

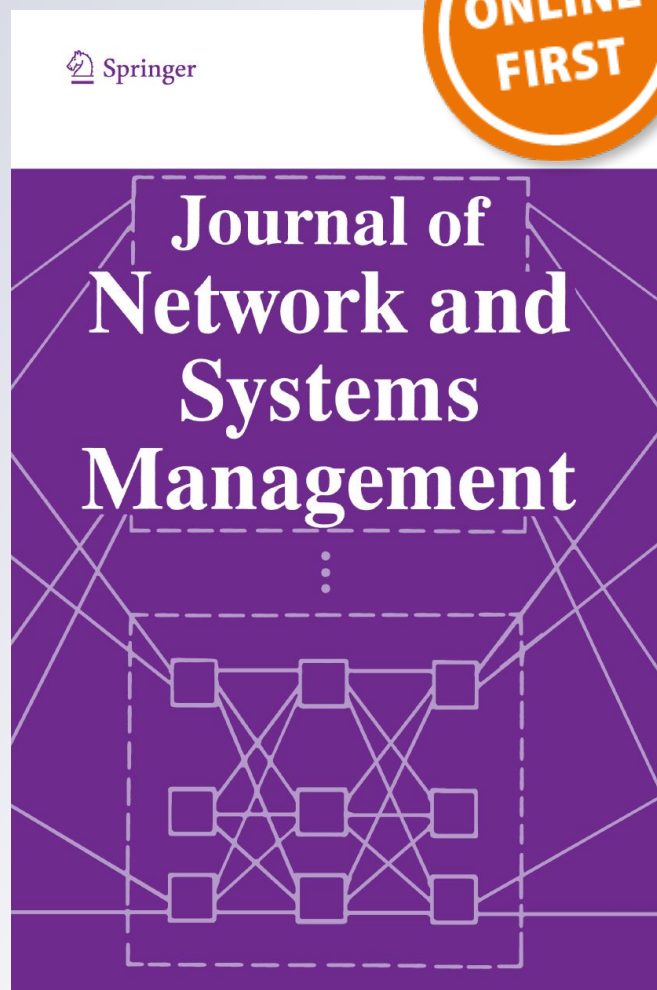
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Managing a World of Things: A Report on APNOMS2017

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Abstract

This article presents a report on APNOMS2017, which was held on Sept. 27–29, 2017 in Seoul, Korea. The theme of APNOMS2017 was “Managing a World of Things.”

Keywords Network operations and management · Software defined network ·
Network functions virtualization · World of things · 5G management

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1 Introduction

Asia-Pacific Network Operations and Management Symposium (APNOMS) has been a premier conference on network operations and management in the Asia-Pacific region. The 19th APNOMS2017 (<http://www.apnoms.org/2017/>) was held on Sept. 27–29, 2017 in Seoul, Korea. APNOMS2017 was organized by the Korean Information and Communications Society (KICS) Committee, Korean Network Operations and Management (KNOM), the Institute of Electronics, Information and Communication Engineers (IEICE), Technical Committee on Information Communication Management (ICM) with support from IEEE ComSoc (IEEE Communications Society), ATTO Research, INSOFT, BOSCO, and CHT (Chunghwa Telecom). APNOMS2017 continues to play a key role for exchanging and discussing all aspects of operations and management of telecommunications networks, enterprise networks, Internet and their services among the academic community, vendor, and the telecommunication industry at large in the Asia-Pacific region. As in the previous APNOMS symposia [1–15], APNOMS2017 was a great success as it attracted nearly 250 scholars, researchers, policy makers, practitioners, service providers and vendors from 11 countries.

The theme of this symposium was “Managing a World of Things.” Research and developments on 5G, SDN/NFV and IoT technologies 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 5G, SDN/NFV, and IoT solutions in the next few years. Thus, the operations and management of 5G, SDN/NFV, and IoT networks and services have become very important to the network operators and service providers. Keeping in mind these challenges, APNOMS2017 provided higher priority in the following areas: 5G Management, SDN/NFV Management, and IoT Management.

