

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ARISTA NETWORKS, INC.,
Petitioner,

v.

ORCKIT CORPORATION,
Patent Owner.

Case No. IPR2024-01238
Patent 8,830,821

**DECLARATION OF PAUL MIN, PH.D. IN SUPPORT OF PETITION FOR
INTER PARTES REVIEW OF U.S. PATENT NO. 8,830,821**

Table of Contents

	Page
I. INTRODUCTION	7
II. PROFESSIONAL BACKGROUND AND QUALIFICATIONS	8
III. MATERIALS CONSIDERED	14
IV. UNDERSTANDING OF APPLICABLE LEGAL STANDARDS	17
A. My Understanding of Claim Construction	17
B. My Understanding of Obviousness	18
C. Level of Ordinary Skill in the Art	22
V. OVERVIEW OF THE '821 PATENT	23
A. Subject Matter.....	23
B. Prosecution History	25
C. Priority Date.....	26
D. Level of Ordinary Skill in the Art	26
E. Listing of Challenged Claims	28
F. Claim Construction.....	33
1. “entity”	33
VI. TECHNOLOGY BACKGROUND AND STATE OF THE ART	33
VII.....APPLICATION OF THE PRIOR ART TO THE CHALLENGED CLAIMS	34
A. Grounds of Unpatentability	36
B. Summary of Prior Art	36
1. Overview of <i>Doshi</i> (Exhibit 1005).....	36
2. Overview of <i>Guichard</i> (Exhibit 1006).....	39
3. Overview of <i>Huang</i> (Exhibit 1007).....	40
4. Overview of <i>Ashwood Smith</i> (Exhibit 1037).....	41
C. Ground 1: Claims 1-7, 9-11, 13, and 17-20 are rendered obvious by <i>Doshi</i> in view of <i>Guichard</i>	43
1. Motivation to Combine <i>Doshi</i> and <i>Guichard</i>	43
2. Claim 1.....	48

(i) 1[Pre]: “An entity selection method performed by a network device, comprising the steps of:”	48
(ii) 1[a]: “providing a plurality of multi protocol label switching (MPLS) transport entities between a first endpoint and a second endpoint;”	52
(iii) 1[b]: “determining an overall cost for each entity pair of said plurality of entities;”	62
(iv) 1[c]: “selecting an entity pair from said plurality of transport entities based at least in part upon said overall cost; and”	68
(v) 1[d]: “if an entity pair reselection event occurs, reselecting said entity pair from the group consisting of said entity pair and a replacement entity pair comprising at least one entity distinct from the entities of said entity pair,”	76
(vi) 1[e]: “wherein said entity pair reselection event is selected from a group consisting of adding an entity to said plurality of transport entities, removing an entity from said plurality of transport entities, an operational status change for one of said plurality of transport entities, and a change in overall cost for one of said plurality of transport entities.”	83
3. Claim 2: “The method of claim 1, wherein said step of selecting an entity pair further comprises: selecting a working entity from said entity pair; and selecting a protection entity from said entity pair.”	85
4. Claim 3: “The method of claim 2, further comprising the step of selecting an active entity from the set consisting of said working entity and said protection entity.”	87
5. Claim 4: “The method of claim 2, wherein selecting an entity pair further comprises minimizing an overall cost function.”	88
6. Claim 5: “The method of claim 4, wherein said overall cost function comprises substantially minimizing a probability of concurrent failure of said protection entity and said working entity.”	91
7. Claim 6: “The method of claim 4, wherein said overall cost function comprises a predefined entity cost metric.”	95
8. Claim 7: “The method of claim 6, wherein said predefined entity cost metric is selected from the group consisting of interior gateway protocol (IGP) and traffic engineering (TE).”	97

9. Claim 9	97
(i) 9[pre] “The method of claim 4,”	97
(ii) 9[a] “wherein said overall cost function comprises: selecting a subset of entity pairs wherein each entity pair of said subset has substantially minimum probability of a concurrent failure of said protection entity and said working entity; and”	97
(iii) 9[b]: “if said subset comprises at least two entity pairs, selecting an entity pair from said subset that minimizes an entity cost function.”	102
10. Claim 10: “The method of claim 9, wherein said entity cost function comprises a predefined metric.”	105
11. Claim 11: “The method of claim 10, wherein said predefined metric is selected from the group consisting of interior gateway protocol (IGP) and traffic engineering (TE).”	106
12. Claim 13: “The method of claim 1, further comprising the step of: if said entity pair reselection results in both working and protection entities being replaced, sequentially replacing said working entity and said protection entity.”	106
13. Claim 17	110
(i) 17[Pre]: “Non-transitory computer readable media configured to perform a method comprising the steps of:”	110
(ii) 17[a]: “providing a plurality of MPLS transport entities between a first endpoint and a second endpoint;”	112
(iii) 17[b]: “determining an overall cost for each entity pair of said plurality of entities;”	113
(iv) 17[c]: “selecting an entity pair from said plurality of transport entities based at least in part upon said overall cost; and”	113
(v) 17[d]: “if an entity pair reselection event occurs, reselecting said entity pair from the group consisting of said entity pair and a replacement entity pair comprising at least one entity distinct from the entities of said entity pair,”	113
(vi) 17[e]: “wherein said entity pair reselection event is selected from a group consisting of adding an entity to said plurality of transport entities, removing an entity from said plurality of transport entities, an operational status change for one of said plurality of transport entities,	

and a change in overall cost for one of said plurality of transport entities.”	113
14. Claim 18	113
(i) 18[a]: “The non-transitory computer readable media of claim 17, wherein said step of selecting an entity pair further comprises: selecting a working entity from said plurality of transport entities; and selecting a protection entity from said plurality of transport entities; and”	113
(ii) 18[b]: “selecting an active entity from the set consisting of said working entity and said protection entity.”	115
15. Claim 19: “The non-transitory readable media of claim 18, wherein said step of selecting an entity pair further comprises minimizing an overall cost function.”	115
16. Claim 20	116
(i) 20[a]: “The non-transitory computer readable media of claim 19, wherein said overall cost function comprises: minimizing a probability of concurrent failure of said protection entity and said working entity; and”	116
(ii) 20[b]: “a predefined metric selected from the group consisting of interior gateway protocol (IGP) and traffic engineering (TE).”	116
D. Ground 2: Claims 8 and 12 are rendered obvious by <i>Doshi</i> in view of <i>Guichard</i> and <i>Huang</i>	116
1. Motivation to Combine <i>Doshi</i> and <i>Huang</i>	116
2. Claim 8: “The method of claim 4, further comprising the step of configuring said working entity as revertive.”	121
3. Claim 12: “The method of claim 10, further comprising the step of configuring said working entity as revertive.”	123
E. Ground 3: Claims 14-16 are rendered obvious by <i>Doshi</i> in view of <i>Guichard</i> and <i>Ashwood Smith</i>	123
1. Motivation to Combine <i>Doshi</i> with <i>Guichard</i> and <i>Ashwood Smith</i>	124
2. Claim 14	129
(i) 14[Pre]: “A system for selecting entities within an MPLS network, comprising:”	129
(ii) 14[a]: “a data structure comprising a plurality of transport entity descriptors;”	129

(iii) 14[b]: “an entity protection switch configured to switch between a working entity and a protection entity; and”	132
(iv) 14[c]: “digital logic configured to select said working entity and said protection entity from said plurality of transport entity descriptors, comprising:”	133
(v) 14[d]: “logic configured to determine a probability of concurrent failure of said working entity and said protection entity;”	135
(vi) 14[e]: “logic configured to determine an entity cost of said plurality of transport entity descriptors: and”	142
(vii) 14[f]: “logic configured to reselect said working entity and said protection entity from said plurality of transport entity descriptors upon a reselection event,”	144
(viii) 14[g]: “wherein said reselection event is selected from a group consisting of adding an entity to said plurality of transport entities, removing an entity from said plurality of transport entities, an operational status change for one of said plurality of transport entities, and a change in overall cost for one of said plurality of transport entities.”	146
3. Claim 15: “The system of claim 14, wherein said entity protection switch comprises a 1:1 switch.”	146
4. Claim 16: “The system of claim 14, wherein said entity protection switch comprises a 1+1 switch.”	147
VIII. SECONDARY CONSIDERATIONS	147
IX. CONCLUSION	148

Appendix A: CV of Paul Min, Ph.D.

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

I. INTRODUCTION

1. I have been retained by counsel for Arista Networks, Inc. (the “Petitioner”) in connection with the above-captioned *inter partes* review (“IPR”) of Claims 1-20 of U.S. Patent No. 8,830,821 (the “’821 Patent”), entitled Method for Supporting MPLS Transport Path Recovery with Multiple Protection Entities, by named inventors Daniel Cohn and Rafi Ram. I understand that the ’821 Patent is assigned to Orckit Corporation (the “Patent Owner”). I have been asked to provide technical review, analysis, insights, and opinions regarding the ’821 Patent and the prior art references that form the basis for the ground of unpatentability set forth in the Petition for *Inter Partes* Review of the ’821 Patent (the “Petition”). I have been asked to provide a declaration regarding my opinions on the validity of Claims 1-20 of the ’821 Patent.

2. This declaration sets forth the opinions I have formed in this IPR and provides the bases and reasons for those opinions. I have summarized in this section my educational background, professional experience, and publications. My education and professional experience are described in my curriculum vita, attached to this declaration as Appendix A.

3. This declaration is based on information currently available to me. I declare that I have personal knowledge of the facts set forth in this declaration and, if called to testify as a witness, could and would do so competently.

4. I am being compensated at my usual consulting rate of \$500 per hour for my work on this matter. I am also being reimbursed for any incurred expenses. My compensation is in no way dependent upon my opinions or testimony or the outcome of this proceeding. I have no other interests in this proceeding or with Petitioner or Patent Owner.

II. PROFESSIONAL BACKGROUND AND QUALIFICATIONS

5. A description of my professional background and qualifications is provided below. An additional account of my work experience and qualifications is included in my curriculum vitae, which is attached as Appendix A.

6. I am an expert in the field of high-speed communication and computing, and the development of electronic devices and software systems and for the related applications. I am currently a Senior Professor in the Department of Electrical and Systems Engineering at Washington University in Saint Louis.

7. 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.

8. 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. I received an Outstanding Achievement Award for my contributions to Bellcore in 1989.

9. In September 1990, I joined the faculty at Washington University in St. Louis. Upon arriving at Washington University, I developed a communication and computer curricula in the School of Engineering and Applied Science. I regularly teach undergraduate and graduate courses. In July 1996, I was promoted to an Associate Professor of Electrical Engineering with tenure. I am currently a Senior Professor of Electrical and Systems Engineering at Washington University. I have 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.

10. At Washington University, I have conducted research in communication, computing, and related electronic hardware and software. My

research group has pioneered a new paradigm for computing and communication systems that can alleviate the speed and performance mismatch against optical technology. I have received several grants from U.S. Federal Agencies, including the National Science Foundation (NSF), the Defense Advanced Research Project Agency (DARPA), and the Air Force Office of Scientific Research (AFOSR), and numerous contracts from companies and organizations around the world.

11. My research group has significantly contributed to development of future generations of wireless technology. I developed methods that enable coordinated transmission and reception of wireless signals among multiple base stations. Previously, radio signals from multiple base stations were considered as interference. Leveraging my research, a cluster of base stations can work together as a single resource enhancing the quality of radio signals across extremely noisy wireless channels.

12. I developed and implemented a number of semiconductor integrated circuit chips. These integrated circuit chips include switch fabrics, processors, high speed interfaces, protocol transposers, controllers, content search engines, look up table processors, and memory cells and arrays.

13. Specifically related to the technology matters in this litigation, I have researched a variety of technologies for the packet switches and routers including packet scheduler, traffic shaper, traffic policing, buffer management, and interposer.

In addition, I have researched and implemented various look-up table configurations for fast packet processing, which is particularly applicable to the Multi Protocol Label Switching or MPLS. Moreover, since the mid-1990s, I have been researching and developing various security technologies such as the deep packet inspection, content searching and matching, regular expression processing, etc.

14. As a faculty member at Washington University, I have taught a number of courses in electronics, communication, and computing at both the undergraduate and graduate levels. For example, I have taught Communication Theory (Washington University ESE 471), Transmission and Multiplexing (Washington University ESE 571), and Signaling and Control of Communication Networks (Washington University ESE 572).

15. I have directly supervised numerous graduate students, a number of whom received a doctoral degree under my guidance. A number of doctoral theses that I have supervised relate specifically to the aforementioned-communication and computing technologies related to this litigation. My students and I have published a number of peer-reviewed articles in these topics.

16. 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.

17. 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 commercial-scale communication technology used today. 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).

18. I am a named inventor on eleven U.S. patents. I have authored and co-authored numerous technical papers and memoranda, many of which have appeared in various peer-reviewed international journals and conferences. I have given more

than 100 seminars and invited talks around the world. I have organized several international conferences and served as an international journal editor.

19. I am a member of, and have been actively involved in, a number of professional organizations. I have served as the Chair of the St. Louis Section of the IEEE, which has 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).

20. I was a member of the Presidential Business Advisors Committee (to President George W. Bush) and was named 2002 Businessman of the Year by the Wall Street Journal for the State of Missouri, for my entrepreneurial efforts.

21. I have received multiple awards for my publications and contributions to technical communication systems. In 1988, I received the Best Paper Award at 18th ISATA Award of Technical Excellence in Florence, Italy. I was also a Rockwell Fellow at the University of Michigan in Ann Arbor in 1988 and 1989. I received a Research Initiation Award in 1993 from the Defense Advance Research Project Agency (DARPA). I received the Best Paper Award at MOBILITY 2011 in Barcelona, Spain. In my more than 30 years of experience with telecommunications technology, I have acquired significant knowledge about telecommunications systems industry standards and standard setting organizations such as ANSI, IEEE, ITU, IETF, and 3GPP.

22. Additional details of my education and work experience, awards and honors, and publications that may be relevant to the opinions I have formed are set forth in my curriculum vitae. *See Appendix A.* A list of cases in which I have testified as an expert at trial or by deposition is included in Appendix A.

III. MATERIALS CONSIDERED

23. The analysis that I provide in this declaration is based on my education, research, experience, and professional judgment, as well as the documents I have considered, including the '821 Patent (Exhibit 1001) and its prosecution history (Exhibit 1002). I have reviewed and am familiar with the specification of the '821 Patent. I have reviewed and am familiar with the file history of the '821 Patent.

24. In preparing this declaration, I have also reviewed and am familiar with the following prior art used in the Petition and in my declaration below¹:

Exhibit 1005 – U.S. Patent Application Publication No. 2004/0205239 by Doshi (“Doshi”) was filed on September 26, 2003 and published on October

¹ The '821 Patent claims priority to U.S. Provisional Application No. 61/499,943 filed on June 22, 2011. For purposes of this declaration, I have been asked to assume that the priority date for the '821 Patent is June 22, 2011, the date the provisional application was filed. I do not offer an opinion on whether the '821 Patent is in fact entitled to claim the benefit of the filing date of the provisional application.

14, 2004, which is more than one year before the June 22, 2011 priority date of the '821 Patent. I understand from counsel for Petitioner that Doshi qualifies as prior art under at least pre-AIA 35 U.S.C. §§ 102(a) and (b).

Exhibit 1006 – “Definitive MPLS Network Designs, Field-proven MPLS design covering MPLS VPNs, pseudowire, QoS, traffic engineering, IPv6, network recovery, and multicast,” by Guichard et al., Cisco Press, 2005 (“Guichard”) was published in 2005, which is more than one year before the June 22, 2011 priority date of the '821 Patent. I understand from counsel for Petitioner that Guichard qualifies as prior art under at least pre-AIA 35 U.S.C. § 102(b).

Exhibit 1007 – U.S. Patent Application Publication No. 2003/0117950 by Huang (“Huang”) was filed on December 26, 2001 and published on June 26, 2003, which is more than one year before the June 22, 2011 priority date of the '821 Patent. I understand from counsel for Petitioner that Huang qualifies as prior art under at least pre-AIA 35 U.S.C. §§ 102(a) and (b).

Exhibit 1037 – WO 2004/068799 A1 by Ashwood Smith (“Ashwood Smith”) was published on August 12, 2004, which is before the June 22, 2011 filing date of the '821 Patent. I understand from counsel for Petitioner that *Xu* qualifies as prior art under at least pre-AIA 35 U.S.C. § 102(b).

25. I have considered the following documents in my analysis below:

Exhibit No.	Description
1001	U.S. Patent No. 8,830,821 (“’821 Patent”) to Cohn et al.
1002	Prosecution File History of the ’821 Patent (“File History”)
1005	U.S. Patent Application Publication No. 2004/0205239 by Doshi (“Doshi”)
1006	“Definitive MPLS Network Designs,” by Guichard Cisco Press, 2005, (“Guichard”)
1007	U.S. Patent Publication No. 2003/0117950 to Huang (“Huang”)
1008	“MATE: MPLS Adaptive Traffic Engineering” by Elwalid et al., IEEE, 2001
1009	“Traffic Engineering with MPLS,” by Osborne et al., Cisco Press, 2003
1010	“Fast Network Re-optimization Schemes for MPLS and Optical Networks” by Bhatia et al., 2006
1011	RFC 3209
1016	U.S. Patent Publication No. 2008/0155257
1017	U.S. Patent No. 7,624,142
1018	U.S. Patent Publication No. 2006/0015781
1022	RFC 3272
1023	“Multiprotocol Label Switching (MPLS) Traffic Engineering,” Cisco IOS Release 12.0(5)
1024	IETF “Multiple Metrics for Traffic Engineering with IS-IS and OSPF,” Fedyk et al.
1025	U.S. Patent Publication No. 2011/0141877 to Xu et al., (“Xu”)
1026	U.S. Patent No. 5,699,403 to Ronnen (“Ronnen”)
1027	RFC 2026
1028	U.S. Patent No. 8,102,774
1029	U.S. Patent Publication No. 2007/0201513
1030	RFC 3469
1031	U.S. Patent No. 6,980,906
1032	U.S. Patent No. 7,502,884
1033	U.S. Patent No. 7,197,418
1034	U.S. Patent Publication No. 2006/0250948
1035	U.S. Patent Publication No. 2007/0047469
1036	U.S. Patent Publication No. 2006/0291391
1037	WO 2004/068799 by Ashwood Smith (“Ashwood Smith”)

26. In reaching the opinions expressed in this declaration, I have also considered the Declaration Of Dr. Henry H. Houh Under 37 C.F.R. § 1.68 In Support Of Petition for *Inter Partes* Review submitted as Exhibit 1003 in IPR2023-00402. Although this declaration is not identical to Dr. Houh's, I have in places repeated portions of Dr. Houh's analysis in this declaration. Where I have repeated or otherwise relied on Dr. Houh's analysis, I agree with Dr. Houh's analysis and adopt it as my own for purposes of this declaration.

IV. UNDERSTANDING OF APPLICABLE LEGAL STANDARDS

27. Although I am not an attorney, I have a general understanding of the applicable legal standards pertaining to the patentability issues presented in this proceeding. My understanding of legal principles as described in this section is based on communication of those principles to me by Petitioner's legal counsel. The analysis in this declaration is in accordance with the legal principles outlined below.

28. I understand that, in this *inter partes* review, Petitioner has the burden of proving that each challenged claim is unpatentable by a preponderance of the evidence.

A. My Understanding of Claim Construction

29. I have been informed by counsel that a purpose of claim construction is to determine what a person of ordinary skill in the art ("POSITA") would have understood the claim terms to mean. I understand that during an IPR proceeding,

claims are to be construed in light of the specification as would be read by a POSITA at the time the application was filed. I understand that claim terms are given their ordinary and customary meaning as would be understood by a POSITA in the context of the entire disclosure. A claim term, however, will not receive its ordinary meaning if the patentee acted as his own lexicographer and clearly set forth a definition of the claim term in the specification. In this case, the claim term will receive the definition set forth in the patent.

30. I understand that the prosecution history can inform the meaning of the claim language by demonstrating how the inventors understood the invention and whether the inventors limited the invention in the course of prosecution, making the claim scope narrower than it otherwise would be. I understand that extrinsic evidence may also be consulted in construing the claim terms, such as dictionary definitions and expert testimony.

B. My Understanding of Obviousness

31. I understand that a patent claim is unpatentable if, at the time of the invention, it would have been obvious to one of ordinary skill in the art to combine the teachings of the prior art to yield the patent claim. I also understand that it is not required (although it is acceptable) that each element of a patent claim be found in a single reference in order to find a patent claim obvious. This means that even if all of the requirements of the claim cannot be found in a single prior art reference that

would anticipate the claim, the claim can still be invalid. For a patent claim to be found obvious, all the elements of the patent claim may be found in a combination of references at which a POSITA would have been reasonable expected to arrive.

32. I understand that the following factors should be considered in analyzing obviousness: (1) the scope and content of the prior art; (2) the differences between the prior art and the claims; (3) the level of ordinary skill in the pertinent art; and (4) other objective considerations identified below. I understand that an invention is obvious when the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious to a POSITA at the time the invention was made.

33. I understand that a showing of obviousness requires some articulated reasoning with a rational underpinning to support the combination of references. I understand that in consideration of the issue of obviousness it is important to identify whether a reason existed at the time of the invention that would have led a person of ordinary skill in the pertinent art to combine elements of the references in a way that yields the claimed invention.

34. I understand that a POSITA is assumed to have knowledge of all prior art references. I also understand that when considering the obviousness of a patent claim, one may consider whether a teaching, suggestion, or motivation to combine

the references exists so as to avoid impermissibly applying hindsight when considering the prior art.

35. I understand that a POSITA can combine various prior art references based on the teachings of those prior art references, the general knowledge present in the art, or common sense. I understand that a motivation to combine the references may be implicit in the prior art, and there is no requirement that there be an actual or explicit teaching to combine two references. Thus, one may take into account the inferences and creative steps that a POSITA would employ to combine the known elements in the prior art in the manner claimed by the patent-at-issue. I understand that one should avoid “hindsight bias” and ex post reasoning in performing an obviousness analysis. This does not mean, however, that a POSITA does not have recourse to common sense for purposes of the obviousness inquiry.

36. I understand that a claim may be considered unpatentable for obviousness for various reasons. I have been informed that the following exemplary rationales may support a finding of obviousness:

- A. combining prior art elements according to known methods to yield predictable results;
- B. simply substituting 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. choosing from a finite number of identified, predictable solutions with a reasonable expectation of success;
- F. a predictable variation of work in the same or a different field of endeavor, which a POSITA would be able to implement;
- G. if, at the time of the alleged invention, there existed a known problem for which there was an obvious solution encompassed by the patent's claim;
- H. known work in one field of endeavor that prompts variations of it for use in either the same field or a different field based on technological incentives or other market forces if the variations would have been predictable to one of ordinary skill in the art; and/or
- I. 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 multiple prior-art references or teachings to arrive at the claimed invention.

37. I understand that even if a prima facie case of obviousness is established, the final determination of obviousness must also consider objective indicia of nonobviousness, which I understand are also referred to as “secondary considerations,” if presented. I understand that these objective indicia can be important evidence as to whether a patent is obvious or nonobvious. Such secondary considerations include: (1) commercial success of products covered by the patent claims; (2) a long-felt but unsolved need for the invention; (3) failed attempts by others to make the invention; (4) copying of the invention by others in the field; (5) unexpected results achieved by the invention as compared to the closest prior art; (6) praise of the invention by the infringer or others in the field; (7) the taking of licenses under the patent by others; (8) expressions of surprise by experts and those skilled in the art at the making of the invention; and (9) the patentee proceeded contrary to the accepted wisdom of the prior art. I further understand that secondary considerations evidence is only relevant if the offering party establishes a connection, or nexus, between the evidence and the claimed invention.

C. Level of Ordinary Skill in the Art

38. I understand that an assessment of the claims of the '821 Patent should be undertaken from the perspective of a POSITA as of the earliest claimed priority date. I understand that a POSITA is presumed to be aware of all pertinent art, thinks

along conventional wisdom in the art, and is a person of ordinary creativity—not an automaton.

39. I understand that to determine the appropriate level of a POSITA, the following factors may be considered: (1) the types of problems encountered by those working in the field and prior art solutions thereto; (2) the sophistication of the technology in question, and the rapidity with which innovations occur in the field; (3) the educational level of active workers in the field; and (4) the educational level of the inventor.

V. OVERVIEW OF THE '821 PATENT

40. I have reviewed the '821 Patent, which is entitled “Method for Supporting MPLS Transport Path Recovery with Multiple Protection Entities.” Ex.1001 (“’821 Patent”) at Cover. I understand that the '821 Patent claims priority to a provisional application filed on June 22, 2011.

A. Subject Matter

41. The '821 Patent is titled “Method for Supporting MPLS Transport Path Recovery with Multiple Protection Entities.” The cover shows the applicants filed a U.S. provisional application on June 22, 2011, and filed the corresponding U.S. non-provisional application on December 5, 2011.

42. The '821 Patent generally describes a “system and method for selecting MPLS network transport entities between a first endpoint and a second endpoint.”

'821 Patent, Abstract. According to the '821 Patent, the noted system and method provide “protection against multiple span or node failures” by utilizing transport entity pairs that are “fully or partially resource disjoint.” '821 Patent, 3:15-18. “[A]n overall cost for each pair of the plurality of transport entities is determined” and an entity pair, comprising a “working entity” and a “protection entity,” is “selected to minimize an overall cost.” '821 Patent, 4:14-16, 4:29-33. For communication, “[a]n active entity may be selected from the working entity and the protection entity.” '821 Patent, 4:57-58.

43. The '821 Patent also discloses that an “event” triggers “[e]ntity pair reselection.” '821 Patent, 4:34-35. The reselection may result in selecting new entity pairs or selecting the same pairs. '821 Patent, 4:63-5:8. The trigger may correspond to “when the operational status changes for an entity in the plurality of transport entities, when an entity is added to the plurality of transport entities, when an entity is removed from the plurality of transport entities, or due to combined cost changes in one or more entities.” '821 Patent, 4:35-41.

44. For reference, representative claim 1 is provided below:

1. An entity selection method performed by a network device, comprising the steps of:
providing a plurality of multi protocol label switching (MPLS) transport entities between a first endpoint and a second endpoint;
determining an overall cost for each entity pair of said plurality of entities;
selecting an entity pair from said plurality of transport entities based at least in part upon said overall cost; and
if an entity pair reselection event occurs, reselecting said entity pair from the group consisting of said entity pair and a replacement entity pair comprising at least one entity distinct from the entities of said entity pair,
wherein said entity pair reselection event is selected from a group consisting of adding an entity to said plurality of transport entities, removing an entity from said plurality of transport entities, an operational status change for one of said plurality of transport entities, and a change in overall cost for
one of said plurality of transport entities.

45. As I will explain below, these concepts were well known as of the priority date of the '821 Patent.

B. Prosecution History

46. The '821 Patent claims priority to Provisional application No. 61/499,943 filed on June 22, 2011.

47. In response to an Office Action, the Applicants amended the independent claims “to clarify that ‘reselecting said entity pair’ means reselecting

said entity pair from the group consisting of said entity pair and a replacement entity pair comprising at least one entity distinct from the entities of said entity pair.” File History, 64. Applicants then argued that the prior art does not teach the amended claim because it only addresses a failover scenario and not reselecting the path pair. File History, 63.

48. Notably, as I demonstrate below, there is nothing novel about the Challenged Claims of the ’821 Patent because all of the claimed features, including the reselection features forming the basis of Applicants’ arguments and amendments, were known in the art and it would have been obvious to combine the relevant prior art teachings as claimed.

C. Priority Date

49. For purposes of this declaration, I have been asked to assume that the ’821 Patent is entitled to a priority date of June 22, 2011, the filing date of U.S. Provisional Application No. 61/499,943. I have not considered whether the ’821 Patent is in fact entitled to the benefit of the filing date of the provisional application.

D. Level of Ordinary Skill in the Art

50. I have been asked to consider the level of ordinary skill in the field that someone would have had at the time the claimed invention was made. My opinions regarding the level of ordinary skill in the art are based on, among other things, my over 40 years of experience in the field of electrical engineering and computer

science, as well as: the levels of education and experience of persons working in the field, the types of problems encountered in the field; and the sophistication of the technology.

51. Based on the disclosure of the '821 Patent, in my opinion a POSITA as of June 22, 2011 would have been someone knowledgeable and familiar with network communications and multiprotocol label switching-transport (MPLS) techniques available at the time. Such a POSITA would have at least a Bachelor's degree in computer science, electrical engineering, computer engineering, or a closely related field, and two or more years of professional experience in packet-switched networking systems. Alternatively, a POSITA would have a Master's degree or similar post-graduate work in computer science, electrical engineering, computer engineering, or a closely related field, and less professional experience. This level of skill is approximate, and more experience would compensate for less formal education, and vice versa.

52. Based on my education and experience, I meet this definition of one of ordinary skill in the art, and I believe that I am qualified to provide opinions about how a POSITA at the relevant time would have interpreted and understood the '821 Patent and the prior art relied upon herein. Although my qualifications and experience exceed those of a POSITA, both in June 2011 and today, I have nevertheless applied the perspective of a POSITA in rendering my opinions below.

53. My opinions below explain how a POSITA would have understood the technology described in the '821 Patent and the prior art references I have identified herein around the June 22, 2011 timeframe. For purposes of this declaration, in general, and unless otherwise noted, my testimony below refers to the knowledge of one of ordinary skill in the art during the time period around the priority date of the '821 Patent. I would have been a person with at least ordinary skill in the art at that time.

E. Listing of Challenged Claims

54. Below I provide a listing of Claims 1-20 of the '821 Patent. I will refer throughout this declaration to the elements of the claims with reference to the number and letter designations that have been added in the left column (e.g., “1[pre],” “1[a],” “1[b],” etc.).

Claim 1	
1[Pre]	An entity selection method performed by a network device, comprising the steps of:
1[a]	providing a plurality of multi protocol label switching (MPLS) transport entities between a first endpoint and a second endpoint;
1[b]	determining an overall cost for each entity pair of said plurality of entities;
1[c]	selecting an entity pair from said plurality of transport entities based at least in part upon said overall cost; and
1[d]	if an entity pair reselection event occurs, reselecting said entity pair from the group consisting of said entity pair and a replacement entity pair

	comprising at least one entity distinct from the entities of said entity pair,
1[e]	wherein said entity pair reselection event is selected from a group consisting of adding an entity to said plurality of transport entities, removing an entity from said plurality of transport entities, an operational status change for one of said plurality of transport entities, and a change in overall cost for one of said plurality of transport entities.
Claim 2	
2	The method of claim 1, wherein said step of selecting an entity pair further comprises: selecting a working entity from said entity pair; and selecting a protection entity from said entity pair.
Claim 3	
3	The method of claim 2, further comprising the step of selecting an active entity from the set consisting of said working entity and said protection entity.
Claim 4	
4	The method of claim 2, wherein selecting an entity pair further comprises minimizing an overall cost function.
Claim 5	
5	The method of claim 4, wherein said overall cost function comprises substantially minimizing a probability of concurrent failure of said protection entity and said working entity.
Claim 6	
6	The method of claim 4, wherein said overall cost function comprises a predefined entity cost metric.
Claim 7	
7	The method of claim 6, wherein said predefined entity cost metric is selected from the group consisting of interior gateway protocol (IGP) and traffic engineering (TE).

