FINAL REPORT

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1. ITU Kaleidoscope 2020 overview

This year the ITU Kaleidoscope conference (K-2020) on *Industry-driven digital transformation* was exceptionally held online from 7 to 11 December 2020.

Nearly 150 delegates from 41 countries participated during the conference. The inhouse tool/platform, MyMeetings, was used and the **webcast** will be available shortly on the event´s webpage.

The conference was technically co-sponsored by the Institute of Electrical and Electronics Engineers (IEEE) and the IEEE Communication Society (IEEE ComSoc) and supported by the IEEE Technology and Engineering Management Society (TEMS).

A 12-month, substantial preparatory process was required for this Kaleidoscope edition. This process involved the efforts and collaboration of five TSB staff, a Steering Committee of eight members (SC), and a Technical Programme Committee (TPC) of 68 members, all internationally recognized ICT experts from academia, research institutes and the private sector.

The ITU Secretariat would like to thank the Kaleidoscope 2020 dedicated Steering Committee members: Andy Chen (Catronic Enterprise & REDDS Capital, Canada and IEEE TEMS), Christoph Dosch (ITU-R Study Group 6 Vice-Chairman; IRT GmbH, Germany), Eva Ibarrola (University of the Basque Country, Spain), Kai Jakobs (RWTH Aachen University, Germany), Gyu Myoung Lee (Liverpool John Moores University, United Kingdom), Mitsuji Matsumoto (Professor Emeritus Waseda University, Japan), Roberto Minerva, (Télécom SudParis, France) and Mostafa Hashem Sherif (Consultant, USA); the whole Technical Programme Committee and in particular its Chairman, Mostafa Hashem Sherif, for ensuring transparency through the double-blind peer-review process; and all the partnering organizations which supported the promotion of the conference: Waseda University, the Institute of Image Electronics Engineers of Japan (IIEEJ), the Institute of Electronics, Information and Communication Engineers of Japan (IEICE) of Japan, the Chair of Communication and Distributed Systems at RWTH Aachen University, the European Academy for Standardization (EURAS), the University of the Basque Country, and Liverpool John Moores University.

Alessia Magliarditi, ITU Kaleidoscope Coordinator, chaired the meeting of the Award Committee that selected the winners of the awards for the best papers. The Award Committee was composed of five conference attendees and SC members: Christoph Dosch, Eva Ibarrola, Kai Jakobs, Mitsuji Matsumoto and Mostafa Hashem Sherif. At the Ceremony, Chaesub Lee, (Director, Telecommunication Standardization Bureau, ITU) announced the winners of the best paper awards and the recipients of the Young Author Recognition (please see the Conference programme for details).

At the and Closing Session, Dr Lee gave his closing remarks and Alessia presented some highlights of the conference and thanked all the people that contributed to its success, including her team, the ITU Kaleidoscope Secretariat, Emer Windsor, Erica Campilongo and Simiso Dlodlo as well as Gent Bajrami and Ilia Londo (IT support) and Pascal Borde (promotional collaterals) from the ITU Telecommunication Standardization Bureau.

2. Conference programme

The Opening Ceremony included welcome remarks from Chaesub Lee (Director, Telecommunication Standardization Bureau, ITU) and Mario Maniewicz (Director, Radiocommunication Bureau, ITU) as well as an opening address from Andy Chen (Catronic Enterprise & REDDS Capital, Canada and IEEE TEMS - K-2020 Supporting Organization).

After the opening addresses, Roberto Saracco, IEEE Future Directions Committee (FDC), Digital Reality Initiative co-Chair and Chair of the Industry Advisory Board of FDC, introduced a keynote speech on "*An accelerated digital transformation, courtesy of the recent pandemic*" [Presentation]. This session was moderated by Roberto Minerva. His full keynote summary is available on pg. xv of the Conference proceedings.

This was followed later in the day by the keynote paper on "*Service-based architectures in production systems: Challenges, solutions and experiences*" [Presentation] that was authored and presented by Thomas Kuhn, and co-written by Frank Schnicke and Pablo Oliveira Antonino, Fraunhofer Institute for Experimental Software Engineering IESE, Germany. This session was moderated by Mostafa Hashem Sherif. His full keynote paper is available on pg. xxiii of the Conference proceedings.

