

Vishal Sharma, Ph.D.
Senior Member, IEEE. Fellow, IETE¹

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PROFILE

Experience: Seasoned international technologist and entrepreneur with 19+ years of experience spanning research, industry, labs., and academia in networking and telecom technologies, with a focus on wireless/wireline system/network architecture, protocol design, system analysis and optimization, software prototyping, and network planning & algorithms. Worked and consulted with organizations such as the Multi-disciplinary Optical Switching Technology (MOST) Center at UCSB, Tellabs, Jasmine Networks, Digital Instruments, ACT Networks, Mahi Networks, Cariden Technologies, Cypress Semiconductor, Ciena Communications, Fujitsu, Covad Communications, Xilinx, ETSA (Electricity Trust of South Australia) Telecoms, SBC/AT&T, France Telecom, Orange, Wipro Technologies and the Indian Institute of Technology Bombay (IITB).

Expertise in devising scheduling schemes and QoS algorithms for wireless broadband networks (Wi-Max, 3G) and wireline (IP/Ethernet/ATM, optical, & next-generation SONET/SDH) networks, mobile backhaul techniques for 2G/3G/4G and LTE networks, LTE network evolution, evaluating security issues in 3G cellular data networks, and analysis & design of high-speed switch/router architectures, development of switch scheduling and flow management algorithms, MPLS technologies, traffic engineering principles, protocols, carrier approaches, planning tools, and algorithms, next-generation SONET/SDH developments and standards; applying queueing theory to analyze telecommunication system design issues, design of IP-based signaling and routing protocols for optical TDM and WDM networks, recovery schemes for MPLS and optical mesh networks, frequency assignment algorithms and capacity analysis for cellular radio, design and analysis of all-optical switching schemes, and connection and flow-control protocols.

Experience in patent analysis & evaluation, patent drafting, and prior art research.

Intensive workshops/sessions at University of California, Santa Cruz (UCSC) Extension, University of California, Berkeley (UCB) Extension, University of California San Diego (UCSD) Extension, and a number of corporates in the US and abroad – ranging from semiconductor houses (Cypress, Xilinx) to service providers (Covad, SBC/AT&T) and large technology houses (Wipro, Infosys).

Core Skills: Critical thinking and analysis, solid understanding of wireless and wireline networking issues and ability to translate them into architectures for networks, systems and chips; distill and effectively disseminate fundamental technical concepts to all levels in academia or industry; develop ideas and concepts into sound network and/or system architectures; systematic design, analysis, and development of algorithms and protocols; translate novel ideas into patentable inventions.

Achievements: **8 patents awarded** and **3+ patents pending** in: high-speed switch architectures, switch scheduling, MPLS recovery, optical routing, and IP control of SONET/SDH networks; Guest Editor of 4 Special Issues of the IEEE Communications Mag. (IEEE's most highly cited publication with a circulation of 50K+ professionals worldwide); 10 IETF RFCs published; core contributor over the last 8+ years in the IETF to the development of IP-based signaling and routing standards for packet, TDM and optical networks; an early-contributor to the Optical Internetworking Forum (OIF)'s evolving UNI and NNI signaling/routing standards; furnished first analytical (probabilistic) framework to characterize limited wavelength translation in optical networks; numerous tutorials, international conference and

¹ The Institution of Electronics and Telecommunications Engineers, India.

journal papers, and book chapters published; *Subject Matter Expert* at the MPLS-ATM Forum/Frame-Relay Alliance; *Senior Member (2001)* of the IEEE (a distinction held by less than 8% of the over 350,000 IEEE members worldwide), *Life Fellow (2005)* of the Institution of Electronics and Telecommunications Engineers (IETE), India (a distinction held by less than 7% of the approximately 70,000 IETE members worldwide).

