Report on the 35th Optical Communication Systems Symposium "Optical Communication Technology Pioneering the Future ~Toward Realization of a Distributed Society~"

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1. Introduction

The 35th Optical Communication Systems (OCS) Symposium "Optical Communication Technology Pioneering the Future ~Toward Realization of a Distributed Society~" was held online as the previous year due to the COVID-19 on Dec. 14–15, 2021. It was organized by the IEICE Technical Committee on OCS, in cooperation with the IEEE Photonics Society Tokyo Section Chapter, the Photonic Internet Forum (PIF), and the IEICE Technical Committee on Extremely Advanced Optical Transmission Technologies (EXAT). As the rage of COVID-19 accelerates the digital transformation of society and industry, transition to distributed societies where local areas are responsible for the economic activities and information management is considered. The diffusion of ICT is very important for the development of a distributed society. Therefore, it is indispensable to advance the optical communication technologies that support the new society. This year's symposium, with 24 exhibitors and more than 260 attendees, was held as an opportunity to explore the future pioneered by optical communication technologies toward the realization of distributed societies.

Fig. 1 Picture of online OCS symposium, from top, Dr. Shuto Yamamoto (Secretary of OCS), and Dr. Takeshi Hoshida (OCS committee chair).

2. Technical sessions

On Day 1 (Dec. 14), following the welcome address (Fig. 1) by Dr. Takeshi Hoshida, the IEICE OCS committee chair, the symposium started with a keynote speech given by Dr. Yutaka Miyamoto (NTT) entitled "Review on research and development and practical application toward the realization of optical transmission exceeding 40 Gbit/s/ch ~With gratitude to technical committee on OCS~" (Fig. 2). He introduced the history of his research and development and practical application of 40 Gbit/s/ch long-distance optical transmission system, and his activities of the OSC society. He also described the future prospects for ultra-high capacity optical communication technologies.

Fig. 2 Keynote speech by Dr. Y. Miyamoto.

The award ceremony whose details described later was followed by an online exhibition, where the research results of nine national research projects were reported.

After that, we had workshop entitled "From urban concentration type to regional distributed type: Social and technical issues toward realization of a distributed society." It was contributed by the following four invited speakers (Fig. 3): Prof. Hiroshi Yamamoto (Ritsumeikan University) speaking about IoT systems and their applications for solving regional issues, Dr. Amane Miura (NICT) presenting on space communication technologies and a distributed society in beyond 5G, Dr. Koji Fukuda (Hitachi) talking about a policy proposal AI technology aiming at a distributed society, and Mr. Takashi Hasegawa (Sansan) describing recent activities for establishing national institute of technology in Kamiyama-cho, Tokushima. From these talks, the present state and issues for constructing new distributed society, and the importance of information and communication technologies that supports the society were realized.

There were totally 245 participants on Day 1. Day 1

Fig. 3 The presenters of Workshop 1: from left, Prof. H. Yamamoto, Dr. A. Miura, Dr. K. Fukuda, and Mr. T. Hasegawa.

of the symposium was closed with an online get-together, where 25 people participated and free discussions on the activities with and after COVID-19 were held.

There were three invited talks at the beginning of Day 2 (Dec. 15) (Fig. 4). The first invited talk was presented by Associate prof. Ryoichi Horisaki (The University of Tokyo) on "Computational imaging technology." He introduced a machine learning type scattering imaging technology that enables us to realize simplification and miniaturization of the system. Dr. Hidemi Tsuchida (AIST) presented on "Digital coherent LiDAR." He described the progress of the research on frequency modulation continuous wave light detection ranging (FMCW-LiDAR) using a coherent detection technique featuring high-sensitivity and high-speed detection. Finally, Mr. Kaoru Kenyoshi (NICT) gave an invited talk entitled "Standardization and social implementation of quantum key distribution network." He introduced the standardization trends for ITU-T SG13 network architecture, ITU-T SG17 security, and ITU-T SG11 protocol of QKD network. He also described the quantum cryptography communication system under construction in Japan.