Claim 8	
8	The method of claim 4, further comprising the step of configuring said working entity as revertive.
Claim 9	
9[pre]	The method of claim 4, wherein said overall cost function comprises:
9[a]	selecting a subset of entity pairs wherein each entity pair of said subset has substantially minimum probability of a concurrent failure of said protection entity and said working entity; and
9[b]	if said subset comprises at least two entity pairs, selecting an entity pair from said subset that minimizes an entity cost function.
Claim10	
10	The method of claim 9, wherein said entity cost function comprises a predefined metric.
Claim 11	
11	The method of claim 10, wherein said predefined metric is selected from the group consisting of interior gateway protocol (IGP) and traffic engineering (TE).
Claim 12	
12	The method of claim 10, further comprising the step of configuring said working entity as revertive.
Claim 13	
13	The method of claim 1, further comprising the step of: if said entity pair reselection results in both working and protection entities being replaced, sequentially replacing said working entity and said protection entity.
Claim 14	
14[pre]	A system for selecting entities within an MPLS network, comprising:

14[a]	a data structure comprising a plurality of transport entity descriptors;
14[b]	an entity protection switch configured to switch between a working entity and a protection entity; and
14[c]	digital logic configured to select said working entity and said protection entity from said plurality of transport entity descriptors, comprising:
14[d]	logic configured to determine a probability of concurrent failure of said working entity and said protection entity;
14[e]	logic configured to determine an entity cost of said plurality of transport entity descriptors: and
14[f]	logic configured to reselect said working entity and said protection entity from said plurality of transport entity descriptors upon a reselection event,
14[g]	wherein said reselection event is selected from a group consisting of adding an entity to said plurality of transport entities, removing an entity from said plurality of transport entities, an operational status change for one of said plurality of transport entities, and a change in overall cost for one of said plurality of transport entities.
Claim 15	
15	The system of claim 14 wherein said entity protection switch comprises a 1:1 switch.
Claim 16	
16	The system of claim 14 wherein said entity protection switch comprises a 1+1 switch.
Claim 17	
17[pre]	Non-transitory computer readable media configured to perform a method comprising the steps of:
17[a]	providing a plurality of MPLS transport entities between a first endpoint and a second endpoint;

17[b]	determining an overall cost for each entity pair of said plurality of entities;
17[c]	selecting an entity pair from said plurality of transport entities based at least in part upon said overall cost; and
17[d]	if an entity pair reselection event occurs, reselecting said entity pair from the group consisting of said entity pair and a replacement entity pair comprising at least one entity distinct from the entities of said entity pair,
17[e]	wherein said entity pair reselection event is selected from a group consisting of adding an entity to said plurality of transport entities, removing an entity from said plurality of transport entities, an operational status change for one of said plurality of transport entities, and a change in overall cost for one of said plurality of transport entities.
Claim 18	
18[a]	The non-transitory computer readable media of claim 17, wherein said step of selecting an entity pair further comprises: selecting a working entity from said plurality of transport entities; selecting a protection entity from said plurality of transport entities; and
18[b]	selecting an active entity from the set consisting of said working entity and said protection entity.
Claim 19	
19	The non-transitory readable media of claim 18, wherein said step of selecting an entity pair further comprises minimizing an overall cost function.
Claim 20	
20[a]	The non-transitory readable media of claim 19, wherein said overall cost function comprises: minimizing a probability of concurrent failure of said protection entity and said working entity; and
20[b]	a predefined metric selected from the group consisting of interior gateway protocol (IGP) and traffic engineering (TE).

F. Claim Construction

55. It is my understanding that in order to properly evaluate the '821 Patent, the terms of the claims must first be interpreted. It is my understanding that the claims are to be construed according to the same claim construction standard that district courts use. I have been informed by counsel for Petitioner that the challenged claims of the '821 Patent are to be given their ordinary and customary meaning as understood by one of ordinary skill in the art at the time of the invention in light of the specification and the prosecution history pertaining to the patent.

56. I have reviewed the entirety of the '821 Patent along with the prosecution history of the '821 Patent. In the section that follows, I provide references from the specification of the '821 Patent for certain terms.

1. “entity”

57. The '821 Patent discloses that multi protocol label switching (“MPLS”) transport entities include “label switch paths (LSPs) or pseudo wires (PWs)[.]” '821 Patent, 3:22-29.

VI. TECHNOLOGY BACKGROUND AND STATE OF THE ART

58. As shown by the analysis that follows, prior to the June 22, 2011 priority date of the '821 Patent, all of the technology at issue in the challenged claims was well known and broadly applied in various commercial applications. In my opinion, no individual elements of the challenged claims of the '821 Patent were

novel at the time of the alleged invention, and there was nothing novel or inventive about the manner in which those elements were combined in the challenged claims. Further, there were no technological barriers to combining these known elements to form the claimed inventions. Indeed, combining these elements would have yielded predictable results.

VII. APPLICATION OF THE PRIOR ART TO THE CHALLENGED CLAIMS

59. I have been asked to provide my opinion as to whether the challenged claims of the '821 Patent would have been obvious in view of the prior art. The discussion below provides a detailed analysis of how the prior art references I reviewed disclose, teach, or suggest the limitations of the challenged claims of the '821 Patent.

60. As part of my analysis, I have considered the scope and content of the prior art and any potential differences between the claimed subject matter and the prior art. I have conducted my analysis as of the assumed priority date of the '821 Patent: June 22, 2011. I have also considered the level of ordinary skill in the pertinent art as of that date.

61. Below, I describe in detail the scope and content of the prior art, as well as any differences between the subject matter claimed and the prior art, on an element-by-element basis for each challenged claim of the '821 Patent. The analysis

supports my finding that the differences between the claims of the '821 Patent and the prior art discussed herein are such that the subject matter as a whole would have been obvious at the time of the priority date of the '821 Patent to a POSITA.

62. In the ground below, I describe on an element-by-element basis how the prior art discloses or teaches all elements of Claims 1-20 of the '821 Patent. In my opinion, Claims 1-20 would have been obvious to a POSITA in view of the prior art.

63. As part of my analysis, I have considered, and discuss in detail, the scope and content of the prior art and any differences between the alleged invention and the prior art. In addition to various U.S. Patents, Patent Publications, articles, and textbooks, I have reviewed and appropriately cite to a number of “Request for Comments” (RFC) documents published by the Internet Engineering Task Force (IETF). RFCs were well-known as of the priority date of the '821 patent, and it is my opinion that they were “printed publications” for the purposes for which they are cited throughout. *See, e.g.*, Ex.1027, 6, (“RFCs can be obtained from a number of Internet hosts...”), 8 (IETF documents are “readily available to a wide audience”), 26 (IETF participants “shall publicly announce...every activity” relating to the standardization process). Exhibits 1011, 1022, and 1030 are documents published by the IETF describing MPLS networking standards and improvements, and a POSITA in the field of network communications, including mesh networks and path

calculation methodologies, would have reasonably relied upon such documents. POSITAs frequently cited these exact documents before the priority date of the '821 patent. Doshi, [0056], [0265] (citing RFC 3209); Ex.1035, [0013], [0040]-[0041] (citing RFC 3209); Ex.1036, [0011], [0040]-[0041] (citing RFC 3209); Ex.1028, 2:22-24 (citing RFC 3469); Ex.1029, [0047] (citing RFC 3272).

A. Grounds of Unpatentability

64. I have reviewed and analyzed the prior art references and materials listed in Section III above. In my opinion, the challenged claims of the '821 Patent are rendered obvious based on the following prior art set forth in Grounds 1-3 below:

Ground	'075 Patent Claims	Basis for Challenge under §103
1	1-7, 9-11, 13, and 17-20	<i>Doshi</i> in view of <i>Guichard</i>
2	8 and 12	<i>Doshi</i> in view of <i>Guichard</i> and <i>Huang</i>
3	14-16	<i>Doshi</i> in view of <i>Guichard</i> and <i>Ashwood Smith</i>

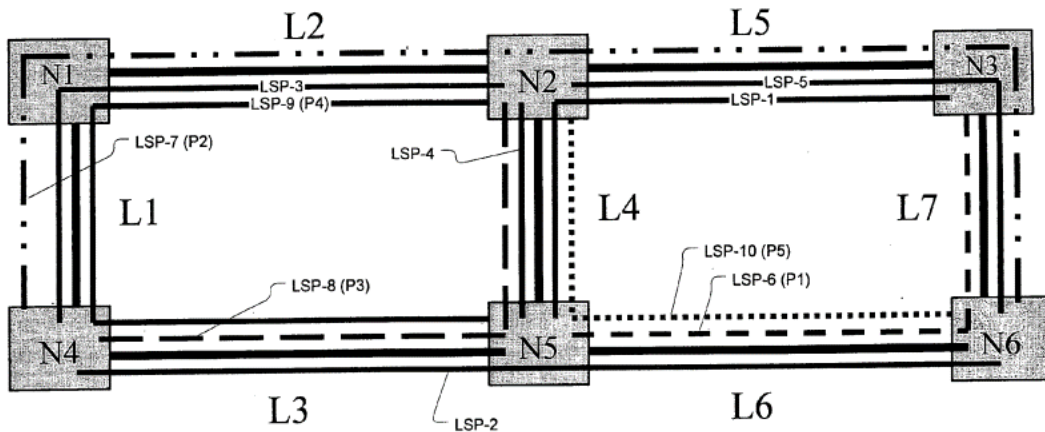
B. Summary of Prior Art

1. Overview of *Doshi* (Exhibit 1005)

65. U.S. Patent Publication No. 2004/0205239 to Doshi et al. (Ex.1005, “Doshi”) was published October 14, 2004. Doshi is titled “Primary/restoration path calculation in mesh networks based on multiple-cost criteria.” Doshi, Title. Doshi was not before the Examiner during prosecution of the '821 Patent.

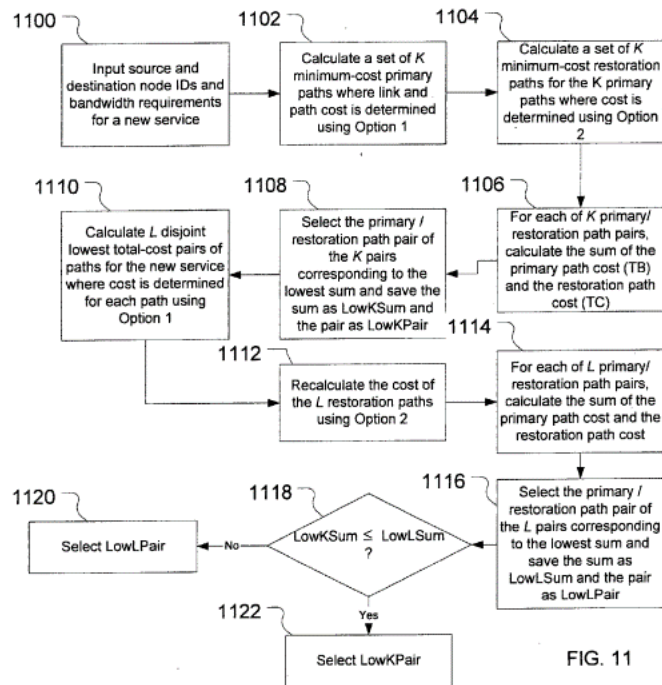
66. Like the '821 Patent, Doshi recognized deficiencies in path “restoration and recovery schemes in the prior art.” Doshi, [0008]; *see* '821 Patent, 1:66-2:4. To address these deficiencies, Doshi describes a method performed by a “network manager” for determining and selecting an overall minimum-cost primary and protection path pair. Doshi, [0014], [0142]. Note that Doshi’s “restoration path” is also referred to as a “protection path.” Doshi, [0076] (“...a protection path (also known as ‘restoration path’”). The determination of the primary and protection path pair considers several factors, including “link utilization, utilization threshold, administrative weight, and sharing degree.” Doshi, [0142]. Another factor considered is whether the primary and protection paths are disjoint. Doshi, [0144]. Doshi explains that the benefit of disjoint paths is that “a failure affecting one of them will not affect the other.” Doshi, [0040].

67. Doshi’s concepts “are discussed in the context of exemplary shared mesh data networks” such as an “MPLS” network. Doshi, [0049]. “A mesh network is a network topology (or a subset thereof) in which there are at least two nodes having two or more paths between them.” Doshi, [0048]. Figure 1, reproduced below, illustrates such an exemplary shared mesh data network where the paths connecting nodes of the mesh are MPLS Label Switched Paths (“LSPs”):



Doshi, Fig. 1

68. In Doshi's Figure 1, nodes within the mesh are connected by pairs of primary and protection LSPs. Doshi, [0052]-[0054]. For example, Node 4 is connected to Node 6 by primary LSP-2 and by protection LSP-7. Doshi, [0052]-[0054]. The protection LSPs serve as a backup path in the event of a failure of their primary LSP. Doshi, [0051]-[0054], [0266]-[0267]. Doshi's LSPs form a plurality of candidate pairs considered in the cost analysis, an example of which is illustrated in Doshi's Figure 11:



Doshi, Fig. 11

69. Each of the plurality of candidate pairs is considered, and the overall minimum-cost pair is selected. Doshi, [0142]-[0145].

70. Accordingly, Doshi shows that selecting an overall minimal-cost MPLS LSP pair (comprising a primary and a protection path), from a plurality of LSPs between two nodes, was known before the filing of the '821 Patent. Additional teachings of Doshi, and how they apply to the claims of the '821 Patent, are discussed below.

2. Overview of *Guichard* (Exhibit 1006)

71. The textbook titled “Definitive MPLS Network Designs, Field-proven MPLS designs covering MPLS VPNs, pseudowire, QoS, traffic engineering, IPv6,

network recovery, and multicast” is authored by Guichard et al. (Ex.1006, “Guichard”). The textbook was published by Cisco Press in 2005.

72. Like the ’821 Patent and Doshi, Guichard describes LSP selection within an MPLS network. Guichard, 79-81; *see* ’821 Patent, Abstract, 3:23-26; *see also* Doshi, [0050]-[0054], [0142]-[0145]. Guichard recognizes that network state may change, including nodes and links failing and coming back online and LSPs being added or removed. Guichard, 79. Guichard notes the advisability of detecting such changes and attempting to reoptimize LSPs along better (or more optimal) paths when they become available. Guichard, 79. Several reoptimization schemes are provided, including: manual reoptimization, timer-based reoptimization, and event-driven reoptimization. Guichard, 81. An event-driven reoptimization evaluation is triggered, for example, by restoration or addition of a link. Guichard, 80-81.

3. Overview of *Huang* (Exhibit 1007)

73. U.S. Patent Pub. No. 2003/0117950 to Huang (Ex.1007, “Huang”) was published June 26, 2003. Huang is titled “Link redial for mesh protection.” Huang at Title. Huang was not before the Examiner during prosecution of the ’821 Patent.

74. Like the ’821 Patent and Doshi, Huang describes LSP selection within an MPLS network. Huang, [0004], [0032], [0035], [0040]; *see* ’821 Patent, Abstract, 3:23-26; *see also* Doshi, [0050]-[0054], [0142]-[0145]. Huang’s LSP selection is described in the context of “protection of connections formed through a mesh-type

communication network.” Huang, [0001]. In Huang, a request is received to set up a label switched path segment between a head end node and a tail end node, where the request further identifies a backup route to the tail end node. Huang, [0016]. The backup routes are “backup LSP[s]” that serve to “protect each of the working links” such that in the event of a failure traffic “may be switched to corresponding individual backup LSPs.” Huang, [0032]. Huang’s “working links” are also LSPs. *See* Huang, [0030]-[0031] (explaining that each “working link” is associated with an LSP and that a link is a “working link” when traffic is flowing over the LSP). After traffic has been switched over to a backup LSP following a failure, Huang describes “revertive switching” such that “the connection will be switched back from the backup LSP to the working link once the working link has cleared the failure that caused the switchover.” Huang, [0053].

4. Overview of *Ashwood Smith* (Exhibit 1037)

75. WO 2004/068799 to Ashwood Smith (Ex.1037, “Ashwood Smith”) has an international filing date of January 30, 2004 and an international publication date of August 12, 2004. Ashwood Smith is titled “Method for Computing a Backup Path for Protecting a Working Path in a Data Transport Network.” Ashwood Smith at Title. Ashwood Smith was not before the Examiner during prosecution of the ’821 Patent.

76. Like the '821 Patent and Doshi, Ashwood Smith describes selecting a backup or protection path to protect against failures in a communication network. Ashwood Smith, Abstract, 2:15-25, 3:16-23, 7:15-21, 7:27-33, 8:13-22, 10:21-11:9; *see* '821 Patent, Abstract; *see also* Doshi, [0050]-[0054], [0142]-[0145]. In Ashwood Smith, a route is determined “by selecting individual backup path segments from a set of possible segments in the data transport network. In the case of a segment that is shared between the first working path and one or more other working paths, the selection process takes into account the existence of a potential point of failure common to the working paths sharing the segment.” Ashwood Smith, 1:18-25. One approach described by Ashwood Smith “consider[s] the probability of failure at that common point. If the probability is fairly low, it might be acceptable for some applications to allow the two working paths to share a common segment on a backup path.” *Id.* at 3:19-23.

77. Ashwood Smith further explains its process of accepting or rejecting segments based on a probability of failure at a common point:

A possible refinement to this process is to take into account the actual probability of failure at a common point shared by two or more working paths in deciding if it is acceptable to deploy a backup path with a segment shared between these two or more working paths....A possible approach to implement this variant is to consider each time a positive

intersection between sets of SRs is observed (step 42 answered in the affirmative) a probability of failure at the common point (allocated by the data transport network operator or otherwise) and accept the segment if the probability is below a certain level or reject the segment if the probability is above the level.

Ashwood Smith, 10:21-11:9.

C. Ground 1: Claims 1-7, 9-11, 13, and 17-20 are rendered obvious by *Doshi* in view of *Guichard*

78. Based on the following analysis, I conclude that a POSITA at the relevant time (June 22, 2011) would have understood the limitations of Claims 1-7, 9-11, 13, and 17-20 were expressly disclosed, taught, or suggested by *Doshi* in combination with *Guichard*.

1. Motivation to Combine *Doshi* and *Guichard*

79. A POSITA would have been motivated to combine the teachings of *Doshi* and *Guichard*, as discussed below. It would have been obvious to a POSITA after selecting MPLS LSPs for communication between two nodes, as described by *Doshi*, to evaluate if the selection should be reoptimized to select a different LSP or pair of LSPs in response to network changes. *Guichard* describes such a reoptimization evaluation of MPLS LSPs.

80. First, Doshi and Guichard are analogous art to the '821 Patent. For example, just like the '821 Patent, both references generally pertain to MPLS networks. '821 Patent, 3:15-18, Abstract; Doshi, [0014], [0049]; Guichard, 79-81. Additionally, both references address the problem of selecting an MPLS LSP from available paths. '821 Patent, 4:63-5:8; Doshi, [0014]; Guichard, 79-81. Thus, given the similarities between the references and the fact that they address the problem of selecting LSPs, a POSITA considering Doshi would have naturally considered the teachings of Guichard.

81. Second, a POSITA would have been motivated to combine the teachings of Doshi and Guichard to produce numerous predictable and beneficial results.

82. Doshi teaches performing cost calculations and selecting an MPLS LSPs pair that has an overall minimum-cost. Doshi, [0014], [0049]. Guichard complements Doshi by teaching how to reoptimize an LSP selection. According to Guichard, the “[n]etwork state keeps changing.” Guichard, 79. As a consequence, Guichard teaches that “[i]t is then highly desirable to detect the existence of such [changes] and reoptimize a TE LSP along a better path when it becomes available.” Guichard, 70. Reoptimization evaluation, for a potentially better path, may be manually triggered by an administrator, time-based or event-driven (e.g., change in the network such as LSP set up and tear down, restoration of a link, or new link).

83. A POSITA would have been motivated to perform reoptimization evaluations over time, as taught by Guichard, when implementing Doshi's pair calculation and selection techniques in order to identify a potentially better LSP (e.g., for primary or protection LSP paths) with an even lower overall minimum-cost. Doshi's initial LSP path selection identifies and selects the lowest cost pair of paths at a point in time; however, a POSITA would have recognized that it would be advantageous – indeed “highly desirable” per Guichard – to evaluate the potential for reoptimization on an ongoing basis as taught by Guichard to determine whether the selected LSP pair remains the overall minimum-cost pair or whether there is a better pair available for reoptimization. Performing repeated reoptimization evaluations as taught by Guichard furthers Doshi's stated objectives of optimization and optimal path choice. Doshi, [0172] (“In general, path selection is a powerful tool that can be used to achieve several objectives such as ... optimization.”), [0200] (“...making an optimal restoration path choice...”). For instance, reoptimization would allow for selecting a shorter path if one becomes available. Doshi expressly describes attempting to identify the shortest primary and protection paths as part of optimization. Doshi, [0151], [0165], [0172].

84. The combination represents the use of a known technique (Guichard's reoptimization evaluation in response to various triggers) to improve a similar system or device (Doshi's MPLS architecture) in the same way with predictable

results (ongoing optimization). The combination represents what would have been common sense to a POSITA – that it is desirable to evaluate whether a selected LSP remains optimal and to reoptimize the selection if a better option is available.

85. I also note that the results would have been predictable and there would have been a reasonable expectation of success in the combination given that Doshi and Guichard are analogous art in the same field of endeavor. Also, a POSITA would have had a reasonable expectation of success in reoptimizing Doshi’s initial LSP pair selection by performing a reoptimization evaluation because Guichard provides significant implementation details, including when to trigger reoptimization evaluations and how to “avoid network instability.” Guichard, 81.

86. Making the combination would be within a POSITA’s skillset since Doshi already sets forth the calculation and selection techniques to be utilized during the reoptimization evaluation. Additionally, the combination would be a simple matter as it pertains to event-driven reoptimization evaluations since Doshi already monitors the network. Doshi, [0270]-[0281] (describing, for example, “monitoring and updating of network topology.”). Doshi is already equipped to detect the event-based reoptimization evaluation triggers described in Guichard, and the reoptimization evaluation itself would utilize Doshi’s own calculation and selection techniques. I also note that Doshi acknowledges that a POSITA would have had the necessary skill set to make “[v]arious modifications of the described embodiments.”

Doshi, [300]. It would have been obvious for such modifications to include a reoptimization evaluation as taught by Guichard.

87. Moreover, the reasonable expectation of success is evidenced by other skilled artisans that had reoptimized similar systems. Ex.1009, 136 (“Event-Drive Reoptimization...If [a] link comes up, should RtrD reoptimize its D→H tunnel so that this tunnel flows over the directly connected link?”); Ex.1010, 1 (“[T]he reoptimizer constantly monitors the network to determine if re-optimization will lead to sufficient network efficiency benefits. When sufficient benefits can be obtained, the re-optimizer computes the least cost set of connections.”); Ex.1023, 34 (“To control the frequency at which tunnels with established LSPs are checked for better LSPs, use the mpls traffic-eng reoptimize timers frequency command.”); Ex.1034, [0027]-[0033], claim 19 (describing that “a re-optimization operation is triggered (for example in the case where there is a change in topology or when an LSP needs to be re-routed due to a failure)” where the re-optimization operation uses “an optimization that treats the two LSPs as a set” and where the LSP set includes a “working path” and a “protecting path.”); Ex.1035, [0024] (“triggering the optimization of TE-LSPs when an event occurs.”).

88. Lastly, the proposed combination relies on the teachings of the references and does not require physical incorporation of elements from Guichard into Doshi.

2. Claim 1

(i) 1[Pre]: “An entity selection method performed by a network device, comprising the steps of:”

89. As an initial matter, as analyzed in the claim construction section, the term “entity” includes a multiprotocol label switching (“MPLS”) label switched path (“LSP”) or a pseudo wire (“PW”).

90. Doshi teaches a path selection method performed by a network manager:

In one embodiment, the invention is a **method for determining primary and restoration paths² for a new service** in a mesh network having a plurality of nodes interconnected by a plurality of links. For each of a plurality of candidate path pairs for the new service, each candidate path pair comprising a candidate primary path and a candidate restoration path for the new service, a path cost associated with said each candidate path pair is generated, wherein the path cost

² I note that Doshi’s “restoration path” is also referred to as a “protection path.” Doshi, [0046] (“Unless otherwise clear from the context, the process of ‘restoration’ is synonymous in this specification with the process of ‘protection.’”). [0076] (“...a protection path (also known as ‘restoration path’)”). In this declaration, for consistency, I will generally refer to these paths as protective paths.

for a candidate path pair is a function of sharability of links within the corresponding candidate restoration path. **The primary and restoration paths for the new service are selected from the plurality of candidate path pairs based on the path cost of each candidate path pair. The method may be implemented by a network manager for the mesh network.**

Doshi, [0014]; *see also* Doshi, [0142] (“In the first flow, illustrated by steps 1102, 1104, 1106, and 1106, one minimum-cost path pair is **selected** from K candidate pairs by a first method.”), claim 11 (...**the network manager is adapted to select** the primary and restoration paths for the new service from the plurality of candidate path pairs based on the path cost of each candidate path pair.”), [0141]-[0145], [0156], [0270]-[0281], Abstract, Figs. 10, 11, 17, 18.

91. Doshi’s network manager is a network device, such as a server or a node within a shared mesh data network “SMDN”:

An SMDN can be partitioned into a variety of modules. These modules are part of a network manager that may be implemented at a centralized server or distributed partially or fully to the nodes.

Some exemplary modules, representing one specific functional partitioning of the components of an SMDN, which provide

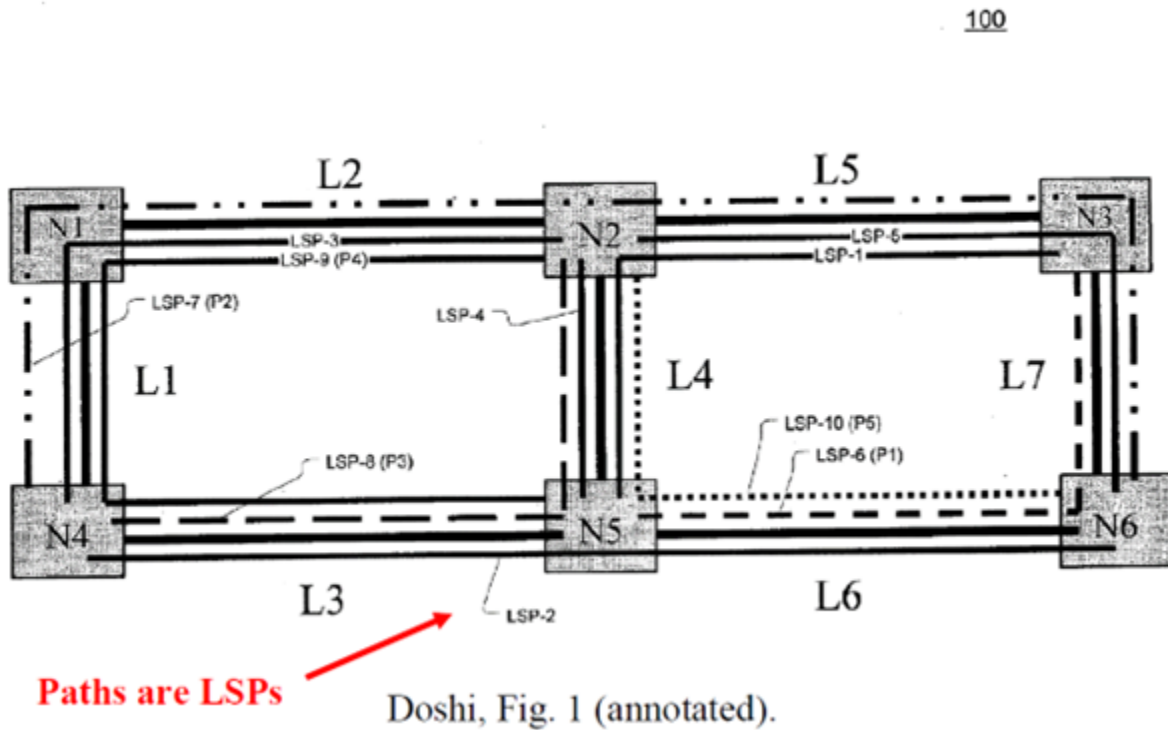
functionality such as fault detection and notification, protection switching, signaling and control, routing, and OAM, are listed below:

Doshi, [0271]; *see also* Doshi, [0082], claim 11.

92. Furthermore, Doshi discloses that its SMDN supports an MPLS architecture:

The concepts of the present invention are discussed in the context of exemplary shared mesh data networks. However, without loss of generality, they may be applied generally to any mesh network (e.g., Sonet, ATM, frame relay, **MPLS**) that provides traffic-switching control at the nodes incident to the links in the network. A mesh data network is a network in which data is communicated asynchronously between nodes in packetized form and it is a specific case of the more general mesh network. In the present example, **SMDN 100 supports the multiprotocol label switching (MPLS) architecture** standard per Rosen, E., et al., “RFC3031—Multiprotocol Label Switching Architecture,” Network Working Group, The Internet Society, January 2001, incorporated herein by reference in its entirety; however, as would be understood by one skilled in the art, other data technologies that offer similar data traffic engineering features (e.g., ATM and frame relay) could be substituted for MPLS.

Doshi, [0049]. Doshi's Figure 1, reproduced below, illustrates how the SMDN 100 supports an exemplary MPLS architecture provisioned with multiple LSPs. Doshi, [0016], [0052]-[0054].



93. Since Doshi's SMDN 100 has an MPLS architecture, it would have been obvious to a POSITA that Doshi's "paths" correspond to LSPs because LSPs are the paths used in MPLS networks.

94. Therefore, Doshi teaches a path (e.g., MPLS LSP) selection method performed by a network manager, which discloses "[a]n entity selection method performed by a network device," as recited in the preamble.

95. As I further explain below, the prior art renders obvious all of the claimed method steps (“*comprising the steps of:*”).

- (ii) 1[a]: “**providing a plurality of multi protocol label switching (MPLS) transport entities between a first endpoint and a second endpoint;**”

96. Consistent with the analysis in the claim construction section, “*multi protocol label switching (MPLS) transport entities*” include LSPs of an MPLS network:

An exemplary embodiment may include a network with a set of **MPLS-TP transport entities, for example, label switch paths (LSPs)** or pseudo wires (PWs) between a first endpoint and a second endpoint. It is preferable that an operator will define the entity set such that, with high probability, at least one entity will stay up in the event of multiple span or node failures.