On Day 2, the keynote speech delivered by Akihiro Nakao, Special Advisor to the President and Vice Dean of the Interfaculty Initiative in Information Studies, Graduate School of Interdisciplinary Information Studies, University of Tokyo, Japan, focused on "*Beyond 5G/6G telecommunications ensuring continuity in business, research and education*" [Presentation], and was moderated by Martin Adolph, Telecommunication Standardization Bureau, ITU. His full keynote summary is available on pg. xix of the Conference proceedings.

An additional keynote paper was delivered on Day 4 by Adam T. Drobot, Chairman, OpenTechWorks, Inc. and Past Chairman of the IEEE IoT Initiative, USA on "*Industrial transformation and the digital revolution*" [Presentation]. His full keynote paper is available on pg. xxxi of the Conference proceedings.

In addition to the four keynote speakers, the programme included one invited paper, co-authored by Maja Barring, Chalmers University of Technology, Sweden; Guodong Shao, Moneer Helu, National Institute of Standards and Technology (NIST), USA; and Bjorn Johansson, Chalmers University of Technology, Sweden, and presented by Maja. It focuses on *"A case study for modeling*

machine tool systems using standard representations" [Presentation], and is available on pg. xlv of the Conference proceedings.

42 research papers from 18 countries were submitted for review, 20 of which were accepted for publication and presentation from 9 countries (almost all from academic circles).

The research presented at this conference, that are related to various ITU activities, highlighted innovations in fields such as cyber-physical systems, digital twins, virtual simulation, augmented reality, immersive technologies, artificial intelligence and machine learning, and 5G/6G telecommunication, uncovering how these innovations all contribute to digital transformation of industrial processes, and also analysing their social and economic impacts.

An overview of Kaleidoscope papers and a mapping of papers and ITU activities (i.e. Study Groups, Focus Groups, etc.) have been prepared for the coming meeting of the ITU Telecommunication Standardization Advisory Group (TSAG), and also for the next 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 CHF 6 000.-.

- **1st prize** (CHF 3 000.-): "Automation of computational resource control of cyber-physical systems with machine learning" [Presentation]

Authors: Ved P. Kafle and Abu Hena Al Muktadir, National Institute of Information and Communications Technology (NICT), Japan

- **2nd prize** (CHF 2 000.-): "AI-based W-band suspicious object detection system for moving persons using GAN: Solutions, performance evaluation and standardization activities" [Presentation]

Authors: Yutaka Katsuyama, Keping Yu, San Hlaing Myint, Toshio Sato, Zheng Wen and Xin Qi, Waseda University, Japan

Best Paper Award

The **International Telecommunication Union**
together with the Steering Committee of the Kaleidoscope Academic Conference
"Industry-driven digital transformation" are honoured to award the paper entitled:

AI-BASED W-BAND SUSPICIOUS OBJECT DETECTION SYSTEM FOR MOVING PERSONS USING GAN: SOLUTIONS, PERFORMANCE EVALUATION AND STANDARDIZATION ACTIVITIES

Keping Yu

Global Information and Telecommunication Institute, Waseda University, Japan

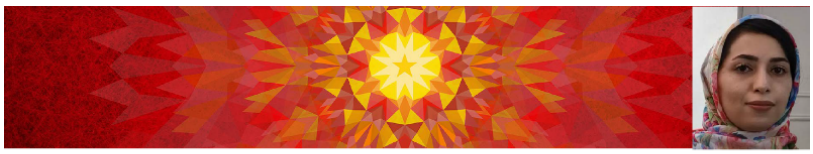
Co-authors: Yutaka Katsuyama, San Hlaing Myint, Toshio Sato and Xin Qi (Global Information and Telecommunication Institute, Waseda University, Japan); Zheng Wen (School of Fundamental Science and Engineering, Waseda University, Japan)

with the second prize at Kaleidoscope 2020
7-11 December 2020

Mostafa Hashem Sherif
Technical Programme
Committee Chair

Chaesub Lee
Director of Telecommunication
Standardization Bureau

- **3rd prize (ex aequo)** (CHF 500.-): "Digital transformation via 5G: Deployment plans" [Presentation]



Best Paper Award

The **International Telecommunication Union**
together with the Steering Committee of the Kaleidoscope Academic Conference
"Industry-driven digital transformation" are honoured to award the paper entitled:

DIGITAL TRANSFORMATION VIA 5G: DEPLOYMENT PLANS

Narges Gholipoor

Tarbiat Modares University, Iran

Co-authors: Abolfazl Zakeri, Mohsen Tajallifar, Sina Ebrahimi, Nader Mokari and Ahmad R. Sharafat (Tarbiat Modares University, Iran); Mohammad Reza Javan (Shahrood University of Technology, Iran)

with the third prize (ex aequo) at Kaleidoscope 2020
7-11 December 2020

Mostafa Hashem Sherif
Technical Programme
Committee Chair

Chaesub Lee
Director of Telecommunication
Standardization Bureau

Authors: Abolfazl Zakeri, Narges Gholipoor, Mohsen Tajallifar and Sina Ebrahimi, Tarbiat Modares University, Iran; Mohammad Reza Javan, Shahrood University of Technology, Iran; Nader Mokari and Ahmad R. Sharafat, Tarbiat Modares University, Iran

- **3rd prize (ex aequo)** (CHF 500.-): "Flexible multiplexing mechanism for coexistence of URLLC and eMBB services in 5G networks" [Presentation]

Authors: Kai Xiao and Xing Liu, ZTE Corporation and State Key Laboratory of Mobile Network and Mobile Multimedia, China; Xianghui Han, Peng Hao, Junfeng Zhang, Dong Zhou and Xingguang Wei, ZTE Corporation, China

Best Paper Award

The **International Telecommunication Union**
together with the Steering Committee of the Kaleidoscope Academic Conference
"Industry-driven digital transformation" are honoured to award the paper entitled:

FLEXIBLE MULTIPLEXING MECHANISM FOR COEXISTENCE OF URLLC AND eMBB SERVICES IN 5G NETWORKS

Kai Xiao

ZTE Corporation and State Key Laboratory of Mobile Network and Mobile Multimedia, China

Co-authors: Xing Liu (ZTE Corporation and State Key Laboratory of Mobile Network and Mobile Multimedia, China); Xianghui Han, Peng Hao, Junfeng Zhang, Dong Zhou and Xingguang Wei (ZTE Corporation, China)

with the third prize (ex aequo) at Kaleidoscope 2020
7-11 December 2020

Mostafa Hashem Sherif
Technical Programme Committee Chair

Chaesub Lee
Director of Telecommunication Standardization Bureau

Alongside the winners of the best paper awards, 22 entrants received **Young Author Recognition Certificates** that are delivered to young authors of up to 30 years of age presenting accepted papers:

Sina Ebrahimi (Tarbiat Modares University, Iran), Narges Gholipoor (Tarbiat Modares University, Iran), Cheng Gong (Institute for Knowledge and Innovation Southeast Asia, Bangkok University, Thailand), Ismail Khram (Beirut Arab University, Lebanon), Aphile Kondlo (University of the Western Cape, South Africa), Zhigang Li (ZTE Corporation and State Key Laboratory of Mobile Network and Mobile Multimedia, China), Yihua Ma (ZTE Corporation and State Key Laboratory of Mobile Network and Mobile Multimedia, China), Ofentse Mabiletsa (University of the Western Cape, South Africa), San Hlaing Myint (Waseda University, Japan), Legogang Nkabinde (University of the Western Cape, South Africa), Balakrishnan Nalin Prashanth (University of Moratuwa, Sri Lanka), Xin Qi (Waseda University, Japan), Mohsen Tajallifar (Tarbiat Modares University, Iran), Xingguang Wei (ZTE Corporation, China), Zheng Wen (Waseda University, Japan), Ruchen Wyngaard (University of the Western Cape, South Africa), Kai Xiao (ZTE Corporation and State Key Laboratory of Mobile Network and Mobile Multimedia, China), Keping Yu (Waseda University, Japan), Abolfazl Zakeri (Tarbiat Modares University, Iran), Chenchen Zhang (ZTE Corporation and State Key Laboratory of Mobile Network and Mobile Multimedia, China), Anqi Zheng (China Academy of Information and Communications Technology (CAICT), China), Hans Aoyang Zhou (RWTH Aachen University, Germany).

All papers presented at the conference are included in the Conference Proceedings, which are freely available for download on the Kaleidoscope 2020 webpage. They will be also listed in the IEEE *Xplore* Digital Library in January 2021.

