Ninth ITU Kaleidoscope Academic Conference
"Challenges for a data-driven society"
Nanjing, China, 27-29 November 2017

Final Report

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1. ITU Kaleidoscope 2017 overview

The ITU Kaleidoscope conference 2017 (K-2017) was held at the Shangri-La Hotel in Nanjing, China, kindly hosted by the Nanjing University of Posts and Telecommunications (NJUPT), which provided excellent logistics.

Nearly 300 delegates from 26 countries participated in the conference, and some 20 participants joint remotely. Some **photos** are available on the ITU Flickr, and the webcast will be posted shortly at the event´s webpage.

The event was technically co-sponsored by the Institute of Electrical and Electronics Engineers (IEEE), IEEE Communication Society (IEEE ComSoc) and the International Conference on Standardization and Innovation in Information Technology (SIIT2017), and sponsored by Jiangsu Institute of Communications, New H3C Technologies, Nanjing Fiberhome Starrysky and Nanjing Ironhorse Information Technology.

A 10 month, substantial preparatory process was required for this Kaleidoscope edition. This process involved the efforts and collaboration of six TSB staff, a Steering Committee of five members (SC), and a Technical Programme Committee (TPC) of 76 members, all internationally recognized ICT experts from academia, research institutes and the private sector.

The ITU Secretariat would like to thank the Kaleidoscope 2017 dedicated Steering Committee members: Mostafa Hashem Sherif (AT&T, USA), Christoph Dosch (ITU-R Study Group 6 Vice-Chairman; IRT GmbH, Germany), Kai Jakobs, and Mitsuji Matsumoto (Waseda University, Japan); the whole Technical Programme Committee and in particular its Chairman, Kai Jakobs (RWTH Aachen University, Germany), for ensuring transparency through the double-blind peer-review process; and all the partnering organizations which supported the promotion of the conference: the Chair of Communication and Distributed Systems at RWTH Aachen University, the European Academy for Standardization, Waseda University, the Institute of Electronics, Information and Communication Engineers of Japan, the Institute of Image Electronics Engineers of Japan, Royal Holloway University of London, UNESCO Chair in ICT for Development, the University of the Basque Country, Chongqing University, Chongqing University of Posts and Telecommunications, the Competition Law Center of the University of International Business and Economics, Hubei University, the Institute of Computing Technology of the Chinese Academy of Science, and Zhejiang University.

Special thanks go to Zhen Yang (President, Nanjing University of Posts and Telecommunications, China), Kaleidoscope 2017 General Chairman, and to all his collaborators, whose invaluable support contributed to making this conference a great success, in particular: Chen Liu, Zhen Yang, Guo-Ping Jiang, Zhihua Zhang, Lianhui Wang, Yangei Sun, Ying Wang, Su Zhao, Jinlong Zhu, Xiefei Ge, Meng'e Li, Zhiya Zhu, Yulong Zou, Li Sheng and Kejia Chen.

Alessia Magliarditi, ITU Kaleidoscope Coordinator, chaired the meeting of the Award Committee members which selected the winners of the awards for the three best papers. The Award Committee was composed of five conference attendees: Stefano Polidori (Study Group Advisor, Telecommunication Standardization Bureau, ITU), Mostafa Hashem Sherif, Joan Garcia-Haro (Technical University of Cartagena, Spain), Ved P. Kafle (National Institute of Information and Communications Technology (NICT), Japan), Ken Krechmer (SIIT2017 Coordinator), and Subin Shen (Nanjing University of Posts and Telecommunications, China). At the ceremony, Alessia announced the winners of the best paper awards and the recipients of the Young Author Recognition whose certificates were kindly delivered by Chaesub Lee (Director, Telecommunication Standardization Bureau (TSB), ITU) and Guo-Ping Jiang, (Vice President of NJUPT, on behalf of Zhen Yang, President, and Kaleidoscope 2017 General Chairman). At the closing session, the TSB Director gave his closing remarks and Alessia presented some highlights of the conference and thanked all the people that contributed to its success, in particular Julia Zhu, Kaleidoscope 2017 local focal point, as well as Emer Windsor, Erica Campilongo, Stefano Polidori, Gent Barjami, and Pascal Borde from the ITU Telecommunication Standardization Bureau.

2. Conference programme

The **opening ceremony** included welcome remarks from Yin Chen (Director General of the Department of Science and Technology, Ministry of Industry and Information Technology (MIIT), China) and Chen Liu (Chairman of NJUPT, China, on behalf of Zhen Yang; an opening address (video) by the Secretary-General of the ITU, Houlin Zhao; an opening address by the Director of the TSB, Chaesub Lee; and an information address by Jian Song (Tsinghua University, China and Editor in Chief, ITU Journal: *ICT Discoveries*).

After the opening addresses, Ken Krechmer, (SIIT2017 Coordinator) introduced a keynote speech on how standards will support a data-driven society [Presentation].