APNOMS2017 had prepared an excellent 3-full day program with keynotes, tutorials, technical sessions, special sessions, distinguished expert 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 APNOMS2017 and current trends of research on managing a World of Things.

2 Tutorials

The symposium started with four tutorials in two parallel tutorial tracks covering the latest hot topics.

In the first two tutorial sessions, Dr. Jian Li (POSTECH, Korea) and Prof. Susumu Ishihara (Shizuoka University) gave tutorials on “A Distributed SDN

Controller—ONOS Technical Tutorial” and “Managing Mobile Sensor Networks in an Underground Pipe” respectively. The tutorials were given simultaneously in two different rooms. The tutorial given by Dr. Jian Li introduced the Open Network Operating System (ONOS) from its background invention to current application and even farther to its potential future evolution. The tutorial given by Prof. Susumu Ishihara, provided details of how underground pipes are designed and managed for mobile sensor networks by discussing drifting sensor network, facilities, characteristics of wireless communication in narrow pipes and cooperative protocol for multiple drifting sensor network.

In the second two tutorial sessions, Prof. Min-Te Sun (National Central University, Taoyuan, Taiwan) and Prof. JongWon Kim (GIST Korea) gave tutorials on “Security and Privacy in Large-Scale RFID Systems” and “Containerized IoT-Cloud Services over SmartX Playgrounds and their Sustained/Secured Orchestration” respectively. Prof. Min-Te Sun investigated a number of security and privacy issues in large-scale RFID systems, and discussed possible solutions to each of these issues, by introducing encryption and non-encryption-based private authentication in RFID. Prof. JongWon Kim introduced the prototyping experience of containerized IoT-Cloud services by showcasing API-driven service function chaining over SmartX playgrounds. The 4 tutorials attracted many participants and generated discussions on these topics towards managing a smart world of things. A questionnaire was taken and feedbacks indicated that more than 95% of tutorial audience were satisfied with the tutorials.

3 Keynotes

Five keynote speakers shared their visions and perspectives on managing a world of things during 3 days of the event. The speakers provided excellent speeches on R&D directions on IoT (World of Things) and 5G development. In the first day, Mr. Jin-Hyo Park (Senior Vice President of Network Technology R&D Center, SK Telecom, Korea) delivered a speech on “SKT’s Vision and Plan for Next-Gen OSS in 5G Era.” He presented SKT’s current efforts and long term plans especially on managing a world of things in the coming 5G era.

In the second day, Prof. Jyh-Cheng Chen (National Chiao Tung University, Taiwan) gave a speech on “Softwarization of 5G Core Networks.” He presented a vision on next generation management on 5G era and the RECO (Reconfigurable Core) as an example. Mr. Tsunemasa Hayashi (CEO/President of BOSCO Technologies Inc, Japan) gave a speech on “IT management for IoT era (A real Web of Things and Intelligent management for network career)”. He generally addressed on how to parallel manage things a networked world of things to save time and resources.

In the last day, Dr. Hyung Kyu Chung (vice president of ETRI, Korea) gave a speech on “The first 5G system PoC in conjunction with the PyeongChang winter Olympics”. He presented his 5G vision, especially a project named CHAMPION and its Proof of Concept deployment plan for the 2018 PyeongChang Olympics which will be held in Korea. Dr. Slawomir Kuklinski (Orange Polska, Poland) delivered a speech on “Network slicing—open issues.” He explained why slicing is a hot

topic and why slicing will be a big revolution in the telecommunication industry and in 5G.

4 Technical, Poster and Innovation Sessions

The main body of the Symposium consisted of nine technical sessions, two poster sessions, and two innovation sessions. This year, we have received 100 submissions for technical sessions and poster sessions from 11 different countries. We are certain that the selected 36 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 36.00%. 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: Vehicular and Maritime, Traffic Analysis and QoS, SDN and NFV, SDN and Fault Management, Security, Cloud and Fog Computing, IoT and WLAN, Wireless Network and CDN. Many papers focused on the management of SDN/NFV, IoT and 5G Network Communication. Many sessions including Vehicular and Maritime, Cloud and Fog Computing, and Wireless Network and CDN were evaluated very well. This year, the SDN/NFV and 5G Network Communication areas were the most attractive. 138 attendees returned a questionnaire about the technical sessions. The responses showed that more than 83% 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. 8 papers were selected and presented in the innovation sessions, whose topics were Service Management and Systems, Architecture and Business Management.

