# Hong Kong Applied Science and Technology Research Institute
## Industry and University Collaboration Forum (IUCF) 2016
### Smart City & 5G Wireless
# Programme Rundown

| Time | |
|---|---|
| 08:30 – 09:00 | **Registration and Networking** |
| 09:00 – 10:30 | **Corporate Video**<br>**Welcome Remarks**<br>・ Mr Wong Ming-yam, BBS, JP, Chairman of the Board of Directors, ASTRI<br>**Opening Remarks**<br>・ Mr Nicholas W. Yang, JP, Secretary for Innovation and Technology<br>**Keynote: Qianhai and Shenzhen-Hong Kong Cooperation**<br>・ Prof Edward Chen Kwan-yiu, CBE, GBS, JP<br>　President, Qianhai Institute for Innovative Research<br>**Joint Lab Signing Ceremonies**<br>・ HKU-ASTRI Joint Research Laboratory<br>・ ASTRI-21Vianet Joint Research and Development Laboratory |
| 10:30 – 11:00 | **Tea Break & Exhibition** |
| 11:00 – 12:15 | **An Overview of ASTRI's Latest Development**<br>**Smart Living**<br>・ Dr Hou Ji-lei – Head of Qualcomm Research China<br>　*"Leading the World to 5G"*<br>・ Mr Andrew Lee – Managing Director, 21Vianet Group<br>　*"Evolution of SIM for Next Generation Mobile Network"*<br>・ Mr Steve Chu – Vice President, Huawei Technologies and Chief Strategy Officer, HiSilicon<br>　*"IoT-The Biggest Business Story"*<br>・ Customer Testimonial (1) |
| 12:15 – 13:30 | **Lunch Break & Exhibition** |

### Breakout Sessions

| Time | Smart City & IoT<br>(Grand Hall) | Brainstorming Workshop on 5G Wireless<br>(Function Hall) |
|---|---|---|
| 13:30 – 15:15 | **Smart Connectivity**<br>Moderated by: Dr Ieong Mei-kei<br>Chief Technology Officer, ASTRI<br><br>・ Dr Tiger Lin<br>　Chief Executive Officer<br>　CITIC Telecom International<br>　*"Mobile Communication Evolution: Its Drivers and Direction"*<br>・ Mr Fred Sheu<br>　National Technology Officer<br>　Microsoft Hong Kong<br>　*"Digital Transformation for Smart City"*<br>・ Mr Andy Bien<br>　Chief Information Officer<br>　Airport Authority Hong Kong<br>　*"How Smart Devices Make Airports Smarter"*<br>・ Mr Li Ru-yue<br>　Technical Director, ZTE<br>　*"5G Wireless Technologies and Standardisation"*<br>・ Mr Simon Yeung<br>　Executive Director and President, Comba Telecom Systems International Limited | **5G Radio Access Technologies**<br>Moderated by: Prof Huang Kai-bin<br>The University of Hong Kong<br><br>・ Prof Min Sheng<br>　Xidian University, China<br>　*"How Much Gain Can We Get From Network Densification?"*<br>・ Dr Justin Chuang<br>　Vice President, Next Generation Network, ASTRI<br>　*"5G Access Technologies for Next Generation Heterogeneous Networks"*<br>・ Prof Wang Li-chun<br>　National Chiao Tung University, Taiwan<br>　*"SDN/NFV-enabled 5G Wireless: Opportunities and Challenges"*<br>・ Prof Chung Char-dir<br>　National Taiwan University<br>　*"Spectrally Efficient Pilot Waveforms for Channel Estimation in OFDM"* |
| 15:15 – 15:30 | **Tea Break & Exhibition** | |

| | | |
|---|---|---|
| **15:30 – 16:15** | **Smart Mobility** | **5G Networks** |

**15:30 – 16:15**

**Smart Mobility**

- Dr Vanja Subotic
  Director, Product Management for InterDigital IoT Solutions, USA
  *"oneTRANSPORT: A oneM2M™ – Based IoT Solution for the Transport Industry"*
- Prof Guan Yong-liang
  Associate Professor, Nanyang Technological University PI of NTU-NXP® Smart Mobility Test Bed, Singapore
  *"NTU-NXP Smart Mobility Testbed: A Campus-Wide Infrastructure for Connected Cars"*
- Customer Testimonial (2)

**5G Networks**

Moderated by: Prof Huang Jian-wei
The Chinese University of Hong Kong

- Prof Dai Lin
  Associate Professor
  City University of Hong Kong
  *"Capacity Analysis of Large-Scale Distributed Antenna System (DAS): From Cellular DAS to Virtual-Cell Based DAS"*
- Prof Zhang Ying-jun
  The Chinese University of Hong Kong
  *"Randomized Message Passing for a Scalable PHY Layer of CRAN"*
- Prof Phone Lin
  National Taiwan University
  *"A Connection-Driven Mechanism for Energy Saving of Small-Cell Networks"*
- Prof Ma Shao-dan
  University of Macau
  *"Transmission Capacity of Clustered Ad Hoc Networks with Virtual Antenna Array"*

**16:15 – 17:05**

**Panel Discussion**

*"What Will be the Key Driver for Cities to Adopt Future Smart Mobility Technology?"*
Moderated by: Dr Ieong Mei-kei
Chief Technology Officer, ASTRI

- Dr Vanja Subotic
  Director, Product Management for InterDigital IoT Solutions, USA
- Prof Guan Yong-liang
  Associate Professor, Nanyang Technological University PI of NTU-NXP® Smart Mobility Test Bed, Singapore
- Mr Andy Bien
  Chief Information Officer
  Airport Authority Hong Kong
- Dr Henry Wong
  Head of Strategic Wireless Technology and Core Network, Hong Kong Telecommunications (HK) Limited
- Mr Simon Yeung
  Executive Director and President, Comba Telecom Systems International Limited

**Recent Trends in 5G**

Moderated by: Prof Wu Yik-chung
The University of Hong Kong

- Prof Xia Ming-hua
  Sun Yat-sen University, China
  *"Unified Analytical Volume Distribution of the Typical Cell of Poisson-Delaunay Tessellations and Its Application in 5G Small Cell Networks"*
- Prof Chen Min
  Huazhong University of Science and Technology, China
  *"5G Cognitive System"*
- Prof Gao Lin
  Harbin Institute of Technology, China
  *"Mobile Crowdsourced Content Delivery Networks for 5G"*

**17:05**

**End of Programme**

**Panel Discussion**

*"Fog Computing and Networking: A New Paradigm for 5G and IoT Applications"*
Moderated by: Prof Russell Hsing
National Chiao Tung University, Taiwan

- Prof Jiao Bing-li
  Peking University, China
  *"CCFD-Based WiFi for 5G"*
- Prof Tony Quek
  Singapore University of Technology and Design
  *"Enabling 5G Technologies for Future Health Care"*
- Prof Huang Jian-wei
  The Chinese University of Hong Kong
  *"Network Economics for Future Wireless Ecosystems"*
- Prof Pang Ai-chun
  National Taiwan University
  *"Enabling Low-Latency Applications in Fog-Radio Access Network"*

**Concluding Remarks and Next Workshop**
Moderated by: Prof Russell Hsing
National Chiao Tung University, Taiwan

**18:05**

**End of Programme**

*Remarks: The programme is subject to change without prior notice.*

# Speakers' Information

## 1. Mr Wong Ming-yam, BBS, JP

**Biography**

Before his appointment as Chairman of Hong Kong Applied Science and Technology Research Institute ("ASTRI"), Mr Wong Ming-yam served as a member of several Government Boards and Committees for more than 35 years. He is the Honorary Chairman of Hong Kong Electronics & Technologies Association, Honorary Chairman of Hong Kong Critical Components Manufacturers Association, Chairman of the Advisory Committee of the Department of Systems Engineering and Engineering Management of The Chinese University of Hong Kong, Member of Electronic Engineering Department Advisory Committee of City University of Hong Kong, Fellow Member of Hong Kong Green Strategy Alliance, Board Advisor of International Intellectual Property Commercialization Council Hong Kong Chapter, Member of Selection Committee and Hong Kong Mentor, Asia America MultiTechnology Association – Pearl River Delta Chapter Cradle Program, Mentor of Innovation and Technology Scholarship Award Scheme 2016, Chairman of CreateSmart Initiative Vetting Committee of Create Hong Kong, and Ex-officio Member of the Advisory Committee on Innovation and Technology of the Hong Kong SAR.

