The 34th International Teletraffic Congress

ITC 34

Teletraffic Engineering for Smart Networking

14 – 16 September 2022

Shenzhen, China

Virtual Conference

Information for Participants

Software
The conference is fully online and is held on the Zoom Meeting platform. Please download the Zoom Meeting software at *https://zoom.us*.

Zoom Links
•Room 1 (main track of the 3-day conference): https://cuhk-edu-cn.zoom.us/j/9078600066?*pwd=U1NpNUo3THIvd05BMmo4dDcvOFVEdz09*

Alternatively, you can access the conference room using
Zoom ID: 907 860 0066, Password: 123456

•Room 2 (Session 1b & Session 2b): https://cuhk-edu-cn.zoom.us/j/7930962887?*pwd=aHNlTFBMbVp5YTRoQnU2MHZzOEw3dz09*

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Time Zone
Beijing Standard Time (GMT+8)

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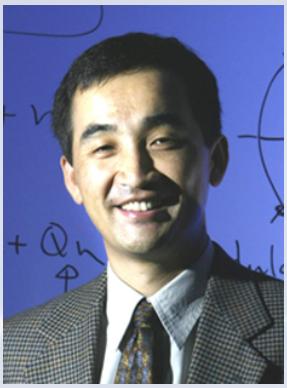
For Audience
Please keep your microphone mute during the presentation if you are not asking a question. Follow the instruction from the session chair for Q&A. Thank you for your cooperation.

WELCOME MESSAGE FROM THE GENERAL CHAIRS



Z.-Q. Tom Luo
The Chinese University of Hong Kong, Shenzhen

Zhisheng Niu
Tsinghua University

On behalf of the Executive Committee, it is with great pleasure that we welcome you to the 34th International Teletraffic Congress (ITC' 34), Shenzhen, China, on September 14-16, 2022. As the first international conference in networking science and practice, ITC was founded in 1955 by enthusiastic scientists and engineers willing to deploy networks in a holistic way. During the past 67 years, it has served as a forum for all theoretical fundamentals and engineering practices for large-scale deployment and operation of communication and information networks. Following the successful 19th ITC' 2005 in Beijing and 25th ITC' 2013 in Shanghai, the 34th ITC' 2022 comes back to China again in another most innovative city of Shenzhen under the theme of "Teletraffic Engineering for Smart Networking" . Despite the COVID-19 spread, you are warmly welcome to "see" the miracle city of Shenzhen and the appealing ICT industry there led by Huawei, ZTE, Tencent, Dajiang, etc.

The ITC' 34 is jointly organized by the Chinese University of Hong Kong at Shenzhen (CUHK-SZ) and Tsinghua University (THU) under the supports from Chinese Institute of Communications (CIC) and International Advisory Council (IAC) of ITC. The technical program consists of two keynote speeches, 18 invited speeches, 13 technical papers, one panel session, one tutorial session, one joint workshop with two plenary speeches and 7 workshop papers, disseminating the latest research and development results in the areas of teletraffic and networking science. By taking this opportunity, we would like to express our sincere thanks and appreciations to all the authors, technical committee members, and anonymous reviewers, in particular to all the committee chairs. The conference would never be possible without your great and exceptional contributions.

We strongly believe you will find the technical program of ITC' 34 very stimulating and inspiring, and cordially invite all of you to join us and interact with the distinguished speakers and panelists. Once again, welcome to ITC' 34 and enjoy the conference.

Committees

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Z.-Q. Tom Luo
The Chinese University of Hong Kong, Shenzhen

Professor Zhi-Quan (Tom) Luo currently serves as the Academic Vice President and Presidential Chair Professor of The Chinese University of Hong Kong, Shenzhen, and also the Director of Shenzhen Research Institute of Big Data. He received his BSc degree in Applied Mathematics from Peking University and Ph.D. Degree in Operations Research from MIT. He has been the department head of ECE, McMaster University, and a full professor at ECE, University of Minnesota. His research interest lies in Optimization Methods for Big Data Analytics, Signal Processing, and Digital Communication. Professor Luo is a Fellow of the Institute of Electrical and Electronics Engineers (IEEE) and a Fellow of the Society for Industrial and Applied Mathematics (SIAM). In 2014, he was elected to the Royal Society of Canada, the highest honor a Canadian scholar can achieve in the Arts, Humanities and Sciences.

