

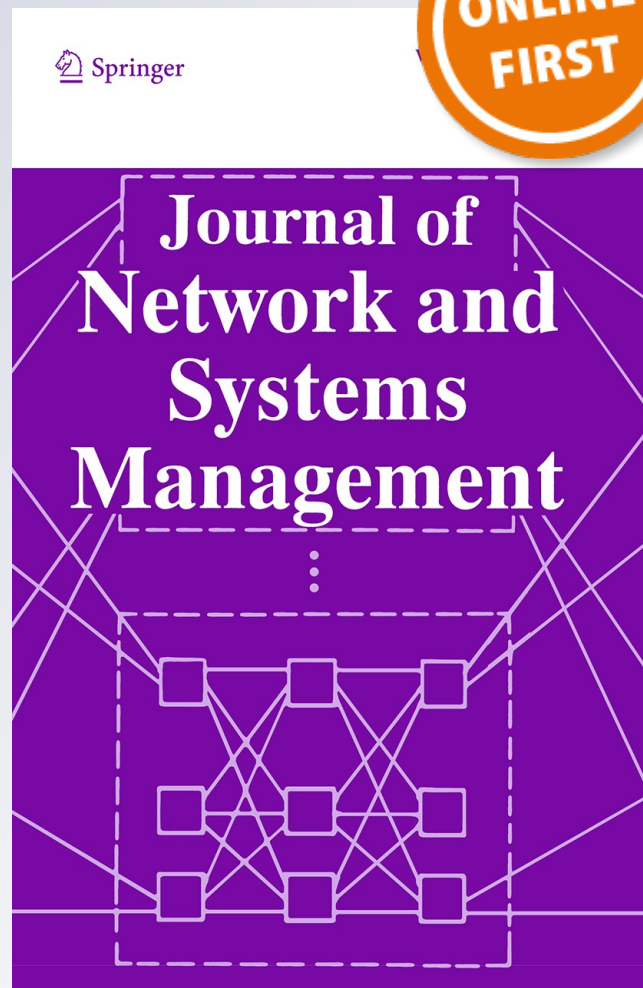
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Journal of Network and Systems Management

ISSN 1064-7570

J Netw Syst Manage
DOI 10.1007/s10922-016-9366-z



 Springer

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Managing a Very Connected World: A Report on APNOMS2015

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Received: 25 October 2015 / Revised: 26 January 2016 / Accepted: 6 February 2016
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Abstract This article presents a report on APNOMS2015, which was held August 19–21, 2015 in Busan, Korea. The theme of APNOMS2015 was “Managing a Very Connected World.”

Keywords Network operations and management · Software defined network · Network functions virtualization · Internet of things

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1 Introduction

APNOMS (Asia–Pacific Network Operations and Management Symposium) has been a premier conference on network operations and management in the Asia–Pacific region. The 17th APNOMS2015 (<http://www.apnoms.org/2015/>) was held on August 19–21, 2015 in Busan, Korea. APNOMS2015 was organized by the Korean Information and Communications Society (KICS) Committee on Korean Network Operations and Management (KNOM) and the Institute of Electronics, Information and Communication Engineers (IEICE) Technical Committee on Information Communication Management (ICM) with support from IEEE CNOM (IEEE Communications Society, Technical Committee on Network Operations and Management), BTO (Busan Tourism Organization), HP (Hewlett–Packard), KT (Korea Telecom), CISCO, NKIA, InfoBiz, AromTech, and CHT (Chunghwa Telecom). APNOMS2015 continues to play an important role for exchanging and discussing all aspects of operations and management of telecommunications networks, enterprise networks, Internet and their services among the academic community and the telecommunication industry at large in the Asia–Pacific region. As in the previous APNOMS symposia [1–14], APNOMS2015 was a great success, attracting over 250 researchers, policy makers, practitioners, service providers, and vendors from 13 countries.

