

APNOMS2016

The 18th Asia-Pacific
Network Operations and Management Symposium

October 5-7 , 2016
Kanazawa, Japan

- Management of Softwarized Infrastructure -



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APNOMS2016

Contents

Welcome to APNOMS2016	3
Organizing Committee	4
Technical Program Committee	5
Program at a Glance	7
Keynotes	10
Distinguished Experts Panel	12
Special Sessions	14
Tutorials	17
Technical Sessions	19
Poster Sessions	22
Innovation Sessions	25
Exhibitions	26
Venue Information	27
Transportation Information	28
Tour Information	30
General Information	33
Registration	34
Symposium Banquet	35

Welcome to APNOMS2016

The 18th Asia-Pacific Network Operations and Management Symposium

“Management of Softwarized Infrastructure”

5 - 7 October 2016, Kanazawa, Japan

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APNOMS (Asia Pacific Network Operations and Management Symposium) has been a premier conference on network operations and management in the Asia Pacific region. APNOMS 2016 is sponsored by IEICE Technical Committee on Information and Communication Management (ICM) and the KICS Committee on Korean Network Operations and Management (KNOM). APNOMS meets every year, and boasts a rich history of successes. It includes a full three-day program of keynotes, tutorials, technical sessions, innovation sessions, panel discussions, poster sessions, and exhibitions that focus on managing networks that span the computing and telecommunications areas.

APNOMS 2016 is the 18th in the series, following the successful APNOMS'97 (Seoul) to APNOMS 2015 (Busan). Our targets are enlarging from network management to total system management, business management and so on. We are proud that APNOMS has been encouraging the industrial activities and the academic activities in these fields.

APNOMS 2016 mainly focuses on the new trend of softwarized infrastructure, which enables a flexible and dynamic system evolution. The management will be more important in this trend. Discussions in the conference are expected to open up new possibilities.

APNOMS 2016 is held in Kanazawa, Japan. Kanazawa once was the second largest castle city in 17th century. The wealth from that period nourished its culture and art. There are many historical monuments and sites. Kenroku-en, built in 1676, is one of the most beautiful gardens in Japan. You will meet traditional art-crafts, which have been inherited and developed for long time. Kanazawa preserves its history, and eight million tourists visit the city every year. Not only being traditional and historical, Kanazawa is also a future-oriented city. The Hokuriku Shinkansen (the bullet train) from Tokyo to Kanazawa started operating in 2015. It connects these two cities in 2 hours and a half in the fastest case. It brings new opportunities to Kanazawa. Kanazawa is a good place to discuss new technology because it is a crossroad of the future and history.

Finally, we would like to express our sincere thanks to the authors, reviewers, committee members, volunteers, and participants of this symposium for their great effort to the success of APNOMS2016.

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Program at a Glance

Wednesday, October 5, 2016				
	Hall	Room 1	Room 2	Room 3
09:00 - 10:30	Tutorial 1 WiFi Network Virtualization Dr. Kiyohide Nakauchi	Tutorial 2 Blockchain Technology and Its Applications Prof. Raylin Tso		
10:30 - 10:45			(Coffee Break)	
10:45 - 12:15	Tutorial 3 M2M/IoT Technical Overview and Its Standardization Prof. Tetsuya Yokotani	Tutorial 4 mOS: A Highly-flexible & Reusable Networking Stack for Software Middleboxes Prof. KyoungSoo Park		Exhibition Preparation
12:15 - 13:15	Lunch			
13:15 - 13:55	Welcome Address: General Chair Keynote Speech 1: Prof. Masayuki Murata			
13:55 - 14:25				(Coffee Break)
14:25 - 16:05	Technical Session 1 Theme: Cellular Networks	Innovation Session 1 Theme: Architectures and Virtualization		Exhibition Demos
16:05 - 16:35				(Coffee Break)
16:35 - 18:15	Technical Session 2 Theme: M2M, D2D, and Wireless Network Design	Special Session 1 Theme: Latest Trends in Asia-Pacific Network Operations and Management		

Thursday, October 6, 2016				
	Hall	Room 1	Room 2	Room 3
09:00 - 10:00	Keynote Speech 2: Dr. Sławomir KUKLIŃSKI Keynote Speech 3: Dr. Woojik Chun			
10:00 - 10:30			Poster Session 1	(Coffee Break)
10:30 - 12:10	Technical Session 3 Theme: Mobile Applications	Technical Session 4 Theme: Virtualized Networks		Exhibition Demos
12:10 - 13:10	Lunch			
13:10 – 14:50	Technical Session 5 Theme: Software Defined Networks	Innovation Session 2 Theme: Service and Performance Management		
14:50 – 15:20			Poster Session 1	(Coffee Break)
15:20 – 17:00	Technical Session 6 Theme: P2P and Data Delivery	Special Session 2 Theme: Network Softwarization and Its Applications		
Symposium Banquet @ Kanazawa Tokyu Hotel				

Friday, October 7, 2016				
	Hall	Room 1	Room 2	Room 3
09:00 - 10:00	Keynote Speech 4: Mr. Kazuo Sugiyama Keynote Speech 5: Prof. Yu-chee Tseng			
10:00 - 10:30			Poster Session 2	(Coffee Break)
10:30 - 12:10	Technical Session 7 Theme: Data Center Networks	Technical Session 8 Theme: Routing		Exhibition Demos
12:10 - 13:10	Lunch			
13:10 – 14:50	Technical Session 9 Theme: Traffic Detection and Identification	Innovation Session 3 Theme: Network and Service Management		
14:50 – 15:20			Poster Session 2	(Coffee Break)
15:20 – 17:20	Distinguished Expert Panel			
17:20 - 17:35	Best Paper Award and Closing Remark			

Keynotes

Keynote 1: Wednesday, October 5, 2016, 13:15–13:55, Hall

Theme: Brain- and Biologically-inspired Information Networking

Prof. Masayuki Murata (Osaka University, Japan)



Prof. Masayuki Murata received the M.E. and D.E. degrees in Information and Computer Science from Osaka University, Japan, in 1984 and 1988, respectively. In April 1984, he joined Tokyo Research Laboratory, IBM Japan, as a Researcher. From September 1987 to January 1989, he was an Assistant Professor with Computation Center, Osaka University. In February 1989, he moved to the Department of Information and Computer Sciences, Faculty of Engineering Science, Osaka University. In April 1999, he became a Professor of Graduate School of Engineering Science, Osaka University, and is now with Graduate School of Information Science and Technology, Osaka University since April 2004. His research interests include information network architecture, brain- and biologically-inspired networking. He is a member of IEEE, ACM and IEICE. He is now serving as the President of IEICE Communications Society.

Keynote 2: Thursday, October 6, 2016, 9:00–9:30, Hall

Theme: Borders Between Management, Control and Orchestration in Softwarized Networks

Dr. Sławomir Kukliński (Orange Labs Poland, Poland)



Dr. Sławomir Kukliński received Ph.D. degree in Telecommunications from Warsaw University of Technology (WUT), Institute of Telecommunications, in 1994 with honors and since then he is Assistant Professor there. He is teaching about mobile and wireless systems. From 2003 he works also for Telekomunikacja Polska R&D Centre (at present it is Orange Labs Poland) as research expert. He has 25 years long experience in telecommunications. At present he is focused on Future Internet and mobile and wireless systems evolution. He led many national research projects as principal investigator. In his career he was involved in many international projects, including EU funded FP6 MIDAS project concerning context aware routing, FP7 project EFIPSANS concerned autonomic management, the ProSense project on sensor networks, and in FP7 project 4WARD in which he was working on new paradigms of network management. At present he is playing a key role in the Celtic COMMUNE Project (2011-2014), which concerns cognitive network management under uncertainty and from 2013 he is the coordinator of 3 years long Polish-Luxembourgish project on Cognitive SDN (CoSDN). He also participates in ITU-T standardization (Study Group 13). He published many conference and journal papers and was a member of TPC of many conferences, and served as a reviewer to many conferences and journals.

Keynote 3: Thursday, October 6, 2016, 9:30–10:00, Hall

Theme: Trustworthy Communication Infrastructure: Principles and Framework

Dr. Woojik Chun (KAIST, Korea)



Dr. Woojik Chun is an invited researcher at Korea Advanced Institute of Science (KAIST) since 2016. From 2009 to 2012 and He worked as a researcher in Electronics and Telecommunication Research Institutes (ETRI). He founded a venture company, Raonet Systems, Inc. in 2000 and served as the CEO till 2009. From 1992 to 2001 he worked as a professor of computer engineering in Chungnam National University (CNU). He received B.E and M.E degree in Computer Engineering from Seoul National University (SNU) in 1982 and 1984 respectively. He received his Ph. D. degree in Information and Computer Sciences from University of Delaware (UD) in 1992. His major research areas include the Internet/Future Internet and protocol engineering. His current research topic is identifier based communication networking and trustworthy communications.

Keynote 4: Friday, October 7, 2016, 9:00–10:00, Hall**Theme: NTT DOCOMO's Continuous Challenges Toward Mobile Network Evolution****Mr. Kazuo Sugiyama (NTT DoCoMo, Japan)**

Mr. Sugiyama joined Nippon Telegraph and Telephone Corporation in 1990 after graduating from Waseda University with a master's degree in the same year. Since then, he has been engaged in research and development of mobile communications network systems and involved in the development of core networks for generations of mobile systems: PDC, PDC packet, IMT-2000 and LTE.

