Report

Edited by Paul Brusil

Managing Next Generation Convergence Networks and Services—A Report on NOMS 2004

Raouf Boutaba,[1,2,4] **Young-Hyun Cho,**[3] **Masayoshi Ejiri,**[3] **and Seong-Beom Kim**[4]

The 9th biannual IEEE/IFIP Network Operations and Management Symposium (NOMS 2004, www.noms2004.org) was held 19–23 April, 2004 in COEX Convention Center, Seoul, Korea, and presented the latest approaches and technical solutions in the area of network operations and management. Held in the even-numbered years since 1988, NOMS 2004 continues the established tradition of NOMS and the Integrated Management Symposium (IM) as the primary forum for technical exchange among the research, standards, development, systems integrator, service provider, and user communities. An exciting, peer-reviewed program of technical sessions, application sessions, panels, tutorials, posters, and vendor exhibits addressed the ever-increasing interest in overall management solutions for all types of communications and computing networks, systems, services and enterprise applications. NOMS 2004 was sponsored by the IEEE Communications Society Technical Committee on Network Operations and Management (CNOM), and by the International Federation for Information Processing (IFIP) Working Group 6.6 on Management of Networks and Distributed Systems.

The theme for NOMS 2004 was "Managing Next Generation Convergence Networks and Services." The theme was chosen to reflect the

[1]Integrated Management Symposium and Network Operation and Management Symposium, (IM/NOMS) Steering Committee Chair.
[2]To whom correspondence should be addressed at University of Waterloo, School of Computer Science, Waterloo, Ontario, N2L 3G1, Canada. E-mail: *rboutaba@bbcr.uwaterloo.ca*
[3]NOMS 2004 General Co-Chair, E-mail: *yhcho@kt.co.kr, ejiri@jp.fujitsu.com*
[4]NOMS 2004 TPC Co-Chairs, E-mail: *rboutaba@bbcr.uwaterloo.ca, sbkimm@kt.co.kr*

current convergence trend of telecommunications and information technology (IT) and to represent the excitement and diversity present in this composite field. The concept of network and service convergence has recently emerged as a new attempt for the merging of telephony, data networks and information technology into a single, multi-service network exploiting the ubiquity of the Internet. To make business models associated with converged networks and services increasingly attractive, in both wired and wireless domains, strategic research is required to devise the best integration architectures, and appropriate accompanying integrated operations and management solutions. This creates a unique opportunity for the network operations and management community to respond to the ever-increasing demand for network resilience, security and security management, quality-of-service and mobility management at unprecedented scales. NOMS 2004 provided such a forum for discussing these research challenges and many other challenges inherent to the operation and management of next generation converged networks and services. This ninth edition of the symposium strengthened the established tradition of NOMS, along with IM, as the premier technical network management symposia.

In accordance with the challenging theme set for NOMS 2004 by the Organizing Committee, the Technical Program Committee (TPC), whose membership represented 19 countries in Asia, Europe, Australia and the Americas, broadened the scope of the IM and NOMS symposia series. The scope of NOMS 2004 included several new areas such as network planning, service engineering and business processes for network and service management. Special attention was given to experiences that emphasize lessons learned and report on practice from industry. The scope of topics within these areas included the management of a plethora of network devices and systems, multiple inter-connected networking technologies, embedded and ad hoc environments and the complexity of distributed applications and operation support systems (OSS).

NOMS 2004 attracted a total of 224 submissions from 31 countries in Asia, the Middle East, Europe, South America, North America, and Oceania—the highest number of submissions in the IM/NOMS history! Of these submissions, only 60 papers were able to be selected—the lowest acceptance rate in the IM/NOMS history! The record number of submissions is a reflection of the growing importance of network operations and management research. The selective acceptance rate (26.7%) is an indication of the very high quality of the technical sessions. More than 800 independent expert reviews from TPC members and additional reviewers were used as a basis for the selection of the 60 highest quality papers.

The NOMS 2004 Technical Program focused on future challenges in network operations and management and the need for new network operations and management paradigms to address these challenges. Network Operations and Management are indeed in the process of significant change, as networks proliferate and are no longer owned by a single provider. Emerging networks are self-organizing, ad hoc, peer-to-peer, interplanetary, or connecting a very large number of tiny sensor devices.

The organization of the Technical Program of NOMS 2004 has been significantly expanded over previous years' Technical Programs. In addition to 15 technical paper sessions, 6 keynote sessions, 5 panel sessions, 12 tutorials, and exhibit and 23 posters in a poster session, the program included two new concepts, namely one workshop and 4 application sessions.

The Technical Paper Sessions covered the latest research results in network operations and management such as Self Managing Systems, Web services, Service level Agreements, Security, Faults, Survivability, Peer to Peer, Overlay, Ad hoc, Sensor networks, Optical, Quality of Service, Routing, Policies, Modeling, Measurements, Charging, Configuration, and Performance Management.

The Application Sessions included 16 papers focusing on the experiences of IT/telecommunications industries (service providers, OSS/equipment vendors, etc.) and customers based on their system implementation and business practice in the operations and management of networks. All Application Sessions' papers, including those presented in poster sessions, were published in the Application Sessions proceedings.

The Poster Sessions included 15 papers selected as posters by the TPC and 2 posters selected by the TPC from the pool of poster submissions. Also, an additional 6 papers were selected as posters by the Applications Sessions Committee.

The Workshop Session provided for intensive discussions on the emerging area of Grid Computing and Economics. As a new program concept, the workshop drew 65 participants who had an excellent opportunity to deepen their knowledge in this specific field.