PROFESSIONAL EXPERIENCE

Principal Technologist & Consultant, Metanoia, Inc., Mtn. View, California. 06/01 – present

- Define company focus, devise strategy and growth plans, and develop customer outreach programs for sustained excellence in niche-telecom consulting for Metanoia, Inc. – interaction with C-level client executives
- Deep-technical interaction with senior-level architects, planners, engineers at vendors/carriers
- Technical consulting for service providers and telecom chip, system, and software vendors:
 - Network architecture roadmap and services definition for Tier 1/2/3 carriers evolving to new services and/or products.
 - System & network architecture, algorithm & protocol design, system analysis, standards.
 - Advanced consulting on architecture issues: e.g. mobile 3G/4G/LTE architecture, mobile backhaul strategies, next-generation Ethernet and/or SONET/SDH chip design.
 - Guidance on topics at the forefront of contemporary networking, covering the latest developments in the design of systems, protocols, and architectures.

Associate Professor (Contract), Dept. of EE, IIT Bombay, Mumbai, India. 08/04 – 08/07

- Lead research in wireline- and wireless-broadband access technologies, based on my past and ongoing industry experience.
- Guide graduate and undergraduate research and theses (remotely and/or in person when in India)
 - Seven students graduated, guided 2 graduate students (as adjunct faculty).
 - Research focused on scheduling and traffic management algorithms, ad-hoc and sensor networks, network infrastructure security, and mobile applications and architecture.

Principal Architect, Jasmine Networks, Inc., San Jose, California. 01/01 – 06/01

- Architected & designed a common MPLS-based control plane for both packet and TDM data.
- Strengthened Jasmine's industry standing by my leadership role in numerous MPLS forums

Research Engineer, Tellabs Research Center (TRC), Cambridge, Massachusetts. 03/98 – 12/00

- Lead the IP networking research effort at the Cambridge office of the Research Center. Projects included:
 - Analysis and design of **high-speed switch router architectures**, conducted architectural evaluation of routers from over 10 leading core- and edge-router startups.
 - Strategic technical guidance to Tellabs' Advanced Business Development for acquisitions in the terabit router space.
 - Designed an **IP flow management algorithm** for application in parallel high-speed switches (patented).
 - Devised path protection schemes for **multiprotocol label switching (MPLS)** (patented) and formulated MPLS-based recovery framework.
- Supervised a summer project for a Ph.D. student from MIT that produced a novel scheduling algorithm for parallel cross-bar switches that is part of the student's Ph.D. dissertation (patented).

-- Responsible for selecting, screening, and phone interviewing over 12 candidates for the position of IP Networking Research Engineer at the Research Center.

Post-Doctoral Researcher, Multi-disciplinary Optical Switching Technology (MOST) Center,
UC Santa Barbara.

11/97-3/98

-- Analysis and design of all-optical switches and switching schemes.

AWARDS & HONORS

Invited Chairman, Debate, MPLS-TP OAM and Issues, MPLS World Congress, February 2011.

Invited Tutorial, "Understanding Military-Grade Optical Ethernet Networks," *IEEE Milcom'10*, San Jose, CA, Nov. 1st, 2010.

Chairman, MPLS World Congress, February, 2010, and 2009.

Chairman, MPLS World Congress, February, 2008.

Invited Tutorial, "Elements of Cross-Layer System & Network Design for QoS-Enabled Wi-Max Networks," *IEEE Milcom'07*, Orlando, FL, Oct. 29th, 2007.

Co-Guest Editor, for the *IEEE Communications Mag.*, Feature Topic Issue on "[Next-Generation Carrier Ethernet Transport Technologies](#)" to appear March 2008.

Keynote Talk, "Network Planning or Design: An Art or a Science," *SANOG (South-Asian Network Operators Group) 9*, Colombo, Sri Lanka, 23rd January, 2007.

Co-Guest Editor for the *IEEE Communications Mag.*, Feature Topic Issue on "[Advances in Virtual Private Networks](#)" April 2007.

Invited Tutorial, "Unraveling QoS in 802.16 Wireless Broadband Networks: The Role of MAC, Scheduling, and Cross-Layer Design," *IEEE Globecom'06*, Nov. 27, San Fransisco, CA.