Mr Wong Ming-yam is the Chairman and Director of InnoLink Investments Limited. He is also the Director of a number of companies: eSPOT Company Limited, eSPOT Lighting Limited, Sanwa Technologies (Holdings) Limited (SEY Company) and Top Brilliant Technology Limited. He is the Non-Executive Director of Sanwa BioTech Limited and Independent Non-Executive Director of DeLight Power Products Limited.

# 2.    Mr Nicholas W. Yang, JP

**Biography**

Mr Yang was appointed Secretary for Innovation and Technology of the fourth-term Government of the Hong Kong Special Administrative Region on 20 November 2015. The Innovation and Technology Bureau is responsible for policy matters on information technology, as well as innovation and technology.

Mr Yang graduated in 1977 from the California Institute of Technology in the United States with a Bachelor of Science in Electrical Engineering and Applied Mathematics.  He pursued further studies in Stanford University and obtained a Master of Science degree in Electrical Engineering in 1978 and a Master of Business Administration degree in 1982. Mr Yang worked as a senior design engineer for Intel Corporation in 1978 and subsequently as a strategic management consultant for Bain & Company. Returning to Hong Kong in 1983, he joined Shell Electric Mfg. (Holdings) Limited as its Executive Director and Deputy Group Managing Director. He was senior consultant and director of several venture capital and private equity investment firms in 2002. Mr Yang was appointed as the Chief Executive Officer of the Hong Kong Cyberport Management Company Limited in 2003 and was an Executive Vice President of the Hong Kong Polytechnic University from 2010 to February 2015.  In March 2015, he was appointed by the Chief Executive of the Hong Kong Special Administrative Region Government as Advisor on Innovation and Technology, and a Non-official Member of the Executive Council which is the Chief Executive's top advising body.

# 3. Prof Edward Chen Kwan-yiu, CBE, GBS, JP

**Biography**

Prof Chen is President of Qianhai Institute for Innovative Research, Chairman of HKU SPACE (School of Professional and Continuing Education), Council Chairman of Centennial College, Distinguished Institute Fellow of The University of Hong Kong, Honorary Professor of the Open University of Hong Kong, and independent non-executive director of First Pacific Company, Delta Asia Financial Group, Hang Seng Qianhai Fund Management Company and Wharf Holdings.

He is former President of Lingnan University, former Member of the Executive Council and the Legislative Council of Hong Kong, former Chairman of the Hong Kong Consumer Council, and former Chairman of the Hong Kong Committee for Pacific Economic Cooperation. He was at various times Visiting Professor at the University of California (Davis).

He was educated at the University of Hong Kong (B.A and M.Soc.Sc) and Oxford University (D.Phil). He is a Justice of the Peace and was awarded CBE by the British Hong Kong Government and GBS by the Hong Kong SAR Government. He received honorary degrees from the University of Hong Kong, the Open University of Hong Kong and Plymouth University.

**Title**

Qianhai and Shenzhen-Hong Kong Cooperation

**Abstract**

Shenzhen-HK cooperation has been less close and deep than expected. Qianhai Shenzhen was established to enhance cooperation via a Qianhai-HK platform and for the achievement of some national development goals. The major barrier to closer Shenzhen-HK cooperation is not only cultural and institutional, but more importantly the need for better cross-border interflow of resources

# 4.  Dr Hou Ji-lei

### Biography

Dr Ji-lei Hou is a Senior Director at Qualcomm and currently the Head of Qualcomm Research China. He obtained his Ph.D from University of California, San Diego and joined Qualcomm in 2003. He has made substantial contributions in standards technology evolution and product commercialization for various wireless 3G/4G/5G standards. In 2011, he moved to his current role. Qualcomm Research China aims to develop innovative enabling technology and applications that benefit Qualcomm business interests in the Greater China region, including wireless, mobile computing, and robotics. Dr Hou is also responsible for Qualcomm Greater China University Relation program and helps the Qualcomm China marketing team to consult China Telecom Operators regarding technology evolution strategy. He is an IEEE Senior Member. He was selected to participate in a few Frontiers of Engineering (FOE) Symposia organized by US and/or China National Academies of Engineering. He is also a member of China FIRST (Robotics) Competition Committee.

### Title

Leading the World to 5G

### Abstract

We first introduce Qualcomm 5G vision as a unifying connectivity fabric for future innovation. It would pioneer new technologies to meet 5G NR requirements; it would be scalable to address diverse service and devices and natively support all different spectrum types including new sharing paradigms. We will then present Qualcomm state-of-the-art 5G NR prototypes at sub-6 GHz for high-throughput low-latency and mmW with robust mobility. Towards the end, we will introduce the 5G NR 3GPP standardization progress aiming for 2H2019 commercial launch. Finally, we will stress the modem and RFFE leadership from Qualcomm to drive the industry towards 5G success.

# 5.  Mr Andrew Lee

**Biography**

Mr Andrew Lee has more than 20 years' experience in telecommunications and Internet industry and is currently working for 21Vianet Group as its Managing Director in Hong Kong. He has previously been a senior executive in various ICT companies including Hutchison Telecommunications, Asia Global Crossing, and Motorola.

**Title**

Evolution of SIM for next generation mobile network

**Abstract**

1. Introduction of 21Vianet
2. What is soft-SIM
3. The current status of soft-SIM development
4. What is the business model of soft-SIM
5. The impact of soft-SIM
5.1 For the users
5.2 For the network operators
5.3 For the device manufacturers
5.4 For the application & content developer
5.5 For the value added service providers
5.6 For the mobile device & service distributors
6. What are the opportunities from the launch of soft-SIM
7. What is the timeline
8. Conclusion

# 6.   Mr Steve Chu

**Biography**

Mr Steve Chu, Chief Strategy Officer of HiSilicon and Vice President of Huawei, has 19 years of experience in the field of communication, semiconductor, strategy and investment. He holds B.Sc and M.Sc degrees from Xi'an Jiaotong University, under the guidance of Chinese Academy of Science Fellow, Zheng Nanning.

Steve holds several international patents and is a pioneer in China and the World's modern mobile communications and microelectronics. He was one of the key persons in charge of China's first commercial base station project; he led the development of World's first SDR broadband base station prototype; he released China's first WCDMA+GSM smartphone chip solution and world's first TD-SCDMA smartphone chip solution. He also played an important role in the formation of the first wide-area IOT standard, NB-IOT.

Steve is also an innovator and created Huawei incubator that pioneered in several fields in high-speed rail communication, e-health and new energy. Moreover, he established an experienced investment team which succeeded in completing dozens of semiconductor investment and acquisition projects in China, UK, Belgium, Israel and Singapore.

Recently, Steve initiated the successful formation of joint venture among four international parties: SMIC, Huawei, IMEC and Qualcomm, and was received by Chinese president Xi and His Majesty King Philippe of Belgium at the signing ceremony.

**Title**

IoT-The Biggest Business Story

**Abstract**

未来物联网的连接点数将是智能手机的数十倍，根据梅特卡夫定律其网络的总商业价值将是智能手机的上千倍，未来全球最有价值的公司可能来自物联网产业。NB-IoT 是由华为公司最早研发的窄带物联网技术，被 ITU、ETSI、3GPP 等国际标准组织接纳为国际标准，并被中国标准组织宣布接纳为中国技术标准。NB-IoT 使用 LTE 技术，网络覆盖广泛，消除了所有传统物联网技术碎片化、局域化、无盈利模式的缺陷，将带领物联网事业进入新时代。 华为将秉承贡献、开放与合作的理念，为更多第三方合作伙伴提供商业机会，共享商业价值.

# 7. Dr Ieong Mei-kei

**Biography**

Dr Ieong joined ASTRI as Chief Technology Officer in January 2016. Before his appointment, Dr. Ieong held various leadership positions in Taiwan Semiconductor Manufacturing Company and IBM Research. He holds a PhD degree in Electrical and Computer Engineering from University of Massachusetts, Amherst and an MBA degree from the MIT Sloan Fellows Program at MIT School of Management.

Dr Ieong brings his rich international experience in managing large complex research and development projects, marketing, commercialisation. He has published more than 100 papers in journals and conference proceedings, more than 80 patents and has received more than 2,000 citations.

Dr Ieong has received many awards over his career such as IBM Master Inventor Award, IBM Outstanding Technical Achievement Award, and IBM Corporate Award. He is an IEEE Fellow in recognition of his leadership and contributions to Complementary Metal-Oxide-Semiconductor (CMOS) Device Technology.