Programme, **presentations,** 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 panels**.

The first one focused on "**The role of ICT for future pandemics**" and was moderated by **Reinhard Scholl** (Deputy Director, Telecommunications Standardization Bureau, ITU). The Panellists included **Sebastian Garcia Saiso** (Director Evidence and Intelligence for Action in Health, Pan American Health Organization (PAHO)/World Health Organization (WHO)) who gave a talk on "*Digital transformation in public health: A new paradigm for health systems strengthening and people-centered care in the post-covid19 era*" [Presentation]. The second panellist was **Jorge García Vidal** (Universitat Politecnica de Catalunya, Spain) who talked on "*Interoperability between European digital contact tracing applications*" [Presentation]; and the third panellist was **Mohamed-Slim Alouini** (King Abdullah University of Science and Technology (KAUST), Saudi Arabia) who spoke on "*How can 6G respond to pandemics?*" [Presentation].

The second special panel "Meet the ITU" was moderated by **Bilel Jamoussi** (Chief, Study Groups Department, Telecommunication Standardization Bureau, ITU). Keynote speakers, authors of K-2020 papers and conference participants were offered the opportunity to interact with **Chaesub Lee** (Director, Telecommunication Standardization Bureau, ITU), **Sergio Buonomo** (Chief, Study Groups Department, Radiocommunication Bureau, ITU), K-2020 session chairs, Chiefs of ITU-T and ITU-R Study Groups, and ITU experts, to exchange information on areas of common interest and explore opportunities for collaboration, including submitting proposals and/or formal contributions to ITU groups.

In addition to these special panels, the programme featured two special sessions on the last day. The first session was dedicated to the K-2020 supporter, IEEE Technology and Engineering Management Society (TEMS), and was given by **Gustavo Giannattasio** (IEEE TEMS Member of the Board 2020-2021, Uruguay) on *Managing industry 4.0* [Presentation] and moderated by **Andy Chen** (Catronic Enterprise & REDDS Capital, Canada and IEEE TEMS) [Presentation].

At the second session, moderated by **Alessia Magliarditi** (ITU Journal Coordinator, Telecommunication Standardization Bureau, ITU), Prof. **Ian F. Akyildiz**, Editor-in-Chief, presented the new **ITU Journal on Future and Evolving Technologies (ITU J-FET)** [Presentation].

Also, on Day 2, included in the programme for the first time was a Video Demonstration Track, moderated by Erica Campilongo (Telecommunication Standardization Bureau, ITU). The video selected by the ITU Kaleidoscope 2020 Steering Committee was authored by Duncan Sparrell (CISSP, CSSLP, CCSK, Senior Member IEEE; sFractal Consulting, USA) and focused on "Cybersecurity automation".

3. Networking

This year's conference aimed to continue to provide a platform for participants to develop meaningful connections and engage in discussions beyond the conference plenary session. Making use of the in-built functions in this year's online conferencing tool, particularly MyEvents and MyMeetings, as well as including other innovative external tools, a set of online networking opportunities was developed.

The MyEvents tool provided participants with the full list of participants to facilitate contact amongst attendees and further provided a matchmaking function based on the listed research interests of each participant. This function enabled a targeted list of suggested individuals for each participant to contact. MyMeetings allowed for the use of breakout rooms and these were used during the conference to encourage smaller group interactions as part of the "Virtual coffee breaks" where participants could move freely from one room to another. Within the Virtual coffee break, the "Virtual mentorship coffee" track was developed for more open interaction between interested attendees and invited guests to the conference, including Roberto Saracco, Thomas Khun, Ian F. Akyildiz, Sebastian Garcia Saiso, Mohamed-Slim Alouini and Jorge Garcia Vidal. This track also provided information to participants on research opportunities including the possibility to contribute to the work of ITU and IEEE TEMS, and received the majority of participants taking part in the virtual coffee break each day.

The Mystery Coffee external online tool was made available to participants, inviting those who signed up to take part in a one-on-one virtual meeting with another conference participant selected at random. This tool was available to participants throughout the conference and remains available for use until 31 January 2021.

4. Next Kaleidoscope

Please stay tuned for news on the 13th edition of the ITU Kaleidoscope academic conferences here.