Chesapeake NETCRAFTSMEN

Dr. Peter J. Welcher, CCIE #1773, CCIP, CCSI #94014

Professional Summary

Dr. Peter Welcher is a highly technically skilled Principal Consultant with broad knowledge and experience in a number of areas, including high-end routing and network design, Cisco QoS, IP Multicast, MPLS, wireless, IP telephony, data center/e-commerce, and network management. He writes quickly and well, and has played a significant role in building a business, both in terms of sales support and internal management.

Dr. Pete has worked with a wide variety of products and technologies in complex environments and supporting many different industries. These consulting projects include broad experience in network design, re-design, implementation, and assessment, including High Availability and failover techniques. They have included very large e-commerce/data center design, strategic corporate and university campus network re-design. Peter has designed and helped implement network management architectures and Network Operations Centers for major corporations. He has taught MPLS, QoS, and new IOS features to Cisco staff internationally. He also taught hundreds of networking personnel attending Cisco Certified courses, Cisco Networkers sessions, "Cisco University" sessions, and seminars using material he wrote. He is skilled at explaining technology simply and relating it to business issues, and at assessing networking technology, designs, and procedures for risks, strengths, and weaknesses with an eye towards improvement.

Peter is certified as Cisco CCIE #1773, CCIP, and certified instructor (CCSI #94014). He holds numerous Cisco specialization certifications as well. He led teams that developed several courses for Cisco. He has done many technical book proposal and content reviews, notably for Cisco Press / Pearson.

Over 20 recent blogs and 140 prior lucid topic summary articles written by Peter have been well received within the industry. They can be found online at the link http://www.netcraftsmen.net/welcher/, along with links to seminars and other materials. The articles together with Peter's excellent presentation skills have gained him quite a following within the industry.

Highlights

- Working with major hotel chain in a review role concerning Data Center of the Future planning document, also High Availability study for on-net Call Center trunking and DR strategy. (Jan-March, 2010).
- Managed a team developing and deploying a network re-design for a government entity with about 12,000 users. Wrote procurement specifications leading to competition and award of contract. The final design involves about 180 Cisco 6509 switches with Sup720-10GE, IPv4

and IPv6 routing to the access layer, multiple 10 Gbps uplinks, IPv4 multicast, out of band NAC-ready addressing, QoS, wireless, replacement of DMZ and firewall complex. The migration to the new network will involve mitigating some extended VLANs to permit a purely Layer 3 core, probably using EoMPLS. Cisco VSS technology may be used to replace Nortel switch SMLT (multi-chassis EtherChannel) to blade servers. The project includes smooth migration to Cisco switches of well over 1000 servers and ESX servers, as well as NAS / SAN front-ends in a multi-vendor large data center, and another 1000+ servers and 500 VM's in the paired development data center. (April 2008-May 2010).

- Worked with a stock market regulatory organization on interviews and NetFlow traffic analysis for WAN Capacity Planning while strongly assisting with RFI interviews and RFP for Service Provider L2 or L3 MPLS VPN services with QoS and IP multicast support. (Nov 2009-2010).
- Supported major design and Best Practices assessment for a significant federal Executive branch organization. (July-August, 2009).
- Assisted regional unit of AAA with QoS in support of Polycom-based IP Video-Conferencing, revisions to existing QoS for Avaya-based IP phones, and campus QoS within new HQ building. (August 2009).
- Developed re-design and plans to move regional credit union to Nexus 7000 collapsed core, routed closets, and VoIP QoS on MPLS WAN. Providing configuration templates and migration support. (2009-2010).
- Worked with major hotel chain on understanding causes of E-Commerce application problems, including packet capture and analysis during attempts to re-create the specific problem. (Spring 2007).
- Worked with major hotel chain (over 3000 sites) concerning High Availability and outage response improvements for e-commerce web site. This web site does over $4B/year in business. Work included comprehensive "due diligence" review of co-located host service provider. (Spring – Fall 2006)

