Raymond Yeung
The Chinese University of Hong Kong

Opening Speech

Speaker Bio:
Raymond W. Yeung received the BS, MEng and PhD degrees in electrical engineering from Cornell University. He joined AT&T Bell Laboratories in 1988. Since 1991, he has been with CUHK, where he is currently Choh-Ming Li Professor of Information Engineering. He has been serving as Co-Director of the Institute of Network Coding since 2010. His textbooks on information theory and network coding have been adopted by over 100 institutions around the world. In spring 2014, he gave the first MOOC in the world on information theory that reached over 25,000 students. His research interest is in information theory and network coding. He was a recipient of the Croucher Senior Research Fellowship for 2000/01, the 2005 IEEE Information Theory Society Paper Award, the Friedrich Wilhelm Bessel Research Award from the Alexander von Humboldt Foundation in 2007, and the 2016 IEEE Eric E. Sumner Award ("for pioneering contributions to the field of network coding"). In 2015, he was named an Outstanding Overseas Chinese Information Theorist by the China Information Theory Society.

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Soung Liew
The Chinese University of Hong Kong

Putting Physical-Layer Network Coding into Practice

Talk Abstract:
This talk focuses on the practical aspects of putting physical-layer network coding (PNC) into practice in our prototyping efforts of PNC. PNC was first proposed in 2006 and has been attracting a wide following. PNC is founded on the idea that the electromagnetic waves received simultaneously from different sources are an additive superposition of signals. A form of network coding operation is performed automatically by nature during the reception process when multiple sources transmit simultaneously. Most work on PNC is theoretical in nature, focusing on various mathematical properties and models related to PNC systems. There has been relatively little implementation effort to examine whether the theoretical advantages of PNC can be realized in real systems when various practical challenges need to be surmounted. In this talk, I will relate our experience in prototyping PNC on the software-defined radio (SDR) platform. I will show a video clip of our prototype of a PNC two-way relay network. The significant achievement of this prototype is that we now have a complete TCP/IP compatible system that can support standard TCP/IP applications (e.g., web browsing, video delivery) in real-time. I will also present a second prototype that realizes network-coded multiple access (NCMA). While the first prototype demonstrates the use of PNC on a

relay network, the second prototype shows that PNC decoding can also find use in non-relay networks where the receiver aims to decode the individual messages simultaneously transmitted by a number of transmitters rather than a network-coded message.

Speaker Bio:
Prof. Soung Liew received his undergraduate and Ph.D. degrees from MIT. From 1984 to 1988, he was at the MIT Laboratory for Information and Decision Systems, where he investigated Fiber-Optic Communications Networks. From March 1988 to July 1993, he was at Bellcore (now Telcordia), New Jersey, where engaged in Broadband Network Research. Prof. Liew is currently Professor and Division Head at the Department of Information Engineering, CUHK. At CUHK, he received the Exemplary Teaching Award in 2000 and the Research Excellence Award in 2013. Prof. Liew's research interests include wireless networks, Internet protocols, multimedia communications, and packet switch design. Besides academic activities, Prof. Liew is active in the industry. He co-founded two technology start-ups in Internet Software and has been serving as consultant to many companies and industrial organizations. He is a fellow of IEEE, IET, and HKIE.

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Jiannong Cao
The Hong Kong Polytechnic University

EdgeMesh: Enabling Scalable Connectivity and Distributed Intelligence for IoT

Talk Abstract:
In the past decade, many Internet of Things (IoT) applications such as Smart Home, Smart Cities, Smart Healthcare etc. have emerged where the devices in our surroundings are interconnected to each other to provide better services and comfort to humans. As the number of devices and data being generated continuously increases, it will become very difficult to send all the data to a centralized server, as done in cloud computing, for processing and decision-making. Therefore, recent trend in IoT has been to move the computation tasks from centralized cloud to edge devices which are closer to data sources. In this talk, I describe a new infrastructure for IoT named Edge Mesh, where the intelligence and decision-making is enabled within the network by sharing the computation tasks and data using a mesh network of Edge devices and routers. Edge Mesh uses mesh network of edge devices which leads to better scalability as chances of network congestion are minimized when all the data is sent to multiple edge devices instead of a single centralized server as done in existing paradigms. Edge Mesh also distributes the computation tasks among different edge devices which leads to higher reliability compared to existing centralized computing paradigms. The use of mesh network also provides multiple communication paths between any two edge devices which further improves reliability of system.