Keynote 5: Friday, October 7, 2016, 9:00–10:00, Hall**Theme: Intelligence in Edges****Prof. Yu-chee Tseng (Dean of the College of Computer Science, NCTU, Taiwan)**

Prof. Yu-Chee Tseng got his Ph.D. in Computer and Information Science from the Ohio State University in January of 1994. He was/is Chairman (2005-2009) and Dean (2011-present), College of Computer Science, National Chiao-Tung University, Taiwan. Prof. Tseng has been awarded as NCTU Chair Professor (2011-present) and Y. Z. Hsu Scientific Chair Professor (2012-2013). He received Outstanding Research Award (National Science Council, 2001, 2003, and 2009), Best Paper Award (Int'l Conf. on Parallel Processing, 2003), Elite I. T. Award (2004), and Distinguished Alumnus Award (Ohio State University, 2005), and Y. Z. Hsu Scientific Paper Award (2009). His research interests include mobile computing, wireless communication, and sensor networks. Prof. Tseng is an IEEE Fellow. He served/serves on the editorial boards of IEEE Trans. on Vehicular Technology, IEEE Trans. on Mobile Computing, IEEE Trans. on Parallel and Distributed Systems, and IEEE Internet of Things Journal. His h-index is more than 60.

Distinguished Experts Panel

DEP Session: Friday, October 7, 2016, 15:20–17:20, Hall

Panel Chair

Dai Kashiwa (NTT Communications, Japan)



Dai Kashiwa is the Director of Technology Development at NTT Communications, where he leads a number of incubation and software development projects using SDN/NFV technologies. After he joined NTT, he was involved in research including network management systems, network security, Active Networks, and received his Ph.D. in 2003. Since 2004, he has worked for NTT Communications, where he developed business network services including video broadcasting, dynamic VPN and SDN services. He has been a board member of ONF(Open Networking Foundation) since 2015 and a board member of ONOS(Open Network Operation System) project since 2016.

Panelist

Mr. Hiroaki Sato (Director of NTT Lab and Specialist of SDN/NFV Technology Development, Japan)



Mr. Hiroaki Sato joined NTT laboratories in 1992 after receiving master's degree in Physics from Tokyo Institute of Technology. He developed PON Access System, IP Multicast CDN System, and IP dual stack backbone for triple play services. When he was working for NTT DOCOMO, he defined "Guidelines for Video Delivery" for content providers and developed SDN System working with NFV (vEPC). After returning NTT laboratories, he currently investigate NetroSphere as future NFV and SDN.

Panelist

Dr. Li-Chun Wang (Professor at National Chiao Tung University, Taiwan)



Dr. Li-Chun Wang (M'96 -- SM'06 -- F'11) received Ph.D. degree from the Georgia Institute of Technology, Atlanta, in 1996. From 1996 to 2000, he was with AT&T Laboratories, where he was a Senior Technical Staff Member in the Wireless Communications Research Department. Since August 2000, he has joined the Department of Electrical and Computer Engineering of National Chiao Tung University in Taiwan and is the current Chairman of the same department.

Dr. Wang won the Distinguished Research Award of National Science Council, Taiwan in 2012, and was elected to the IEEE Fellow grade in 2011 for his contributions to cellular architectures and radio resource management in wireless networks. He was the co-recipient of 2015 IEEE Communications Society Asia-Pacific Board Best Award. He also won the 2013 Y. Z. Hsu Scientific Paper Award, and was the co-recipient of the 1997 IEEE Jack Neubauer Best Paper Award.

His current research interests are in the areas of radio resource management and cross-layer optimization techniques for wireless systems, heterogeneous wireless network design, and cloud computing for mobile applications. He is holding 10 US patents and editing a book, "Emerging Technologies for 5G Wireless Systems," with Cambridge University Press.

Panelist**Prof. Sueng-Yong Park (Yonsei University/KulCloud, Korea)**

Prof. Sueng-Yong Park is currently involved in the Fed4FIRE (Federation for Future Internet Research and Experimentation). It is the integration project of various Future Internet (FI) facilities under the governance of European Union 7th Framework Programme (EU FP7). National Information Society Agency (NIA) of Korea and Yonsei Univ. are the partner of the project. And Prof. Sueng-Yong Park is in charge of research and technical aspects of contribution from Korea. He is both affiliated with Yonsei University, and a start-up, KulCloud Corp, the first Korean SDN company. Previously he worked for Cisco Systems as a senior software engineer in San Jose, U.S.A. and a principal engineer for Samsung Electronics, Suwon, Korea. He earned his MS and Ph.D. from University of Illinois at Urbana-Champaign, U.S.A., and BS from Yonsei University, Korea.

Panelist**Prof. Akihiro Nakao (The University of Tokyo, Japan)**

Prof. Akihiro Nakao received B.S. (1991) in Physics, M.E. (1994) in Information Engineering from the University of Tokyo. He was at IBM Yamato Laboratory, Tokyo Research Laboratory, and IBM Texas Austin from 1994 till 2005. He received M.S. (2001) and Ph.D. (2005) in Computer Science from Princeton University. He is a full professor and also a department chair at Interfaculty Initiative in Information Studies, Graduate School of Interdisciplinary Information Studies, the University. He has also been appointed by the Japanese government as a chairman of network architecture committee of the fifth generation mobile network promotion forum (5GMF) in Japan.

Special Sessions

Special Session 1: Wednesday, October 5, 2016, 16:35–18:15, Room 1

Theme: Latest Trends in Asia-Pacific Network Operations and Management

Chair: Myung-Sup Kim (Korea University, Korea)

Digital Terrestrial Broadcasting Deployment in Thailand: Case study of ThaiPBS

Prof. Teerapat Sanguankotchakorn (IS, Thailand)



Prof. Teerapat Sa-nguankotchakorn received the B.Eng. in Electrical Engineering from Chulalongkorn University, Thailand in 1987, M.Eng. and D.Eng. in Information Processing from Tokyo Institute of Technology, Japan in 1990 and 1993, respectively under Japanese Government Scholarship. In 1993, he joined Telecommunication and Information Systems Research Laboratory at Sony Corporation, Japan, where he holds two patents on Signal Compression. Since 1995, he had been with ABCN Co. Ltd. Thailand. Since 1998, he joined Asian Institute of Technology (AIT) as an Assistant Professor in Telecommunications Field of Study, School of Engineering and Technology. Currently, he is an Associate Professor at the same school and the same institute. He was a recipient of Foreigner Research Funding from National Institute of Information and Communications Technology (NICT), Japan in year 2008 and 2011. He was invited as a research scholar by NHK Science and Technology Research Lab in year 2009. He was a member of board of Directors at MCOT Plc the largest Thai Government own Television and Radio Broadcaster in Thailand. Currently, he is a member of Board of Governors of Thai Public Broadcasting Service, the only one public broadcaster in Thailand and South-east Asia. His research interests includes Image Compression, High Speed and Broadband Access Network, IP-based multimedia applications, QoS and Cross-layer Design in wireless and wire network (Ad Hoc and infrastructure-type network).

Towards a Metadata Driven Network Management

Mr. Chen-Min Hsu (ChungHwa Telecom, Taiwan)



Mr. Chen-Min Hsu is a researcher of Network Management Laboratory at Chunghwa Telecom Labs, Taiwan. He received his M.S. degree from Information Management Department at National Taiwan University of Science and Technology, Taiwan in 2000. Mr. Hsu has been engaged in the domain of network management from 2002 until now. In 2014, he was invited to join a SDN/NFV project and was in charge of solutions development for managing new software defined network environment. Recently, he is also involved in developing a small cell management system for wireless networks. He is now the leader of a network monitoring system development team in Chunghwa Telecom. His team is targeting complex network management issues, like automatic process design, CPE security mechanism plan and SDN/NFV monitoring mechanism. His current research interests include traditional network management, CPE management, SDN/NFV management, business model analysis, and operation support system development.

Cache Control in Content Delivery Networks

Dr. Noriaki Kamiyama (NTT Network Technology Laboratories, Japan)



Dr. Noriaki Kamiyama received his M.E. and Ph.D. degrees in communications engineering from Osaka University in 1994 and 1996, respectively. From 1996 to 1997, he was with the University of Southern California as a visiting researcher. He joined NTT Multimedia Network Laboratories in 1997, and he is now working at NTT Network Technology Laboratories. He was also with the Osaka University as an invited associate professor from 2013 to 2014 and an invited professor in 2015. He has been engaged in research concerning content distribution systems, network design, network economics, traffic measurement and analysis, traffic engineering, and optical networks. He received the best paper award at the IFIP/IEEE IM 2013. He is a member of IEEE and IEICE.

IoT for Smart Buildings

Prof. Pachamuthu Rajalakshmi (Department of Electrical Engineering, IIT Hyderabad, India)



Prof. Pachamuthu Rajalakshmi has M.Tech. and Ph.D. degrees from Indian Institute of Technology Madras, both in Communication Systems. She is currently an Associate Professor in the Department of Electrical Engineering at Indian Institute of Technology Hyderabad, which she has joined in 2009. Her research interests are in the broad areas of wireless communications, sensor networks, embedded systems and IoT/CPS. She has over 60 publications in peer-reviewed international journals and conferences. She has filed 4 patents. She has been a recipient of 'Digital Trail Blazer Award 2016' by India Today, awarded as an "INDIA's Most Inspiring Women Engineer/Scientist" for the year 2014 by Engineering Watch and IETE-M N SAHA MEMORIAL AWARD for the best application oriented paper of the year 2009. Prof. P. Rajalakshmi is actively involved in various government (DST, DeITY) and industry sponsored projects. Some of them are Pervasive sensor networks for air pollution monitoring, IoT chipset development for Healthcare applications, IoT enabled Handheld ultrasound system design, Smart building architecture research for energy savings, Mobile Sensor Networks, Cyber Physical Systems. She developed products, such as 'IITH-mote' - 802.15.4 complaint node, 'IoT Enabled Power Monitoring' – deployed in IITH Academic block A. For more details: <http://www.iith.ac.in/~raji/>

Special Session 2: Thursday, October 6, 2016, 15:20–17:00, Room 1**Theme: Network Softwarization and Its Applications**

Chair: Teh-Sheng Huang (Chunghwa Telecom, Taiwan)

The Status and Issues for Network Softwarization

Dr. Ki-Sang Ok (KT, Korea)



Dr. Kisang Ok is the researching Director and Project Leader for NFV Platform Division in KT. He joined KT in 1997 and had worked on the network management areas including network management and Operation Supporting System (OSS), and CDN Platform until 2012. He has worked on the Network softwarization areas including NFV and SDN until now. He received B.S. and M.S. degree in Computer Science & Engineering from Hanyang University in 1995 and 1997. He received MBA degree from Seoul National University in 2014.

