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Data-Driven Future Wireless Network beyond Human Intelligence

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1. Introduction

Since the demand for wireless communication including not only personal mobile devices but also IoT devices increases, sustainable growth of wireless networks will be limited by a shortage of spectrum resources. Radio frequency has been managed by the regulator of each country according to the international rule decided by International Telecommunication Union Radiocommunication Sector (ITU-R) more than 100 years and the spectrum band is fixedly allocated to each system in general. Last 20 years, the discussions of changing spectrum allocation policy from fixed allocation to dynamic allocation become active and the concepts of cognitive radio, dynamic spectrum allocation, smart radio, smart spectrum, and so on have been launched [1]. On the other hand, in recent years, artificial intelligence (AI) and machine learning have been attracted attention because the computational power of devices is dramatically increased to calculate complex algorithms. The various applications are discussed in the related issues of information and communication technologies. Also, a data platform for collecting big data have been developed and it is easy to use a huge amount of data obtaining through everyday activities. Even in wireless communication technologies, many research works have been published. These kinds of data-driven wireless technologies may overcome human designed wireless networks. In particular, it is expected that spectrum issues can be solved by efficient design of wireless networks according to the exact demand of users. In this article, we summarize current research issues in the field of data-driven wireless networks and present a vision for data-driven future wireless networks beyond human intelligence.

2. Current Research Issues of AI/ Machine Learning in Field of Wireless Communications

Many papers have published in the field of AI and machine learning related to wireless networks. Several tutorial papers summarize the research trend of AI and machine learning applied for wireless networks [2,3]. The spectrum monitoring and signal identification using machine learning are discussed for obtaining exact radio environment information in complicated wireless environments [4]. Channel assignment and resource allocation using machine learning are famous topics for the optimization of limited wireless resources [5]. Many

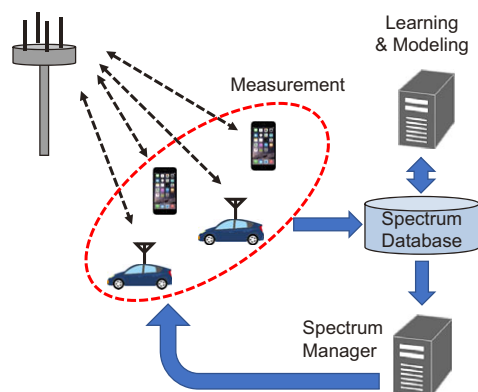


Fig. 1 Concept of Smart Spectrum.

papers have focused on exact mobile systems with AI and machine learning such as 5G and beyond [6] and WiFi [7]. Higher layer approaches are also discussed such as traffic control for software defined wireless networks [8]. We can understand that huge numbers of researches related to AI and machine learning have been considered in the field of wireless networks. The data-driven wireless networks with AI and machine learning is one of the trends for targeting the development of future wireless networks.

3. Smart Spectrum Concept

To realize data-driven wireless technologies, it is required to decide the framework of the data and wireless resource management with collecting the wireless environment data. One important issue for future wireless networks is how to manage the limited spectrum resource. As one of the concepts for spectrum management based on the measurement data, we have proposed the concept of the smart spectrum, in which, measurement, database, learning, and smart management are integrated for a platform of data-driven wireless networks [9]. The basic concept of the smart spectrum is shown in Fig. 1. As shown in this figure, the measurement radio environment data and the measurement network environment data are gathered at the spectrum database and the spectrum for the various wireless systems can be adaptively allocated. In the smart spectrum, the hierarchical database structure is considered as shown in Fig. 2 for realizing scalable spectrum management with considering local precise spectrum allocation and also adaptive spectrum policy decided by regulators.

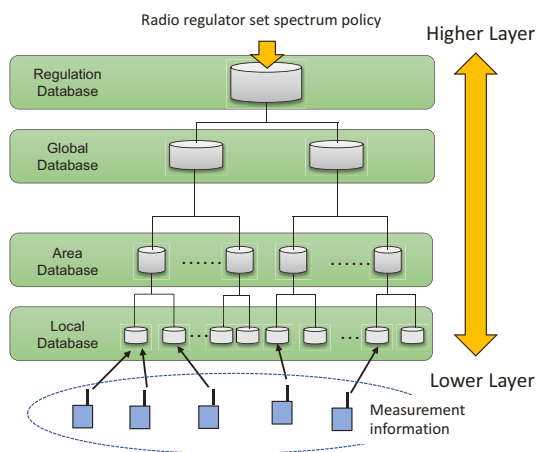


Fig. 2 Hierarchical spectrum database structure.

