

Timothy J. Salo

Salo IT Solutions, Inc.
P.O. Box 141049
Minneapolis, MN 55414-6049

(612) 605-6896
salo <at> saloits <dot> com
www.saloits.com/Resume.pdf

QUALIFICATIONS

- Three decades' experience researching, designing, developing, marketing, deploying and operating data communications and Internet technologies, products and networks
- Principal Investigator for AFRL, DARPA, NASA, NOAA, NSF research contracts
- Fifteen years' management experience: research, product management, software development
- Long-time participant in Internet Engineering Task Force (IETF)

RESEARCH INTERESTS

Principal research interests include: enhanced, Internet-like protocols and related technologies for use in severely resource-constrained environments, where very limited bandwidth, processor power, memory, or electrical power make the use of unmodified Internet protocols infeasible; potential applications of these technologies include large-scale, wide-area wireless networks for environmental monitoring and hydrologic warning, wireless machine-to-machine networks, wireless ad hoc networks, low-power wireless networks, wireless sensor networks, tactical networks, and space networks.

EXPERIENCE

2000 – **Founder and President, Salo IT Solutions, Inc.**, Minneapolis, MN.
<<http://www.saloits.com/>>

Research, design, and implement advanced Internet technologies and solutions for demanding network environments, such as wireless ad hoc networks, low-power wireless networks, wireless sensor networks, tactical networks, space networks, hydrologic warning systems and large-scale environmental monitoring networks.

- **Principal Investigator**, *NOAA/eNvironmental Beacon (nBeacon) System*, Funded by National Oceanic and Atmospheric Administration (NOAA)
- **Principal Investigator**, *Wide-area Environmental Sensing and alerting networks (WESTnets)*, Funded by NOAA.
- **Principal Investigator**, *Analysis of Very Narrowband Requirements for Hydrologic Frequencies*. Funded by NOAA.
- **Principal Investigator**, *ALERT-2 Protocol Development*. Funded by NOAA.
- **Principal Investigator**, *An Extensible QoS Framework for Secure Tactical Networks*. Funded by Air Force Research Laboratory (ARFL).

EXPERIENCE (continued)

- 2017 **Lecturer (temporary), University Wisconsin Stout, Menomonie, WI**
- Will teach two sections of CS-442, Systems Programming (operating systems).
- 2014 **Adjunct Faculty, University of St. Thomas, St. Paul, MN**
- Taught CISC 370, Computer Networks.
- 2001 – 2004 **Sr. R&D Engineer, Architecture Technology Corp., Eden Prairie, MN.**
- Created proposals for and oversaw execution of federally funded network research and development projects. Projects included:
- **Architect**, Future Combat Systems (FCS) System of System (SoS) Common Operating Environment (SOSCOE). Under contract to Boeing.
 - **Principal Investigator**, *Embedded Transport Agents for Near-Earth Communications*. Funded by NASA Glenn Research Center.
 - **Principal Investigator**, *Proximity Networks Technology Assessment*. Funded by NASA Glenn Research Center.
- 1988 – 2000 **Director, Advanced Networking Group, Network Computing Services, Inc.** (formerly Minnesota Supercomputer Center, Inc.; acquired by Cray Research, Inc., SGI, and netASPx), Minneapolis, MN.
- Created, acquired external funding for, and managed an Internet research group. Responsible for projects from conception through completion, including:
- **Principal Investigator**, *Real-Time Visualization of IP Flows over Switched WANs*. Funded by DARPA.
 - **Principal Investigator**, *MAGIC-II*. Funded by DARPA.
 - **Principal Investigator**, *MAGIC Gigabit Testbed*. Funded by DARPA.
- 1979 – 1988 **Manager, Product Management; Product Manager; Manager, Compiler and Tools Development; Systems Engineer; Senior Systems Programmer, NCR Comten, St. Paul, MN.**
- 1976 – 1979 **Systems Software Programmer, University of Minnesota, Minneapolis, MN.**

EDUCATION

- Graduate Student, Computer Science Ph.D. program, University of Minnesota, present
- Master of Science, Computer Science, University of Minnesota, anticipated 2016.
- Master of Science, Software Engineering, University of St. Thomas, 2002
- Master of Business Administration, University of Minnesota, 1986
- Bachelor of Science with Distinction, Computer Science, University of Minnesota, 1978

RESEARCH CONTRACTS AND GRANTS

- Principal Investigator, *NOAA/eNvironmental Beacon (nBeacon) System*, National Oceanic and Atmospheric Administration (NOAA), Contract WC-133R-15-CN-0084, September 14, 2015 – March 16, 2016.