SDN/NFV Technologies and Applications

Prof. Jiann-Liang Chen (NTUST, Taiwan)



Prof. Jiann-Liang Chen received the Ph.D. degree in Electrical Engineering from National Taiwan University, Taipei, Taiwan in 1989. Since August 1997, he has been with the Department of Computer Science and Information Engineering of National Dong Hwa University, where he is a professor and Vice Dean of Science and Engineering College. Prof. Chen joins the Department of Electrical Engineering, National Taiwan University of Science and Technology, as a distinguished professor and chairman now. He is a Fellow of Chartered IT Professional of British Computer Society. His current research interests are directed at SDN networking, cloud computing, Internet-of-Things and 5G computing.

Utilizing Software Defined Wireless Network to Improve Ship Area Network

Dr. Shih-Hao Chang (TamKang University, Taiwan)



Dr. Shih-Hao Chang received the M.Sc. degree in distributed multimedia system in year 2000, and the Ph.D. degree in computing & mathematic sciences in year 2009 from the Liverpool John Moores University, Liverpool, UK. He also became a member of the BCS and IEEE from 2009. Prior to his PhD, he worked in industry for several years as a system and software engineer and has been directly involved in the development of several national and international projects for Lucent and Chung-Hwa Telecommunication Lab. He is currently an Assistant Professor with the Dept. of Computer Science and Information Engineering, Tamkang University, Taiwan. His research interests include wireless sensor network, cloud computing, network security, and internet-of-things.

Evolution of Software Defined Networking (SDN): Interaction with Legacy Platform

Prof. Sueng-Yong Park (Yonsei University/KulCloud, Korea)



Prof. Sueng-Yong Park is currently involved in the Fed4FIRE (Federation for Future Internet Research and Experimentation). It is the integration project of various Future Internet (FI) facilities under the governance of European Union 7th Framework Programme (EU FP7). National Information Society Agency (NIA) of Korea and Yonsei Univ are the partner of the project. And Prof. Sueng-Yong Park is in charge of research and technical aspects of contribution from Korea. He is both affiliated with Yonsei University, and a start-up, KulCloud Corp, the first Korean SDN company. Previously he worked for Cisco Systems as a senior software engineer in San Jose, U.S.A. and a principal engineer for Samsung Electronics, Suwon, Korea. He earned his MS and Ph.D. from University of Illinois at Urbana-Champaign, U.S.A., and BS from Yonsei University, Korea.

Tutorials

Tutorial 1: Wednesday, October 5, 2016, 09:00–10:30, Hall

Chair: Kazuhiko Kinoshita (Tokushima University, Japan)

WiFi Network Virtualization

Dr. Kiyohide Nakauchi (NICT, Japan)



Dr. Kiyohide Nakauchi is a senior researcher at Network Research Headquarters in National Institute of Information and Communications Technology (NICT), Tokyo, Japan. He joined the Communications Research Laboratory (currently NICT), Ministry of Posts and Telecommunications, Japan, in 2003. Since then, he has been actively involved in research and development activities in the field of high-performance transport protocols, overlay network, network virtualization, and mobile networks. He received his B.E., M.E., and Ph.D. degrees in Information and Communication Engineering from the University of Tokyo, Tokyo, Japan, in 1998, 2000, and 2003, respectively. He is a member of IEEE, the Association for Computer Machinery (ACM), and the Institute of Electrical, Information and Communication Engineers (IEICE).

Tutorial 2: Wednesday, October 5, 2016, 09:00–10:30, Room 1

Chair: Nai-Wei Lo (NTUST, Taiwan)

Blockchain Technology and Its Applications

Prof. Raylin Tso (National Chengchi University, Taiwan)



Prof. Raylin Tso is currently an Associate Professor in the Department of Computer Science, National Chengchi University, Taiwan. He obtained his B.Eng. degree from National Tsing Hua University, Taiwan, in 1995. He received his M.Eng. and PhD degrees in Systems and Information Engineering from Tsukuba University, Japan, in 2004 and 2006, respectively. He has authored or co-authored over 60 papers in referred journals and conferences in the area of information security. His research interests are mainly in the areas of cryptography, IoT security, privacy preserving data analysis, and blockchain technology. Prof. Raylin Tso has received many academic awards including, IPSJ Digital Courier Award for Young Researcher (2006), Dean's Award of the Graduate School of Systems and Information Engineering, University of Tsukuba, Japan (2006), Research Award of College of Science (NCCU) for Early Career Researchers (2015) and Award of WITC 2015 Outstanding Researcher (2015). He is also served as the Executive Editor of Internal Journal of Information and Computer Security.

Tutorial 3: Wednesday, October 5, 2016, 10:45–12:15, Hall

Chair: Kazuhiko Kinoshita (Tokushima University, Japan)

M2M/IoT Technical Overview and Its Standardization

Prof. Tetsuya Yokotani (Kanazawa Institute of Technology, Japan)



Prof. Tetsuya Yokotani obtained B.S., M. S, and Ph. D degrees on information science from the Tokyo University of Science in 1985, 1987, and 1997, respectively. He joined Mitsubishi Electric Corporation in 1987. Since then, he has researched high-speed data communication, optical access and home network, and system performance evaluation based on queuing theory, and has promoted development of these related systems, in Information Technology R&D Center. In 2012, he moved to Global Standardization and R&D relation group, corporate research and development in headquarter as a senior manager. In 2015, he moved to Kanazawa Institute of Technology as a professor of College of Engineering. Moreover, his interests include international standardization for communication networks. He has joined standardization activity in ITU-T SG15 for FTTH and Home networks and in ISO/IEC JTC1 WG10 for IoT architecture. In academia, he has experienced many TPC, symposia and session chairs in major conferences, such as IEEE ICC and GLOBECOM. Currently, he is a chair elect of Technical committee of CQR (Communication Quality and Reliability) in IEEE Communication Society, and a char of Technical committee of Communication System in IEICE.

Tutorial 4: Wednesday, October 5, 2016, 10:45–12:15, Room 1

Chair: Ji-Yeon Son (ETRI, Korea)

mOS: A Highly-flexible & Reusable Networking Stack for Software Middleboxes

Prof. KyoungSoo Park (KAIST, Korea)



Prof. KyoungSoo Park is an associate professor in the Electrical Engineering department at KAIST. He received his B.S. degree from Seoul National University in 1997, and his M.A. and Ph.D. degrees from Princeton University in 2004 and 2007, respectively, all in computer science. Before joining KAIST, he worked as assistant professor in the computer science department at University of Pittsburgh in the year of 2009. His research interest is focused on the reliability, performance, and security issues in the design and implementation of networked computing systems. He has developed CoBlitz, a scalable large-file content distribution network (CDN), which is acquired by Verivue, Inc., and subsequently by Akamai, Inc. in 2012. He has co-developed HashCache, a memory-efficient caching storage system for developing regions, which was chosen one of the top 10 technologies in 2009 by the MIT technology review magazine. More recently, his co-authored mTCP paper received the community award at USENIX NSDI 2014. His recent research topic is focused on high performance packet/flow processing systems using multicore/manycore processors, such as PacketShader (a 40Gbps software router), SSLShader (13Gbps SSL proxy), and Kargus (33Gbps software IDS).

Technical Sessions

Technical Session 1: Wednesday, October 5, 2016, 14:25–16:05, Hall

Theme: Cellular Networks

Chair: Chih-Wei Yi (National Chiao Tung University, Taiwan)

TS1-1	Small Cells Placement Scheme in Metropolitan Area Environment Yen-Wen Chen, Wang-Hsin Lu (National Central University, Taiwan)
TS1-2	Joint Base Station Association and Power Control for Uplink Cognitive Small Cell Network Tuan LeAnh, Seon Hyeok Kim, Choong Seon Hong (Kyung Hee University, Korea)
TS1-3	Pricing and Revenue Optimization Strategy in Macro-Femto Heterogeneous Networks Wafa Werda*, Bo Gu**, Kyoko Yamori***, Yoshiaki Tanaka* (*Waseda University, Japan, **Kogakuin University, Japan, ***Asahi University, Japan)
TS1-4	QoS Aware Collaborative Communications with Incentives in the Downlink of Cellular Network: A Matching Approach Anupam Kumar Bairagi, Nguyen H. Tran, Namho Kim, Choong Seon Hong (Kyung Hee University, Korea)

Technical Session 2: Wednesday, October 5, 2016, 16:35–18:15, Hall

Theme: M2M, D2D, and Wireless Network Design

Chair: Yen-Wen Chen (National Central University, Taiwan)

TS2-1	Charging Models for M2M Communications Fuchun Joseph Lin*, Wandu Tsai*, Bo Ting Lin**, Wan-Hsun Hu** (*National Chiao Tung University, Taiwan, **Chunghwa Telecom Labs., Taiwan)
TS2-2	Enhanced Registration Procedure with NAV for Mitigated Contentions in M2M Communications Nurullah Shahin, Libea Tann, Young-Tak Kim (Yeungnam University, Korea)
TS2-3	Decentralized Spectrum Allocation in D2D Underlying Cellular Networks S. M. Ahsan Kazmi, Nguyen H. Tran, Tai Ho, Dong Kyu Lee, Choong Seon Hong (Kyung Hee University, Korea)
TS2-4	Design and Implementation of a Cluster-based Channel Assignment in High Density 802.11 WLANs Hong-Jie Chen, Chin-Ping Chuang, Ya-Shian Wang, Shaw Wei Ting, Hsin-Yi Tu, Che-Chun Teng (Chunghwa Telecom Labs., Taiwan)

