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PROFILE

International technologist and entrepreneur with 20+ years of experience in networking and telecom technologies, who has lead research, industry, labs, and academia; coordinated globally diverse expert teams; a technology leader, system & network architect, sharp project & product manager, deep-researcher, respected evangelist, and expert communicator and influencer all rolled into one; 10 US patents granted; 10 IETF RFCs published; 4 IEEE Communications Magazine special issues edited; Associate Professor (3 years): 8 students graduated, 10 courses taught, 32 seminars & course research projects supervised; considerable standards participation & solid understanding of standards processes; Invited speaker/keynote speaker, session chair, panel moderator, & panelist at leading industry conferences; 145+ workshops, talks, seminars, tutorials, panels in the US, Europe, Australia, Asia; Sample clients: Fujitsu, Tellabs, Cariden/Cisco, Mahi Networks, France Telecom, Covad, ETSA/Silk Telecom (Australia), CTS Telecom, Xilinx, Cypress, Wipro, Infosys.

Focus Areas

Packet and optical system & network architectures, protocol design, system analysis and optimization, software prototyping, network design & planning techniques and algorithms, and intellectual asset management, with applications to traditional and virtualized: Layer 1 (SONET/SDH, OTN) – Layer 3 (IP/MPLS, Ethernet, optical) networks, wireless backhaul, wireless broadband & packet-core networks, and inter- and intra-data center networks.

Core Skills

Reverse-engineering of complex systems and networks; translating between network-level operation and system-level implementation; sound understanding of wireline, broadband wireless, and optical networking issues and ability to convert them into architectures for services, networks, systems and chips; grasp customer requirements, interpret and prioritize features/options, translate them into clear product requirements, high-level architectural specifications and detailed system-level/chip-level operational flows/specs; work seamlessly with executive/engineering management, hardware & software engineering and product marketing teams to realize next-generation products/networks/services; rapidly consume, digest, elucidate, and improvise on cutting-edge industry advances; demystify the complex, and create

¹ The Institution of Electrical and Electronics Engineers, Inc.

² The Institution of Electronics and Telecommunications Engineers, India.

technical, but clearly understood, customer- and market-focused documentation/messaging; translate novel ideas into patentable inventions.

POSITIONS HELD

Principal, Metanoia, Inc., Silicon Valley, CA. 2001 – present

- Advise executive and engineering management at system, software, and chip vendors and carriers/operators on devising technology and product/services strategy & roadmaps.
- Architect next-generation systems/chips/software or network services & networks via deep technical synergy with senior architects, planners, hardware/software design engineers, and/or network architects, network engineers, and operations teams at clients.
- Analyze and guide clients on subjects at the forefront of contemporary networking. E.g. cloud-based technologies – intra- and inter-data center design: principles, methodologies, technologies, best-practices; public- and private-cloud architectures; hybrid cloud. Virtualization technologies: SDN and NFV – operation, insights, applications, open-issues, deployment trade-offs; E-VPNs, SD-WAN, data center interconnects, service chaining (SFC), and overlay networking.
- Solve complex system design, architecture and customer issues for clients, from emerging startups to companies in the Fortune 1000 (impacting a \$300+M product line), interacting up-and-down the chain of command from engineers to senior architects to executive & engineering leadership.
- Engage with carriers ranging in size from small local and regional operators to global giants, helping them with technology strategy, knowledge enhancement, best-practices; have earned recognition for our work.
- Track SDN/NFV standards in the industry, such as those at the ONF, IETF (NVO3, SFC, and BESS WGs), MEF (LSO), ETSI NFV ISG, and P4 Consortium. Strong participation in the IETF during 1998-2005, which was focused on the development of core Internet protocols & architectures: e.g. in the L2 VPNs, L3 VPNs, MPLS, Diffserv, TE, IP-Optical WGs.
- Retained by some of the highest ranking law firms in the country (AM Law 100) for deep technology analysis of highly complex telecommunications patent portfolios and litigation assistance, over diverse technologies & concepts, spanning IP/MPLS, Carrier Ethernet, VPNs, DOCSIS, 3G/4G wireless protocols, optical switching and networking, TDM, QoS, resilience, and resource allocation.