The Panel Sessions focused on business implications, market trends of cutting edge technologies and applications. The panel sessions covered some of the hottest topics in the field: Management of ubiquitous computing and communications, multi-service packet networks management, network control, optical networking and management, and next generation OSS platforms. Many participants enjoyed the lively debate between the panelists and participants.

The Tutorial Sessions offered outstanding tutorials given by experts in the field. The topics included Pervasive Computing and Management,

Management of Mobile Ad hoc Networks, Traffic Engineering and QoS Management in IP-based packet networks, Internet Management Challenges, Broadband Wireless Access, Security and Firewall Management, Autonomic Networking, Integrated Management from e-Business perspective, Traffic Measurement, Emerging paradigms in Managing Intelligent IP Networks, and Charging and Accounting in the Internet.

The Keynote Sessions included talks by leaders from industry and academia who provided fresh and exciting perspectives on different aspects of management. The keynote speakers included Sanghoon Lee (Executive Vice President, Korea Telecom, Korea) who addressed the future beyond broadband networks in terms of emerging services and business challenges. Pieter Knook (Senior Vice President, Microsoft, USA) gave a perspective on the role of XML and Web Services in accelerating OSS/BSS agility. Tomonori Aoyama (Professor, University of Tokyo, Japan) covered the emerging Ubiquitous Networking paradigm and presented several demonstration videos of embedded Internet research prototypes in Japan. Todd DeLaughter (Vice President, HP, USA) focused on Operations Support Processes and Business Agility for delivering maximum value to the service provider's business. Virgilio Almeida (Professor, Federal University of Minas Gerais, Brazil) gave a comprehensive survey on capacity planning. Enrico Bagnasco (Head of Service Innovation, Telecom Italia, Italy) discussed a new OSS paradigm for the broadband era.

During the last plenary session, a Distinguished Expert Panel chaired by Mehmet Ulema (Professor, Manhattan College, USA) took place. The panelists were Ilsoo Ahn (Vice President, Samsung Electronics Co., Korea), Rolf Stadler (Professor, KTH, Sweden), Tadanobu Okada (Vice President, NTT, Japan), Fernando Cuervo (Senior Researcher, Alcatel, Canada), and Duane Elmquist (Vice President, Telcordia Technologies, USA). Each of the panelists presented his expert view on the role of network management in reviving the telecom industry.

During the 3 days of the symposium and in parallel to the technical, applications and panel session, an exhibition took place. This was one of the biggest exhibitions organized during the past IM/NOMS events. In addition to key vendors of network operations and management products, the exhibition included booths for organizations such as the IEEE Communications Society, the Tele-Management Forum as well as a booth dedicated to the launch of the IEEE Communications Society electronic Transactions on Network and Service Management.

The reader is referred to the NOMS 2004 Web site (http://www.noms 2004.org) for more detailed information about the technical content of the symposium including copies of the presentations of keynote speakers,

abstracts of tutorials, description of discussion panels, technical/application/session papers titles and authors as well as contact information for obtaining the symposium proceedings for technical sessions and application sessions.

At the closing ceremony, the best student paper award was given to the paper "Discovering IPv6-in-IPv4 tunnels in the Internet" presented by Lorenzo Colitti. Travel grants were also presented to several students during the closing ceremony.

In memory of our friend and colleague Salah Aidarous who passed away last year while acting as a general co-chair for NOMS 2004, the IM/NOMS steering committee instituted a "Salah Aidarous Award" to be presented at every NOMS to those who (1) have provided unremitting service and dedication to the IT and Telecommunications Network Operations and Management community, (2) have a passion for dissemination of their scientific expertise and skills to the next generation, and (3) are held in high esteem by a wide international circle of their peers. During the conference banquet the first "Salah Aidarous Award" was given to Roberto Saracco.

Overall, NOMS 2004 through its technical and social program provided a great experience to the 425 attendees. NOMS 2004 will be remembered as one of the best in the history of IM/NOMS.

We thank the authors of all submitted manuscripts for their effort and creativity. We owe much to the reviewers from within and from outside the TPC, and to the session chairs who ensured that the accepted papers addressed the concerns raised during the reviews. We express our sincere thanks to all members of the NOMS 2004 organizing committee, participating IEEE ComSoc staff and IFIP staff, panel organizers, keynote speakers, panelists and authors who presented their high quality work in NOMS 2004.

Finally, we invite you to attend IM 2005, May 15–19, 2005 in Nice, France (http://www.ieee-im.org).

Raouf Boutaba is an Associate Professor in the School of Computer Science of the University of Waterloo in Canada. He conducts research in the area of network and distributed systems management. He is the Chair of the IFIP WG6.6 on Network and Distributed Systems Management, and serves on the Editorial Advisory Board of JNSM, the editorial boards of the Journal of Communications and Networks and the Journal of Computer Networks.

Young-Hyun Cho is a Senior Vice President of Korea Telecom (KT) and responsible for the Technology Investigation and Evaluation Center. He received the Master's and Ph.D. degrees in Electronics Engineering from Yonsei University in Korea. He has been involved in researching and developing the technology and OSS systems in network operations and management for KT.

Masayoshi Ejiri has been responsible for directing the telecommunications management business strategy and technology in Fujitsu group since he joined Fujitsu in 1995. Before that he worked for NTT and was responsible for various areas in telecommunications systems development and operations. He was General Co-Chair of NOMS'96 and Chair of IEEE Enterprise Networking Technical Committee in 2001–2002.

Seong-Beom Kim is an Assistant Vice President of Korea Telecom (KT) and has been responsible for the network and service management architecture modeling and OSS development as a Project Manager since he joined KT in 1984. He received the Master's degrees in Computer Science from Hanyang University in Korea. He was General Co-Chair of APNOMS'2003, and served in the Board of Directors of the TeleManagement Forum.