Technical Session 3: Thursday, October 6, 2016, 10:30–12:10, Hall

Theme: Mobile Applications

Chair: Kiyohito Yoshihara (KDDI Research, Inc., Japan)

TS3-1	ICBMS SM: A Smart Mediator for Mashup Service Development Doyoung Lee, Seyeon Jeong, Taeyeol Jeong, Jae-Hyoung Yoo, James Won-Ki Hong (POSTECH, Korea)
TS3-2	Dynamic Module Deployment in a Fog Computing Platform Hua-Jun Hong, Pei-Hsuan Tsai, Cheng-Hsin Hsu (National Tsing Hua University, Taiwan)
TS3-3	A Reinforcement Learning Approach for Cost- and Energy-Aware Mobile Data Offloading Cheng Zhang*, Bo Gu**, Zhi Liu*, Kyoko Yamori***, Yoshiaki Tanaka* (*Waseda University, Japan, **Kogakuin University, Japan, ***Asahi University, Japan)
TS3-4	Mobile malware detection in sandbox with live event feeding and log pattern analysis Wei-Ting Lin, Jen-Yi Pan (National Chung Cheng University, Taiwan)

Technical Session 4: Thursday, October 6, 2016, 10:30–12:10, Room 1**Theme: Virtualized Networks**

Chair: Osamu Mizuno (Kogakuin University, Japan)

TS4-1	A PSO-based Wireless Network Virtual Mapping Algorithm in Smart Grid Zhiling Li*, Shaoyong Guo*, Yang Yang*, Cheng Zhong**, Zhu Liu*** (*Beijing University of Posts and Telecommunications, China, **State Grid Hebei Electric Power, China, ***State Grid Information & Telecommunications, Group, China)
TS4-2	A load-balancing-based fault-tolerant mapping method in smart grid virtual networks. Li-Qian Sun*, Shao-Yong Guo*, Si-Ya Xu*, Zhu Liu**, Lei Wei*** (*Beijing University of Posts and Telecommunications, China, **State Grid Information & Telecommunication Group, China, ***State Grid Nanjing Power Supply, China)
TS4-3	An Adaptive Load Monitoring Solution for Logically Centralized SDN Controller Syed Asif Raza Shah*, Sangwook Bae**, Amol Jaikar*, Seo-Young Noh* (*Korea University of Science and Technology, Korea, **Korea Institute of Science and Technology, Korea)
TS4-4	Dynamic Application Load Balancing in Distributed SDN Controller Kenji Hikichi, Toshio Soumiya, Akiko Yamada (Fujitsu Labs., Japan)

Technical Session 5: Thursday, October 6, 2016, 13:10–14:50, Hall**Theme: Software Defined Networks**

Chair: Young-Tak Kim (Yeungnam University, Korea)

TS5-1	GreSDN: Toward a Green Software Defined Network Ying Hu, Tao Luo, Wenjie Wang, Chunxue Deng (Beijin University of Posts and Telecommunications, China)
TS5-2	Failure Detection Service with Low Mistake Rates for SDN Controllers Tsai-Wei Yang, Kuochen Wang (National Chiao Tung University, Taiwan)
TS5-3	Backup-Resource Based Failure Recovery Approach in SDN Data Plane Shujuan Zhang, Ying Wang, Qichao He, Jinke Yu, Shaoyong Guo (Beijing University of Posts and Telecommunications, China)
TS5-4	Application-aware Traffic Management for OpenFlow Networks Seyeon Jeong, Doyoung Lee, Junemuk Choi, Jian Li, James Won-Ki Hong (POSTECH, Korea)

Technical Session 6: Thursday, October 6, 2016, 15:20–17:00, Hall**Theme: P2P and Data Delivery**

Chair: Toshiro Nunome (Nagoya Institute of Technology, Japan)

TS6-1	Impact of Item Popularity and Chunk Popularity in CCN Caching Management Zhi Liu*, Mianxiong Dong**, Bo Gu***, Cheng Zhang*, Yusheng Ji****, Yoshiaki Tanaka* (*Waseda University, Japan, **Muroran Institute of Technology, Japan, ***Kogakuin University, Japan, ****NII, Japan)
TS6-2	Packet Cache Network Function for Peer-to-Peer Traffic Management with Bloom-Filter Based Flow Classification Kengo Sasaki*, Akihiro Nakao** (Toyota Central R&D Labs., Japan, **University of Tokyo)
TS6-3	P2PTV Multi-channel Peers Analysis Marwan Ghanem*, Olivier Fourmaux*, Fabien Tarissan**, Takumi Miyoshi*** (*UPMC Sorbonne University, France, **University Paris-Saclay, France, ***Shibaura Institute of Technology, Japan)
TS6-4	Interference-Aware Video Streaming Over Crowded Unlicensed Spectrum Ching-Ling Fan, Daniel Huang, Pin-Chun Wang, Cheng-Hsin Hsu (National Tsing Hua University, Taiwan)

Technical Session 7: Friday, October 7, 2016, 10:30–12:10, Hall**Theme: Data Center Networks**

Chair: Kazunori Ueda (Kochi University of Technology, Japan)

TS7-1	Network-aware Service Function Chaining Placement in a Data Center Cheng-Husan Hsieh, Je-Wei Chang, Chien Chen, Ssu-Hsuan Lu (National Chiao Tung University, Taiwan)
TS7-2	High Speed Optical Flow Switch Architecture Design and IDC Application Based on SDN Technologies Yuh-Jiuh Cheng, Yhi Shiao, Shu-Ying Cheng, Bor-Tauo Chen (Chunghwa Telecom Labs., Taiwan)
TS7-3	Towards Deadline-aware TCP with SDN for Datacenter Networks Yifei Lu (Nanjing University of Science and Technology, China)
TS7-4	Equation-Based Multicast Congestion Control in Data Center Networks Junya Akamatsu, Kenta Matsushima, Miki Yamamoto (Kansai University, Japan)

Technical Session 8: Friday, October 7, 2016, 10:30–12:10, Room 1**Theme: Routing**

Chair: Kazuhiko Kinoshita (Tokushima University, Japan)

TS8-1	Forwarding Mechanism Using Prioritized Forwarders for Opportunistic Routing Taku Yamazaki*, Ryo Yamamoto**, Takumi Miyoshi***, Takuya Asaka****, Yoshiaki Tanaka* (*Waseda University, Japan, **The University of Electro-Communications, Japan, ***Shibaura Institute of Technology, Japan, ****Tokyo Metropolitan University, Japan)
TS8-2	Context-Aware Routing for hovering information in Vehicular Ad-Hoc Networks Zubair Amjad, Wang-Cheol Song, Khi-Jung Ahn (Jeju National University, Korea)
TS8-3	Discovering Maritime Traffic Route from AIS Network Po-Ruey Lei*, Tzu-Hao Tsai**, Wen-Chih Peng** (*ROC Naval Academy, Taiwan, **National Chiao Tung University, Taiwan)
TS8-4	Modified Controlling Queue Delay for TCP Fairness Improvement Masato Hanai, Saneyasu Yamaguchi, Aki Kobayashi (Kogakuin University, Japan)

Technical Session 9: Friday, October 7, 2016, 13:10–14:50, Hall**Theme: Traffic Detection and Identification**

Chair: Takumi Miyoshi (Shibaura Institute of Technology, Japan)

TS9-1	Finding the Highly Efficient Application Signature through Payload Signature Quality Evaluation Sung-Ho Lee, Young-Hoon Goo, Baraka D. Sija, Myung-Sup Kim (Korea University, Korea)
TS9-2	Adaptive Mobile Application Identification Through In-Network Machine Learning Takamitsu Iwai, Akihiro Nakao (University of Tokyo)
TS9-3	A New Fusion Structure Model for Real-time Urban Traffic State Estimation by multisource traffic data fusion Pan Zhang, Lanlan Rui, Xuesong Qiu, Ruichang Shi (Beijing University of Posts and Telecommunications, China)
TS9-4	Delay-Insensitive Traffic Detection and Transfer on Network Edges Quang Tran Minh*, Le Van An*, Dang Tran Khanh*, Nam Thoai*, Takeshi Kitahara**, Yasuhiko Hiehata** (*Ho Chi Min City University of Technology, Vietnam, **KDDI R&D Labs., Japan)

Poster Sessions

Poster Sessions 1: Thursday, October 6, 2016, 10:00–10:30, 14:50–15:20, Room 2

Chair: Haruo Oishi (NTT, Japan)