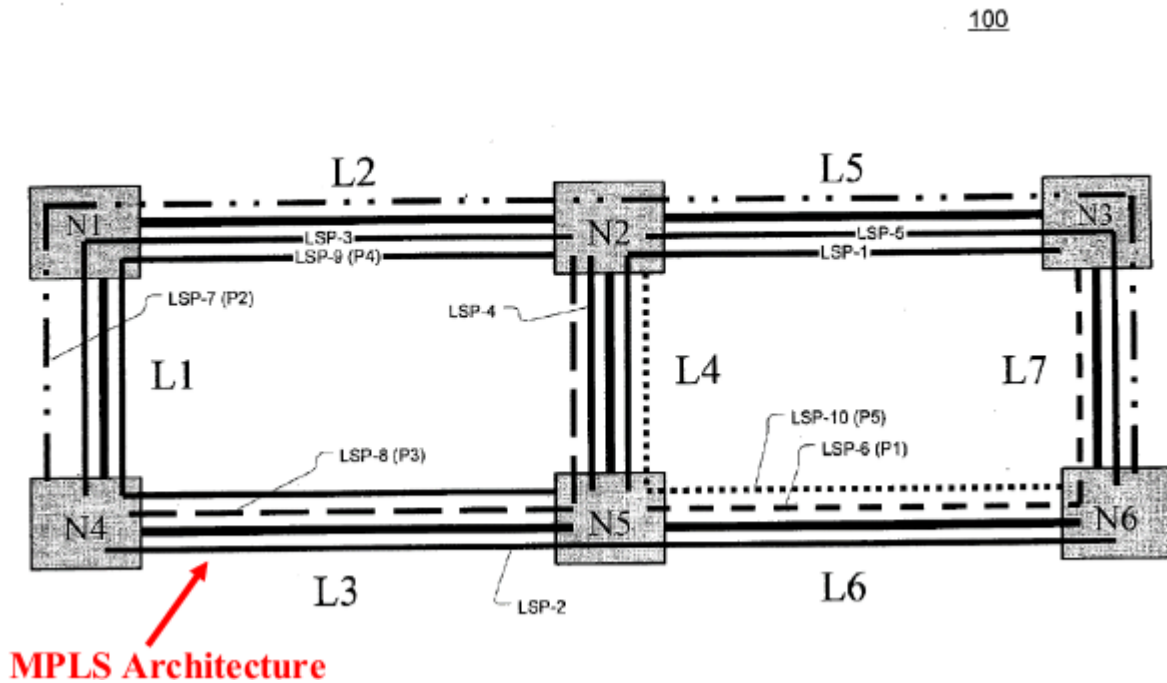
’821 Patent, 3:22-29.

97. **First**, as already analyzed above (*see* preamble 1[pre]), Doshi at Figure 1 discloses an SMDN that supports an MPLS architecture:

In the present example, SMDN 100 supports the multiprotocol label switching (MPLS) architecture standard per Rosen, E., et al., “RFC3031—Multiprotocol Label Switching Architecture,” Network

Working Group, The Internet Society, January 2001, incorporated
herein by reference in its entirety.

Doshi, [0049].



Doshi, Fig. 1 (annotated).

98. In the MPLS architecture shown above, five primary LSPs (1-5) and five protection LSPs (6-10) are provisioned:

FIG. 1 illustrates the **five primary LSPs** as follows: LSP-1 carries traffic along path N3-N2-N5, LSP-2 carries traffic along path N4-N5-N6, LSP-3 carries traffic along path N2-N1-N4, LSP-4 carries traffic along path N2-N5, and LSP-5 carries traffic along path N2-N3-N6.

Doshi, [0052].

FIG. 1 also illustrates **five exemplary protection paths** LSP- 6 to LSP-10 (also of unit bandwidth in this example) that have been reserved to use for protection of services given a failure of one of the primary paths. LSP-6 (along path N3-N6-N5) protects LSP-1, LSP-7 (along path N4-N1-N2-N3-N6) protects LSP-2, LSP-8 (along path N2-N5-N4) protects LSP-3, LSP-9 (along path N2-N1-N4-N5) protects LSP-4, and LSP-10 (along path N2-N5-N6) protects LSP-5.

Doshi, [0054]; *see also* Doshi, [0050]-[0053].

99. Doshi teaches that the LSPs are formed “**between two nodes**” that correspond to “**source and destination nodes**” or “**end nodes** of an LSP.” Doshi, [0050], [0154], [0267].

In general, each connection or service in the network is carried by a primary path that (1) **connects the source and destination nodes** and (2) provides the necessary bandwidth for the service.

Doshi, [0154]; *see also* Doshi, [0156].

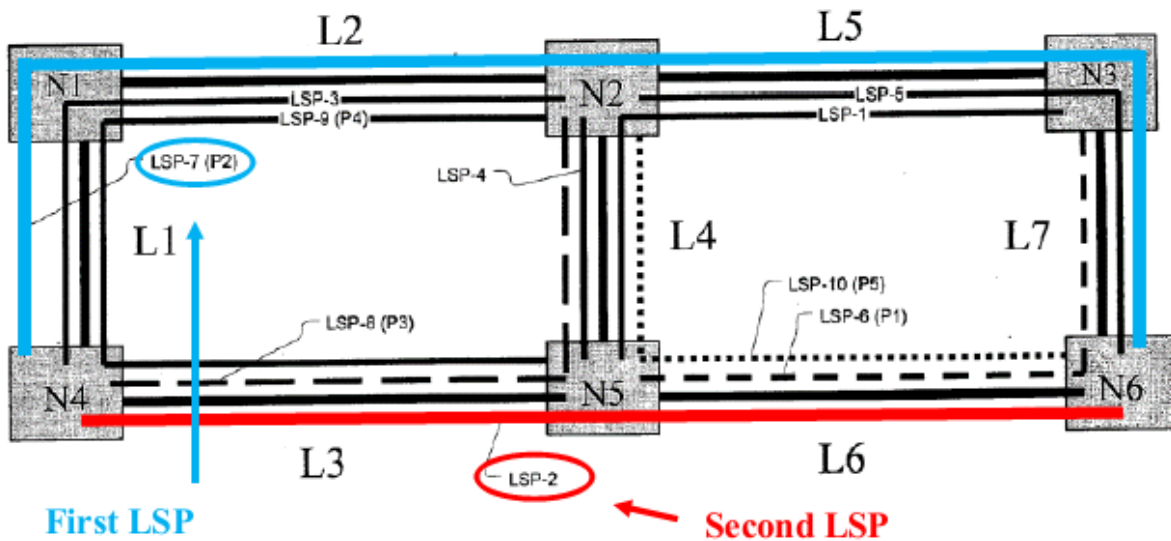
As discussed above, after detecting a failure, **end nodes of an LSP** switch traffic from a primary (i.e., working) LSP to its corresponding protection LSP. Note that both working and protection LSPs typically enter the ingress node and exit the egress node using different ports.

Doshi, [0267].

As illustrated, SMDN 100 has been provisioned with five primary label-switched paths (LSPs) LSP-1 to LSP-5. **A label-switched path is effectively a tunnel between two nodes** that carries service traffic according to a predetermined route.

Doshi, [0050]; *see also* Doshi, [0056], [0142], [0188], [0190], [0192], [0195], Fig. 5, Fig. 8, Fig. 11, Fig. 17, Fig. 18, and Fig. 20.

100. Since Doshi's LSPs are provided "between" and terminate at the two end nodes, a POSITA would have understood that one end node (e.g., the source node) corresponds to "a first endpoint" and that the other end node (e.g., the destination node) corresponds to "a second end point." Any two LSPs (or more as discussed below) that are provided between two end nodes correspond to "a plurality of multi protocol label switching (MPLS) transport entities." 79. For reference, I have highlighted an example at Figure 1 of providing a primary LSP-2 and a protection LSP-7 between end node N4 and end node N6:



Doshi, Fig. 1 (modified and annotated).

101. Importantly, although Figure 1 only illustrates two LSPs between a node pair, Doshi makes clear that this figure is merely “exemplary” and expressly teaches “two or more paths between” the nodes:

FIG. 1 illustrates an exemplary shared mesh data network (SMDN) according to one embodiment of this invention.

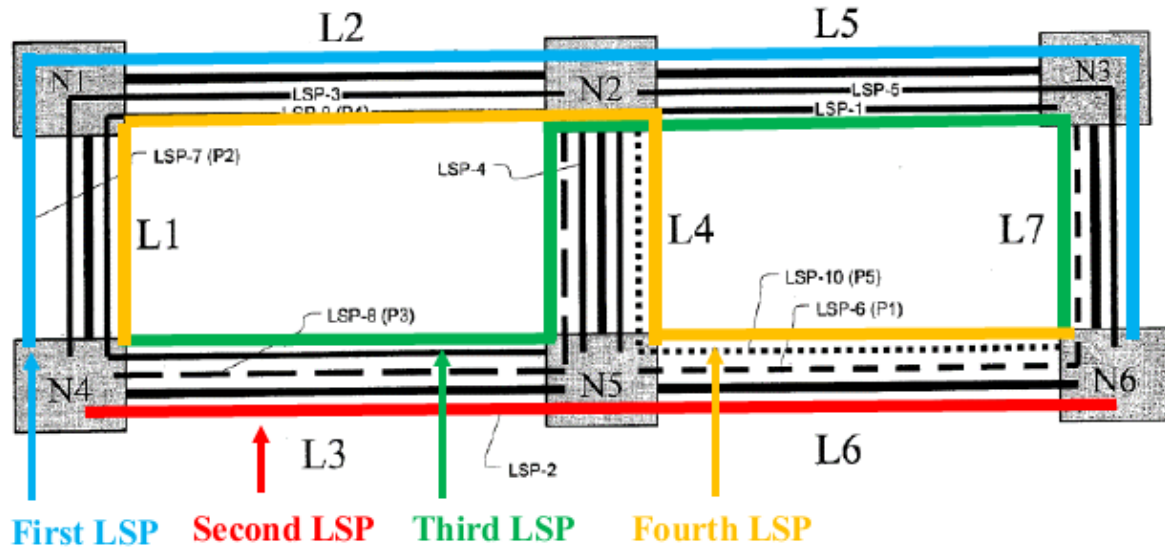
Doshi, [0016]; *see also* Doshi, [0048]-[0055] (describing Fig. 1 as exemplary)

FIG. 1 illustrates an exemplary shared mesh data network (SMDN) 100 according to one embodiment of this invention. A mesh network is a network topology (or a subset thereof) in which there are at least two nodes having **two or more paths between** them.

Doshi, [0048]. Doshi further contemplates making “[v]arious **modifications**” to the exemplary embodiments. Doshi, [0300].

102. Since Figure 1 is merely exemplary and subject to modification, and since Doshi expressly teaches “**two or more paths between**,” a POSITA would have found it obvious to provide additional LSPs between each node pair. Doshi, [0048]. That is, it would have been obvious to a POSITA to provide a sufficient number of LSPs between two nodes to meet bandwidth requirements for communication between the nodes. Doshi contemplates more than two LSPs between two nodes by describing “two or more paths between” the end nodes and that there are a “plurality of candidate path pairs” from which to select. Doshi, [0048], Abstract; *see also* Doshi, Abstract (“[S]electing the primary and restoration paths for the new service from the plurality of candidate path pairs”), [0014]. This would mean that each node pair has at least two primary LSPs and two protection LSPs, with different primary and protection LSP combinations corresponding to candidate pairs. *See* Doshi, [0014], (“...each candidate path pair comprising a candidate primary path and a candidate restoration path...”); *see also* analysis at 1[b]-1[e].

103. Below in modified Figure 1, I illustrate an example of providing two primary LSPs and two protection LSPs between nodes N4 and N6:



Doshi, Fig. 1 (modified and annotated).

104. A POSITA would have recognized that providing more than two LSPs between each node pair (e.g., at least two primary LSPs and two protection LSPs) would be beneficial since doing so facilitates path diversity to reduce the probability of service interruption between the nodes. For example, the illustrated third and fourth LSPs between N4 and N6 offers additional protection against failures along different paths, at least in part. A concurrent failure of, for example, L2 and L6 would cause both the first and second LSP (the original two LSPs illustrated in Doshi) to go down; however, such a failure would not bring down the third LSP. Having the third LSP available would allow traffic to be switched over with minimal interruption of service as compared to if the first and second LSPs were the only LSPs connecting N4 and N6. Having the fourth LSP available in the event of

concurrent failure of, for example, L3 and L7 (which would affect both the first and second LSP without affecting the fourth LSP) would similarly allow traffic to be switched over to the fourth LSP with minimal interruption of service.

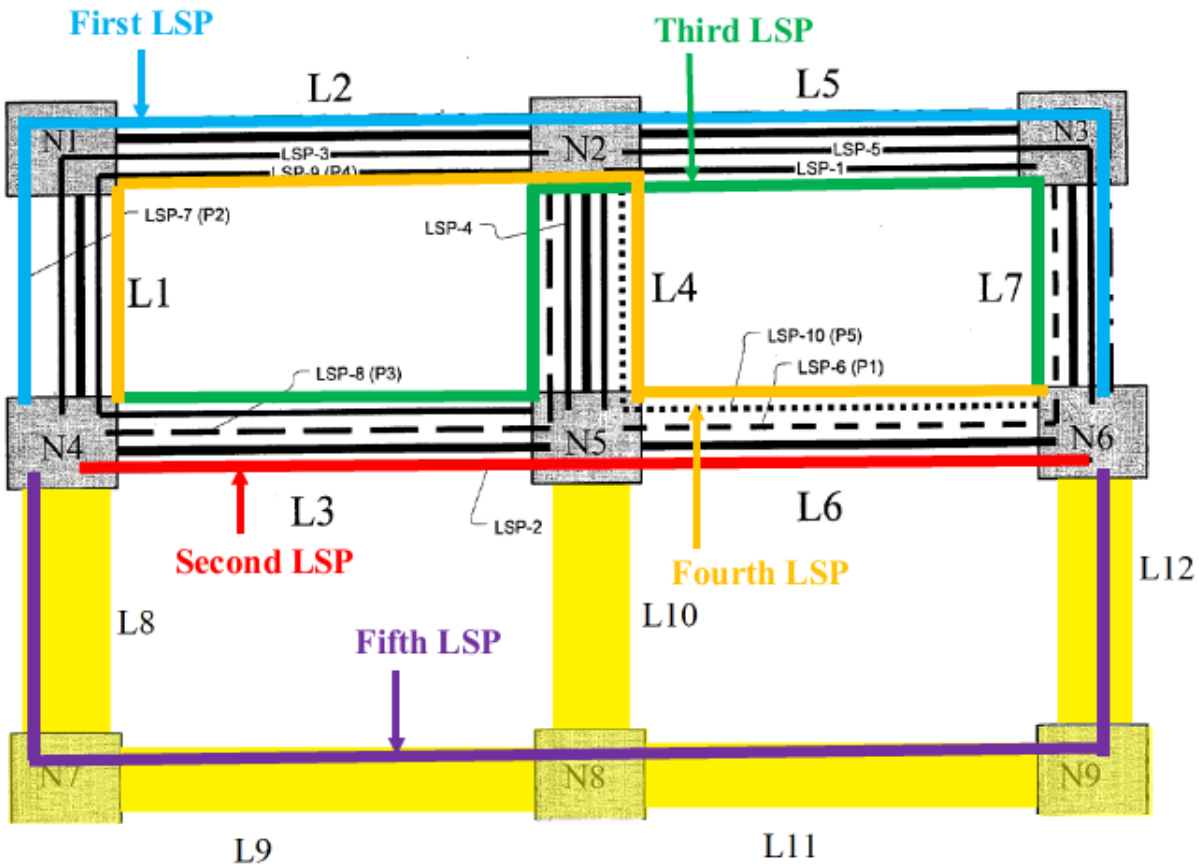
105. Another advantage of having more than two LSPs (e.g., more than just one primary and one protection LSP) between each node pair is that it allows traffic with different quality of service (QoS) requirements to be allocated and aggregated on different LSPs. *See* Doshi, [0265] (describing assigning QoS characteristics to LSPs), [0272] (describing provisioning paths with different QoS). For example, traffic with a high QoS requirement, e.g., video traffic, would be assigned to an LSP configured to handle such high QoS traffic while traffic with a lower QoS requirement would be assigned to a different LSP.

106. Moreover, I note that providing more than two LSPs between each node pair also facilitates reoptimization. Consistent with the below analysis at elements 1[c]-1[e], it was known in the art that it is “highly desirable” to reoptimize LSP selection over time (e.g., based on a manual trigger, time-based, or event-driven). Guichard, 79-81. When reoptimizing for the best LSPs between two end nodes, a POSITA would have understood to consider all possible LSP paths and choose the optimal LSP pair (e.g., primary and protection LSPs). Doshi, [0172] (“In general, path selection is a powerful tool that can be used to achieve several objectives such as ... optimization.”), [0200] (“...making an optimal restoration path choice...”). If

only one primary LSP and one protection LSP were provided between two end nodes, then reoptimization would not be possible in some failure situations. Thus, facilitating reoptimization is another benefit of providing more than two LSPs between each node pair in Doshi.

107. I note that the modified example of Figure 1 is not intended to be limiting and it would be understood that there may be additional nodes with corresponding LSPs not illustrated. *See, e.g.*, Doshi, [0055] (Describing that the example is not limiting and that there are cases where other paths and nodes may exist). Also, per Guichard, it would have been understood that the network may change such that new nodes with new LSPs may be added. *See e.g.*, Guichard, 79 (“**Network state keeps changing.** Links and nodes fail and recover ... new TE LSPs are set up...”). A POSITA would have been motivated to provide, as the network changes, additional LSPs along new links between new nodes in Doshi so that the paths between a node pair are completely disjoint, thereby further reducing the probability of service interruption. Further support for the combination is provided in Section VII.C.1 above.

108. I have provided an example of such an implementation below, illustrating additional nodes N7-N9 with new links L8-L12 that provide corresponding a new Fifth LSP between nodes N4 and N6 that is completely disjoint with respect to the First and Second LSPs:



Doshi, Fig. 1 (modified and annotated).

109. Providing more than two LSPs between a node pair would have been consistent with other prior art implementations. *See* Ex.1008, 1305 (disclosing six LSPs between an ingress node and an egress node). Accordingly, a POSITA would have had a reasonable expectation of success in implementing more than two LSPs between two end nodes (as shown at the modified Figure 1) since Doshi itself suggests this implementation and others had successfully provided up to six LSPs between node pairs.

110. Therefore, Doshi in combination with Guichard discloses providing a plurality of MPLS LSPs (e.g., at least two primary LSPs and at least two protection LSPs) between a first end node (e.g., source node) and a second end node (e.g., destination node), which renders obvious “*providing a plurality of multi protocol label switching (MPLS) transport entities between a first endpoint and a second endpoint,*” as claimed.

(iii) 1[b]: “determining an overall cost for each entity pair of said plurality of entities;”

111. As an initial matter, the ’821 Patent describes that the overall cost for an entity pair may be determined based on various factors, including entity cost resulting from the sum of link metrics along the entity:

An overall cost for each pair of the plurality of transport entities is determined, as shown by block 220. **The overall cost may be determined based on** the probability of simultaneous failure of the working and protection entities (SFP), as described below, the entity cost, or a combination of SFP and entity cost. The entity cost may be defined as the sum of the link metrics, for example IGP or TE metrics, along the entity.

’821 Patent, 4:14-21.

112. **First**, as discussed above at 1[pre]-1[a], Doshi in combination with Guichard discloses providing a plurality of MPLS LSPs (e.g., at least two primary and at least two protection LSPs), which corresponds to “*said plurality of entities.*”

113. **Second**, Doshi discloses determining the cost of each path (e.g., each primary or protection LSP) by calculating the cost for each link along the path:

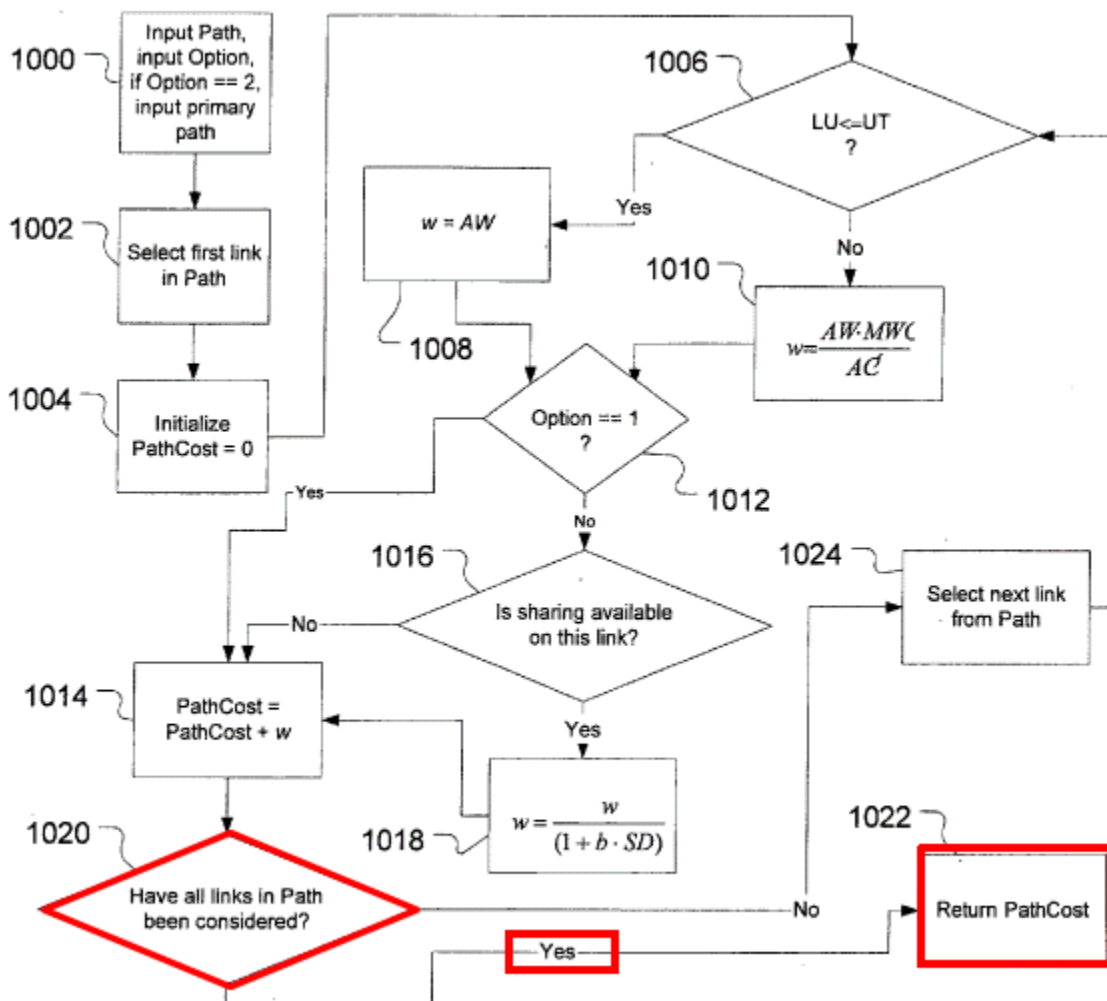


FIG. 10

Doshi, Fig. 10 (annotated).

114. Doshi explains that “path cost is considered to be the sum of the link costs.” Doshi, [0125]. This is consistent with the ’821 Patent’s definition of the “entity cost” on which determination of “overall cost” is based. Since Doshi’s paths are LSPs (*see* analysis at 1[pre]-1[a]) and since LSPs correspond to “entities” in the ’821 Patent, a POSITA would have understood that the path cost described in Doshi corresponds to an “entity cost” in the ’821 Patent. As discussed below, Doshi’s path cost is used to determine the cost of each candidate pair. In other words, the cost of each of Doshi’s pairs is based on path cost (just like the ’821 Patent).

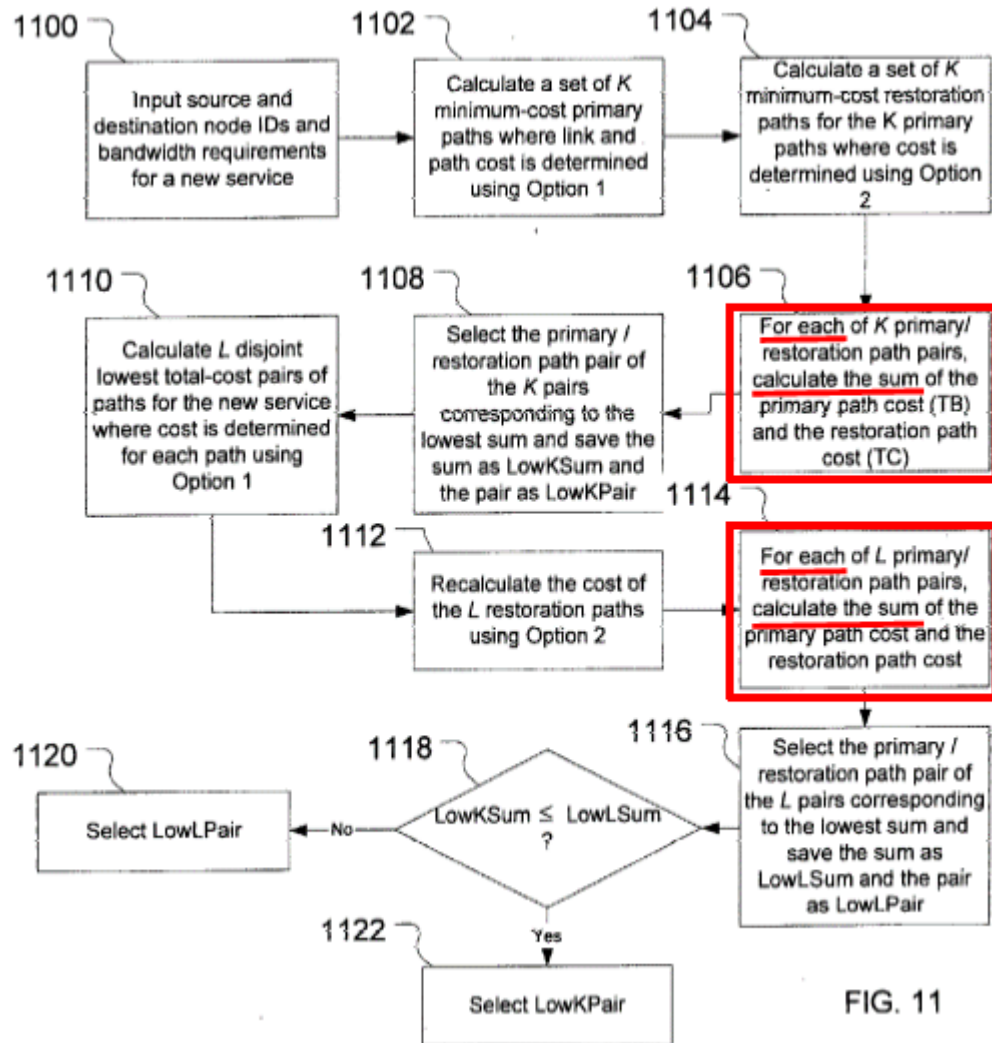
115. Further, Doshi discloses determining a cost associated with each candidate path pair (e.g., a primary path and a protection path):

For each of a plurality of candidate path pairs for the new service, each candidate path pair comprising a candidate primary path and a candidate restoration path for the new service, a path cost associated with said each candidate path pair is generated, wherein the path cost for a candidate path pair is a function of sharability of links within the corresponding candidate restoration path.

Doshi, [0014]; *see also* Doshi, Abstract, [0026], [0046], [0050]-[0054], [0076], [0082], [0130], [0124]-[0181], Fig. 1, Fig. 10, Fig. 11, Fig. 12, and Fig. 13.

116. In the context of Figure 11 (building upon Figure 10’s example for determining individual path cost), Doshi provides an example where the cost of each

candidate pair is determined by summing a primary path cost and a protection path cost to identify an overall-minimum cost pair:



Doshi, Fig. 11 (annotated).

The method involves two major flows. In the first flow, illustrated by steps 1102, 1104, 1106, and 1106, one minimum-cost path pair is selected from K candidate pairs by a first method. In the second flow, illustrated by 1110, 1112, 1114, and 1116, one minimum-cost path pair

is selected from L candidate pairs by a second method. **Then in step 1118, and steps 1120 or 1122, the lowest-cost pair of these two lowest-cost results is selected as the overall minimum-cost pair.**

Doshi, [0142].

117. Summing the cost of a primary path and a protection path determines the cost of the pair as a whole. As discussed above, Doshi's cost calculation is performed for each possible pair. A POSITA would have understood that this corresponds to the '821 Patent's determination of "*overall cost for each entity pair of said plurality of entities*" based on "entity cost."

118. As discussed above, the '821 Patent's "*overall cost*" can also be determined based on probability of simultaneous failure. Doshi's cost determination takes into account whether paths are "**disjoint**," where disjoint paths would be understood as lowering the probability of simultaneous failure. Doshi, [0146]-[0156], Fig. 11 (step 1110 "Calculate L **disjoint** lowest total-cost pairs of paths"). The cost determination also "consider[s]...link utilization, utilization threshold, administrative weight, and sharing degree." Doshi, [0142]. A POSITA would have understood that Doshi's cost determination—which considers a myriad of factors such as link utilization, sharing degree, and path disjointedness—represents the "*overall cost*" for each candidate path pair.

119. Consistent with the analysis at 1[pre]-1[a], it would have been obvious to a POSITA for the candidate path pairs to be implemented as LSPs, since Figure 1 supports an MPLS architecture and provides a plurality of LSPs. Also, a POSITA would have found it obvious for the candidate path pairs to be selected from the provided plurality of MPLS LSPs (at least two primary and at least two protection LSPs) between the end nodes (*see* analysis at 1[a]), because these LSPs would have already been in existence and available for immediate use for the new service.

120. By determining the cost for the provided LSPs, assessment can be made whether the provided LSPs have sufficient resources for the new service—without having to allocate additional resources. Considering the provided LSPs for the new service would allow such LSPs to be more fully utilized. Ex.1008 at 1306 (describing the known problem of underutilized LSPs and solution of allocating traffic to such LSPs).

121. Consistent with the analysis at 1[c]-1[e] below, in view of Guichard's teaching of ongoing reoptimization efforts, it would have been an obvious aspect of path selection to perform Doshi's cost calculations repeatedly to attempt to determine whether the original LSP pair still has the overall minimum-cost or if there is another LSP pair that is more optimal. A POSITA would have understood that the cost calculations for such reoptimization efforts would consider existing paths,

including, for example, an originally selected LSP pair that is currently being utilized.

122. Therefore, Doshi in combination with Guichard discloses determining an overall cost for each LSP pair (e.g., a primary and a protection LSP) of the plurality of MPLS LSPs, which renders obvious “*determining an overall cost for each entity pair of said plurality of entities*,” as claimed.

(iv) 1[c]: “**selecting an entity pair from said plurality of transport entities based at least in part upon said overall cost; and**”

123. **First**, as discussed above at 1[a]-1[b], Doshi in combination with Guichard determines the “*overall cost*” for each LSP pair (e.g., a primary and a protection LSP) of the plurality of MPLS LSPs (“*said plurality of transport entities*”).