Speaker Bio:
Dr. Cao is currently a Chair Professor of Department of Computing at The Hong Kong Polytechnic University, Hong Kong. He is also the director of the Internet and Mobile Computing Lab in the department and the director of University's Research Facility in Big Data Analytics. His research interests include parallel and distributed computing, wireless sensing and networks, pervasive and mobile computing, and big data and cloud computing. He has co-authored 5 books in Mobile Computing and Wireless Sensor Networks, co-edited 9 books, and published over 500 papers in major international journals and conference proceedings. Dr. Cao is a fellow of IEEE. He served the Chair of the Technical Committee on Distributed Computing of IEEE Computer Society 2012-2014, a member of IEEE Fellows

Evaluation Committee of the Computer Society and the Reliability Society, a member of IEEE Computer Society Education Awards Selection Committee, a member of IEEE Communications Society Awards Committee, and a member of Steering Committee of IEEE Transactions on Mobile Computing. Dr. Cao has served as chairs and members of organizing and technical committees of many international conferences, and as associate editor and member of the editorial boards of many international journals. Dr. Cao received the B.Sc. degree in computer science from Nanjing University, China, in 1982, and the M.Sc. and Ph.D. degrees in computer science from Washington State University, USA, in 1986 and 1990 respectively.

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Danny Tsang

Hong Kong University of Science and Technology

Delay-Aware Task Offloading in Shared Fog Networks

Talk Abstract:
Offloading computation tasks from resource-poor end devices to distributed in-network computing facilities in proximity to the end devices is the core notion of fog computing. This talk focuses on an efficient and practical scheme to dynamically schedule the offloading of computation tasks. Specifically, we construct a task scheduling model that captures the heterogeneous task delay sensitivities and the task migration costs, as well as the major characteristics of the underlying fog computing infrastructure. The model enforces lexicographic max-min fairness in delay-aware task dis-utilities. The scheduling problem is an integer program. An efficient solution method is proposed based on problem-specific analysis. Finally, numerical results of the synthesized-trace-driven simulations demonstrate the efficacy of our task offloading scheme.

Speaker Bio:
Dr. Tsang received the Ph.D. degree in electrical engineering from the Moore School of Electrical Engineering at the University of Pennsylvania, U.S.A., in 1989. He has joined the Department of Electronic & Computer Engineering at the Hong Kong University of Science and Technology since summer of 1992 and is now a professor in the department. He was a Guest Editor for the IEEE Journal of Selected Areas in Communications' special issue on Advances in P2P Streaming Systems, an Associate Editor for the Journal of Optical Networking published by the Optical Society of America, and a Guest Editor for the IEEE Systems Journal. He currently serves as Technical Editor for the IEEE Communications Magazine. He was nominated to become an IEEE Fellow in 2012 and an HKIE Fellow in 2013. During his leave from HKUST in 2000-2001, Dr. Tsang assumed the role of Principal Architect at Sycamore Networks in the United States. He was responsible for the network architecture design of Ethernet MAN/WAN over SONET/DWDM networks. He invented the 64B/65B encoding (US Patent No.: US 6,952,405 B2) and contributed it to the proposal for Transparent GFP in the T1X1.5 standard that was advanced to become the ITU G.GFP standard. The coding scheme has now been adopted by International Telecommunication Union (ITU)'s Generic Framing Procedure recommendation GFP-T (ITU-T G.7041/Y.1303)). His current research interests include cloud computing, cognitive radio networks and smart grids.