P1-1	Evidence-based Context-aware Log Data Management for Integrated Monitoring System Tatsuya Sato, Yosuke Himura, Yoshiko Yasuda (Hitachi, Ltd., Japan)
P1-2	An HMM-based Performance Diagnosis Approach for Hadoop Clusters Jiacong Li, Ying Wang, Jinke Yu, Shaoyong Guo (Beijing University of Posts and Telecommunications, China)
P1-3	Yang Data Model for SFC Control Plane Soo-Gil Choi*, Mi-Jung Choi*, Myung-Ki Shin**, Seungik Lee** (*Kangwon National University, Korea, **ETRI, Korea)
P1-4	Auto Scaling of Containerized ACSs for CPE Management Tse-Han Wang*, Yen-Cheng Chen**, Chen-Min Hsu*, Kai-Sheng Hsu*, Hey-Chyi Young* (*Chunghwa Telecom Laboratories, Taiwan, **National Chi Nan University, Taiwan)
P1-5	Design of Service Abstraction Model for Enhancing Network Provision in Future Network I Gde Dharma Nugraha, Quyet Nguyen-Van, Tiep Vu Duc, Ngoc Nguyen-Sinh, Alvin Prayuda Juniarta Dwiyanoro, Kyungbaek Kim, Deokjai Choi (Chonnam National University, Korea)
P1-6	SFS: A Massive small file processing middleware in Hadoop YongHua Huo*, ZhiHao Wang*, XiaoXiao Zeng**, Yang Yang**, Wenjing Li**, Cheng Zhong*** (*Science and Technology on Information Transmission and Dissemination in Communication Networks Laboratory, China electronics Technology Group Corporation 54th Research Institute, China, **State Key Laboratory of Networking and Switching Technology, Beijing University of Posts and Telecommunications, China, *** State Grid Hebei Electric Power Company, China)
P1-7	Crowdsourcing Platform for Collaboration Management in Vulnerability Verification Hung-Jen Su, Jen-Yi Pan (National Chung Cheng University, Taiwan)
P1-8	Computational Time Complexity of Allocation Problem for Distributed Servers in Real-time Applications Seydou Ba, Akio Kawabata, Bijoy Chatterjee, Eiji Oki (The University of Electro-Communications, Japan)
P1-9	Primary Reference Time Clocks Performance Monitoring Using GNSS Common-View Technique in Telecommunication Networks Sammy Siu, Jia-Lun Wang, Wen-Hung Tseng, Chia-Shu Liao and Hsiu-Fang Hu (Telecommunication Laboratories Chunghwa Telecom Co., Ltd., Taiwan)
P1-10	An integrated security testing framework for Secure Software Development Life Cycle Yuan-Hsin Tung, Sheng-Chen Lo, Jen-Feng Shih, Hung-Fu Lin (ChungHwa Telecomm., Taiwan)
P1-11	The Monitoring System of Business Support System with Emergency Prediction Based on Machine Learning Approach Jen Hao Chen, Chao Wen Huang, Chien-Wei Cheng (Telecommunication Laboratories Chunghwa Telecom Co., Ltd., Taiwan)
P1-12	Towards task scheduling in a cloud-fog computing system Qui Pham, Huh Eui-Nam (Kyung Hee University, Korea)
P1-13	sFlow-Based Resource Utilization Monitoring in Clouds Muhammad Afaq, Wangcheol Song (Jeju National University, Korea)
P1-14	A SLA-based Spark Cluster Scaling Method in Cloud Environment Yoori Oh, Jieun Choi, EunJung Song, MoonJI Kim, Yoonhee Kim (Sookmyung Women's university, Korea)
P1-15	The Effect of Audiovisual Cross-Modality on QoE of Multi-View Video and Audio IP Transmission Toshiro Nunome, Kazunori Sako (Nagoya Institute of Technology, Japan)
P1-16	A Crowdsourcing based Road Anomaly Classification System Ru-Yu Wang, Yi-Ta Chuang, Yi Chih-Wei (National Chiao Tung University, Taiwan)
P1-17	Development of QoE Initiated Wireless LAN Base Station with DPI Based QoS Control Shiho Asano, Yoshihiro Ito (Nagoya Institute of Technology, Japan)
P1-18	Congestion Field Detection for Service Quality Improvement Using Kernel Density Estimation Yuki Shitara*, Tatsuya Yamazaki*, Takumi Miyoshi**, Kyoko Yamori*** (*Niigata University, Japan, **Shibaura Institute of Technology, Japan, ***Asahi University, Japan)
P1-19	Distributed Resource Allocation for Interference Management and QoS Guarantee in Underlay Cognitive Femtocell Networks Tai Ho, Nguyen H. Tran, S. M. Ahsan Kazmi, Do Hyun Kim, Choong Seon Hong (Department of Computer Science and Engineering, Kyung Hee University, Korea)
P1-20	Policy-based Verification Method for Configurations of Large Network with Header-space Analyses Toshio Tonouchi (NEC, Japan)
P1-21	Improving Quality of Experience in P2P IPTV Yaw-Chung Chen (National Chiao Tung University, Taiwan)
P1-22	A Optimized Solution of Application Layer Protocol Identification Based on Regular Expressions Tian Chen (CAICT, China)

P1-23	Whitelist Representation for FTP Service in SCADA system by using Structured ACL Model Woosuk Jung, Sung-Min Kim, Young-Hoon Goo, Myung-Sup Kim (Korea University, Korea)
P1-24	Mitigating DDoS Attacks towards Top Level Domain Name Service Lanlan Pan, Xuebiao Yuchi, Yong Chen (CNNIC, China)
P1-25	Security Analysis of a NTRU-based Mutual Authentication Scheme Raylin Tso (National Chengchi University, Taiwan)
P1-26	Power Modeling of Base Stations Based on Energy Storage Monitoring Xie Chen*, Ao Xiong*, Peng Yu*, Mingxiong Wang**, Wenjing Li* (*Beijing University of Posts and Telecommunications, China, **Tibe Vocational Technical College, China)
P1-27	Efficient Data Collection for Participatory Sensing using Smartphones Hiro Onishi, Takuya Asaka (Tokyo Metropolitan University, Japan)
P1-28	A multi-applications comprehensive traffic prediction model for the electric power data network Yu Zhou*, Ningzhe Xing**, Yutong Ji**, Wenjing Li*, Shaoyong Guo* (*State Key Laboratory of Networking and Switching Technology, Beijing University of Posts and Telecom, China, **State Grid Jibei Electric Power Company Limited Information & Communication Dispatch, China)
P1-29	LM-BP based Operation Quality Assessment Method for OTN in Smart Grid Manman Wu*, Shaoyong Guo*, Xingyu Chen*, Ningzhe Xing**, Cheng Zhong*** (*Beijing University of Posts and Telecommunications, China, **State Grid Jibei Electric Power Company Limited Information & Communication Dispatch, China, ***State Grid Heibei Electric Power Company, China)
P1-30	RTagCare: deep human activity recognition powered by passive computational RFID sensors Guibing Hu, Xuesong Qiu, Meng Luoming (Beijing University of Posts and Telecommunications, China)
P1-31	A Two-Layer Hierarchical Framework for Activity Sequence Recognition by Wearable Sensors Chan Guo-Jing, Lin Dong-Hung, Yi Chih-Wei, Chien-Chao Tseng (National Chiao Tung University, Taiwan)
P1-32	An Efficient and Reliable Green Light Optimal Speed Advisory System for Autonomous Cars VanDung Nguyen, Oanh Tran Thi Kim, Tri Nguyen Dang, Seungil Moon, Choong Seon Hong (Kyung Hee University, Korea)
P1-33	Volume and Irregularity Effects on Massively Multicore Packet Processors Marat Zhanikeev (Tokyo University of Science, Japan)

Poster Sessions 2: Friday, October 7, 2016, 10:00-10:30, 14:50–15:20, Room 2

Chair: Cheng-Hsin Hsu (National Tsing Hua University, Taiwan)

P2-1	Double Ended Spectrum Defragmentation on Software Defined Optical Networks Tsan-Chang Kuo, Min-Chia Chang, Tai-Yuan Li, Ying-Tien Tsai (Network Management Laboratory, Chunghwa Telecom Laboratories Co., Ltd., Taiwan)
P2-2	A Proposal of SDN Based Mobility Management in Multiple Domain Networks Misumi Hata, Satoru Izumi, Toru Abe, Takuo Suganuma (Tohoku University, Japan)
P2-3	Resources Management in Virtualized Information Centric Wireless Network Kyi Thar, Nguyen H. Tran, Jaehyeok Son, Choong Seon Hong (Kyunghee University, Korea)
P2-4	Scalable Aggregation-based Packet Forwarding in Content Centric Networking Anselme Ndikumana, Saeed Ullah, Choong Seon Hong (Kyung Hee University, Korea)
P2-5	A Shapley Value-Based Forwarding Strategy in Information-Centric Networking Shi Chang, LanLan Rui, Haoqiu Huang, Xuesong Qiu, Guo Hui, Pan Zhang (Beijing University of Posts and Telecommunications, China)
P2-6	Propose of The Dynamic Route Switching Method in Information-Centric Networking-based Wireless Sensor Network Masafumi Koike, Osamu Mizuno (Kogakuin University, Japan)
P2-7	Delivering Scalable Video Streaming in ICN Enabled Long Term Evolution Networks Saeed Ullah, Kyi Thar, Md Golam Rabiul Alam, Jaehyeok Son, Jin Won Lee, Choong Seon Hong (Kyung Hee University, Korea)
P2-8	Online Learning-based Clustering Approach for News Recommendation Systems Minh Nguyen, Chuan Pham, Jaehyeok Son, Choong Seon Hong (Kyung Hee University, Korea)
P2-9	Anonymity: An Efficient Anonymization Scheme Using Entropy in Smart Mediator for Mashup Service DaEun Lee, YoungKi Kim, Choong Seon Hong (KyungHee University, Korea)
P2-10	The support path with time constraint in wireless Lili Zhang, Chen Xiaoqiang, Jianxi Fan, Cheng-Kuan Lin (Soochow University, China)
P2-11	A Novel Approach of Mobility Management For the D2D Communications in 5G Mobile Cellular Network System Shouman Barua, Robin Braun (University of Technology, Sydney, Australia)
P2-12	Performance Analysis of Indoor-Outdoor Wireless Caching Relay System Ying Li, Lei Feng, Yu Peng, Yang Yang, Wenjing Li (Beijing University of Posts and Telecommunications, China)
P2-13	A Method for Reducing TCP Latency due to Consecutive Packet Losses in Mobile Networks Yoshiaki Nishikawa, Kousuke Nogami, Eiji Takahashi (NEC, Japan)
P2-14	Estimating Available Bandwidth in Mobile Networks by Correlation Coefficient Yosuke Takano*, Ryoichi Mutoh*, Naoki Oguchi*, Shunji Abe** (*Fujitsu Laboratories Ltd., Japan, **National Institute of Informatics, Japan)

