that identify said single physical tunnel port; and wherein said switching said data packet comprises extracting said set of bits to determine an identity of said single physical tunnel port.

272. It is my opinion that the element of Claim 9 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

j. Claim 10

[10] The method according to claim 1, wherein said preparing comprises storing said data packet label along with an identifier of said single physical tunnel port in a memory, and wherein said switching said data packet comprises retrieving said identifier from said memory responsively to said data packet label.

273. It is my opinion that the element of Claim 10 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

k. Claim 11

[11] The method according to claim 1, further comprising the steps of selecting a backup port from among the plurality of physical data ports, different from said single physical tunnel port; and responsively to a service interruption of said single physical tunnel port, switching said data packet to said backup port

and sending said data packet to said second MPLS/LAG switch via said backup port.

274. It is my opinion that the element of Claim 11 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

l. Claim 12

[12] The method according to claim 11, further comprising the step of responsive to a restoral of said service interruption of said single physical tunnel port, reverting switching of said data packet from said backup port and sending said data packet to said second MPLS/LAG switch via said single physical tunnel port.

275. It is my opinion that the element of Claim 12 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

m. Claim 13

[13] The method according to claim 1, wherein said first MPLS/LAG switch comprises a Label Switched Router (LSR).

276. It is my opinion that the element of Claim 13 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

n. Claim 14

[14] The method of claim 1, further comprising the step of designating by said first MPLS/LAG switch, the plurality of physical data ports in said first MPLS/LAG switch as a single logical port.

277. It is my opinion that the element of Claim 14 is obvious over RFC 3209 in view of Raz in further view of Ferguson. EX1001, 10:35-38.

278. With respect to the element of Claim 14, I provided my opinions about RFC 3209 and Raz above as part of Ground 1, and I incorporate that analysis here by reference.

279. Ferguson builds on that functionality when it explains that “[t]he term ‘link aggregation’ refers to a technique by which the multiple physical interconnects are **logically associated and treated as a single, aggregated link.**” EX1007, 1:28-30 (emphasis added); see EX1007, 1:60-63, 2:44-47, 3:42-44, 4:1-7. It is my opinion that a POSITA would have understood from these disclosures in Ferguson that the plurality of physical data ports of an MPLS/LAG switch that are used to implement a LAG would be considered a single logical port. A POSITA would have understood that a LAG is created by bonding multiple physical links to act as a single logical port.

280. Accordingly, it is my opinion that Ferguson discloses and renders obvious the element of Claim 14.

o. Claim 15

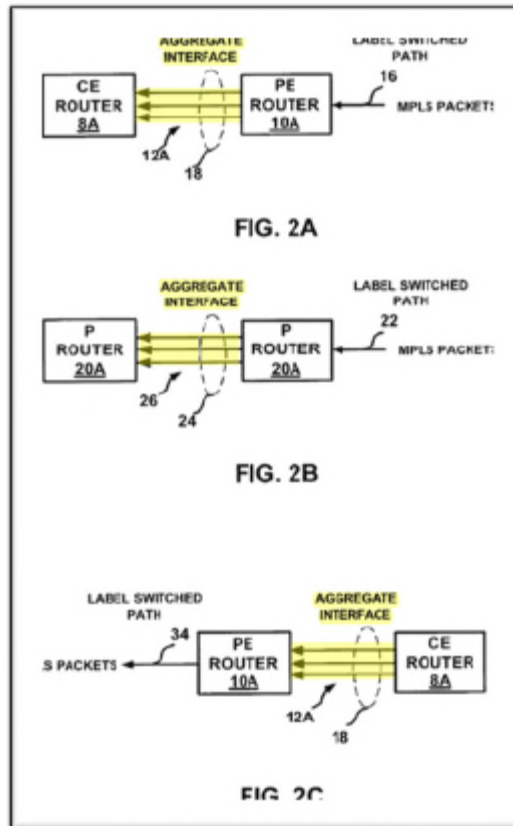
[15.0] An apparatus for assigning and utilizing an Ethernet physical data port in an Ethernet Link Aggregation Group (LAG) located downstream from a

preceding node in a MultiProtocol Label Switching (MPLS) network tunnel employing Resource Reservation Protocol Traffic Engineering (RSVP-TE) tunnel provisioning, the LAG having a first MPLS/LAG switch and a second MPLS/LAG switch, the apparatus comprising:

281. It is my opinion that Element [15.0] is obvious over RFC 3209 in view of Raz and in further view of Ferguson.

282. With respect to Element [15.0], I provided my opinions about RFC 3209 and Raz above as part of Ground 1, and I incorporate that analysis here by reference.