# 8. Dr Tiger Lin

## Biography

Dr Lin Zhenhui, has been an Executive Director and the Chief Executive Officer ("CEO") of CITIC Telecom International since 1 January 2015. Dr Lin is also the Vice Chairman of CTM and China Enterprise ICT Solutions Limited ("CEC", a subsidiary of the Company), and a director of CITIC Telecom International CPC Limited. Dr Lin is a professorate senior engineer. He obtained a Bachelor degree of Engineering from the Beijing University of Post and Telecommunications, a Master degree of Business Administration from the Australian National University and a Doctor degree of Business Administration from the Hong Kong Polytechnic University. Dr Lin was formerly the Deputy Managing Director of Guangdong China Mobile Co., Ltd. ° (廣東移動有限責任公司) as well as Chairman and General Manager of China Mobile Group Yunnan Company Limited. Before joining the Company, Dr Lin was the Chairman of China Mobile Hong Kong Company Limited and the Chairman and CEO of China Mobile International Limited. Dr Lin has been conferred the national science and technology progress award (second class) and China provincial management innovation award (first class). Dr Lin is also a director of Hong Kong Applied Science and Technology Research Institute Company Limited.

## Title

Mobile Communication Evolution: Its Drivers and Direction

## Abstract

Yesterday 2G/3G, Today 4G. As a telecom industry veteran, Dr. Tiger Lin will share his opinion about mobile communication's evolution from 1G, 2G, 3G to 4G. He will analyze the key drivers behind the evolution, argue why the quick acceptance of 4G worldwide is more reasonable and foreseeable than 3G's. Dr. Lin will share his view on the direction of 5G and the next generation ICT technology, and how we can embrace with the changing world.

# 9.  Mr Fred Sheu
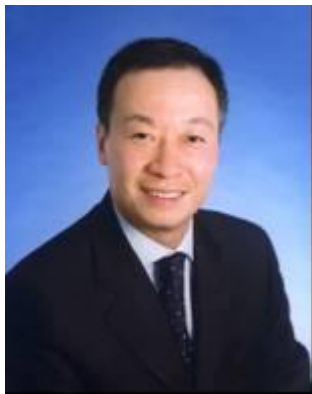
**Biography**

As National Technology Officer at Microsoft Hong Kong, Mr Sheu supports policy decision and delivers technologically relevant and scalable solutions into the Hong Kong market. His main objectives are to align IT value propositions to public policies in such areas as healthcare, education, the environment, and local social and economic development; and to promote a digital agenda in top policy areas, including innovation, security and privacy, technology neutrality, accessibility, and interoperability.

**Title**

Digital Transformation for Smart City

**Abstract**

Today's cities face challenges, including shrinking economic growth, outdated infrastructure and a growing and aging population. They need to deliver enhanced services and administrative capabilities that put people first in order to help them to achieve more. In particular, both citizens and businesses increasingly expect seamless, personalized, and convenient self-service options. This presentation will share how cities can transform digital services to innovate people-first services and solutions to provide better services and quality of life for their citizens.

# 10. Mr Andy Bien

### Biography

Currently the Chief Information Officer (CIO) of the Airport Authority of Hong Kong, Mr Bien has been in the Information Technology (IT) industry for over thirty years.

Trained as an engineer, his technical expertise spans from hardware design, software development to lectureship in tertiary institution. In addition to his technical background, he has gained extensive business and management experience through general management roles in the finance, telecommunication, logistics, transportation and aviation industries.

As Chief Information Officer, he is responsible for the strategic planning and provisioning of IT services to the Hong Kong International Airport and its community. He is also active in engaging community work in promoting IT industry development, green IT, innovation and talent cultivation.

Mr Bien obtained his BSc Degree (Hons) in Computer Engineering from Queen's University, Canada in 1981 and his MSc Degree in Communication Engineering from Imperial College, University of London in 1986.

### Title

How smart devices make airports smarter

### Abstract

The presentation will talk about the Smart Airport vision of HKIA with illustration of current implementation and planned initiatives around mobility and IoT

# 11. Mr Ru-yue YN Li

**Biography**

Mr Ru-yue YN Li is currently a Technical Director of Wireless Product R&D in ZTE Corporation.  He received his BEng(EEE) degree from the University of Hong Kong in 2000 and M.S. degree in Electrical Engineering from Stanford University in 2002.  His research focuses on physical layer system algorithms and network optimization in the cellular communication area.  He is actively involved in research and global standardization activities in 5G wireless.  His interest topics include massive MIMO, small cell, interference coordination, D2D, etc.  He is currently leading the project on massive MIMO research and standardization in ZTE.  Prior to ZTE, he worked for several telecommunication and semiconductor companies including Qualcomm and Marvell Semiconductor on the projects related to 2G/3G baseband algorithm design and 4G LTE standardization.

**Title**

5G Wireless Technologies and Standardisation

**Abstract**

Fifth-generation wireless technology, or 5G, has been a hot topic in the telecommunications industry. The 5G key technologies include massive MIMO, millimeter wave communication, machine type communication (MTC)/Internet of Things (IoT), Vehicle-to-X (V2X) communication, new multiple access scheme, etc.  These technologies can be applied to a broad range of usage scenarios in a smart city including enhanced mobile broadband (eMBB), massive MTC (mMTC) and ultra-reliable and low latency communication (URLLC). This talk is about the recent trends on 5G wireless key technologies and the corresponding standardisation activities in the industry.

## 12.  Mr Simon Yeung

**Biography**

Mr Simon Yeung is an executive director of Comba Telecom Systems Holding Limited and president of Comba Telecom Systems International Limited, an indirect wholly-owned subsidiary of the Company.  At Comba Telecom, Simon is responsible for international business and strategic development amongst others.  Prior to joining Comba Telecom, Simon was the vice president of strategy and business development and a founding employee of LGC Wireless, Inc. ("LGC") based in the Silicon Valley, USA which was successfully acquired by Commscope Inc. He also held various positions at LGC including general manager, director of technical marketing, general manager of Asia Pacific region and principal engineer.

Simon holds a master of science degree in engineering from University of California at Berkeley and a bachelor of science degree in electrical engineering from Purdue University, USA. He has over 20 years of experience in the telecom industry and holds various patents in wireless technology.

# 13. Dr Vanja Subotic

### Biography

Dr Vanja Subotic is a Director of Product Management for InterDigital IoT Solutions group based out of New York City. In her current role, Dr Subotic leads product planning, customer engagements, partner management, trade shows participation, and other product marketing activities. This touches various industry segments including industrial, healthcare and smart cities. Prior to her work at InterDigital, Dr Subotic held a variety of roles that included consulting, program and solutions management, strategy planning, carrier sales of next-generation solutions, and doctoral research on wireless communications systems. Dr Subotic holds Bachelor and Doctorate degrees in Electrical Engineering from the University of Western Ontario in London, Canada.

### Title

oneTRANSPORT: A oneM2M$^{TM}$ – Based IoT Solution for the Transport Industry

### Abstract

In this talk, we will discuss oneTRANSPORT project requirements, lessons learned from the deployment, and the overall role of InterDigital's IoT Solutions. oneTRANSPORT, a public-private sector initiative comprised of eleven organizations is currently conducting a trial of an intelligent transport system to support multiple IoT applications. The public-sector participants include four county authorities as well as the UK's highways transport agency, which are responsible for transportation services for local residents and transiting commuters. They also serve travelers who may be journeying to major events such as the annual Formula 1 race or more frequent Premier League football games. The private sector participants include transportation sector experts, IoT technology providers, contractors managing transportation sensors, analytics specialists, and application developers. We will detail how oneTRANSPORT relies on InterDigital's IoT platform which is based on the oneM2MTM standard. We will discuss how it brings diverse data assets into a common environment including sensor feeds, geographic information system data sets and planning information about road repairs. We will also review through other examples how InterDigital's IoT solutions are reusable and eliminate silo solutions, unify multiple interfaces, are extensible to new data sets, and help service providers avoid vendor and technology lock-ins.