P2-15	Mobile Bandwidth Sharing: Pricing Analysis under Buffet Plans Cheng-Ju Lin, Qin Wang, Che-An Lee, Yu-Lin Sheu, Min-Te Sun (National Central University, Taiwan)
P2-16	An Experimental Study of Reliable Wireless Communications in Vehicles Tadahide Kunitachi*, Kazuhiko Kinoshita**, Takashi Watanabe*** (*Yazaki Corporation, Japan, **The University of Tokushima, Japan, ***Osaka University, Japan)
P2-17	User Matching Game in Virtualized 5G Cellular Networks Tra Le, Nguyen H. Tran, Choong Seon Hong, Tuan Le (Kyung Hee University, Korea)
P2-18	A Double-Auction Mechanism for Wireless Charging Networks Tri Nguyen Dang, S. M. Ahsan Kazmi, Tai Ho, Nguyen H. Tran, Choong Seon Hong (Kyung Hee University, Korea)
P2-19	A New Method to Evaluate Flow Classified One-to-all Reliability Koki Kodama, Masahiro Hayashi (TOKYO CITY UNIVERSITY, Japan)
P2-20	DNS Recursive Server Health Evaluation Model Keyu Lu*, Zhengmin Li**, Zhaoxin Zhang*, Jiantao Shi* (*Harbin Institute of Technology Harbin, China, **CNCERT, IIE CAS Beijing, China)
P2-21	TOCA: A Tenant-Oriented Control Architecture for Multi-domain Cloud Networks Jiawei Ye*, Huang Lu**, Kazuhiro Maeda** (*Department of Computer Science, Fudan University, Shanghai, China **Center for Technology Innovation - Information and Telecommunications, Research & Development Group, Hitachi, Ltd., Japan)
P2-22	A Load Balancing Mechanism for multiple SDN Controllers based on Load Informing Strategy Jinke Yu, Ying Wang, Keke Pei, Shujuan Zhang, Jiacong Li (Beijing University of Posts and Telecommunications, China)
P2-23	A Converged Network Architecture for ICT and IoT Combined Applications Chung-Shih Tang, Yi-Kai Chiang, Ying-Dian Tsou, Jen-Hong Ju, Chin-Ywu Twu (Chunghwa Telecom Labs, Taiwan)
P2-24	Propose of the Dynamic Routing Methods using Available Bandwidth and Degree for Congestion Avoidance Yuuki Udagawa, Osamu Mizuno (Kogakuin University, Japan)
P2-25	Bandwidth Distribution for Applications in Slicing Network Toward SDN on vCPE Framework Nen-Fu Huang, Sheng-Jung Wu, I-Ju Liao, Che-Wei Lin (National Tsing Hua University, Taiwan)
P2-26	Payload Signature Structure for Accurate Application Traffic Classification Young-Hoon Goo, Kyu-Seok Shim, Su-Kang Lee, Myung-Sup Kim (Korea University, Korea)
P2-27	Finding Realistic Shortest Path in Road Networks with Lane Changing and Turn Restriction Oanh Tran Thi Kim, VanDung Nguyen, Seungil Moon, Choong Seon Hong (Kyung Hee University, Vietnam)
P2-28	Routing discovery Mechanism based on Fault Tolerance in Container yard Environment Shibo Xu*, Peng Ni*, WenSheng Cao*, Yang Yang**, Shaoyong Guo**, Wenjing Li** (*China Waterborne Transport Research Institute, China, *Beijing University of Posts and Telecommunications, China)
P2-29	Application Performance Improvement with Application Aware DPN Switches Shinnosuke Nirasawa*, Masaki Hara*, Masato Oguchi**, Shu Yamamoto***, Akihiro Nakao***, Saneyasu Yamaguchi* (*Kogakuin University Graduate School, Japan, **Ochanomizu University, Japan, ***The University of Tokyo, Japan)
P2-30	Improvement of WMNs routing method for the purpose of reduction of control communications Shinya Yano, Kazunori Ueda (Kochi University of Technology, Japan)

Innovation Sessions

Innovation Session 1: Wednesday, October 5, 2016, 14:25–16:05, Room 1

Theme: Architectures and Virtualization

Chair: Takuya Asaka (Tokyo Metropolitan University, Japan)

IS1-1	A Flexible and Efficient Service Chain Orchestration for Virtual Private Cloud Wei-Te Wu, Chen Chen Hsiang, Chung-Tsen Fan Chiang, Kuo-Hua Chang, Chia-Chen Chu (Chunghwa Telecom., Taiwan)
IS1-2	Quantitatively Assess Network Security Risk for Virtual Network's Triage Zelong Li, Shingo Ata, Ikuo Oka (Osaka City University, Japan)
IS1-3	A study for practical L2VPN service with SDN technology Hironori Kurokawa (NTT Comware, Japan)
IS1-4	A charging mechanism of cloud platform based on NetFlow Pohsun Chiang, Kai-Wei Kuo, Yao-Te Huang, Chia-Chen Chu, Taiwan (Chunghwa Telecom, Taiwan)

Innovation Session 2: Thursday, October 6, 2016, 13:10–14:50, Room 1

Theme: Service and Performance Management

Chair: Tsan-Chang Kuo (Chunghwa Telecom Labs., Taiwan)

IS2-1	Decentralized scalable network management architecture Seongbok Baik, Youngwoo Lee (KT, Korea)
IS2-2	SDN based collision free flight path control for drones Seongbok Baik, Youngwoo Lee (KT, Korea)
IS2-3	Statistical Analysis of Network Traffic by Applications of Smart Devices Takeshi Tsumuro, Shingo Ata, Ikuo Oka (Osaka City University, Japan)
IS2-4	The Design and Implementation of SLA-based Customizable Dashboard for Heterogeneous ICT Resource Monitoring System Yi Hsuan Hung, Jia-Bin Yuan (Chunghwa Telecom, Taiwan)

Innovation Session 3: Friday, October 7, 2016, 13:10–14:50, Room 1

Theme: Network and Service Management

Chair: Shingo Ata (Osaka City University, Japan)

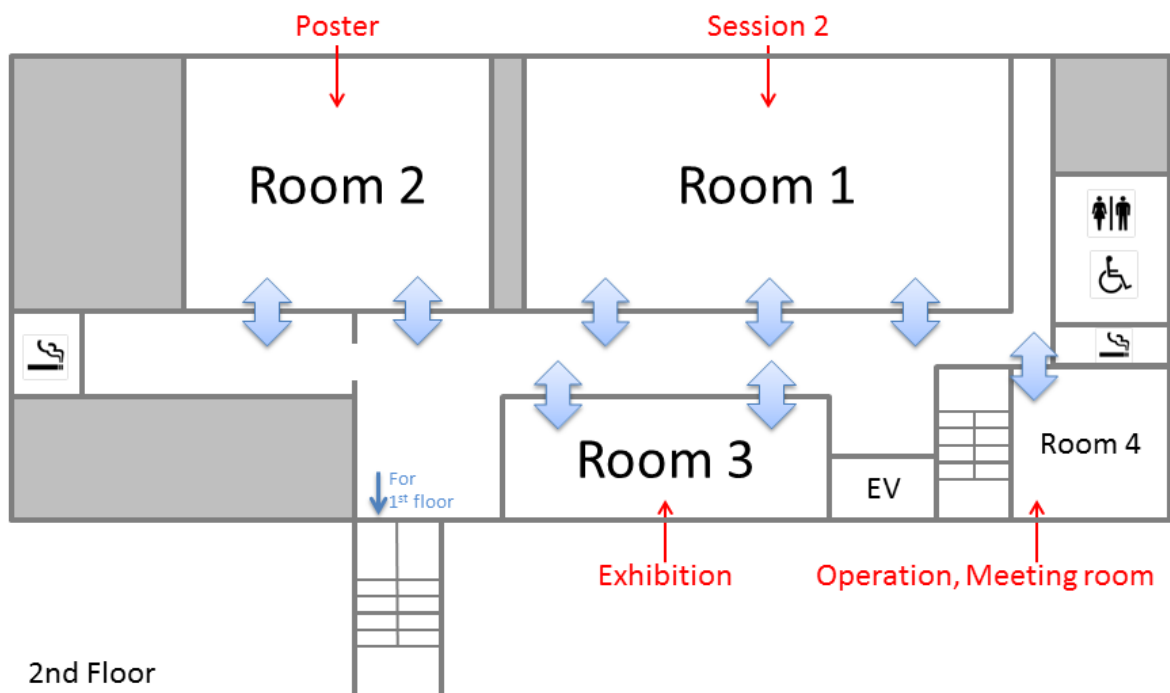
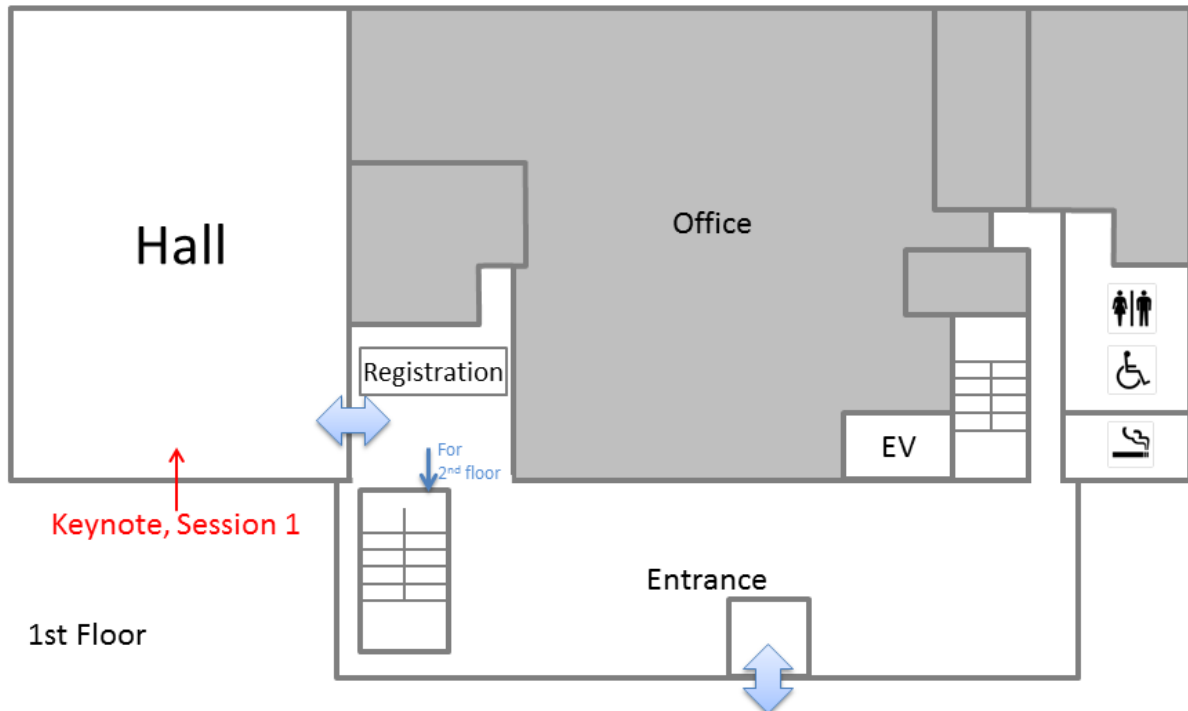
IS3-1	The Generation Management of CMDB(Configuration Management Database) from Deployment Automation Script Shinsaku Numata, Shoji Hashimoto, Dai Kashiwa (NTT Communications, Japan)
IS3-2	A Tree Path Retrieval Method for Electronic Forms Ikuko Takagi, Kouichi Yamada, Yuki Urabe, Tsutomu Maruyama (NTT, Japan)