The theme of this symposium was “Managing a Very Connected World.” Research and development on Clouds, SDN/NFV and IoT have been carried out around the world over the last few years and we are already seeing their deployments and operations in many parts of Asia–Pacific countries. We are also beginning to experience new and interesting services that utilize these state-of-the-art technologies. We are certain that we will see more deployment of Clouds, SDN/NFV, and IoT in the next few years. Thus, the operations and management of Cloud, SDN/NFV, and IoT have become very important to the network operators and service providers. Keeping in mind these challenges, APNOMS2015 provided higher priority in the following areas: Cloud Management, SDN/NFV Management, and IoT Management.

APNOMS201 had prepared an excellent 3-full day program with keynotes, tutorials, technical sessions, special sessions, a distinguished experts panel (DEP), poster sessions, innovation sessions and exhibitions with the theme in mind. Synopses of each event are given in the following sections. The summarized events show the entire scenario of APNOMS2015 and recent trends of research on management of a very connected world.

2 Tutorials

The symposium started with 4 tutorials in two tutorial sessions covering the latest hot topics. In the first tutorial session, Chih-Wei Yi (NCTU, Taiwan) gave a tutorial on “Smartphone Probe Cars for Traffic and Road Sensing.” This tutorial introduced

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recent research works in NCTU on Smartphone Probe Cars (SPCs), which use hybrid sensing systems utilizing the sensing and communication capability of onboard smartphones to collect traffic and road data. In the second tutorial session, Yusuke Fukushima (NICT, Japan) gave a tutorial on “Mobile Sensing.” This tutorial introduced a design concept of a mobile sensor network using ID-based communication that enables communications over heterogeneous network protocols, while providing device authentication, discovery, remote control and management. In the third tutorial session, Jeonghoon Moon (KISTI, Korea) gave a tutorial on “Very Connected Scientific World.” This tutorial introduced the data intensive science with distributed data and the supporting technologies: such as international R&D network, data intensive science, science DMZ, and resource federation with network QoS. In the fourth tutorial session, Jong-Moon Chung (Yonsei University, Korea) gave a tutorial on “IoT and Smart Network Efficiency Enhancement Technologies.” This tutorial introduced the technical issues of IoT networks and IoT supportive smartphone networks: such as clustering techniques, multipath techniques, handover techniques, and advanced LTE-A mobile communication technologies. These 4 tutorials attracted many participants and generated discussions on these timely topics of managing smart networks for a very connected smart world. A questionnaire requesting feedback about the tutorials showed all the tutorial sessions were very useful, whereby more than 80 % of attendees marked with “4” out of “1” (not so useful) to “5” (very useful).

3 Keynotes

Five keynote speakers shared their visions and perspectives on a very connected smart world at the symposium. The speakers provided excellent speeches on the current status and R&D directions for IoT and 5G development.

Dr. Dongmyun Lee (KT, Korea) delivered a speech on “Towards 5G Unified Network.” Firstly, he defined the 5G unified network and introduced key requirements for 5G unified network. Secondly, he talked about the 5G unified network in the perspective of operations and management. Dr. Jeffrey Voas (NIST, USA) gave a speech on “Why is IoT Definitionless.” He defines the Internet of Things (IoT) with his own view and introduced the 6 primitives to impact the trustworthiness of IoT and the additional 6 important elements. Prof. Jenn-Hwan Tarng (ITRI, Taiwan) gave a speech on “Connected Health: The Driver to Transform Health Services.” He mentioned the connected health service and its potential global markets, and introduced the ITRI technologies and solutions to enable innovative connected health services. Dr. Hyun Kyu Chung (ETRI, Korea) gave a speech on “Enabling Technologies on 5G mobile Access—Revolution or Evolution?” He summarized the current status of 5G standards in ITU Radio sector and introduced various enabling technologies considered from 5G mobile access perspective in the area of below and above 6 GHz. Mr. Satoru Taniguchi (Toyota InfoTechnology Center, Japan) gave a speech on “Future Mobility Society using Information Technologies.” He introduced TOYOTA’s vision and activities towards a smart mobility society. He emphasized 4 keywords for a smart mobility

society: Safety connected with vehicle and roads, Comfort connected with people, Convenience connected with society, and Ecology connected with community.