Chairman, Day Three, [MPLS World Congress](#), February, 2007.

Chairman, Day One, [MPLS World Congress](#), February, 2006.

Co-Guest Editor for the *IEEE Communications Mag.*, Feature Topic Issue on "[Challenges in Enabling Inter-Provider Service Quality on the Internet](#)" June 2005.

Chairman, Day One, [MPLS World Congress](#), February, 2005.

Elected IETE Fellow, IETE Memberships Committee, February 2005.

Co-Guest Editor for the *IEEE Communications Mag.*, Feature Topic Issue on "[OAM in MPLS-based Networks](#)," October 2004.

Chairman, Day One, *MPLS World Congress*, February, 2004.

Chairman, Day Three, *MPLS World Congress*, February 2003.

Elected Subject Matter Expert, *MPLS Forum (now MFA Forum)*, October 2002.

Co-Chair Industry Watch Program, *SPIE Int'l Conference on Optical Networking and Communications (Opticomm 2002)*, August 2002.

Elected IEEE Senior Member, IEEE Admissions & Advancement Committee, August 2001.

Key Contributor Award, Tellabs Operations, Inc., December 1999 and July 2000.

Innovation Certificate, Tellabs Operations, Inc., June 2000.

Inducted to Who's Who in Information Technology, February, 1999.

Judging Committee, STC Student Technical Writing Contest, Santa Barbara, May 1996 & 1997.

Motorola Paul V. Galvin Fellow, Sept. 1991-June 1993. (Awarded to only 2 engineers (one male one female) throughout India.)

Best B. Tech. Project in Electrical Engineering, Indian Institute of Technology, Kanpur, 1991.

National Talent Search Scholarship, Govt. of India, 1985-1991 (Awarded to only 330 candidates throughout India for undergraduate study.)

PROFESSIONAL ACTIVITIES

- **Invited Panelist**
 - “MPLS and Carrier Ethernet,” *MPLS World Congress*, February 2009.
- **Invited Moderator**
 - “MPLS and Carrier Ethernet: Where and How?,” *MPLS World Congress*, February 2007.
 - “Carrier Ethernet and MPLS,” *MPLS World Congress*, February 2006.
 - “Scaling MPLS, MPLS OSS and Billing, Edge/Metro/Access Network issues,” *MPLS World Congress*, February 2005.
- **Workshop Leader**, Workshop on “Next-generation Systems and Networks” Workshop Series, Bangalore, India, 17th July 2007.
- **Workshop Leader**, Workshop on “Facts You Should know about QoS Enabled Wi-MaX Networks,” Bangalore, India, 25th January, 2007.
- **Workshop Leader**, Workshop on “[Next-Generation Networking Technologies](#),” Bangalore, India, 19-23 July, 2005.
- **Core Contributor** to the MFA Forum tutorials “Migrating to MPLS,” December 2002 and “Generalized MPLS” June 2004.
- **Committee Member, Scientific Committee**, *Wi-Max Summit*, 2005-present.
- **Committee Member, Scientific Committee**, *MPLS World Congress*, 2003-present..
- **Board Member, Conference Advisory Board**, *MPLSCon*, 2001-present.
- **Technical Program Committee Member**
 - *IEEE Globecom*, 2006, 2007, 2008, *iPOP (Int’l Conference on IP and Optical Networks)*, 2005, 2006, 2007, 2008, *14th IEEE LAN/MAN Workshop*, 2005, 2006, 2007, *1st International Workshop on Bandwidth-on-Demand*, 2006, *SPIE Opticomm*, 2002, 2003, *Int’l Workshop on Design of Reliable Communication Networks (DRCN)* 2003, 2005.
- **Invited Panelist**
 - “Future Directions,” *MPLS 2002*, Washington D.C., October 2002.
 - “The Optical Revolution: When?,” *MPLSCon02*, McLean, VA, March 2002.
 - “MPLS: State of the Art and Evolutions,” *MPLS World Congress*, Paris, France, Feb. 2000.
- **Mentor, Stanford IEEE Mentor Program**, Stanford University, 2001-02 and 2002-03.
- **Over 125+ invited talks, seminars, workshops** at numerous organizations in the **US** (e.g. Cisco Systems, SBC Communications, Tellabs, Univ. of Colorado, George Washington Univ., Bell Labs, BBN/GTE, Fujitsu Labs., Cypress Semiconductor, RazaFoundries) and abroad: **India** (e.g. Indian Institute of Science, Indian Institutes of Technology (Bombay, Madras, Kanpur, Delhi), TataInfotech, Sasken Systems, Motorola India, Infosys, Wipro, Tata Elxsi, Cisco India, Tejas Networks, and HCL Technologies, MTNL (Mahanagar Telephone Nigam Ltd.), Tata Indicom/VSNL); **Europe**: Acreo AB, *Sweden*, MPLS World Congress, *France*, FTW, Vienna, *Austria*, Univ. of Patras, Patras, *Greece*; **Australia**: Australian Communications Industry Forum (ACIF), Sydney, Australia, CSIRO (Commonwealth Industrial Scientific and Research Organization), Australia, Western Australian Telecom Research Institute (WATRI), Perth, Australia.

