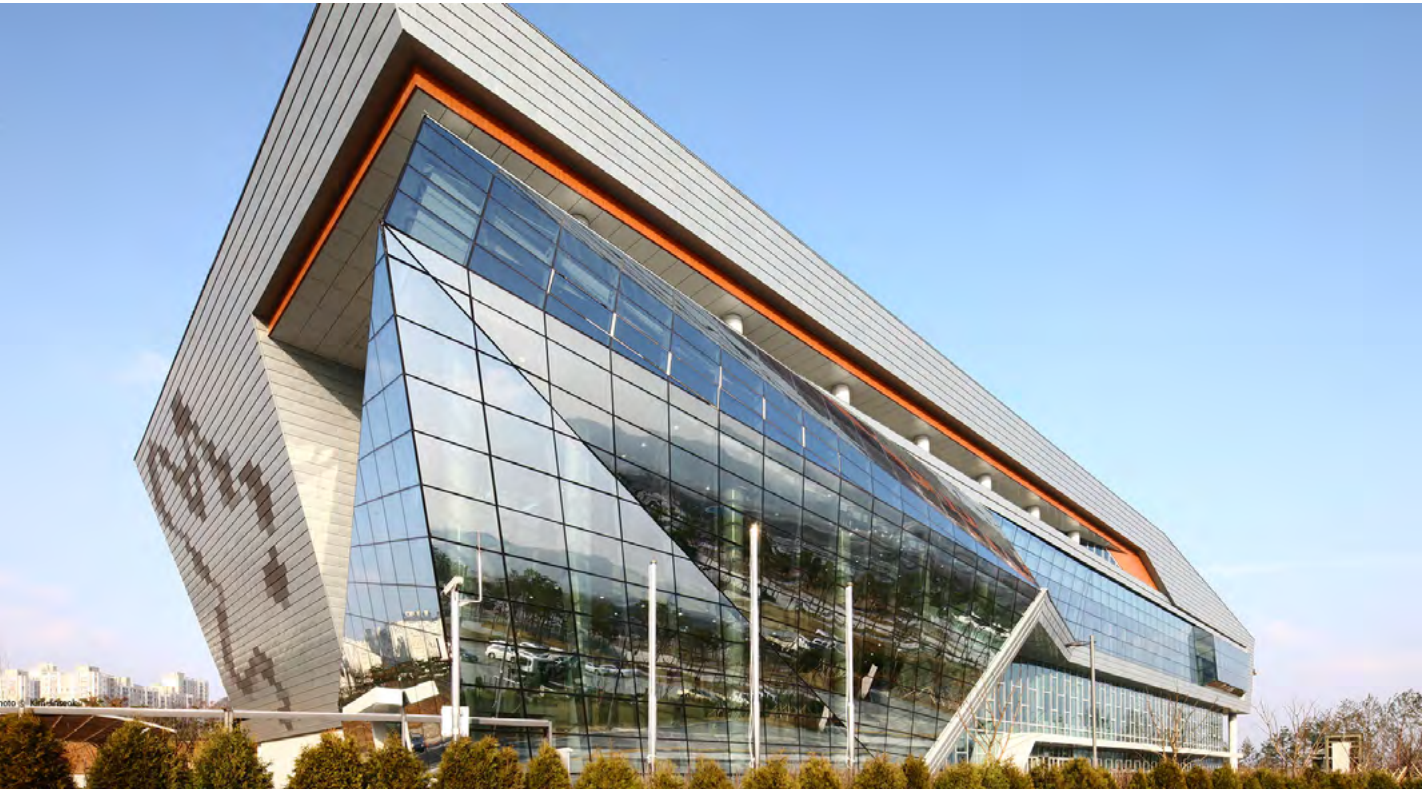# APNOMS 2023

The 24th Asia-Pacific Network Operations and Management Symposium

Intelligent Management for Enabling the Digital Transformation

September 6 (Wed.) ~ 8 (Fri.), 2023
Sejong Convention Center(SCC), Sejong, Korea

Final Program

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The 24th Asia-Pacific Network Operations and Management Symposium (APNOMS 2023)

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Welcome to APNOMS 2023

The 24th Asia-Pacific Network Operations and Management Symposium
Intelligent Management for Enabling the Digital Transformation

September 6-8, 2023, Sejong, Korea

Sponsored by: KICS KNOM, IEICE ICM
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The Asia-Pacific Network Operations and Management Symposium (APNOMS) is the premier conference on network operations and management in the Asia-Pacific region. APNOMS meets every year, typically during September, and boasts a rich history of successes. It includes a full three-day program of keynotes, tutorials, technical sessions, panel discussions, poster sessions, and exhibits focusing on managing networks that span the computing and telecommunications areas.

APNOMS 2023 marks the 24th, following the successful APNOMS'97 (Seoul), APNOMS'98 (Sendai), APNOMS'99 (Kyongju), APNOMS 2000 (Nara), APNOMS 2001 (Sydney), APNOMS 2002 (Jeju), APNOMS 2003 (Fukuoka), APNOMS 2005 (Okinawa), APNOMS 2006 (Busan), APNOMS 2007 (Sapporo), APNOMS 2008 (Beijing), APNOMS 2009 (Jeju), APNOMS 2011 (Taipei), APNOMS 2012 (Seoul), APNOMS 2013 (Hiroshima), APNOMS 2014 (Hsinchu), APNOMS 2015 (Busan), APNOMS 2016 (Kanazawa), APNOMS 2017 (Seoul), APNOMS 2019 (Matsue), APNOMS 2020 (Daegu), APNOMS 2021 (Tainan), APNOMS 2022 (Takamatsu).

We cordially invite you to submit papers for technical session, poster session and innovation session. Along with this we enocurage you to submit tutorial proposal on recently advanced topics. We look forward to seeing you in Sejong, Korea.

Finally, we would like to express our sincere thanks to the authors, reviewers, committee members, volunteers, and participants, who make a great effort to the success of APNOMS 2023.

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(Kyungnam University, Korea)

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(NSYSU, Taiwan)

APNOMS 2023 Program at a Glance

Wednesday, September 6, 2023

Time	Track I	Track II	Track III
08:30 ~	Registration		
09:00 ~ 10:30	Tutorial 1 (T1)	Technical Session 1 (TS1)	
10:30 ~ 10:45	Coffee Break		
10:45 ~ 12:15	Tutorial 2 (T2)	Technical Session 2 (TS2)	
12:15 ~ 13:20	Lunch Break		
13:20 ~ 14:00	Welcome Address Keynote Speech 1 (K1) Jongsik Lee Chair: Wootae Kim		
14:00 ~ 14:10	Coffee Break		
14:10 ~ 15:00	Poster Session 1 (PS1)		Exhibitions
15:00 ~ 16:40	Technical Session 3 (TS3)	Technical Session 4 (TS4)	
16:40 ~ 16:50	Coffee Break		
16:50 ~ 18:10	Innovation Session 1 (IS1)	Special Session 1 (SS1)	

Thursday, September 7, 2023

Time	Track I	Track II	Track III
08:30 ~	Registration		
09:00 ~ 09:30	Keynote Speech 2 (K2) Satoshi Konishi Chair:Yuji Nomura		
09:30 ~ 09:40	Coffee Break		
09:40 ~ 10:30	Poster Session 2 (PS2)		Exhibitions
10:30 ~ 12:10	Technical Session 5 (TS5)	Technical Session 6 (TS6)	
12:10 ~ 13:10	Lunch Break		
13:10 ~ 14:50	Tutorial 3 (T3)	Technical Session 7 (TS7)	
14:50 ~ 15:00	Coffee Break		
15:00 ~ 16:40	Tutorial 4 (T4)	Technical Session 8 (TS8)	
16:40 ~ 16:50	Coffee Break		
16:50 ~ 18:10	Innovation Session 2 (IS2)	Special Session 2 (SS2)	
18:30 ~ 20:30	Banquet		

Friday, September 8, 2023

Time	Track I	Track II	Track III
08:30 ~	Registration		
09:00 ~ 09:30	Keynote Speech 3 (K3) Ai-Chun Pang Chair: Tsi-Ui Ik		
09:30 ~ 09:40	Coffee Break		
09:40 ~ 10:30	Poster Session 3 (PS3)		Exhibitions
10:30 ~ 12:10	Technical Session 9 (TS9)		
12:10 ~ 13:10	Lunch Break		
13:10 ~ 14:00	Poster Session 4 (PS4)		
14:00 ~ 14:10	Coffee Break		
14:10 ~ 16:00	Distinguished Experts Panel (DEP)		
16:00 ~ 17:00	Paper Award and Closing		

Keynote 1

AI-driven Network Operations 2.0 for Evolution from Telco to Techco Era

Time & Date: 13:30~14:00, Wednesday, September 6, 2023

Chair: Wootae Kim (KT, Korea)

Speaker: Dr. Jongsik Lee (KT, Korea)

Jongsik Lee is currently responsible for leading Infra DX R&D Center, one of KT Institute of Convergence Technology. He joined KT in 1998 and has worked on various wireless areas including 3G, Mobile WiMAX, and LTE-related R&D project. Since 2014, he has been leading LTE Evolution and 5G-related R&D projects. His latest contributions include developing, deploying and improving key 5G technologies leading up to and beyond KT's commercial launch in 2019 and AI Operations 2.0 for network stability and survivability. He received the B.S. & M.S. degrees in Electrical Engineering from the Seoul National University in 1996 and in 1998, respectively. His main research areas were RF and microwave engineering.

Summary of Presentation

Recently, all CSP operators are preparing to evolve from the existing Telco business to the Techco business. It is a new way to reflect a long-standing desire of telcos to change. There are several drivers for CSP operators to change from Telco to Techco. First, the value in the market is accelerating to shift to Techco like Amazon, google, meta. Second, Techco can respond more quickly to market and customer needs. In other words, the biggest reason is that telcos are also trying to get on board with the trend of market change. However, the stability and survivability of the network infrastructure, which is the basis for evolution into this Techco, must be the most basic, To do this, network outage or failure must not be happened, and you must have a technology to prevent it in advance. Since 2018, KT has introduced AI Operation 1.0 technology to network operation and used it for automation of network configuration tasks and analysis of causes of failure, that is Root Cause Analysis. However, there was a limit to applying it to all operation tasks because 1.0 is focused on automation and failure response for repetitive operation tasks. Therefore, KT introduced the AI Operation 2.0 system to overcome the limitations of 1.0 by introducing automation and failure prevention technology for all operation tasks, We want to ensure network stability and survivability, which is essential for evolving from Telco to Techco. Today's keynote session will introduce KT's AI Operation 2.0 technology

Keynote 2

User-centric network and autonomous network operation for 6G era

Time & Date: 09:00 ~ 09:30, Thursday, September 7, 2023

Chair: Yuji Nomura (Fujitsu, Japan)

Speaker: Satoshi Konishi (KDDI, Japan)

Satoshi KONISHI joined KDDI in 1993. From 1995, he was mainly involved in research and development in wireless communication systems such as LEO satellite systems, mesh-type fixed wireless access (FWA) systems, and mobile cellular systems. He led development of base stations for LTE in KDDI while contributing for standardizations in 3GPP, 3GPP2 and ITU-R. He succeeded, as 1st telco operator in Japan, development and commercialization of new features such as carrier aggregation, Voice over LTE (VoLTE), Femto cell, and so on for the LTE-Advanced system in KDDI since 2014, as Head of Mobile Access Technology Division in KDDI. He then conducted numerous demonstrations using 5G and 5G commercialization in KDDI since 2017 as Head of Next Generation Network Development Division in KDDI. Since April 2020, he has been leading B5G/6G as Head of Advanced Technology Laboratories and EVP in KDDI Research Inc. as well as numerous committee members of MIC, Japan, and leading Beyond 5G white paper at Beyond 5G promotion consortium in Japan. He received M.S. degree in Electronic Engineering from the University of Electro-Communications (UEC), Ph.D. degree from Waseda University, and MBA degree from Globis University in 1993, 2006, and 2017, respectively.