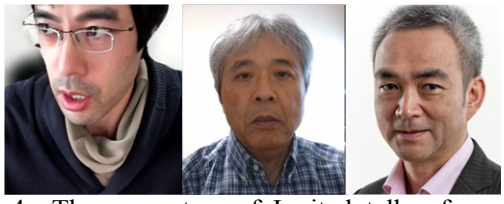

Fig. 4 The presenters of Invited talks: from left, Associate prof. R. Horisaki, Dr. H. Tsuchida, and Mr. K. Kenyoshi.

The invited talks were followed by an online poster session, where 11 posters were presented by 10 young researchers, including this year's OCS award winners, presented on their latest research results.

After that, an invited lecture, organized by IEEE Photonics Society Tokyo Section Chapter, was given by Prof. Masaya Notomi (Tokyo Institute of Technology) (Fig. 5). His lecture was entitled "New development by nanophotonics technologies with nanomaterials." He introduced the recent progress of research on ultra-high speed, low-power consumption optical switches using a hybrid platform that combines plasmonic waveguides and graphene. He also talked on the future prospects for research on hybrid platforms.

The invited lecture was followed by an online exhibition, in which nine exhibitors introduced the latest optical communication devices and systems.

In the afternoon session, we had another workshop

Fig. 5 The presenters of Invited lecture: Prof. M. Notomi.

entitled "Innovative optical transmission technology that attracts attention." Invited talks were given by Dr. Shigehiro Takasaka (Furukawa Electric) on Raman amplifier using incoherent light, Dr. Tsuyoshi Umeki (NTT) on advances in an optical parametric amplification technology and its applications, Mr. Keisuke Matsuda (Mitsubishi Electric) on free-space optical communication system by applying optical fiber communication technologies and Mr. Takanori Inoue (NEC) on the research trends in space-division multiplexing transmission technologies for submarine optical cable systems (Fig. 6). The advanced technologies introduced in the session are expected to realize future large-capacity, long distance optical communication systems and greatly contribute to the realization of new distributed societies. There were totally 263 attendees on Day 2.

Fig. 6 The presenters of Workshop 2: from left, Dr. S. Takasaka, Dr. T. Umeki, Mr. K. Matsuda, and Mr. T. Inoue.

3. Award ceremony

During the technical sessions, we celebrated this year's OCS award winners at the award ceremony (Fig. 7). The OCS Technical Committee presented the awards to the following winners:

- OCS Best Paper Award: "Real-time strongly-coupled 4-core fiber transmission." by Mr. Shohei Beppu (KDDI Research) et al.
- OCS Young Researchers Award: Mr. Takeo Sasai (NTT) for "Digital backpropagation for optical path monitoring －Loss and dispersion profile estimation－."
- OCS Young Researchers Award: Mr. Kozo Sato (Tohoku University) for "Study on chromatic dispersion dependence of GAWBS noise."

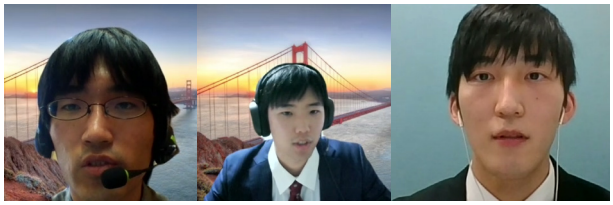

Fig. 7 OCS award-winners: from left, Mr. S. Beppu, Mr. T. Sasai, and Mr. K. Sato.

4. Conclusion

This year's OCS symposium was held online as the previous year under the continued influence of COVID-19. The OCS technical committee would like to express its gratitude to all the speakers, exhibitors, and audiences, for their contributions to the successful symposium. We hope that the innovative optical communication technologies discussed in this symposium will open up future distributed societies.