Associate Professor (Contract), Dept. of Electrical Engineering, IIT Bombay, Mumbai, India & Silicon Valley, CA. 2004 – 2007

- Founded the WiNETS (Wireless Networks) Research Group for research in wireline- and wireless-broadband access technologies, including: metro/access network traffic management and QoS, wireless & sensor network routing and test bed development, wireless network infrastructure security, mobile applications and architecture.
- Graduated 8 students (with student research published in prestigious international industry- and academic-conferences: SANOG'06, APRICOT'06, IEEE Milcom'07, IEEE Milcom'08, and one winning the Best B. Tech. Project Award in EE), and guided 20 graduate course research projects (three of which were published nationally and internationally), and over a dozen student seminars.
- Developed and taught junior- to- graduate-level courses, spanning digital circuits, basic electronics, and labs. to queueing theory, scheduling algorithms, circuit- and- packet-switching, and advanced networking protocols and systems to different class sizes, several exceeding 100+ students and a half-dozen+ teaching assistants.

Principal Architect, Jasmine Networks, Inc., San Jose, CA 2001

- Architected & designed an MPLS-based control plane for packet and TDM (SONET/SDH) data for Jasmine's CNS (Converged Network System).
- Strengthened Jasmine's industry standing by my leadership role in numerous MPLS forums & standards bodies (IETF, OIF).

Research Engineer, Tellabs Research Center (TRC), Cambridge, MA 1998 - 2000

- Analyzed and designed high-speed switch router architectures:
 - Only member of the Research Center to be part of the Tellabs' Advanced Business Development team for evaluating potential acquisitions in the terabit router space; performed deep-dive architectural evaluations of 10+ switch router startups (including names like Avici, Pluris, Torrent, Redstone, Ironbridge).
 - Designed an IP flow management algorithm for parallel high-speed switches (patented, US 7123581), and devised path protection schemes for MPLS networks (6 patents; US 7298693, 7315510, 7796504, 7804767, 7881184, 8588058).
- Supervised a summer project for a Ph.D. student from MIT that produced a novel scheduling algorithm for parallel cross-bar switches (patented, US 7123623).
- Contributed in the Diffserv, MPLS, Traffic Engineering, L2/L3 VPN WG's of the IETF. Devised an MPLS recovery framework; eventually published as RFC 3469.

Post-Doctoral Researcher, Multi-disciplinary Optical Switching Technology (MOST) Center, Santa Barbara, CA. 1997 - 1998

- Architected & evaluated all-optical switches and switching schemes for WDM/DWDM networks, based on MEMS technologies.
- Led to one conference (IEEE MPPOI'98) and one journal (IEEE TON) paper.

EDUCATION

Ph.D., Electrical & Computer Engineering, UC Santa Barbara. 1997

Research led to six conference- and four journal-papers (IEEE TPDS, IEEE TON, IEEE JLT, & Computer Networks).

M.S. (Computer Engineering), UC Santa Barbara. 1993

Research led to one journal (IEEE Trans. on VT) and one conference (ICC) paper.

M.S. (Signals & Systems), UC Santa Barbara. 1993

Motorola Paul V. Galvin Fellowship (given to only two engineers from India annually).

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

Winner **Best B. Tech. Project** in Electrical Engineering Award for designing, fabricating, and testing a fully-functional Ethernet repeater.

AWARDS & HONORS (selected)

1. **"How Do NFV and MEC Play Together? How Can Advances in NFV Synergistically Help in Advancing MEC?"** Leader, Interactive Roundtable, Mobile Edge Computing (MEC) Focus Day, CNV 2015, Palo Alto, CA, Dec. 3, 2015.
2. **"Roadmap & Requirements for MEC: 2016 and Beyond,"** Invited Panelist, Mobile Edge Computing (MEC) Focus Day, CNV 2015, Palo Alto, CA, Dec. 3, 2015.
3. **"Status of NFV Transformation Going into 2016,"** Panel Chair, Carrier Network Virtualization (CNV 2015), Palo Alto, CA, Dec. 2, 2015.
4. **Chairman, Service Provider Track A, Day Two**, Carrier Network Virtualization (CNV 2015), Palo Alto, CA, Nov. 30 - Dec. 3, 2015.
5. **"Network Functions Disaggregation: Innovations in NFV, SDNs, and Optical Networks,"** Invited Moderator, MEF GEN 15, Dallas, TX, November 18, 2015
6. **Chairman, Service Provider Technology Track 2**, MEF GEN 15, Dallas, TX, Nov. 18, 2015.
7. **"The Impact of SDN on Service Provider Networks"**, Co-Guest Editor, *IEEE Communications Mag.*, Feature Topic Issue approved by the Editor-in-Chief, September 19, 2015 (to appear Summer 2016).