The preliminary practical systems have been launched in the world, such as spectrum access system (SAS) in the USA, in which spectrum band between cellular systems and military radar with spectrum database and spectrum sensors, dynamic spectrum sharing system in Japan, in which spectrum band between 5G / LTE systems and other terrestrial systems are shared with database [10]. Japanese commercial dynamic spectrum sharing system is planned to start in 2021. In the initial system, AI and machine learning technologies are not utilized for designing the spectrum allocation but the system can be expanded to spectrum propagation estimation and spectrum management based on AI for more precise spectrum usage. Active R&D is still ongoing to find solutions for future wireless spectrum management issues.

4. Current Wireless Network Design

Before discussing the future data-driven wireless networks, current wireless network design suitable for human intelligence is briefly summarized. The development of the Internet is one of the evolutionary innovations in the field of communications around the late 1900s to early 2000s. One of the key concepts is the hierarchical protocol reference model known as the OSI reference model. In this model, the protocol is categorized into seven protocol layers and the protocol and management are separated in each protocol layer. The internet protocol (IP) is designed by this kind of hierarchical layer model and robust networks can be developed. The protocol layers of the Internet are slightly different from the OSI reference model but the lower layers are almost the same. The layer is categorized into the network interface layer (physical and MAC protocol), Internet layer (IP), transport layer (TCP, UDP), and application layer. Current communication devices are designed according to these layers. Moreover, the fields of research related to communications are also categorized by these protocol layers. The hierarchical structure of communication protocol is suitable for human designed communication systems because complex issues crossing the layer are not required to consider. Many researchers know this kind of structure is not optimal and “cross-layer” is a

keyword for a new network. However, cross-layer technologies are not succeeded in creating a new network beyond the Internet for a long time. In particular, since wireless networks require short term control for rapid change of wireless channel and long term control for higher-layer applications, it is difficult to apply cross-layer design in the current communication design. On the contrary, AI and machine learning may completely change the design process because data-driven control does not care about the layer structure and the layer structure may limit the optimization.

5. Data-Driven Future Wireless Networks beyond Human Intelligence

Several types of researches for AI and machine learning in wireless networks just solve an optimization problem by using the learning algorithm. Among them, the solution can be found by the traditional optimization method and it is not required to use AI and machine learning. From this point of view, AI and machine learning have to be used for the field in which it is difficult to solve by using traditional optimization methods. One of the big issues of wireless communication is that it is difficult to guarantee the communication reliability due to unstable wireless channel. The calculation of wireless channel behavior is difficult because the exact solution has to be calculated by the theory of electromagnetic field based on Maxwell's equations. However, it is difficult to decide the exact model of radio propagation by considering the material of the surrounding stuff. Therefore, radio propagation modeling is the first candidate for applications using AI and machine learning for finding a suitable model for wireless channels. Traditional radio propagation models are created by heuristics with a huge amount of measurement data and the propagation curb, which is the relation between the received signal powers vs. the distance, is predicted. For cellular networks, the Okumura-Hata propagation model is famous and accurate average received power can be predicted. However, usually, the wireless environment is site-specific and it is difficult to predict the shadowing effect, which fluctuates the received power due to surrounding buildings and trees.

Data-driven radio propagation estimation can predict the shadowing level fluctuation by automatically processing a huge amount of measurement data gathered through personal mobile devices [11]. The basic method is just statistical calculation like averaging in a certain area, like a 10 m mesh area, and the averaged received power is utilized for estimating the received power at the receiver mesh. Interpolation techniques can be used for estimation wide area with limited active mesh. Kriging can accurately interpolate multiple meshes with the minimum estimation error of the receive signal power.