General Chairs

Zhisheng Niu
Tsinghua University

Zhisheng Niu graduated from Northern Jiaotong University (currently Beijing Jiaotong University), Beijing, China, in 1985, and got his M.E. and D.E. degrees from Toyohashi University of Technology, Toyohashi, Japan, in 1989 and 1992, respectively. After spending two years at Fujitsu Laboratories Ltd., Kawasaki, Japan, he joined Tsinghua University, Beijing, China, in 1994, where he is now a professor at the Department of Electronic Engineering. His current research interests include teletraffic theory, mobile Internet, radio resource management of wireless networks, and green communication and networks. Dr. Niu received the Outstanding Young Researcher Award from the Natural Science Foundation of China in 2009. Currently, he is a fellow of the IEICE and IEEE, vice-chair of the Information and Communication Network Committee of the Chinese Institute of Communications (CIC).

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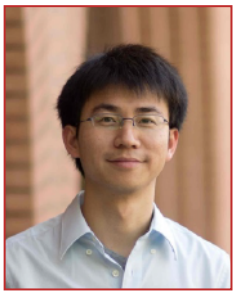

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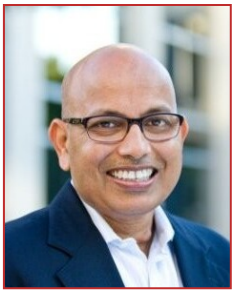

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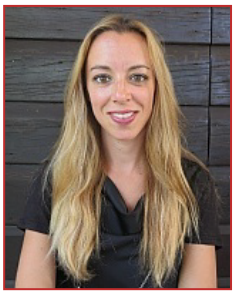

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Program at a Glance

14 September, 2022, Wednesday

9:00 – 12:30	Tutorial: Age of Information in Wireless Networks: Concepts, Algorithms and Applications
13:30 – 18:00	Workshop: Joint Workshop of Smart Industrial Networking and Satellite Based IoT
18:00	Welcome reception

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15 September, 2022, Thursday

8:00 – 8:30	Opening
8:30 – 9:30	Keynote 1: Prof. Mor Harchol-Balter (Carnegie Mellon University) Recent Breakthroughs in Stochastic Scheduling Theory
9:30 – 10:00	Break
10:00 – 12:10	Session 1: Invited talks (session 1a & session 1b)
12:10 – 13:30	Noon break
13:30 – 15:40	Session 2: Technical symposium (session 2a & session 2b)
15:40 – 16:10	Break
16:10 – 17:40	Panel discussion: AI Native Networking

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16 September, 2022, Friday

9:00 – 10:00	Keynote 2: Prof. Jim Dai (The Chinese University of Hong Kong, Shenzhen & Cornell) WWTA Load-Balancing for Parallel-Server Systems with Heterogeneous Servers
10:00 – 12:10	Session 4: Invited talks
12:10 – 13:30	Noon break
13:30 – 15:00	Session 6: Invited talks
15:00 – 15:30	Break
15:30 – 17:00	Session 7: Invited talks

Keynote Speech

Prof. Mor Harchol-Balter
(Carnegie Mellon University)

Keynote 1: Recent Breakthroughs in Stochastic Scheduling Theory
8:30 – 9:30, 15 September 2022, Thursday

Abstract: This talk considers stochastic scheduling, where job sizes and arrival times are drawn from a distribution. As empirical job size variability has skyrocketed, stochastic scheduling research has grown increasingly important. What scheduling policies should we use to keep response times low? How should we schedule when job sizes are unknown or only partially known? What scheduling policies should we use in a multi-server (M/G/k) setting, as compared with a single-server (M/G/1) setting? How can we analyze the response times of scheduling policies in single-server and multi-server settings? In this talk, we discuss recent breakthroughs over the last 3 years in the area of stochastic scheduling. These include:

(1) The SOAP scheduling framework, which greatly expands the class of scheduling policies whose response times we can now analyze in the M/G/1 setting.
(2) The first response time analysis of common scheduling policies in the M/G/k.
(3) Asymptotically optimal scheduling in the M/G/k.