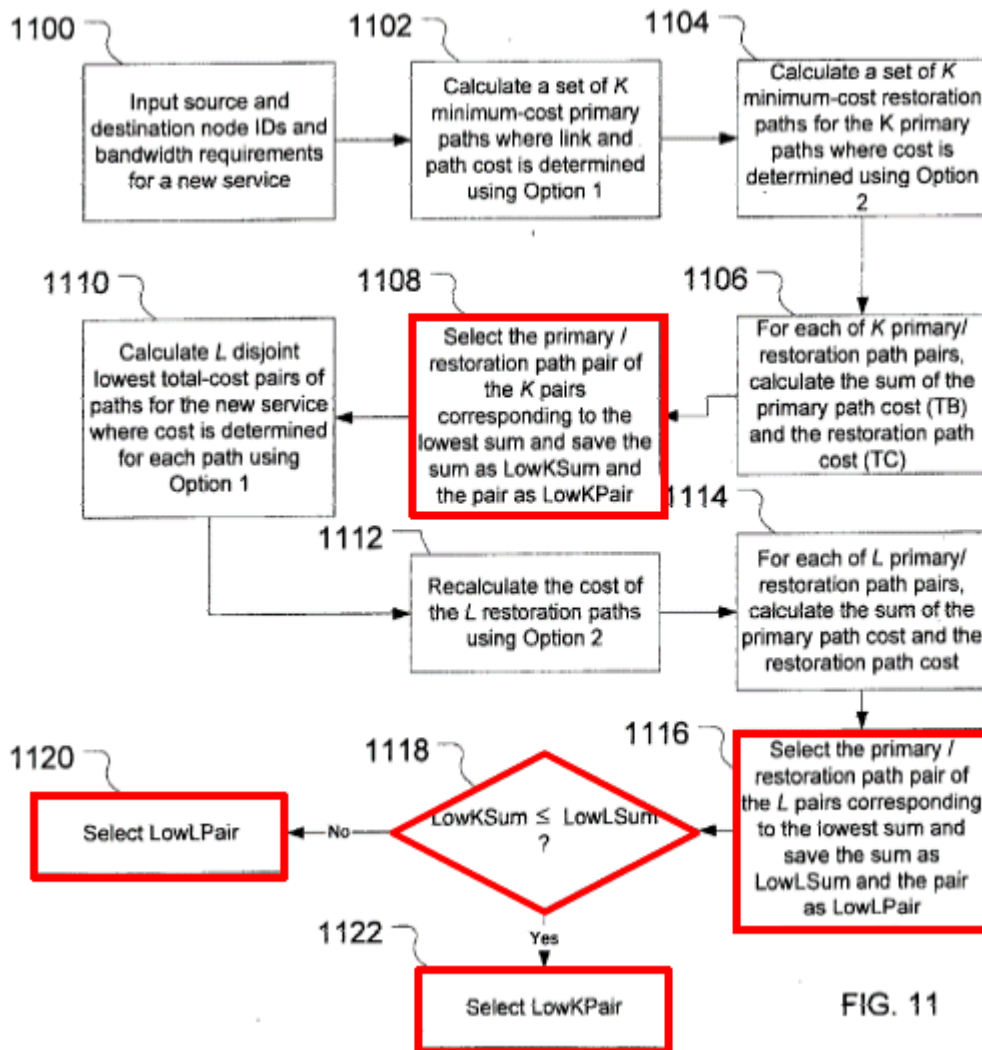
124. **Second**, Doshi teaches that a primary and a protection pair are selected from the plurality of paths of the MPLS network:

For each of a plurality of candidate path pairs for the new service, each candidate path pair comprising a candidate primary path and a candidate restoration path for the new service, a path cost associated with said each candidate path pair is generated, wherein the path cost for a candidate path pair is a function of sharability of links within the corresponding candidate restoration path. **The primary and**

restoration paths for the new service are selected from the plurality of candidate path pairs based on the path cost of each candidate path pair. The method may be implemented by a network manager for the mesh [MPLS] network.

Doshi, [0014]; *see also* Doshi, Abstract, [0046], [0076], [0142]-[0145], Claim 1, Claim 11. Consistent with the analysis at 1[a]-1[b], it would have been obvious for the “plurality of candidate path pairs” (pairs of primary and protection LSPs) to correspond to the provided plurality of LSPs of the MPLS architecture. Doshi, [0014]. Accordingly, Doshi renders obvious “*selecting an entity pair from said plurality of transport entities.*”

125. Doshi further teaches that the primary and protection path pair is selected based, at least in part, on the overall cost. More particularly, Doshi’s Figure 11 and accompanying description teach selecting the overall minimum-cost pair:



Doshi, Fig. 11 (annotated).

FIG. 11 depicts an exemplary **method for calculating a minimum-cost primary/restoration path pair** for a new service in consideration of link utilization, utilization threshold, administrative weight, and sharing degree.

Doshi, [0142].

The method involves two major flows. In the first flow, illustrated by steps 1102, 1104, 1106, and 1106, one minimum-cost path pair is selected from K candidate pairs by a first method. In the second flow, illustrated by 1110, 1112, 1114, and 1116, one minimum-cost path pair is selected from L candidate pairs by a second method. **Then in step 1118, and steps 1120 or 1122, the lowest-cost pair of these two lowest-cost results is selected as the overall minimum-cost pair.**

Doshi, [0142]; *see also* Doshi, [0026], [0125]-[0139], [0143]-[0145].

126. Accordingly, Doshi renders obvious that the selection is “*based at least in part upon said overall cost.*”

127. **Third**, in view of Guichard’s teaching of ongoing reoptimization efforts, it would have been obvious to perform Doshi’s cost calculations repeatedly over time to attempt to determine whether the originally selected LSP pair still has the overall minimum-cost or if another LSP pair should be selected. A POSITA would have understood that the cost calculations for such reoptimization efforts would consider existing LSP paths, including, the originally selected LSP pair that had the overall minimum-cost. If the originally selected LSP pair still has the overall-minimum cost, a POSITA would have understood that Doshi’s selection techniques identified above would reselect the original pair. On the other hand, if another LSP pair is determined to have the overall-minimum cost, then that LSP pair would be

selected. Each such selection is an example of “*selecting an entity pair from said plurality of transport entities based at least in part upon said overall cost.*”

128. In more detail, Guichard teaches attempting to reoptimize LSP selection on an ongoing basis. Specifically, Guichard teaches it is highly desirable to detect the existence of better a path that is available and reoptimize the LSP selection accordingly:

Network state keeps changing. Links and nodes fail and recover; new TE LSPs are set up while others may be torn down. Consequently, for any TE LSP, a more optimal path may appear in the network. **It is then highly desirable to detect the existence of such a path and reoptimize a TE LSP along a better path when it becomes available.**

Guichard, 79.

129. Guichard teaches that reoptimization evaluation may be, for example, manual and timer-based:

When a reoptimization evaluation process is triggered by R6, it determines that a **more optimal (shortest) path** exists between R6 and R5 (the path R6-R2-R3-R4-R5), and it reroutes the TE LSP along this more optimal path.

Guichard, 80-81.

- **Manual reoptimization**—A command is issued on the headend router that triggers a reoptimization evaluation for each TE LSP the router is the headend for. If a **better path** is found, the TE LSP is reoptimized according to the make-before-break procedure.
- **Timer-based reoptimization**—A reoptimization timer is configured on the headend router. Upon expiration, the headend tries to reoptimize each TE LSP it is the headend for.

Guichard, 81; *see also* Guichard, 79.

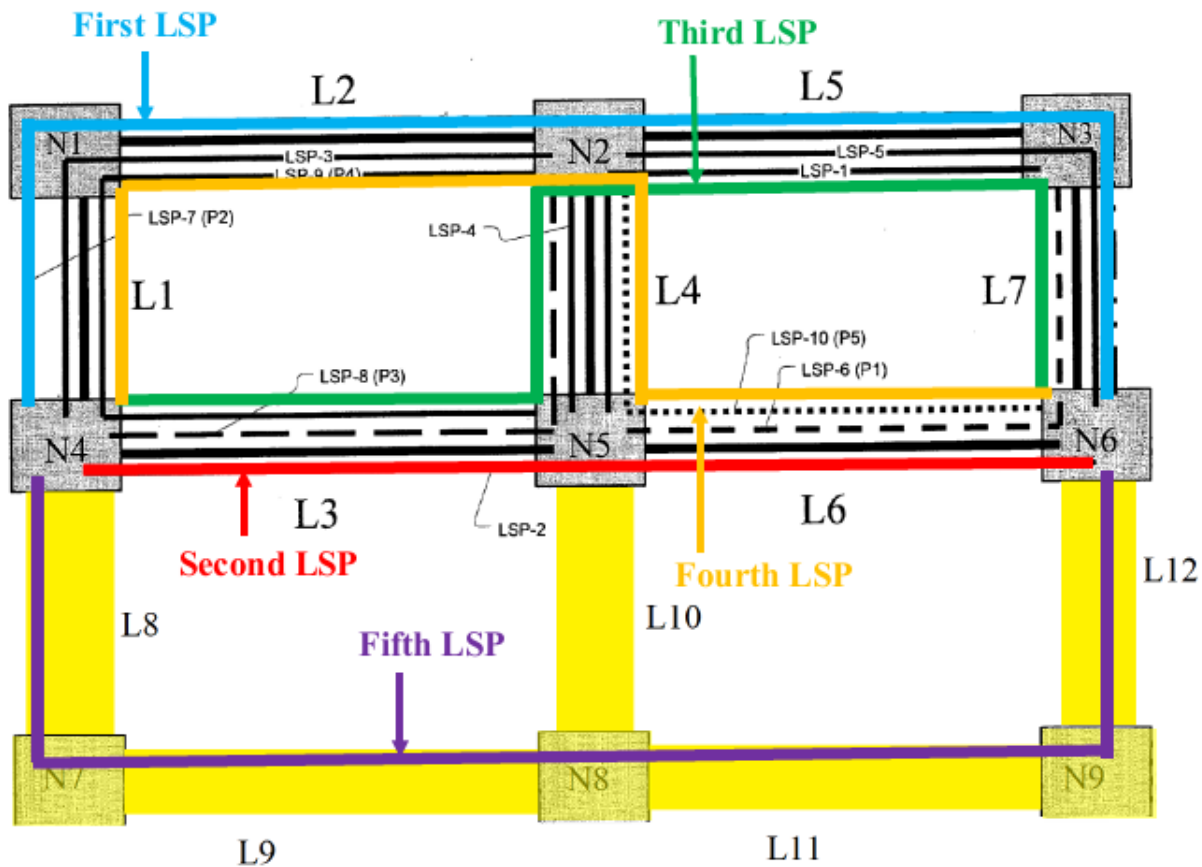
130. Guichard merely describes what would have been common sense to a POSITA—reoptimizing a system such that the LSP or LSP pair used is the best available. In other words, a POSITA would have understood that Guichard teaches that original path selections (e.g., LSP pair selection) should be evaluated on an ongoing basis to determine whether better or more optimal paths exist for the LSP pair.

131. It would have been obvious to a POSITA, in view of Guichard, to perform ongoing reoptimization attempts, when implementing Doshi's MPLS architecture, so that an optimum LSP pair (e.g., an overall minimum-cost pair) is selected over time for communication between two end nodes. In implementing the combination, a POSITA would have evaluated all existing available LSPs (including previously selected LSPs) by repeating Doshi's candidate pair cost determination

(*see* analysis at 1[b]) and selection techniques in response to a manual trigger or expiration of a timer to thereby select the LSP pair with an overall minimum-cost.

132. A POSITA would have been motivated to perform ongoing reoptimization to identify potentially better primary and protection LSP paths (for the LSP pair between two end nodes) that minimize the overall cost. *See e.g.*, Doshi, [0172] (“In general, path selection is a powerful tool that can be used to achieve several objectives such as ... **optimization.**”), [0200] (“...making an **optimal** restoration path choice...”). For instance, this would allow for selecting the shortest path during reoptimization if available. Doshi expressly describes attempting to identify the shortest primary and protection paths as part of optimization. Doshi, [0151], [0165], [0172]. Guichard also recognizes that a shorter path is more optimal than a longer path. Guichard, 80. Other potential benefits would have been apparent and motivating to a POSITA as well, such as finding a path with more available bandwidth or finding a path with fewer nodes or links in common with the other path in Doshi’s pair of paths. *See* Doshi, [0158] (describing the advantages of disjoint paths). Further support for the combination is provided in Section VII.C.1 above.

133. Below, in the context of Doshi’s modified Figure 1, I provide an example of selecting an LSP pair, based on the combined teachings:



Doshi, Fig. 1 (modified and annotated).

134. Take, for instance, where an original LSP pair (e.g., First LSP and Second LSP) was being utilized for communications between end nodes N4 and N6. In response to a manual trigger or expiration of a timer, as Guichard teaches, potential reoptimization of the LSPs would take place to determine if there is a better or more optimal LSP. All things being equal, in the circumstance where the links of the First LSP are heavily utilized as compared to the links of the Fifth LSP, it would have been obvious for Doshi's cost determination to result in a new pair (e.g., the Fifth LSP as the primary and the Second LSP as the protection) as having the overall

minimum cost. In such a circumstance, these LSPs would be selected for further communications between end nodes N4 and N6 while the First LSP would be replaced by the Fifth LSP as the primary. Of course, this is just an example, and given network status it would be understood that other LSPs may be selected as the overall minimum cost pair.

135. Therefore, Doshi in combination with Guichard discloses selecting an LSP pair (e.g., a primary and a protection LSP) from the plurality of existing MPLS LSPs based on the overall cost, which renders obvious “*selecting an entity pair from said plurality of transport entities based at least in part upon said overall cost,*” as claimed.

- (v) **1[d]: “if an entity pair reselection event occurs, reselecting said entity pair from the group consisting of said entity pair and a replacement entity pair comprising at least one entity distinct from the entities of said entity pair,”**

136. **First**, as discussed above at 1[pre]-1[c], Doshi teaches selecting an LSP pair (e.g., a primary and a protection LSP) (“*said entity pair*”).

137. **Second**, Guichard teaches attempting to reoptimize LSP selection based on various trigger events that impact the network:

Network state keeps changing. Links and nodes fail and recover;

new TE LSPs are set up while others may be torn down.

Consequently, for any TE LSP, a more optimal path may appear in the

network. It is then highly desirable to detect the existence of such a path and reoptimize a TE LSP along a better path when it becomes available.

Guichard, 79; *see also* Guichard, 80.

Event-driven reoptimization—In some cases, it may be desirable to trigger a reoptimization upon the occurrence of a particular event, such as the restoration of a link in the network. Indeed, if a link is restored in the network, some TE LSPs may benefit from that new link to follow a more optimal path. When configured, **each time a new link is advertised as newly operational, this triggers the evaluation of any potential reoptimization.**

Guichard, 81; *see also* Guichard, 79-80.

138. A POSITA would have understood that Guichard generally teaches that the current LSP path selection should be evaluated following a trigger event (e.g., change in the network such as LSP set up and tear down, restoration of a link, or new link) to determine whether a more optimal LSP path is available. Also, a POSITA would have recognized that this evaluation may or may not result in a reoptimization. *See* Guichard, 81 (referring to “evaluation of any **potential** reoptimization.”); *see also* Ex.1035, [0057]-[0059] (describing “determining whether a network event could create a more optimal path for one or more TE-LSPs” and comparing a “cost of the [new path] to the old cost of the current TE-LSP path”

while recognizing that if the “new cost exceeds the old cost ... no optimization of the TE-LSP is performed.”). A person of skill would have understood that there is only a potential for reoptimization since if the evaluation indicates that the currently utilized path is still the best option, then no reoptimization would occur and the previously utilized path is reselected.

139. It would have been obvious to a POSITA, in view of Guichard, to perform event-driven reoptimization on an ongoing basis, when implementing Doshi’s MPLS architecture, to determine if there are better LSP paths available or if the currently selected LSP pair represents the overall minimal cost. Further support for the combination is provided in Section VII.C.1 above.

140. In implementing the combination with Doshi, a POSITA would have evaluated any restored and new LSPs along with all existing LSPs (including the currently utilized LSP pair) by repeating Doshi’s candidate pair cost determination and selection techniques (*see* analysis at 1[b]-1[c]) in response to a trigger event to potentially reoptimize the selection.

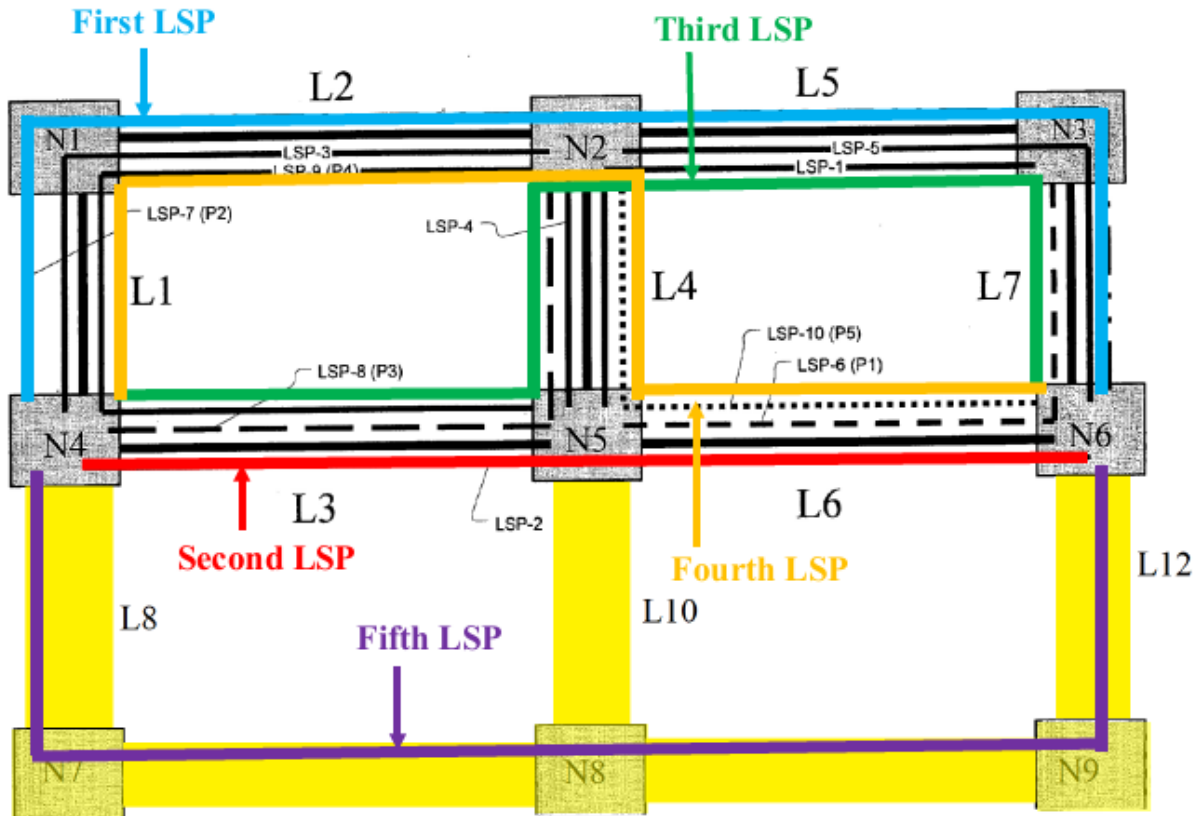
141. It would have been obvious to a POSITA that repeating Doshi’s candidate path pair cost determination and selection would—in certain instances—result in the reselection of the currently utilized LSP pair. This would be the case where the currently utilized LSP pair still provides the overall minimum-cost, despite an LSP path being restored, a new LSP path being set up, or some other

change in the network. In the combination, Doshi's currently utilized LSP pair would be repeatedly evaluated and reselected, per Guichard's event-driven reoptimization technique, if it has the overall-minimum cost per Doshi's cost determination (*see* analysis at 1[b]).

142. Thus, Doshi in combination with Guichard discloses an event (e.g., change in the network such as LSP set up and tear down, restoration of a link, or new link) triggering candidate pair cost determination and, if the cost determination indicates that the currently used LSP pair still has the overall-minimum cost, reselecting the LSP pair, which renders obvious *"if an entity pair reselection event occurs, reselecting said entity pair."* See also analysis at element 1[e], below, analyzing further the reselection event.

143. **Third**, as discussed above at 1[pre]-1[c], Doshi's plurality of candidate path pairs include a plurality of LSPs (e.g., at least two primary and at least two protection LSPs) between a pair of end nodes. The currently used primary and protection LSP pair would be initially selected based on the overall minimum cost (*see* analysis above at 1[c]) and the remaining LSPs would be available (with any restored or new LSPs in the network that generate the trigger event, per Guichard) as potential replacements during reoptimization. Thus, in the proposed combination, the reselection is *"from the group consisting of said entity pair and a replacement entity pair comprising at least one entity distinct from the entities of said entity pair."*

144. Below, in the context of Doshi's modified Figure 1, I continue with my example, based on the combined teachings:



Doshi, Fig. 1 (modified and annotated).

145. As noted at 1[c], the selection step selected the Fifth LSP as the primary path and the Second LSP as the protection path. When performing event-based reoptimization, per Guichard, an overall cost for each LSP pair permutation would be determined, per Doshi. Doshi, [0014] (“...a path cost associated with said each candidate path pair is generated...”). If the cost determination indicates that the currently used LSP pair (e.g., Fifth LSP and Second LSP) still has the overall-

minimum cost, then the same LSP pair would be reselected. Doshi, [0142] (“...the lowest-cost pair...is selected as the overall minimum-cost pair...”).

146. Note that it would have been obvious to a POSITA that the reselection is from the group consisting of the currently used LSP pair (e.g., Fifth LSP and Second LSP) and a replacement LSP pair comprising at least one LSP distinct from the currently used LSP pair since, as discussed at 1[b] above, Doshi considers all possible pairs in the cost calculation. In my example, the replacement LSP pair is made from the different permutations of LSP pairs, including:

- 1) First LSP and Second LSP;
- 2) First LSP and Third LSP;
- 3) First LSP and Fourth LSP;
- 4) First LSP and Fifth LSP;
- 5) Fifth LSP and Third LSP;
- 6) Fifth LSP and Fourth LSP; and
- 7) Fifth LSP and Fifth LSP.

I note that there are additional permutations of possible LSP pairs with entirely different LSPs (i.e., both the primary and protection LSPs are distinct from the currently used LSP pair), but for brevity these permutations are not shown here. In the present example, the reselected LSP pair (e.g., Fifth LSP and Second LSP) would correspond to “*said entity pair*” while each remaining permutation of LSP pairs not

reselected would correspond to “*a replacement entity pair comprising at least one entity distinct from the entities of said entity pair.*”

147. **Fourth**, to the extent Patent Owner contends that the claimed “*reselecting said entity pair*” refers to selecting a different LSP pair (e.g., replacing one or both of the currently utilized primary and protection LSPs) instead of reselecting the same LSP pair, the proposed combination also renders that obvious. A POSITA would have found it obvious to select a different LSP pair, if the different LSP pair is determined to have a lower overall-minimum cost than the currently used LSP pair. To illustrate, in the current example, if the First LSP and Second LSP are now determined to have the lowest overall-minimum cost, then that LSP pair would be reselected. Of course, this is just an example, and given network status it would be understood that other LSPs may be reselected as the overall minimum cost pair.

148. Therefore, Doshi in combination with Guichard renders obvious “*if an entity pair reselection event occurs, reselecting said entity pair from the group consisting of said entity pair and a replacement entity pair comprising at least one entity distinct from the entities of said entity pair,*” as claimed.

- (vi) 1[e]: “wherein said entity pair reselection event is selected from a group consisting of adding an entity to said plurality of transport entities, removing an entity from said plurality of transport entities, an operational status change for one of said plurality of transport entities, and a change in overall cost for one of said plurality of transport entities.”

149. **First**, as discussed at 1[d], Doshi in combination with Guichard discloses an event triggering candidate pair cost determination and pair selection, which corresponds to “an entity pair reselection event.”

150. **Second**, Guichard teaches that a reoptimization evaluation is triggered by various events representative of changes in the network:

Event-driven reoptimization—In some cases, it may be desirable to trigger a reoptimization upon the occurrence of a particular event, such as the restoration of a link in the network. Indeed, if a **link is restored in the network, some TE LSPs may benefit from that new link to follow a more optimal path.** When configured, each time a new link is advertised as **newly operational, this triggers the evaluation of any potential reoptimization.**

Guichard, 81. A POSITA would have understood that restoring a link restores LSPs of the link, which may provide a more optimal path.

151. As discussed above at 1[pre]-1[d], the plurality of MPLS LSPs between end nodes correspond to “*said plurality of transport entities.*” It follows that

restoring a link that previously went down to “newly operational,” means that the operational status of the link’s LSPs has also changed to operational, which discloses “*an operational status change for one of said plurality of transport entities.*”

152. An additional network change contemplated by Guichard is the setting up and tearing down LSPs:

**Network state keeps changing. Links and nodes fail and recover;
new TE LSPs are set up while others may be torn down.**

Consequently, for any TE LSP, a more optimal path may appear in the network. It is then highly desirable to detect the existence of such a path and reoptimize a TE LSP along a better path when it becomes available.

Guichard, 79.

153. It follows that a new LSP set up between end nodes would be added to the plurality of MPLS LSPs between the end nodes, which corresponds to “*adding an entity to said plurality of transport entities.*” Conversely, tearing down an LSP between the end nodes would remove the LSP from the plurality of MPLS LSPs between the end nodes, which corresponds to “*removing an entity from said plurality of transport entities.*”

154. Therefore, Doshi in combination with Guichard discloses that the triggering event includes setting up an LSP, tearing down an LSP, and restoring the operational status of an LSP of the plurality of LSPs between the end nodes, which

renders obvious “*wherein said entity pair reselection event is selected from a group consisting of adding an entity to said plurality of transport entities, removing an entity from said plurality of transport entities, an operational status change for one of said plurality of transport entities, and a change in overall cost for one of said plurality of transport entities,*” as claimed.

3. Claim 2: “The method of claim 1, wherein said step of selecting an entity pair further comprises: selecting a working entity from said entity pair; and selecting a protection entity from said entity pair.”

155. As discussed above at 1[c], Doshi discloses selecting an LSP pair from the plurality of MPLS LSPs. The selection includes selecting a primary LSP and selecting a protection LSP, which corresponds to “*selecting a working entity*” and “*selecting a protection entity*”:

For each of a plurality of candidate path pairs for the new service, each candidate path pair comprising a candidate primary path and a candidate restoration path for the new service, a path cost associated with said each candidate path pair is generated, wherein the path cost for a candidate path pair is a function of sharability of links within the corresponding candidate restoration path. **The primary and restoration paths for the new service are selected** from the plurality of candidate path pairs based on the path cost of each candidate path

pair. The method may be implemented by a network manager for the
mesh [MPLS] network.

Doshi, [0014]; *see also* Doshi, Abstract, [0046], [0142]-[0145], Claim 1, Claim 11.

156. Doshi’s “primary path” is also referred to as a “**working path**” (e.g., working LSP), and Doshi’s “restoration path” is also referred to as a “protection path” (e.g., protection LSP).³ Note that the ’821 Patent describes switching traffic over to a protection entity after failure of a working entity. ’821 Patent, 1:51-53; *see also* ’821 Patent, 2:35-36 (“an entity protection switch configured to switch between a working entity and a protection entity”). Doshi similarly describes “Switching Between Working and Protection LSPs” and explains that “after detecting a failure, end nodes of an LSP switch traffic from a primary (i.e., working) LSP to its corresponding protection LSP.” Doshi, [0266]-[0267]. Given the similarity in functionality and description, a POSITA would have understood that Doshi’s working LSP corresponds to the claimed “*working entity*” while Doshi’s protection LSP corresponds to the claimed “*protection entity*.” Since Doshi’s working and

³ Doshi, [0046] (“Unless otherwise clear from the context, the process of ‘restoration’ is synonymous in this specification with the process of ‘protection.’”), [0076] (“a primary path (also known as “**working path**”) ... a **protection path** (also known as “restoration path”)”).

protection LSPs are part of the selected LSP pair, a POSITA would have understood that the selection of the working and protection LSPs are “*from said entity pair.*”

157. Therefore, Doshi renders obvious “*wherein said step of selecting an entity pair further comprises: selecting a working entity from said entity pair; and selecting a protection entity from said entity pair,*” as claimed.

4. Claim 3: “The method of claim 2, further comprising the step of selecting an active entity from the set consisting of said working entity and said protection entity.”

158. As discussed for Claim 2, Doshi describes selecting a working LSP and a protection LSP, which respectively correspond to the claimed “*working entity*” and “*protection entity.*” Doshi further describes “Switching Between Working and Protection LSPs” and explains that “after detecting a failure, end nodes of an LSP switch traffic from a primary (i.e., working) LSP to its corresponding protection LSP.” Doshi, [0266]-[0267]. Doshi’s working LSP is the path actively carrying traffic absent a failure while Doshi’s protection LSP becomes active when traffic is switched over following a failure. These switching decisions are consistent with the disclosure of the ’821 Patent. The ’821 Patent explains that “in the absence of entity failures, the working entity will be active” (’821 Patent, 5:54-55) and that traffic is switched over to the ’821 Patent’s protection entity in the event of a failure of the working entity (’821 Patent, 1:51-43), which is to say that the protection entity then becomes active. Thus, a POSITA would have understood that Doshi’s switching

decisions correspond to “*selecting an active entity from the set consisting of said working entity and said protection entity*” because such decisions select which of the working LSP and protection LSP is in use.

159. Therefore, Doshi renders obvious “*further comprising the step of selecting an active entity from the set consisting of said working entity and said protection entity,*” as claimed.

5. Claim 4: “The method of claim 2, wherein selecting an entity pair further comprises minimizing an overall cost function.”

160. **First**, as discussed at 1[b]-1[c], Doshi calculates the path cost of each path (e.g., each primary and protection LSP) in a candidate path pair and sums the path costs to find the cost of the pair together. The cost calculation considers various factors, including link utilization, utilization threshold, administrative weight, sharing degree, and disjointedness, and which represent the “*overall cost*” for each candidate path pair. The calculation used to determine the “*overall cost*” corresponds to the claimed “*overall cost function.*”

161. **Second**, as also discussed at 1[b]-1[c], Doshi’s Figure 11 and accompanying description teach calculating and selecting an “**overall minimum-cost**” pair:

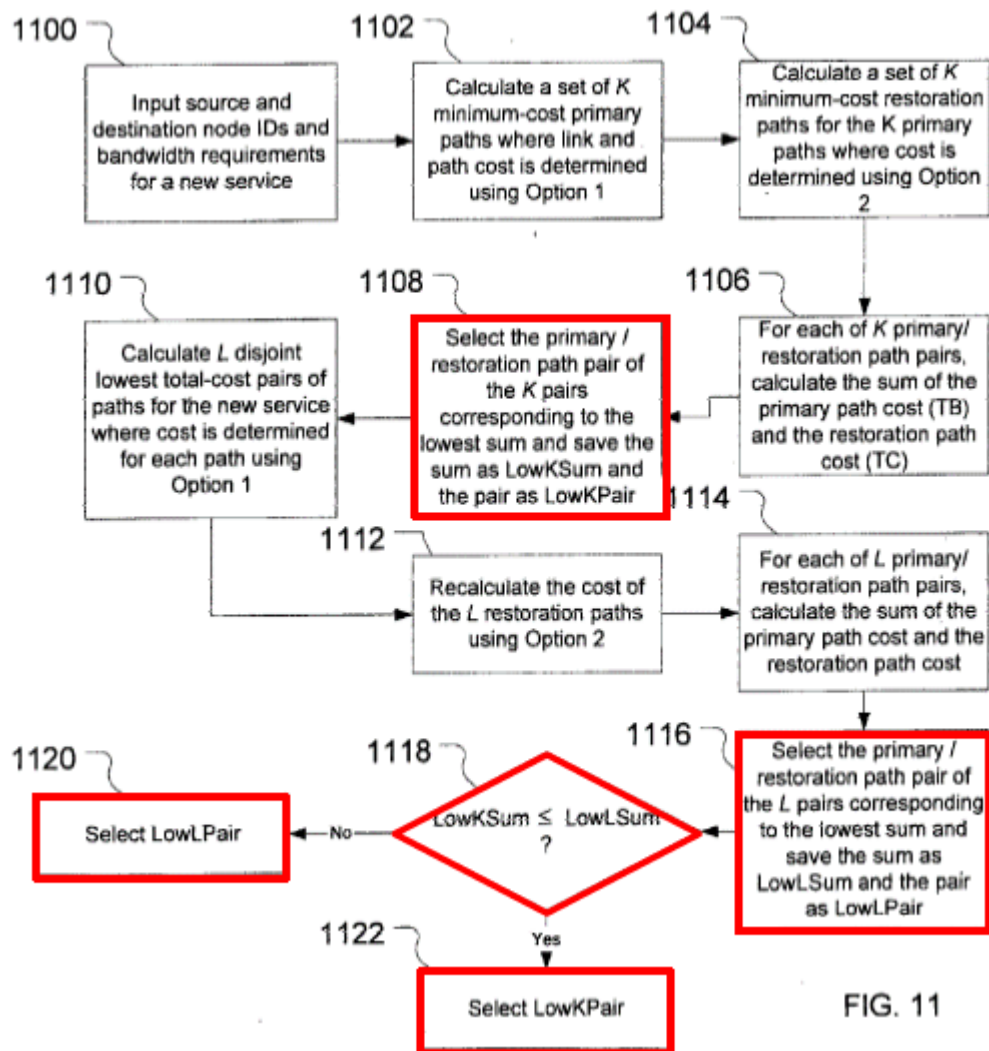


FIG. 11

Doshi, Fig. 11 (annotated).