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Xu Chen
Sun Yat-sen University

Computation Offloading for Mobile Edge Computing

Talk Abstract:
Mobile edge computing is a new paradigm to leverage a multitude of collaborative end-user devices and/or near-user infrastructure to carry out a substantial amount of communication and computation tasks. Along this line, in this talk I will present our recent studies on three different applications: (1) a distributed multi-user computation offloading algorithm for mobile-edge cloud computing in a multi-channel wireless environment; (2) a novel self-organized mobile crowd-sourcing framework to exploit user workers at the mobile network edge for fulfilling quick and high-quality mobile tasks in real-time; (3) a socially-driven prefeteching mechanism that adopts the mobile-inference and edge-training architecture for reducing user's mobile multimedia access delay. These results demonstrate the profound benefits enabled by mobile edge computing.

Speaker Bio:
Dr. Xu Chen received the Ph.D. degree from the Chinese University of Hong Kong in 2012. From 2012 to 2014, Dr. Chen was a postdoctoral research fellow with Arizona State University, Tempe, USA. From April 2014 to Aug. 2016, he was with the Faculty of Mathematics and Computer Science, University of Goettingen, Germany, as a Humboldt Scholar. He is currently a full professor with School of Data and Computer Science, Sun Yat-sen University, Guangzhou, China. He is the recipient of Thousand Young Talents Award by the Government of China, the prestigious Humboldt research fellowship awarded by Alexander von Humboldt-Foundation, 2014 Hong Kong Young Scientist Runner-Up Award, Best Paper Award in IEEE ICC 2017, Best Paper Runner-Up Award in IEEE INFOCOM 2014, and Honorable Mention Award in IEEE ISI 2010.

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Qian Zhang
Hong Kong University of Science and Technology

Secure Pairing for IoT devices

Talk Abstract:
Forming secure pairing between wearable devices has become an important problem in many scenarios, such as mobile payments and private data transmission. In this talk, I will introduce some of our efforts in this direction. I will first introduce EMG-KEY, a system that can securely pair wearable devices by leveraging the electrical activity caused by human muscle contraction to generate a secret key. Then, another try Touch-And-Guard (TAG) will be introduced, which is a system that uses hand touch as an intuitive manner to establish a secure connection between a wristband wearable and the touched device.

Speaker Bio:
Dr. Zhang joined Hong Kong University of Science and Technology in Sept. 2005 where she is now Tencent Professor of Engineering and Chair Professor of the Department of Computer Science and Engineering. She is also serving as the co-director of Huawei-HKUST innovation lab and the director of digital life research center of HKUST. Before that, she was in Microsoft Research Asia as the research manager of the Wireless and Networking Group. Dr. Zhang has published more than 300 refereed papers in international leading journals and key conferences in the areas of wireless/Internet multimedia networking, wireless

communications and networking, wireless sensor networks, and overlay networking. She is the inventor of about 30 pending International patents. She is a Fellow of IEEE.

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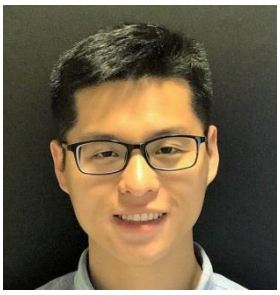