Summary of Presentation

Mobile network operators will have to provide stable mobile networks in 6G era to strictly meet End-to-End service level agreement (SLA), in terms of not only network availability but also throughput, latency jitter and so on. Considering the

bottleneck of such mobile network performances exists in radio access network (RAN), KDDI proposes a new mobile network named "User-centric RAN," in which cell-edge areas with less throughput will be minimized by introducing cell-free massive MIMO and radio intelligent surface (RIC), so that it will be easier to meet SLA. Mobile core network needs to be modified toward 6G, considering a variety of services with much traffic requiring SLA upon users' intents. KDDI proposes "User-centric mobile core," in which users' intents are reflected to a new network slicing scheme that is different from the existing network slicing scheme provided by 5G Stand-alone. Autonomous network operations are highly required even in 5G. KDDI announced that we will introduce the scheme using AI within this year and it will be enhanced toward 6G considering evolution of both the RAN and mobile core as mentioned above. This talk firstly introduces KDDI Vision 2030 toward 6G era followed by introductions of our proposals mentioned above.

Keynote 3
Privacy-Preserving Edge Computing for Connected Cars

Time & Date: 09:00 ~ 09:30, Friday, September 8, 2023

Chair: Prof. Tsi-Ui Ik (National Chiao Tung University, Taiwan)

Speaker: AI-Chun Pang (NTU, Taiwan)

Ai-Chun Pang received B.S., M.S., and Ph.D. degrees in Computer Science and Information Engineering from National Chiao Tung University, Taiwan, in 1996, 1998, and 2002, respectively. Dr. Pang joined the Department of Computer Science and Information Engineering, National Taiwan University (NTU), Taiwan, in 2002 and is now a Distinguished Professor. She was the Associate Dean of the College of Electrical Engineering and Computer Science from 2018 to 2022. Her research interests include wireless and mobile networking, edge computing, and IoT. Dr. Pang is currently the editor of IEEE Transactions on Mobile Computing, IEEE Transactions on Vehicular Technology, IEEE Transactions on Network and Service Management, IEEE Transactions on Emerging Topics in Computing, and ACM Transactions on Cyber-Physical Systems. She received the Outstanding Research Award (a prestigious award in Taiwan) from the Ministry of Science and Technology (MOST) in 2019 and 2022. She was an IEEE Vehicular Technology Society (VTS) Distinguished Lecturer in 2018-22 and an IEEE Communications Society Distinguished Lecturer in 2022-2023. She received VTS Women's Distinguished Career Award in 2020. She is a Fellow of the IEEE.

Summary of Presentation
With advances in wireless communications and sensing technologies, autonomous and connected cars are becoming a reality. Emerging vehicular applications will require significant computing power to process data generated by vehicle sensors (e.g., cameras) for an intelligent and near-real-time response. Edge computing is a promising solution in vehicular networks to fulfill the requirement. Vehicles constitute a collaborative computing platform and can jointly conduct AI learning tasks to optimize performance. However, due to privacy issues, drivers may not allow their vehicles to share raw sensor data with other vehicles. To tackle this problem, Google has advocated a new kind of privacy-preserving edge learning, Federated Learning (FL). In this lecture, we will give a usage scenario to elaborate on how edge intelligence is adopted for connected vehicles and present the development of our edge-based mobile video platform, "OmniEyes," to support timely video analytics for cars. The platform collects live street videos and converts them, using AI technologies, to various location-based information for real-time task executions and long-term statistical analytics via connected mobile cameras. We will present how FL aids OmniEyes in preserving user privacy while maintaining AI model accuracy. Specifically, we are interested in the effects of limited labeled data and Non-IID (Non-Identically Independently Distributed) data in FL. We will also discuss the vulnerability of the FL framework and some defense methods against privacy leakage and security threats.

Distinguished Experts Panel (DEP)

Time & Date: 14:10-16:00, Friday, September 8, 2023

Theme: Intelligent Management for Enabling the Digital Transformation: Challenges and Opportunities for Networking Research

Chair: Changhyun Lee (ETRI, Korea)

Speaker 1
Creating Extensible and Resilient Communication Infrastructures for Smart Communities

Speaker: Prof. Nalini Venkatasubramanian (University of California, Irvine, USA)

Nalini Venkatasubramanian is currently a Professor in the School of Information and Computer Science at the University of California Irvine. She has had significant research and industry experience in the areas of distributed systems, adaptive middleware, pervasive and mobile computing, cyber-physical systems, distributed multimedia and formal methods and has over 350 publications in these areas. As the Co-Director of the Center for Emergency Response Technologies at UC Irvine, Nalini's recent research has focused on enabling resilient, sustainable and scalable observation and analysis of situational information from multiple input sources; dynamic adaptation of the underlying systems to enable information flow under massive failures and the dissemination of rich notifications to members of the public at large. She is the recipient of the prestigious NSF Career Award, multiple Undergraduate Teaching Excellence Awards and best paper awards. Prof. Venkatasubramanian has served in numerous steering and organizing committees of conferences on middleware, distributed computing and cyber-physical systems and on the editorial boards of journals. She received and M.S and Ph.D. in Computer Science from the University of Illinois in Urbana-Champaign. Her research has been supported both by government and industrial sources such as NSF, DHS, ONR, DARPA, NIST, NASA, Novell, Hewlett-Packard and Nokia. Prior to arriving at UC Irvine, Nalini was a Research Staff Member at the Hewlett-Packard Laboratories in Palo Alto, California.

Summary of Presentation
In recent years, advances in the Internet-of-Things, edge/cloud technologies, wireless networks, and AI-driven data analytics have spurred the creation of smart communities and smart city applications. Here, new modalities of information and new channels of communication have enabled the interconnection of physical components, software objects, and data to provide novel services to enrich the lives of citizens and build resilience to unexpected events/disasters. We will highlight our experiences in deploying emerging technologies to enable resilient smart communities - from smart-assisted living facilities for the elderly to smart firefighting in urban high-rises to sustainable city-scale water infrastructure systems. In particular, we highlight the need to balance non-functional requirements of interoperability and dependability as we seek to design and operate these systems at scale and under duress. We discuss the role of multi-networking methods, different forms of land and aerial mobility, and the device-to-cloud continuum to support intelligent data collection and interpretation of this data for higher-level semantic observations for decision-making. We discuss how adaptive middleware techniques can help integrate strategies across system layers for community resilience.

Speaker 2
AI-empowered Fast, Efficient, and Fair Access Management for Ultra-dense Small Cells

Speaker: Prof. Hyun Jong Yang (POSTECH, Korea)

Dr. Hyun Jong Yang received the B.S. degree in electrical engineering from Korea Advanced Institute of Science and Technology (KAIST), Korea, in 2004, and the M.S. and Ph.D. degrees in electrical engineering from KAIST, in 2006 and 2010, respectively. From Aug. 2010 to Aug. 2011, he was a research fellow at Korea Research Institute of Ships & Ocean Engineering (KRISO), Korea. From Oct. 2011 to Oct. 2012, he worked as a post-doctoral researcher in the Electrical Engineering Department, Stanford University, Stanford, CA. From Oct. 2012 to Aug. 2013, he was a Staff II Systems Design Engineer, Broadcom Corporation, Sunnyvale, CA,

where he developed physical-layer algorithms for LTE-A MIMO receivers. In addition, he was a delegate of Broadcom in 3GPP RAN1 standard meetings. From Sept. 2013 to July 2020, he was an assistant/associate professor in the School of Electrical and Computer Engineering, UNIST, Korea. Since July 2020, he has been an associate professor in the department of electrical engineering, Pohang University of Science and Technology (POSTECH), Pohang, Korea. He is a co-founder of a start-up company EgoVid Inc. He is currently serving as Editor in IEEE Wireless Communications Letters and as Workshop Chair in IEEE AVSS, served as Guest Editor in EURASIP Journal on Advances in Signal Processing and Program, and served as Workshop Chair in IEEE AVSS. His fields of interests are signal processing, wireless communications, and machine learning.

Summary of Presentation

Despite the continual progress in 5G technology, it has yet to fully satisfy the demanding throughput and latency requirements of future killer applications such as streaming gaming or AR/VR. To improve propagation delay and channel gain, an emerging trend involves caching substantial volumes of data and computation-intensive services within edge servers close to users. This trend indicates that high-density small cell networks, characterized by significantly reduced cell radii, may become prevalent in the future. In comparison to networks with larger cell radii, high-density small cell networks present specific challenges that necessitate effective solutions. These challenges encompass the substantial increase in real-time data exchange between edge servers through feedback/feedforward backhaul, declining energy efficiency, SINR degradation due to interference, and computational delays in optimizing user and resource allocation. This talk delves into several methods designed to overcome these challenges. Furthermore, the talk briefly explores the essential technologies required to meet the demands of the most challenging scenario: real-time bidirectional high-volume interactive services.

Speaker 3
AI-based Intelligent Operation for Innovative Optical and Wireless Network (IOWN®)

Speaker: Mr. Jun Okamoto (NTT Network Service Systems Laboratories, Japan)

Jun Okamoto received B.E. and M.E. degrees in electrical engineering from the Science University of Tokyo in Japan in 1994 and 1996, respectively. He joined NTT Laboratories in 1996 and has been engaged in the quality assessment of telecommunication and network performance measurement methods. Currently, he is the Manager of the Communication Traffic, Quality, Operation Research Project in NTT Laboratories. He received the Telecommunications Advancement Foundation Award in 2009 and the International Telecommunication Union Encouragement Award in Japan in 2010.

Summary of Presentation

NTT has proposed the Innovative Optical and Wireless Network (IOWN®), which is a new communication infrastructure that can provide high-speed broadband communication and enormous computing resources. As a commercial service for IOWN®, NTT has launched all-photonics network (APN) IOWN® 1.0. In IOWN®, Cognitive Foundation® (CF) enable full automation, autonomy, and self-evolution of operations and managements, including optimal deployment and configuration of various ICT resources. To realize IOWN® CF, NTT Laboratories is researching AI-based intelligent network operation technologies, such as self-evolving zero-touch operation, network control to optimize energy supply and demand, and intent-based multi-domain resource control. This presentation will introduce the future concept of intelligent operations called IONW® CF and technologies under research to realize the concept.

Speaker 4

When Ubiquitous Coverage Meets Heavy Computing: Challenges and Opportunities of NTN with AI/ML Computing

Speaker: Prof. Shao-Yu Lien (National Yang Ming Chiao Tung University, Taiwan)

Shao-Yu Lien is an associate professor of the Institute of Intelligent Systems, National Yang Ming Chiao Tung University (NYCU), Taiwan. Before joining NYCU, he was an associate professor of the Department of Computer Science and Information Engineering, National Chung Cheng University (CCU), Taiwan, and an associate professor and assistant professor of the Department of Electronic Engineering, National Formosa University (NFU), Taiwan. Dr. Lien is also a technical director of Institute for Information Industry (III), Taiwan, since 2020. Dr. Lien received a number of prestigious research recognition, including IEEE Tainan Section Best Young Professional Member Award 2019, IEEE Communications Society Asia-Pacific Outstanding Paper Award 2014, Scopus Young Researcher Award (issued by Elsevier) 2014, URSI AP-RASC 2013 Young Scientist Award, IEEE ICC 2010 Best Paper Award, Outstanding Faculty Award of CCU, and WPMC 2022 Best Paper Award. Dr. Lien was a guest editor of IEEE Transactions on Cognitive Communications and Networking in 2019, IEEE Transactions on Vehicular Technology in 2023, and Wireless Communications and Mobile Computing (WCMC) in 2017. In the meantime, Dr. Lien also served as the leading organizers of a number of technical workshops in IEEE VTC-Spring 2015, IEEE GLOBECOM 2015, Qshine 2015 and 2016, and IEEE PIMRC 2017, IEEE GLOBECOM 2019 and IEEE ICC 2020. Particularly, he is also a 3GPP standardization delegate since 2009 for LTE, LTE-A, LTE Pro and 5G NR, and in this role, he has contributed more than 70 technical documents and patents in conjunction with HTC Corporation, Institute for Information Industry (III), Industrial Technology Research Institute (ITRI) and Huawei. Dr. Lien's research interests include (AI/ML) computing in wireless networks and robotic networks.

