TOPICS IN NETWORK TESTING

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The objective of the Network Testing Series of *IEEE Communications Magazine* is to provide a forum across academia and industry to address the design and implementation defects unveiled by network testing. In the industry, testing has been a mean to evaluate the design and implementation of a system. But in academia, a more common practice is to evaluate a design by mathematical analysis or simulation without actual implementations. A less common practice is to evaluate a design by testing a partial implementation. That is, academia focuses more deeply on algorithmic design evaluation, while industry has broader concerns on both algorithmic design and system implementation issues. Often an optimized algorithmic component cannot guarantee optimal operation of the whole system when other components throttle the overall performance.

This series thus serves as a forum to bridge the gap, where the design or implementation defects found by either community can be referred to by another community. The defects could be found in various dimensions of testing. The type of testing could be functionality, performance, conformance, interoperability, and stability of the systems under test (SUT) in the laboratory or field. The SUT could be black-box without source code or binary code, grey-box with binary code or interface, or white-box with source code. For grey-box or white-box testing, profiling would help identify and diagnose system bottlenecks. For black-box testing, benchmarking devices of the same class could reflect the state of the art. The SUT can range from link-layer systems such as Ethernet, WLAN, WiMAX, third-/fourth generation (3G/4G) cellular, and digital subscriber line (xDSL) to mid-layer switches and routers, and upper-layer systems such as voice over IP, Session Initiation Protocol (SIP) signaling, multimedia, network security, and consumer devices such as handhelds, to even a large-scale network system.

Our first call received nine submissions, and we selected two of them. The selection is based on several factors: how relevant to network testing the work is, how new the test methodology or result is, how informative the article is, and so on. The selected two happen to represent two extremes in terms of scale, with the first on a specific issue of a network component and the second on a large-scale distributed testbed. Both articles have authors at universities or research organizations. We shall continue to solicit contributions from industry, although industry people usually do not have publication as their priority job.

The first article answers the question of how adjacent channel interference (ACI) affects the performance of IEEE 802.11a, which was believed to be ACI-free due to better channelization combined with orthogonal frequency-division multiplexed (OFDM) transmissions. They present a modified model for the signal-to-interference-plus-noise ratio (SINR) and quantify the throughput degradation due to ACI. The model is verified by the emulated wireless medium with cables and attenuators to isolate the affected 802.11 mechanisms. The result implies that even with a large number of channels in 802.11a, careful channel selection is still needed in order to achieve higher throughput.

The second article presents a large-scale testbed, Panlab, for future Internet applications. Panlab is a testbed to pilot future Internet applications over the existing Internet. It is a distributed testbed with platform resources contributed by the Panlab partners, coordinated and configured by the Panlab office, and offering testing services to Panlab customers to test deployed applications or their control modules. With the shared Panlab testbed, piloting a new application becomes easier than constructing a global-scale testbed of one's own to experiment with an application. The article illustrates how to use Panlab through a case study on testing adaptive admission control and resource allocation algorithms for web and database applications, where traffic generators are configured at two testbeds, and the web and database applications, along with the algorithms under test, reside at a third testbed.

BIOGRAPHIES

YING-DAR LIN () is a professor of computer science at National Chiao Tung University, Taiwan. He received his Ph.D. in computer science from the University of California at Los Angeles in 1993. He spent his sabbatical year, 2007–2008, as a visiting scholar at Cisco Systems, San Jose, California. Since 2002 he has been the founder and director of the Network Benchmarking Laboratory (NBL, www.nbl.org.tw), which reviews network products with real traffic. He also cofounded L7 Networks Inc. in 2002, which was later acquired by D-Link Corp. His research interests include design, analysis, implementation, and benchmarking of network protocols and algorithms, quality of service, network security, deep packet inspection, P2P networking, and embedded hardware/software co-design. His work on multihop cellular has been cited over 500 times. He is currently on the editorial boards of *IEEE Communications Magazine*, *IEEE Communications Surveys and Tutorials*, *IEEE Communications Letters*, *Computer Communications*, and *Computer Networks*.

ERICA JOHNSON is the director of the University of New Hampshire InterOperability Laboratory. In this role, she manages and oversees over 20 different data networking and storage technologies providing all aspects of administration, including coordination of high profile testing events, coordination with different consortiums, and working with various industry forums. She is also a prominent member of organizations both internally and externally, She enjoys a powerful mix of technology and business related activities. At the University of New Hampshire she participates in the UNH Steering Committee for Information Technology, Senior Vice Provost for Research Working Group, and Computer Science Advisory Board. In the industry she was appointed technical representative of North America for the IPv6 Ready Logo Committee and was also chosen to be an IPv6 Forum Fellow. Passionate about the laboratory and its possibilities, she continues to work with many industry forums, commercial service providers, network equipment vendors, and other universities in order to further the InterOperability Laboratory's mission.

EDUARDO JOO is software project leader at Empirix, Inc., Bedford, Massachusetts. He received his M.S. in computer system engineering, computer communications and networks, from Boston University in 2006. He joined Empirix, Inc., in 2001 and has led the successful development of network testing and emulation systems, including PacketSphere Network Emulator, PacketSphere RealStreamer, Hammer NxT, and Hammer G5. He is currently leading the development of next-generation mobile broadband data network monitoring and testing tools. His areas of interest include voice and data protocols, and wired, wireless, and mobile network communications.