FIG. 11 depicts and exemplary **method for calculating a minimum-cost primary/restoration path pair** for a new service in consideration of link utilization, utilization threshold, administrative weight, and sharing degree.

Doshi, [0142].

The method involves two major flows. In the first flow, illustrated by steps 1102, 1104, 1106, and 1106, one **minimum**-cost path pair is selected from K candidate pairs by a first method. In the second flow, illustrated by 1110, 1112, 1114, and 1116, one minimum-cost path pair is selected from L candidate pairs by a second method. **Then in step 1118, and steps 1120 or 1122, the lowest-cost pair of these two lowest-cost results is selected as the overall minimum-cost pair.**

Doshi, [0142]; *see also* Doshi, [0026], [0125]-[0139], [0143]-[0145]. Doshi's cost determination also takes into account whether paths are "disjoint," where disjoint paths would be understood as lowering the probability of simultaneous failure. Doshi, [0146]-[0156], Fig. 11 (step 1110 "Calculate L disjoint lowest total-cost pairs of paths").

162. A POSITA would have understood that the selected overall minimum-cost pair is the pair having the lowest overall cost function in consideration of various factors, including link utilization, utilization threshold, administrative weight, sharing degree, and disjointedness.

163. Therefore, Doshi renders obvious "*wherein selecting an entity pair further comprises minimizing an overall cost function,*" as claimed.

6. **Claim 5: “The method of claim 4, wherein said overall cost function comprises substantially minimizing a probability of concurrent failure of said protection entity and said working entity.”**

164. **First**, as discussed at 1[b]-1[c], and Claim 4, Doshi calculates the path cost of each path (e.g., each primary and protection LSP) in a candidate path pair and sums the path costs to find the cost of the pair together. The cost calculation considers a myriad of factors such as link utilization, sharing degree, and **path disjointedness** and which represent the “*overall cost*” for each candidate path pair. The calculation used to determine the “*overall cost*” corresponds to the claimed “*overall cost function*.”

165. **Second**, regarding path disjointedness, Doshi describes selecting a primary path and a protection path (e.g., primary and protection LSPs) that are strictly disjoint from each other, having only source and destination nodes (e.g., end nodes) in common:

Disjoint Primary and Protection Paths

...

Note that the protection paths in the example of FIG. 1 are strictly disjoint from the primary paths that they protect. In this context, **strictly disjoint means that the two paths in each primary/protection path**

pair share no common links or nodes other than their common ingress and egress nodes.

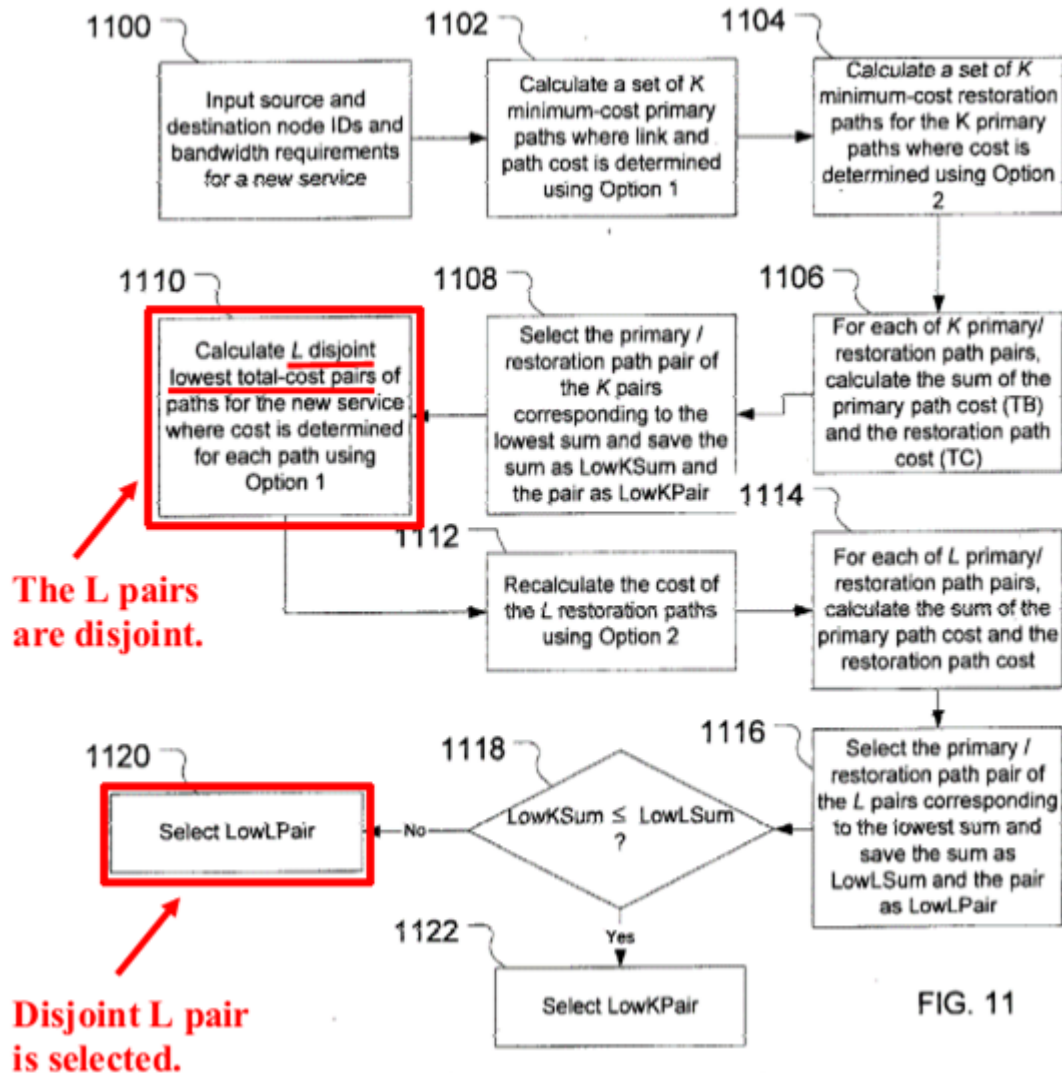
Doshi, [0053], [0055].

Primary/Restoration Paths: **Disjoint for Protection**

Some of the services can be protected against a single transit node or link failure. This protection is made possible by **selecting a protection or restoration path for the service that is node and link disjoint from the primary path except for the source and destination nodes.**

Whenever one of the primary path elements fails, the connection is switched automatically to the restoration path.

Doshi, [0155]-[0156]; *see also* Doshi, [0056], [0062], [0080], [0131], [0142]-[0152], [0287], Fig. 1.



Doshi, Fig. 1 (annotated)

166. Doshi explains that when two paths are strictly disjoint, e.g., by being node and link disjoint as above, “then a failure affecting one of them will not affect the other.” Doshi, [0040]. By considering path disjointedness in its cost calculation and selecting a pair of primary and protection paths that are node and link disjoint such that the failure of one does not affect the other, Doshi’s calculation

“substantially minimize[es] a probability of concurrent failure” of the primary and protection paths. I should also point out that Doshi’s selection of disjoint paths is consistent with exemplary concurrent failure minimization described in the ’821 Patent. *See* ’821 Patent, 3:47-50 (recognizing that “a pair having multiple spans and/or nodes in common may be more likely to simultaneously fail than a pair having no spans or nodes in common.”).

167. Although the discussion above refers to primary and protection or restoration paths, I again point out that as discussed in Claim 2, Doshi clarifies that its “primary path” is also referred to as a “working path” (e.g., working LSP), and its “restoration path” is also referred to as a “protection path” (e.g., protection LSP).⁴ These working and protection LSPs correspond to the claimed “*working entity*” and “*protection entity*” in the ’821 Patent. Accordingly, the discussion above applies equally to considering path disjointedness in cost calculation and selection of a pair of working and protection paths that are node and link disjoint such that the failure of one does not affect the other.

⁴ Doshi, [0046] (“Unless otherwise clear from the context, the process of ‘restoration’ is synonymous in this specification with the process of ‘protection.’”), [0076] (“... a primary path (also known as ‘working path’) ... a protection path (also known as ‘restoration path’)”).

168. Therefore, Doshi renders obvious “*wherein said overall cost function comprises substantially minimizing a probability of concurrent failure of said protection entity and said working entity,*” as claimed.

7. Claim 6: “The method of claim 4, wherein said overall cost function comprises a predefined entity cost metric.”

169. As discussed at 1[b]-1[c] and Claim 4, Doshi calculates the path cost of each path (e.g., each primary and protection LSP) in a candidate path pair and sums the path costs to find the cost of the pair together. The cost calculation considers various factors—including link utilization, utilization threshold, administrative weight, sharing degree, and disjointedness—which represent the “*overall cost*” for each candidate path pair. The calculation used to determine the “*overall cost*” corresponds to the claimed “*overall cost function.*”

170. Each of these factors, considered in the cost calculation, is predefined in the sense that the cost calculation is pre-configured to consider each factor. For example, before a calculation is performed, it is understood that the calculation will consider link utilization, sharing degree, and path disjointedness. Additionally, the utilization threshold (e.g., nominally set to 80%) and administrative weight (e.g., a coefficient for scaling) are predefined metrics. Doshi, [0128], [0141]. Each of these metrics has an impact on the cost of the path being evaluated. Doshi, [0142]. Thus,

each of link utilization, utilization threshold, administrative weight, sharing degree, and disjointedness correspond to “*a predefined entity cost metric*.”

171. Additionally, I note that traffic engineering metrics is an exemplary “*predefined entity cost metric*” described in the ’821 Patent. ’821 Patent, 5:49-51. A POSITA would have understood that Doshi’s link utilization, utilization threshold, and administrative weight each correspond to traffic engineering data since it was well known that traffic engineering metrics includes such factors. *See* Ex.1022, 56 (Entitled “Overview and Principles of Internet Traffic Engineering” describing use of “administrative weights” to implement traffic engineering decisions.); Ex.1023, 28, 30 (Entitled “Multiprotocol Label Switching (MPLS) Traffic Engineering” describing setting an administrative weight with an “mpls traffic-eng administrative-weight” command, setting a bandwidth threshold level of reserved bandwidth with an “mpls traffic-eng flooding thresholds” command, and identifying traffic engineering output fields that include administrative weight, reservable bandwidth, and bandwidth thresholds.); Ex.1024, 4, 6 (Entitled “Multiple Metrics for Traffic Engineering with IS-IS and OSPF” describing several metrics, including “administrative weight” and “bandwidth available.”).

172. A POSITA’s understanding that Doshi’s link utilization, utilization threshold, and administrative weight each correspond to traffic engineering metrics

would have been further confirmed by the fact that Doshi's disclosure is in the context of MPLS traffic engineering:

[T]his invention has been described in one or more embodiments in the context of mesh data networks running one or more of the **multiprotocol-label switched (MPLS) traffic engineering extension protocols ...**

Doshi, [0298]; *see also* Doshi, [0010], [0093], [0191], and [0257].

173. Therefore, Doshi renders obvious "*wherein said overall cost function comprises a predefined entity cost metric,*" as claimed.

8. Claim 7: "The method of claim 6, wherein said predefined entity cost metric is selected from the group consisting of interior gateway protocol (IGP) and traffic engineering (TE)."

174. *See* analysis at Claim 6.

9. Claim 9

(i) 9[pre] "The method of claim 4,"

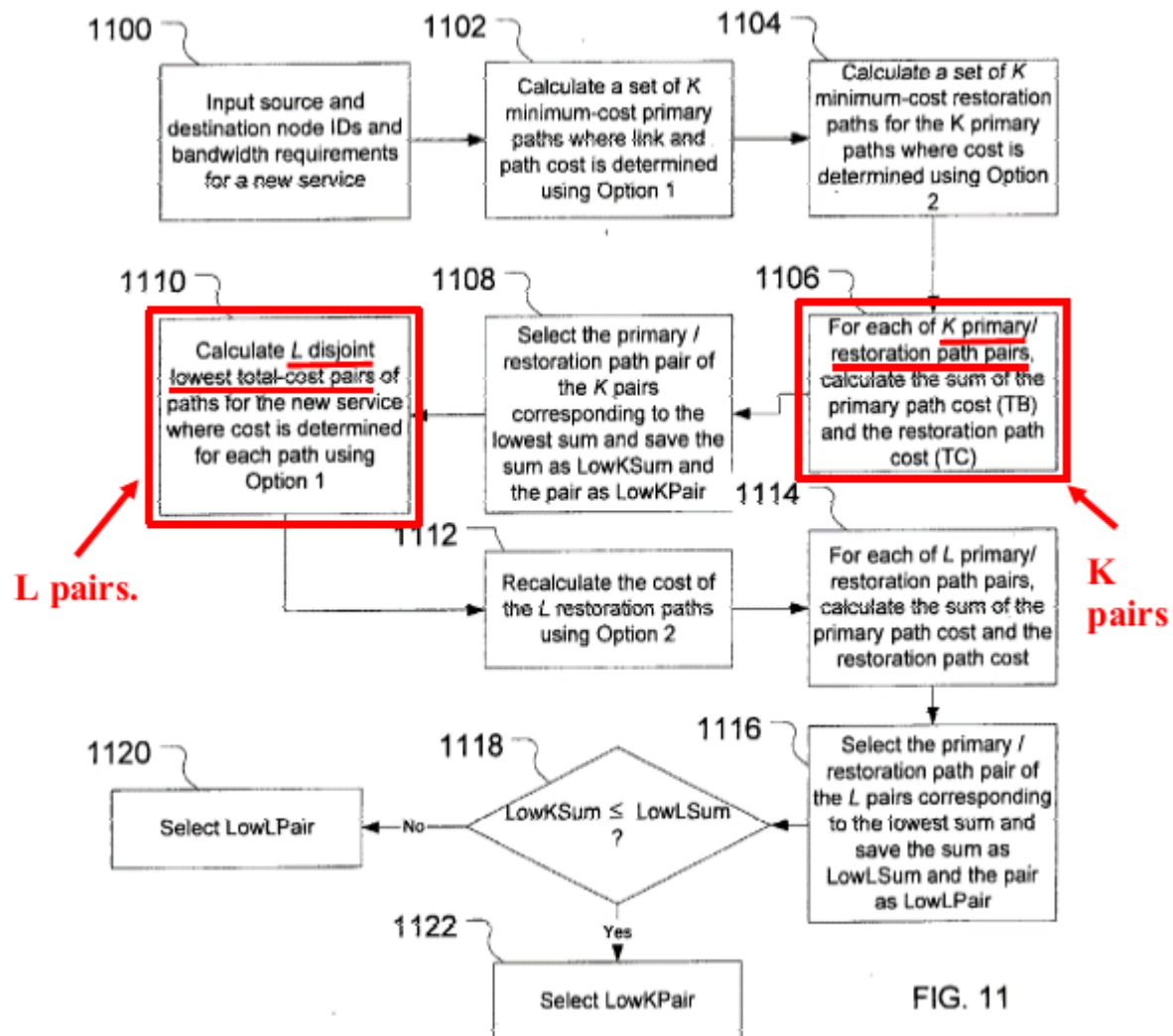
175. *See* analysis at Claim 4.

(ii) 9[a] "wherein said overall cost function comprises: selecting a subset of entity pairs wherein each entity pair of said subset has substantially minimum probability of a concurrent failure of said protection entity and said working entity; and"

176. As discussed at 1[b]-1[c], Doshi calculates the path cost of each path (e.g., each primary and protection LSP) in a candidate path pair and sums the path

costs to find the cost of the pair together. The cost calculation considers various factors, including link utilization, utilization threshold, administrative weight, sharing degree, and **disjointedness**, and which represent the “*overall cost*” for each candidate path pair. The calculation used to determine the “*overall cost*” corresponds to the claimed “*overall cost function*.”

177. As shown at Doshi’s Figure 11 and disclosed in the accompanying description, the cost calculation includes calculating and comparing two sets of candidate path pairs—K candidate pairs and L candidate pairs, where the L pairs are disjoint pairs:



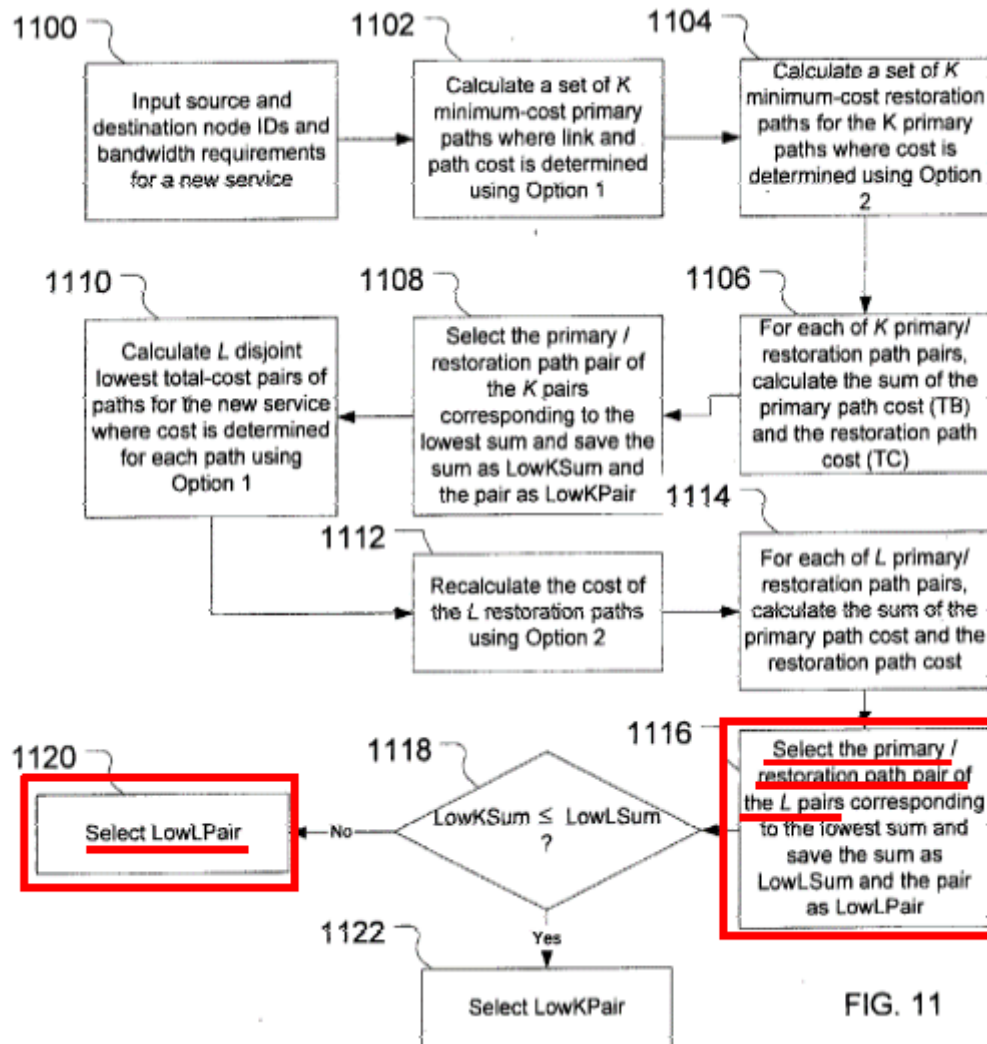
Doshi, Fig. 11 (annotated).

In the first flow, illustrated by steps 1102, 1104, 1106, and 1106, one minimum-cost path pair is selected from **K candidate pairs** by a first method. In the second flow, illustrated by 1110, 1112, 1114, and 1116, one minimum-cost path pair is selected from **L candidate pairs** by a second method.

Doshi, [0142]; *see also* Doshi, [0143]-[0145].

178. The L candidate pairs and K candidate pairs are both subsets of the total number of candidate pairs available. In the case of the L candidate pairs, the subset consists of pairs that are disjoint. As I discussed at Claim 5, the pairs include both a working path (e.g., working LSP) and a protection path (e.g., protection LSP) that are disjoint from each other, which substantially minimizes the probability of concurrent failure. Thus, Doshi's L candidate pairs correspond to "*a subset of entity pairs wherein each entity pair of said subset has a substantially minimum probability of a concurrent failure of said protection entity and said working entity.*" A POSITA would have understood selecting the set of L candidate pairs for calculations corresponds to "*selecting*" as claimed.

179. Moreover, since the claim does not specify any particular number of "*entity pairs*" within the claimed "*subset*," I note that the subset would be understood to consist of a single pair or multiple pairs. Doshi also discloses selection of a single L disjoint candidate pair as illustrated in annotated Figure 11 below:



Doshi, Fig. 11 (annotated).

180. Therefore, Doshi renders obvious “*wherein said overall cost function comprises: selecting a subset of entity pairs wherein each entity pair of said subset has substantially minimum probability of a concurrent failure of said protection entity and said working entity.*”

(iii) 9[b]: “if said subset comprises at least two entity pairs, selecting an entity pair from said subset that minimizes an entity cost function.”

181. Regarding a subset including at least two pairs, Doshi discloses calculating L “disjoint lowest total-cost pairs,” plural, as discussed at 9[a] above. Thus, Doshi’s L candidate pairs include at least two pairs. Doshi goes on to explain that the L candidate pairs are assessed for cost, which as discussed at 1[b] includes assessing the cost of each path in the pair consistent with the ’821 Patent’s description of “*entity cost*.” As discussed at 1[b]-1[c] and Claim 4, Doshi calculates the path cost of each path (e.g., each primary and protection LSP) in a candidate path pair. The cost calculation considers various factors, including link utilization, utilization threshold, administrative weight, sharing degree, and disjointedness. Doshi, [0124]-[0141]. The calculation used to determine the path cost corresponds to the claimed “*entity cost function*.”

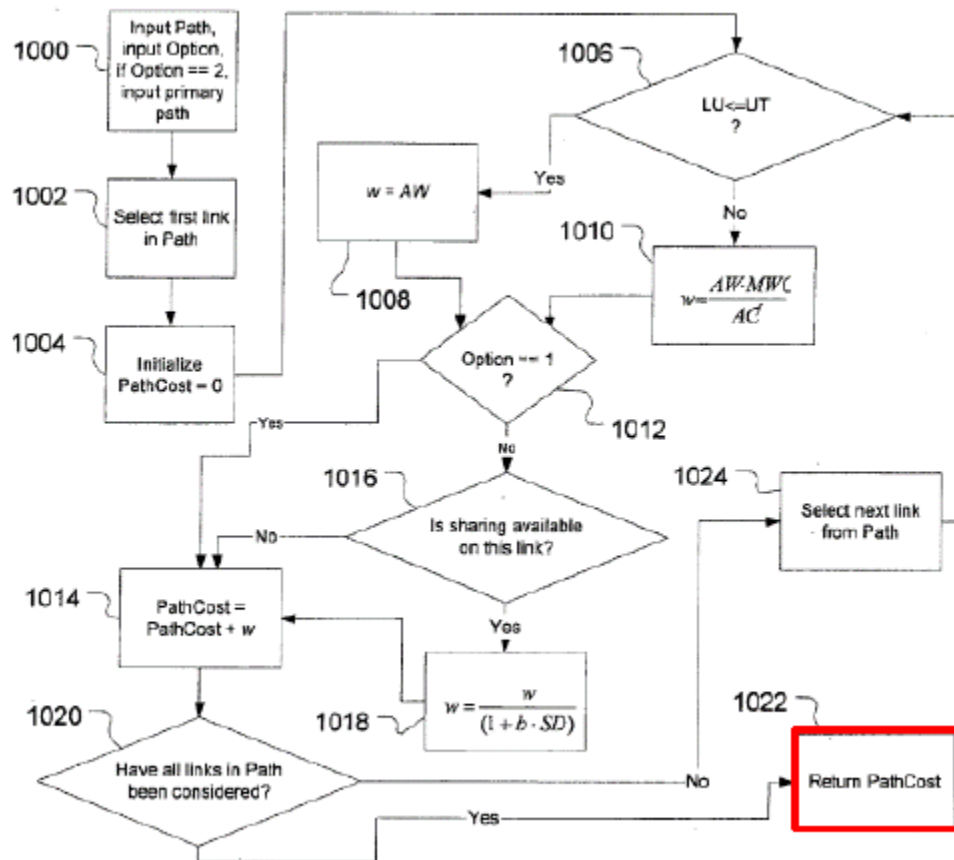
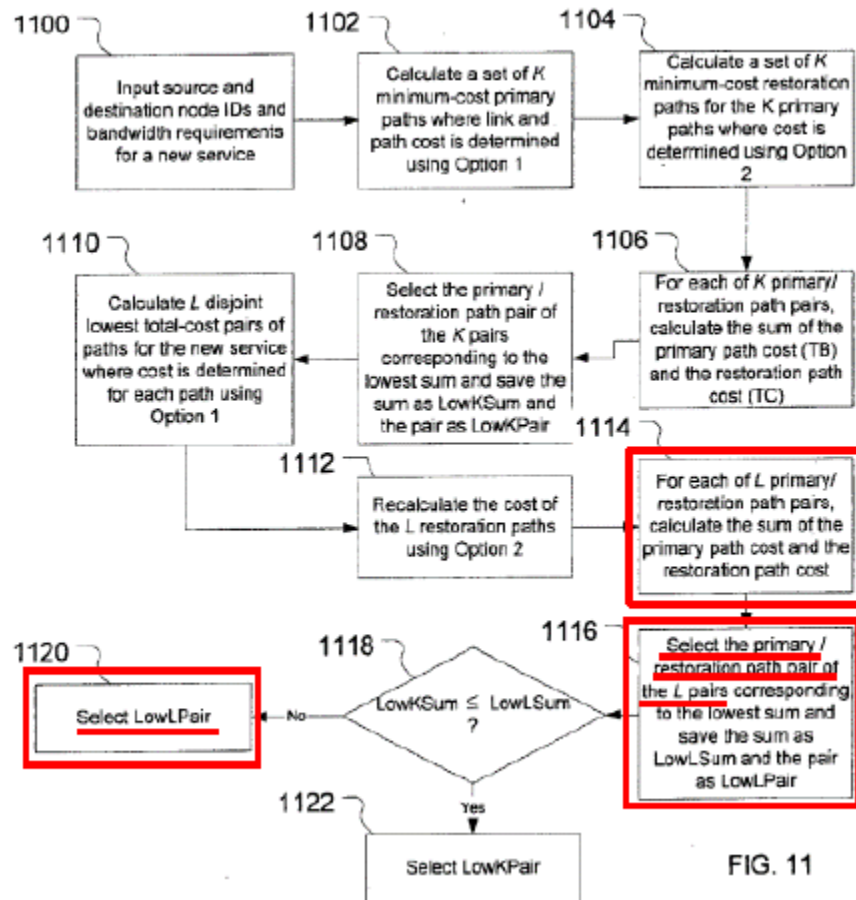


FIG. 10

Doshi, Fig. 10 (annotated).

182. Doshi describes selecting the lowest cost pair of the L candidate pairs after assessing for cost:



Doshi, Fig. 11 (annotated).

Next in step 1114, the sum is calculated of the cost of the primary and the restoration path for each of the L pairs and in step 1116, the lowest sum is stored in the variable LowLSum and the lowest-cost pair is stored in the data structure LowLPair.

Finally, in the test of step 1118, LowKSum is compared to LowLSum. If LowKSum is lower than or equal to LowLSum, then in step 1122,

LowKPair is selected as the minimum-cost path pair. If it is not lower, then in step 1118, LowLPair is selected.

Doshi, [0144]-[0145].

183. Not only is the lowest cost pair of the L candidate pairs selected, its selection marks it as the lowest cost pair out of all pairs, including K candidate pairs. It would have been obvious to a POSITA for the lowest cost pair to include the lowest cost path. Accordingly, it would have been obvious to a POSITA that selection of the lowest cost L pair—the lowest cost pair out of all the pairs—“minimizes an entity cost function.”

184. Therefore, Doshi renders obvious “*if said subset comprises at least two entity pairs, selecting an entity pair from said subset that minimizes an entity cost function,*” as claimed.

10. Claim 10: “The method of claim 9, wherein said entity cost function comprises a predefined metric.”

185. As discussed at 1[b]-1[c] and Claim 4, Doshi calculates the path cost of each path (e.g., each primary and protection LSP) in a candidate path pair. As discussed at 9[b], the cost calculation considers various factors, including link utilization, utilization threshold, administrative weight, sharing degree, and disjointedness and corresponds to the claimed “*entity cost function.*” Further, as

discussed at Claim 6, these factors, along with traffic engineering, correspond to a “*predefined entity cost metric*,” which renders obvious “*a predefined metric*.”

11. Claim 11: “The method of claim 10, wherein said predefined metric is selected from the group consisting of interior gateway protocol (IGP) and traffic engineering (TE).”

186. See analysis at Claim 10.

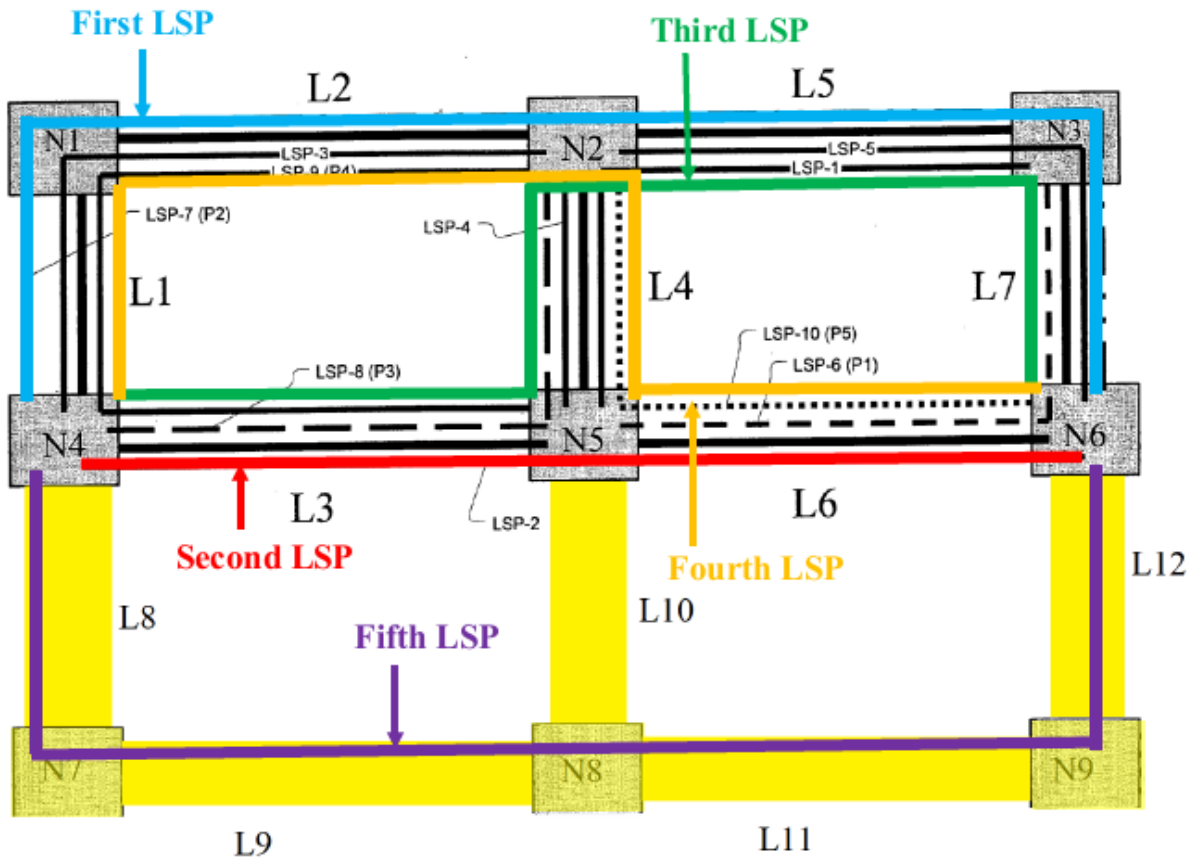
12. Claim 13: “The method of claim 1, further comprising the step of: if said entity pair reselection results in both working and protection entities being replaced, sequentially replacing said working entity and said protection entity.”