Summary of Presentation

Non-terrestrial Networks (NTN) have been regarded as a novel paradigm shift toward ubiquitous coverage for global mobility and information access. Different from the conventional terrestrial networks with limited single-cell coverage and number of users, a cell in NTN should support an enormous number of users, which leads to unprecedented challenges in terms of resource allocation and user access control. The recent innovation of artificial intelligence (AI) and machine learning (ML) thus turn out to be a promising remedy toward massive accesses in NTN. Unfortunately, AI/ML computing generally imposes considerable complexity, and NTN generally equip with very limited computing capability, as a powerful computing platform generally requires abundant energy consumptions and energy is very scarce in NTNs. In this talk, the use cases and challenges of applying AI/ML computing on NTN will be introduced. The promising schemes and the recent analytical foundations will also be discussed.

Special Session (SS1)

Time & Date: 16:50-17:50, Wednesday, September 6, 2023 | Track II

Theme: Digital transformation beyond 5G/6G era

Chair: Kyoung-Youl Kim (KT, Korea)

SS1-1 (16:50 ~ 17:20)
Digital transformation in the Beyond 5G and AI era

Chuan-Sheng Lin (Kaohsiung University, Taiwan)

SS1-2 (17:20 ~ 17:50)
Sustainable and inclusive future society through digital transformation in the Beyond 5G/6G era

Hajime Matsuoka (Fujitsu, Japan)

Special Session (SS2)

Time & Date: 16:50-17:50, Thursday, September 7, 2023 | Track II

Theme: Intelligent Management use cases for Industry verticals

Chair: Woojin Seok (KISTI, Korea)

SS2-1 (16:50 ~ 17:20)
Research on Integrated Network Control Architecture for Terrestrial and Non-Terrestrial Network Convergence

Ved P. KAFLE and Mariko SEKIGUCHI (NICT, Japan)

SS2-2 (17:20 ~ 17:50)
Extending the Impact of Generative and Predictive AI from Medical Imaging to Beyond 5GA

Hyunseung Choo (Sungkyunkwan University, Korea)

Speaker 1
Digital transformation in the Beyond 5G and AI era

Chuan-Sheng Lin (Kaohsiung University, Taiwan)

Dr. Chuan-Sheng Lin is an assistant professor at the Department of Intelligent Commerce, National Kaohsiung University of Science and Technology, Kaohsiung, Taiwan. His research interests include the Internet of Things (IoT), mobile networks, and edge computing

Summary of Presentation
Digital transformation is impacting enterprises, governments, and citizens today. Digital transformation improves all fields by involving social media, AI, smart devices, mobile networks, edge computing, etc. Significantly mobile networks have changed the world dramatically. The key features of 5G, like enhanced mobile broadband (eMBB), ultra-reliable and low latency communications (URLLC), and massive machine-type communications (mMTC), bring the hard-to-accomplish services from theory to the front like digital twin, metaverse, etc. AI is also a major technology for improving performance in all fields including mobile networks and digital transformation. Digital transformation is the main foundation of Industry 4.0, it leads new technology into manufacturing and organizes for constructing creative procedures and services. In this speech, I will introduce the challenges and opportunities of Digital transformation with the new mobile networks and new technology in the next decade.

Speaker 2
Sustainable and inclusive future society through digital transformation in the Beyond 5G/6G era

Hajime Matsuoka (Fujitsu, Japan)

Hajime Matsuoka received his Master's degree in Public Administration from National University of Singapore. He joined Fujitsu Ltd. in 2022 and is a manager, Strategy Office, 6G Infrastructure Strategy and Planning Division. He is now in charge of public relations and government relations in the field of 6G. From 2004 to 2022, he worked for Japan International Cooperation Agency(JICA) and has engaged in official development assistance for developing countries especially in Southeast Asia.

Summary of Presentation
Fujitsu envisions the society in the Beyond 5G/6G era as sustainable and inclusive society. Digital technology will make society sustainable and inclusive through addressing environmental, economic and well-being issues. Technology in the Beyond 5G/6G will shape a physical-digital converged world and it will contribute to solving several social issues and empower people and society. In this presentation, it will be presented how the digital technology will change the society in the Beyond 5G/6G era.

Speaker 3
Research on Integrated Network Control Architecture for Terrestrial and Non-Terrestrial Network Convergence

Ved P. KAFLE and Mariko SEKIGUCHI (NICT, Japan)

VED P. KAFLE received the B.E. degree in electronics and communications engineering from Punjab Engineering College, Chandigarh, India, the M.S. degree in computer science and engineering from Seoul National University, South Korea, and the Ph.D. degree in informatics from the Graduate University for Advanced Studies, Japan. He joined the National Institute of Information and Communications Technology, Tokyo, Japan, as a Researcher in 2006, and is currently working as a Research Manager. His recent research interests include 5G and beyond network architectures, Internet of things (IoT), network resource management, network operation automation by AI/machine learning, and standardization. He has been serving as a Rapporteur of ITU-T Study Group 13 since 2014. He received the ITU Association of Japan's Encouragement Award and Accomplishment Award in 2009 and 2017, respectively. He received the Nepali Diaspora ICT Award 2022 (The Biggest Tech Award of Nepal) in 2022 and the Information and Communication Technology Award (TTC Chairman's Commendation) from Japan in 2023.

Summary of Presentation

The integrated monitoring and control of both terrestrial and non-terrestrial networks is being essential for offering high-quality communication services not only in cities and developed areas but also in rural and remote areas such as islands, mountains, and deserts. For this purpose, research and development of integrated network control architecture for terrestrial and non-terrestrial network convergence has been progressing rapidly. Research has focused on extending the network control mechanisms of terrestrial 5G network and cloud platform-based data networks to non-terrestrial network components such satellites and high-altitude platform systems (HAPS).

In this talk, we present a framework of the integrated network control architecture (INCA), and the related research and standardization activities. We provide an overview of the design and development of a work-in-progress experimental system of the integrated network control system, which can monitor and control the operations of non-terrestrial network emulator/simulator, 5G mobile testbed, and data network configured in virtualized network platforms.

Speaker 4

From Pixels to Connec0vity: Extending the Impact of Genera0ve and Predic0ve AI from Medical Imaging to Beyond 5G

Hyunseung Choo (Sungkyunkwan University, Korea)

Hyunseung Choo (Ph.D., University of Texas at Arlington, USA, in 1996; MS, University of Texas at Dallas, USA, in 1990; BS, Sungkyunkwan University (SKKU), S. Korea, in 1988) is the Professor in College of Computing and Informatics, SKKU, and Director of the ICT Creative Consilience program supported by the Ministry of Science and ICT (MIST), S. Korea. Previously, Choo was the Head of 6G Mobile Core (AI/Cloud Native) Planning Division under MIST, and the Director of the Intelligent HCI Convergence Research Center supported by the Ministry of Knowledge Economy, S. Korea. He has also served as technical adviser of Samsung Electronics DMC R&D Center (Next generation interaction). Choo specializes in AI networking, network so`warization, and intelligent multiaccess edge computing, with over 510 publications in international journals and refereed conferences, and 29 international (USA, EU, Japan) and 238 domestic patents (S. Korea) in the field of mobile and sensor networks with intelligence and autonomicity. For his outstanding research, he has received two excellence awards and one commendation award over the years by MIST. Choo has been Editor-in-Chief of the Journal of Korean Society for Internet Information for three years and Journal Editor of ACM Transactions on Internet Technology, Journal of Communications and Networks, Journal of Supercomputing, and Founding Editor of Transactions on Internet and Information Systems since 2010. He is a member of the ACM, IEEE, and IEICE.

Summary of Presentation

There exists a similarity between pixels paDerns in images and users connectivity/mobility paDerns incellular networks that opens an opportunity to exploit well established AI techniques in imaging for networks. Benefiting from this correlation, generative and predictive AI from medical imaging are adapted for proactive operations, management, and orchestration in Beyond 5G (B5G) cellular networks. Transformation of our effective generative and predictive AI methods for translating fundus images and forecasting bone age, respectively, is showcased for intelligent mobility, localization, and traffic engineering use cases in B5G. Main emphasis is on describing how well-established AI techniques in the field of medical imaging and computer vision are adapted to particular network use case requirements through data pre-processing and simple model variations. Difficulties faced, experiences gained, and lessons learned in this transformation are shared to identify the challenges that lay ahead and accelerate AI innovation in future networks.

Tutorial 1 (T1)
Learning and Resource Co-Optimization for Mobile Vision Applications

Date & Time: 09:00 ~ 10:30, Wednesday, September 6, 2023

Chair: Prof. Sangheon Pack (Korea University, Korea)

Speaker: Jeongho Kwak (DGIST, Korea)

Jeongho Kwak received the B.S. degree (summa cum laude) in electrical and computer engineering from Ajou University, Suwon, South Korea, in 2008, and the M.S. and Ph.D. degrees in electrical engineering from Korea Advanced Institute of Science and Technology (KAIST), Daejeon, South Korea, in 2011 and 2015, respectively. He was a Postdoctoral Researcher with INRS-EMT, Montreal, QC, Canada, and also a Marie Sklodowska-Curie Fellow with Trinity College Dublin, Dublin, Ireland. He is currently an associate professor with the Department of Electrical Engineering and Computer Science and the Department of Artificial Intelligence, Daegu Gyeongbuk Institute of Science and Technology (DGIST), Daegu, South Korea. His research interests include learning and resource optimization in hybrid cloud/edge network architecture and multiple resource management for 6G low-Earth orbit satellite networks.

Summary of Presentation
As deep learning technology advances, mobile vision applications such as augmented reality (AR) and autonomous vehicles are becoming increasingly prevalent. The performance of these services is heavily reliant on the computing capability of mobile devices, dynamic service requests, stochastic mobile network environments, and learning models for inference. Previous studies have independently optimized mobile resource allocation and learning model design while considering specific parameters and computing/network resources. However, these studies fail to accurately reflect realistic mobile environments as they make unrealistic assumptions about time-varying wireless channels and service request distributions. In this tutorial, we study several resource optimization and learning model optimization techniques. Moreover, we introduce VisionScaling algorithm, which jointly optimizes learning models and process/network resources, adapting to system dynamics. Via real trace-driven simulations and experiment to evaluate the performance of VisionScaling and other algorithms, we show that how joint optimization of learning model and mobile resources affect the inference accuracy and end-to-end latency performance of services.

Tutorial 2 (T2)
Millimeter-Wave Backscatter System for Massive-scale, Long-range, and Super-precision Localization

Date & Time: 10:45 ~ 12:15, Wednesday, September 6, 2023.

Chair: Prof. Sangheon Pack (Korea University, Korea)

Speaker: Song Min Kim (KAIST, Korea)

Song Min Kim is an associate professor in the School of Electrical Engineering at KAIST. He leads SMILE (SMart and MobILE) lab, focusing on HW/SW co-design of low-power wireless systems for pervasive communication and sensing. He received the best paper awards in ACM MobiSys 2022 and IEEE ICDCS 2018. He has served on the editorial board of IEEE/ACM Transactions on Networking, and TPC for MobiCom and NSDI. Prior to joining KAIST, he was with Computer Science at George Mason University.

Summary of Presentation
Massive-scale, long-range, and super-precision indoor/outdoor localization system is a key to advancing emerging services of AR, autonomous driving, and many more. This tutorial introduces our 4 year-effort on designing a millimeter wave backscatter system that achieves sub-cm localization for 1000 tags currently, at a 180 m distance -- outperforming the latest competitors in all scalability, coverage, and accuracy aspects. The system runs on commodity mmWave FMCW radars and custom-designed tags. The backscatter tag consumes only 7 microwatts for 40-year battery life on a single cell. All source codes and tag design files are released online: https://smile.kaist.ac.kr/research/mmwave-backscatter

Tutorial 3 (T3)
Anti-Drone Phased Array Radar Technology

Date & Time: 13:10 ~ 14:50, Thursday, September 7, 2023.

Chair: Prof. Shao-Yu Lien (National Yang Ming Chiao Tung University, Taiwan)

Speaker: Yenming Huang (NTU, Taiwan)

Yenming Huang is currently the Supervisor of the Algorithm Design Department at Tron Future Tech Inc., Hsinchu, Taiwan, and serves as an Adjunct Assistant Professor in the Graduate Institute of Communication Engineering (GICE) at National Taiwan University (NTU), Taipei, Taiwan. He received the Ph.D. degree in Communication Engineering from NTU, Taipei, Taiwan, in Jan. 2019. In the subsequent six months, he was a Postdoctoral Researcher in the GICE at NTU to execute the EU-TW Clear5G project. Dr. Huang's expertise is mainly in signal and data processing for radar and communications from architecture to algorithms. His recent research interests include active electronically scanned array (AESA) radar system development, digital calibration for hardware non-ideal effects, and multi-antenna multi-carrier transceiver design.