Two additional **keynote speeches** on the role to be played by data in future wireless communication, and how China is looking at Artificial Intelligence to achieve smarter road transport, were included in the programme:

1. *Data-driven future wireless communication* [Presentation]
Jianhua Zhang, (Professor, Beijing University of Posts and Telecommunications, China)
The keynote summary is available at pg. 19 of the Conference proceedings.

2. *AI and Intelligent Vehicles Future Challenge (IVFC) in China: From Cognitive Intelligence to Parallel Intelligence* [Presentation]
Fei-Yue Wang (Professor, The State Key Laboratory of Management and Control for Complex Systems, Institute of Automation, Chinese Academy of Science, China)
The keynote summary is available at pg. 20 of the Conference proceedings.

In addition to the keynote speeches, the programme included one **invited paper** - "Legal challenges for data-driven society" [Presentation] - which addresses the changes that big data are bringing to society and the legal challenges that the data-driven society will be confronted with. It puts forward suggestions regarding the development and security of big data industry, protection of personal privacy through the establishment of commercial rules for big data and through international coordination mediated by international organizations. This invited paper was authored by Liu Duo (President, China Academy of Information and Communication Technology (CAICT)) and presented on her behalf by Xin Yongfei (Vice Director of the Policy and Economy Research Department of CAICT).

63 papers from 22 countries were submitted for review, 23 of which were accepted for publication and presentation (17 in the lecture sessions, 6 in the poster session) from 14 countries (almost all from academic circles).

All continents were represented in the conference programme, with some papers presented by a team of authors coming from different regions of the world. Representatives of **six ITU academia members** submitted papers to the conference (3 of which were included in the conference programme): Berlin University of Technology (Germany), Waseda University (Japan), and the Nanjing University of Posts and Telecommunications (China).

The research results submitted are related to various ITU activities, including: network architecture design and data-driven networking; data retrieval, processing, analysis, and analytics; small data; video quality adaptation data in mobile and pervasive computing; trusted computing, network security and privacy; cloud computing techniques for data management; data standardization, policies and regulation; legal aspects of standards and standardization; digital identity; data ownership models; open data licensing; business models for data and open data; inclusiveness, affordability and access to data; blockchain network performance analysis; data as a service (DaaS); e-Services; green, energy-efficient models and sustainability issues for data; e-Health; data for smart sustainable cities; IoT; machine learning; virtual production intelligence; drones and drone ecosystem; open data for education, research and public good; ensemble learning; Sustainable Development Goals etc. As in previous editions of the conference, a number of papers addressed radio-related issues such as wireless sensor and actuator networks; cognitive radio network; optical wireless communication; spectrum management and sharing.

Presenters made reference to ITU-T Recommendations (ITU-T G-Series: Transmission systems and media, digital systems and networks, in particular G.1070; ITU-T J-Series: Cable networks and transmission of television, sound programme and other multimedia signals, in particular ITU-T J.247; ITU-T Y-Series: Global information infrastructure, Internet protocol aspects, next-generation networks, Internet of Things and smart cities, in particular ITU-T Y.3052); ITU-T Technology Watch Reports: "Big Data: Big Today, Normal Tomorrow", Nov. 2013; "E-health standards and interoperability", Apr. 2012; study group activities (ITU-T Study Group 16, Question 28:

Multimedia framework for e-health applications; ITU-T Study Group 13, and in particular Question 16 "Knowledge-centric trustworthy networking and services"); focus group activities (ITU-T Focus Group on Digital Currency including Digital Fiat Currency (FG DFC); ITU-T Focus Group on Application of Distributed Ledger Technology (FG DLT); ITU-T Study Group 13 Correspondence Group on Trust (CG-Trust); "ITU Software Copyright Guidelines," no. April, 2012; ICT Development Index (IDI) 2016); "Understanding patents, competition & standardization in an interconnected world", 2014; World Telecommunication/ICT Indicators Database, 2016; ITU events: "Joint ITU-NGMN Alliance Workshop 'Open Source and Standards for 5G" 2016; etc.

An overview of Kaleidoscope papers and a mapping of papers and ITU activities (i.e. Study Groups, Focus Groups, etc.) has been prepared for the next meeting of the ITU Telecommunication Standardization Advisory Group (TSAG), and also for the ITU Radiocommunication Advisory Group (RAG) and the ITU Telecommunication Development Advisory Group (TDAG). Temporary documents providing information on selected papers will be also submitted to the various ITU Study Groups for consideration in their activities.

The authors of the award winning papers shared the prize fund of 6,000 CHF.

- **1st prize** (CHF 3 000.-): *A holistic approach to exploring the divided standards landscape in e-health research*. [Presentation]

Authors: Doyoung Eom, Heejin Lee (Yonsei University, Rep. of Korea)

Doyoung Eom and Heejin Lee of Korea's Yonsei University have claimed 1st prize at Kaleidoscope 2017 for their review of research into e-health standards and integration of related findings, an exercise intended to bring more cohesion to analyses of standards' contribution to ICT-enabled healthcare innovation. The winning paper highlights that the growing volume of research into e-health standards has not been matched with broader analysis of the common themes appearing in such research. The paper shares the results of a review of 84 articles, integrating their findings into three major identified themes: comparisons of the role played by e-health standards in developed and developing countries; analyses of the types and effects of e-health standards; and studies into the factors influencing the adoption of e-health standards.