# 14. Prof Guan Yong-liang

**Biography**

Prof Yong-liang Guan (http://www.ntu.edu.sg/home/eylguan/) obtained his Ph.D. degree from the Imperial College of London, UK, and Bachelor of Engineering degree with first class honors from the National University of Singapore. He is a tenured associate professor at the School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore, where he was a Head of Division in 2011-2014 and the Director of the Positioning and Wireless Technology Center in 2007-2011. His research interests broadly include coding and signal processing for communication systems, storage systems and information security systems. He has published an invited monograph, 3 book chapters, and over 350 journal and conference papers. He is an Associate Editor of the IEEE Transactions on Vehicular Technology, and was an AE of the IEEE Signal Processing Letter. He has led 12 past and present externally funded research projects on V2X communication, wireless communication signal processing, coding for 10Tb-per-sq-inch magnetic recording, acoustic telemetry for drilling application, etc., with cumulative grant of over SGD 9 million. He also has 3 granted patents.

**Title**

NTU-NXP Smart Mobility Testbed: A Campus-Wide Infrastructure for Connected Cars

**Abstract**

V2X (vehicle to everything) communication refers to a new vehicular WiFi technology that allows moving cars to communicate not just directly with each other (i.e. in ad-hoc mode), but also with "access points" installed on lamp poles or roadside infrastructure. This technology promises to enhance road safety, cut driving time, save fuel, augment GPS, drive big data, even enable new road pricing. International standards have been defined. Market products have emerged. In this talk, I will give an overview of a compus-wide V2X testbed jointly developed by NTU and NXP that conforms to the IEEE *WAVE* standard suite, the applications that the testbed is capable of supporting, and the research effort that are conducted in conjunction with it.

# 15.  Prof Huang Kai-bin

**Biography**

Prof Kai-bin Huang (M'08-SM'13) received his B.Eng. (first-class hons.) and his M.Eng. from the National University of Singapore, respectively, and his Ph.D. degree from The University of Texas at Austin (UT Austin), all in electrical engineering.

Since Jan. 2014, Prof Huang has been an assistant professor in the Department of Electrical and Electronic Engineering (EEE) at the University of Hong Kong. He is an adjunct professor in the School of EEE at Yonsei University in S. Korea. He used to be a faculty member in the Department of Applied Mathematics (AMA) at the Hong Kong Polytechnic University (PolyU) and the Department of EEE at Yonsei University. His research interests focus on the analysis and design of wireless networks using stochastic geometry and multi-antenna techniques.

He frequently serves on the technical program committees of major IEEE conferences in wireless communications. He will be the lead chair for the Wireless Comm. Symp. of IEEE Globecom 2017 and has been the technical chair/co-chair for the IEEE CTW 2013, the Comm. Theory Symp. of IEEE GLOBECOM 2014, and the Adv. Topics in Wireless Comm. Symp. of IEEE/CIC ICCC 2014 and has been the track chair/co-chair for IEEE PIMRC 2015, IEE VTC Spring 2013, Asilomar 2011 and IEEE WCNC 2011. Currently, he is an editor for the newly established IEEE Transactions on Green Communications and Networking, and IEEE Transactions on Wireless Communications. He was an editor for  IEEE Journal on Selected Areas in Communications (JSAC) series on Green Communications and Networking in 2015-2016, for IEEE Wireless Communications Letters in 2011-2016, and for IEEE/KICS Journal of Communication and Networks in 2009-2015. He edited a JSAC 2015 special issue on communications powered by energy harvesting. He was an elected member of the SPCOM Technical Committee of the IEEE Signal Processing Society in 2012-2015. Prof Huang received the 2015 IEEE ComSoc Asia Pacific Outstanding Paper Award, Outstanding Teaching Award from Yonsei, Motorola Partnerships in Research Grant, the University Continuing Fellowship from UT Austin, and a Best Paper Award from IEEE GLOBECOM 2006 and PolyU AMA in 2013.

# 16. Prof Min Sheng

### Biography

Prof Min Sheng (M 03-SM 16) received her M.S. and Ph.D. degrees in communication and information systems from Xidian University, Shaanxi, China, in 2000 and 2004, respectively. She has been a faculty member of the School of Telecommunications Engineering at Xidian University since 2000, where she is currently a Full professor with the State Key Laboratory of ISN. Her current research interests include interference and resource management in heterogeneous networks, ultra dense networks (UDN), self-organizing networks (SON), big data processing, green communications, and satellite networks. She has published 2 books and over 130 papers in refereed journals and conference proceedings. She was honored with the Second Prize for the State Technological Innovation Award in 2014, the New Century Excellent Talents in University by the Ministry of Education of China, the Young Teachers Award from the Fok Ying-Tong Education Foundation, China, in 2008, and the Best Paper Award at IEEE/CIC ICCC 2013.

### Title

How much gain can we get from network densification?

### Abstract

Besides advanced telecommunications techniques, the most prominent evolution of wireless networks is the densification of network deployment. In particular, the increasing access points/users density and reduced cell size significantly enhance spatial reuse, thereby improving network capacity. Nevertheless, does network ultra-densification and over-deployment always boost the performance of wireless networks? In this talk, we first discuss the near-field propagation features in densely deployed network and verify through experimental results the validity of the proposed near-field propagation model. Considering near-field propagation, we further explore how much network capacity gain can be obtained throughput network densification. Surprisingly, aided by network densification, it is shown that more than 1000-fold network capacity gain could be achieved compared to the long-term evolution (LTE) system. Meanwhile, as near-field propagation makes interference more complicated and difficult to handle, we shed light on the key challenges of applying interference management in ultra-dense wireless networks and possible solutions are presented to suggest future directions.

# 17. Dr Justin Chuang

**Biography**

Dr Justin Chuang, Vice President, Next Generation Network, ASTRI. Dr Chuang joined ASTRI in December 2011 with nearly three decades of experience in research, teaching, development and engineering in communications technologies. He received his B.Sc. in Electrical Engineering from National Taiwan University in 1977, and M.Sc. and Ph.D., also in Electrical Engineering, from Michigan State University in 1980 and 1983 respectively. He was elected an IEEE Fellow in 1997. Dr Chuang has held various positions in several multinational corporations including Broadcom Corporation, AT&T, Bellcore, and General Electric (GE). Furthermore, he has also served as Professor in the Department of Electrical and Electronic Engineering of the Hong Kong University of Science and Technology (HKUST) from 1993 to 1996. Dr Chuang is experienced in taking research through engineering to commercialization for wireless and cellular systems, from chip sets to platform solutions.

In the 1980s he studied personal and mobile communications at GE and Bellcore (Telcordia, now a part of Ericsson) when modern digital wireless communications technology was at its infancy. The 1990s saw Dr Chuang active in teaching and research in Asia and involved in development of cellular systems for 3G and beyond. At HKUST, he established the teaching and research program in wireless communications and actively supported R&D activities in Taiwan and the Chinese mainland. From 1996 to 2001, he was with AT&T Labs where he worked closely with AT&T Wireless on 3G systems evolution based on EDGE and WCDMA. In 2001 he started his career in development and engineering in the IC industry, which is crucial in bringing wireless services to affordable consumer units, first as the Chief Scientist of Mobilink Telecom and later with Broadcom following its acquisition of Mobilink in 2002. Prior to joining ASTRI, Dr Chuang was Senior Director of Broadcom. During this period, his team was responsible for providing modem software and platform supports for Broadcom's mobile communications chipsets from its inception.

At ASTRI, Dr Chuang and his team are leveraging the collaborative efforts among government, industry, university and research organizations to drive the advancement and commercialization of enabling technologies for 4G and beyond.

**Title**

5G Access Technologies for Next Generation Heterogeneous Networks

**Abstract**

Recently, 5G standardization took a major step forward driven by 3GPP's 5G NR (New Radio) specification efforts. The transition to 5G from 4G will involve both revolution and evolution, where 5G will be built upon disruptive technologies along with enhancements on 4G access technologies and network architecture. In ASTRI, we are innovating to develop 5G enabling algorithms and products that can realize 5G-like experience. In this presentation, first, we will present ASTRI's recent technology development towards 5G including C-RAN (configurable radio access network) base station and MEC (mobile edge computing) solutions. Second, we will introduce ASTRI's on-going R&D work on 5G access technologies for next generation heterogeneous networks, which are expected to include a mix of cell types and radio technologies working together seamlessly. Towards that end, ASTRI is developing a proof-of-concept 5G base station prototype and a simulation platform to support millimeter wave access, multi-RAT (Radio Access Technology) coexistence and interworking, and joint transmission and reception with multiple transmission and reception points. Finally, we will share ASTRI's 5G strategy towards contributing to 5G standardization and adding value to 4G-to-5G products.

# 18. Prof Wang Li-chun

## Biography

Prof Li-chun Wang (M'96-SM'06-F'11) received his 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.