Summary of Presentation
The technology of phased array radar, a.k.a. active electronically scanned array (AESA) radar, has been developed since 1950. Using fully digital arrays for radar has drawn extensive attention, thanks to the benefits of beam agility, design flexibility, performance reliability, scalability, ease of calibration, and so on, without moving antennas and pedestals. Owing to obvious advancements in solid-state microwave integrated circuits and the evolution of digital processors, a cost-effective ultra-thin AESA radar becomes feasible in recent years. On the other hand, demands for drones, or unmanned aerial vehicles (UAVs), are increasing for various purposes and applications. Affordability, portability, and simplicity are three main reasons for making drone products much more popular. However, the misuse of drones may pose a severe threat to personal security, important facilities, and national infrastructures. Promptly constructing anti-drone systems to detect, track, and take countermeasures on hostile drone targets is becoming more and more desirable. An effective drone surveillance radar, independent of weather and visibility, is indispensable to such counter-UAV solutions. Therefore, in this tutorial, we first introduce modern applications and basic principles of phased array radar systems. Then, we study a new design paradigm for lightweight portable phased array radars, called T-shaped AESA radar, which features a 2D sparse orthogonal linear array to facilitate micro-drone flying target positioning and tracking in 3D space.

Tutorial 4 (T4)
From 5G to 6G: Towards a Ubiquitous Network with Intelligent Air Interface

Date & Time: 15:00 ~ 16:30, Thursday, September 7, 2023.

Chair: Prof. Shao-Yu Lien (National Yang Ming Chiao Tung University, Taiwan)

Speaker: Chu-Hsiang Huang (NTU, Taiwan)

Chu-Hsiang Huang received B.S. and M.S. degrees in Electrical Engineering from National Taiwan University, Taiwan in 2007 and 2009, respectively. and his Ph.D. degree in Electrical Engineering from University of California, Los Angeles in 2015. He is now with Qualcomm Technologies, Inc. as a RAN working group delegate for 3GPP Standard Organization. Besides representing Qualcomm in 3GPP standard meetings, he is working on product development projects including multi-user interference mitigation, energy efficient receiver and demodulation algorithm as a staff engineer. He was a research assistant for NTU-INTEL research center in Taiwan in 2010. His research interest includes robust inference on unreliable hardware, probabilistic graphical model and machine learning algorithm.

Summary of Presentation
Fifth generation (5G) cellular communication system provides a flexible system architecture that enables wireless communication technology to penetrate different verticals and connect various devices. Since 5G devices began to appear in the market, we have seen connected systems implemented across multiple use cases in different scenarios, e.g., vehicular network, high speed train, broadcast, and even satellite communications. However, emerging application scenarios under different conditions and with diverse objectives bring new challenges to traditional wireless system design methodology, which mainly relies on abstract models to capture the environment accurately and develop algorithms accordingly. Applying machine learning to develop AI models applicable to various application scenarios becomes a promising direction for designing wireless communication systems. Therefore, creating a new generation of machine learning-based intelligent air interface, which can adapt to different conditions, is a key technology for successfully developing and deploying wireless communication systems to cover all the use cases envisioned by 5G, 6G, and beyond. In this tutorial, we start with the flexible system architecture in the 5G standard, and explain how connected systems in different scenarios can be developed from the 5G system architecture. Then we show how machine learning can help to develop AI models in various wireless communication system use cases, and the challenge to design an intelligent air interface leveraging the vast capability of machine learning methodology, to provide a promising vision to the future 6G systems.

Technical Session 1 (TS1)

09:00-10:30, Wednesday, September 6, 2023, Track II

Theme: Artificial Intelligence and Machine Learning

Chair: Te-Chuan Chiu (National Tsing Hua University, Taiwan)

TS1-1   **Test Suite Generation Based on Context-Adapted Structural Coverage for Testing DNN**
Wei Kong (Nanjing University of Information Science and Technology, China); Qianjin Du (Tsinghua University, China); Cao Huayang (National University of Defense Technology, China); Hu Li (Nanjing University of Information Science and Technology); Tong Wang (Nanjing University of Information Science and Technology, Japan); Jianwen Tian (National University of Defense Technology, China); Xiaohui Kuang (Academy of Military Science, China)

TS1-2   **Metalens: Federated Meta-Learning Ensemble Using Flexible Classifiers on Non-IID Data**
Ming-Hsuan Tsai (National Taiwan University & Academia Sinica, Taiwan); Wei-Sheng Syu (National Taiwan University, Taiwan); Te-Chuan Chiu (National Tsing Hua University, Taiwan); Sheng Chen and Chia-Che Sa (National Taiwan University, Taiwan); Yuan-Yao Shih (National Chung Cheng University, Taiwan); Ai-Chun Pang (National Taiwan University, Taiwan)

TS1-3   **Distribution Matching with Multi-Formation Function for Dataset Distillation**
Hieu Quang Vo and Choong Seon Hong (Kyung Hee University, Korea (South))

TS1-4   **Knowledge Distillation in Federated Learning: Where and How to Distill?**
Yu Qiao, Chaoning Zhang, Huy Q. Le, Avi Deb Raha, Apurba Adhikary and Choong Seon Hong (Kyung Hee University, Korea (South))

Technical Session 2 (TS2)

10:45-12:15, Wednesday, September 6, 2023, Track II

Theme: Edge/Fog/Cloud Computing

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

TS2-1   **Mobility-Aware Fog Offloading**
Young Choon Lee and Ferdous Sharifi (Macquarie University, Australia); Shaahin Hessabi and Ali Rasai (Sharif University of Technology, Iran); Melika Honarmand (Amirkabir University of Technology, Iran)

TS2-2   **EFCKD: Edge-Assisted Federated Contrastive Knowledge Distillation Approach for Energy Management: Energy Theft Perspective**
Luyao Zou, Huy Q. Le and Avi Deb Raha (Kyung Hee University, Korea (South)); Dong Uk Kim (Kyung Hee & Networking Intelligence, Korea (South)); Choong Seon Hong (Kyung Hee University, Korea (South))

TS2-3   **Cluster Caching Strategy Based on User Characteristics in Edge Networks**
Ye Zhang (Qilu University of Technology, China); Wei Zhang (Qilu University of Technology(Shandong Academy of Sciences), China); Hao Hao (Shandong Academy of Sciences & Shandong Computer Science

Center, China); Kai Zhang (Qilu University of Technology, China)*

TS2-4   **Optimizing Performance Using GPU Cache Data Residency Based on Application's Access Patterns**
Theodora Adufu (Sookmyung Womens University, Korea (South)); Yoonhee Kim (Sookmyung Women's University, Korea (South))

Technical Session 3 (TS3)

15:00-16:40, Wednesday, September 6, 2023, Track I

Theme: Network Security

Chair: Woojin Seok (KISTI, Korea)

TS3-1   **Machine Learning-Based Approach for Enhancing Multi-Step Attack Prediction**
Yueyang Li (National University of Singapore, Singapore); Wenjun Fan (Xi'an Jiaotong-Liverpool University, China); Ruxue Luo (Xi'an Jiaotong - Liverpool University, China)

TS3-2   **Malicious Traffic Classification for IoT Based on Graph Attention Network and Long Short-Term Memory Network**
Lei Zhang, Lizhuang Tan, Huiling Shi and Hongyang Sun (Qilu University of Technology (Shandong Academy of Sciences), China); Wei Zhang (Qilu University of Technology(Shandong Academy of Sciences), China)

TS3-3   **CA-STCNN: An Attention-Based Hybrid Deep Learning Model for Encrypted Traffic Classification**
Hongyang Sun, Huiling Shi, Lei Zhang, Lei Huang and Wei Zhang (Qilu University of Technology (Shandong Academy of Sciences), China)

TS3-4   **Cooperative Spectrum Sensing Method Against Spectrum Sensing Data Falsification Attack**
Xiaojun Wu, Zhenghan Tang and Yaya Lu (Xi'an Jiaotong University, China); Daolong Wu (China Electronics Technology Group Corporation 20th Institute, China); Haitao Xiao and Yong Tang (Xi'an Jiaotong University, China)

Technical Session 4 (TS4)

15:00-16:40, Wednesday, September 6, 2023, Track II

Theme: SDN/NFV 1

Chair: Ved P. Kafle (NICT, Japan)

TS4-1   **SMWT: A Universal and Lightweight SDN-Based Meter Table Watermarking Traceback Scheme**
Heng He and Sen Yang (Wuhan University of Science and Technology, China); Xiaohu Zhou (Guilin Medical University, China); Jia Wang (Wuhan University of Science and Technology, China)

TS4-2   **Blockchain and Intent-Based Networking: A Novel Approach to Secure and Accurate Network Policy Implementation**
Javier Jose Diaz Rivera, Afaq Muhammad and Wang-Cheol Song (Jeju National University, Korea (South))

TS4-3   **When Configuration Verification Meets Machine Learning: A DRL Approach for Finding Minimum K-Link Failures**
Hao Chen (Xiamen University, China); Yili Jin (McGill University, Canada); Weipeng Wang (Xiamen University, China); Wei Liu (NARI Group

Corporation. State Grid Electric Power Research Institute Nanjing, Singapore); Lizhao You, Liqun Fu and Qiao Xiang (Xiamen University, China)

TS4-4   Efficient Decomposition-Based Methods for Optimal VNF Placement and Chaining
Issam Abdeldjalil Ikhelef (Université Sorbonne Paris Nord & L2TI - Institut Galilée, France); John A Warwicker and Steffen Rebennack (Karlsruhe Institute of Technology, Germany); Mohand Yazid Saidi (University of Paris 13, France); Ken Chen (Université Paris 13, France)

Technical Session 5 (TS5)
10:30-12:10, Thursday, September 7, 2023, Track I

Theme: Vehicular Networks

Chair: Yuji Nomura (Fujitsu, Japan)

TS5-1   Research on Fog Computing Offloading Mechanism for VANETs
Kexin Zhou (Inner Mongolia University, China); Xiangyu Bai (Inner Mongolia University & Institute of Computing Technology, Chinese Academy of Sciences, China)

TS5-2   Performance Enhancements of C-V2X Mode 4 with Virtual Cell and Resource Usage Bitmap
Moin Ali and Young-Tak Kim (Yeungnam University, Korea (South))

TS5-3   QKD-Based Secure Communication for UAV
Zhenxu Gao and Wenjun Fan (Xi'an Jiaotong-Liverpool University, China); Ruxue Luo (Xi'an Jiaotong - Liverpool University, China)

TS5-4   Segment Anything Model Aided Beam Prediction for the Millimeter Wave Communication
Avi Deb Raha and Apurba Adhikary (Kyung Hee University, Korea (South)); Md. Shirajum Munir (Old Dominion University, USA); Yu Qiao and Choong Seon Hong (Kyung Hee University, Korea (South))

Technical Session 6 (TS6)
10:30-12:10, Thursday, September 7, 2023, Track II

Theme: SDN/NFV 2

Chair: Pang-Wei Tsai (National Cheng Kung University, Taiwan)

TS6-1   An Energy Efficient SDN Controller Placement with Delay Constraints
Tomofumi Kondo and Luis Guillen (Tohoku University, Japan); Satoru Izumi (National Institute of Technology Sendai College, Japan); Toru Abe, Takaaki Mizuki and Takuo Suganuma (Tohoku University, Japan)

TS6-2   Design and Development of a Trust Mechanism to Enhance Security Protection on SDN-Based IoT Network
Pang-Wei Tsai (National Cheng Kung University, Taiwan); Chao-Wei Lee and Ting-Wen Wang (National Central University, Taiwan)

TS6-3   Network Traffic Prediction and Auto-Scaling of SFC Using Temporal Fusion Transformer
MinJi Choi and Heegon Kim (POSTECH, Korea (South)); Jae-Hyoung Yoo (Pohang University of Science and Technology, Korea (South)); James Won-Ki Hong (POSTECH, Korea (South))