Exhibitions

E1. BOSCO Technologies Inc.: SMART Gateway and BOSCO SDN Controller based on NFV technologies Booth number: 1	
	<p>We present NFV management solution with our product "SMART-GW" and "A3", and Hierarchical SDN controller solution "BOSCO SDN Controller". We have presented these some portion of activities on APNOMS2014 and IEICE ICM. We have already introduced our solution into NTT Communications, "Ministry of Land, Infrastructure and Transport", and two mega-banks of Japan, and so on. Please come to our booth, watch the demo, and discuss on our solution and your matter.</p> <p>http://www.bosco-tech.com/apnoms2014/ http://www.bosco-tech.com/150116-icm-2/ http://www.bosco-tech.com/150320-icm/ http://www.bosco-tech.com/160310-11-icm/</p>
E2. NEC: Support of Digital Transformation to lean CSP with SDN/NFV Booth number: 2	
	<p>Today SDN/NFV has become technically well-defined and is essential not only for cost reduction but also for quick deployment of new services with effective operation.</p> <p>Netcracker/NEC support CSPs who need to take new approach for introduction and operation of SDN/NFV capability along with each CSP's unique business condition to maximize its value by providing best-fit solution based on our variety of global OSS/BSS delivery experiences.</p> <p>Visit Netcracker/NEC booth to see our capability through demonstrations such as vCPE.</p>
E3. NIPPON TELEGRAPH AND TELEPHONE CORPORATION: The World of "One Stop Operation" Booth number: 3	
	<p>"One Stop Operation" technologies aim to combine various network services, cloud services, and applications in order to make new services easily.</p> <p>Collaboration Function and Advanced Functions encourage new players to join in as service providers, and these functions achieve quick service delivery by uniform management of various services.</p>
E4. FUJITSU Ltd.: Service Aware Network Guides Business to Digital Innovation Booth number: 4	
	<p>Supports our ever-changing client services through digital innovation of business with a fast, economical, and safe optimized network.</p> <ul style="list-style-type: none"> - Network DevOps Fujitsu's NW platform quickly and reliably connects "new values" to ever-transforming business - SDN solution Suppresses complexity and responds quickly to changing services by virtualizing various network devices.

Venue Information

- APNOMS will be held at the Kanazawa Chamber of Commerce and Industry in Kanazawa, Japan.
 - ✓ Please see the [Kanazawa Chamber of Commerce and Industry](http://www.kanazawa-cci.or.jp/guidance/position.html)'s website (the webpage is in Japanese).
 - Address: 9-13 Oyama-Machi, Kanazawa, Ishikawa, 920-8639 Japan
 - Tel: +81-76-263-1151
 - Access Map: <http://www.kanazawa-cci.or.jp/guidance/position.html>
 - ✓ Floor 1 and 2 are used for APNOMS 2016.
 - ✓ **Notice: The ranges to use are different in Room 2 depending on the day.**

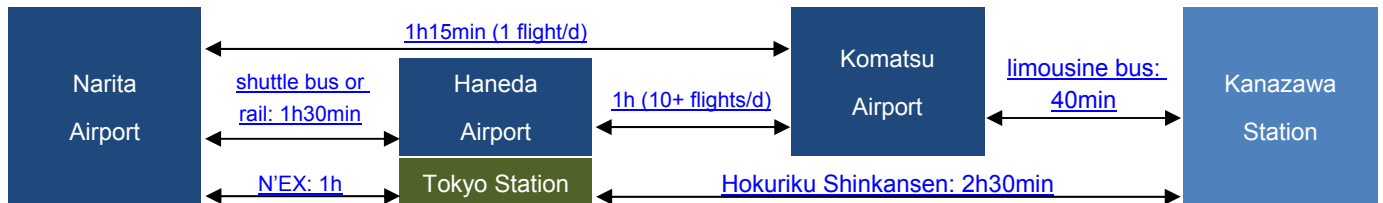


Transportation Information

■ How to get to Kanazawa

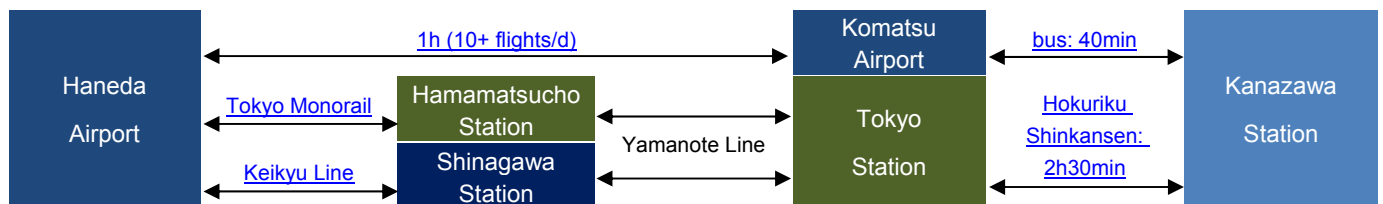
- From Narita International Airport (NRT)

Visitors arrived at Narita can take the only one direct flight to Komatsu scheduled every day. If inconvenient to take above, visitors can consider transfer through Haneda (by shuttle bus or rail, 1,500~3,000 JPY) or Tokyo Station (by JR Narita Express, 4,560 JPY).



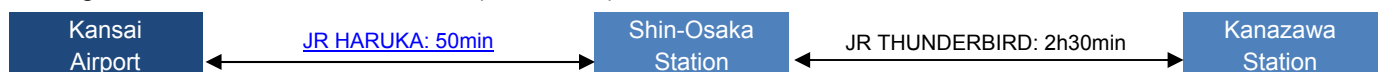
- Tokyo International Airport (Haneda Airport, HND)

Visitors arrived at Haneda can transfer to Domestic Terminal 1 or 2 to take flights to Komatsu, as many scheduled every day. One can also transfer to Tokyo Station via Tokyo Monorail (to Hamamatsucho) or Keikyu Line (to Shinagawa Sta.) to take Hokuriku Shinkansen (KAGAYAKI or HAKUTAKA) to Kanazawa Station if ground transportation is preferred.



- Kansai International Airport (KIX)

Visitors arrived at Kansai is recommended to catch the JR train HARUKA (2,850 JPY) to Shin-Osaka Station and change to the JR train THUNDRBIRD (7,650 JPY) to Kanazawa Station.



- Komatsu Airport (KMQ)

There are three international direct flights from Seoul, Shanghai and Taipei, which are not available every day. Please check the flight schedule: http://www.komatsuaiport.jp/flight/index_en.html

The limousine bus to Kanazawa Station (ten to fifteen minutes after the flight arrival, 1,130 JPY for one way) is scheduled: http://www.komatsuaiport.jp/access/bus_en.html

or, http://www.hokutetsu.co.jp/en/en_airport

For more information, see <http://www.hot-ishikawa.jp/english/access.html>

■ How to get to the Venue (Kanazawa Chamber of Commerce and Industry)

The nearest bus stop from venue is “Minami-cho · Oyama Jinja Shrine”. Kanazawa Loop Bus (Left Loop), Kenroku-en Garden Shuttle and other most route buses are operated via the bus stop.



Tour Information



Photo credit: Kanazawa City

Oyama jinja shrine

http://www.kanazawa-tourism.com/eng/guide/guide1_2.php?no=5

(five-minute walk from the conference venue)

The shrine that enshrines Maeda Toshiie was moved to its present location in 1873. The main gate is a peculiar mix of traditional Japanese, Chinese, and European religious architectural elements. This gate, which was designated as one of Japan's important cultural assets, was completed in 1875. A highlight of the Oyama Shrine is the garden surrounding the pond with an artificial island and bridge in the shape of old musical instruments, such as the biwa (Japanese short-necked fretted lute).



Photo credit: Kanazawa City

Omi-cho Market

http://www.kanazawa-tourism.com/eng/guide/guide1_3.php?no=2

(seven-minute walk from the conference venue)

The Omi-cho Market was established around the mid-18th century. Since then, it has been supporting the gastronomic culture of Kanazawa for over 280 years. There are as many as 170 stores including a large number of fish stores that sell fresh fish and seafood caught in the Sea of Japan, vegetable stores that sell unique Kaga vegetables, fruit stores, dried food and marine product stores, grocery stores, and clothing stores besides restaurants. Crabs, yellowtail, and small shrimp from the Sea of Japan that are sold around mainly in November are highly valued in Japan. The market is crowded with residents and tourists during the season. Over 10 businesses, including restaurants and drugstores, are in operation during Omi-cho Ichibankan's redevelopment.