Network Design Experience

- Conducted two rural fiber small provider designs using VRF's and Cisco ME3400 or 3560-E switches. One of the designs is upgrading a hospital from 2xT1 to 10 Gbps capacity at lower monthly cost. The other is using fiber to provide 1 Gbps connectivity to rural schools that formerly only had Cisco outdoor wireless connectivity at much lower speed. (2009)
- Conducted onsite 3-day quick network design and Best Practices review for a West Coast medical research organization. (Fall, 2007).
- Conducted comprehensive design review for a pharmaceutical company concerning deploying 30 6509 switches and 20 Gigabit EtherChannel links into new buildings and data center. Review assessed design for appropriate High Availability practices, as well as Best Practices regarding L2 and L3 switching to the access layer, L2 security, QoS, IP multicast, ACE module deployment, Cisco controller-based wireless. (Winter 2006)
- Performed network design for small network using switches and wireless access points with the Cisco NAC appliance. (Winter – Spring 2006)
- WAN capacity planning, Citrix/web PeopleSoft Financials deployment (Spring 2006).
- Worked with military organization on assessing and improving navigation-centric CONUS network, also installation and use of selected network management tools. (Spring 2006)

- Have conducted several network health, design, and/or strategic assessments for customers such as a large NYC law firm, a medical research institute, a hospital, a rapidly-growing e-mortgage company, and a federal mortgage organization. These involved a varied mix of automated information collection, interviews, design review, and strategic plan development, commentary, or revision.
- Conducted strategic needs, gap, and coming technology analysis, baseline performance analysis, and strategic network design for a 13,000 student university.
- Reviewed Metro Ethernet design ideas and itemized potential issues for a mortgage firm considering radical restructuring of their WAN architecture.
- Determined 802.1x-ready network design and provided configuration templates and deployment support for a 1200 student university (40+ switches, 50 WAP's, CiscoWorks, VPN Concentrator, WLSE, ACS, and Bradford Campus Manager). (2004)
- Lead team project for health insurer, re-implementing the current data WAN using ATM to converge PBX trunks and data traffic onto common infrastructure. Alternatives under study included VoATM and VoIP. Project included review of design requirements and design alternatives, assistance with RFP and SLA development for Service Provider bids, as well as evaluation criteria. We assisted with bid evaluation, and with developing the CPE equipment list and vendor selection. We provided an initial cost/ROI analysis of the alternatives as well. This project will enable moving Call Center trunks onto the IP network greatly reducing telephony costs for the organization.
- Also reviewed and proposed modifications to existing multi-campus switch and OSPF implementation.
- Multiple large network design, design review, and analysis consulting projects. Clients have included two stock quotation firms, one of 2000 and one of 3000 routers. These projects also include repeated network and Internet connectivity design reviews for an multi-national electronics distributor with over 350 sites in a high speed international network and over $1B/year in internal e-commerce, and a state Department of Motor Vehicles Frame Relay/SNA network.

Data Center and High Availability

- (Several major engagements listed above)
- Conducted quick design planning with an electrical transmission industry firm concerning Data Center segmentation and virtualization design, also design discussions concerning Layer 2 versus Layer 3 Metro Ethernet for GeoClustered applications. Plan developed should allow consolidation of a large number of Cisco 6500 switches and simpler management while adding more separate security zones in two Data Centers. (Fall, 2007).
- Conducted network design review for major hotel chain, data center and main corporate sites with an emphasis on increasing High Availability. Work included assessment of overall design, documentation, people, processes, management tools, etc. (Spring – Fall 2006)
- Conducted design review for comprehensive data center restructuring for one of the top online stock trading firms. (Spring 2005).
- Worked alone and then with a team at major travel-related data center housing a large number (40+) of top e-commerce brands. The task was to critique network upgrade plans, identify design, procedural, and any other network-related management risks. The overall