PATENTS

8 US patents granted.

1. Method and Apparatus for Validating a Path Through a Switched Optical Network, 7,095,956, Granted 22 August, 2006.
2. Method and Apparatus to Switch Data Flows Using Parallel Switch Fabrics, 7,123,581, Granted 17 October, 2006.
3. High-Speed Parallel Crossbar Switch, 7,123,623, Granted 17 October, 2006.
4. Reverse Notification Tree for Data Networks, 7,298,693 B1, Granted 20 November 2007.
5. Method and Apparatus for Detecting MPLS Network Failures, 7,315,510 B1 Granted 1 January 2008.
6. System and Method for Network-Layer Protocol Routing in a Peer-Model Integrated Optical Network, 7,457,277, Granted 25 November, 2008.
7. Method for establishing an MPLS data network protection pathway”, 7,796,504, Granted September 14 2010.
8. Protection/restoration of MPLS networks, 7,804,767, Granted September 28 2010.

3+ patents in process.

One in *IP control of SONET UPSRs*, and two in *IP-based control of optical transport networks*.

EDUCATION

- Ph.D., Electrical and Computer Engineering**, University of California, Santa Barbara. Aug. 1997
Thesis: “Efficient Communication Protocols and Performance Analysis for Gigabit Networks.”
Advisor: Professor Emmanouel (Manos) Varvarigos.
- M.S. (Computer Engineering)**, University of California, Santa Barbara. Dec. 1993
Thesis: “Frequency Assignment and Capacity Analysis for Cellular Radio.”
Advisors: Professors Allen Gersho and Emmanouel (Manos) Varvarigos.
- M.S. (Signals & Systems)**, University of California, Santa Barbara. April 1993
- B.Tech., Electrical Engineering**, Indian Institute of Technology, Kanpur. June 1991
Project: “Design, Fabrication, and Testing of an Ethernet Repeater.”
Advisors: Professors K. R. Srivathsan and R. N. Biswas.