Demonstrated the technical feasibility of using Bluetooth beacons to deliver real-time, contextual, NOAA environmental data products to public users' smartphones.

- **Principal Investigator**, *Wide-area Environmental Sensing and alerting networks (WESTnets)*, National Oceanic and Atmospheric Administration, Contract WC133R11CN0135, September 7, 2011 – March 6, 2012.

Developed proof-of-concept implementation of the Wide-area, Environmental Sensing and alerting network (WESTnet) protocols, a next-generation suite of wireless network protocols that will provide enhanced services for hydrologic warning systems and large-scale, wide-area, environmental monitoring networks.

- **Principal Investigator**, *Analysis of Very Narrowband Requirements for Hydrologic Frequencies*, National Oceanic and Atmospheric Administration, order DG133W10SE3038, October 1, 2010 – September 30, 2011.

Analyzed the implications for the hydrologic warning system (HWS) community of the future federal very narrowband requirement for radio equipment; conducted field trials to evaluate potentially applicable radio equipment.

- **Principal Investigator**, *ALERT-2 Protocol Development*, National Oceanic and Atmospheric Administration, contract DG133R07CN0175, July 16, 2007 – January 15, 2008.

Design next-generation wireless communication protocols for automated flood-warning systems. <<http://www.alert-2.com/>>

- **Principal Investigator**, *An Extensible QoS Framework for Secure Tactical Networks*, Air Force Research Laboratory, contract FA8750-05-C-0151, April 11, 2005 – January 10, 2006.

Developed an extensible architectural framework, protocol enhancements and other technologies that provide scalable, fine-grained, content-aware, quality-of-service (QoS) assurances and other advanced services in IP networks.

- **Principal Investigator**, *Embedded TCP Agents for Near-Earth Communications*, National Aeronautics and Space Administration, Glenn Research Center, contract NNC04CA52C, January 2004 – July 2004.

Developed extensible, embedded transport agents, which continuously adapt the behavior of the Internet-standard Transmission Control Protocol (TCP) to the unique requirements of near-Earth space communications.

- **Principal Investigator**, *Proximity Networks Technology Assessment*, National Aeronautics and Space Administration, Glenn Research Center, April 1, 2002 - July 30, 2002.

Evaluated maturity of technologies potentially applicable to NASA proximity (e.g., sensor) networks.

RESEARCH CONTRACTS AND GRANTS (continued)

- **Principal Investigator**, *Real-Time Visualization of IP Flows over Nontraditional Media*, Defense Advanced Research Projects Agency, contract F30602-98-C-0211, June 1998 - December 2000.

Demonstrated techniques for detailed, global visualization of the state of IP-over-connection-oriented networks such as IP-over-ATM networks. <<http://www.networkvisualization.com/>>

- **Principal Investigator**, *MAGIC-II*, Defense Advanced Research Projects Agency, subcontract to contract F19628-95-C-0215, August 1996 - September 1998. Researched architectures and technologies for integrating high-speed, wide-area ATM networks into large, public IP internets. Also, develop Host ATM Research Platform (HARP) software, a freely available platform for research of IP/ATM networks, which is distributed with the FreeBSD operating system. <<http://www.msci.magic.net/>>

- **Additional Principal Investigator**, *National Virtual Network Access Point*, National Science Foundation, subcontract to cooperative agreement NCR-9321072, July 1994 - June 1998.

Explored architectures for using ATM as a medium for public inter-network interconnections.

- **Principal Investigator**, *Network Research for MAGIC Gigabit Testbed*, Advanced Projects Research Agency, contract F19628-92-C-0072, June 1992 - December 1995.

Conducted network research on integrating high-speed, wide-area, ATM networks into large, public IP internets. Also ensured end-to-end connectivity for the MAGIC Gigabit Testbed at the ATM through TCP/UDP layers by selecting and procuring equipment and providing systems engineering and systems integration services.

- **Principal Investigator**, *Very High-Speed Remote File System*, Advanced Projects Research Agency, contract DAAL03-91-C-0049, September 1991 - September 1992.

Examined issues resulting from connecting very high-speed remote file systems to supercomputers over high-speed, wide-area networks.

- **Principal Investigator**, *New Connections to NSFNET*, National Science Foundation, NCR-9120190, June 1992 - January 1995.

Connected four Minnesota private colleges (College of St. Benedict; Concordia College, St. Paul; Minneapolis College of Art and Design; St. John's University) to the NSFNET.