8. **Group Moderator & Manager**, Carrier Ethernet Group on LinkedIn, March 2012 - present. (9,577+ members spanning 123 nations, 2, 236 companies, 6 continents)
9. **Sponsorship Chair & Organizing Committee Member**, *IEEE 5G Summit Silicon Valley*, Google Campus, Mountain View, CA, November 16, 2015.
10. **Judge**, MEF Ethernet Excellence Awards, GEN 15, October 2015, and GEN 14, October 2014.
11. **“Reliability in the NFV World - How Can 100% Service and Application Availability be Achieved?”** Panel Chair, NFV World Congress, San Jose, CA, May 6, 2015.
12. **“Open Source IoT in the Cloud,”** Session Chair, IoT Open-Source Summit at IoT World Summit, San Francisco, CA, May 13, 2015.
13. **“The SDN & NFV Promise to Make the Network Agile and Optimum,”** Chair, 5G Forum USA, Palo Alto, CA, April 15, 2015.
14. **SDx Summit**, Chair, Carrier Network Virtualization (CNV 2014), Palo Alto, CA, December 9, 2014.
15. **“Evolution of the Carrier Ethernet Professionals Community,”** Invited Moderator, Panelists from PLDT, Telin Singapore, & Sri Lanka Telecom, MEF GEN 14, Washington, D.C., November 17, 2014.
16. **“Making the Intangible Tangible via R&D Innovation,”** Invited Talk, 2nd Futurewei Vision Summit, Santa Clara, CA, November 6, 2014.
17. **Co-Chair, Cloud Infrastructure Track**, TiECon 2014, Santa Clara, CA, May 16, 2014.
18. **Member, Scientific Committee**, MPLS & Ethernet World Congress, Paris, France, 2003 - 2013.
19. **Innovation Certificate**, Tellabs Operations, Inc., June 2000.

PATENTS GRANTED (US)

1. **Method and Apparatus for Validating a Path Through a Switched Optical Network**, 7,095,956, Issued August 22, 2006.
2. **Method and Apparatus to Switch Data Flows Using Parallel Switch Fabrics**, 7,123,581, Issued October 17, 2006.
3. **High-Speed Parallel Crossbar Switch**, 7,123,623, Issued October 17, 2006.
4. **Reverse Notification Tree for Data Networks**, 7,298,693 B1, Issued November 20, 2007.

5. **Method and Apparatus for Detecting MPLS Network Failures**, 7,315,510 B1 Issued January 1, 2008.
6. **System and Method for Network-Layer Protocol Routing in a Peer-Model Integrated Optical Network**, 7, 457, 277, Issued November 25, 2008.
7. **Method for Establishing an MPLS Data Network Protection Pathway**, 7,796,504, Issued September 14, 2010.
8. **Protection/Restoration of MPLS Networks**, 7,804,767, Issued September 28, 2010.
9. **Reverse Notification Tree for Data Networks**, 7,881,184, Issued February 1, 2011.
10. **Method and Apparatus for Detecting MPLS Network Failures**, 8,130,637 B1 Issued March 6, 2012.
11. **Reverse Notification Tree for Data Networks**, 8,588,058, Issued November 19, 2013.
12. **Method for Establishing an MPLS Data Network Protection Pathway**, 8,737,203, Issued May 27, 2014.

A full Curriculum Vitae including: a complete list of publications, industry service, standards contributions, research guidance, academic teaching, and editorships, may be requested by calling Dr. Sharma's office or cell phone above.