goal was to provide technical information allowing senior management to prioritize efforts to reduce number and severity of outages, improve delivery on SLA's. (Early 2005)
- Lead team working to understand and rectify problems that had occurred after changes to a large corporate data center's switched network (700+ servers). Wrote reports describing causes and further actions. (2003 – 2005).
- Provided high availability design and implementation guidelines and templates, for network aspects of a new backup data center for a major financial institution. Design includes optical MAN with upwards of 32 Gbps of DWDM connectivity between mainframe and backup mainframe, also IP connectivity to existing sites. Design uses multiple Cisco 6509 switches to provide 10/100 and Gigabit Ethernet connectivity to over 1000 UNIX, NT, and Novell servers. (1999)

QoS Experience

- Worked with regional credit union to resolve WAN application performance and voice problems on a Cisco-based MPLS WAN network using Packeteers for QoS and compression.
- Revisited and provided the basis for rework of the QoS design for a switching and MPLS-based large city government network carrying substantial voice traffic. (March 2008).
- Provided design guidance concerning QoS, and Layer 2 server clusters via TLS Metro Ethernet for a major teaching hospital. (Fall, 2007).
- Conducted network health, QoS, VoIP readiness assessment for a US Army base pilot project using the NetMRI tool. Demonstrated IP SLA (SAA) and Cisco Call Manager data collection and reporting capabilities of NetMRI. (Spring 2006)
- Conducted QoS / RSVP technology overview and product review for phone / video call reservation product. (Spring 2006)
- Worked with well-known credit card organization on design of custom QoS classes with labs to support deployment of a new enterprise architecture.
- Team lead for a Netcraftsmen team specifying the QoS architecture for a federal agency of 300,000 users. Work included pilot QoS performance testing, visual demonstration of QoS benefits to executives, QoS architecture and design documents, network management requirements and tools documents, and knowledge transfer to CCIE's and other staff with the agency. Presented at QoS meeting of WAN staff concerning architecture and deployment considerations. Concluding phase involved live pilot on production network. (2002)
- Worked with large lending institution on overall QoS architecture, business case, risks, and impact statements. Also produced configuration templates for initial deployment, including support for VoIP and Streaming Video on Demand. Conducted mini-classes on QoS for Operations staff.
- Performed follow-on work for health insurer, presenting best campus design practices, facilitating requirements discussion, and (separately) determining QoS requirements to support WAN and LAN VoIP trunking between PBX's.

Wireless-Specific Experience

- Worked with large government / military contractor on design for, and deployment of, Cisco controller-based wireless design for 150 APs on corporate campus. (Winter 2006-Spring 2007)

- Performed initial technical design with Netcraftsmen team for a major hospital deployment of 700 Cisco lightweight Wireless APs and 6 controllers. (Early 2006)
- Assisted a federal organization in preparing a four-phase multi-million dollar budget for WLAN deployment by preparing own shadow budget as a cross-check on tasks and costs. (Summer 2005)
- Design review and technical resource for Cisco wireless deployment at a steel plant. (Summer 2005)
- Conducted WLAN Security audit and provided recommendations to a pediatrics hospital. (Spring 2005)
- Worked with Netcraftsmen team to provide technical advice and oversight for a WLAN design for a medium-sized financial organization occupying 5 high-rise floors in NYC. (Spring 2005)
- Performed in-house lab testing validating correct configuration for 802.1x and per-user dynamic VLAN assignment for Cisco switches and WAPs.
- Worked with a Maryland County Government with Cisco wireless bridging infrastructure to overlay an IPSec network providing separate and secure connectivity for county offices and schools. Project included sizing and testing performance of Cisco IPSec implementation in certain Cisco router models.
- Reviewed and improved a proposed network design for an international satellite wireless provider.

