01 Sep 2006

Trustworthy Computing Needs

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The very label "Critical Infrastructure" implies that such systems are important. They are.

Within the US alone, there are approximately 28,600 networked Federal Deposit Insurance Corporation (FDIC) institutions, 2 million miles of oil/gas pipelines, 2,800 power plants with 300,000 production sites, 104 nuclear power plants, 80,000 dams, 60,000 chemical plants, 87,000 food processing plants, and 1,600 water treatment plants. And, this is just part of our national infrastructure. Add to this telecommunications and other "everyday" utilities and the scope is enormous.

Most of these systems, alone, would qualify as a network-centric system; that is, a system of systems (SoS) whose totality provides additional functionality over each of the aggregate systems - in other words, an SoS is truly greater than the sum of each of its parts. For example, in the electric power grid, a utilitiy can trade power daily (even hourly) with its neighbors, thereby assuring its customers of continued service. This connectivity provides robustness of service; unfortunately, it also provides an access point for interdependency which can lead to a cascading failure, – "the domino effect" that was seen in the 14 August 2003 blackout and numerous other incidents.

With the realization that most network-centric systems are critical comes the acceptance that we need to make these systems more "trustworthy". Given the complexity and scale of these systems, zero-defect software (while admirable) is a daunting goal. Trustworthiness, however, may be achievable. By trustworthiness we mean that "as humans" we expect that the "non-human system" will behave in some reliable, predictable form with "reasonable" recovery techniques when problems are encountered.

This talk will highlight the network-centric system attributes which should be considered in any integration effort, as well as commercial off-the-shelf (COTS) encapsulation techniques, and other engineering trade-offs in a large-scale design and development effort.

Dr. Ann Miller is the Cynthia Tang Missouri Distinguished Professor of Computer Engineering at the University of Missouri-Rolla. Previously, she was the Deputy Assistant Secretary of the Navy for Command, Control, Communications, Computing, Intelligence, Electronic Warfare, and Space for the U. S. Department of the Navy; for a portion of that time, she also served as the Department of the Navy Chief Information Officer (CIO). Dr. Miller also served as Director for Information Technologies, U. S. Department of Defense Research and Engineering. Prior to that, Dr. Miller served for over 12 years with Motorola, Inc. where she held a variety of technical and managerial positions, including Chief Software Engineer for Motorola's Tactical Secure Communications Office and for Motorola's Satellite Communications Division. She holds one U. S. patent in satellite communications, has co-authored four books, and is the author of numerous journal articles and monographs.

Dr. Miller is a member of the NATO Information Systems Technology Panel; she serves on the NATO-Russia Research and Technology Study Group as well as NATO's Dual Use of High Assurance Technologies Task Group.

She is a Senior Member of IEEE and a member of the IEEE Communications Society, Computer Society, Reliability Society (RS) and serves on the Administrative Committee of IEEE RS and the Advisory Board of IEEE SOFTWARE.

Dr. Miller's research areas include systems and software engineering, with an emphasis on trustworthy systems, including system assurance, survivability, reliability, and security, and on the design and test of large-scale networked systems. She can be contacted at milleran@umr.edu

Proceedings of the 30th Annual International Computer Software and Applications Conference (COMPSAC'06)
0-7695-2655-1/06 $20.00 © 2006 IEEE