187. Regarding replacement of the claimed “*working entity*” and “*protection entity*,” I first note that as discussed at Claims 2 and 5, Doshi’s “primary path” is also referred to as a “working path” (e.g., working LSP), and its “restoration path” is also referred to as a “protection path” (e.g., protection LSP)⁵. Doshi’s primary path (aka working path) corresponds to the claimed “*working entity*” and Doshi’s restoration path (aka protection path) corresponds to the claimed “*protection entity*.”

⁵ Doshi, [0046] (“Unless otherwise clear from the context, the process of ‘restoration’ is synonymous in this specification with the process of ‘protection.’”), [0076] (“... a primary path (also known as ‘**working path**’) ... a **protection path** (also known as ‘restoration path’)”).

188. As discussed at 1[c]-1[d], Doshi teaches that a primary and a protection pair (e.g., LSP pair) are selected from the plurality of paths of the MPLS network and that, in view of Guichard's teaching of ongoing reoptimization efforts, it would have been an obvious to perform Doshi's cost calculations repeatedly to attempt to determine whether the originally selected LSP pair still has the overall minimum-cost or if another LSP pair should be selected.

189. It would have been obvious for the LSPs of the originally selected pair (e.g., a primary LSP and a protection LSP) to be sequentially replaced as the ongoing reoptimization efforts identify lower cost LSPs, which corresponds to "*if said entity pair reselection results in both working and protection entities being replaced, sequentially replacing said working entity and said protection entity.*" To build upon an earlier example, consider Doshi's modified and annotated Figure 1 below:



Doshi, Fig. 1 (modified and annotated).

190. As previously discussed at 1[c]-1[d], the Fifth LSP was selected as the primary path and the Second LSP was selected as the protection path. Upon an event trigger as taught by Guichard, attempted reoptimization of the LSPs would take place to determine if there is a better or more optimal LSP. If, for example, the reoptimization evaluation determined that the links of the Fifth LSP are heavily utilized as compared to the links of the First LSP, it would have been obvious for Doshi's cost determination to result in a new pair (e.g., the First LSP as the primary while the Second LSP remains as the protection) as having the overall minimum

cost. Thus, the Fifth LSP would be replaced. A subsequent such reoptimization evaluation would find that, for example, the Second LSP has become suboptimal as a protection path and replace the Second LSP with another LSP (e.g., a newly added Sixth LSP (not shown)). Of course, this is just an example, and given network status it would be understood that other LSPs may be selected as the overall minimum cost pair, but I note that the LSPs have been replaced sequentially in this example—first the primary LSP followed by the protection LSP. It would have been obvious for the sequence of replacement to be reversed in other examples where the protection LSP becomes suboptimal before the primary LSP.

191. It would have been similarly obvious for a single event-triggered reoptimization evaluation to find that both the Fifth and Second LSPs are suboptimal. When both LSPs are determined to be suboptimal, a POSITA would have found it obvious to replace the LSPs sequentially in order to minimize interruption in service. In that regard, a POSITA would have appreciated the desirability of maintaining a working and protection path throughout the replacement process. In replacing the Fifth and Second LSPs with the First and Sixth LSPs, for example, a POSITA would have found it obvious to first designate the First LSP (determined to be the optimal primary LSP) as a new protection LSP temporarily, thereby replacing the Second LSP. Next, traffic on the Fifth LSP would be switched over to the First LSP with the Fifth LSP temporarily serving as a

protection LSP. The First LSP would thus become the new primary LSP as was determined to be optimal. The Fifth LSP, now acting as a protection LSP, would then be replaced by the Sixth LSP, which was determined to be the optimal protection LSP. A POSITA would have recognized that such sequential replacement would advantageously maintain two LSPs (e.g., one primary and one protection) throughout the replacement.

192. Therefore, Doshi in combination with Guichard renders obvious “*if said entity pair reselection results in both working and protection entities being replaced, sequentially replacing said working entity and said protection entity,*” as claimed.

13. Claim 17

(i) 17[Pre]: “Non-transitory computer readable media configured to perform a method comprising the steps of:”

193. Claim 17 is substantially similar to claim 1 and is therefore obvious for the reasons stated above. The below analysis addresses the obviousness of the preamble’s different recitations, to the extent limiting.

194. As discussed at 1[pre], Doshi discloses that the claimed method steps are performed by a network manager, that may be a server or other computing device. It was common knowledge that computing devices, such as servers, would include a processor and memory. *See* Ex.1025, [0092], Fig. 10 (describing

“exemplary computer system 1000 that can be used as ... a server” where the computer system 1000 includes “one or more processors,” “a main memory,” “and may also include a secondary memory”); *see also* Ex.1031, 8:30-31 (describing that “server 502 includes a processor 504 operably coupled to memory 506”); Ex.1032, 7:46-47 (“Each server may include a processor and memory.”); Ex.1033, 17:60-61 (“The server computer system 103 may comprise a CPU and a memory medium.”). Indeed, Doshi expressly discloses storing, for example, protection information and information about path pairs which would have informed a POSITA that Doshi’s network manager includes a memory. Doshi, [0143]-[0144], [0196], [0214].

195. It was similarly common knowledge for such memory to be non-volatile and computer readable by the processor (“*[n]on-transitory computer readable media*”) while storing instructions for execution by the processor. *See* Ex.1025, [0092] (describing that “[c]omputer programs (also referred to as computer control logic) are stored in main memory 1008 and/or secondary memory 1010” and that “[c]omputer programs, when executed, enable the computer system 1000 to perform the features of the present disclosure.”); *see also* Ex.1016, [0072] (describing “computer-readable” hard disk drives and flash memory cards “provide nonvolatile storage of data, data structures, computer-executable instructions, and so forth.”); Ex.1017, 17:29-31, 41:31-32 (describing “software and/or firmware provided in a read only memory ... for execution” by a processor, where the memory

includes “non-volatile memory 812” comprising “Flash memory or Static RAM”); Ex.1018, [0021], [0003] (describing a processor “executing sequences of instructions contained in a memory” and explaining that “[n]on-volatile memory retains the stored data after the power is removed for a period of time.”).

196. Accordingly, a POSITA would have found it obvious for Doshi’s network manager to include a memory that corresponds to a “*non-transitory computer readable medium*.” As discussed above at 1[pre]-1[e], Doshi’s network manager performs the method steps. Since, as evidenced by the citations above, it was common knowledge to store executable instructions in memory, and since Doshi’s network manager performs the method steps, a POSITA would have considered it obvious to store instructions to perform each step of the method in the memory of Doshi’s network manager. Accordingly, a POSITA would have found it obvious for Doshi’s network manager to include “[n]on-transitory computer readable media configured to perform a method comprising the steps of:”

197. Therefore, Doshi renders obvious “*Non-transitory computer readable media configured to perform a method comprising the steps of:*”

- (ii) **17[a]: “providing a plurality of MPLS transport entities between a first endpoint and a second endpoint;”**

198. See analysis at 1[a].

- (iii) **17[b]: “determining an overall cost for each entity pair of said plurality of entities;”**

199. *See* analysis at 1[b].

- (iv) **17[c]: “selecting an entity pair from said plurality of transport entities based at least in part upon said overall cost; and”**

200. *See* analysis at 1[c].

- (v) **17[d]: “if an entity pair reselection event occurs, reselecting said entity pair from the group consisting of said entity pair and a replacement entity pair comprising at least one entity distinct from the entities of said entity pair,”**

201. *See* analysis at 1[d].

- (vi) **17[e]: “wherein said entity pair reselection event is selected from a group consisting of adding an entity to said plurality of transport entities, removing an entity from said plurality of transport entities, an operational status change for one of said plurality of transport entities, and a change in overall cost for one of said plurality of transport entities.”**

202. *See* analysis at 1[e].

14. Claim 18

- (i) **18[a]: “The non-transitory computer readable media of claim 17, wherein said step of selecting an entity pair further comprises: selecting a working entity from said plurality of transport entities; and selecting a protection entity from said plurality of transport entities; and”**

203. As discussed above at 1[c], Doshi discloses selecting an LSP pair from the plurality of MPLS LSPs. The selection includes selecting a primary LSP and

selecting a protection LSP, which corresponds to “*selecting a working entity from said plurality of transport entities; and selecting a protection entity from said plurality of transport entities*”:

For each of a plurality of candidate path pairs for the new service, each candidate path pair comprising a candidate primary path and a candidate restoration path for the new service, a path cost associated with said each candidate path pair is generated, wherein the path cost for a candidate path pair is a function of sharability of links within the corresponding candidate restoration path. **The primary and restoration paths for the new service are selected** from the plurality of candidate path pairs based on the path cost of each candidate path pair. The method may be implemented by a network manager for the mesh [MPLS] network.

Doshi, [0014]; *see also* Doshi, Abstract, [0046], [0142]-[0145], Claim 1, Claim 11.

204. Doshi’s “primary path” is also referred to as a “**working path**” (e.g., working LSP), and Doshi’s “restoration path” is also referred to as a “protection path” (e.g., protection LSP). Note that the ’821 Patent describes switching traffic over to a protection entity after failure of a working entity. ’821 Patent, 1:51-43; *see also* ’821 Patent, 2:35-36 (“an entity protection switch configured to switch between a working entity and a protection entity”). Doshi similarly describes “Switching

Between Working and Protection LSPs” and explains that “after detecting a failure, end nodes of an LSP switch traffic from a primary (i.e., working) LSP to its corresponding protection LSP.” Doshi, [0266]-[0267]. Given the similarity in functionality and description, a POSITA would have understood that Doshi’s working LSP corresponds to the claimed “*working entity*” while Doshi’s protection LSP corresponds to the claimed “*protection entity*.” Since Doshi’s working and protection LSPs are part of the selected LSP pair, a POSITA would have understood that the working and protection LSPs are “*from said entity pair*.”

205. Therefore, Doshi renders obvious “*wherein said step of selecting an entity pair further comprises: selecting a working entity from said plurality of transport entities; and selecting a protection entity from said plurality of transport entities,*” as claimed.

(ii) **18[b]: “selecting an active entity from the set consisting of said working entity and said protection entity.”**

206. See analysis at Claim 3.

15. Claim 19: “The non-transitory readable media of claim 18, wherein said step of selecting an entity pair further comprises minimizing an overall cost function.”

207. See analysis at Claim 4.

16. Claim 20

- (i) **20[a]: “The non-transitory computer readable media of claim 19, wherein said overall cost function comprises: minimizing a probability of concurrent failure of said protection entity and said working entity; and”**

208. *See* analysis at Claim 5.

- (ii) **20[b]: “a predefined metric selected from the group consisting of interior gateway protocol (IGP) and traffic engineering (TE).”**

209. *See* analysis at Claims 6 and 7.

D. Ground 2: Claims 8 and 12 are rendered obvious by *Doshi* in view of *Guichard* and *Huang*

210. Based on the following analysis, I conclude that a POSITA at the relevant time (June 22, 2011) would have understood the limitations of Claims 8 and 12 were expressly disclosed, taught, or suggested by *Doshi* in combination with *Guichard* and *Huang*. In my opinion, Claims 8 and 12 would have been obvious to a POSITA in view of the prior art.

1. Motivation to Combine *Doshi* and *Huang*

211. A POSITA would have been motivated to combine the teachings of *Doshi* and *Huang*, as discussed below.

212. First, *Doshi* and *Huang* are analogous art to the '821 Patent. For example, just like the '821 Patent, both references generally pertain to MPLS networks. '821 Patent, 3:15-18, Abstract; *Doshi*, [0049]; *Huang*, [0004]-[0007].

Additionally, both references address the problem of selecting a pair of MPLS paths from available paths. '821 Patent, 4:63-5:8; Doshi, [0014]; Huang, [0004], [0032], [0035], [0040], [0048]. Thus, given the similarities between the references and the fact that they address the problem of selecting LSPs, a POSITA considering Doshi would have naturally considered the teachings of Huang.

213. Second, a POSITA would have been motivated to combine the teachings of Doshi and Huang to produce numerous predictable and beneficial results.

214. Doshi teaches “Switching Between Working and Protection LSPs” and explains that “after detecting a failure, end nodes of an LSP switch traffic from a primary (i.e., working) LSP to its corresponding protection LSP.” Doshi, [0266]-[0267]. Huang complements Doshi by teaching what to do when the failure affecting the working LSP has been cleared. Huang teaches “revertive switching” where “the connection will be switched back from the backup LSP to the working link once the working link has cleared the failure that caused the switchover.” Huang, [0053].

215. A POSITA would have been motivated to perform revertive switching, as taught by Huang, when implementing Doshi’s switching between working and protection LSPs in order to avoid the need to calculate and select a replacement working LSP when the previously selected working LSP (which as discussed at [1.2]-[1.4] is part of the overall minimum-cost pair) has been quickly restored. In

that regard, Doshi recognizes the known problem that LSPs are sometimes incorrectly declared to have failed as a result of packet loss or delay. Doshi, [0261]. A working LSP that was incorrectly declared to have failed would quickly be identified as being “restored” when, for example, the state of the LSP can be checked using a fast failure detection function. *See* Doshi, [0256]-[0263].

216. A POSITA would have recognized that in instances of quick restoration, e.g., in the case of a mistaken failure diagnosis that is quickly resolved, it would be simpler to revert back to the working LSP instead of calculating the costs for all LSPs (e.g., by the network manager) to ultimately reach the same result of selecting the working LSP. Reverting allows for the previously selected working LSP (which as discussed at [1.2]-[1.4] is part of the overall minimum-cost pair) to be utilized without any additional computations or selections. Thus, Huang’s teachings obviate unnecessary efforts.

217. The combination is merely the use of a known technique (Huang’s technique of configuring the working LSP as revertive) to improve a similar method (Doshi’s method for selecting working and protection LSPs) in the same way with predictable results (reverting back to Doshi’s working LSP once the failure has been cleared without performing needless calculations). The combination represents what would have been common sense to a POSITA—reverting back to a preferred low-cost path when that path becomes operational again.

218. I also note that the results would have been predictable and there would have been a reasonable expectation of success in the combination given that Doshi and Huang are analogous art and in the same field of endeavor. Also, a POSITA would have had a reasonable expectation of success in reverting back to Doshi's working LSP as taught by Huang because Huang provides implementation details such as waiting to revert back until the working LSP has been restored. Huang, [0053].

219. Implementing the combination would have been within a POSITA's skillset since Doshi already sets forth techniques for switching between working and protection LSPs. Additionally, the combination would be a simple matter since Doshi already describes how to switch between LSPs. Doshi, [0266]-[0268] (describing, for example, switching between LSPs by "activating one or the other of [the next-hop label-forwarding entry (NHLFE) entries] will serve to direct packets coming into an ingress node to the working or the protection path, effectively switching between working and protection LSPs."). Accordingly, Doshi is already equipped to switch back and forth between working and protection LSPs. Building upon Doshi to configure working LSPs as revertive, per Huang, would utilize already existing switching techniques. I also note that Doshi acknowledges that a POSITA would have had the necessary skill set to make "[v]arious modifications of the described embodiments." Doshi, [0300]. It would have been obvious for such

modifications to include reverting back to the working LSP after a failure of the working LSP has been cleared as taught by Huang.

220. Moreover, the reasonable expectation of success is evidenced by the fact that revertive switching was described in multiple RFCs discussing MPLS operation. Ex.1011, 12 (describing returning to an “original path when the failed resource becomes re-activated.”); Ex.1030, 16 (describing a “Revertive 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.”). As explained above, RFCs are intended for and familiar to POSITAs. *See, e.g.*, Ex.1027, 6, (“RFCs can be obtained from a number of Internet hosts...”), 8 (IETF documents are “readily available to a wide audience”), 26 (IETF participants “shall publicly announce...every activity” relating to the standardization process). Indeed, POSITAs had implemented the revertive switching described in these RFCs. *See*, Ex.1036 [0011], [0040]-[0041], [0067] (incorporating by reference the entire teachings of RFC 3209 and explicitly recognizing that “once P1 [the failed resource] is restored, the redirected traffic will return to its original path”).

221. Lastly, the proposed combination relies on the teachings of the references and does not require physical incorporation of elements from Huang into Doshi.

2. Claim 8: “The method of claim 4, further comprising the step of configuring said working entity as revertive.”

222. **First**, as discussed at Claim 2, Doshi describes “Switching Between Working and Protection LSPs” and explains that “after detecting a failure, end nodes of an LSP switch traffic from a primary (i.e., working) LSP to its corresponding protection LSP.” Doshi, [0266]-[0267]. Doshi also incorporates by reference in its entirety RFC 3209 (Doshi, [0056]), which describes returning to an “original path when the failed resource becomes re-activated.” Ex.1011, 12. Since Doshi describes switching from a working LSP to a protection LSP after a failure, and since Doshi incorporates RFC 3209’s disclosure of returning to an original path that is re-activated after a failure, it would have been obvious to POSITA for Doshi to revert back from the protection LSP to its original working LSP once the working LSP has been re-activated. That is, it would have been obvious to a POSITA to configure Doshi’s working LSPs as revertive. Thus, Doshi renders obvious “*configuring said working entity as revertive.*”

223. **Second**, like RFC 3209, Huang also teaches switching traffic from a failed working LSP to a backup LSP (e.g., a “protection LSP” in terms of Doshi):

A backup LSP may be set up between the head end node 102A and the tail end node 102B to protect each of the working links in the working bundle such that, **in the event of a failure in the fiber, each of the**

working links in the working bundle may be switched to corresponding individual backup LSPs, i.e., a backup bundle.

Huang, [0032].

224. I note that Huang’s “working links” are LSPs. *See* Huang, [0030]-[0031] (explaining that each “working link” is associated with an LSP and that a link is a “working link” when traffic is flowing over the LSP). Accordingly, I will refer to Huang’s “working links” as “working LSPs.”

225. Huang goes on to teach revertive switching such that traffic is switched back to the working LSP once the failure affecting the working LSP has been cleared, which corresponds to “*configuring said working entity as revertive*”:

Additionally, the mesh protection may support **revertive switching** and there may be an option to set a limit on the number of hops in the backup route and the maximum cost (customer defined) that the backup route can have. Note that **under revertive switching, the connection will be switched back from the backup LSP to the working link once the working link has cleared the failure that caused the switchover,** and a provisioned wait to restore period has timed out.

Huang, [0053].

226. A POSITA would have found it obvious to build upon Doshi’s teaching of switching between working and protection LSPs by adding revertive switching as

taught by Huang, such that the switch configures the working LSP to be used again once the fault is cleared. As discussed at Section VII.D.1, a POSITA would have recognized that in instances of quick restoration, e.g., in the case of a mistaken failure diagnosis that is quickly resolved, it would be simpler to revert back to the working LSP instead of calculating the costs for all LSPs to ultimately reach the same result of selecting the working LSP. Moreover, revertive switching was generally known in the art at the time as evidenced by, for example, RFC 3469 which describes a “Revertive Mode” in which “traffic is automatically switched back from the recovery path to the original working path upon restoration of the working path to a fault-free condition.” Ex.1030, 16; *see also* Ex.1036, [0067] (recognizing that “once P1 [the failed resource] is restored, the redirected traffic will return to its original path”). Further support for the combination is provided in Section VII.D.1.

227. Therefore, Doshi in combination with Huang renders obvious “*further comprising the step of configuring said working entity as revertive,*” as claimed.

3. Claim 12: “The method of claim 10, further comprising the step of configuring said working entity as revertive.”

228. *See* analysis at Claim 8.

E. Ground 3: Claims 14-16 are rendered obvious by *Doshi* in view of *Guichard* and *Ashwood Smith*

229. Based on the following analysis, I conclude that a POSITA at the relevant time (June 22, 2011) would have understood the limitations of Claims 14-

16 were expressly disclosed, taught, or suggested by Doshi in combination with Guichard and Ashwood Smith. In my opinion, a POSITA would have found Claims 14-16 obvious in view of the prior art.

1. Motivation to Combine Doshi with Guichard and Ashwood Smith

230. As explained above for Ground 1, a POSITA would have been motivated to combine Doshi with Guichard. A POSITA would have also been motivated to combine Ashwood Smith with Doshi (as modified by Guichard) for the reasons below.⁶

231. First, Doshi and Ashwood Smith are analogous art to the '821 Patent. Similar to the '821 Patent and Doshi, Ashwood Smith relates to communication networks and, more particularly, to methods for determining a backup path for protecting a working path in a data transport network. '821 Patent, 3:15-18, Abstract; Doshi, [0049]; Ashwood Smith, Title, 1:6-8, 1:11-12, 2:15-25. Thus, Ashwood Smith also addresses the problem of selecting paths within a communication network. '821 Patent, 4:63-5:8; Doshi, [0014]; Ashwood Smith, Abstract, 1:15-25. Accordingly, given the similarities between the references and the fact that they address the problem of selecting paths in a communication network, a POSITA

⁶ The proposed combination relies on the teachings of the references and does not require physical incorporation of elements from Ashwood Smith into Doshi.

considering Doshi would have naturally considered the teachings of Ashwood Smith.

232. Second, a POSITA would have been motivated to combine the teachings of Doshi and Ashwood Smith to produce numerous predictable and beneficial results.

233. Doshi teaches protecting services against link failures by considering disjointedness when selecting primary and protection paths. Doshi, [0155]-[0156]. Doshi explains that strictly disjoint paths share no common links or nodes other than their common ingress and egress nodes such that a single network element failure is unlikely to impact two different strictly disjoint paths. Doshi, [0055], [0158]. Doshi recognizes, however, that there “will be some cases...where no strictly disjoint path exists” or where “other factors or constraints of the routing algorithm may lead to selection of a protection path, for a given primary path, that is not strictly disjoint from the primary path (e.g., the protection path may share some common links with the primary path).” Doshi, [0055].

234. Ashwood Smith complements Doshi by teaching “to take into account the actual probability of failure at a common point shared by” two paths when selecting a path. Ashwood Smith, 10:21-26; *see also id.*, 3:19-21 (“probability of failure at the common point”), 2:21-25, 11:4-9. Ashwood Smith’s method determines the probability of failure at a common point shared between two paths

and, based on the probability of concurrent failure of the two paths, determines if it is “acceptable to allow working paths sharing that common point to also share a common segment on a backup path.” Ashwood Smith, 10:26-11:1. It further teaches that the determination of whether to accept or reject a segment may be made based on whether “the probability [of concurrent failure] is below [or above] a certain level.” *Id.*, 11:1-9. Thus, Ashwood Smith demonstrates that it was known to take into account the probability of concurrent failure of two paths as part of the path selection process. Moreover, a POSITA would have understood that calculating a probability of concurrent failure of two paths sharing a common segment would provide an added layer of protection against network failure, by assuring that the chosen protection path would serve its purpose, in that it is still working when needed (e.g., not failing at the same time as the working path) and available (e.g., not being used by another working path that has failed at the same time).

235. A POSITA would have been motivated to apply Ashwood Smith’s teaching of determining a probability of concurrent failure among two paths when implementing Doshi’s path selection process, because Doshi expressly contemplates situations in which the working and protection entities are not strictly disjoint. Doing so would better inform Doshi’s path selection decisions and better protect services against link failures in circumstances where no strictly disjoint pair of paths exists or where other factors lead to selection of a partially disjoint pair as discussed

above. Determining the probability of concurrent failure of the two paths, as taught by Ashwood Smith, would allow for a more refined selection between pairs of paths that have the same level of disjointedness (e.g., between pairs all having a primary path that shares an equal number of links in common with its protection path) as contemplated by Doshi. Even though such pairs have the same disjointedness, a POSITA would have understood that there may be differences in risk of failure for different common points along the paths (e.g., different links). *See, e.g.*, Ashwood Smith at 10:26-31 (recognizing that “the probability of failure at a certain common point may vary depending on the type of hardware or software used at that location”). For example, a pair in which the link in common between primary and protection paths of the pair has a higher risk of failure would, everything else being equal, be more likely to concurrently fail than a pair in which the link in common has a lower risk of failure. A POSITA would have been motivated to apply Ashwood Smith’s probability of concurrent failure determination to differentiate between such possible pairs of paths when implementing Doshi’s selection techniques. This would reduce the probability of concurrent failure of Doshi’s selected pair and thereby improve reliability in the network.

236. The combination is merely the use of a known technique (Ashwood Smith’s probability determination) to improve a similar method (Doshi’s method for selecting paths) in the same way with predictable results (selecting a working entity

and protection entity with a lower probability of concurrent failure). I also note that the results would have been predictable and there would have been a reasonable expectation of success in the combination given that Doshi and Ashwood Smith are analogous art and in the same field of endeavor.

237. Implementing the combination would have been within a POSITA's skillset since techniques for determining the probability of network failures were known in the art. *See* Ex.1026, 10:20-21 (describing a "method for computing various network element failure probabilities"). Ashwood Smith leaves implementation details of failure probability determination to a POSITA and thus recognizes that a POSITA would have had sufficient skills to configure the determination. Indeed, Ashwood Smith explains that the method "can be implemented on a computer...a program element with functional blocks corresponding to the various steps of the process is stored on a computer readable storage medium." *Id.* at 11:11-16. I also note that Ashwood Smith states that "[a]lthough various embodiments have been illustrated, this was for purpose of describing, not limiting, the invention." Ashwood Smith, 11:19-24. Since Doshi is analogous art in the same field of endeavor, it would have been obvious to carry out Ashwood Smith's probability of concurrent failure determination in the context of Doshi's path selection. In that regard, Doshi acknowledges that a POSITA would have had the necessary skill set to make "[v]arious modifications of the described

embodiments.” Doshi, [0300]. It would have been obvious for such modifications to include a probability determination of concurrent failure of two paths being considered, as taught by Ashwood Smith, especially given that Doshi expressly contemplates the possibility of selecting paths that are not strictly disjoint.

2. Claim 14

(i) 14[Pre]: “A system for selecting entities within an MPLS network, comprising:”

238. As discussed at 1[pre], Doshi teaches a path selection method where the selected paths are LSPs within an SMDN having an MPLS network architecture, which corresponds to “selecting entities within an MPLS network.” The network manager, nodes, components, modules, switches, and corresponding communication paths, involved in performance of the method correspond to the claimed “system.” See Doshi, [0014], [0035], [0081], [0214], [0271].

239. As I further explain below, the prior art renders obvious all of the claimed features that the system comprises (“*comprising:*”).

(ii) 14[a]: “a data structure comprising a plurality of transport entity descriptors;”

240. First, as I discussed at 1[a], Doshi in combination with Guichard discloses providing a plurality of LSPs between two end nodes where the LSPs correspond to “*a plurality of [] transport entit[ies].*”

241. Second, as discussed at 1[b]-1[e], Doshi in combination with Guichard discloses calculating the cost of various LSP pairs and selecting the lowest cost pair. A POSITA would have found it obvious to store and reference “descriptors” of the LSPs at least temporarily in order to accomplish the cost calculation and selection described above. Such storage would be in a memory, entries in which a POSITA would understand corresponds to a “data structure.” Moreover, Doshi expressly describes saving information about a plurality of LSP pairs in a data structure during cost calculation:

In step 1108, the minimum sum is saved in the variable LowKSum and the minimum-cost pair is saved in the data structure LowKPair.

Doshi, [0143].

Next in step 1114, the sum is calculated of the cost of the primary and the restoration path for each of the L pairs and in step 1116, the lowest sum is stored in the variable LowLSum and the lowest-cost pair is stored in the data structure LowLPair.

Doshi, [0144].

242. Doshi goes on to describe maintenance of link-state databases that include information used for path computation:

The information made available to network nodes by these extensions can be used to build an extended link-state database just as node link-

state advertisements are used to build a “regular” link-state database.

The difference is that the extended link-state database (referred to below as the TE/Share database) has additional link attributes. Uses of the TE/Share database include (1) monitoring the extended link attributes and (2) globally optimized computation of protection paths.

Doshi, [0196].

243. These link-state databases include data structures containing path information:

In this scheme, in order to support sharing/restoration, every node maintains a local sharing information database (e.g., the TE/Share database). This database contains a data structure for each link L that the node owns. The data structure for each link contains information (e.g., bandwidth, link-id) about all the other links in the network for which link L provides restoration capacity.

Doshi, [0197]; *see also* Doshi, [0082], [0091]-[0095], [0172]-[0176].

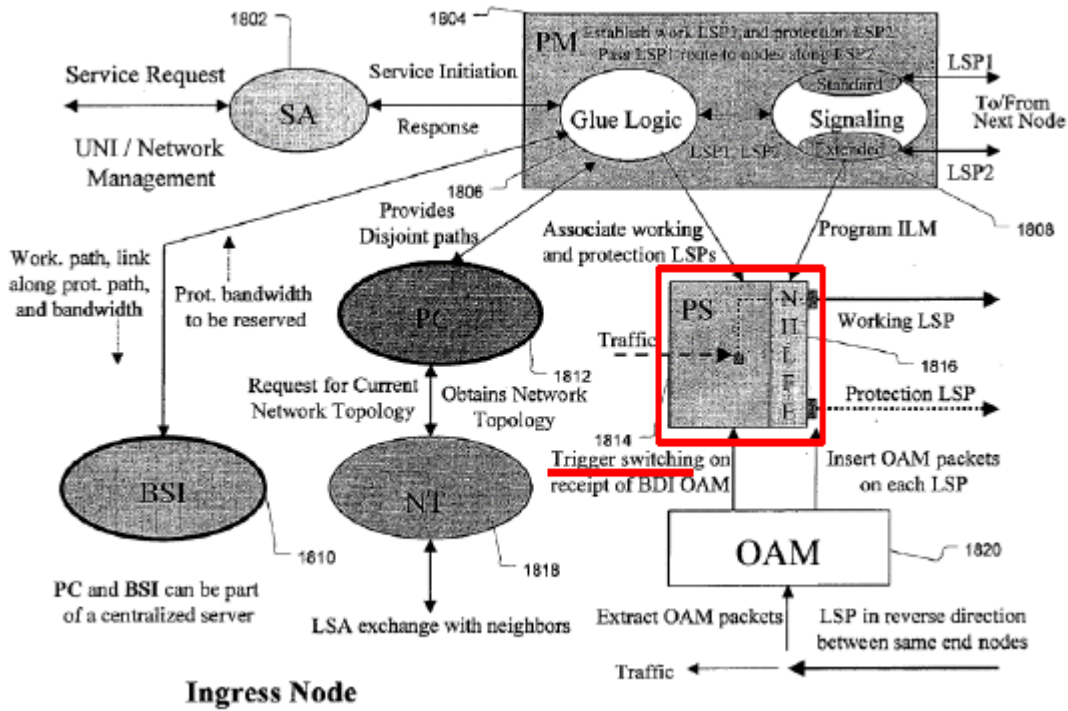
244. Doshi also describes a functional architecture that includes a “Path Management” module that is “responsible for path setup, refresh, tear-down, and monitoring functions.” Doshi, [0273]. It would have been obvious to a POSITA to store “descriptors” of the monitored paths in order to differentiate the paths and to

provide data entries for the paths such that changes can be tracked over time and saved in association with the relevant path.