PATENTS

- Method and Apparatus for Providing Semantically Aware Network Services, Patent Number 8,745,185 B1, Issued June 3, 2014.
- Apparatus and method for providing semantically aware network services, Patent Number 9,338,253, Issued May 6, 2016.

PUBLICATIONS AND PRESENTATIONS

- Salo, Timothy J., "Bluetooth Low Energy (BLE) Beacons: A Technical Introduction", Embedded Systems Conference, San Jose, CA, December 6, 2016.
- Salo, Timothy J., "Bluetooth Low Energy (BLE) Beacon Technologies from Google", DevFestMN, Minneapolis, MN, February 6, 2016
- Salo, Timothy J., "Wire the Plant, Save the World: The Internet of Natural Things", Ignite presentation, Google I/O Developers Conference, San Francisco, CA, June 25, 2014.
- Salo, Timothy J., "Narrowband IP over Amateur Radio Networks (NIPARnets): Next-Generation Networking for Amateur Radio", *Proceedings of the ARRL and TAPR 32nd Digital Communications Conference*, Seattle, WA, September 20-21, 2013. Pages 51-58. <<http://www.saloits.com/papers/AMSAT2013.pdf>>
- Salo, Timothy J., "Proposed Network-Centric Architecture for the Advanced Communications Package (ACP)". *Proceedings of the AMSAT-NA 22nd Space Symposium, Atlanta, GA, October 24-26, 2008*. Silver Spring, MD: The Radio Amateur Satellite Corporation. Pages 33-43. <<http://www.saloits.com/papers/AMSAT2008.pdf>>
- Salo, Timothy J., "ALERT-2 Protocol Development Project", ALERT Users Group 22nd Conference and Exposition, Palm Springs, CA, May 8, 2008. <<http://www.saloits.com/papers/ALERT-2-AUG.05-08-08.pdf>>
- Salo, Timothy J., *ALERT-2 Protocol Development: Phase I Final Report*, January 15, 2008. <<http://www.saloits.com/papers/ALERT-2-Phase-I-Final-Report.pdf>>
- Salo, Timothy J. "Multi-Factor Fingerprints for Personal Computer Hardware". *Proceedings of the 2007 Military Communications Conference (MILCOM 2007)*, Orlando, FL, October 29-31, 2007. IEEE, 2007.
- Salo, Timothy J., "ALERT-2 Working Meeting", ALERT Users Group, Sacramento, CA, October 25, 2007. <<http://www.saloits.com/papers/ALERT-2-Sacramento-10-24-07.pdf>>
- Salo, Timothy J. "The DoD Space Test Program: Free Launches for Amateur Satellites". *Proceedings of the AMSAT-NA 22nd Space Symposium*, Arlington, VA, October 8-10, 2004. Newington, CT: ARRL, 2004. Pages 184-190.
- Salo, Timothy J. "Embedded Transport Agents for Near-Earth Communications". The Fourth Space Internet Workshop (SIW-4), Baltimore, MD, June 8-10, 2004.
- Salo, Timothy J. "A Proposed Microsat Open Experimental Platform for Amateur Space Communications Research". *Proceedings of the AMSAT-NA 21st Space Symposium*, Toronto, Ontario, October 17-19, 2003. Newington, CT: ARRL, 2003. 93-103.
- Salo, Timothy J., Barry A. Trent, and Timothy Hartley. *Proximity Networks Technology Assessment*. NASA Contractor Report NASA/CR-2003-212623. NASA Glenn Research Center, October 2003.
- Bonney, Jordan and Timothy J. Salo. *Modeling Report for Ad Hoc Quality of Service in FCS*. Boeing contractor report, March 17, 2002.

PUBLICATIONS AND PRESENTATIONS (Continued)

- Bonney, Jordan and Timothy J. Salo. *A Study of Network Quality of Service*. Boeing contractor report, March 14, 2002.
- Salo, Timothy J. “Real-Time Visualization of IP Streams Over Switched WANs”. NLANR/Internet-2/CANARIE Techs Workshop, Toronto, Ontario, August 21, 2000.
- Salo, Timothy J. “Real-Time Visualization of IP Streams Over Switched WANs”. North American Network Operators' Group (NANOG), Albuquerque, NM, June 13, 2000.
- Chinoy, Bilal and Timothy J. Salo. “Internet Exchanges: Policy-Driven Evolution”. *Coordinating the Internet*, Brian Kahin and James H. Keller, eds. Cambridge, MA: MIT Press, July 1997.