4 Technical, Poster and Innovation Sessions

The main body of the Symposium consisted of nine technical sessions, three poster sessions, and two innovation sessions. This year, we received 129 submissions for technical sessions and poster sessions from 9 different countries. We are certain that the selected 38 technical papers for oral presentation are high-quality papers on the latest hot topics in the fields of network operations and service management. The acceptance rate was 29.46 %. For each paper, we provided at least three independent reviews, most of which were offered by TPC members and some were offered by a few external reviewers.

Accepted papers and posters presented the latest results of research and development in the operations and management of smart networks and services, covering research areas including: SDN/NFV Management, Ad Hoc and Cellular Network Management, Wireless and Mobile Network Management, Traffic and Fault Management, Contents-Oriented Network Management, Multimedia and Service Management, Distributed and Accounting Management, and IoT Management. Many papers focused on the management of SDN/NFV and IoT. Many sessions including Distributed and Accounting Management, Multimedia and Service Management, and SDN/NFV Management were evaluated very well, but this year, the SDN/NFV and IoT Management sessions were the most attractive. The number of attendees of each session was 36 on average, 26 on minimum, and 51 on maximum. The technical session with the most attendees was the session about SDN/NFV Management. 318 attendees returned a questionnaire about the technical sessions. The responses showed that more than 82 % of attendees evaluated these sessions “Very Useful” or “Useful”.

Also, the Innovation Sessions were organized to present and to discuss ongoing research, work-in-progress ideas, practical solutions, experimental studies, and various topics of interest to the community. Eight papers were selected and presented in the innovation sessions, whose topics were Service and Performance Management, SDN/NFV Management.

Because of the MERS outbreak in Korea and VISA problem, 4 presenters from Japan, Taiwan, and China could not attend the symposium in person. But these papers were presented by showing pre-recorded voice over PowerPoint presentations. Furthermore, a real-time skype connection between the author and session chair was successfully used to handle questions from the audience.

5 Special Sessions

Two special sessions were held on the second and third day of the symposium. Eight representatives of various countries from the Asia–Pacific region discussed the latest research topics: “Managing an IoT society, IoT techniques, and applications” and “Container technologies and Cloud.”

On the second day, four speakers gave talks on “Managing an IoT society, IoT techniques, and applications,” as current hottest issues. Soohong Park (Samsung Electronics, Korea) gave a talk on “IoTivity: a new IoT open source and its full potential.” He introduced the new IoT consortium called the OIC-Open Interconnect Consortium and its open source project as IoTivity. He also spoke about several important aspects of IoT such as license, patents and governance for better open collaboration. Yasuhide Matsumoto (Fujitsu Labs, Japan) gave a speech on “IoT impact for ICT architecture and Management technology.” He described the history of IoT and the hypothesis of IoT Impact. Then he proposed ICT architecture and management technology for IoT Impact. Fuchun Joseph Lin (National Chiao Tung University Hsinchu, Taiwan) gave a talk on “Data Management in IoT/M2M.” He proposed a mechanism to preprocess any IoT/M2M streaming data of fast velocity and large volume nature before delivering them to the IoT/M2M system. He emphasized the importance of saving lots of resources in an IoT/M2M system to reduce transmission, storage, management and processing overhead. Yong-Geun Hong (ETRI, Korea) gave a talk on “Internet based IoT connectivity Technologies.” He introduced the status of technical standardization of the IoT in the IETF and Internet-based IoT device connectivity technologies. In particular, he emphasized the technical development of IoT device connectivity technologies in the constrained IoT environments.

