Editorial

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Biographical notes: Thomas Magedanz is a Professor in the Electrical Engineering and Computer Sciences Faculty at the Technische Universität Berlin, Germany. In addition, he is the Director of the 'Next Generation Network Infrastructure' division of the Fraunhofer Institute FOKUS, which provides various testbeds and tools in the context of converging networks and open service delivery platforms. He has been working for more than 20 years in the convergence field of fixed and mobile telecommunications, the internet and information technologies. In the course of his research activities, he published more than 300 technical papers/articles. In addition, he is a Senior Member of the IEEE, and an Editorial Board Member of several journals. In 2007, he joined the European Future Internet Research and Experimental (FIRE) Facilities Expert Group as he is researching NGN/NGMN to future internet evolution.

Shiwen Mao is an Assistant Professor in the Department of Electrical and Computer Engineering, Auburn University, Auburn, AL. He was a Research Scientist in the Department of Electrical and Computer Engineering, Virginia Tech, Blacksburg, VA from 2003 to 2006. His research interests include performance analysis and cross-layer optimisation of wireless networks with current focus on cognitive radio networks and multimedia communications. He is a co-author of *TCP/IP Essentials: A Lab-Based Approach* (Cambridge University Press, 2004). He received the 2004 IEEE Communications Society Leonard G. Abraham Prize in the field of communications systems and the Best Paper Runner-up Award from QShine 2008.

Scott F. Midkiff received his BSE and PhD from Duke University, Durham, NC, and his MS from Stanford University, Stanford, CA, all in Electrical Engineering. He worked at Bell Laboratories and held a visiting position at Carnegie Mellon University, Pittsburgh, PA. In 1986, he joined the Bradley Department of Electrical and Computer Engineering, Virginia Polytechnic Institute and State University, Blacksburg, where he is now a Professor. He is with the National Science Foundation (NSF) from September 2006–2009 as a Program Director in the Electrical, Communications and Cyber Systems (ECCS) Division in the Directorate for Engineering (ENG). His research interests include system issues in wireless and ad hoc networks, network services for pervasive computing, and performance modelling of mobile ad hoc networks.

"A theory is something nobody believes, except the person who made it. An experiment is something everybody believes, except the person who made it." Although Albert Einstein might be kidding when making the above comparison, nevertheless this quote indicates the importance of experimental research, with its unique strength for proof-of-concept demonstration of abstract theory. This is especially true for networking research, where the subject under study is becoming tremendously complex with a global scale. Network testbeds are now indispensible means of verifying theoretical results developed under simplifying assumptions and abstractions. Often the underlying network system is so complex that analysis and modelling are intractable. In this case simulation and testbeds are the only means that are available for validation and performance evaluation. Network testbeds provide the bridge from theory to practice and are essential in bringing reality from experiments and prototypes into basic research. These are key ingredients to the innovation that is needed to not only advance networking research, but to move the global telecommunications infrastructure and even the global economy forward.

With the rapid convergence of networks and applications, changes in related industries, more complex value chains and increased competition, early prototyping and experimentation will become a key means for driving innovation and development of market oriented solutions. In this context, value generation has shifted from network technologies towards applications and content. Thus, the nature and scope of testbeds have changed substantially in recent years from solely network technologies towards complex service delivery infrastructures riding on various networks. In contrast to traditional vendor, operator and technology specific 'closed' testbeds, the notion of 'open' testbeds has emerged. 'Open' in this context means both wide access as a shared resource and extensibility to include on-demand new end systems, network technologies, protocol stacks, and, most importantly, new middleware and service delivery platforms for specific test purposes. To meet this need, major research and development programs have started around the globe, including GENI in the US and FIRE in Europe, to establish large scale experimental facilities.

TridentCom 2009, the 5th International Conference on Testbeds and Research Infrastructures for the Development of Networks & Communities, represents a landmark in the history of international testbed conferences. It was sponsored by Institute for Computer Sciences, Social-Informatics and Telecommunications Engineering (ICST) and technically co-sponsored by Create-Net, ACM SIGARCH, IEEE Industrial Electronics Society, IEEE Computer Society, and Panlab. This special issue consists of ten selected papers from the Proceedings of TridentCom 2009, consisting of 41 papers from 12

nations. We aim to provide a small but representative sample of the extensive ongoing effort in this important area from research groups all over the world.

The papers selected for this special issue can be roughly classified into four categories. The first category includes three papers on wireless testbeds. The first paper, 'A virtual ad hoc network testbed', presents a testbed for testing various applications over ad hoc networks, with a special focus on network management applications. The objective is to enable software testing in large-scale (500–1000 nodes) ad hoc networks. The second paper, 'Novel results on SCTP multihoming performance in native IPv6 UMTS-WLAN environments', describes a real native IPv6 universal mobile telecommunications system (UMTS) and WLAN testbed equipped with novel IPv6-based mobile technologies. The paper reports extensive experimental studies of the performance of multihomed SCTP hosts in an integrated heterogeneous environment. The third paper, 'A reconfigurable test platform to experiment with wireless heterogeneous networks in a laboratory', presents a wireless heterogeneous testbed that allows experimentation with WLANs and cellular networks in a laboratory environment. The testbed integrates emulation components and real equipments in a single experimental platform, therefore achieving goals of both fidelity and scalability.

The second category consists of four papers on wired network testbeds. The first paper, 'Pan-European testbed and experimental facility federation – architecture refinement and implementation', presents a testbed based on the network domain federation model to enable trials and evaluation of network architectures, service concepts, new technologies, cross-domain system solutions, and business models for future internet research. The second paper in this group, 'Execution of service workflows in grid environments', introduces the grid service testbed (GST), an infrastructure for performance evaluation of grid service compositions in grid environments, and discusses how GST manages the dynamicity of grid environments using its particular functionalities to choose the best computational resources without user interference. The third paper, 'Qualitative comparison of link shaping techniques', provides a qualitative comparison of three link shaping approaches for emulated testbeds. The fourth paper in the category, 'A model-driven emulation approach to large-scale TCP performance evaluation', presents a TCP performance evaluation testbed where real implementations of TCP variants can be accurately evaluated under diverse network configurations and workloads from real applications in large-scale network settings.

The third category consists of two papers that focus on security related issues in testbed-driven research. The first paper, 'Tools for worm experimentation on the DETER testbed', presents simulation tools for studying internet-wide worm propagation and defense strategies in local area networks. In the second paper, 'Integration of IEEE 802.21 services and pre-authentication framework', the authors discuss how the IEEE 802.21 standard and its services address the challenges of seamless mobility for multi-interface devices and present a proof-of-concept implementation that integrates IEEE 802.21 services and a pre-authentication framework to optimise handover performance.

The last category consists of one paper on optical network testbed. The paper, 'Testbed for experimental analysis on seamless evolution architectures from GPON to high capacity WDM-PON', describes a testbed for the evaluation of simple and cost effective gigabit passive optical networks (GPONs) evolutions.

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