PUBLICATIONS

Refereed Publications

Conferences

1. M. Veerayya, V. Sharma, and A. Karandikar, "A novel stability-based routing algorithm for QoS support in ad-hoc wireless networks," *Proc. IEEE Milcom'08*, San Diego, CA, 19-21 Nov. 2008.
2. H. Rath, A. Karandikar, V. Sharma, "Adaptive modulation-based TCP-aware uplink scheduling in IEEE 802.16 (Wi-Max) networks," *Proc. IEEE ICC'08*, Beijing, China, May 2008.
3. V. Sharma and N. Vamaney, "The uniformly-fair deficit round-robin scheduler for IEEE 802.16 WiMax networks," *Proc. IEEE Milcom'07*, Orlando, FL, October 2007.
4. N. Agrawal and V. Sharma, "Network security in public GPRS/EDGE and CDMA 1X networks: A comparative evaluation and analysis," *submitted*.
5. A. Gumaste, J. Chandarana, P. Bafna, N. Ghani and V. Sharma, "On control plane for service provisioning in light-trail WDM optical networks," *Proc. 42nd IEEE Intl Conf on Commun. (ICC)*, Glasgow, United Kingdom, June 2007.
6. K. Barapatre and V. Sharma, "Infrastructure security threats in cellular data networks – An evaluation of GSM and CDMA networks in India," *submitted*.
7. H. Rath, A. Bhorkar, V. Sharma, "An opportunistic uplink scheduling scheme to achieve bandwidth fairness and delay for multiclass traffic in Wi-Max (802.16) broadband networks," *IEEE Globecom'06*, San Fransisco, CA, 27 Nov. – 1 Dec. 2006.
8. H. Rath, A. Bhorkar, V. Sharma, "An opportunistic deficit round robin (O-DRR) uplink scheduling scheme for Wi-Max networks," *Proc. IETE Int'l Conf. on Next-Generation Networks (ICNGN'06)*, Mumbai, 9-11 February, 2006.
9. V. Bhedaru and V. Sharma, "Packet classification algorithms for next-generation networks: A perspective," *Proc. IETE Int'l Conf. on Next-Generation Networks (ICNGN'06)*, Mumbai, 9-11 February, 2006.
10. R. Rabbat, V. Sharma, F. Ricciato, R. Albanese, "Strategies for rapid and scalable recovery in next-generation networks," *Proc. of Workshop 4, Protection and Restoration: From SDH/SONET to Next-Generation Networks, IEEE Globecom 2003*, San Fransisco, CA, 1 Dec. 2003.
11. V. Sharma, A. Das, and C. Chen, "Leveraging IP signaling and routing to manage UPSR-based SONET networks," *Proc. IEEE ICC 2003*, Anchorage, Alaska, 11-15 May 2003.
12. B. Rajagopalan, D. Saha, G. Bernstein, and V. Sharma, "Signaling for fast restoration in heterogenous optical mesh networks," *Proc. SPIE Asia Pacific Conf. on Optical Communication*, 12-16 November, 2001, Beijing, China.
13. S. Mneimneh, V. Sharma, and K. Y. Siu, "On scheduling using parallel input-output queued crossbar switches with no speedup," *Proc. IEEE Workshop on High-Perf. Switching and Routinig (HPSR)*, May 2001.
14. D. Levandovsky, V. Makam, and V. Sharma, "Physical constraints affecting connectivity in the dynamic optical network," *Proc. National Fiber Optic Engineers Conf. (NFOEC)* Denver, CO, 7-11 August 2000.

15. C. H. Yeh, E. A. Varvarigos, V. Sharma, and B. Parhami, "Scalable communication protocols for high-speed networks," *Proc. IASTED Int'l Conf. on Parallel and Distributed Computing Systems*, Cambridge, MA, 3-6 November, 1999.
16. J. P. Lang, V. Sharma, and E. A. Varvarigos, "A new analysis for wavelength translation in regular all-optical networks," *Proc. MPOI'98 (Massively Parallel Processing Using Optical Interconnections)*, Las Vegas, NV, 15-17 June 1998, pp. 131-139.
17. V. Sharma and E. A. Vavarigos, "Limited wavelength translation in all-optical WDM mesh networks," *Proc. IEEE Infocom'98*, San Fransisco, CA, 29 March-2 April 1998, pp. 893-901.
18. V. Sharma and E. A. Varvarigos, "Some closed form results for circuit switching in hypercube networks with input queueing," *Proc. Euro-Par'96*, Lyon, FR, 27-29 August, 1996, pp.738-742.
19. V. Sharma and Srirajshekhar Koritala, "Can distributed workgroups work without tears? Lessons learnt from coordinating a dispersed organization," *Proc. IEEE Int'l Conf. on Professional Communication (IPCC'96)*, Saratoga Springs, NY, 17-20 September 1996.
20. E. A. Varvarigos and V. Sharma, "A loss-free connection control protocol for the Thunder and Lightning network," *Proc. IEEE Global Telecom. Conf.*, Singapore, 13-17 Nov. 1995, pp. 450-456.
21. E. A. Varvarigos and V. Sharma, "Loss-free communication in high-speed networks," *Proc. Singapore Int'l Conf. on Networks (SICON'95)*, 3-7 July 1995, pp. 230-236.
22. T. Kawashima, V. Sharma, and A. Gersho, "Network control of speech bit rate for enhanced cellular CDMA performance," *Proc. Int'l. Conf. on Communications (ICC'94)*, New Orleans, LA, 1-5 May 1994, vol. 3, pp. 1276-80.