On the third day, four speakers gave talks on internationally emerging issues—Container technologies and Cloud. Teng-Kai Fan (Chunghwa Telecom Labs, Taiwan) gave a talk on “A Cloud-based Architecture for Visual Effect Rendering System.” He introduced a cloud-based rendering system built on cloud virtualization environments to reduce rendering time. He emphasized that the proposed rendering system make it possible to render highly complex 3D models, monitor rendering progress, and download the finished images to their own computer. Yukihiro Nakagawa (Fujitsu Laboratories, Japan) gave a speech on “Automatically Constructing Virtual Networks between Linux Containers using Physical Switch.” He introduced an SDN technology to construct virtual networks between containers in dynamic container placement. Furthermore, he emphasized that virtual networks can be automatically constructed with no interaction with SDN controller by their prototype system. JongWon Kim (GIST, Korea) gave a talk on “Inter-Connected Functions for Agile and Economic Service Realizations.” He talked about the exploding paradigm shift toward SDI (Software-Defined Infrastructure) that leverages the harmonized orchestration of SDN, NFV, and Cloud Computing technologies. Jaesuk Ahn (SKT, Korea) gave a talk on “Open Source Cloud Technology Evolution: Container vs. Virtual Machine.” He reviewed recently rising container technology, and compared container with existing virtualization technologies to find out similarities as well as differences. Further, he gave his perspective about that how these two technologies will co-exist in cloud computing ecosystem.

6 Exhibitions

The exhibition program provided an opportunity for vendors and service providers to exhibit their latest technologies, tools, platforms, products and systems on network operations and management. This program also provided an excellent

environment for operators, researchers and academics to interact with the exhibitors. Each exhibition attracted many visitors who eagerly asked many questions to learn more information.

Four companies including KT (Korea), NKIA Corporation (Korea), Cisco Korea (Korea), and Chunghwa Telecom (Taiwan) participated in the exhibition program. KT demonstrated their flexible service designer for NFV. The flexible service designer for NFV is a tool, which enables you to compose an ICT Infra service based on customer's needs. Through a GUI, a new ICT Infra service can be built easily and quickly. NKIA Corporation demonstrated their real-time network fault management system, which is a solution that performs fault management by collecting several data of complex network devices and infrastructures such as configuration/performance/fault based on big data technology. CISCO Korea demonstrated their CMX (Connected Mobile experiences) solution, which is a smart Wi-Fi solution that uses the Cisco wireless infrastructure to detect and locate smartphones, tablets, and other mobile devices. Chunghwa Telecom demonstrated their hicloud render solution, which is a cloud-based rendering system. The hicloud render can satisfy worldwide growing needs by allocating dynamic scalable rendering resources in cloud virtualization environments, providing high-performance computation for visual effect rendering.

7 Distinguished Experts Panel

APNOMS2015 ended with a very exciting distinguished experts panel (DEP) on the symposium's theme of "Managing a Very Connected World," chaired by Tae-Sang Choi (ETRI, Korea). Four DEP panelists, Song-hoon Baik (KT, Korea), Shingo Fujimoto (Fujitsu Laboratories LTD., Japan), Fuchun Joseph Lin (NCTU, Taiwan), and Soumya Kanti Datta (Eurecom, France) discussed and debated a large range of issues on the APNOMS2015 theme. These issues included "Internet of Things from Consumers Standpoint", "Manufacturer Point of View on IoT", "oneM2M to build IoT eco-system", and "Smart Data Pricing for M2M Communications." A flexible smart data charging model and an open IoT middleware platform were introduced as key technologies for the realization of IoT society by the panelists. Some management system architectures were also introduced by them to show how the IoT system and their services would be managed. More than 1 h was spent to discuss the symposium's theme, especially how to overcome the gap between the expectation and reality of IoT industry and society, and how to solve the consumer centric requirements: such as real-time and seamless interaction, easy user interface, local data processing. All panelists stressed that the management functionalities would be essential with IoT systems and services.