Prof 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 architecture and radio resource management in wireless networks. He was the co-recipient of the 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.

## Title

SDN/NFV-enabled 5G Wireless: Opportunities and Challenges

## Abstract

Software-Defined Networking (SDN) is a promising technology that can provide flexibility, scalability and performance enhancement for the next generation versatile networking environments. SDN aims at making the behaviors of the network devices programmable by separating a centralized control element (brain) from the distributed forwarding (muscle) functions, with an emphasis on network service orchestration and automation. On the other hand, network function virtualization (NFV), initiated by a consortium of service providers, attempts to accelerate service innovation and provisioning, and reduce increasingly high CAPEX and OPEX of complex hardware-based appliances. NFV exploiting the standard IT virtualization technologies to decouple the network functions, such as caching, DNS, etc., from proprietary hardware appliances, focusing on network services optimization. Since SDN and NFV adopt software-based approach, they share many common goals and can be mutually beneficial, thereby making integrated SDN/NFV more compelling in supporting more efficient orchestration, virtualization, and automation for future network services and management.

As we move into the era of 5G wireless communications, SDN/NFV will play an even more important role in providing more versatile value added services. SDN/NFV-enabled 5G wireless can help achieve the ultimate goal of providing a personalized network for each individual customer of the next generation mobile network. The management and operation of SDN/NFV-enabled 5G wireless, however, are different from traditional cellular networks, and need to rethink how to exploit the potentials of SDN/NFV and deal with its corresponding issues.

In this talk, we will give some examples of SDN/NFV-enabled 5G wireless systems, including load-balancing machine-to-machine (M2M) networks, delay-guarantee flow traversal mechanism for secure mobile network, traffic-aware video streaming network, and energy-efficient ultra-dense small cells. At the end of this presentation, we will highlight some open issues of SDN/NFV-enabled 5G wireless systems and hope to inspire more innovative ideas to enrich this exciting field further.

# 19. Prof Chung Char-dir

**Biography**

Prof Char-dir Chung (S'87-M'89-SM'03-F'09) received his B.S. degree in electrical engineering from the National Taiwan University, Taipei, Taiwan in 1983, and his M.S. and Ph.D. degrees in electrical engineering from the University of Southern California, Los Angeles in 1986 and 1989, respectively.

From 1989 to 1992, Prof Chung was with the LinCom Corporation, Los Angeles, where he worked on analytical and simulation modeling of scientific and military satellite communication systems. From 1992 to 2005, he joined the faculty of the National Central University (NCU) in Taiwan. At NCU, he founded the Advanced Communication Laboratory in 1998, the Graduate Institute of Communication Engineering in 2000 and the Communication Engineering Department in 2003, and was the founding heads of these organizations. Since 2005, he has been on the faculty of the National Taiwan University (NTU), where he is now a Professor of the Electrical Engineering Department and the Graduate Institute of Communication Engineering. At NTU, he was endowed with SiS Technology Chair Professor from 2009 to 2010. Prof Chung is a Fellow of the IEEE. His current research interest is in digital modulation theory, with special emphasis on wireless communications.

Prof Chung has been very active in industrial development and government services in Taiwan. From 2004 to 2008, he served as the Chairman of the Wireless System Group of the National Science and Technology Program for Telecommunications, and the founding Chairman of the Taiwan Broadband Wireless Communications Industry Alliance. Since 2001, Prof Chung joined several Technology Review Boards of the Ministry of Economic Affairs, and acted as the Chairman of the Board of Computer, Consumer Electronics, Communications, Optoelectronics, and Semiconductor Electronics from 2005 to 2008 and the Board of the Technologies and Applications from 2012 to 2013. Dr. Chung has acted as Deputy Executive Secretary of the Science and Technology Advisory Group and of the National Information and Communication Security Taskforce during 2008-2011, Executive Secretary of the Digital Convergence Taskforce during 2011-2012 and of the National Information and Communication Initiative Committee since 2014, Member and Executive Secretary of the Board of Science and Technology during 2014-2016, and Minister without Portfolio (in Science and Technology) in 2016, all under the Executive Yuan (the Cabinet) and has been involved in cross-ministry national policy making and coordination in a variety of science and technology areas including information and communications, digital content, digital convergence, electronics, technological innovation, biotechnology, agrobiology, talent cultivation, etc.

**Title**

Spectrally Efficient Pilot Waveforms for Channel Estimation in OFDM

**Abstract**

Pilot-aided channel estimation is essential to orthogonal frequency division multiplexing systems and standards. Under the system setup that data and pilot waveforms are processed individually for enhancing the spectral efficiency of the composite waveform, pilot patterns are designed to jointly optimize channel estimation on quasistatic multipath channels and provide extremely high spectral compactness by suppressing spectral sidelobes. Specifically, a general constraint on pilot pattern is developed to endow the pilot waveform with very small spectral sidelobes and thus compact spectrum. Using the constraint, systematic multiple-stage design procedures are proposed to develop the desired pilot patterns achieving Cramér Rao bound for channel estimation on quasistatic multipath channels while providing fast decaying spectral sidelobes. Among the demonstrated pilot patterns achieving optimum channel estimation, the pilot waveforms using A- and B-typed pilot patterns developed from the procedures are shown to exhibit higher spectral compactness than conventional pilot waveforms. Besides, C-typed pilot pattern that exploits extremely high spectral compactness without resort to channel estimation optimization is also developed. By sacrificing a slight loss in channel estimation, the pilot waveforms using C-typed pilot pattern are shown to exhibit spectrums approaching the Nyquist spectrum.

# 20.  Prof Huang Jian-wei

**Biography**

Prof Jian-wei Huang (S'01-M'06-SM'11-F'16) is an Associate Professor and Director of the Network Communications and Economics Lab (ncel.ie.cuhk.edu.hk), in the Department of Information Engineering at the Chinese University of Hong Kong. He received his Ph.D. degree from Northwestern University in 2005, and worked as a Postdoc Research Associate at Princeton University during 2005-2007. He is the co-recipient of 8 international Best Paper Awards, including IEEE Marconi Prize Paper Award in Wireless Communications in 2011. He has co-authored five books: "Wireless Network Pricing", "Monotonic Optimization in Communication and Networking Systems", "Cognitive Mobile Virtual Network Operator Games", "Social Cognitive Radio Networks", and "Economics of Database - Assisted Spectrum Sharing".  He has served as an Associate Editor of IEEE Transactions on Cognitive Communications and Networking, IEEE Transactions on Wireless Communications, and IEEE Journal on Selected Areas in Communications - Cognitive Radio Series. He is the Vice Chair of IEEE ComSoc Cognitive Network Technical Committee and the Past Chair of IEEE ComSoc Multimedia Communications Technical Committee. He is a Fellow of the IEEE and a Distinguished Lecturer of IEEE Communications Society.

**Title**

Network Economics for Future Wireless Ecosystems

**Abstract**

Today's wireless networks are highly complex, carry heterogeneous traffic in diverse environments, and are often owned by multiple profit-making entities. To successfully maintain, optimize, and upgrade such large distributed wireless networks, it is important to design new economic incentive mechanisms as well as develop new technologies. We will discuss some of our recent work on the network economics of future wireless ecosystems, and outline some of the challenges and opportunities.

# 21.  Prof Dai Lin

## Biography

Prof Lin Dai (S'00-M'03-SM'13) received her B.S. degree from Huazhong University of Science and Technology, Wuhan, China, in 1998, and her M.S. and Ph.D. degrees from Tsinghua University, Beijing, China, in 2003, all in electronic engineering.

She was a postdoctoral fellow at the Hong Kong University of Science and Technology and University of Delaware. Since 2007, she has been with City University of Hong Kong, where she is an associate professor. She has broad interest in communications and networking theory, with special interest in wireless communications. She was a co-recipient of the Best Paper Award at the IEEE Wireless Communications and Networking Conference (WCNC) 2007 and the IEEE Marconi Prize Paper Award in 2009.

## Title

Capacity Analysis of Large-Scale Distributed Antenna System (DAS): From Cellular DAS to Virtual-Cell Based DAS

## Abstract

The distributed antenna system (DAS) has become a promising candidate for next-generation (5G) mobile communication systems. In DASs, many remote antenna ports are geographically distributed over a large area and connected to a central processor by fiber or coaxial cable. Although the idea of DAS was originally proposed to cover the dead spots in indoor wireless communication systems, it has attracted considerable attention from both industry and academia in recent years, and been applied to cellular systems with the cutting-edge technologies such as small cells and the Cloud Radio Access Network (C-RAN).