Lei Deng and Minghua Chen
The Chinese University of Hong Kong

Device-to-Device Load Balancing for Cellular Networks

Talk Abstract:
Small-cell architecture is widely adopted by cellular network operators to increase network capacity. By reducing the size of cells, operators can pack more (low-power) base stations in an area to better serve the growing demands, without causing extra interference. However, this approach suffers from low spectrum temporal efficiency. When a cell becomes smaller and covers fewer users, its total traffic fluctuates significantly due to insufficient traffic aggregation and expresses a large "peak-to-mean" ratio. As operators commonly provision spectrum to a cell according to its peak traffic, large traffic temporal fluctuation inevitably leads to low spectrum temporal efficiency. In this talk, we first show a case-study based on real-world 3G data traffic traces and confirm that 90% of the cells in a metropolitan district are less than 40% utilized. Our study also reveals that peak traffic of adjacent cells is highly asynchronous. Inspired by these observations, we advocate device-to-device (D2D) load-balancing as a useful mechanism to address the fundamental drawback of small-cell architecture. The idea is to shift traffic from a congested cell to its adjacent underutilized cells by leveraging inter-cell D2D communications, so that the traffic can be served without using extra spectrum, effectively improving the spectrum temporal efficiency. We provide theoretical modeling and analysis to characterize the benefit of D2D load balancing, in terms of sum peak traffic reduction of individual cells. We also derive the corresponding cost, in terms of incurred D2D traffic overhead. We carry out empirical evaluations based on real-world 3G data traces to gauge the benefit and cost of D2D load balancing under practical settings. The results show that D2D load balancing can reduce the sum peak traffic of individual cells by 35% as compared to the standard scenario without D2D load balancing, at the expense of 45% D2D traffic overhead.

Speaker Bio:
Lei Deng received his B.Eng. degree from the Department of Electronic Engineering, Shanghai Jiao Tong University, Shanghai, China in 2012 and his Ph.D. degree from the Department of Information Engineering, the Chinese University of Hong Kong, Hong Kong, China in 2017. From May 2015 to October 2015, he was a visiting scholar in School of Electrical and Computer Engineering, Purdue University, West Lafayette, IN, USA. His research interests are timely network communications, energy efficient timely transportation, and spectral-energy efficiency in wireless networks.

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Minghua Chen received his B.Eng. and M.S. degrees from the Department of Electronic Engineering at Tsinghua University in 1999 and 2001, respectively. He received his Ph.D. degree from the Department of Electrical Engineering and Computer Sciences at University of California at Berkeley in 2006. He spent one year visiting Microsoft Research Redmond as a Postdoc Researcher. He joined the Department of Information Engineering, the Chinese

University of Hong Kong, in 2007, where he is now an Associate Professor. He is also currently an Adjunct Associate Professor in Tsinghua University, Institute of Interdisciplinary Information Sciences. He received the Eli Jury award from UC Berkeley in 2007 (presented to a graduate student or recent alumnus for outstanding achievement in the area of Systems, Communications, Control, or Signal Processing) and The Chinese University of Hong Kong Young Researcher Award in 2013. He also received several best paper awards, including the IEEE ICME Best Paper Award in 2009, the IEEE Transactions on Multimedia Prize Paper Award in 2009, and the ACM Multimedia Best Paper Award in 2012. He is currently an Associate Editor of the IEEE/ACM Transactions on Networking. He serves as TPC Co-Chair of ACM e-Energy 2016 and General Chair of ACM e-Energy 2017. He receives the ACM Recognition of Service Award in 2017 for service contribution to the research community. His recent research interests include energy systems (e.g., smart power grids and energy-efficient data centers), intelligent transportation systems, distributed optimization, multimedia networking, wireless networking, delay-constrained network coding, and characterizing the benefit of data-driven prediction in algorithm/system design.

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Dan Wang
The Hong Kong Polytechnic University

Data-driven Analysis and Applications for Smart Buildings

Talk Abstract:
Future smart buildings will be able to provide a huge amount of data than today. This provides great opportunities for research in data transmission/networking architecture, data mining algorithms, and application development. In this talk, we emphasizes on data that are related to human activities, from a micro scope in individual levels to a macro scope in building levels. We show that with data, we can improve human thermal comfort and save energy and costs by activities planning. In particular, we present a case study, where we use big building data to assist urban traffic prediction in Central, Hong Kong, one of the densest urban areas in the world. We further discuss that to assist these applications, there needs new building ICT architecture. A clean slate could be a long term choice, yet incremental design is also needed.

Speaker Bio:
Dan Wang is currently an associate professor in Department of Computing, The Hong Kong Polytechnic University. His current research interest is Internet Architecture and QoS, and smart buildings. He has published extensively in INFOCOM, SIGMETRICS, ICNP, RTSS, ICDCS, e-Energy, Buildsys. He received B.S. in Peking Univ, M.S. in Case Western Reserve Univ, and Ph.D. in Simon Fraser Univ, all in Computer Science.