245. Therefore, Doshi in combination with Guichard renders obvious “*a data structure comprising a plurality of transport entity descriptors*,” as claimed.

(iii) 14[b]: “an entity protection switch configured to switch between a working entity and a protection entity; and”

246. As discussed at Claim 2, Doshi describes “Switching Between Working and Protection LSPs” and explains that “after detecting a failure, end nodes of an LSP switch traffic from a primary (i.e., working) LSP to its corresponding protection LSP.” Doshi, [0266]-[0267]. Doshi further discloses a “Protection Switching (PS)” module that is “responsible for switching the affected traffic onto a protection LSP after detecting a failure or receiving failure notification.” Doshi, [0278]. Doshi illustrates one example of the Protection Switching module in Figure 18 showing its inclusion in a node of an LSP:



Doshi, Fig. 18 (annotated).

247. A POSITA would have understood that the node (including the Protection Switching module) or the Protection Switching module itself corresponds to the claimed “entity protection switch.”

248. Therefore, Doshi renders obvious “*an entity protection switch configured to switch between a working entity and a protection entity,*” as claimed.

(iv) 14[c]: “digital logic configured to select said working entity and said protection entity from said plurality of transport entity descriptors, comprising:”

249. First, as discussed at 1[pre]-1[e] and Claim 2, Doshi in combination with Guichard discloses logical flowcharts (e.g., at Figures 10 and 11) for selecting an LSP pair from the plurality of MPLS LSPs. The selection includes selecting a

primary LSP and selecting a protection LSP. Doshi's "primary" LSP is also referred to as a "working path" (e.g., working LSP). As discussed above at Claim 2, these working and protection LSPs correspond to the claimed "working entity" and "protection entity," respectively. As discussed at 14[a], a POSITA would have found it obvious to store and reference "descriptors" of the LSPs at least temporarily in order to accomplish cost calculation and selection of the LSPs. Accordingly, selection of a working LSP and protection LSP as discussed at 1[pre]-1[e] and Claim 2 corresponds to "select[ing] said working entity and said protection entity from said plurality of transport entity descriptors."

250. Second, a POSITA would have found it obvious to implement Doshi's flowchart logic (e.g., at Figures 10 and 11) with software or a combination of software and hardware ("digital logic") to perform the calculation and selection techniques using a series of modules. Doshi, [0270]-[0281]. A POSITA would have found it obvious to implement these modules in, for example, software or a combination of software and hardware ("digital logic") since it was well known that such an implementation would allow for execution of instructions to control functionality (e.g., performing calculations and making decisions). *See* Ashwood Smith, ("...can be implemented on a computer. More specifically, a program element with functional blocks corresponding to the various steps of the process is stored on a computer readable storage medium."); *see also* Ex.1016, [0072]

(describing “computer-executable instructions for performing the methods of the disclosed innovation.”); Ex.1017, 17:29-33 (describing “software and/or firmware provided in a read only memory ... for execution” by a processor “to implement the various functions as detailed below.”); Ex.1018, [0021] (describing using “software instructions to implement the present invention.”).

251. Software or a combination of software and hardware that executes instructions, for example to carry out the flowchart of Figures 10 and 11, to calculate and select the lowest cost pair, corresponds to “digital logic configured to select said working entity and said protection entity.” A POSITA would have found it obvious to include such software or a combination of software and hardware in, for example, Doshi’s “network manager,” including the “Path Management” module that is “responsible for path setup, refresh, tear-down, and monitoring functions.” *See* Doshi, [0271]-[0273].

252. Therefore, Doshi in combination with Guichard and Ashwood Smith renders obvious “*digital logic configured to select said working entity and said protection entity from said plurality of transport entity descriptors,*” as claimed.

(v) 14[d]: “logic configured to determine a probability of concurrent failure of said working entity and said protection entity;”

253. As discussed at 1[b] and Claim 5, Doshi’s path calculation considers disjointedness. As discussed at Claim 2, these paths are working and protection LSPs

(“working entity” and “protection entity,” respectively). A POSITA would have understood that probability of concurrent failure is inversely related to disjointedness—as paths become more disjoint, the likelihood they will fail concurrently goes down.

254. For example, Doshi recognizes that when two paths are disjoint, e.g., by being node and link disjoint, “then a failure affecting one of them will not affect the other.” Doshi, [0040]. Thus, it would take two distinct failures (one affecting each path) for both paths to fail concurrently. Since Doshi explains that “the probability of occurrence of more than one failure during the time interval required to repair a failure is very insignificant,” a POSITA would have understood that determining that two paths are disjoint with no nodes or links in common is also a determination that the paths have a “very insignificant” probability of failing concurrently. Doshi, [0040].

255. Accordingly, determining path disjointedness (which is part of Doshi’s flowchart) corresponds to “determin[ing] a probability of concurrent failure” since knowledge of disjointedness represents a determination that there is a “very insignificant” likelihood that the paths will fail at the same time.

256. Doshi plainly considers the probability of concurrent failure as part of its calculations and selection process of Figure 11. The probability of failure is a factor in Doshi’s cost determination since it performs one calculation (LowKSum)

that is based on shared paths (which have a higher probability of joint failure) and another calculation (LowLSum) for disjoint paths (with “very insignificant” probability of joint failure).

257. I also note that Doshi’s process of Figure 11 is very similar to the ’821 Patent’s method of Figure 4C, which determines a subset of entity pairs with a minimum probability of failure (e.g., disjoint pair).

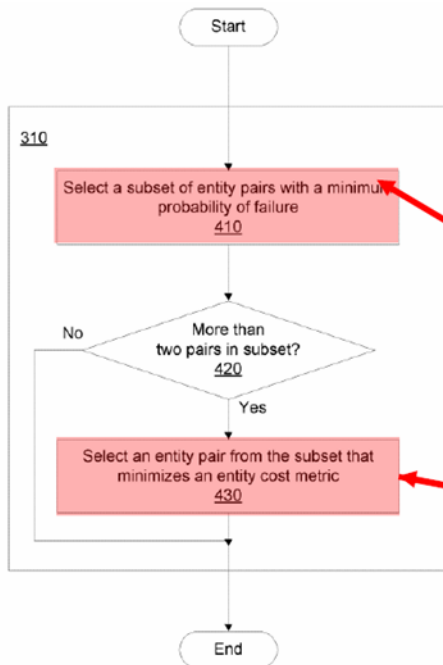


FIG. 4C

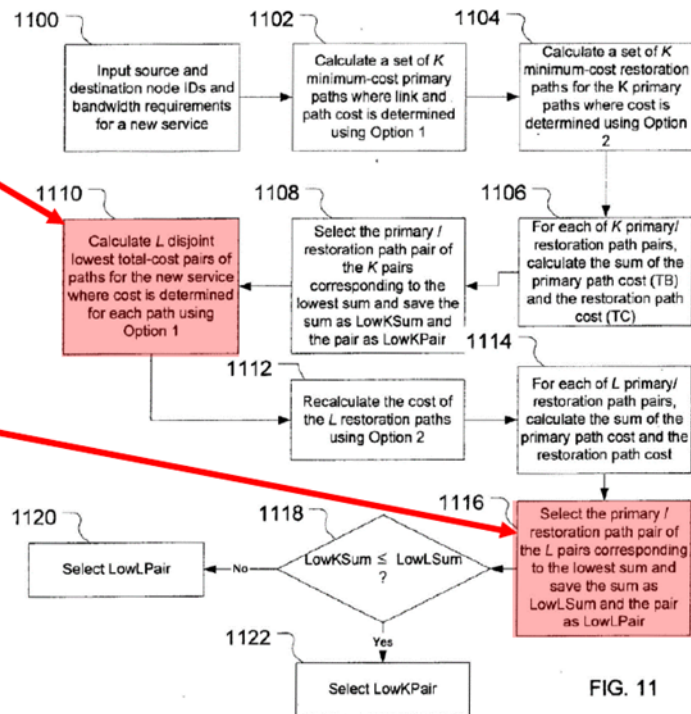


FIG. 11

Ex.1001, Fig. 4C (annotated).

Ex.1005, Fig. 11 (annotated).

258. Therefore, Doshi’s disclosure of selection logic configured to perform the method of Figure 11, including logic to determine disjoint pairs that have “very

insignificant” probability of simultaneous failures, teaches “logic configured to determine a probability of concurrent failure...”

259. Likewise, in circumstances where no disjoint paths having a “very insignificant” probability of failing concurrently exist, or where other factors prevent selection of such disjoint paths, it would have been obvious to build upon Doshi’s calculation and selection techniques by applying Ashwood Smith’s teaching of determining the probability of concurrent failure of two paths. *See* Doshi, [0055] (recognizing that there “will be some cases ... where no strictly disjoint path exists” or where “other factors or constraints” lead to a selection “that is not strictly disjoint.”).

260. Similar to Doshi, Ashwood Smith discloses a network architecture that uses a working path and a backup path for the transportation of data and selects a path out of multiple possible paths. Ashwood Smith, Abstract. To inform path selection, Ashwood Smith “takes into account the existence of a potential point of failure common to the working paths sharing the segment.” Ashwood Smith, 2:15-25; *see also id.*, 7:2-13 (describing shared segments between working paths and the problems with concurrent failure). Ashwood Smith teaches to take into account the “actual probability of failure at a common point” shared by two paths (i.e., a probability of concurrent failure of the two paths) when selecting a backup path. *See* Ashwood Smith, 10:21-26. Ashwood Smith further explains that “[i]f the common

point is highly unlikely to fail, it may be acceptable to allow working paths sharing that common point to also share a common segment on a backup path.” Ashwood Smith, 10:21-11:1.

261. Thus, Ashwood Smith demonstrates that it was known to take into account the probability of concurrent failure among two paths as part of a path selection process, and that such a technique advantageously permits the selection of paths for which the probability of concurrent failure due to the failure of the common segment is very low, i.e., “highly unlikely.” Ashwood Smith, 10:31-11:1. Thus, as discussed above, a POSITA would have understood that calculating a probability of concurrent failure of two paths that share a common segment (i.e., two paths that are not strictly disjoint, as contemplated by Doshi), would provide an extra layer of protection in the network by providing additional assurance that that such simultaneous failure would be unlikely.

262. Moreover, Ashwood Smith teaches calculating the probability of concurrent failure of two paths in a data communication network. Doshi teaches that there is a possibility of the paths being disjointed, meaning that two paths – such as a working path and a protection path – share a link or node in common with one another. Both Doshi and Ashwood Smith describe a process of selecting a backup path in an effort to minimize disruptions based on failure of a working path. Ashwood Smith makes a selection of an appropriate backup path by, in part,

determining the probability of concurrent failure of two of its working paths by checking the particular instances where the two working paths share a common point and calculating the probability of failure at that common point (i.e., the probability of concurrent failure of the two paths). It would have been obvious to a POSITA, in view of this description of a probability of concurrent failure of the two working paths, to calculate the probability of concurrent failure of two other paths in Doshi's system – a working path and a protection path.

263. In summary, a POSITA would have found it obvious to determine the probability of concurrent failure, as taught by Ashwood Smith, when implementing Doshi's calculation and selection techniques. As discussed at VII.E.1, determining the probability of concurrent failure would allow for a more refined selection between pairs of paths that have the same disjointedness (e.g., between pairs all having a primary path that shares one link in common with its protection path). A POSITA would have been motivated to apply Ashwood Smith's probability determination to differentiate between such pairs when implementing Doshi's selection techniques. Further support for the combination is provided in Section VII.E.1.

264. Furthermore, as discussed at 14[c], in view of Doshi, Guichard, and Ashwood Smith, a POSITA would have found it obvious to use “digital logic” to perform Doshi's flow chart logic, including calculation and selection techniques. As

discussed above, it would have been obvious to expand Doshi's calculation and selection techniques to determine Ashwood Smith's probability of concurrent failure. A POSITA would have found it obvious to implement Doshi's various modules that would perform the combined techniques in, for example, software or a combination of software and hardware ("digital logic") since it was well known that such an implementation would allow for execution of instructions to control functionality (e.g., performing calculations and making decisions). Software or a combination of software and hardware that executes instructions, for example to carry out the flowchart of Figures 10 and 11, including as modified with the teachings of Ashwood Smith, to calculate and select the lowest cost pair corresponds to "logic" for performing the task specified by the instruction(s). It would have been obvious for the instruction(s) to "determine a probability of concurrent failure" to be part of Doshi's "Path Computation" module, since this is the module that performs cost calculations. *See* Doshi, [0274].

265. Therefore, Doshi, Guichard, and Ashwood Smith render obvious "*logic configured to determine a probability of concurrent failure of said working entity and said protection entity,*" as claimed.

(vi) 14[e]: “logic configured to determine an entity cost of said plurality of transport entity descriptors: and”

266. First, as discussed at 1[b], Doshi’s calculation calculates the path cost for each path in a candidate pair so that the path cost can be summed to generate the cost of the pair together. This is done for all candidate pairs, which means that a path cost is calculated for each path. As discussed at 14[a], a POSITA would have found it obvious to store and reference “descriptors” of the LSPs at least temporarily in order to accomplish cost calculation and selection of the LSPs. Accordingly, calculating the path cost corresponds to “determin[ing] an entity cost of said plurality of transport entity descriptors.”

267. Second, as discussed at 14[c], in view of Doshi, Guichard, and Ashwood Smith, a POSITA would have found it obvious to use “digital logic” to perform Doshi’s flowchart logic, including calculation and selection techniques. For example, a POSITA would have found it obvious to implement Doshi’s various modules that perform the techniques in, for example, software or a combination of software and hardware (“digital logic”) since it was well known that such an implementation would allow for execution of instructions to control functionality (e.g., performing calculations and making decisions). Software or a combination of software and hardware that executes instructions, for example to carry out the flowchart of Figures 10 and 11, to calculate and select the lowest cost pair

corresponds to “logic” for performing the task specified by the instruction(s). It would have been obvious for the instruction(s) to “determine an entity cost” to be part of Doshi’s “Path Computation” module, since this is the module that performs cost calculations. *See* Doshi, [0274].

268. Therefore, Doshi, Guichard, and Ashwood Smith render obvious “*logic configured to determine an entity cost of said plurality of transport entity descriptors,*” as claimed.

(vii) 14[f]: “logic configured to reselect said working entity and said protection entity from said plurality of transport entity descriptors upon a reselection event,”

269. First, as discussed at 1[pre]-1[e] and Claim 2, Doshi in combination with Guichard discloses reselecting an LSP pair from the plurality of MPLS LSPs in response to an event. The reselection includes reselecting a primary LSP and a protection LSP provided that they remain the lowest cost pair. Doshi’s “primary” LSP is also referred to as a “working path” (e.g., working LSP). Put differently, Doshi discloses reselecting a working LSP and a protection LSP. As discussed above at Claim 2, these working and protection LSPs correspond to the claimed “working entity” and “protection entity,” respectively. As discussed at 14[a], a POSITA would have found it obvious to store and reference “descriptors” of the LSPs at least temporarily in order to accomplish cost calculation and selection of the LSPs. Accordingly, reselection of a working LSP and protection LSP as discussed at 1[pre]-1[e] and Claim 2 corresponds to “reselect[ing] said working entity and said protection entity from said plurality of transport entity descriptors upon a reselection event.”

270. Second, as discussed at 14[c], in view of Doshi, Guichard, and Ashwood Smith, a POSITA would have found it obvious to use “digital logic” to perform Doshi’s flow chart logic, including calculation and selection techniques. Such selection techniques are simply repeated in the case of reselection, so it

likewise would have been obvious to use “digital logic” to perform Doshi’s reselection. A POSITA would have found it obvious to implement Doshi’s various modules for performing the techniques in, for example, software or a combination of software and hardware (“digital logic”) since it was well known that such an implementation would allow for execution of instructions to control functionality (e.g., performing calculations and making decisions). Software or a combination of software and hardware that executes instructions, for example to carry out the flowchart of Figures 10 and 11, to calculate and select the lowest cost pair corresponds to “logic” for performing the task specified by the instruction(s). For example, a POSITA would have found it obvious to include instruction(s) to monitor and reselect the current pair if it remains the lowest cost pair following a reoptimization evaluation in, for example, Doshi’s “Path Management” module that is “responsible for path setup, refresh, tear-down, and monitoring functions.” *See* Doshi, [0273].

271. Therefore, Doshi, Guichard, and Ashwood Smith render obvious “*logic configured to reselect said working entity and said protection entity from said plurality of transport entity descriptors upon a reselection event,*” as claimed.

(viii) 14[g]: “wherein said reselection event is selected from a group consisting of adding an entity to said plurality of transport entities, removing an entity from said plurality of transport entities, an operational status change for one of said plurality of transport entities, and a change in overall cost for one of said plurality of transport entities.”

272. See analysis at 1[e].

3. **Claim 15: “The system of claim 14, wherein said entity protection switch comprises a 1:1 switch.”**

273. Doshi discloses “wherein said entity protection switch comprises a 1:1 switch.”

274. First, as discussed at 14[b], Doshi discloses the claimed “entity protection switch.”

275. Second, Doshi describes a 1:1 protection scheme. As Doshi points out, “[i]f the bandwidth were allocated in advance of a failure, this would correspond, in the parlance of the field of protection and restoration for optical transport networks, to a 1:1 protection scheme.” Doshi, [0060]. Accordingly, Doshi recognizes that some embodiments would use such a 1:1 protection scheme. Doshi’s protection switching module in the context of a 1:1 protection scheme renders obvious “*wherein said entity protection switch comprises a 1:1 switch,*” as claimed.

4. Claim 16: “The system of claim 14, wherein said entity protection switch comprises a 1+1 switch.”

276. Doshi discloses “*wherein said entity protection switch comprises a 1+1 switch.*”

277. First, as discussed at 14[b], Doshi discloses the claimed “*entity protection switch.*”

278. Second, Doshi describes a 1+1 protection scheme. As Doshi points out, “If the bandwidth were not only allocated, but additionally if a copy of the service path's data were to be duplicated to the protection path, this would correspond to a 1+1 protection scheme.” Doshi, [0060]. Doshi expressly recognizes there are circumstances “when a 1+1 restoration scheme is the best option available for restoration” and notes that 1+1 protection schemes are “popular.” Doshi, [0147], [0178]. Doshi’s protection switching module in the context of a 1+1 protection scheme renders obvious “*wherein said entity protection switch comprises a 1+1 switch,*” as claimed.

VIII. SECONDARY CONSIDERATIONS

279. During prosecution of the ’821 patent, the applicant did not identify any evidence of secondary considerations of non-obviousness tied to the claimed invention of the ’821 patent. I understand from counsel for Petitioner that Patent

Owner in the co-pending district court litigation has not yet identified any evidence with respect to secondary considerations of non-obviousness.

280. Accordingly, there is no objective evidence of non-obviousness that might warrant a finding that Claims 1-20 are patentable. To the extent the Patent Owner at a later date cites or provides any other evidence regarding secondary considerations, including any expert opinions, I reserve the right to supplement my analysis and opinions to address it.

IX. CONCLUSION

281. For at least the above-described reasons, in my opinion Claims 1-20 of the '821 patent would have been obvious to a POSITA based on the prior art references that I have cited and analyzed above.

282. In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

283. I reserve the right to supplement my opinions in the future to respond to any arguments raised by Patent Owner and to consider any new information that becomes available to me.

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 2nd day of August 2024, in St. Louis, Missouri.

Respectfully submitted,

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

Paul Min, Ph.D.

APPENDIX A

Paul S. Min, Ph.D.
Washington University in Saint Louis
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Education

<u>Year</u>	<u>College or University</u>	<u>Degree</u>
1987	The University of Michigan	Ph.D. in Electrical Engineering
1984	The University of Michigan	M.S. in Electrical Engineering
1982	The University of Michigan	B.S. in Electrical Engineering

Professional Experience

From: 1990
To: Present
Organization: Washington University, St. Louis

Summary:

2015 - Senior Professor - Department of Electrical Systems Engineering

2011 – 2014 Chair – Undergraduate Curriculum, Department of Electrical and Systems Engineering

2000 – 2002 Chair – Graduate Curriculum, Department of Electrical and Systems Engineering

2002 - 2014 Associate Professor - Department of Electrical and Systems Engineering

1997 - 2008 On leave from full-time duty at Washington University – as Presidents of MinMax Technologies and Erlang Technology.)

1996 - 2002 Associate Professor - Department of Electrical Engineering

1996 Promoted with Tenure

1990 - 1996 Assistant Professor - Department of Electrical Engineering

- Teaching Experience
- “Transmission System and Multiplexing,” Washington University, ESE 571
 - “Electrical Laboratory I,” Washington University, EE 250.
 - “Communication Theory,” Washington University, ESE 471.
 - “Reliability and Quality Control,” Washington University, ESE 405/505
 - “Signaling and Control of Communications Networks,” Washington University, ESE 572.
 - “Introduction to Electronic Circuits,” Washington University, ESE232
 - “Queueing Systems and Discrete Stochastic Processes,” Washington University, EE 536 / CS 567.
 - “Digital Computer,” Washington University, EE 260M / CS 260.
 - “Data Networks,” Washington University, EE 530.
 - “Electrical Circuit Analysis,” Washington University, ESE 230.
 - “Computer/Communications System Analysis I,” Washington University, EE 557/ CS 557.
 - “Computer/Communications System Analysis II,” Washington University, EE558 / CS 558.
 - “Digital Systems Laboratory,” Washington University, EE 455 / CS 455.

From: 1999
To: 2008
Organization: Erlang Technology, Inc., St. Louis, Missouri
Title: Founder and President
Summary: Up to 70 employees, \$40M in total capital raised from 5 VCs and 3 Corporations
Received “Product of Year” Award from Analog Zone Magazine in 2004

From: 1997
To: 1999
Organization: MinMax Technologies, Inc., St. Louis, Missouri
Title: Founder and President
Summary: Fabless semiconductor company, designing high performance switching ASICs

From: September 1987
To: August 1990
Organization: Bellcore, New Jersey
Title: Member of Technical Staff
Summary: Member of New Network Architecture Development Group

From: 1983
To: 1987

Organization: Department of Electrical Engineering, The University of Michigan
Title: Graduate Instructor
Summary: Instructor for senior level Electrical Engineering Laboratory Class. Received a Best “Best Graduate Instructor Award” from the Department of Electrical Engineering

Professional Affiliations, Achievements & Awards

- Technical Program Committee, COMCAS 2021, Tel Aviv, November 2021.
- Technical Program Committee, COMCAS 2019, Tel Aviv, November 2019.
- Technical Program Committee, COMCAS 2017, Tel Aviv, November 2017.
- Technical Program Committee, COMCAS 2015, Tel Aviv, October 2015.
- Past-Chair, Saint Louis Section of the Institute of Electrical and Electronics Engineers (IEEE), 2015.
- Member of Executive Committee, Saint Louis Section of the IEEE, 2010-2015.
- Chair, Saint Louis Section of the IEEE, 2014.
- Technical Program Committee, COMCAS 2013, Tel Aviv, October 2013.
- Vice Chair, Saint Louis Section of the IEEE, 2013
- Treasurer, Saint Louis Section of the IEEE, 2012.
- The Best Paper Award at MOBILITY 2011, October 2011, Barcelona, Spain.
- Counselor, Student Chapter of the Year, the Institute of Electrical and Electronics Engineers, 2011.
- Award of Appreciation, Saint Louis Section of the Institute of Electrical and Electronics Engineers, 2011, for contribution to various activities of the Saint Louis Section the Institute of Electrical and Electronics Engineers.
- Secretary, Saint Louis Section of the IEEE, 2010.
- Counselor, Student Chapter of the Year, the Institute of Electrical and Electronics Engineers, 2010.
- Wall Street Journal Businessmen of Year, 2003.
- American Men and Women of Science, listed in 1997.
- Member, Eta Kappa Nu (Honor Society for Electrical Engineers), inducted in 1992
- Outstanding Achievement Award, Bellcore, 1990.
- 18th ISATA Award of Technical Excellence, the best paper award at ISATA 1988.
- Rockwell Fellow, Rockwell International, 1985, 1986.
- Outstanding Graduate Student Award, the University of Michigan, 1985.
- Outstanding Teaching Award, the University of Michigan, 1984, 1986.
- Member of Honor's College, the University of Michigan, 1979, 1980.

- Honor's Convocation, the University of Michigan, 1979.
- Outstanding Freshman Award, the University of Michigan, 1979.
- Woodhaven Rotary Club Scholarship, Woodhaven Rotary Club, 1978.
- Second Place Winner, the State of Michigan Mathematics Prize Competition, 1977.
- International Program Committee, *IASTED International Conference on Communications, Internet and Information Technology (CIIT 2005)*, Cambridge, Massachusetts from October 31-November 2, 2005.
- International Program Committee, *IASTED International Conference on Communications 2003*, Scottsdale, Arizona, 2003.
- International Program Committee, *Wireless and Optical Communications 2003*, Banff, Canada, 2003.
- International Program Committee, Session Chair, *Wireless and Optical Communications 2002*, Banff, Canada, 2002.
- Invited participant, *NSF Workshop on Enhancing International Cooperation in CS/CE Research and Education*, Portland, 1997.
- Session Chair, *the 1993 Conference on Information Sciences and Systems*, Baltimore, March 1997.
- Member, Board of Editors, *Journal of Network and Systems Management*, 1996-1998.
- Program Committee, *International Symposium on Integrated Network Management*, San Diego, 1997.
- Guest Editor, *Journal of Network and Systems Management, Special Issue on Routing in Broadband Networks*, December 1995 and June 1996.
- Invited participant, *ARPA Workshop on Survivability of Large Scale Systems*, Washington D.C., 1996.
- Special Event Organizer, *International Symposium on Integrated Network Management*, Santa Barbara, 1995.
- Organizing Committee, *International Symposium on Integrated Network Management*, Santa Barbara, 1995.
- Local Arrangements Chair, *IEEE Information Theory Workshop on Information Theory Multiple Access and Queueing*, St. Louis, 1995.
- Chair, *Communications Chapter, St. Louis Section of the IEEE*, 1995.
- Participant, *IEEE Information Theory Workshop on Information Theory, Multiple Access and Queueing*, St. Louis, 1995.
- Participant, *ARPA/AFOSR Non-Linear Optics and Communication Workshop*, Denver, 1994.
- Participant, *CNRI Giga Bit Network Workshop*, Washington D.C., 1993.
- Participant, *IFIP/IEEE International Workshop on Distributed Systems*, New Jersey, 1993.
- Program Committee, *International Conference on Computer Communications and Networks*, San Diego, 1992.
- Session Chair, *ISMM International Conference*, New Orleans, 1990.
- Senior Member, *IEEE*.

- Member, *IEEE Committee on Network Operations and Management*.
- Member, *IEEE Committee on Computer Communications*.
- Registered Specialist, *Hong Kong Research Grant Council*.
- Reviewer, *IEEE Transactions on Communications*.
- Reviewer, *IEEE Transactions on Networking*.
- Reviewer, *IEEE Journal on Selected Areas in Communications*.
- Reviewer, *Journal of Network and Systems Management*.
- Reviewer, *Telecommunication Systems*.
- Reviewer, *Computers and Electrical Engineering*.
- Reviewer, *ETRI Journal*.
- Reviewer, *IEEE Transactions on Automatic Control*.
- Reviewer, *IEEE Communications*.
- Book Reviewer, *Prentice Hall*.
- Book Reviewer, *Morgan Kaufmann Publishers, Inc.*
- Book Reviewer, *Irwin Publishing Co.*

University Activities:

- Undergraduate Studies Committee, School of Engineering and Applied Science (2012 – Present)
- Faculty Advisor for IEEE Student Chapter (2009 – Present)
- Ambassador for McDonnell International Scholar Academy (2007 – 2013)
- Web Development Committee (2006 – 2008)
- University Judicial Board (1998 - 2000)
- Resource Generation Committee (1994 - 1995)
- Top 20 Committee (1992 - 1995)
- Telecommunications Committee, Chair (1991 - 1997)
- Library Planning Committee (1991 - 1992)
- Computer Engineering Committee (1990 - 1996)
- Communications Curriculum Committee (1990 - 1992)
- Resources Committee (1990 - 1992)

Patents

<u>Patent No.</u>	<u>Date</u>	<u>Title</u>
10,623,323	04/14/20	Network Devices and a Method for Signature Pattern Detection
10,284,476	05/07/19	Hierarchical Pattern Matching Devices and Methods

7,110,411	09/19/06	Method of and Apparatus for WFQ Scheduling Using a Plurality of Scheduling Queues to Provide Fairness, High Scalability, and Low Computational Complexity
7,106,738	09/12/06	Method of and Apparatus for High Speed Packet Switching Using Train Packet Queuing and Providing High Scalability
6,859,455	02/22/05	Method of and Apparatus for Building and Using Multi-Dimensional Index Trees for Multi-Dimensional Data Objects
6,614,789	09/02/03	Method of and Apparatus for Matching Strings of Different Lengths
6,359,885	3/19/02	Multi-Channel Packet Switching Apparatus Having Traffic Flow Controlling and Checking Functions
6,128,292	10/03/00	Packet Switching Apparatus with Multi-Channel and Multi-Cast Switching Functions and Packet Switching System Using the Same
5,788,161	12/13/98	Network Designer for Communication Networks
5,526,352	06/11/95	Integrable Low Complexity Multi-Channel Switch
5,440,549	08/08/95	Nonblocking Multi-Channel Switching with Multicasting Capability

Publications

- Yu, Qixiang, Luo, Z., and Min, P.S., “Intrusion Detection in Wireless Sensor Networks for Destructive Intruders.” Proceedings of the APSIPA 2015 conference. December 16-19, 2015.
- Hung, C.P., and Min, P.S., “Simple Web Application Framework.” Submitted for publication in the IEEE Transactions on Cloud Computing.
- Luo, Z., and Min, P.S., “Parallel Implementation of Energy-Based Target Localization Methods in Wireless Sensor Networks.” Proceeding of the 2014 IEEE SOUTHEASTCON.
- Yu, Q., Luo, Z., and Min, P.S., “Intrusion Detection in Wireless Sensor Networks for Destructive Intruder.” Proceeding of 2014 International Conference on Smart Computing (SMARTCOMP 2014).
- Luo, Z., and Min, P.S., “Survey of Target Localization Methods in Wireless Sensor Networks,” 19th IEEE International Conference on Networks (ICON 2013), Singapore, December 11-13, 2013.
- Hung, C.P., and Min, P.S., “Deriving and Visualizing the Lower Bounds of Information Gain for Prefetch Systems,” 19th IEEE International Conference On Networks (ICON 2013), Singapore, December 11-13, 2013.
- Hung, C.P., and Min, P.S., “Access LUT without CAM - Improved Pearson Hashing for Collision Reduction,” 19th IEEE International Conference On Networks (ICON 2013), Singapore, December 11-13, 2013.
- Luo, Z and Min, P.S., “Target Localization in Wireless Sensor Networks for Industrial Control with Selected Sensors.” International Journal of Distributed Sensor Networks, Volume 2013 (2013), Article ID 304631.
- Hung, C.P., and Min, P.S. “Performance Evaluation of Distributed Mobile Application Virtualization Services,” International Journal on Advances in Internet Technology, Vol. 5, no. 3&4, 2012, pp. 65-83.