Journals/Books/Magazines

1. H. Rath, A. Karandikar, V. Sharma, "Adaptive modulation-based TCP-aware uplink scheduling in IEEE 802.16 (Wi-Max) networks," *under submission, IEEE Trans. on Wireless Communications*.
2. V. Sharma and A. Karandikar, "Quality-of-Service in Wireless Networks," Invited Chapter in *Technical, Commercial, and Regulatory Challenges for QoS: An Internet Service-Model Perspective*, by Xipeng Xiao, John Wiley & Sons, September 2008.
3. T. Nadeau, V. Sharma, and A. Gumaste, "Next-generation Carrier Ethernet transport technologies," Guest Editorial, *IEEE Commun. Mag.*, vol. 46, no. 3, March 2008.
4. V. Sharma, N. Ghani, L. Fang, "Virtual Private Networks," Guest Editorial, *IEEE Commun. Mag.*, vol. 45, no. 4, April 2007, pp. 24-25.
5. M. Morrow, V. Sharma, and T. Nadeau, L. Andersson, "Challenges in enabling IP-service quality in the Internet," Guest Editorial, *IEEE Commun. Mag*, vol. 43 , no. 6, June 2005, pp. 88-90.
6. M. Morrow, V. Sharma, and T. Nadeau, "OAM in MPLS-based networks," Guest Editorial, *IEEE Commun. Mag*, vol. 42 , no. 10, October 2004, pp. 88-90.
7. V. Sharma, A. Das, and C. Chen, "On the issues in implementing the Peer Model in integrated optical networks," *Photonic Network Communications*, Special Issue on the IP-Centric Control and Management of WDM Optical Networks, vol. 8, issue 1, June 2004, pp. 7-21.
8. V. Sharma, A. Das, and C. Chen, "On the IP-oriented control of UPSR-based transport networks," *OSA J. of Optical Networking*, vol. 2, no. 3, March 2003, pp. 69-82.