5 Special Sessions

Two special sessions were held on the second and third day of the symposium. Eight representatives of various countries from Asia–Pacific region discussed the latest research topics on network intelligence and mobile edge computing.

On the second day, four speakers gave talks on “Network intelligence in the age of IoT with SDN and NFV,” as the current hottest issues. Prof. Ryota Kawashima (Nagoya Institute of Technology, Japan) gave a talk on “Finding the Right Way for High-Performance NFV.” He introduced ways and reasons why everything should be virtualized after giving the background of NFV. He spoke about D-Plane technologies, performance and future NFV research areas. Dr. Sangho Shin (Manager, SK Telecom, Korea) gave a speech on “Network Intelligence in the age of IoT with SDN and NFV.” He defined SDN in detail and explained why SDN is helpful with examples. He provided and introduced several real use cases that are applicable in the

SKT. Prof. Jyh Cheng Chen (National Chiao Tung University, Taiwan) gave a talk on “RECO: An Open-Source Reconfigurable Core Network.” Dr. Jian Li (POSTECH, Korea) gave a talk on “Towards a distributed SDN controller—ONOS.” He gave the backgrounds of ONOS, explained about how it operates and presented several ONOS applications. He further introduced the SDN evolution and ONF from their inventions to potential future research.

On the third day, four speakers gave talks on “Mobile Edge Computing and V2X for Autonomous Driving”. Dr. Yuan-Yao Shih (Academia Sinica, Taiwan) gave a talk on “Fog/Edge computing Platform: Enabling Low-Latency Application in Next Generation Network”. On the topic, he presented the trends of previous (1G-TACS, 2G-GSM, 3G-UMTS and 4G-LTE) wireless communication gave insights of how the future (5G) wireless communication might look like. He emphasized that in the future 5G wireless communication there will be data traffic avalanches, massive growth of connected devices, diversification of services and equipment and vertical markets. Dr. Si Bok Yu (Korea Automotive Technology Institute (KATECH), Korea) gave a speech on “Cooperative safety with V2X for automated driving systems and some ADAS applications: use cases and technologies.” Prof. Akihiro Nakao (University of Tokyo, Japan) gave a speech on “App-Specific Edge Computing and In-Network Deep Learning.” Prof. Byung-Seo Kim (Hongik University, Korea) gave a talk on “Wireless Information-Centric Networking with Edge Computing for Vehicular Applications.” He talked about V2X networks, ICN, Fog computing, ICN edge computing and issues on ICN for multi-hop V2X.

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 academia to interact with the exhibitors. Each exhibition attracted many visitors, and those asked questions and learned something new to develop innovative ideas.

Four companies including Atto Research (Korea), INSOFT (Korea), Chunghwa Telecom (Taiwan) and BOSCO Technologies (Japan) participated in the exhibition program. Atto Research presented their innovation on Networking by SDN and NFV. It is specialized in network virtualization with SDN and NFV technologies. It also specialized in security-enhanced SDN control, network management and cloud network virtualization. INSOFT mainly dealt with their next generation network management solution, CloudMesh for NFV. CloudMesh provides simple ways to design complex network topology and apply it to real world network configuration seamlessly via user friendly designer tool. CloudMesh also offers a complete management for multi data center via distributed NFV technology.

Chunghwa Telecom presented an EyeSee-Integrated ICT management service. Chunghwa Telecom generally provides enterprise customers with a variety of managed ICT services with superior quality and has developed a one-stop, brand new management platform, called EyeSee for enterprise customers to easily check the quality of

these ICT services from the perspective of customers. BOSCO Technologies dealt with their IT management solution for IoT era. Being motivated from large ICT infrastructure and complicated IoT and SDN/NFV, BOSCO Technologies is developing the unified, simplified and flexible ICT infrastructure management that does not depend on other network environments. For instance, it provides a SMART-GW, the brand-new web-based unified and simplified ICT management system where an operator can login to SMART-GW via a web browser and establish a connection, such as SSH, http, RDP and so on to manage the ICT infrastructures.