Security

- Redeployed ASA and routers for small (1200 student) university shifting Internet links to 150 Mbps WiMax fixed link, including setting up IPsec VPN between satellite and main campus, and coordinating updates to student SSL VPN access. (2009)
- Developed PERL scripts and automated compliance reporting for major hotel chain. Reports are for security, governance, and PCI compliance checks for thousands of routers. (Summer – Fall 2007)
- Supported smooth phased migration of a medical insurance firm Internet connection, DMZ firewalls, CSS content load balancers, etc. to new hardware and new Data Center locations. (Fall, 2007).
- Did basic study for a U. S. government agency on NAC Framework technology, Cisco Security Manager support, AAA audit trail and authorization. Project required government contractor background check. (Spring – Summer 2007)
- Worked with leading mortgage organization on planning, design, short-term migration techniques, and technology testing for network segmentation for financial servers, in support of governance, ISO, and PCI compliance requirements. Design approach included temporary NAC Appliances near data centers, longer-term user re-addressing and out-of-band NAC, and transparent mode FWSM in data center switches. (Winter 2006 – Spring 2007)
- Worked with a health care insurer to plan how to smoothly transition their Internet DMZ and load balancing complex to new switches and firewalls.
- Upgraded PIX firewall to ASA, installed IDSM and MARS, set up SSL VPN, swapped out WAN link and router for DS-3, for a small university. (12/2007)
- Performed network security assessment for a municipal organization as part of a team security assessment report, for a major metropolitan utility service organization.

- Conducted rapid security facilitated discussion and assessment for a medical school.
- Set up a secure and mirrored system for a city water and sanitation organization. Used OpenBSD and RANCID and CVSWeb for router/switch configuration archival and difference viewing. This is accessed via HTTPS and an Apache web server. The system also collects 500 MB/day or more of syslog data from network devices, security devices, and servers (using software to convert Windows events to syslog message). The system automatically archives and compresses all collected data to be burned to CD weekly for offsite storage of configuration and audit trail information.

IPv6

- Worked with a government sub-agency to conduct independent testing of their backbone IPv6 deployment, including documenting compliance for the GAO.
- Supplied a large U. S. government entity with an IPv6 strategy and light IPv6 network technology training and demo. (Fall 2006 – Summer 2007)

IP Multicast

- Conducted troubleshooting of CEO video / IP multicast forwarding problems in a large financial organization, helped narrow the scope of the problem down to where Cisco TAC could provide some suggestions. (12/2008).
- Worked with a regional hospital to improve and stabilize IP multicast deployment for key clinical applications. (12/2008).
- Provided design guidance concerning robust, safe IP multicast deployment for a major teaching hospital. (Fall, 2007).
- Designed and assisted in implementation of controlled safe IP multicast for an enterprise. System supports multicast for Call Center applications including Nortel Symposium, for managing call queue depth, response time, etc. (Spring 2006)
- Worked with large home mortgage lending organization to troubleshoot multicast problems related to Novell use of SLP protocol and daily network outages in Cisco 6509 switches due to overflow of TCAM due to excessive number of multicast sources combined with number of outgoing VLAN interfaces. (2002)
- Worked with a Cisco partner to identify issues and risks in an IP multicast design involving 30 Gbps of data in up to 1024 multicast flows. Follow-on testing and revision work on this design required several months' effort of a Cisco NSA Consulting Engineer and another Consulting Engineer. Returned 1-2 years later to assist in troubleshooting performance and application design issues. (2000 – 2002)

MPLS Experience

- Worked with several companies on dual WAN routing and related issues for large-scale MPLS VPN WAN deployments with IPsec or other backup paths. (Spring-Summer 2007)
- Conducted MPLS VPN WAN design review for a portion of a U.S. government agency concerning best practices, controlled routing, IPsec over MPLS VPN, and security. (Spring 2007).