283. Further, as discussed above for Element [1.0], Ferguson discloses the utilization of an Ethernet physical data port in a LAG in an MPLS network for the purpose of communicating high speed packet streams. EX1007, 1:21-26, 1:43-53, 3:36-4:19, 6:10-31, Figures 2A-2C. As shown below in Figures 2A-2C of Ferguson, MPLS packets are communicated along a physical interconnect that is part of an aggregate interface between ports on two routers:



Figures 2A-2C of Ferguson (Annotated)

Ferguson also discloses that the physical interconnects may be Ethernet physical data ports (EX1007, 1:21-24, 1:43-53, 3:36-4:19, 5:4-24 (Table 1), 7:4-12) and that “the physical interconnects may couple other devices, e.g., **two switches**, a switch and a server, two routers, a switch and an end user station, and the like.” EX1007, 1:24-26 (emphasis added), 8:61-64.

284. In addition, Ferguson explains to a POSITA that techniques used to communicate high speed data streams *within* a router or switch in an MPLS network can also be applied to communicating high speed data streams *between* two routers or *between* two switches in an MPLS network. EX1007, 5:61-6:6. Ferguson states

that “[a]lthough [its] techniques have been described in reference to distribution of MPLS packets across parallel physical interconnects of an aggregated link, the techniques may be applied in a variety of environments.” EX1007, 5:63-67. “For example, the techniques may be readily applied to internal parallel data paths within a device.” EX1007, 5:67-6:2. “For example, the techniques may be used by a router [or switch] to distribute packets across internal data paths that begin at the same input interface of the router [or switch] and end at the same output interface of the router [or switch], but traverse through different internal, high-speed switch fabrics.” EX1007, 6:2-6. A POSITA would have understood from these statements that techniques used to communicate high speed data streams between routers or switches in an MPLS network can also be used to communicate high speed data streams within a router or switch in an MPLS network, and vice versa. This knowledge would have motivated a POSITA to take the techniques used to communicate packets within the LSR of Raz and use them to communicate packets between LSRs or switches in the same MPLS network, and would have carried these techniques into the system of RFC 3209.

285. In view of the above, it is my opinion that the combination of RFC 3209, Raz, and Ferguson discloses and renders obvious Element [15.0].

[15.1] a processor, which is configured to:

286. It is my opinion that Element [15.1] is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

[15.2] assign a single physical tunnel port of a LAG to a network tunnel, wherein said single physical tunnel port meets a bandwidth requirement of the network tunnel, and wherein said single physical tunnel port has a port serial number.

287. It is my opinion that Element [15.2] is obvious over RFC 3209 in view of Raz and in further view of Ferguson.

288. With respect to Element [15.2], I provided my opinions about RFC 3209 and Raz above as part of Ground 1, and I incorporate that analysis here by reference.

289. As discussed above with respect to Elements [1.0] and [15.0], Ferguson teaches a POSITA that the method of assigning a subport with appropriate bandwidth within the LSR of Raz could also be implemented between network devices (such as MPLS/LAG switches) in an MPLS network. Ferguson discloses that its techniques can be implemented to communicate packets along “physical interconnects” between “two switches” in an MPLS network. EX1007, 1:22-27, 1:57-66. In addition, Ferguson discloses that the physical interconnects between network devices (such as switches or routers) can be used as part of a LAG. EX1007, 1:28-53, 2:44-47.

290. In addition, and as discussed above for Elements [1.0] and [15.0], Ferguson teaches that the techniques used to reserve the bandwidth needed to communicate packets within a network device can also be applied to reserve the bandwidth needed to communicate packets between network devices in an MPLS network. A POSITA would have understood this to mean that the techniques disclosed in Raz for forwarding packets within an LSR in an MPLS network could also be applied when communicating packets from one MPLS/LAG switch to another MPLS/LAG switch. Indeed, a POSITA would have been motivated to apply the teachings of Ferguson to RFC 3209 and Raz because this increases the available bandwidth to communicate high speed packet streams.

291. In view of the above, it is my opinion that the combination of RFC 3209, Raz, and Ferguson discloses and renders obvious Element [15.2].