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Yang Yang
ShanghaiTech University

Fog As A Service Technology

Talk Abstract:
Fog computing has emerged as a promising solution for the Internet of Things (IoT) and next generation mobile networks. As an extension to cloud computing, it enables service provisioning along the continuum from the cloud to things for reducing latency and bandwidth demands, and for empowering end users in their vicinity. Such cloud-to-thing continuum requires full technology support in infrastructure, platform, software and service levels. We propose fog as a service technology (FA2ST) and its architecture to underpin a multi-level system of fog computing services for end-to-end support of various IoT applications. It enables services sharing at network edges by a fog service overlay and introduces a hierarchical fog network for seamless service provisioning. We introduce the concept of FA2ST and describes its architecture, design goals, main features and some relevant use cases in vertical industries.

Speaker Bio:
Dr. Yang Yang is currently a professor with Shanghai Institute of Microsystem and Information Technology (SIMIT), Chinese Academy of Sciences, serving as the Director of CAS Key Laboratory of Wireless Sensor Network and Communication, and the Director of Shanghai Research Center for Wireless Communications (WiCO). He is also a Distinguished Adjunct Professor with the School of Information Science and Technology, ShanghaiTech University. Prior to that, he has held faculty positions at The Chinese University of Hong Kong, Brunel University, and University College London (UCL). Yang is a member of the Chief Technical Committee of the National Science and Technology Major Project "New Generation Mobile Wireless Broadband Communication Networks" (2008-2020), which is funded by the Ministry of Industry and Information Technology (MIIT) of China. In addition, he is on the Chief Technical Committee for the National 863 Hi-Tech R&D Program "5G System R&D Major Projects", which is funded by the Ministry of Science and Technology (MOST) of China. Since January 2017, he has been serving the OpenFog Consortium as the Director for Greater China Region. Yang's current research interests include wireless sensor networks, Internet of Things, Fog computing, Open 5G, and advanced wireless testbeds. He has published more than 150 papers and filed over 80 technical patents in wireless communications.

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Yonggang Wen
Nanyang Technological University

Training Acceleration for Distributed Machine Learning at Scale: A Swiss-Army-Knife Approach

Talk Abstract:
Distributed machine-learning (ML) applications play an important role in fueling the emerging artificial intelligence revolution. In this context, the parameter server (PS) framework is widely used to train models at scale in modern ML systems, such as Petuum, MxNet, TensorFlow and Factorbird. It tackles the big-data problem by having worker nodes perform data-parallel computation, and having server nodes maintain globally shared parameters. However, when training models of large size,

worker nodes frequently pull parameters from server nodes and push updates to server nodes, often resulting in high communication overhead. Our investigations show that modern distributed ML applications could spend up to 5 times more time on communication than computation. To address this problem, we propose an optimized communication layer for the PS framework, called as Parameter Flow (PF). The PS employs a Swiss-army-knife approach by staking three complementary techniques. First, we introduce an update-centric communication (UCC) model to exchange data between worker/server nodes via two operations: broadcast and push. Second, we develop a dynamic value-bounded filter (DVF) to reduce network traffic by selectively dropping updates before transmission. Third, we design a tree-based streaming broadcasting (TSB) system to efficiently broadcast aggregated updates among worker nodes. Our proposed PF can significantly reduce network traffic and communication time. Extensive performance evaluations have showed that PF can speed up popular distributed ML applications by a factor of up to 4.3 in a dedicated cluster, and up to 8.2 in a shared cluster, compared to a generic PS system without PF. The PF framework has been used by a few industry partners.