- Hung, C.P. and Min, P.S., “Performance evaluation of distributed application virtualization services using the UMTS mobility model,” *MOBILITY 2011 The First International Conference on Mobile Services, Resources, and Users*, 23-29 Oct. 2011.
- Hung, C.P. and Min, P.S., “Service Area Optimization For Application Virtualization Using UMTS Mobility Model,” *International Conference on Internet Computing*, pp. 128-134, Las Vegas, July 18-21, 2011.
- Hung, C.P. and Min, P.S., “Application Virtualization Using UMTS Mobility Model,” *ICOMP'11*, September, 2011.
- Hung, C.P. and Min, P.S., “Infrastructure Arrangement for Application Virtualization Service,” the 9th International Information and Telecommunication Technologies Symposium, Vol.1, pp. 78-85, Rio de Janeiro, December 2010.
- Hung, C.P. and Min, P.S., “Probabilistic Approach to Network-Based Virtual Computing,” the 9th International Information and Telecommunication Technologies Symposium, Vol.1, pp. 117-124, Rio de Janeiro, December 2010.
- Shiravi, A. and Min, P. S., “On the Latency Bound of Proportional Nested-DRR with Credit Adjusting,” *2007 Workshop on High Performance Switching and Routing HPSR 2007*, July 2007.
- Shiravi, A. and Min, P. S., “LOOFA-PB: A Modified LOOFA Scheduler for Variable-Length Packet Switching.” *2007 IEEE International Conference on Communications (ICC 2007)*, Glasgow, June 2007.
- Shiravi, A., Kim, Y. G., and Min, P. S., “Congestion Prediction of Self-Similar Network through Parameter Estimation,” *Proceedings of 2006 IEEE/IFIP Network Operations & Management Symposium*, April 2006, Vancouver.
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Testimony Provided or Expected to Provide as Expert Witness

Matter: Patent Infringement for Wireless Local Area Networks
Law Firm: Quinn Emanuel Urquhard & Sullivan LLP

Case Name: Certain Audio Players and Components thereof (II). U.S.I.T.C. Inv. No. 337-TA-1330.
Testifying Expert for Google Inc.
Completed in June 2023.
(Expert reports submitted and deposited.)

Matter: Patent Infringement for Wireless Communications
Law Firm: Alston & Bird
Case Name: Atlas Global Technologies LLC v. ASUSTek Computers Inc. USDC WD TX
Civil Action No. 6:21-cv-820
Testifying Expert for ASUSTek
Completed in November 2023
(Expert report submitted.)

Matter: Patent Infringement for Wireless Communications
Law Firm: Perkins Coie
Case Name: Bell Northern Research, LLC v. HMD AMERICA, INC. et al., Case No.: 1:22-cv-22706-SCOLA/GOODMAN (S.D. Fla.)
Testifying Expert for HMD
Completed in December 2023
(Expert report submitted. Deposited.)

Matter: Patent Infringement for Wireless Communications
Law Firm: LAW OFFICES S. J. CHRISTINE YANG
Case Name: Atlas Global Technologies LLC v. ZyXEL Communications Corp. et al.,
U.S.D.C., W.D.T.X., Waco Div., Case No. 6:22-cv-00355 Atlas Global
Technologies LLC v. D-Link Corp. U.S.D.C., W.D.T.X., Waco Div., Case No.
6:22-cv-00520
Testifying Expert for ZyXel
Retained in March 2023.
(Expert report submitted.)

Matter: Patent Infringement for Wireless Communications
Law Firm: Finnegan, Henderson, Farabow, Garrett & Dunner, LLP
Case Name: Bell Northern Research v. MeidaTek Inc.
Testifying Expert for MediaTek Inc.
Retained in August 2023.

Matter: Patent Infringement for Home Security System
Law Firm: Foley and Lardner LLP
Case Name: Alarm.com v. Vivint, Inc., AAA Arbitration Case. No. 01-22-0004-5525 and
U.S.D.C. Case No. 2:23-cv-00004-JRG-RSP (E.D. Tex.),
Testifying Expert for Vivint, Inc.
Completed in 2023.

Matter: Patent Infringement for Wireless Communications and Electronics

Law Firm: Perkins Coie
Case Name: Bell Northern Research, LLC v. HMD AMERICA, INC. et al., Case No.: 1:22-cv-22706-SCOLA/GOODMAN (S.D. Fla.)
Testifying Expert for HMD
Completed in December 2023.

Matter: Patent Infringement for Network Switches
Law Firm: Charhon Callahan Robson & Garza, PLLC
Case Name: Sable Networks, Inc. and Sable IP, LLC v. CouldFlare, Inc. U.S.D.C. WD Tx
Case No. 6:21-cv-261
Testifying Expert for CloudFlare, Inc.
Completed in January 2024.
(Expert report submitted and deposed.)

Matter: Patent Infringement for Network Security
Law Firm: Fish and Richardson
Case Name: Finjan LLC v. Palo Alto Networks, Inc. – Case No. 4:14-cv-04908-PJH. USDC
ND CA, Oakland Division.
Testifying Expert for Finjan LLC.
Retained in September 2022.
(Expert report submitted and deposed.)

Matter: Patent Infringement for Network Management
Law Firm: Irell & Manella LLP
Case Name: SNMP Research, Inc. & SNMP Research International, Inc. v. Broadcom Inc.,
Brocade Communications Systems LLC, & Extreme Networks, Inc. U.S.D.C.
E.D. Tennessee at Knoxville Case No. 3:20-CV-451
Testifying Expert for SNMP Research.
Retained in May 2022.

Matter: Inter Parte Reexamination for Wireless Communications
Law Firm: Finnegan, Henderson, Farabow, Garrett & Dunner, LLP
Case Name: Patent reexamination in front of the U.S.P.T.O.
Testifying Expert for MediaTek
Retained in March 2023.

Matter: Patent Infringement for Network Switching
Law Firm: Baker Botts
Case Name: Corrigent Corp. v. Arista Networks, Inc., Case No. 1:22-cv-00497-UNA. USDC
Delaware
Testifying Expert for Arista
Retained in October 2022.

Matter: Patent Infringement for Mobile Devices
Law Firm: Fish and Richardson
Case Name: GComm v. Samsung, U.S.D.C. ED. TX. Case No.:2:22-cv-0078-JRG

Testifying Expert for Samsung
Completed in January 2024.

Matter: Patent Infringement for Wireless Networks
Law Firm: McKool Smith
Case Name: Certain Mobile Telephones, Tablet Computers with Cellular Connectivity, and Smart Watches with Cellular Connectivity, Components Thereof, and Products Containing Same. U.S.I.T.C. Inv. No. 337-TA-1299
Testifying Expert for Ericsson
Completed in July 2022.
(Expert report submitted and deposed.)

Matter: Patent Infringement for Semiconductor Manufacturing
Law Firm: Kramer Levin
Case Name: Oasis Tooling, Inc. v. Siemens Indus. Software, Inc., 1:22-cv-151 (D. Del.), Oasis Tooling, Inc. v. GlobalFoundries U.S. Inc., 1:22-cv-312 (D. Del.)
Testifying Expert for Oasis Tooling
Retained in June 2022.
(Expert reports submitted.)

Matter: Patent Infringement for Optical Networks
Law Firm: Duane Morris
Case Name: NextGen Innovations, LLC v. Infinera Corporation. U.S.D.C. ED. TX (Marshall)
Case No. 2:22-cv-00306-JRG-RSP / IPR
Testifying Expert for Infinera
Retained in April 2023.

Matter: Patent Infringement for Wireless Devices
Law Firm: King and Spalding LLP
Case Name: Intellectual Ventures, et. al. v. General Motors Company and General Company Motors, LLC, Case No. 6:21-CV-1088 pending in the Western District of Texas, Waco Division
Testifying Expert for General Motors
Completed in January 2023.
(Expert report submitted.)

Matter: Patent Infringement for Wireless Devices
Law Firm: Sterne Kessler
Case Name: Neo Wireless LLC v. Volkswagen Group of America, Inc. and Volkswagen Group of America Chattanooga Operations, LLC and related matters
Testifying Expert for Volkswagen
Completed in September 2023.
(Expert report submitted and deposed. IPR declarations submitted)

Matter: Patent Infringement for Wireless Networks
Law Firm: Covington & Burling LLP

Case Name: XR Communications, LLC v. D-Link Systems, Inc., No. 8:17-cv-00596
(Consolidated) (C.D. Cal.)
Testifying Expert for Hewlett Packard Enterprise
Completed
(Expert report submitted and deposed.)

Matter: Patent Infringement for USB Charging System
Law Firm: Orrick, Herrington & Sutcliffe LLP
Case Name: Fundamental Innovation Systems International LLC v. TCT Mobile (US), TCT
Mobile (US) Holdings, Inc., et al. U.S.D.C. Delaware No. 20-552-RGA-CJB
Testifying Expert for TCL
Completed in June 2022.
(Expert report submitted and deposed.)

Matter: Inter Parte Reexamination for Wireless Communications
Law Firm: Alston & Bird
Case Name: Patent reexamination in front of the U.S.P.T.O.
Testifying Expert for Nokia
Retained in May 2022.
(Expert report submitted.)

Matter: Patent Infringement for Network Management System
Law Firm: Morgan, Lewis & Bockius, LLP
Case Name: Certain Routers, Access Points, Controllers, Network Management Devices,
Other Networking Products, and Hardware and Software Components Thereof,
U.S.I.T.C. Inv. No. 337-TA-1227
Testifying Expert for Hewlett Packard, Netgear, and CommScope
Completed in August 2021.
(Expert report submitted, deposed, and testified during trial.)

Matter: Contract Dispute
Law Firm: Orrick, Herrington & Sutcliffe LLP
Case Name: Allied Telesis, Inc., et al vs. Micron Technology, Inc., Santa Clara County
Case No: 2015-1-CV-282977
Testifying Expert for Micron
Retained in 2021. Deposed in October 2021.
Completed in 2022

Matter: Patent Infringement for Security Systems
Law Firm: Forley and Lardner LLP
Case Name: Certain Residential Premises Security Monitoring and Automation Control
Panels, and Components Thereof (ITC Inv. No. 337-TA-1273) and ADT LLC et
al v. Vivint, Inc., Case No. 6:21-cv-00687 (W.D. Tex.)
Testifying Expert for Vivint, Inc.
Completed in April 2022.
(Expert report submitted, deposed, and testified during trial.)

Matter: Inter Parte Reexamination for Internet Communications

Law Firm: Perkins Coie

Case Name: Patent reexamination in front of the U.S.P.T.O.
Testifying Expert for Twitter
Retained in June 2020.
(Expert report submitted.)

Law Firm: Fisher Broyles

Case Name: Vaxcel International Co., Ltd. v. Heathco LLC, U.S.D.C. Delaware No. 20-224-LPS
Testifying Expert for Vaxcel
Retained in February 2021.
(Expert report submitted and deposed.)

Matter: Patent Infringement for Network Communication System

Law Firm: Charhon Callahan Robson & Garza, PLLC

Case Name: Sable Networks, Inc. and Sable IP, LLC, v. ClouFlare, Inc. U.S.D.C. WDTX,
Civil Action No. 6:21-cv-261
Testifying Expert for CloudFlare, Inc.,
Completed in January 2024.

Matter: Patent Infringement for Mobile Wireless Device

Law Firm: Pearl Cohen

Case Name: In the Matter Of Certain UMTS And LTE Cellular Communications Modules
And Products Containing The Same, U.S.I.T.C. Inv. No. 337-TA-1240
Testifying Expert for Telit Wireless Communication, Quectel, and Thales
Completed in March 2023.
(Expert reports submitted and deposed.)

Matter: Transactional Taxes for Internet Application

Law Firm: Ryan Rapp & Underwood, PLC

Case Name: ADP, LLC v. Arizona Department of Revenue (TX2018-000246),
Testifying Expert for ADP, LLC.
Completed in June 2020.
(Expert report submitted.)

Matter: Trade Secret Misappropriation in Digital Electronics

Law Firm: Goodwin Proctor LLP

Case Name: Guzik Technical Enterprises versus Keysight Technologies, Inc. Superior Court
of the State of California for the County of Santa Clara, Case No.: 19CV355879
Testifying Expert for Keysight Technologies, Inc.
Retained in August 2020.

Matter: Patent Infringement for Fiber Optic Devices

Law Firm: Cooley

Case Name: Certain High-Density Fiber Optic Equipment and Components Thereof,
U.S.I.T.C. Inv. No. 337-TA-1194
Testifying Expert for AFL Communications, Panduit, FS.Com, Wirewerk, and
Siemon
Completed in October 2020.
(Expert reports submitted, deposed, and testified during trial.)

Matter: Patent Infringement for Optical Transport Networks
Law Firm: Venerble
Case Name: Huawei Technologies Co. Ltd v Verizon Communications, Inc., et. al., 2:20-cv-
0030
Testifying Expert for Verizon.
Retained in March 2020.
(IPR declarations submitted.)

Matter: Patent Infringement for Lighting System
Law Firm: Fisher Broyles
Case Name: Vaxcel International Co., Ltd., v. Jasco Products Company, LLC., (Case No.
USDC Western District of Oklahoma, 5:19-CV-00154-JD
Testifying Expert for Vaxcel.
Retained in August 2020.

Matter: Patent Infringement for Wireless Communication
Law Firm: McDermott Will & Emery
Case Name: Bell Northern Research LLC v. ZTE. (Case No. 3:18-cv-01786 - S.D. Cal)
Testifying Expert for ZTE.
Retained in July 2019.
(IPR declarations submitted.)

Matter: Patent Infringement for Wireless Communication
Law Firm: Jones Day
Case Name: Bell Northern Research LLC v. Kyocera Corp. (Case No. 3:18-cv-1785 - S.D.
Cal)
Testifying Expert for Kyocera.
Completed in May 2019.
(Claim construction declaration submitted, and deposed.)

Matter: Patent Infringement for Electronic Payment Systems
Law Firm: Paul Hastings
Case Name: ID Tech Corp. v. Samsung Electronics Co., Ltd., et al. (Case No. No. 8:17-cv-1748-
DOC-JDE (C.D. Cal))
Testifying Expert for Samsung.
Retained in January 2019.
(Expert reports submitted, and deposed.)

Matter: Patent Infringement for Internet Switching

Law Firm: Maynard Cooper
Case Name: Parity Networks, LLC v. Juniper Networks, Inc., Case No. 6:17-CV-00495-RWS-KNM (U.S.D.C.E.D. Tx.)
Testifying Expert for Juniper.
Retained in April 2018.
(IPR declarations submitted.)

Matter: Patent Infringement for Internet Switching
Law Firm: Morgan Lewis
Case Name: Parity Networks, LLC v. Hewlett Packard Enterprise Company, Case No. 6:17-CV-00682 (U.S.D.C.E.D. Tx.)
Testifying Expert for Hewlett Packard Enterprise Company.
Retained in September 2018.
(IPR declarations submitted.)

Matter: Inter Parte Rexamination for Covered Business Method
Law Firm: Reed Smith LLP
Case Name: NASDAQ v. Miami International
Expert for Miami International.
Retained in February 2018.
(Expert declarations submitted, and deposited.)

Matter: Patent Infringement for Mobile Devices
Law Firm: Quinn Emanuel
Case Name: Qualcomm v. Apple, Case No. 3:17-cv-00108-GPC-MDD (U.S.D.C.S.D. Cal.)
Testifying Expert for Qualcomm.
Completed in April 2019.
(Expert reports submitted, and deposited.)

Matter: Patent Infringement for Communication Devices
Law Firm: Venable
Case Name: Sycamore IP Holdings LLC v. Verizon Communications Inc, Case No. 2:16-cv-591-JRG-RSP (U.S.D.C. E.D. Texas)
Testifying Expert for Verizon and Level 3.
Completed in September 2017.
(Expert reports submitted, and deposited.)

Matter: Patent Infringement for Mobile Devices
Law Firm: Alston Bird
Case Name: Huawei Technologies Co. Ltd. V. Nokia Solutions and Networks, Case No. 2:16-cv-0056-JRG-RSP (U.S.D.C. E.D. Texas)
Testifying Expert for Nokia.
Completed in December 2017.
(Expert reports submitted.)

Matter: Patent Infringement for Mobile Devices
Law Firm: Quinn Emanuel
Case Name: Huawei Technologies Co. Ltd. V. Samsung Electronics C. Ltd, Case No. 3:16-cv-02787 (U.S.D.C. N.D. Cal)
Testifying Expert for Samsung.
Completed in March 2019.
(Expert reports submitted, and deposed.)

Matter: Arbitration for Licensing
Law Firm: Alston Bird
Case Name: Nokia v. LG Electronics, International Chamber of Commerce Arb. No. 21326
Testifying Expert for Nokia.
Completed in October 2016.
(Expert reports submitted.)

Matter: Patent Infringement for Mobile Devices
Law Firm: Ropes and Gray
Case Name: Godo Kaisha IP Bridge 1 v. TCL Communication Technology Holdings, Case No. 15-634-SLR-SRF (U.S.D.C.S.D. Delaware.)
Testifying Expert for IP Bridge.
Completed in October 2018.
(Expert reports submitted, and deposed.)

Matter: Patent Infringement for Mobile Devices
Law Firm: Paul Hastings
Case Name: Odyssey Wireless, Inc., v. Samsung Electronics Co., Ltd., et al, Case No. 3:15-cv-1738-H-RBB (U.S.D.C.S.D. Cal.)
Testifying Expert for Samsung.
Completed in October 2016.
(Expert reports submitted.)

Matter: Patent Infringement for Mobile Devices
Law Firm: Greenberg Traurig
Case Name: Mobile Telecommunications Technologies LLC v. Amazon.com, Inc., 2:13-cv-883-JRG-RSP (U.S.D.C. E.D. Texas)
Testifying Expert for Amazon.
Completed in April 2015.
(Expert reports submitted, and deposed.)

Matter: Patent Infringement for Mobile Devices
Law Firm: Mayer Brown
Case Name: Mobile Telecommunications Technologies LLC v. LG Electronics Mobilecomm U.S.A., Inc., 2:13-cv-947-JRG-RSP (U.S.D.C. E.D. Texas)
Testifying Expert for LG Electronics Mobilecomm.
Completed in February 2016.
(Expert reports submitted, and deposed.)

Matter: Patent Infringement for Semiconductor Devices
Law Firm: Mayer Brown
Case Name: Inter Parte Reexamination for U.S. Patent Nos. 6,895,520 and 6,899,332
Expert for LG Electronics.
Completed in February 2016.
(Expert declaration submitted, and deposed.)

Matter: Patent Infringement in Vehicular Electronics
Law Firm: Gardner, Linn, Burkhardt & Flory, L.L.P
Case Name: *Magna Electronics Inc. v. TRW Automotive Holdings Corp. et al.*, Civil Action No. 1:12-cv-00654 (Western District of Michigan), and relating to the action styled *Magna Electronics Inc. v. TRW Automotive Holdings Corp. et al.*, Civil Action No. 1:13-cv-00324 (Western District of Michigan).
Testifying Expert for Magna Electronics
Completed in February 2016.
(Expert reports submitted, and deposed.)

Matter: Patent Infringement in Electronic Circuits
Law Firm: Ropes and Gray
Case Name: Certain Devices Containing Non-Volatile Memory and Products Containing the Same (USITC Inv. Nos. 337-TA-922)
Testifying Expert for Spansion Inc.
Completed in February 2015.
(Expert reports submitted.)

Matter: Trade Secret Misappropriation in Software Method for Cable Television Advertisement
Law Firm: Brownstein Hyatt Farber Schreck
Case Name: Cross MediaWorks v. EMT Holdings, USDC Southern District of New York, Case No. 1:14-cv-00561-VSB
Testifying Expert for Cross MediaWorks.
Completed in April 2015.
(Testified during injunction hearing.)

Matter: Patent Infringement in Vehicular Electronics
Law Firm: Steptoe and Johnson
Case Name: Certain Vision-Based river Assistance System Cameras and Components Thereof (USITC Inv. Nos. 337-TA-899 and 907)
Testifying Expert for Magna Electronics
Completed in February 2015.
(Expert reports submitted, deposed, and testified during trial.)

Matter: Patent Infringement for Vehicular System
Law Firm: Susman Godfrey

Case Name: Eagle Harbor Holdings, LLC, and Mediustech, LLC, v. Ford Motor Company, 3:11-cv-05503-BHS (U.S.D.C. Western District of Washington at Tacoma)
Testifying Expert for Mediustech.
Completed in March 2015.
(Expert reports submitted, deposed, and testified during trial.)

Matter: Patent Infringement for Communication Networks
Law Firm: Davis Polk & Wardwell LLP
Case Name: Sprint Communications Company L.P., v. Comcast Cable Communications, LLC, Comcast IP Phone, LLC, and Comcast Phone of Kansas, LLC. 2:11-cv-02684-KHV-DJW (U.S.D.C. Kansas)
Testifying Expert for Comcast.
Retained in March 2012.
(Expert reports submitted, and deposed.)

Matter: Patent Infringement for Communication Networks
Law Firm: Quinn Emanuel
Case Name: France Telecom S.A. v. Marvell Semiconductor, Inc., 12-Civ-4986 (S.D.N.Y.)
Testifying Expert for Marvell.
Completed in September 2014.
(Expert reports submitted, deposed, and testified during trial.)

Matter: Wireless Image Distribution
Law Firm: Jones Day
Case Name: *Inter Partes* Review of U.S. Patent No. 8,437,797
Expert for Google Inc.
Completed in November 2014.
(Expert declaration submitted.)

Matter: Nonvolatile Semiconductor Memories
Law Firm: Jones Day
Case Name: *Inter Partes* Review of U.S. Patent Nos. 8,301,833 and 8,516,187
Expert for SanDisk.
Completed in May 2014.
(Expert declaration submitted.)

Matter: Communication Protocols for Wireless Device
Law Firm: Dorsey & Whitney, LLP
Case Name: Certain Point-To-Point Network Communication Devices and Products Containing Same (USITC Inv. No. 337-TA-892)
Testifying Expert for Toshiba
Completed in May 2014.
(Expert reports submitted, and deposed.)

Matter: Patent Infringement for Wireless Networks
Law Firm: Ropes and Gray

Case Name: In the Matter of Certain Wireless Devices With 3G and/or 4G Capabilities and Components Thereof (USITC Inv. No. 337-TA-868) InterDigital Comms., Inc. v. Huawei Techs. Co., Ltd., No. 13-00008 (D. Del., filed January 2, 2013), InterDigital Comms., Inc. v. ZTE Corp., No. 13-00009 (D. Del., filed January 2, 2013), InterDigital Comms., Inc. v. Nokia Corp., No. 1:13-cv-00010 (D. Del., filed January 2, 2013), InterDigital Comms., Inc. v. Samsung Elec. Co., Ltd., No. 13-00011 (D. Del., filed January 2, 2013)
Testifying Expert for Joint Defense Group.
Completed in February 2014.
(Expert reports submitted, deposed, and testified during trials.)

Matter: Patent Infringement for Mobile Communication
Law Firm: Finnegan, Henderson, Farabow, Garrett & Dunner, L.L.P.
Case Name: Certain Digital Media Devices, Including Televisions, Blu-Ray Disc Players, Home Theater Systems, Tablets and Mobile Phones, Components Thereof and Associated Software (USITC Inv. No. 337-TA-882)
Testifying Expert for LG Electronics, Inc.
Completed in February 2014.
(Expert reports submitted, deposed, and testified during trial.)

Matter: Patent Infringement for Wireless Networks
Law Firm: Vinson & Elkins LLP
Case Name: Wi-LAN USA, Inc. and Wi-LAN, Inc. v. Telefonaktiebolaget LM Ericsson and Ericsson, Inc. (USDC: Southern District of FL - Case #1: 12-cv-23569), Wi-LAN USA, Inc. and Wi-LAN, Inc. v. Alcatel-Lucent USA, Inc. (USDC: Southern District of FL - Case #1: 12-cv-23568-Altonaga/Simonton)
Testifying Expert for Wi-LAN.
Completed in May 2015.
(Expert reports submitted, and deposed.)

Matter: Patent Infringement for Data Storage
Law Firm: Ropes and Gray, Weil Gotshal
Case Name: Summit Data Systems, LLC v. EMC Corporation., et al. 1:10-cv-00749-GMS (U.S.D.C. Delaware)
Testifying Expert for EMC Corporation and Netapp, Inc.
Completed in December 2012.
(Expert reports submitted, and deposed.)

Matter: Patent Infringement for Wireless Mobile Device
Law Firm: Ashurst Australia
Case Name: Samsung v. Apple, Australian Federal Court Proceeding No. NSD 1243 of 2011
Testifying Expert for Samsung Electronics.
Completed in December 2012.
(Expert reports submitted, deposed, and testified during trial.)

Matter: Patent Infringement for Wireless Mobile Devices

Law Firm: Quinn Emanuel
Case Name: Apple Inc. v. Samsung Electronics Co., Ltd., et al., 4:11-cv-01846-LHK (N.D. Cal.) and Samsung Electronics Co., Ltd., et al. v. Apple Inc., 4:11-cv-02079 (N.D. Cal.)
Testifying Expert for Samsung Electronics.
Completed in July 2012.
(Expert reports submitted, and deposited.)

Matter: Patent Infringement for Wireless Mobile Device
Law Firm: Quinn Emanuel
Case Name: Certain Electronic Devices, Including Wireless Communication Devices, Portable Music And Data Processing Devices, And Tablet Computer, U.S.I.T.C. Inv. No. 337-TA-794
Testifying Expert for Samsung Electronics.
Completed in June 2012.
(Expert reports submitted, deposited, and testified during trial.)

Matter: Patent Infringement for Portable Storage Device
Law Firm: White and Case
Case Name: CERTAIN UNIVERSAL SERIAL BUS (“USB”) PORTABLE STORAGE DEVICES, INCLUDING USB FLASH DRIVES AND COMPONENTS THEREOF, US International Trade Commission Investigation No. 337-TA-788
Testifying Expert Witness for Trek
Completed in May 2012.
(Expert reports submitted, and deposited.)

Matter: Copyright Infringement for Petroleum Processing Software
Law Firm: Osha Liang LLP
Case Name: Aspen Technology, Inc. v. Tekin A. Kunt and M3 Technology, Inc., Case Number: H-10-1127, US District Court, Texas, Houston Division.
Testifying Expert for M3 Technology, Inc.
Completed in May 2012.
(Expert reports submitted, deposited, and testified during trial.)

Matter: Trade Secret Misappropriation for DC-DC converter
Law Firm: Covington & Burling, Haynes Boone
Case Name: Certain DC—DC Controllers and Products Containing Same, US International Trade Commission Investigation No. 337-TA-698
Testifying Expert for UPI.
Completed in March 2012.
(Expert reports submitted, deposited, and testified during trial.)

Matter: Patent Infringement for Parallel Processor
Law Firm: Orrick, Herrington, & Sutcliffe. Kirkland and Ellis.
Case Name: BIAx Corporation v. Nvidia and Sony Civil Action No. 09-cv-01257-PAB-MEH
Testifying Expert for Nvidia and Sony

Completed in March 2012.
(Expert reports submitted, and deposed.)

Matter: Patent Infringement for Call Center Technology
Law Firms: Duffy, Sweeney, and Scott. Foley Lardner.
Case Name: Ronald Katz Technology Licensing v. Citizens Financial Group 7-ML-1816-C
RGK (FFM)
Testifying Expert Witness for Citizens Financial Group.
Completed in 2011.
(Expert reports submitted, and deposed.)

Matter: Patent Infringement for Storage Area Network
Law Firm: DLA Piper
Case Name: Network Appliance, Inc., v. Sun Microsystems, Inc., Case Number: C-07-06053
EDL, US District Court, Northern District of California, San Francisco Division.
Testifying Expert for Sun Microsystems, Inc.
Completed in 2010.
(Expert reports submitted, and deposed.)

Matter: Patent Infringement for Flat Panel Display Controller
Law Firm: Jones Day
Case Name: Certain Video Displays, Components Thereof, and Products Containing Same, US
International Trade Commission Investigation No. 337-TA-687
Testifying Expert for Vizio, Inc.
Completed in 2010.
(Expert reports submitted, deposed, and testified during trial.)

Matter: Patent Infringement for Call Center Technology
Law Firms: Foley Lardner
Case Name: Ronald Katz Technology Licensing v. US Bank 7-ML-1816-C RGK (FFM)
Testifying Expert Witness for US Bank
Completed in May 2009.
(Expert reports submitted, and deposed.)

Matter: Patent Infringement for USB to VGA Converter
Law Firm: Wang Hartmann, Gibbs, & Cauley, P.C.
Case Name: Displaylink Corporation v. Magic Control Technology Corporation, Case No.
5:07-CV-01998-RMW, US District Court, Northern District of California, San
Francisco Division.
Testifying Expert for Magic Control Technology Corporation
Completed in 2009.
(Expert reports submitted, and deposed.)

Matter: Patent Infringement for Flash Memory
Law Firm: Jones Day and Wilson Sansini

Case Name: Certain Flash Memory Controllers, Drives, Memory Card, and Media Players and Products Containing Same. US International Trade Commission Investigation No. 337-TA-619

Testifying Expert for SanDisk Corporation.

Completed in 2008.

(Expert reports submitted, deposed, and testified during trial.)

Matter: Patent Infringement for Semiconductor Packaging

Law Firm: Jones Day

Case Name: Certain Semiconductor Chips with Minimized Chip Package Size and Products Containing the Same. US International Trade Commission Investigation No. 337-TA-605

Testifying Expert for Freescale Semiconductor

Completed in 2008.

(Expert reports submitted, deposed, and testified during trial.)

Matter: Patent Infringement for Automatic Switching System

Law Firms: Jones Day, and Heller Ehrman, LLP.

Case Name: ATEN International Co., Ltd and ATEN Technology, Inc. v. Belkin Corporation, Belkin Logistics, Inc. and Emine Technology Co., Ltd. US International Trade Commission Investigation No. Ltd 337-TA-589

Testifying Expert for Belkin Corporation, Belkin Logistics, Inc., and Emine Technology Co., Ltd.

Completed in 2007.

(Expert reports submitted, deposed, and testified during trial.)

Matter: Patent Infringement for Dual Mode Communication

Law Firm: Wilmer Cutler Pickering Hale and Dorr, LLP

Case Name: Broadcom Corporation v. Qualcomm Incorporated SACV05-467-JVS (RNBx)
Testifying Expert Witness for Broadcom Corporation

Completed in 2007.

(Expert reports submitted, deposed, and testified during trial.)