9. S. Mneimneh, V. Sharma, and Kai Yeung (Sunny) Siu, "On scheduling using parallel input-output crossbar switches with no speedup," *IEEE/ACM Trans. on Networking*, vol. 10, issue 5, October 2002, pp. 653-665.
10. C. Huang, V. Sharma, K. Owens, S. Makam "Building reliable MPLS networks using a path protection mechanism," *IEEE Commun. Mag.*, vol. 40, no. 3, March 2002, pp. 156-162.
11. G. Bernstein, V. Sharma, and L. Ong, "Inter-domain optical routing," *Optical Society of America (OSA) Journal of Optical Networking*, vol. 1, no. 2, February 2002, pp. 80-92.
12. V. Sharma and R. Sharma, "Web switching," Invited contribution to *Enterprise Networking: multi-layer switching and applications*, Idea Publishing Group, PA, USA, Eds. V. Theoharakis and D. Serpanos (Editors), January 2002, pp. 86-104.
13. G. Bernstein, E. Mannie, V. Sharma, "MPLS-based control of SDH/SONET optical networks," *IEEE Network*, Special Issue on "IP-Optical Integration," vol.15, no. 5, July/August 2001, pp. 20-27.
14. J. P. Lang, V. Sharma, and E. A. Varvarigos, "A new analysis for oblivious or adaptive routing in all-optical networks with wavelength translation," *IEEE/ACM Trans. on Networking*, vol. 9, no. 4, pp. 503-517, August 2001.
15. V. Sharma and E. A. Vavarigos, "An analysis of limited wavelength translation in regular all-optical WDM networks," *J. of Lightwave Technology*, Special Issue on "Optical Networks," December 2000.
16. E. A. Varvarigos and V. Sharma, "An efficient reservation connection control protocol for gigabit networks," *Computer Networks and ISDN Systems*, vol. 30, no. 12, 13 July 1998, pp. 1135-1156.
17. E. A. Varvarigos and V. Sharma, "The ready-to-go virtual circuit protocol: a loss-free protocol for gigabit networks with FIFO buffers," *IEEE/ACM Trans. on Networking*, Vol. 5, No. 5, October 1997, pp. 705-718.
18. V. Sharma and E. A. Varvarigos, "Circuit switching with input queueing: An analysis for the d-dimensional wraparound mesh and the hypercube," *IEEE Trans. on Parallel and Distributed Systems*, Vol. 8, No. 4, April 1997, pp. 349-356.
19. T. Kawashima, V. Sharma, and A. Gersho, "Capacity enhancement of cellular CDMA by traffic-based control of speech bit rate," *IEEE Trans. on Veh. Tech.*, Vol. 45, No. 3, Aug.1996, pp.543-550.

Standards Contributions

Representative IETF Standards Co-Authored (total IETF draft contributions exceed 50+ over the last 8+ years)

1. G. Bernsterin, E. Mannie, V. Sharma, E. Gray, "A framework for GMPLS-based control of SDH/SONET networks," RFC 4257, December 2005.
2. K. Kompella, Y. Rekhter (Editors) "Routing Extensions in Support of Generalized MPLS," RFC 4202, October 2005.
3. K. Kompella, Y. Rekhter (Editors) "OSPF extensions in support of Generalized MPLS," RFC 4203, October 2005.

4. K. Kompella, Y. Rekhter (Editors) "IS-IS extensions in support of Generalized MPLS," RFC 4205, October 2005.
5. E. Mannie (Ed.), "Generalized Multi-Protocol Label Switching (MPLS) Architecture," RFC 3945, October 2004.
6. E. Mannie, D. Papadimitrou (Editors), "Generalized MPLS Extensions for Synchronous Optical Networks (SONET) and Synchronous Digital Hierarchy (SDH) Control," RFC 3946, October 2004.
7. V. Sharma and F. Hellstrand (Editors), "A framework for MPLS-based recovery," RFC3469, February 2003.
8. L. Berger (Editor), "Generalized MPLS: Signaling functional description," RFC 3471, January 2003.
9. P. Ashwood Smith, L. Berger (Editors), "Generalized MPLS: Signaling – CR-LDP extensions," RFC 3472, January 2003.
10. P. Ashwood Smith, L. Berger (Editors), "Generalized MPLS: Signaling – RSVP-TE extensions," RFC 3473, January 2003.