Technical Session 7 (TS7)
13:10-14:50, Thursday, September 7, 2023, Track II

Theme: 5G Network

Chair: Kyungbaek Kim (Chonnam National University, Korea)

TS7-1   Accelerating free5GC Data Plane Using Programmable Hardware
Muthuraman Elangovan (National Yang Ming Chiao Tung University, Taiwan); Muhammad Shahid Iqbal (National Yang-Ming Chiao Tung University, Taiwan); Chien Chen and Jyh-Cheng Chen (National Yang Ming Chiao Tung University, Taiwan)

TS7-2   Latency Minimization in Terrestrial-Non-Terrestrial Integrated Network: Joint Association and Bandwidth Allocation Framework
Nway Nway Ei, Ki Tae Kim, Yu Min Park and Choong Seon Hong (Kyung Hee University, Korea (South))

TS7-3   Heterogeneous UPF Integration Framework and 5G User Plane Acceleration
Tse-Han Wang, Min-Chih Hu and Li-Hsing Yen (National Yang Ming Chiao Tung University, Taiwan); Chien-Chao Tseng (National Chiao-Tung University, Taiwan)

TS7-4   Energy Saving in 5G Cellular Networks Using Machine Learning Based Cell Sleep Strategy
YinHsin Liu and Bo-Chen Kung (Chunghwa Telecom Laboratories, Taiwan)

Technical Session 8 (TS8)
15:00-16:40, Thursday, September 7, 2023, Track II

Theme: Network Monitoring and Configuration

Chair: Meng-Shiuan Pan (National Taipei University of Technology, Taiwan)

TS8-1   Analyzing the Effect of Observer Node Addition Strategy on Bitcoin Double-Spending Attack Detection Using Graph Neural Network
Changhoon Kang, Jongsoo Woo and James Won-Ki Hong (POSTECH, Korea (South))

TS8-2   CSLog: Anomaly Detection for Syslog Based on Contrastive Self-Supervised Representation Learning
Shuhao Yan, Shanshan Wang, Zhenxiang Chen and Xiaoqing Jiang (University of Jinan, China); Xueyang Cao (Uninersity of Jinan, China)

TS8-3   An Anomaly Detection Approach by AIML in IP Networks with eBPF-Based Observability
Minato Sakuraba and Takuya Miyasaka (KDDI Research, Inc., Japan)

TS8-4   Online Updating in Multicast Time-Sensitive Networking
Jiachen Wen, Ying Wang, Qianqian Zhang, Jingjing Chen and Xuesong Qiu (Beijing University of Posts and Telecommunications, China)

Technical Session 9 (TS9)

10:30-12:10, Friday, September 8, 2023, Track I

Theme: Network Management

Chair: Yoonhee Kim (Sookmyung Women's University, Korea)

TS9-1   A Efficient Adaptive Data Rate Algorithm in LoRaWAN Networks: K-ADR
Yi Jiang, Minghua Wang and Xingbin Wang (University of South China, China)

TS9-2   A Heuristic Online Algorithm for Routing in Large-Scale Deterministic Networks
Mengyu Wang (Institute of Computing Technology, Chinese Academy of Sciences, China; University of Chinese Academy of Sciences, China); Shuyong Zhu (Institute of Computing Technology Chinese Academy of Sciences, China); Yujun Zhang (Institute of Computing Technology, Chinese Academy of Sciences, China)

TS9-3   Enhancing QoE of WebRTC-Based Video Conferencing Using Deep Reinforcement Learning
Kyungchan Ko, Sangwoo Ryu and James Won-Ki Hong (POSTECH, Korea (South))

TS9-4   Federated Multimodal Learning for IoT Applications: A Contrastive Learning Approach
Huy Q. Le, Yu Qiao, Loc X. Nguyen, Luyao Zou and Choong Seon Hong (Kyung Hee University, Korea (South))

Poster Session 1 (PS1)

14:10-15:00, Wednesday, September 6, 2023

Chair: Changhyun Lee (ETRI, Korea)

PS1-1 Energy-Efficient Geographic Routing with an Autonomous Mobile Sink Under Partial Coverage
Ziyan Zhu, Minghua Wang and Wenbo Chen (University of South China, China)

PS1-2 SDRA: A Sensor Data Retrieval Architecture for the Heterogeneous IoT Node
Weigang Wang, Wei Jing and Sining Jiang (Ocean University of China, China)

PS1-3 Network State Prediction with Attention-Based Graph Convolutional Network
Li Longfei, Chen Haoyu, Sungwoong Yeom, Shivani Sanjay Kolekar and Kyungbaek Kim (Chonnam National University, Korea (South))

PS1-4 Seamless Integration of Wireless Interface to SDN Switch
Jiayang Chen, Kien Nguyen and Hiroo Sekiya (Chiba University, Japan)

PS1-5 An Efficient Local Search Algorithm for Traffic Engineering in Segment Routing Networks
Jingjing Chen, Ying Wang, Jiachen Wen, Qianqian Zhang and Xuesong Qiu (Beijing University of Posts and Telecommunications, China)

PS1-6 Preprocessing and Analysis of an Open Dataset in Application Traffic Classification
Ui-Jun Baek, Min-Seong Lee, Jee Tae Park and Jeong-Woo Choi (Korea University, Korea (South)); Chang-Yui Shin (Defense Agency for Technology and Quality, Korea (South)); Myung-Sup Kim (Korea University, Korea (South))

PS1-7 A Machine Learning-Based Intrusion Detection Approach for Intelligent Connected Vehicles
Jia Liu and Wenjun Fan (Xi'an Jiaotong-Liverpool University, China)

PS1-8 Novel Convergence of Fixed-Access and Mobile Network Architectures with Ultra-Low Latency Multi-Slicing
Pang-Chen Liu, Ping Chang Tsai and Fei-Hua Kuo (Chunghwa Telecom, Taiwan); Kou-Hsiang Lai (Chunghwa Telecom Co., Ltd., Taiwan)

PS1-9 Dynamic Selection Scheme of LTE-M and 5G for Efficient Maritime Communication Based on Traffic Volume
Mahn-suk Yoon (Gumi Electronics & Information Technology Research Institute, Korea (South)); Jaeuk Kwon and Hyunjoo Lee (Gumi Electronics and Information Technology Research Institute, Korea (South)); Keuchul Cho (Kyungpook National University, Korea (South)); Jihun Seo (Korea Transport Institute, Korea (South)); Jang kyu Yun (Gyeongbuk Institute of IT Convergence Industry Technology, Korea (South))

PS1-10 Transformer-Based Communication Resource Allocation for Holographic Beamforming: A Distributed Artificial Intelligence Framework
Apurba Adhikary, Avi Deb Raha and Yu Qiao (Kyung Hee University, Korea (South)); Md. Shirajum Munir (Old Dominion University, USA); Ki Tae Kim and Choong Seon Hong (Kyung Hee University, Korea (South))

PS1-11 Shot-By-Shot Technical Data Collection for Badminton Doubles Games
Pei-Chieh Sung, Yu-Hsien Huang, Yung-Chang Huang, Tsì-Uí İk and Jiun-Long Huang (National Yang Ming Chiao Tung University, Taiwan)

PS1-12 Design of Personal Data Protection Decentralized Model Using Blockchain and IPFS
Jiwon Bang and Mi-Jung Choi (Kangwon National University, Korea (South))

PS1-13 Crowdsensing Data Trading Mechanism Based on Personalized Local Differential Privacy
Jiahao Zeng, Feng Qi and Chang Liu (Beijing University of Posts and Telecommunications, China); Qun Zhang (China Electronics Standardization Institute, China); Wang Zhili (Beijing University of Posts and Telecommunications, China)

PS1-14 QR-Code with Superimposed Text
Naoya Tahara, Senling Wang, Hiroshi Kai and Hiroshi Takahashi (Ehime University, Japan); Masakatu Morii (Kobe University, Japan)

Poster Session 2 (PS2)

09:40-10:30, Thursday, September 7, 2023

Chair: Wang-Cheol Song (Jeju National University, Korea)

PS2-1 Encrypted Model Stealing: A Threat to the Fairness of Federated Learning Based on Blockchain
Chenghan Wang, Shanshan Wang, Chuan Zhao, Wenyue Wang and Zhenxiang Chen (University of Jinan, China)

PS2-2 Developing an Interview Recording System with Speaker Recognition and Emotion Classification
Wei-Yi Hsieh, Hsun-Ching Tsai, Lu-An Chen and Tsì-Uí İk (National Yang Ming Chiao Tung University, Taiwan)

PS2-3 Optimizing Cluster Head Placement in Federated Clustering: A Genetic Algorithm Approach
Shivani Sanjay Kolekar and Kyungbaek Kim (Chonnam National University, Korea (South))

PS2-4 Automation of Human Decision Making by Using Reinforcement-Learning for Office Work with PC
Misa Fukai, Masashi Tadokoro, Haruo Oishi and Ryou Uchida (NTT, Japan); Kimio Tsuchikawa (Nippon Telegraph and Telephone Corporation, Japan)

PS2-5 AI Research Platform for Agriculture Sector
Ki-Hyeon Kim (Korea Institute of Science and Technology Information, Korea (South)); Jeonghoon Moon (Korea Institute of Science and Technology Information & KISTI, Korea (South)); Woojin Seok (Korea Institute of Science and Technology Information, Korea (South)); Kwangsoo Kim (Seoul National University, Korea (South)); Joonyong Sim (Rural Development Administration, Korea (South))

PS2-6 Research on Decompostion Method of Relational Database Oriented to Microservice Refactoring
Jiaqi Hao, Junfeng Zhao and Yuxian Li (Inner Mongolia University, China)

PS2-7 Efficient Cloud Computing Resource Management Strategy Based on Auction Mechanism

Qian Chen (Harbin Institute of Technology, Shenzhen, China); Xuan Wang (Harbin Institute of Technology Shenzhen Graduate School, China); Cenying Yang (City University of Hong Kong, China); Zoe Jiang (Harbin Institute of Technology, Shenzhen, China)

PS2-8 The Smart Applications of ICT and IoT with AI Techniques in IMS Network

Jih-Wei Tsai (Chunghwa Telecommunication Labs., Taiwan)

PS2-9 A Multi-Agent Deep Reinforcement Learning Based Cooperative Edge Data Caching Approach

Yongzhe Yu (Beijing University of Posts and Telecommunications, China); Shuang Wu (State Grid Ningxia Electronic Power Co.LTD.,China); Sujie Shao, Jinqian Chen and Xingyu Chen (Beijing University of Posts and Telecommunications, China)

PS2-10 A Federated Learning Approach for Net Load Forecasting in Microgrids

Zihan Qin, Sujie Shao, Shaoyong Guo and Xuesong Qiu (Beijing University of Posts and Telecommunications, China)

PS2-11 A Honey-Imprint Enabled Approach for Resisting Social Engineering Attacks

Zhaoxi Zhong and Wenjun Fan (Xi'an Jiaotong-Liverpool University, China)

PS2-12 An Extensive Evaluation of TCP Congestion Control in 10 Gbps Network

Shunji Aoyagi (Chiba University, Japan); Jong Deok Kim (Pusan National University, Korea (South)); Kien Nguyen and Hiroo Sekiya (Chiba University, Japan)

PS2-13 Accurate Identification of Encrypted Videos in Asymmetric Routing Scenarios

Weiwei Zhu, Hua Wu, Jingwen Quan, Guang Cheng and Xiaoyan Hu (Southeast University, China)

Poster Session 3 (PS3)

09:40-10:30, Friday, September 8, 2023

Chair: Seunghae Kim (KISTI, Korea)

PS3-1 Lightweight-Heavyweight Hybrid Approach for Application Traffic Classification

Min-Seong Lee, Jee Tae Park and Ui-Jun Baek (Korea University, Korea (South)); Chang-Yui Shin (Defense Agency for Technology and Quality, Korea (South)); Jeong-Woo Choi and Myung-Sup Kim (Korea University, Korea (South))

PS3-2 Network User Action Detection Based on PSD Signature Through Encrypted Traffic Analysis

Jee Tae Park and Ui-Jun Baek (Korea University, Korea (South)); Chang-Yui Shin (Defense Agency for Technology and Quality, Korea (South)); Min-Seong Lee, Jeong-Woo Choi and Myung-Sup Kim (Korea University, Korea (South))