In addition, there were many discussions on questions from the audiences. Especially, the features for the future IoT society, the key technologies to realize the IoT society, and the necessary management issues were hotly debated. Some audiences asked the possible research issues for the key technologies and all panelist expressed their opinion on the question during the most of discussion time. The discussion concluded by suggesting upon which areas to concentrate research,

namely policy-based management, traffic management, context awareness, semantic management, QoS/QoE control and security management to realize the future IoT society.

8 APNOMS2015 Best Paper Awards

The APNOMS2015 organizing committee selected the top four papers presented in the technical session for the “Best Paper Award”. The Best Paper Award Committee was organized with nine members—three members from Japan, Korea and Taiwan. Before the symposium, eight papers were nominated for best paper consideration. Representatives from each country nominated two papers with the highest review scores from their country. The award committee evaluated the nominees’ presentations and finally selected four papers with the highest overall (paper and presentation) scores. The first best paper was “A Metric-Correlation-Based Distributed Fault Detection Approach in Wireless Sensor Networks,” by Qian Liu, Yang Yang, Xuesong Qiu (BUPT, China), which proposed a metric-correlation-based distributed fault detection (MCDFD) approach to reduce communication overhead or computational cost in wireless sensor network. The second best paper was “Hybrid Caching and Requests Forwarding in Information Centric Networking,” by Kyi Thar, Saeed Ullah, Rim Haw, Tuan Le, Thant Zin Oo, Choong Seon Hong (Kyung Hee University, Korea), which proposed a hybrid caching, cache replacement and requests forwarding approaches to improve the performance of the Content Centric Networking. The third best papers was “An Hourly Day-Ahead Paris Metro Pricing Scheme for Mobile Data Networks,” by Huai-Sheng Huang, Po-Han Lee, Yu-Chee Tseng, Bo Ting Lin, Wan-Hsun Hu (NCTU, Taiwan), which proposed a dynamic Paris Metro Pricing (DPMP) scheme that determines the prices and capacities of different classes for the next 24 h. And the fourth best paper was “Universal Fault Detection for NFV using SOM-based Clustering,” by Tomonobu Niwa, Masanori Miyazawa, Michiaki Hayashi, Rolf Stadler (KDDI, Japan), which proposed a fault detection technique for NFV that covers a range of different faults using a single set of local statistics and SOM clustering parameters.

9 Concluding Remarks

APNOMS2015 paid much attention to several interesting and important topics, such as Cloud management, SDN/NFV management, and IoT management. APNOMS2015 was a very successful symposium. It was well attended and the feedback on all aspects of the symposium organization, in particular, on the technical program was very positive. It contributed to the growth of APNOMS into a very important international symposium. The audience’s feedback reinforced the positive aspects of the symposium: a good mixed participation from both industry and academia in technical contributions, the tradition of special sessions focusing on experiences and lessons learned by different countries in this region, excellent

venue and social events, and the overall collaborative, interactive and friendly atmosphere of the symposium.

In APNOMS2015, the technical and poster session papers were published in IEEE Xplore like previous APNOMS. Also, the proceedings have been distributed to the participants in an USB, which also included all innovation session papers, and presentation materials of keynote speeches, and special sessions. The keynote and DEP presentations as well as the pictures taken at the symposium are all available from the symposium website: <http://www.apnoms.org/2015>. We expect that APNOMS 2016 will be even more successful and will be held October 5–7, 2016 in Kanazawa, Japan. For more information, please visit <http://www.apnoms.org/2016>.

Acknowledgments The authors would like to thank all APNOMS2015 organizing committee members, including KICS KNOM and IEICE ICM members, for their dedication and continuous efforts to make this symposium a success. Our special thanks are extended to the IEEE CNOM (IEEE Communications Society Technical Committee on Network Operations and Management), BTO (Busan Tourism Organization), HP (Hewlett–Packard), KT (Korea Telecom), CISCO, NKIA, InfoBiz, AromTech, and CHT (Chunghwa Telecom) for their support.

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