For cellular systems, the use of distributed base-station (BS) antennas enables efficient utilization of spatial resources, which, on the other hand, also significantly complicates the channel modeling and performance analysis. In this talk, I will introduce my recent work on the capacity analysis of large-scale cellular DASs. I will start from a single-cell multi-user system, and then extend it to the multi-cell case. I will show that with distributed BS antennas, despite substantial gains on both the uplink sum capacity and downlink sum rate owing to the reduction of the inter-cell interference level, the cell-edge problem could be exacerbated. To demonstrate that the performance disparity originates from the cellular structure rather than the BS antenna layout, I will further introduce the concept of "virtual cell" and show that a uniform inter-cell interference density can be achieved in a DAS if each user chooses a few surrounding BS antennas to form its virtual cell. By doing so, each BS antenna serves a declining number of users as the density of BS antennas increases, indicating good scalability that is much appreciated in a large-scale network. I will conclude the

talk by discussing the implications to cutting-edge cellular technologies such as small cells and pCell.

## 22. Prof Zhang Ying-jun

**Biography**

Prof Ying-jun (Angela) Zhang received her Ph.D. degree in Electrical and Electronic Engineering from the Hong Kong University of Science and Technology, Hong Kong in 2004. Since 2005, she has been with Department of Information Engineering, The Chinese University of Hong Kong, where she is currently an Associate Professor. Her research interests include mainly wireless communications systems and smart power systems, in particular optimization techniques for such systems.

She is an Executive Editor of the IEEE Transactions on Wireless Communications. She is also an Associate Editor of the IEEE Transactions on Communications. Previously, she served many years as an Associate Editor of the IEEE Transactions on Wireless Communications, Security and Communications Networks (Wiley), and a Feature Topic in the IEEE Communications Magazine. She has served as a Workshop Chair of IEEE ICCC 2014 and 2013, TPC Vice Chair of Wireless Networks and Security Track of IEEE VTC 2014, TPC Vice-Chair of Wireless Communications Track of IEEE CCNC 2013, TPC Co-Chair of Wireless Communications Symposium of the IEEE GLOBECOM 2012, Publication Chair of the IEEE TTM 2011, TPC Co-Chair of Communication Theory Symposium of the IEEE ICC 2009, Track Chair of ICCCN 2007, and Publicity Chair of the IEEE MASS 2007. She was a Co-Chair of the IEEE ComSoc Multimedia Communications Technical Committee and the IEEE Communication Society GOLD Coordinator.

She was the co-recipient of the 2014 IEEE ComSoc APB Outstanding Paper Award, the 2013 IEEE SmartgridComm Best Paper Award, and the 2011 IEEE Marconi Prize Paper Award on Wireless Communications. She was also the recipient of the Young Researcher Award from the Chinese University of Hong Kong in 2011. As the only winner from engineering science, she has won the Hong Kong Young Scientist Award 2006, conferred by the Hong Kong Institution of Science. Prof Zhang is a Fellow of IET.

**Title**

Randomized message passing for a scalable PHY layer of CRAN

**Abstract**

With centralized processing, cooperative radio, realtime cloud computing, and clean infrastructure, Cloud Radio Access Network (CRAN) is a "future proof" solution to sustain the mobile data explosion in future wireless networks. The technology holds great potential in enhancing future wireless systems with necessary capability to accommodate unprecedented traffic demand. However, cloud wireless systems inevitably encounter scalability issues in terms of computational and implementation complexities. This talk discusses the challenges and recent developments in technologies that potentially address the scalability issues of CRANs. In particular, I will focus on a randomized Gaussian message passing algorithm to achieve perfect scalability and convergence in the PHY layer of CRANs.

## 23. Prof Phone Lin

**Biography**

Prof Phone Lin is a Professor at National Taiwan University (NTU), holding professorship in the Department of Computer Science and Information Engineering, Graduate Institute of Networking and Multimedia, Telecommunications Research Center of College of EECS, and Graduate Institute of Medical Device and Imaging, Collage of Medicine.

Prof Lin serves on the editorial boards of IEEE Trans. on Vehicular Technology, IEEE Wireless Communications Magazine, IEEE Network Magazine, IEEE Internet of Things Journal, etc. He has also been involved in several prestigious conferences, such as holding, Local Arrangement Co-Chair, IEEE VTC2010-Spring, Taipei, Taiwan, the Technical Program Chair of WPMC 2012, Co-Chair of the Wireless Networking Symposium of IEEE Globecom 2014, and TPC member of Infocom 2010-2014. He was Chair of IEEE Vehicular Technology Society Taipei Chapter 2014-2015.

Prof Lin served as Associate Chairman, Department of Computer Science and Information Engineering, National Taiwan University from 2010-2011, and as Director in Computer and Information Networking Center at National Taiwan University from 2005-2009. Prof Lin served as technical consultants for major corporations in Taiwan including Telcordia Applied Research Center Taiwan, Institute for Information Industry (III), Far EasTone Telecommunications, and Industrial Technology Research Institute of Taiwan, and Chunghwa Telecommunications.

Prof Lin's current research interests include "Fog Networks", "Machine to Machine (M2M)/Internet of Things (IoT)", "Software Defined Networks (SDN)", "Smart Data Pricing", "Relation, Privacy, Security of Social Networks", "Decision Process" and "Performance Modeling". Prof Lin has received many prestigious technical research/service awards, such as The Outstanding Research Award, Minstry of Science and Technology, Taiwan in 2016, The Best Young Researcher of IEEE ComSoc Asia-Pacific Young Researcher Award in 2007, The Distinguished Electrical Engineering Professor Award of the Chinese Institute of Electrical Engineering in 2012, Ten Outstanding Young Persons Award of Taiwan (Science & Technology) in 2009. Prof Lin's email address is plin@csie.ntu.edu.tw

**Title**

A Connection-Driven Mechanism for Energy Saving of Small-Cell Networks

**Abstract**

The small cell technology is proposed to provide wireless transmission services in the indoor environment and offload the traffic from a macro cell. Because of the small coverage of a small cell, there are usually a large number of small cells deployed in the mobile network, and it is likely that there is no User Equipment (UEs) in a small cell. A small cell may be idle most of the time and waste energy. In this talk, I would like to show a Connection-Driven (CD) mechanism for energy saving of small cells, where a small cell in the sleep mode is woken up when there are UEs (that have ongoing dedicated bearers) within its service area. I will also show the performance of the CD mechanism through analysis and simulation experiments. The preliminary results of this work has been accepted by the 25th International Conference on Computer Communication and Networks (ICCCN 2016).

## 24. Prof Ma Shao-dan

**Biography**

Prof Shao-dan Ma received her double Bachelor degrees in Science and Economics, and her Master degree of Engineering, from Nankai University, Tianjin, China. She obtained her Ph.D. degree in electrical and electronic engineering from the University of Hong Kong, Hong Kong, in 2006. After graduation, she joined the University of Hong Kong as a Postdoctoral Fellow. Since August 2011, she has been with the University of Macau and is now an Associate Professor there. She was a visiting scholar in Princeton University in 2010.

Her research interests are in the general areas of signal processing and communications, particularly, transceiver design, resource allocation and performance analysis.

**Title**

Transmission Capacity of Clustered Ad Hoc Networks with Virtual Antenna Array

**Abstract**

In this talk, a clustered ad hoc network with virtual antenna array (VAA) is investigated. Considering the random distribution of the nodes in ad hoc networks, the nodes are modeled as a Poisson point process (PPP). Different from prior analyses, interference in the ad hoc network is taken into account. Outage probability and transmission capacity of a single hop network are first derived. It is found that the outage probability decays as $\Theta\left(\lambda_c^{-2\alpha}\right)$ where $\lambda_c$ is the intensity of potential cooperative nodes and $\alpha$ is the path loss exponent. Namely, the outage probability obeys an inverse-$2\alpha$ law with the intensity of cooperative nodes $\lambda_c$. Moreover, there exists a unique optimal packet transmission rate to maximize the transmission capacity, and the optimal rate is shown to be within a specific interval which is only related to path loss exponent. Finally, the analysis of transmission capacity is extended to a multi-hop network. The results show that multi-hop transmission is not beneficial to the transmission capacity, but it does improve the outage performance.