Speaker Bio:
Dr. Yonggang Wen is an associate professor with School of Computer Science and Engineering (SCSE) at Nanyang Technological University (NTU), Singapore. He is also the Assistant Chair for Innovation at SCSE and the founding director of SCSE Innovation Lab at NTU. He received his PhD degree in Electrical Engineering and Computer Science (minor in Western Literature) from Massachusetts Institute of Technology (MIT), Cambridge, USA, in 2008. Previously he has worked in Cisco to lead product development in content delivery network, which had a revenue impact of 3 Billion US dollars globally. Dr. Wen has published over 170 papers in top journals and prestigious conferences. His systems research has gained global recognitions. His work in Multi-Screen Cloud Social TV has been featured by global media (more than 1600 news articles from over 29 countries) and received ASEAN ICT Award 2013 (Gold Medal). His work on Cloud3DView for Data Centre Life-Cycle Management, as the only academia entry, has won the 2015 Data Centre Dynamics Awards – APAC (the 'Oscar' award of data centre industry) and 2016 ASEAN ICT Awards (Gold Medal). He is the winner of 2017 Nanyang Award for Innovation and Entrepreneurship, the highest recognition at NTU. He is a co-recipient of Best Paper Awards at 2016 IEEE Globecom, 2016 IEEE Infocom MuSIC Workshop, 2015 EAI Chinacom, 2014 IEEE WCSP, 2013 IEEE Globecom and 2012 IEEE EUC, and a co-recipient of 2015 IEEE Multimedia Best Paper Award. He serves on editorial boards for IEEE Communications Survey & Tutorials, IEEE Transactions on Multimedia, IEEE Transactions on Circuits and Systems for Video Technology, IEEE Wireless Communication, IEEE Transactions on Signal and Information Processing over Networks, IEEE Access Journal and Elsevier Ad Hoc Networks, and was elected as the Chair for IEEE ComSoc Multimedia Communication Technical Committee (2014-2016). His research interests include cloud computing, green data center, big data analytics, multimedia network and mobile computing.

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Jianwei Huang
The Chinese University of Hong Kong

Sharing Economy of Wi-Fi Networks

Talk Abstract:
Stable and high-quality Wi-Fi networks play an important role in supporting fast-growing wireless data demands. According to the forecast by the Cisco Visual Networking Index, global Wi-Fi networks will carry 54% of the smartphones traffic and 70% of the tablets traffic by 2019. Comparing with cellular networks, Wi-Fi network equipments are often low-cost, easy to install and manage, and can offer high transmission rates. However, the operation of large-scale Wi-Fi networks often faces several challenges, including the limited coverage of each Wi-Fi access point. In this talk, we will discuss the sharing economy of Wi-Fi networks, with the aim of achieving a large network coverage by forming a wireless community network through sharing a large number of private Wi-Fi hotspots.

Speaker Bio:
Jianwei Huang is a Professor and Director of the Network Communications and Economics Lab, in the Department of Information Engineering at the Chinese University of Hong Kong. He received the 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 Best Paper Awards, including IEEE Marconi Prize Paper Award in Wireless Communications in 2011. He has co-authored six books, including the textbook on "Wireless Network Pricing." He received the CUHK Young Researcher Award in 2014 and IEEE ComSoc Asia-Pacific Outstanding Young Researcher Award in 2009. He has served as an Associate Editor of IEEE/ACM Transactions on Networking, IEEE Transactions on Network Science and Engineering, IEEE Transactions on Wireless Communications, IEEE Journal on Selected Areas in Communications - Cognitive Radio Series, and IEEE Transactions on Cognitive Communications and Networking. He has served as an Editor of Wiley Information and Communication Technology Series, Springer Encyclopedia of Wireless Networks, and Springer Handbook of Cognitive Radio. He has served as the Chair of IEEE ComSoc Cognitive Network Technical Committee and Multimedia Communications Technical Committee. He is the recipient of IEEE ComSoc Multimedia Communications Technical Committee Distinguished Service Award in 2015 and IEEE GLOBECOM Outstanding Service Award in 2010. He is an IEEE Fellow, a Distinguished Lecturer of IEEE Communications Society, and a Thomson Reuters Highly Cited Researcher in Computer Science.

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