[15.3] dedicate a sub-set of bits in a data packet label to encode said port serial number of said single physical tunnel port of the LAG into the data packet label;

292. It is my opinion that Element [15.3] is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

293. Moreover, for the reasons discussed above with respect to Elements [1.0] and [15.0], Ferguson discloses that the techniques used to forward packets

within a network device could also be applied to forward packets between network devices in an MPLS network. Thus, Ferguson would have motivated a POSITA to take the teachings of RFC 3209 and Raz of dedicating a subset of bits in MPLS label 140 to encode the serial number of a physical subport, and extend that to dedicating a subset of bits in an MPLS label to encode the serial number of the physical LAG port of a network device (such as an MPLS/LAG switch) to be used to forward packets between switches over an LSP tunnel.

294. In view of the above, it is my opinion that the combination of RFC 3209, Raz, and Ferguson discloses or renders obvious Element [15.3].

[15.4] publish said packet label upstream;

295. It is my opinion that Element [15.4] is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

[15.5] and a mapper, which is configured to:

296. It is my opinion that Element [15.5] is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

[15.6] receive a data packet from an upstream node;

297. It is my opinion that Element [15.6] is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

[15.7] detect said data packet label in said data packet; and

298. It is my opinion that Element [15.7] is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

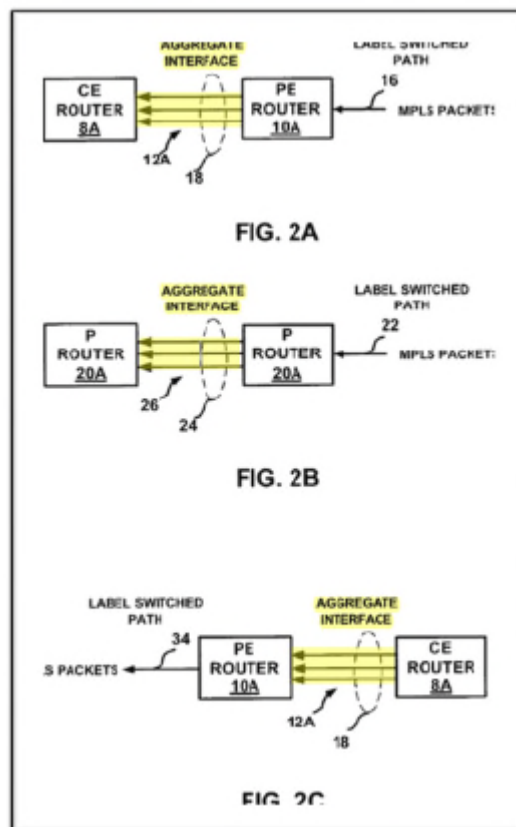
[15.8] if said data packet contains said data packet label, send said data packet to the second MPLS/LAG switch via said single physical tunnel port.

299. It is my opinion that Element [15.8] is obvious in view of the combination of Raz and Ferguson.

300. With respect to Element [15.8], I provided my opinions about RFC 3209 and Raz above as part of Ground 1, and I incorporate that analysis here by reference.

301. Moreover, for the reasons discussed above with respect to Elements [1.0]-[1.4], Ferguson discloses that the techniques used to forward packets within a network device could also be applied to forward packets between network devices in an MPLS network, as shown below in Figures 2A-2C of Ferguson. Thus, Ferguson would have motivated a POSITA to treat packets communicated between

MPLS/LAG switches in an MPLS network in the same way as packets communicated between LSRs in Raz, and this functionality would have been carried over into the combination with RFC 3209 and Raz.



Figures 2A-2C of Ferguson (Annotated)

302. In view of the above, it is my opinion that the combination of RFC 3209, Raz, and Ferguson discloses and renders obvious Element [15.8].

p. Claim 16

[16] The apparatus according to claim 15, wherein the processor is configured to make said selection in compliance with a service property.

303. It is my opinion that the element of Claim 16 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons

as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

q. Claim 17

[17] The apparatus according to claim 16, wherein said service property comprises at least one of the group consisting of a guaranteed bandwidth, a peak bandwidth, and a class of service.

304. It is my opinion that the element of Claim 17 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

r. Claim 18

[18] The apparatus according to claim 17, wherein said processor is configured to make said selection of a port having a maximum available bandwidth of the plurality of ports.

305. It is my opinion that the element of Claim 18 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

s. Claim 19

[19] The apparatus according to claim 17, wherein said processor is configured to make said selection of a port having a minimum available bandwidth of the plurality of ports which is not less than said bandwidth requirement of the network tunnel.

306. It is my opinion that the element of Claim 19 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

t. Claim 20

[20] The apparatus according to claim 15, wherein said processor is configured to insert into said data packet label a set of bits which identify said single physical tunnel port; and wherein said mapper is configured to extract said set of bits to determine an identity of said single physical tunnel port.