## 25. Prof Wu Yik-chung

**Biography**

Prof Yik-chung Wu received his B.Eng. (EEE) degree in 1998 and the M.Phil. degree in 2001 from the University of Hong Kong (HKU). He received the Croucher Foundation scholarship in 2002 to study Ph.D. degree at Texas A&M University, College Station, and graduated in 2005. From August 2005 to August 2006, he was with the Thomson Corporate Research, Princeton, NJ, as a Member of Technical Staff. Since September 2006, he has been with HKU, currently as an Associate Professor. He was a visiting scholar at Princeton University, in the summers of 2011 and 2015.

His research interests are in general areas of machine learning, signal processing and communication systems, and in particular distributed signal processing and communications; optimization theories for communication systems; estimation and detection theories in transceiver designs; and smart grid. Prof Wu served as an Editor for IEEE Communications Letters, is currently an Editor for IEEE Transactions on Communications and Journal of Communications and Networks. He was a TPC member for over 30 IEEE major conferences. He received three best paper awards in international conferences. He is a senior member of the IEEE.

# 26.  Prof Xia Ming-hua

### Biography

Prof Ming-hua Xia (M'12) obtained his Ph.D. degree in Telecommunications and Information Systems from Sun Yat-sen University, Guangzhou, China, in 2007. Since 2015, he has been working as a Professor at the same university.

From 2007 to 2009, he was with the Electronics and Telecommunications Research Institute (ETRI) of South Korea, Beijing R&D Center, Beijing, China, where he worked as a member and then as a senior member of engineering staff and participated in the projects on the physical layer design of 3GPP LTE mobile communications. From 2010 to 2014, he was in sequence with The University of Hong Kong, Hong Kong, China; King Abdullah University of Science and Technology, Jeddah, Saudi Arabia; and the Institute National de la Recherche Scientifique (INRS), University of Quebec, Montreal, Canada, as a Postdoctoral Fellow. His research interests are in the general area of 5G wireless communications, and in particular the design and performance analysis of multi-antenna systems, cooperative relaying systems and cognitive relaying networks. His recent focus is on the design and analysis of wireless power transfer and/or energy harvesting systems, as well as massive MIMO and small cells. He holds two patents granted in China. Prof Xia received the Professional Award at IEEE TENCON'15, Macau, 2015. He was also awarded as an Exemplary Reviewer by IEEE Transactions on Communications (2014), IEEE Communications Letters (2014), and IEEE Wireless Communications Letters (2014, 2015).

### Title

Unified Analytical Volume Distribution of the Typical Cell of Poisson-Delaunay Tessellations and Its Application in 5G Small Cell Networks

### Abstract

As a long-standing open problem in the field of stochastic geometry, the probability density function (PDF) and cumulative distribution function (CDF) of the volume of the typical cell, for Poisson-Delaunay tessellations in d-dimensional Euclidean space Rd, are analytically solved in this talk. More importantly, the resulting PDF and CDF are exact and unified, applicable to the space with $\forall d \geq 1$. Then, the shape characteristics of the resulting PDF are examined. Finally, various applications of the obtained distribution functions are outlined and, in particular, the void cell effect of small cell networks in 5G wireless communications, which was generally overlooked in the open literature due to extreme difficulty of mathematical tractability, is analytically investigated.

## 27.  Prof Chen Min

**Biography**

Prof Min Chen is a professor in School of Computer Science and Technology at Huazhong University of Science and Technology (HUST). He is Chair of IEEE Computer Society (CS) Special Technical Communities (STC) on Big Data. He was an assistant professor in the School of Computer Science and Engineering at Seoul National University (SNU) from September 2009 to February 2012. He worked as a Post-Doctoral Fellow in Department of Electrical and Computer Engineering at the University of British Columbia (UBC) for three years. Before joining UBC, he was a Post-Doctoral Fellow at SNU for one and half years. He received Best Paper Award from IEEE ICC 2012, and Best Paper Runner-up Award from QShine 2008. He serves as editor or associate editor for Information Sciences, Wireless Communications and Mobile Computing, IET Communications, IET Networks, Wiley I. J. of Security and Communication Networks, Journal of Internet Technology, KSII Trans. Internet and Information Systems, International Journal of Sensor Networks. He is managing editor for IJAACS and IJART. He is a Guest Editor for IEEE Network, IEEE Wireless Communications Magazine, etc. He co-chaired the IEEE ICC 2012-Communications Theory Symposium, and IEEE ICC 2013-Wireless Networks Symposium. He was General Co-Chair for the 12th IEEE International Conference on Computer and Information Technology (IEEE CIT-2012) and Mobimedia 2015. He was General Vice Chair for Tridentcom 2014. He was the Keynote Speaker for CyberC 2012, Mobiquitous 2012 and Cloudcomp 2015. He has more than 280 paper publications, including 150+ SCI papers, 60+ IEEE Trans./Journal papers, 8 ISI highly cited papers and 1 hot paper. He published two books: OPNET IoT Simulation (2015) and Big Data Inspiration (2015) with HUST Press, and a book on big data: Big Data Related Technologies (2014) with Springer Series in Computer Science. His Google Scholars Citations reached 7,000+ with an h-index of 41. His top paper was cited 790+ times. An IEEE Senior Member since 2009, Prof Chen's research focuses on Cyber Physical Systems, IoT Sensing, 5G Networks, Mobile Cloud Computing, SDN, Healthcare Big Data, Medica Cloud Privacy and Security, Body Area Networks, Emotion Communications and Robotics, etc.

**Title**

5G Cognitive System

**Abstract**

In the past decade, the computer and information industry has experienced rapid changes in both platform scale and scope of applications. Computers, smart phones, clouds, social networks, and supercomputers demand not only high performance but also a high degree of machine intelligence.

As a matter of fact, we are entering an era of big data and cognitive computing. On the other hand, recent developments in 5G wireless networks are enabling a 5G system with innovative design and implementation towards cognitive applications.

The 5G system with cognitive capability is called 5G cognitive system, and this talk mainly introduces the architecture and key technologies of 5G Cognitive System. The requirements on ultra-reliability and ultra-delay are discussed. Several archetypal cognitive applications, such as tactile internet based remote surgery, and emotion communications, are described.

# 28.  Prof Gao Lin

**Biography**

Prof Lin Gao (S'08-M'10) is an Associate Professor at the Harbin Institute of Technology (Shenzhen), China. He received his M.S. and Ph.D. degrees in Electronic Engineering from Shanghai Jiao Tong University (China), in 2006 and 2010, respectively. He was a Postdoctoral Fellow at The Chinese University of Hong Kong from 2010 to 2015. His research interests are in the interdisciplinary area combining telecommunications and microeconomics, with particular focus on game-theoretic and economic analysis for various communication networks, including cognitive radio networks, TV white space networks, cooperative communications, 5G communications, mobile crowdsourcing, and mobile Internet. He is the co-recipient of several research awards, including two Best Paper Awards in WiOpt 2013 and 2014, a Best Student Paper Award in WiOpt 2015, and a Best Paper Award Finalist in IEEE INFOCOM 2016.

Prof Gao is currently a Guest Editor of the journal of Mobile Information Systems. He has served as a Publicity & Social Media Chair of the 7th EAI International Conference on Game Theory for Networks (GameNets 2017), a Symposium Chair of the 5th EAI International Conference on Game Theory for Networks (GameNets 2014), and Publicity Chairs of the 4th IEEE Workshop on Smart Data Pricing (SDP 2015) and the 1st International Workshop on Green and Sustainable Networking and Computing (GSNC 2016). He has also served as a Technical Program Committee (TPC) Member for many leading IEEE conferences and a Technical Reviewer for many international journals/conferences in communications and networking.

**Title**

Mobile Crowdsourced Content Delivery Networks for 5G

**Abstract**

Nowadays we are witnessing the explosive growth of mobile devices and their content requests. Thus, the massive content delivery technology over wireless networks becomes one of the key technologies in 5G networks. In this talk, we argue a new content delivery network scheme called mobile crowdsourced content delivery network (MC-CDN). The key idea of MC-CDN is to enable nearby mobile devices to form a local network via device-to-device (D2D) technologies and aggregate their cellular network resources (e.g. cellular link capacity) for the cooperative content delivery. Moreover, MC-CDN enables mobile devices to cache the contents that they have downloaded, hence can potentially share these contents to other devices that they may encounter in the future. We will focus on discussing the economic incentive issue in such a new content delivery network.