- Provided high-level escalation support for troubleshooting a large city government optical + MPLS + VoIP network, as well as MPLS, routing, and QoS design issues. Work included reconfiguration to work around major optical deployment problems. (2006-2007).
- Taught MPLS VPN course for Service Provider personnel in Cisco office, Bellevue WA. (Spring 2007).
- Outside presenter and lab supervisor for Cisco Networkers 2008 (BPG Route Reflectors and Confederations), 2006 and 2007 (MPLS VPNs, two 4-hour sessions). Also presented at Networkers 2005, and Cisco Powered Networks conferences in 2003 and 2004.
- Presented at MPLScon 2005 and 2006 in NY City (*Buyer's Guide to MPLS VPN Services*).
- Taught MPLS to teams from a major international services organization deploying international MPLS VPN's with QoS service offering for multi-national firms. Worked with this vendor to understand, clarify, and answer technical and design issues related to the deployment.
- Provided remote design and configuration assistance for MPLS and QoS aspects of a small Service Provider data and VoIP network in New Zealand. (Fall 2005)
- Reviewed technical MPLS VPN basics and some of the relevant patents to assist a legal team preparing their case for an MPLS-related patent suit. (Early 2005)
- Performed a detailed Security and Business Risk study for a proposed managed MPLS VPN deployment by a major retailer (1700+ stores).
- Reviewed proposed network design for a Maryland county. The design proposed substitution of Cisco high-speed Ethernet switches and/or optical equipment routing IP, IPX, AppleTalk to mostly replace existing ATM-based network. Report discussed the county requirements and the pros and cons of using a 6500 switch-based MPLS approach versus a Layer 2 optical approach. (2002)
- Worked with international law firm on routing issues and alternatives related to U.S. part of MPLS VPN service deployment. Also provided initial QoS policy to support Citrix and IP VideoConferencing and light training of Operations staff on QoS. (2003)
- Taught and consulted on Cisco MPLS technology and design considerations for a wireless and Internet Service Provider in Taiwan. (2001)
- Worked with a network modeling tool vendor to provide MPLS and BGP expertise for new features and product modeling Cisco devices in a Service Provider setting. Work includes test lab scenarios exercising the various Cisco MPLS configuration options and features. (2000)

Network Management Experience

- Conducted HP OpenView, CiscoWorks, and WLSE configuration and tuning for a federal customer. Analyzed possible WLAN design and security issues. (Early 2005)
- Integrated SNMP traps for comprehensive event management at a health insurance provider, tying NetIQ and server-related management tools into Tivoli Netview and Enterprise Console. (Early 2005)
- Assisted net management team for a large federal agency in planning and procedural preparation for 20-copy hierarchical CiscoWorks deployment, and in post-deployment troubleshooting for completion in accord with tight deadline. Conducted customized onsite CiscoWorks training. (Late 2004, Fall 2005)

- Numerous other installations of CiscoWorks. These usually include device population, resolution of network management readiness issues, hands-on knowledge transfer, and strategy for use. Taught the various Cisco CiscoWorks courses since 1996.
- Performed installation, device population, SNMP trap tuning, and other integration with HP OpenView Network Node Manager and Tivoli Netview.
- Installation and knowledge transfer concerning CiscoSecure ACS and NetScout probes and software.
- Participated in designing criteria for evaluation of comprehensive manager products (Tivoli, CA TNG, HP OpenView) for the U.S. House of Representatives.
- Experienced at Network Management system architecture design, scaling and sizing, and implementation. Have installed, configured, and integrated many of the above products on the management station(s) at some of the above clients, also at a regional utility holding company, at a State Motor Vehicle department, and a international X.25 and Frame Relay Service provider, an international food company, and a County government.
- Wrote SNMP MIB prototype for SNMP configuration of Cisco routers (IOS 10.0).