7 Distinguished Experts Panel

The APNOMS 2017 DEP session was led by the Session Chair Prof. Jong-Moon Chung from Yonsei University, where the three panelists from Taiwan, Japan, and Korea first made presentations, which was followed by questions.

The DEP Taiwan panelist Prof. Li-Chun Wang, from NCTU, Taiwan, first introduced what data science and driven research is, followed by explaining how to take power control issues of ultra-dense small cells (UDSC) as an example to illustrate how a data-driven approach can empower self-organizing network (SON) to enhance the throughput and energy efficiency of UDSC, and provide application-aware flow QoS control. Last, he explained some important future data-driven wireless network research directions.

The DEP Japan panelist Satoru Matsushima, from Japan's SoftBank Corporation, made a talk on the key concepts of software defining work and the programmable data-plane. He explained that the software defining work reference model can be based on RFC7426, where available solutions include the Group-based-policy (GBP), Network Modeling Language (NEMO), and Network Intent Composition (NIC). In addition, based on the programmable data-plane characteristics, descriptions of how networks work in the stack was described based on SRv6 and the Segment Routing Header (SRH).

The DEP Korea panelist Dr. Jian Li, from ONF of the SDN and NFV Forum, made a presentation that covered the following three topics. First, the new ONF was introduced based on open innovation pipelines to build integrated solutions, and software defined standards. Second, open source versus standardization was explained, based on the ONF open innovation pipeline, new ONF's scope, new ONF restructuring for the open source era, and the Linux Foundation's view. Third, he explained his view in that why open source for orchestrator is needed.

Many questions were asked, which include, what is most necessary for IoT hyper-connectivity support, what is needed most urgently to enable optimized 5G mobile communications network management, and what is the most critical security issue. Abundant discussion was made by the panelists and audience.

8 APNOMS2017 Best Paper Awards

The APNOMS2017 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, 12 papers were nominated for best paper consideration from four countries. The award committee evaluated the nominees’ presentations and finally selected four papers with the highest overall (paper and presentation) scores. The selected papers were “Towards Comprehensive Protection for OpenFlow Controllers,” by Shengzhi Zhang, Xiaoqi Jia, and Weijuan Zhang (Florida Institute of Technology, USA, CAS, Beijing, China, University of Chinese Academy of Science, Beijing, China), “Design of Optical Aggregation Network with Carrier Edge Functions Virtualization,” by Takashi Miyamura, Akira Misawa, and Jun-ichi Kani (NTT Corporation, Tokyo, Japan, NTT Corporation, Kanagawa, Japan), “A Novel vCPE Framework for Enabling Virtual Network Functions with Multiple Flow Tables Architecture in SDN Switches,” by Nen-Fu Huang, Chi-Hsuan Li, Chia-Chi Chen, I-Hsien Hsu, Che-Chuan Li, and Ching-Hsuan Chen (National Tsing Hua University, Hsinchu, Taiwan) and “OpenAPI-based Message Router for Mashup Service Development,” by Doyoung Lee, Seyeon Jeong, and James Won-Ki Hong (POSTECH, Pohang, Korea).

9 Concluding Remarks

APNOMS2017 paid much attention to several interesting and important topics, such as 5G management, SDN/NFV management, and IoT management. APNOMS2017 was a very successful symposium. It was well attended and the feedback on all aspects of the symposium program was very positive. It contributed to the growth of APNOMS into a very important international symposium. The audience 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 APNOMS2017, 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. Most of the presentation files are all available at the symposium website: <http://www.apnoms.org/2017>. The APNOMS2019 is not planned since the NOMS2018 (<http://noms2018.ieee-noms.org/>), which is held in April 23–27 2018 in Taipei, Taiwan . We expect that next APNOMS will be even more successful and will be held in September 2019 in Japan.

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