PS3-3 Satellite Anomaly Detection Based on Improved Transformer Method

Yuqiao Hou (Institute of Information Engineering, China); Hongjia Li (Chinese Academy of Sciences, China); Yuxiang Wang, Liming Wang and Zhen Xu (Institute of Information Engineering, Chinese Academy of Sciences, China)

PS3-4 IoT Intrusion Detection Based on Personalized Federated Learning

Qianqian Zhang, Ying Wang, Tongyan Wei, Jiachen Wen, Jingjing Chen and Xuesong Qiu (Beijing University of Posts and Telecommunications, China)

PS3-5 Federated Learning Based Network Intrusion Detection Model

Beom-Su Lee, Jong-wouk Kim and Mi-Jung Choi (Kangwon National University, Korea (South))

PS3-6 RPChain: Regulatable Privacy-Preserving Group Data Sharing Based on Consortium Blockchain

Puhe Hao, Tianyu Pan, Rui Han, Xiao Qu, Zhexuan Yang and Guozi Sun (Nanjing University of Posts and Telecommunications, China)

PS3-7 Detecting Digital Ad Fraud by Active Reinforcement Learning
Seongbok Baik (KT, Korea (South))

PS3-8 Coherent PON Interconnect System with Phase Compensation

Ping Chang Tsai, Pang-Chen Liu and Fei-Hua Kuo (Chunghwa Telecom, Taiwan); Kou-Hsiang Lai (Chunghwa Telecom Co., Ltd., Taiwan)

PS3-9 Progress and Challenges of Polymorphic Smart Networks

Peixin Liu (Inner Mongolia University, China); Xiangyu Bai (Inner Mongolia University & Institute of Computing Technology, Chinese Academy of Sciences, China); Zhaoran Wang (Inner Mongolia University, China)

PS3-10 EeCA: A Novel Approach for Energy Conservation in MEC via NDN-Based Content Caching

Jiaxin Xu (Qilu University of Technology (Shandong Academy of Sciences),China); Huiling Shi and Haoxiang Chu (Qilu University of Technology (Shandong Academy of Sciences), China); Wei Zhang (Qilu University of Technology (Shandong Academy of Sciences), China)

PS3-11 Modeling and Optimization for Computing Power Resource-Aware in CPN

Jiacong Li (China Telecom Corporation Limited Research Institute, China); Hang Lv, Bo Lei and Yunpeng Xie (China Telecommunication, China)

PS3-12 enCBS: Delay Guarantee Mechanism Based on Credit-Based Shaping for Programmable Switch

Xinhang Wang, Lizhuang Tan and Wei Zhang (Qilu University of Technology(Shandong Academy of Sciences), China)

PS3-13 Proposal of Annotation Method for RPA Scenario

Ryou Uchida, Misa Fukai and Taisuke Wakasugi (NTT, Japan); Kimio Tsuchikawa (Nippon Telegraph and Telephone Corporation, Japan); Haruo Oishi (NTT, Japan)

Poster Session 4 (PS4)
13:10-14:00, Friday, September 8, 2023

Chair: Buseung Cho (KISTI, Korea)

PS4-1 The Effectiveness of Online Reputation Score Under Silence Bias
Lirong Chen and Qiang Li (Inner Mongolia University, China)

PS4-2 Precision Time Transfer Using ITU-T G.8275.1 over Optical Transport Network
Po-Kai Chuang (Chunghwa Telecom Co., Ltd., Taiwan); Hsiu-fang Hu (Telecommunication Laboratories, Chunghwa Telecom Co., Ltd., Taiwan); Jian-Kai Huang (Chunghwa Telecom, Taiwan); Chin-Cheng Hu (Chunghwa Telecom Laboratories, Taiwan); Ming-Hung Lee, Yu-Ping Yu and Kou-Hsiang Lai (Chunghwa Telecom Co., Ltd., Taiwan)

PS4-3 Ethernet VPN Provisioning Towards Slicing for 5G Transport Networks
Yi-Cheng Chu (Chunghwa Telecom Laboratories Co., Ltd., Taiwan); Hong-Jie Chen (Chunghwa Telecom Co., Ltd, Taiwan); Che-Chun Teng (Chunghwa Telecom, Taiwan); Chin-Ping Chuang (Chunghwa Telecom Laboratories, Taiwan); Min-Han Hung (Chunghwa Telecom Laboratories Co., Ltd., Taiwan)

PS4-4 Implementation of an OAM System for Multi-Vendor Open RAN Base Station
Pin-Hua Wu, Tse-Han Fang, Wan Chien Yang and Wei-Jie Huang (Chunghwa Telecom Laboratories, Taiwan)

PS4-5 Secure and Scalable eSIM Service Provisioning Framework for Mobile Virtual Network Operators
Ramneek Ramneek (Korea University, Korea (South)); Patrick Hosein (The University of the West Indies, Trinidad and Tobago); Sangheon Pack (Korea University, Korea (South))

PS4-6 Bandwidth Factor Computation Framework for Traffic Routing in 5G Networks
Kai-Mao Cheng (Chunghwa Telecom, Taiwan); Hsing-Chen Chi, Yu-Ping Yu and Kou-Hsiang Lai (Chunghwa Telecom Co., Ltd., Taiwan)

PS4-7 An Empirical Study: Use Autoencoder Model to Determine the Abnormal Data
Yun-Jie Li and Jhao-Yin Li (Chunghwa Telecom, Taiwan); Hao-Yu Kao (Telecommunication Laboratories, Chunghwa Telecom, Taiwan); Yi-lin Tsai (Chunghwa Telecom, Taiwan)

PS4-8 An All-Photonics Network Management System
Li-Hsuan Chu, Yen-Lin Tung and Yong-Zen Huang (Telecommunication Laboratories, Chunghwa Telecom Co., Ltd., Taiwan)

PS4-9 Machine Learning Based Optical Transmission System Link Performance Degradation Prediction and Application
ZhiQiang Fan (FiberHome Telecommunication Technologies Co. Ltd, China); ZhenWei Wu (Wuhan FiberHome Technical Services Co. Ltd, China); JianXin Lv (Fiberhome Technology LTd, China); Peng Zhang and Yong Xiao (Huazhong University of Science and Technology, China)

PS4-10 Accelerating Non-Preemptive Multicast Flows in Reconfigurable Data Center Networks
Yuhang Wu, Quan Chen and Cheng Liang lun (Guangdong University of Technology, China)

PS4-11 GrayINT - Detection and Localization of Gray Failures via Hybrid In-Band Network Telemetry
Kuichao Zhang (Qilu University of Technology (Shandong Academy of Sciences), China); Wei Su (Beijing Jiaotong University, China); Huiling Shi and Kai Zhang (Qilu University of Technology (Shandong Academy of Sciences), China); Wei Zhang (Qilu University of Technology(Shandong Academy of Sciences), China)

PS4-12 A Novel Equivalence Proof of Clock and Network Synchronization Model Towards Distributed Clouds
Feng Jiang, Yongyang Cheng, Tao Zhang, Boqin Qin and Zhao Hui (China Telecom Cloud Computing Corporation, China)

PS4-13 Survey on Blockchain P2P Network
Aeri Kim, Meryam Essaid and Hongtaek Ju (Keimyung University, Korea (South))

Innovation Session 1 (IS1)

16:50-18:10, Wednesday September 6, 2023, Track I

Theme: Intelligent Management for the Future

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

IS1-1 A Low-Code-No-Code Framework for Cross-Domain Integrated Network Management System
Ching-Chieh Huang, Chi-Jung Chiu, Sheng-Ho Chang, I Han Liu (Chunghwa Telecom, Taiwan)

IS1-2 Design and Implementation of a Digital Twin Topology System for Telecom Networks
Chien-Che Hung, ChangChi Wang, Chih Yuan Chang, Pei Jung (Chunghwa Telecom, Taiwan)

IS1-3 A Study on Digital-Native Network Architecture in Web 3.0 Era
Wootae Kim (Korea Telecom, Korea)

IS1-4 Collaborative Modeling of Industry Data and Academic Research: Bridging the Gap Between Industry and Academia
Seongbok Baik (Korea Telecom, Korea)

Innovation Session 2 (IS2)

16:50-18:10, Thursday, September 7, 2023, Track I

Theme: Intelligent Management usecases for Industry verticals

Chair: Dr. Kisang Ok (Korea Telecom, Korea)

IS2-1 Cognitive Fault Locations Methods for Heterogeneous Networks
Pei Jung, Chih-Wei Chang (Chunghwa Telecom, Taiwan)

IS2-2 Architecture and Requirements for AI-Powered B5G Network Automation
Kyungmin Kim (Korea Telecom, Korea)

IS2-3 ML Approach of Detection and Prediction of Cyber-Attacks in Remote Controlled Vehicle
Taesang Choi, Sangsik Yoon (ETRI, Korea)

IS2-4 Cost Comparison of Chaos Engineering Gameday for Training System Operator
Seiji Inomata, Shinsaku Numata (INTERNETMULTIFEED CO., NTT Communications, Japan)

Chunghwa Telecom: SPACE - WAN SDN Controller for 5G Transport Networks
Booth Number : 1

Chunghwa Telecom (CHT) has developed a WAN SDN controller solution called SPACE that leverages SDN technology within IP/MPLS networks. This innovative solution enables centralized control and network programmability, improving the flexibility and efficiency of WAN resource scheduling while reducing operating expenses (OPEX).

SPACE collects and analyzes global topology and traffic data to calculate optimal paths and deploy path assignments, enabling closed-loop automation through autonomous adjustments. By leveraging data-driven operational automation, SPACE enables intelligent networks, resulting in significant savings in capital expenditure (CAPEX) savings for transport networks.

In addition, network data analysis is critical for generating network slicing strategies, driving the transition to intelligent network automation to meet the evolving requirements of next-generation networks, such as B5G/6G.

Edgecore: P4 Programmable Network
Booth Number : 2

The Edgecore switchs is a programmable leaf or spine switch for large scale data centers. In a 1RU form factor, the switch provides line-rate L2 switching and L3 routing, deep packet inspection, and traffic load balancing etc, across the 32 x QSFP-DD ports that support up to 32 x 400 GbE connections. The switchs can be deployed as a leaf switch supporting 25/50/100 GbE to servers, routers etc. with 100/400 GbE uplinks, or as a spine switch supporting 100/400 GbE leaf and spine interconnects. This open network switch is loaded with the Open Network Install Environment (ONIE), which supports the installation of compatible network operating system (NOS) software, including the open source option Open Network Linux and commercial NOS offerings.

Edgecore provides end-to-end services and support for SONiC at different stages including presales and post sales services, such as Plan and Design Service, Deployment Service, Hardware Support Service and Software Support Service. Edgecore supports SONiC across a full spectrum of platform bandwidths, including a choice of different Switch Abstraction Interfaces (SAIs) – from 1G to 400G and from leaf to super-spine layer switches.

In fact, this exhibition will show software defined packet control and traffic blocking solution based on P4 programable Network Switch platform.

CIENA: Open API, Multi-vendor network and service monitoring, Automation
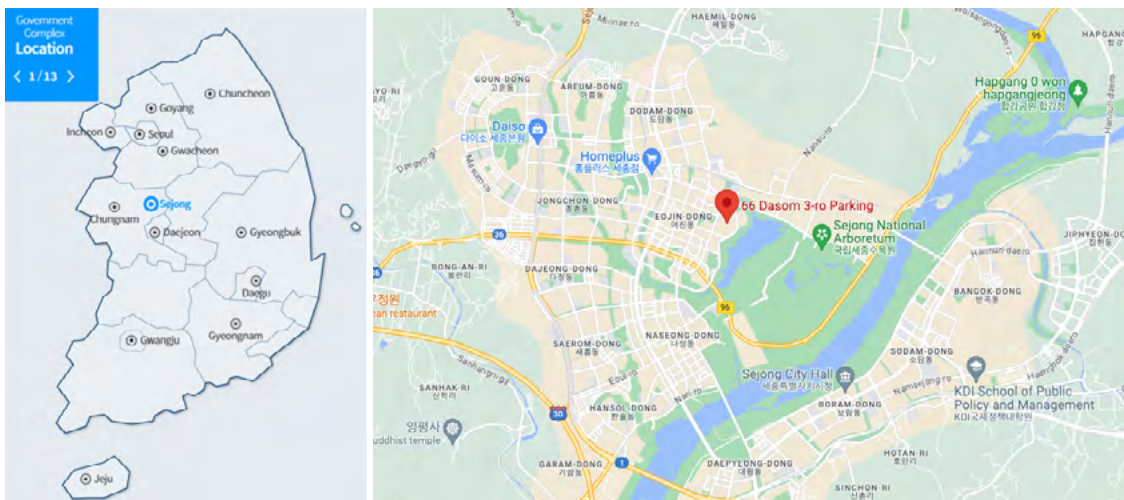### Booth Number : 3

Ciena's AIPA (Adaptive IP Application) is real time network, service, routing and performance monitoring tool for multi-vendors applications. It can improve your network operation efficiency with micro service structure, automation and open API, it can be deployed stand alone, HA or Cloud environment as your preference. You can see what you want to see through MCP AIPA.