This is a joint work with PhD students: Ziv Scully and Isaasc Grosof.

Bio: Mor Harchol-Balter is the Bruce J. Nelson Professor of Computer Science at Carnegie Mellon. She received her Ph.D. from U.C. Berkeley in 1996, joined CMU in 1999, and served as the Head of the PhD program from 2008-2011. Mor is a Fellow of both ACM and IEEE. She is a recipient of the McCandless Junior Chair, the NSF CAREER award, and several teaching awards, including the Herbert A. Simon Award and Spira Teaching Award. She is a recipient of dozens of Industrial Faculty Awards including multiple awards from Google, Microsoft, IBM, EMC, Facebook, Intel, Yahoo!, and Seagate. Mor's work focuses on designing new resource allocation policies, including load balancing policies, power management policies, and scheduling policies, for distributed systems. Mor is heavily involved in the SIGMETRICS / PERFORMANCE research community, where she has received many paper awards (SIGMETRICS 21, SIGMETRICS 19, PERFORMANCE 18, INFORMS APS 18, EUROSYS 16, MASCOTS 16, MICRO 10, SIGMETRICS 03, ITC 03, SIGMETRICS 96). She is also the author of a popular textbook, Performance Analysis and Design of Computer Systems, published by Cambridge University Press, which bridges Operations Research and Computer Science.

Keynote Speech

Prof. Jim Dai
(Cornell University & The Chinese University of Hong Kong, Shenzhen)

Keynote 2: WWTA Load-Balancing for Parallel-Server Systems with Heterogeneous Servers
9:00 – 10:00, 16 September 2022, Friday

Abstract: The weighted-workload-task-allocation (WWTA) load-balancing algorithm, first proposed by Xie, Yekkehkhany, and Lu (2016), is known to be throughput optimal for parallel-server systems with heterogeneous servers. In this work, we derive and justify heavy-traffic approximations for steady-state workload vector under a complete-resource-pooling condition. I will explain the practical implications of these results and the mathematical tools used. These tools include Lyapunov functions for proving state space collapse and the BAR-approach, also known as the drift method. This is a joint work with Yaosheng Xu.

Bio: Jim Dai is the Leon C. Welch Professor of Engineering in the School of Operations Research and Information Engineering. He also serves as the Dean of School of Data Science at The Chinese University of Hong Kong, Shenzhen. Prior joining Cornell, he held the Chandler Family Chair Professorship in the School of Industrial and Systems Engineering at Georgia Institute of Technology, where he was a faculty member from 1990 to 2012. He is an elected fellow of Institute of Mathematical Statistics and an elected fellow of Institute for Operations Research and the Management Sciences (INFORMS). He has received a number of awards for research contributions including the Best Publication Award twice, in 1997 and 2017, The Erlang Prize in 1998, all from the Applied Probability Society of INFORMS, and the ACM SIGMETRICS Achievement Award in 2018. He served as the Editor-In-Chief for Mathematics of Operations Research (MOR) from 2012 to 2019. Jim Dai's research interests include stochastic processing networks, fluid and diffusion models of queueing networks, reflecting Brownian motions, Stein's method, customer contact center management, hospital inpatient flow management, semiconductor wafer manufacturing, and airline revenue management. Jim Dai received B.A. and M.A. from the Mathematics Department of Nanjing University.