307. It is my opinion that the element of Claim 20 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

u. Claim 21

[21] The apparatus according to claim 15, further comprising a memory, and wherein said processor is configured to store said data packet label along with an identifier of said single physical tunnel port in said memory, and wherein said mapper is configured to retrieve said identifier from said memory responsively to said data packet label.

308. It is my opinion that the element of Claim 21 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

v. Claim 22

[22] The apparatus according to claim 15, wherein said processor is further configured to select a backup port from among the plurality of physical data ports, different from said single physical tunnel port, and wherein said mapper is further configured, responsively to a service interruption of said single physical tunnel port, to direct the first MPLS/LAG switch to switch said data packet to said backup port, and send said data packet to the second MPLS/LAG switch via said backup port.

309. It is my opinion that the element of Claim 22 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

w. Claim 23

[23] The apparatus according to claim 15, wherein said first MPLS/LAG switch comprises a Label Switched Router (LSR).

310. It is my opinion that the element of Claim 23 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

x. Claim 24

[24] The apparatus according to claim 15, wherein said processor comprises a network processor.

311. It is my opinion that the element of Claim 24 is obvious over RFC 3209 in view of Raz in further view of the knowledge of a POSITA for the same reasons

as those explained above in Ground 1. The described functionality would be carried over into the combination with RFC 3209, Raz, and Ferguson.

y. Claim 25

[25] The apparatus according to claim 15, wherein said plurality of physical data ports are selected from a single logical port.

312. It is my opinion that the element of Claim 25 is obvious over RFC 3209 in view of Raz in further view of Ferguson. EX1001, 12:1-3. The element of Claim 25 covers substantially the same material as the element of Claim 14. Accordingly, I incorporate my analysis for Claim 14 from above into this Element, and this Element is obvious over RFC 3209 in view of Raz, Ferguson, and the knowledge of a POSITA for the same reasons as those discussed for Claim 14. *See supra* VII.B.n.[14].

313. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of Ferguson and the knowledge of a POSITA discloses or renders obvious the element of Claim 25.

z. Claim 26

[26.0] A method for assigning and utilizing an Ethernet physical data port in an Ethernet Link Aggregation Group (LAG) in a Multi-Protocol Label Switching (MPLS) network, the method comprising the steps of

314. It is my opinion that Element [26.0] is obvious over RFC 3209 in view of Raz in further view of Ferguson. EX1001, 12:4-7. Element [26.0] of Claim 26 is a preamble which covers substantially the same material as Element [1.0] of Claim

1. Accordingly, I incorporate my analysis for Element [1.0] from above into this Element, and this Element is obvious over RFC 3209 in view of Raz, Ferguson, and the knowledge of a POSITA for the same reasons as those discussed for Element [1.0] of Claim 1. See *supra* VII.B.a.[1.0].

315. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of Ferguson and the knowledge of a POSITA discloses or renders obvious Element [1.0] of Claim 26.

[26.1] receiving from a preceding node located upstream from a first MPLS/LAG switch, at said first MPLS/LAG switch, a request message requesting configuration of a network tunnel, the message further requesting a data packet label associated with said network tunnel, said request message specifying a bandwidth requirement;

316. It is my opinion that Element [26.1] is obvious over RFC 3209 in view of Raz in further view of Ferguson. EX1001, 12:8-13. Element [26.1] of Claim 26 covers substantially the same material as the element of Claim 2, with the addition of a bandwidth requirement as in Element [1.1] of Claim 1. Accordingly, I incorporate my analysis for Claim 2 and for Element [1.1] of Claim 1 from above into this Element, and this Element is obvious over RFC 3209 in view of Raz, Ferguson, and the knowledge of a POSITA for the same reasons as those discussed for the element of Claim 2 and element [1.1] of Claim 1. See *supra* VII.B.b.[2]; VII.B.a.[1.1].

317. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of Ferguson and the knowledge of a POSITA discloses or renders obvious Element [1.1] of Claim 26.

[26.2] assigning, at the first MPLS/LAG switch, a single physical tunnel port of a LAG to the network tunnel wherein the single physical tunnel port of the LAG, which meets the specified bandwidth requirement, wherein said single physical tunnel port of said LAG has a port serial number;

318. It is my opinion that Element [26.2] is obvious over RFC 3209 in view of Raz in further view of Ferguson. EX1001, 12:14-19. Element [26.2] of Claim 26 covers substantially the same material as Element [1.1] of Claim 1. Accordingly, I incorporate my analysis for Element [1.1] from above into this Element, and this Element is obvious over RFC 3209 in view of Raz, Ferguson, and the knowledge of a POSITA for the same reasons as those discussed for Element [1.1] of Claim 1. *See supra* VII.B.a.[1.1].

319. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of Ferguson and the knowledge of a POSITA discloses or renders obvious Element [26.2] of Claim 26.

[26.3] dedicating a sub-set of bits in a data packet label prepared by said first MPLS/LAG switch to encode said port serial number of said single physical tunnel port of the LAG into the data packet label;

320. It is my opinion that Element [26.3] is obvious over RFC 3209 in view of Raz in further view of Ferguson. EX1001, 12:20-23. Element [26.3] of Claim 26 covers substantially the same material as Element [1.2] of Claim 1. Accordingly, I

incorporate my analysis for Element [1.2] from above into this Element, and this Element is obvious over RFC 3209 in view of Raz, Ferguson, and the knowledge of a POSITA for the same reasons as those discussed for Element [1.2] of Claim 1. *See supra* VII.B.a.[1.2].

321. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of Ferguson and the knowledge of a POSITA discloses or renders obvious Element [26.3] of Claim 26.

[26.4] sending, by said first MPLS/LAG switch, said data packet label, in which said port serial number of said single physical tunnel port is encoded, to the preceding node;

322. It is my opinion that Element [26.4] is obvious over RFC 3209 in view of Raz in further view of Ferguson. EX1001, 12:24-26. Element [26.4] of Claim 26 covers substantially the same material as Element [1.3] of Claim 1. Accordingly, I incorporate my analysis for Element [1.3] from above into this Element, and this Element is obvious over RFC 3209 in view of Raz, Ferguson, and the knowledge of a POSITA for the same reasons as those discussed for Element [1.3] of Claim 1. *See supra* VII.B.a.[1.3].

323. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of Ferguson and the knowledge of a POSITA discloses or renders obvious Element [26.4] of Claim 26.

[26.5] receiving from the preceding node, at said first MPLS/LAG switch, a data packet that includes said data packet label, in which said port serial number of said single physical tunnel port is encoded; and

324. It is my opinion that Element [26.5] is obvious over RFC 3209 in view of Raz in further view of Ferguson. EX1001, 12:27-30. Element [26.5] of Claim 26 covers substantially the same material as Element [1.4] of Claim 1. Accordingly, I incorporate my analysis for Element [1.4] from above into this Element, and this Element is obvious over RFC 3209 in view of Raz, Ferguson, and the knowledge of a POSITA for the same reasons as those discussed for Element [1.4] of Claim 1. See *supra* VII.B.a.[1.4].

325. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of Ferguson and the knowledge of a POSITA discloses or renders obvious Element [26.5] of Claim 26.

[26.6] sending said data packet from said first MPLS/LAG switch to a second MSPLS/LAG switch via said single physical tunnel port having the port serial number encoded in the data packet label.

326. It is my opinion that Element [26.6] is obvious over RFC 3209 in view of Raz in further view of Ferguson. EX1001, 12:31-34. Element [26.6] of Claim 26 covers substantially the same material as Element [1.5] of Claim 1. Accordingly, I incorporate my analysis for Element [1.5] from above into this Element, and this Element is obvious over RFC 3209 in view of Raz, Ferguson, and the knowledge of

a POSITA for the same reasons as those discussed for Element [1.5] of Claim 1. *See supra* VII.B.a.[1.5].

327. Accordingly, it is my opinion that RFC 3209 in view of Raz in further view of Ferguson and the knowledge of a POSITA discloses or renders obvious Element [26.6] of Claim 26.

VIII. OBJECTIVE INDICIA OF NON-OBVIOUSNESS

328. I am not aware of any objective indicia of non-obviousness that would make Claim 1 of the '602 Patent non-obvious over the prior art considered herein. In my opinion, any possible objective indicia of non-obviousness would not overcome the prior art that clearly demonstrates that the subject matter of Claim 1 of the '602 Patent would have been obvious to a POSITA as of May 6, 2005.

329. I reserve the right to supplement my opinions as appropriate if Corrigent alleges or offers any purported evidence of any such objective indicia of non-obviousness.

I hereby 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 1001 of Title 18 of the United States Code.

Executed this 18th day of April, 2023.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Paul Min", written in a cursive style.

Paul Min, Ph.D.