- **2nd prize** (CHF 2 000.-): *Socio-economics and educational case study with cost-effective IoT campus by the use of wearable, tablet, cloud and open e-learning services*. [Presentation]

Authors Toshiki Ueda, Yoshikazu Ikeda (Otani University, Japan).

The 2nd prize paper presents a case study of the ability of tablets and wearable e-health devices to decrease universities' costs and support a more dynamic education experience. Tablets assisted the distribution of course materials, encouraged interactive communication among professors and students, and enabled students to capitalize on open databases and e-learning services. Wearable

e-health devices were shown to assist the planning of university services and encourage healthy behaviours known to contribute to successful study habits.

- **3rd prize** (CHF 1 000.-): *Fostering smart city development in developing nations: A crime series data analytics approach*. [Presentation]

Authors: Omowunmi E. Isafiade, Antoine Bigomokero Bagula (University of the Western Cape, South Africa).

The 3rd prize paper presents a novel crime clustering model, 'CriClust', based on a dual threshold scheme, to detect and map patterns in crime data and thus derive useful knowledge from crime datasets. The CriClust model was developed with the intention of assisting security agencies in combating crime in low-resource environments. The model identifies patterns in crime data to assist the anticipation of criminal behaviour and the development of evidence-based policy.

Alongside the winners of cash prizes, **11** entrants received **Young Author Recognition Certificates:** Amba Kak (Mozilla Foundation, India), Doyoung Eom (Yonsei University, Rep. of Korea), Jingze Li (Tilbury University, The Netherlands), Olia Kanevskaia (TILEC & Tilbury Law School, The Netherlands), You Wang (RWTH Aachen University & Fraunhofer Institute for Laser Technology, Germany), Rene Kabagamba (Carnegie Mellon University Africa, Rwanda), Rongzhao Wu (North China Electric Power University, China), Jiang Yuhan (Nanjing University of Posts and Telecommunications, China), Myeongha Hwang (University of Science and Technology, Rep. of Korea), Ming Sun (Nanjing University of Posts and Telecommunications, China), and Sebastian Canovas-Carrasco (Technical University of Cartagena, Spain).

For the sixth time at Kaleidoscope, a short "Fast-forward Poster Preview" session, chaired by Stefano Polidori, in the conference plenary gave more prominence to poster presenters. Presenters had a few minutes and not more than three PowerPoint slides each to pitch their research and to stir the participants' interest in the following **poster session**. The poster session was held in the same open space where the Kaleidoscope Exhibit took place.

The **Local Universities Exhibit** was organized to allow Universities from the Region to present their research projects and literature on innovative and bold approaches relevant to technology, business and policy aspects of data management and analysis and encourage the development of applications and services building on data technologies to improve society. All local partners were invited. Nanjing University of Posts and Telecommunications (NJUPT), China, and Competition Law Center, University of International Business and Economics (UIBE), China, accepted ITU invitations and joined the Exhibit.

All papers presented at the conference are included in the **Conference proceedings**, which are freely available for download on the Kaleidoscope 2017 webpage. They will be also listed in the IEEE *Xplore* digital library.

Programme, presentations, abstracts and biographies are available online.

Relevant recommendations and conclusions from the technical sessions, as drafted and presented by the Session Chairs, are available online in PDF format on the programme webpage, Wrap up session.

The conference programme also included two special sessions and a Tutorial.

The special session on "**ITU-T standardization work on future network technologies and data processing and management for IoT and Smart Cities & Communities**" was organized and moderated by Jun Kyun Choi (Korea Advanced Institute of Science and Technology (KAIST), Korea) with the aim of sharing information on the activities of the ITU-T Focus Group on DPM and relevant initiatives in the field of data processing and management.

The seventh edition of the **Jules Verne's corner** (JVc) was entitled "*The quantum revolution*" and featured a panelist, Yu-Ao Chen, from the University of Science and Technology (USTC), China, who shared his experience as Leader of the Beijing-Shanghai Quantum Communication Project.

A **Tutorial** on how the academic community can contribute to ITU standardization and participate in the activities of the Union [Presentation] was organized and run by Ved P. Kafle (National Institute of Information and Communications Technology (NICT), Japan & Rapporteur, ITU-T Study Group 13).

All participants received a CD which included an electronic version of the proceedings.

3. Next Kaleidoscope

The 10th edition of the ITU Kaleidoscope academic conferences will be hosted by the Universidad Tecnológica Nacional, Santa Féde la Vera Cruz, Argentina, from 26 to 28 November 2018. The theme will be *Machine Learning for Future Networks including 5G*. Further information will be made available soon here.