Other Project Experience

- Completed design and configuration of Cisco GSS site load balancing and failover for an online testing organization. (Summer 2005).
- Completed troubleshooting Cisco CSS issues for a health insurance provider. (Summer 2005)
- Developed presentation on NetFlow for FlukeNetworks. (Summer 2005)
- Assisted with network review and design as well as worm traffic storm troubleshooting at a large medical school hospital. Conducted packet capture and analysis in troubleshooting the network behavior of new radiology program causing user computer lockups.
- Technical book reviewer for Cisco Press books: *WLAN Security*, *Top Down Network Design* (2nd ed.), *Optimizing Applications on Cisco Networks*, and *The IT Career Builder's Toolkit*, among others. Also reviewed several book proposals.
- Worked with a branch of the U.S. government to implement and perform technology transfer, for use of NetFlow reporting in a nation-wide network. (1999)
- Have conducted numerous reviews of prospective books or books in development for publishers, including Cisco Press, MacMillan Press, and Addison-Wesley-Longman. Book topics include network management, switching, MPLS, IPv6, Internet Services (CISS certification track), QoS, NAT, IPsec, and IP multicast.
- C programming of a small portion of the embedded router software and help system (CLI command parser) now in Cisco Systems routers.

Other Course Development

- Provided beta feedback on the courseware, and qualified as an instructor for, the new Cisco CCIE R&S 360 prep course. (April, 2008).
- Provided Subject Matter Expertise for initial planning and content determination for Cisco CCDA and CCDP supporting course revisions (DESGN and ARCH courses). Assisted with ideas and detailed technical review during actual course revisions. The courses got a top rating from the Forrester organization for meeting job skill objectives. (2006 – Spring 2007)
- Provided detailed contents design and new content for the Cisco Foundations Express certifications courses (SEs and FEs). This course covers the new initial requirement for

certification for Cisco Premier Partners. Worked as Subject Matter Expert and reviewer with the ElementK team producing the materials. (Fall – Winter 2005)
- Authored or led team developing a number of courses for internal use, also for Cisco, and for customers. Topics included Basic Routing and Switching, Frame Relay, HP OpenView, CiscoWorks, SE Design Workshop (Cisco), BGP, Local Director, Distributed Director, Web Cache Engine, Service Provider Fundamentals, Deploying Cisco IOS Intelligent Network Services, QoS. Course durations ran from 2 to 7 days.

Cisco Courses Taught:

- Taught over 14 different Cisco courses, including Routing, Switching, Design, Troubleshooting, Network Management, MPLS VPN and TE, and QoS.

Hardware Platforms:

- Cisco routers (800 series, 1700/1800 series, 2500/2600/2800 series, 3600/3800 series, MC3810, 4000 series, 7000/7500 series, 7600 series).
- Catalyst switches (1900 series, 2900/3500 XL series, 3550/3560, 4000 series, 4500, 6500, 6500 VSS, RSM, Sup IIIG + RSFC, MSFC2, PFC2, Sup720, Sup32, NAM).
- Cisco LS1010.
- Cisco WLSE, ACS.
- Cisco VPN Concentrator 3000 Series.
- Cisco PIX, ASA.
- Cisco CSS, GSS.

Protocols and Media:

- Transparent LAN Services (TLS).
- 802.1x and the EAP protocols.
- MPLS (Basic MPLS, Traffic Engineering, QoS for MPLS, MPLS VPN). L2 over MPLS.
- QoS (all aspects).
- IP Telephony (MGC, SIP, VoIP, voice gateway routers, some work with Call Manager).
- IP Multicast, including Anycast RP, MBGP and MSDP.
- Wireless LAN and 802.11, Cisco WDS, TKIP, Cisco controller-based wireless
- Network Management: deep knowledge of CW2000 components, including Cisco QoS Policy Manager, Device Fault Manager (DFM), Wireless LAN Solution Engine (WLSE), Cisco Network Analysis Module (NAM). Also thoroughly knowledgeable and experienced with NetScout nGenius, HP OpenView, NetFlow, Netsys, Netview, NetIQ. Technical reviewer of Cisco Press *Performance and Network Management* book.
- IPSec VPN, IKE/ISAKMP.
- IBNS, 802.1x, NAC Appliance, and NAC Framework.
- Routing and related protocols: RIP, IGRP, EIGRP (for IP, IPX, AppleTalk), OSPF, BGP, IS-IS, DECnet, RTMP, NLSP, RSRB, DLSw+.
- Design and implementation of large-scale redundant routed and switched networks
- Layer 3: IP, IPX, AppleTalk, DECnet, CLNS, XNS

- Layer 2: HDLC, PPP, LANE, bridging (Transparent and Source Route), X.25, Frame Relay, ATM, LANE, APPC Layer 1: Ethernet, FastEthernet, Gigabit Ethernet, Token Ring, FDDI, ATM.