Industry Publications

Conferences

1. V. Sharma, "Network design and planning: An art or a science?," *Plenary Talk, SANOG'09 (South-Asian Network Operators Group)*, Colombo, Sri Lanka, 23 Jan. 2007.
2. K. Barapatre, N. Koshta, V. Sharma and F. Ricciato, "Case study: Infrastructure security in cellular data networks," *APRICOT'06 (Asia-Pacific Regional Internet Conference on Operating Technologies)*, Perth, Australia, 1-2 March, 2006.
3. V. Sharma, "A survey of recent advances in traffic engineering/network planning tools," *APRICOT'06 (Asia-Pacific Regional Internet Conference on Operating Technologies)*, Perth, Australia, 1-2 March, 2006.
4. K. Barapatre, N. Koshta, V. Sharma and F. Ricciato, "Infrastructure security in cellular data networks: An initial investigation," *SANOG 7 (South-Asian Network Operators Group)*, Mumbai, India, 23-24 January 2006.
5. R. Hartani and V. Sharma, "State-of-the-art router design techniques for efficient MPLS network design and traffic engineering," *MPLS World 2004*, Paris, France, 10-13 February, 2004.
6. R. Papneja and V. Sharma, "Characterising MPLS VPNs: Analysis and role of core routers," *MPLS 2002*, Washington, D.C., 27-29 October, 2002.
7. V. Sharma, "Survivability considerations in MPLS-controlled multi-service networks," *MPLSCon Spring 2002*, McLean, Virginia, 25-28 March, 2002.
8. G. Bernstein and V. Sharma, "Inter-domain routing considerations for MPLS-controlled optical networks," *MPLS World 2002*, Paris, France, 4-8 February, 2002.
9. S. Dharanikota et al, "Inter-domain routing with shared risk groups," *MPLS World 2002*, Paris, France, 4-8 February, 2002.

10. V. Sharma, "Dynamic path establishment in MPLS-controlled multi-service networks," *MPLSCon'01*, San Jose, CA, 26-29 March, 2001.
11. G. Bernstein, E. Mannie, V. Sharma, and B. Mack-Crane, "Issues in MPLS-based control of SDH/SONET optical networks," *MPLS World Congress*, Paris, France, 6-9 Feb. 2001.
12. V. Sharma, V. Makam, C. Huang, and K. Owens, "Protection and restoration in MPLS networks," *MPLS Forum'2000 Conf.*, Paris, France, 7-10 March, 2000.
13. V. Sharma, V. Makam, C. Huang, and K. Owens, "MPLS: Much potential leading somewhere: An assessment of QoS and protection in MPLS," *MPLS'99*, Paris, France, 22-25 June, 1999.

Articles & Tutorials

1. V. Sharma and M. Allen, "Packet-Optical Integration – The Key to Enabling Agile Optical Networks," *NASA Tech. Briefs*, February 2011.
2. V. Sharma and M. Allen, "Packet-Optical Integration – The Key to Enabling Agile Optical Networks," *Metanoia, Inc. Technology Paper*, Jan. 2011.
3. V. Sharma and S. Davari, "Illuminating Optical Ethernet Networks!," *Metanoia, Inc. Technology Paper*, March 2010.
4. V. Sharma and S. Davari, "Demystifying Optical Ethernet Networks," *Photonic Tech. Briefs.*, February 2010.
5. V. Sharma and A. Gumaste, "Design considerations for converged optical Ethernet networks," *Photonic Tech. Briefs.*, February 2008.
6. V. Sharma and D. Sharma, "Photonic switching, distributed routing and ultra-fast packet forwarding: key advances or pipe dream," *Communications Design Conference (CDC)*, Sept. 30-Oct. 2, 2003, San Jose, CA.
7. D. Sharma and V. Sharma, "[Next-generation SONET/SDH: Impact on network deployment.](#)" ChipCenter (an EE Times publication), Networking Series, Technical Note, April 2003.
8. V. Sharma, "Building resilience in MPLS-controlled multi-layer networks," Technical Focus, MPLSWorld, June 2002, http://www.mplsworld.com/archi_drafts/focus/analy-sharma2.htm.
9. V. Sharma, "Considerations for dynamic path establishment in MPLS-controlled multi-service networks," Technical Focus, MPLSWorld, August 2001, http://www.mplsworld.com/archi_drafts/focus/analy-sharma.htm
10. V. Sharma, "Multiprotocol lambda switching: The role of IP technologies in controlling and managing future optical networks," Tutorial in the *First Online Symposium for Electronics Engineers (OSEE)*, <http://www.techonline.com>, January 2001.