Full Technical Program

14 September, 2022, Wednesday

ZOOM ID: 907 860 0066, Password: 123456; Beijing Standard Time (GMT+8)

Tutorial & Workshop		
9:00 – 12:30 **Tutorial: Age of Information in Wireless Networks: Concepts, Algorithms and Applications** *Sheng Zhou (Tsinghua University), Shan Zhang (Beihang University), Xiaoqi Qin (Beijing University of Posts and Telecommunications), Zhiyuan Jiang (Shanghai University)*		
Noon break		
13:30 – 18:00 **Workshop: Joint Workshop of Smart Industrial Networking and Satellite Based IoT**		
13:30-13:40		**Workshop opening and welcome**
13:40-14:30		**Plenary talk 1: NGMN Sustainable Trust** *Stan Wong (Ubiquitous Space)*
14:30-14:45		**Break**
14:45 - 15:44	**14:45 - 14:59**	**Paper 1: Joint Time and Power Allocation for NOMA-Assisted Low-Latency Mobile Edge Computing** *Liu Zhilin (Wuhan University, China), Yao Zhu (RWTH Aachen University, Germany), Yulin Hu (RWTH Aachen University, Germany), Peng Sun (Duke Kunshan University, China), Ning Guo (Wuhan University, China), Anke Schmeink (RWTH Aachen, Germany)*
	15:00 - 15:14	**Paper 2: Cooperative Resource Trading for Network Slicing in Industrial IoT: A Multi-Agent DRL Approach** *Gordon Owusu Boateng (UESTC, China), Guisong Liu (UESTC, China)*
	15:15 - 15:29	**Paper 3: Single Observer Geolocation for Periodic Communication Signals based on Doppler and TOA** *Jinzhou Li (Beijing Remote Sensing Information, China), Shouye Lv (Beijing Remote Sensing Information, China), Chenglin Wang (Beijing Remote Sensing Information, China), Shuai Liao (Beijing Remote Sensing Information, China), Shaoqing Zhou (Beijing Remote Sensing Information, China), Yang Liu (Beijing Remote Sensing Information, China)*
	15:30 - 15:44	**Paper 4: Modern OpenAI Gym Simulation Platforms for Vehicular Ad-hoc Network Systems** *Anjie Qiu (University of Kaiserslautern, Germany), Donglin Wang (Technical University of Kaiserslautern, Germany), Sanket Partani (University of Kaiserslautern, Germany), Hans D. Schotten (University of Kaiserslautern, Germany)*
15:45-15:00		**Break**
16:00-16:50		**Plenary talk 2: Industrial Communications - the Way-Forward from 5G to 6G** *Hans D. Schotten (University of Kaiserslautern, Germany)*
16:50-17:05		**Break**
17:05 - 17:34	**17:05 - 17:19**	**Paper 5: Adaptive Digital Twin and Communication-Efficient Federated Learning Network Slicing for 5G-enabled Internet of Things** *Daniel Ayepah-Mensah (UESTC, China), Guolin Sun (University of Electronic Science and Technology of China, China), Pang Yu (Chongqing University of Posts and Telecommunications, China), Wei Jiang (German Research Center for Artificial Intelligence, Germany)*

14 September, 2022, Wednesday

17:05 - 17:34	**17:20 - 17:34**	**Paper 6: DeepSmart: A Deep Learning Strategy for Real-time B5G/6G Edge Analytics and Anomaly Detection** *Bruce Mareri (University of Electronic Science and Technology of China, China), Ruijie Ou (University of Electronic Science and Technology of China, China), Pang Yu (Chongqing University of Posts and Telecommunications, China)*

15 September, 2022, Thursday

ZOOM ID: 907 860 0066, Password: 123456; Beijing Standard Time (GMT+8)