APNOMS 2023 will be held at Sejong Convention Center (SCC), Sejong, Korea.

Location Details

- **Venue:** Sejong Convention Center(SCC), Conference/Exhibition Hall 4th Floor
- Please see the webpage of Sejong Convention Center (https://gbmo.go.kr/scc/main.do)
- You can access the Map of Sejong Convention Center Here
  (https://gbmo.go.kr/eng/cm/cntnts/cntntsView.do?mi=1507&cntntsId=1267).
- **Address:** 66, Dasom 3-ro (Eojin-dong), Sejong City, South Korea
- **Access the map at:** https://goo.gl/maps/ycPn1DuHdSD6gLwp9
- **Tel:** +82-44-330-1470

Venue & Floor Plan
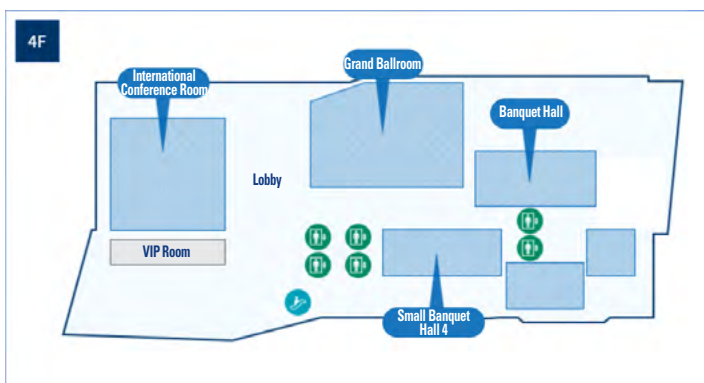
International Conference Room
- Keynote, DEP
- Tutorial, Technical Session
- Innovation Session, Special Session

Banquet Hall
- Tutorial, Technical Session
- Innovation Session, Special Session

Grand Ballroom
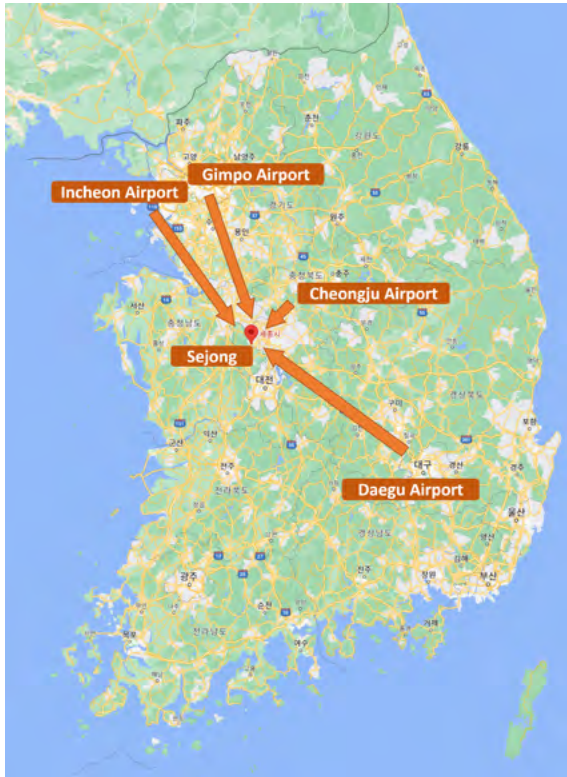- Lunch, Banquet

Lobby
- Exhibition
- Poster Session

Small Banquet Hall
- Staff/ OC Office

VIP Room
- OC/ VIP room

Airport ⇨ Sejong

From Incheon Airport (2:30)

• Way 1 by KTX: Incheon Airport ⇨ Seoul Station ⇨ Osong Station ⇨ Sejong

Take Airport Railroad at Incheon Airport Terminal 1 Station
⇨ Get off at Seoul Station (Takes about 1 hour)
⇨ Take KTX at Seoul Station
⇨ Get off at Osong Station (Takes about 56 minutes)
⇨ Take the A3, B2, B3 (BRT) bus at Osong Station bus stop
⇨ Get off at the bus stop in the northern section of Government Complex Sejong (Takes about 20 minutes)

• Way 2 by Express Bus: Incheon Airport ⇨ Express Bus Terminal ⇨ Osong Station ⇨ Sejong

Take Airport Railroad at Incheon Airport Terminal 1 Station
⇨ Get off at Gimpo Airport Station (Takes about 40 minutes)
⇨ Take Subway Line 9 at Gimpo Airport Station
⇨ Get off at Express Bus Terminal station (takes about 30 minutes)
⇨ Take the bus at Express Bus Terminal station
⇨ Get off at the Government Complex Sejong (Takes about 1 hour 20 minutes)

• Way 3 by Limousine Bus: Incheon Airport ⇨ Sejong (recommended)

Take Airport Limousine Bus at Incheon Airport Terminal 1 or 2 Station
⇨ Get off at Government Complex Sejong (Takes about 2.5 hours) for Limousine Ticket Booking

From Gimpo Airport (2:30)

• Way 1 by Express Bus: Gimpo Airport ⇨ Express Bus Terminal ⇨ Osong Station ⇨ Sejong

Take Subway Line 9 at Gimpo Airport Station
⇨ Get off at Express Bus Terminal station (takes about 30 minutes)
⇨ Take the bus at Express Bus Terminal station
⇨ Get off at the Government Complex Sejong (Takes about 1 hour 20 minutes)

From Cheongju Airport (1:10)

• Way 1 by Bus: Cheongju Airport ⇨ Sejong

Take the B3 (BRT) bus at Cheongju airport bus stop
⇨ Get off at the bus stop in the northern section of Government Complex Sejong (Takes about 1 hour)

• Way 2 by Train & Bus: Cheongju Airport ⇨ Osong Station ⇨ Sejong

Take the train at Cheongju Airport Station
⇨ Get off at Osong Station (takes about 20 minutes)
⇨ Take the A3, B2, B3 (BRT) bus at Osong Station bus stop
⇨ Get off at the bus stop in the northern section of Government Complex Sejong (Takes about 20 minutes)

From Daegu Airport (2:10)

- **Way 1 by KTX:** Daegu Airport ⇨ East Daegu Station ⇨ Osong Station ⇨ Sejong

  Take Bus or Subway at Daegu Airport
  ⇨ Get off at East Daegu Station (Takes about 20 minutes)
  ⇨ Take KTX at East Daegu Station
  ⇨ Get off at Osong Station (Takes about 1 hour)
  ⇨ Take the A3, B2, B3 (BRT) bus at Osong Station bus stop
  ⇨ Get off at the bus stop in the northern section of Government Complex Sejong (Takes about 20 minutes)

- **Way 2 by KTX:** Daegu Airport ⇨ East Daegu Station ⇨ Daejeon Station ⇨ Sejong

  Take Bus or Subway at Daegu Airport
  ⇨ Get off at East Daegu Station (Takes about 20 minutes)
  ⇨ Take KTX at East Daegu Station
  ⇨ Get off at Daejeon Station (Takes about 50 minutes)
  ⇨ Take the B1 (BRT) bus at Daejeon Station bus stop
  ⇨ Get off at the bus stop in the southern section of Government Complex Sejong (Takes about 50 minutes)

Sejong ⇨ Sejong Convention Center (SCC)