# 29.  Prof Russell Hsing

**Biography**

Prof T. Russell Hsing, Life Fellow of the IEEE and Fellow for the British Computer Society (BCS) and SPIE, is now Chair Professor of National Chiao Tung University in Taiwan, Guest Professor of Peking University in China, Adjunct Professors with the Arizona State University in US, and the Chinese University of Hong Kong. He has been teaching a course of "Technology Entrepreneurship: Curiosity, Opportunity, Risk, and Money" at POSTECH (Korea) in 2012, National Chiao Tung University (Taiwan) since 2013, and Peking University (China) since 2014. Currently he is Board Member for the OpenFog Consortium, Advisory Board Member for four high-tech start-ups in US (DataMi, Inc.; Smartiply Inc.; and IoT Eye, Inc.) and Taiwan (ePass2UInc.). He has been Academic Advisor for the Next Generation Mobile Networks (NGMN) Alliance since March 2014. His current research efforts concentrate on Wireless 5G, Internet of Things, Network Economics & Neutrality, Fog Network & Computing, and Technology Entrepreneurship. From 1976 to 2012, He was with the Applied Research Center in Bellcore/Telcordia/Ericsson as Director (1986-1995) and Executive Director (1995-2012). He has also established and supervised the Directors for Telcordia Applied Research Centers in Taiwan (TARC-TW) and Poland (TARC-PL) (2004-2012). He accumulated rich R&D experience of 35 years through affiliations with Burroughs, Xerox, GTE Labs, Telco Systems Fiber Optics Corporation, and Bellcore/Telcordia/Ericssson. From 1987 to 1995, he led a research team to propose and to develop the world's first working QAM-based ADSL system.  He then designed the world's first working DCT chip for video communication applications at Bellcore. In 2002, he was given a responsibility to establish a new Emerging Technologies and Services R & D Department for Vehicular Telematics, Healthcare, and physical security systems applications. He pioneered the technology commercialization in emerging technologies and services through joint business ventures with commercial partners. Prof Hsing holds a B.Sc. (1970) from Taiwan, M.Sc. (1974) and Ph.D. (1977) of Electrical Engineering, the University of Rhode Island. His research and publications cover communication signal processing, multimedia communications, wireless technologies & sensors network, vehicular networks & telematics, video communications and VLSI implementations. He has been co-editing the ICT book series for John Wiley & Sons, Inc. since 2007. Within the IEEE Communications Society, he was member (2006-2008) and chair (2010-2011) of the Fellow Evaluation Committee, and a member of the Award Committee (2010-2012). He was founding chair (2010-2012) of Sub-TC on Vehicular Networks and Telematics Applications for the IEEE Communications Society. Within the IEEE, he was a member (2008-2010)/ Chair (2010-2011)/ Past Chair (2012) for the IEEE Kiyo Tomiyasu Award Committee, and then the IEEE Eric Sumner Award Committee (2010-2012). He has been a member for the IEE Fellow Committee since 2012, the Strategic Planning Committee in 2013, and Chair for the IEEE Technical Field of Award (TFA) Council & Member for the IEEE Award Board since 2015.

# 30. Prof Jiao Bing-li

**Biography**

Prof Bing-li Jiao obtained his B.S. and M.S. from Peking University in 1983 and 1988, and Ph.D. from University of Saaland, F.R. Germany, in 1995, respectively. In 2000, he became a full professor in Peking University. He is a founder of advanced institute of wireless communication and signal processing. Now, he serves as the director of the institute.

His researches are in the field of wireless communication, primarily, on the problems of physical layer. The research work includes wireless access techniques of CDMA and OFDM, adaptive filter, MIMO. So far, has published more than 50 papers in Journals and Conferences. Recently, he led a national team working in field of m-health care.

**Title**

CCFD-Based WiFi for 5G

**Abstract**

Co-frequency and co-time full duplex (CCFD) is a promising technique for improving spectral efficiency in next generation wireless communication systems. However, for the applications of CCFD in a cellular network, severe co-channel interference is an essential problem. Specifically, there are two significant interferences, i.e., inter-terminal interference (ITI) and inter-cell interference (ICI), which lead to an obvious performance degradation. In this paper, two techniques are proposed for suppressing the ITI and ICI in a CCFD cellular system, respectively. The first technique is obtained by modeling the three-node CCFD system as the Z-channel. After deriving the sum-capacity of the Z-channel, a sum-capacity-achieving scheme based on successive interference cancellation (SIC) is proposed. The second technique is designed by combining the fractional frequency reuse scheme with CCFD. The performance gains of the proposed two techniques in terms of signal-to-interference plus noise ratio (SINR) and sum capacity are analyzed. Simulation results show that the proposed scheme can achieve significant interference suppression performance and higher system capacity, especially for cell edge users.

# 31. Prof Tony Quek

**Biography**

Prof Tony Q.S. Quek received his B.E. and M.E. degrees in Electrical and Electronics Engineering from Tokyo Institute of Technology, Tokyo, Japan, respectively. At MIT, he earned the Ph.D. in Electrical Engineering and Computer Science. Currently, he is a tenured Associate Professor with the Singapore University of Technology and Design (SUTD). He also serves as the deputy director of the SUTD-ZJU IDEA. His main research interests are in the application of mathematical, optimization, and statistical theories to communication, networking, signal processing, and resource allocation problems. Specific current research topics include heterogeneous networks, green communications, wireless security, internet-of-things, big data processing, and cognitive radio.

Prof Quek served as a member of the Technical Program Committee as well as symposium chairs in a number of international conferences. He is serving as the Workshop Chair for IEEE Globecom in 2017 and the Special Session Chair for IEEE SPAWC in 2017. He is currently an Editor for the IEEE Transactions on Communications and an Executive Editorial Committee Member for the IEEE Transactions on Wireless Communications. He was Editor for the IEEE Wireless Communications Letters, Guest Editor for the IEEE Signal Processing Magazine (Special Issue on Signal Processing for the 5G Revolution) in 2014, and the IEEE Wireless Communications Magazine (Special Issue on Heterogeneous Cloud Radio Access Networks) in 2015. He is a co-author of the book "Small Cell Networks: Deployment, PHY Techniques, and Resource Allocation" published by Cambridge University Press in 2013 and the book "Cloud Radio Access Networks: Principles, Technologies, and Applications" by Cambridge University Press.

Prof Quek was honored with the 2008 Philip Yeo Prize for Outstanding Achievement in Research, the IEEE Globecom 2010 Best Paper Award, the 2012 IEEE William R. Bennett Prize, the IEEE SPAWC 2013 Best Student Paper Award, the IEEE WCSP 2014 Best Paper Award, the IEEE PES General Meeting 2015 Best Paper, and the 2015 SUTD Outstanding Education Awards — Excellence in Research.

**Title**

Enabling 5G technologies for future health care

**Abstract**

Fog computing allows devices to conduct critical analytics on their own, without the need for the cumbersome cloud storage process.  Speed is the name of the game for this type of processing, and it could be the key to making the healthcare Internet of Things (IoT) truly useful for inpatient care, patient engagement, population health management, and remote monitoring. In this talk, we provide our vision of future health care and the different components to make this healthcare IoT possible. In particular, we present some of our preliminary results from developing wireless heterogeneous body area networks, gateways, visualisation platform, and data analytics platform.

# 32. Prof Pang Ai-chun

**Biography**

Prof Ai-chun Pang received her 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. She joined the Department of Computer Science and Information Engineering (CSIE), National Taiwan University (NTU), Taipei, Taiwan in 2002. She is now a Professor in CSIE and INM, and is also an Adjunct Research Fellow of Research Center for Information Technology Innovation, Academia Sinica, Taiwan. Her research interests include the design and analysis of wireless and multimedia networking, mobile communications, and cloud datacenter networking.

**Title**

Enabling Low-Latency Applications in Fog-Radio Access Network

**Abstract**

The ultra low-latency operations of communications and computing enable many potential IoT applications and thus have gained widespread attention recently. Existing mobile devices and telecommunication systems may not be able to provide the highly desired low-latency computing and communications services. To meet the needs of those applications, we present Fog-Radio Access Network (F-RAN) architecture which brings the efficient computing capability of the cloud to the edge of network. In this talk, we first introduce the F-RAN and its rationale in serving ultra low-latency applications; then we depict the need of a service framework for F-RAN to cope with the complex tradeoff among the performance, the computing cost, and communication cost. Finally, we illustrate the mobile AR service as an exemplary scenario to provide insights for the design of the framework.