8:00-8:30	**Opening**	
8:30-9:30	**Keynote: Recent Breakthroughs in Stochastic Scheduling Theory** *Mor Harchol-Balter (Carnegie Mellon University)*	
	Session 1a (Invited) ZOOM ID: 907 860 0066; Password: 123456 Chair: Simon Pun	**Session 1b (Invited)** ZOOM ID: 793 096 2887; Password: 123456 Chair: Xin Liu
10:00-10:30	**Pushing the limits of at-scale future experiments with FABRIC** *Kuangching Wang (Clemson University, US)*	**A Theory of Second-Order Wireless Optimization and Its Application on AoI** *I-Hong Hou (Texas A&M University, US)*
10:30-11:00	**Peer-to-Peer Network Design for Blockchains** *Shaileshh Bojja Venkatakrishnan (Ohio State University, US)*	**How Does Data Freshness Affect Real-time Supervised Learning?** *Yin Sun (Auburn University, US)*
11:10-11:40	**Federated Architecture Design and Resource Sharing Policies for Multi-protocol Internet of Things** *Beatriz Lorenzo (University of Massachusetts Amherst, US)*	**To Talk or to Work: Efficient Federated Learning over Mobile Devices** *Miao Pan (University of Houston, US)*
11:40-12:10	**Wireless Access in Ambient Power-Enabled IoT: Stability and Freshness** *Jihong Yu (Beijing Institute of Technology, China)*	**Adaptive Streaming for Real-time Video Analytics** *Fangxin Wang (The Chinese University of Hong Kong, Shenzhen (CUHKSZ), China)*
	Session 2a ZOOM ID: 907 860 0066; Password: 123456 Chair: Zhixuan Fang	**Sessiotn 2b** ZOOM ID: 793 096 2887; Password: 123456 Chair: Junting Chen
13:30-13:50	**Age-and Deviation-of-Information of Time-Triggered and Event-Triggered Systems** *Mahsa Noroozi (Leibniz Universität Hannover, Germany), Markus Fidler (Leibniz Universität Hannover, Germany)*	**Rare Yet Popular: Evidence and Implications from Labeled Datasets for Network Anomaly Detection** *Jose M Navarro (Huawei Technologies Co. Ltd., France), Alexis Huet (Huawei Technologies Co. Ltd, France), Dario Rossi (Huawei Technologies, France)*
13:50-14:10	**Discrete-Time Analysis of Multi-Component Queuing Networks under Renewal Approximation** *Stefan Geissler (University of Wuerzburg, Germany), Stanislav Lange (NTNU, Norway), Gerhard Hasslinger (Deutsche Telekom, Germany), Phuoc Tran-Gia (University of Wuerzburg, Germany), Tobias Hoßfeld (University of Würzburg, Germany)*	**Regularized Bottleneck with Early Labeling** *Gabriele Castellano (Inria & Nokia Bell Labs, France), Fabio Pianese (Nokia Bell Labs, France), Damiano Carra (University of Verona, Italy), Tianzhu Zhang (Nokia Bell Labs & Laboratory of Information, Networking and Communication Sciences, France), Giovanni Neglia (Inria, France)*

	Session 2a ZOOM ID: 907 860 0066; Password: 123456	Session 2b ZOOM ID: 793 096 2887; Password: 123456
14:10-14:30	**Age of Information in an M/M/2 Queue with In-Order Delivery** *Huang Yijie (Shanghai University, China), Zhiyuan Jiang (Shanghai University, China)*	**User-Centric Markov Reward Model on Example of Cloud Gaming** *Tobias Hoßfeld (University of Würzburg,Germany), Poul E. Heegaard (Norwegian University of Science and Technology, Norway), Martín Varela (Profilence, Finland), Michael Jarschel (Technische Hochschule Ingolstadt, Germany)*
14:40-15:00	**A Grouping-based Scheduler for Efficient Channel Utilization under Age of Information Constraints** *Lehan Wang (Tsinghua University, China), Jingzhou Sun (Tsinghua University, China), Yuxuan Sun (Beijing Jiaotong University, China), Sheng Zhou (Tsinghua University, China), Zhisheng Niu (Tsinghua University, China)*	**A Physics-based and Data-driven Approach for Localized Statistical Channel Modeling** *Shutao Zhang (The Chinese University of Hong Kong, Shenzhen, China), Xinzhi Ning (Tongji University, Shanghai, China), Xi Zheng (Networking and User Experience Lab, Huawei Technologies, Shenzhen, China), Qingjiang Shi (Tongji University, China), Tsung-Hui Chang (The Chinese University of Hong Kong, Shenzhen, China), Zhi-Quan Luo (Tencent AI Lab Joint Laboratory on Machine Intelligence, China)*
15:00-15:20	**Looking Beyond the First Moment: Analysis of Packet-related Distributions in P4 Systems with Controller Feedback** *Nicolai Kröger (Technical University of Munich (TUM), Germany), Hasanin Harkous (Nokia & Technical University of Munich, Germany), Fidan Mehmeti (Technical University of Munich, Germany), Wolfgang Kellerer (Technische Universität München, Germany)*	**Impact Evaluation of Control Signalling onto Distributed Learning-based Packet Routing,** *Redha Abderrahmane Alliche (Université Côte d'Azur, CNRS, I3S, France), Tiago Da Silva Barros (Université Côte d'Azur, Inria, France), Ramon Aparicio-Pardo (Université Côte d'Azur, CNRS, I3S, France), Lucile Sassatelli (Université Cote d'Azur, CNRS, I3S, France)*
15:20-15:30	**Short Paper:** **Analyzing FIFO-Multiplexing Tandems with Network Calculus and a Tailored Grid Search** *Alexander Scheffler (Ruhr University Bochum, Germany), Steffen Bondorf (Ruhr University Bochum, Germany), Jens Schmitt (TU Kaiserslautern, Germany)*	**Short paper:** **AoI-Based Opportunistic-Fair mmWave Schedulers** *Shiksha Singhal (Indian Institute of Technology, India), Veeraruna Kavitha (IIT Bombay, India), Sreenath Ramanath (Lekha Wireless Solutions, India)*
15:30-15:40		**Short paper:** **Fair opportunistic schedulers for Lossy Polling systems** *Vartika Singh (IIT Bombay, India), Veeraruna Kavitha (IIT Bombay, India)*