Photo credit: Kanazawa City

Kenrokuen Garden

<http://www.pref.ishikawa.jp/siro-niwa/kenrokuen/e/index.html>

(15-minute walk from the conference venue)

Kenrokuen Garden is a beautiful Japanese garden with an area of 11.4 hectares located at the heights of the central part of Kanazawa and next to Kanazawa Castle. The Maeda family, who ruled the Kaga Clan (the present Ishikawa and Toyama areas) in feudal times, maintained the garden from generation to generation. Due to its scale and beauty, it is regarded as one of the most beautiful feudal lords' gardens in Japan.

Kenrokuen Garden has a large manmade pond, and hills and houses are scattered throughout the garden. Visitors can visit and appreciate all of these areas. The big pond, Kasumigaike, was compared to an open sea. An island, on which an ageless hermit with miraculous powers was believed to live, was constructed in the pond in hopes of the lord's long life and eternal prosperity. Kenrokuen, which means "having six factors," was given the name because of the six attributes that bring out the garden's perfect landscape: spaciousness, seclusion, artifice, antiquity, water courses, and panoramas.

There is a stone lantern designed in the image of the Japanese koto (harp) by the pond, which is the symbol of Kenrokuen Garden. There is a fountain created using the natural pressure of water flowing from the higher pond.

Visitors can enjoy the beauty of the flowers and trees, such as plum and cherry blossoms in spring, azaleas and irises in early summer, and colorful red and yellow leaves in autumn. Additionally, visitors have a glorious view of seasonal, natural beauty, including the snow-covered landscape with yukitsuri (literally "snow hanging"), which is performed annually for approximately one month from November 1. This is a method of protecting pine trees' branches from breaking by attaching ropes to the trees in a conical array.



Photo credit: Kanazawa City

Kanazawa Castle Park

<http://www.pref.ishikawa.jp/siro-niwa/kanazawajou/e/index.html>

(15-minute walk from the conference venue)

In 1583, Lord Maeda Toshiie, Toyotomi Hideyoshi's first retainer, moved to Kanazawa. The Maeda family resided in Kanazawa Castle and governed the Kaga Clan (the present Ishikawa and Toyama areas) for over 280 years. The castle tower was destroyed by a fire and has not been rebuilt, but other fortress buildings were reconstructed repeatedly. The Ishikawamon Gate, which was rebuilt in 1788, and the Sanjikken Nagaya (50-yard-long warehouse), which was rebuilt in 1858, still remain. Both have been designated as Japan's important cultural assets.

The building was used as a Japanese army base. Later, Kanazawa University used it as a campus. It was repaired in 1996, and the Hishiyagura (diamond-shaped turret), Gojikken Nagaya (90-yard-long warehouse), and Hashizumemon Tsuzuki Yagura (turret protecting the nearby gate) were restored and the park opened.

In the time of the Maeda family, moats surrounded Kanazawa Castle. The castle had loopholes for matchlocks on the outer wall to defend the castle from enemies. The beautiful white tiles that grace the roof are weathered lead and the wall is made of white mortar with flat tiles attached to it.

The stone walls vary between buildings, and it is apparent that they were built in separate periods. The stone walls include those that were built over 400 years ago.



Photo credit: Kanazawa City

21st Century Museum of Contemporary Art, Kanazawa

<https://www.kanazawa21.jp/en/>

(10-minute walk from the conference venue)

The 21st Century Museum of Contemporary Art, Kanazawa is a modern art museum that is stylistically different from conventional art museums. It opened in October 2004.

This museum is round in shape, as if it were the sight of a UFO that touched down; all the walls are made of glass, and the building has five gates opening to all directions.

The museum exhibits experimental contemporary art that visitors can interact with and includes areas where visitors can enter for free. Both adults and children can experience the excitement of the museum. Some of the museum's highlights are commissioned works, i.e., art integrated with the building structure. These pieces include a work that enables visitors to feel as if they are standing on the bottom of a swimming pool, a wall colored with flowers from the suburbs of Kanazawa, and a room with an opening in the ceiling through which visitors can see the sky changing.

Olafur Eliasson's works were installed in the square in March 2010.

The museum's shop offers a wide variety of products, such as original items in the image of the museum, accessories, and selected goods.



Photo credit: Kanazawa City

Ninja-dera Temple (Myoryuji Temple)

<http://www.myouryuji.or.jp/en.html>

(12 minutes by taxi from the conference venue)

*All visitors must apply for the official tour provided by Myoryuji (reservations are required)

Myoryuji Temple was built as a place of prayer in the Kaga Domain soon after Lord Maeda Toshiie, founder of the Kaga Domain, moved to Kanazawa Castle. Later, in preparation for a sudden attack on the central government (Tokugawa Shogunate), the Maeda family considered the temples in Tera-machi as fortresses. The family then added a number of functions to Myoryuji Temple so it could serve as a lookout and fort. To counter the invasion of enemies, Myoryuji Temple is provided with a variety of mechanisms, which is why the temple is also called Ninja Temple.



Photo credit: Kanazawa City

Higashi Chaya District

http://www.kanazawa-tourism.com/eng/guide/guide1_4.php?no=1

(seven minutes by taxi/20-minute walk from the conference venue)

Chaya is a traditional place of feasts and entertainment, where geisha (traditional female Japanese entertainers) have been entertaining people by performing dances and playing Japanese traditional musical instruments since the Edo period. The central part of Kanazawa was scattered with a number of chaya houses in the past. These houses were relocated into four districts, far from the city center, in 1820. The largest of the chaya districts in Kanazawa is the Higashi Chaya District.

The construction of two-story houses (except for chaya houses) was prohibited in the Edo period. A chaya house is characterized with a beautiful lattice called kimusuko on the outside of the first floor and Japanese-style guestrooms located on the second floor. On the streets, you will find a maze of continuous alleys. The historical rows of this teahouse town along with Kyoto's Gion and Kanazawa's Kazuemachi have been designated as Japan's cultural assets. There are no other chaya districts designated as cultural assets. The district includes facilities where you can see the interior of a chaya house that was built 180 years ago. Additionally, several old buildings have been converted into restaurants, teahouses, and souvenir shops. It is a three-minute walk to the banks of the Asano River from the Higashi Chaya District. The Higashi Chaya District and Asano River area are places where you can stroll and become acquainted with Japanese history and culture. The Kanazawa City Tourism Association holds a geisha performance in the city's three chaya districts every Saturday.

■Additional Information

We have many more tour spots in Kanazawa. Please visit the following webpages (available not only in English but also many Asian languages).

Kanazawa Tourist Information Guide

<http://www.kanazawa-tourism.com/>

Tourism ISHIKAWA

<http://www.hot-ishikawa.jp/english/attraction/history/kanazawa.html>

General Information

■ About Kanazawa

Kanazawa is one of the most beautiful cities in Japan. In Kanazawa, you are exposed to historical cultures by walking through a castle town or a merchant city and visiting shrines and temples. Visitors are recommended to travel to scenic sites, historic sites, and tourist spots: Kenroku-en known as one of the three most beautiful gardens in Japan, tasteful streets with stores and houses (Higashi Chaya District and Naga-machi Buke Yashiki, the name for a samurai's residence, District), Kanazawa 21st Century Museum, Omi-cho Market, and Kanazawa Station. Kanazawa is also famous as a city of traditional arts and crafts: Kanazawa lacquer ware, Kanazawa gold leaf, and Kaga-Yuzen silk dyeing. Kaga Ryori, cuisines and the traditional crafts, includes dishes characteristic of Kanazawa.

Please visit [Tourism ISHIKAWA](http://www.tourism-ishikawa.jp), Ishikawa's tourism site, for more detailed information on Ishikawa.



Photo Credit: Kanazawa City

Registration

■Registration Fees

Attendee/Type	Early Bird/Presenters (by Aug. 15, 2016)	Advance (by Sept. 6, 2016)	Regular
Full	20,000 JPY	25,000 JPY	30,000 JPY
Student	5,000 JPY	8,000 JPY	10,000 JPY
Student (auditing only)	Free of charge		
Exhibitor	10,000 JPY	10,000 JPY	15,000 JPY
Extra Proceedings	4,000 JPY	4,000 JPY	Not Available
Extra Banquet Ticket	7,000 JPY	7,000 JPY	Not Available

- **Full** registration fee includes proceedings, admissions to tutorial sessions, all technical sessions, * the banquet, and coffee breaks.
- **Student** registration fee includes the same events as the full registration.
- **Student (auditing only)** registration includes admission to tutorial sessions and all technical sessions.*
- **Exhibitor** registration fee includes the banquet and coffee breaks.
- Registration fees will **be charged in Japanese yen (JPY) only** according to local financial regulations.

*Technical sessions, innovation sessions, poster sessions, special sessions, keynote sessions and DEP session.

[Especially For Authors]







- **For each accepted paper, at least one author, including students, must register by the Early Bird due date at the full rate (Authors Registration)** in order to guarantee their papers to be published in the symposium proceedings, IEICE I-Scover and IEEE Xplore.

One full rate payment is necessary and only valid for one paper, not multiple papers.

- **For Authors Registration**, a JEMS paper number (e.g., 110000) must be provided.
- **A paper must be presented at the conference site.** Online presentations (e.g., Skype) are not permitted without an unavoidable reason, such as a natural disaster.

One full rate payment is necessary and only valid for one paper, not applicable for multiple papers.
(In case below, Mr. X's FULL Registration is NOT valid for paper 000002.)

Registration Example

Student A  First author (Student Registration)	Mr. X  Co-Author FULL(Authors Registration) For Paper 000001 (NOT FOR Paper 000002)	 Paper ID 000001
Student B  First Author FULL(Authors Registration) For Paper 000002	Mr. X  Co-author Registration not necessary For Paper 000002	 Paper ID 000002

Symposium Banquet

Symposium Banquet

- Date and Time: Thursday, October 6, 2016, 17:30–19:30
- Location: Kanazawa Tokyu Hotel

Invited speakers, exhibitors, and all attendees with full registration are welcome to the symposium banquet.

From the venue to the Kanazawa Tokyu Hotel