Software Platforms:

- Sun Solaris, HP HPUX, IBM AIX, various forms of Linux.
- Windows 95, 98, ME, NT 4.0, XP, Windows 2000.
- HP Openview, Tivoli Netview, CiscoWorks, and others.

Certifications:

- Passed CCDE written, took the beta (first) practical test once. (Through October 2008).
- CCIE #1773
- CCSI #94014. Certified Cisco Instructor
- CCIP (BSCI, MCAST + QOS, MPLS certification tests).
- CCDE: passed written, taken Practical exam twice.
- Cisco Qualified Specialist (CQS): IP Telephony Support Specialist
- CQS: IP Telephony Design Specialist
- CQS: Network Management Specialist
- Cisco Sales Expert: Network Management for Account Managers
- Cisco Product Solutions Essentials IPT, IP Telephony Solutions, Telephony Fundamentals
- Cisco Technical Expert: Network Management Specialist

Publications:

- Over 20 blogs and 140 articles on Cisco networking topics, posted on the Netcraftsmen web site.
- Numerous seminars and presentations, also posted on the Netcraftsmen web site.
- Wrote book on True BASIC (published), book on C programming (unpublished).

Other Presentations:

- Helped determine outline for and resented half of a wireless course for the BluesNet Network Advisory Group. (November, 2009).
- Presenting / presented on BGP at Cisco Networkers (2009, 2010).
- Presented on Network Management, and later on IP Multicast, for the BluesNet Network Advisory Group.
- Prepared and presented a large number of presentations at MD/VA Cisco U, Cisco seminars in NY / NJ / CT, Cisco Powered Networks (Service Providers), HP OpenView Forum, and customer sites for audiences of up to 200 people.
- Topics included Security Best Practices, Firewall Deployment, IPsec VPN, Wireless Design and Security, IP Telephony, IP Multicast, QoS, Switching, MPLS, 802.1x, and High Availability.
- Have presented material (MPLS, MPLS-TE, QoS, other) in Tokyo, Taipei, Amsterdam, Brussels, Munich, Sao Paulo Brazil, and Mexico City.

Education:

- Ph.D. in Mathematics, M.I.T. 1978.
- B.A. in Mathematics, Wesleyan University, High Honors. 1974.

Employment History:

- 2001-present. Partner in and Principal Consultant with Chesapeake NetCraftsmen, LLC.
- 1993-2001. Mentor Technologies. Senior Instructor/Consultant. See above for some of the projects and work performed.
- 1988-1990. Goldstein Software (and unpaid leave from USNA). Completed programming Lotus 2.2 compatible spreadsheet for DOS and Macintosh. Added substantial statistical functionality. Directed 2 programmers in later stages.
- 1979-1993. U.S. Naval Academy. Full Professor of Mathematics. Brought computers to department with annual budget of several hundred thousand dollars. Lead and managed a volunteer team in administering 40+ Sun workstations and 150+ PC's for about 350 users. Taught Math courses, wrote papers in Mathematics and Physics (computer modeling). Wrote book on True BASIC (published), book on C programming (unpublished).
- 1978-1979. Baruch College (CUNY). Assistant Professor of Mathematics.

Contact Info:

Email: pjw@netcraftsmen.net or p.welcher@att.net
Phone: (410) 626-7735 or –7122 (East Coast U.S., please call between 9 AM – 9 PM only)
Cell phone: (443) 995-4859

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