	Panel discussion	
16:10-17:40	**AI Native Networking**	
	Erol Gelenbe	Institute of Theoretical and Applied Informatics, Polish Academy of Sciences, Poland
	Albert Cabellos	Technical University of Catalonia, Spain
	Diego Perino	Telefonica Research, Spain
	Georg Carle	Technical University of Munich, Germany
	Laurent Ciavaglia	Rakuten, France
	Moderator: Dario Rossi	Huawei, France

16 September, 2022, Friday

ZOOM ID: 907 860 0066, Password: 123456; Beijing Standard Time (GMT+8)

9:00-10:00	**Keynote: WWTA Load-Balancing for Parallel-Server Systems with Heterogeneous Servers** *Jim Dai (The Chinese University of Hong Kong, Shenzhen & Cornell University)*
	Session 4: Invited talks Chair: Li Xia
10:00-10:30	**Knowledge Centric Networking: Challenges and Opportunities** *Dapeng Wu (City University of Hong Kong, China)*
10:30-11:00	**Toward Multi-modal Spatio-Temporal Traffic Prediction** *Kohei Shiomoto (Tokyo City University, Japan)*
11:10-11:40	**A c/μ-Rule for Job Assignment in Heterogeneous Group-Server Queues** *Li Xia (Sun Yat-Sen University, China)*
11:40-12:10	**Designing submarine cable network for a connected world: Bridging the gap between theory and practice** *Moshe Zukerman (City University of Hong Kong, China)*
	Session 6: Invited talks Chair: Tsung-Hui Chang
13:30-14:00	**Network Calculus: A Theory for Ultra Reliable Low Latency Guarantees** *Yumin Jiang (Norwegian University of Science and Technology, Norway)*
14:00-14:30	**A matrix-analytic approach to mining process of Bitcoin blockchain: How is the transaction-confirmation time affected by transaction arrival process?** *Shoji Kasahara (Nara Institute of Science and Technology, Japan)*
14:30-15:00	**Enlightening the Darknets: Augmenting Darknet Visibility with Active Probes** *Danilo Giordano (Politecnico di Torino, Italy)*
	Session 7: Invited talks Chair: Qiulin Lin
15:30-16:00	**Distributed Multi-Agent Decision Making for Vehicular Crowd Sensing Systems** *Haiming Jin (Shanghai Jiao Tong University, China)*
16:00-16:30	**Competitive Online Optimization with Inventory Constraints and its Application in IoT Communication and Cloud Resource Provisioning** *Qiulin Lin (City University of Hong Kong, China)*
16:30-17:00	**Large-System Insensitivity of Zero-Waiting Load Balancing Algorithms** *Xin Liu (ShanghaiTech University, China)*

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