1. It takes about 20 minutes on foot from the bus stop on the northern section of Government Complex Sejong.
   Access the map at: https://naver.me/xWiRt46I
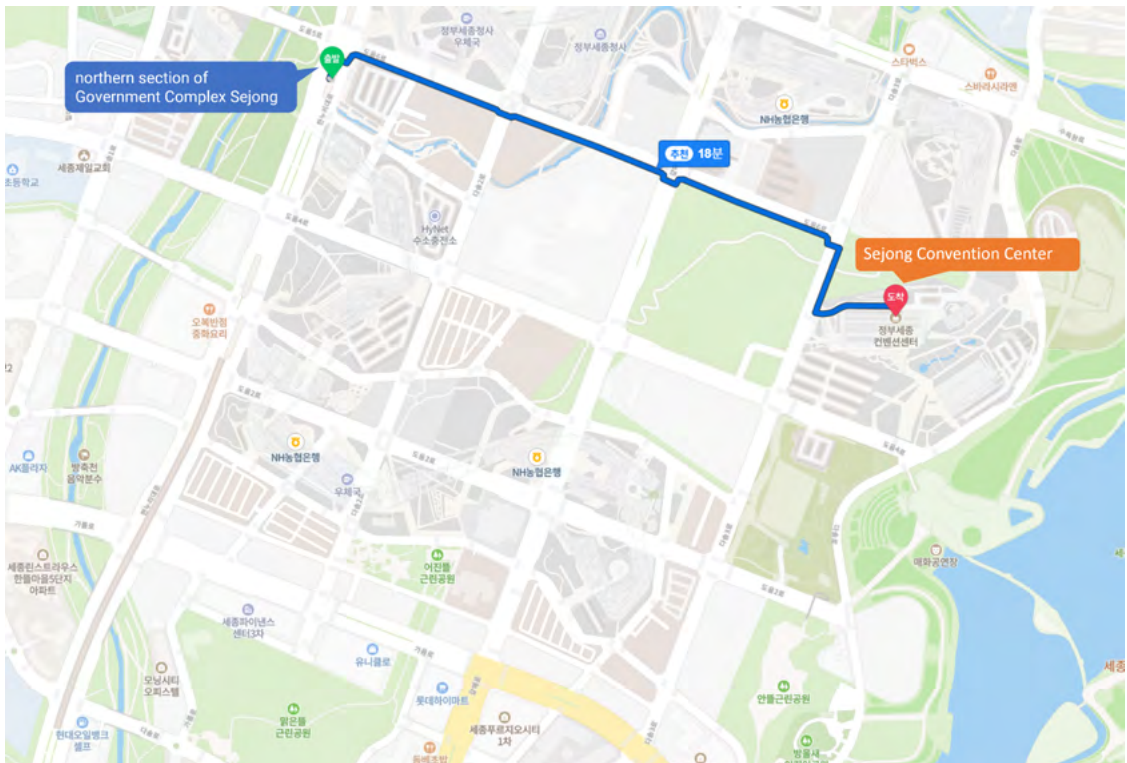
2. It takes about 25 minutes on foot from the Best Western Plus Hotel.
   Access the map at: https://naver.me/xOmwqod3
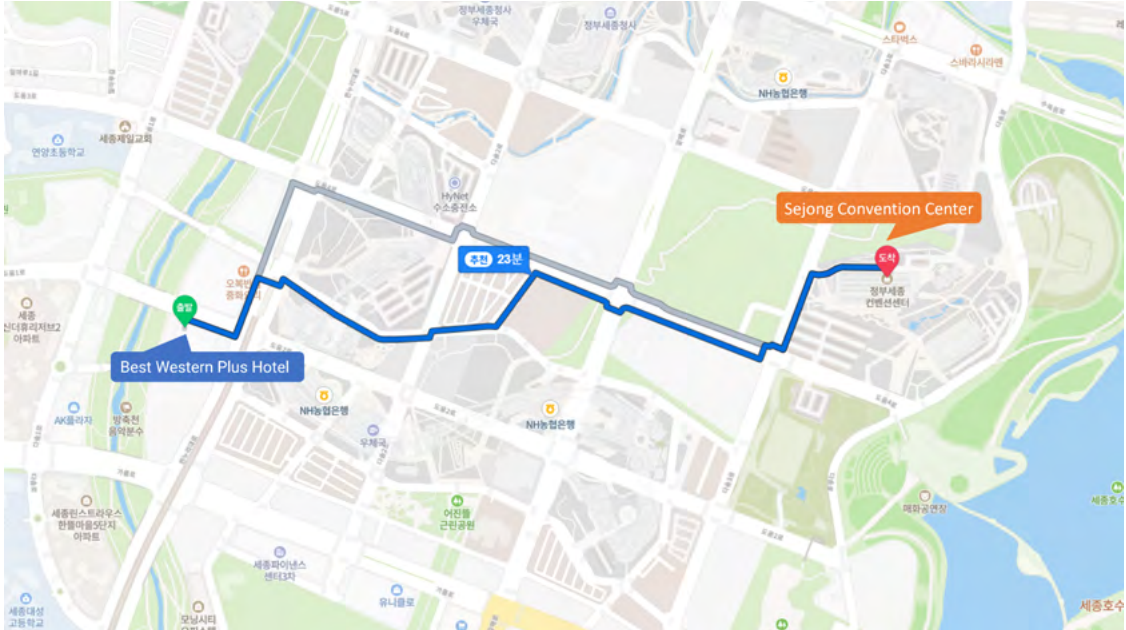
3. It takes about 15 minutes on foot from the Courtyard by Marriott Sejong.
   Access the map at: https://naver.me/FtI4yEgH
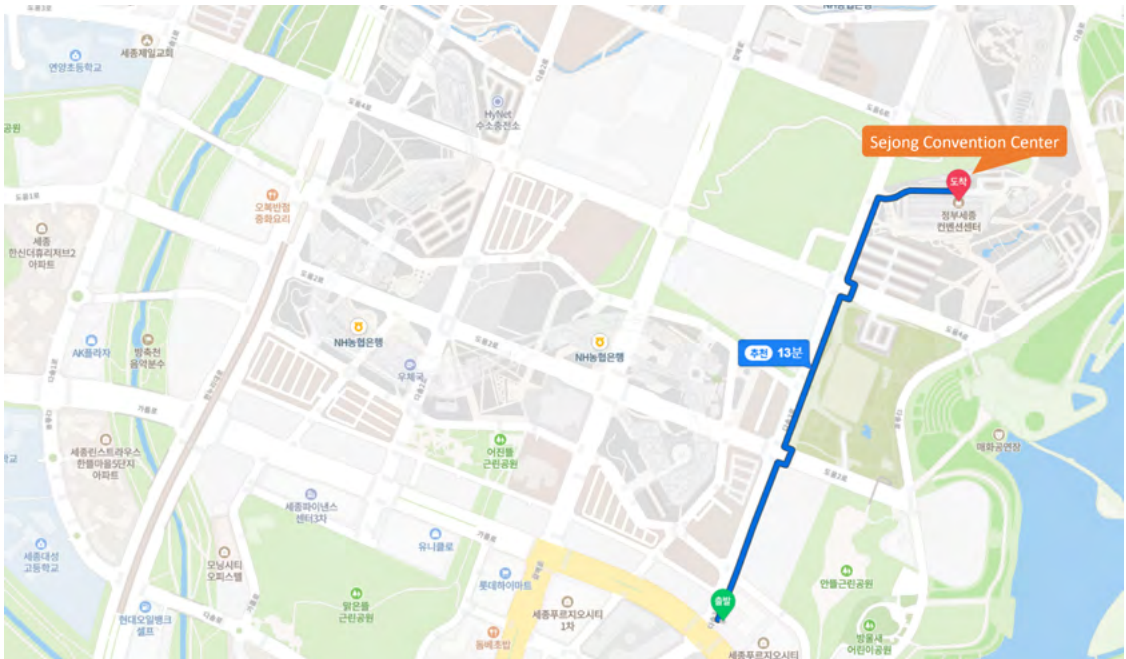
Sejong lake Park

The Sejong Lake Park has Korea's largest artificial lake, which is 62 times as big as a soccer field and has 3m of average water level. You can find a beautifully unfolded screen in the neighborhood with the National Library of Sejong and the Jeonwolsan Mountain, which fit in perfectly with the park. The Sejong Lake Park has five artificial islands: the Festival Island as a place for various festivals, the Stage Island that can boast of being the best floating stage in Korea, the Pool Island that associates with the seashore in the city, and the Water Flower Island and the Marsh Island with various water plants and ecological marshes. Plus, a trail and bicycle road near the lake can be a place for Sejong citizens to have a leisurely and relaxed time.

The National Library of Korea, Sejong

With two underground floors and four floors above the ground, the National Library of Korea, Sejong represents the city's cultural center which is frequently visited by families since its foundation in 2013. It has the necessary facilities including a library, reading rooms, lecture hall and cafeteria, and provides various educational programs and lectures.The design of the National Library of Korea, Sejong, is a main attraction. The rooftop has the appearance of a book placed upside down, and as though flipping through the pages of a book passes data from folder to folder. This design has the meaning of accepting the digital concept with the analogue foundation along with humanistic emotions in an effort to make it an expressive library.

Gongju City

Announcement of Inscription of the Baekje Historic Areas
on the UNESCO World Heritage List
Located in the mountainous mid-western region of the Republic of Korea, the three cities that were the capital of Baekje contain historical sites that provide a glimpse into the ancient kingdom of Baekje, whose culture flourished through interchanges with the neighboring regions.
Baekje, one of the early three kingdoms on the Korean peninsula, existed for 700 years from 18 BC until its fall in AD 660. The Baekje Historic Areas consist of eight archaeological sites found across three regions: Gongju, Buyeo and Iksan.
They are Gongsanseong Fortress and the Ancient Tombs in Songsan-ri, which are associated with Ungjin (present-day Gongju); the Archaeological Site in Gwanbuk-ri associated with Sabiseong Fortress, Busosanseong Fortress, Jeongnimsa Temple Site, and Ancient Tombs
in Neunggsan-ri and Naseong Fortress associated with Sabi (present-day Buyeo); and the Archaeological Site in Wanggung-ri and the Mireuksa Temple Site in Iksan associated with the second capital of Baekje during the Sabi periodl. Together these sites present the history of the Baekje Kingdom spanning from 475 to 660.
The Baekje Historic Areas testify to the adoption and refinement of Chinese principles by Baekje when it comes to urban planning, architectural technology, arts and religion as well as the subsequent transmission of these principles that it redefined to Japan and other parts of East Asia.
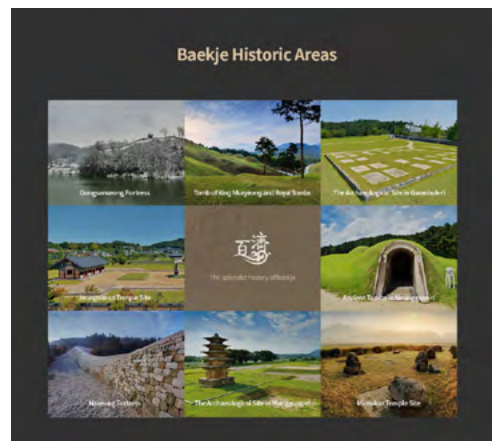
Best Western Plus Hotel, Sejong.

Best Western Plus Hotel Sejong, located near the Sejong Government Office, is a luxury hotel by Best Western, a world-class hotel chain. It is equipped with 367 rooms with contemporary designs, a restaurant that provides a global level of service, a business lounge, a banquet hall, and multi-purpose conference facilities.

Please see the webpage at Best Western Plus Hotel, Sejong (https://www.hotelsejong.kr/en/main)

Special Rate for APNOMS 2023 : KRW 130,000 Standard Double / Twin (including 10% tax) / Special rate deadline is August 21st. 2023 (Details, Request Form)

Courtyard Sejong.

As the first Marriott International Hotel in Sejong City, South Korea, Courtyard Sejong boasts a convenient location just 50 minutes away from Seoul. Stay in the heart of the Chungcheong area, near Sejong High-Tech Industrial Complex and the Sejong National Research Complex and steps from the Government Complex. Relax in beautifully appointed rooms and suites with floor-to-ceiling windows overlooking scenic Sejong Lake Park and Sejong City

Please see the webpage at Courtyard Sejong (https://www.marriott.com/en-us/hotels/cjjcy-courtyard-sejong/overview/)

Registration Fees

Attendee Type	Early-Bird (by ~~Aug.02, 2023~~ Aug.12, 2023)	Advance (by ~~Aug.20 2023~~ Aug.30, 2023)	Late (~~After Aug.20 2023~~ Aug.30, 2023)
Full	500 USD or 600,000 KRW	550 USD or 650,000 KRW	600 USD or 700,000 KRW
Student	200 USD or 240,000 KRW	240 USD or 290,000 KRW	280 USD or 330,000 KRW
Extra Banquet Ticket	60 USD or 70,000 KRW	60 USD or 70,000 KRW	60 USD or 70,000 KRW
Exhibitor	200 USD or 240,000 KRW	250 USD or 300,000 KRW	350 USD or 400,000 KRW
Exhibition	2,000,000 KRW	2,000,000 KRW	2,000,000 KRW

- If you want to check your registration status(specifically, online card transaction result), please email to Ji-Won Bang (jiwonbang@kangwon.ac.kr) and ask him with detailed card transaction information.
- For each of all accepted papers, at least one author must register by the Early-Bird due date at the Full rate even if a registrant is a student in order to guarantee their papers to be published in the symposium proceedings
- Presenters must provide the paper number and title of their paper.
- Full registration fee includes proceedings, admissions to tutorial sessions, technical sessions, banquet, three lunches and coffee breaks.
- Student registration fee includes the same as full onsite registration except the banquet is not included.
- Exhibitor registration fee includes banquet, three lunches and coffee breaks.
- Exhibition registration : For more information about the exhibition, please refer to the Call for Exhibitions web page.
- Registration fees will be charged in Korean WON (KRW) only according to local financial regulations.

Payment Methods

- Online Credit Card Payment Advance [Overseas_link, Korea]
  – Online Credit Card Payment Advance(Korea).
  – Credit Card Payment System for Overseas is available only for VISA, Master, Amex and JCB.
  – Overseas payment method is provided by Eximbay and is billed as www.eximbay.com.
    At the very beginning, users have to put their personal information and then click the [payment] button to continue payment process.

- Credit Card Payment by E-Mail
  – You may want to pay registration fee by credit card, but not to use online payment system due to security concern.
  – In this case, please use a hard copy registration form (Word , PDF).
  – Please complete the form to provide registration and credit card information.
  – Scan the completed form in order to make a PDF or image file of it.
  – And then, send it to Prof. Mi-Jung Choi via E-Mail (mjchoi@)kangwon.ac.kr)

- Bank Transfer
  * For USD (United States Dollar) or KRW (Korean Won) transfer
  – Name of Bank: Woori Bank, Seoul, Korea
  – Account No.: 133-118981-13-120
  – Account Holder: Korea Information and Communication Society (KICS)
  – Address of Bank : 1-203, Hoehyeon-dong, Jung-gu, Seoul, Korea
  – Swift Code: HVBKKRSE
  – All bank service charges for bank transfer must be paid by the registrants. Please email us a copy of the remittance statement to us along with this registration form(English: Word, PDF)
  – E-Mail: mjchoi@kangwon.ac.kr

Request an Invoice

You can request an invoice for your registration you made with KICS (The Korea Institute of Communication and Information Sciences), a main sponsor of APNOMS 2023. Just download and fill out the form (Invoice Request Form.docx). And then send it by e-mail to the address (budget@kics.or.kr) . We will send the invoice back to you within 48 hours via your e-mail address.

Refund Policy

There is 100 USD cancellation fee for registration. APNOMS 2023 must receive a written cancellation notice no later than August 20, 2023 to remit the curtailed refund. Refund will not be made after August 31, 2023. Author registration cannot be refunded.

Contact Information

For inquiries related to registration, please contact Prof. Mi-Jung Choi.
E-Mail: mjchoi@kangwon.ac.kr
Tel: +82-33-250-8442

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