In more complicated situations, transmitter and receiver are not fixed like vehicle to vehicle communications (V2V). We can use Neural Network for predicting radio propagation because the number of measurement data in each pair of transmitter and

receiver mesh is small. Neural Network-based radio propagation estimation can predict complicated situations in which humans cannot understand the mutual relationship between measurement data and the predicted receive power. In these days, AI-based radio propagation estimation with the limited measurement data and satellite image or three-dimensional map have been considered [12]. Here, deep learning is used for predicting the received power by finding the typical propagation patterns by using limited measurement data. Many researchers try to improve prediction accuracy with a limited number of measurement data. From these points of view, in future wireless communication, radio propagation is no longer an unpredictable item for realizing reliable wireless communication.

We can understand unstable radio propagation can be relaxed by using measurement data and AI/machine learning algorithm as shown above. However, wireless communication quality is not decided only by radio propagation issues. In particular, upper layer communication quality including the influence of radio propagation and physical layer cannot be guaranteed in current wireless systems. As shown in the previous section, current communication protocols are separately controlled in each protocol layer and it is difficult to find global optimization considering multiple layers. This kind of layer separated control is suitable for human designed systems but data-driven wireless networks can unify the multiple layers because it is not required to consider the human-friendly design. Currently, many types of researches focus on AI and machine learning for targeting optimization and design of wireless systems in each layer. However, researches considering the cross-layer wireless design from radio propagation to applications based on obtaining data are not many. Data-driven wireless design can remove the barrier of the layered structure and directly connects physical layer data, network layer data, and application layer data through the learning algorithms. There is a possibility that we can create user demanded high-quality wireless networks through data-driven wireless design for future wireless networks.

6. Conclusion

In this article, a vision for data-driven future wireless networks beyond human intelligence by using AI and machine learning is introduced. The data-driven wireless design can relax the limitation of the hierarchical structure of communication protocol and global optimization can be achieved. Also, the unreliability of wireless channels can be predicted by gathering measurement data from personal mobile devices. As a result, global optimization from the lower layer to the higher layer by using AI and machine learning will solve the spectrum issues of future wireless networks by improving the efficient usage of wireless resources according to the user demand.

7. Acknowledgment

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Broadcast Technology for Sports Coverage

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1. Introduction

With sports programs, viewers can see video from the best angles and listen to commentary while in their homes, but they can also have viewing experiences not possible when watching directly, with production features such as replays and slow motion. Many people watch sports broadcasts regularly on television, and sports programming is an important genre for broadcasters, able to utilize the immediacy and visual expressiveness of television effectively. For these reasons, we conduct R&D on broadcasting technology for sports coverage, to deliver it to viewers with as much interest, appeal and immediacy as possible.

This article introduces our research on technologies for video production and transmission of program contributions intended for use in sports coverage.

2. Video Production Technology for Sports

We are studying new video production technologies for use in sports coverage because it is important to convey the quickness and complexity of movements in sports scenes in ways that are easy to comprehend. We will introduce three technologies for video production that can support commentary in sports coverage, giving technical details and examples of application in programming. These include a technology that estimates the head pose of players, a technology that analyzes and creates visualizations of the 2D/3D motion of balls and other objects, and an image representation technology that uses video captured from multiple directions.

2.1 Head Pose Estimation Technology

Knowing what players in a game are looking at can help viewers understand the intentions of a player. As such, we are conducting research estimating the head pose of each player in soccer game video captured with a fixed, wide-field-of-view camera, to help with commentary on tactics and other aspects of the game [1].

The process for head-pose estimation is as follows. Regions showing the players' heads are first detected in the captured video. Player areas are extracted by background subtraction. Head regions are then detected by assuming the players are upright, and then fitting a circle to the contour of the upper part of the player area. Head poses are then estimated from the head image regions by using a support vector machine (SVM) that was pre-trained using face images of the eight head-

pose directions. Since the original video was taken at a wide field-of-view and the detected head regions are of low resolution, the positions of facial features such as eyes, nose and mouth cannot be used to determine face orientation. Instead, we extract image feature descriptors from the image head regions, using Histogram of Gradients (HOG) [2] for shape, and a color histogram for the color distribution. The results from discriminators trained beforehand for these features are combined to estimate one of eight orientations for the face (Fig. 1). Figure 2 shows examples of the results of estimating head pose, displayed as a fan-shaped mark. Here, the soccer images were taken from the Soccer Video and Player Position Dataset [3].

We checked the performance of this technology for providing explanation in a sports commentary program, in scenes where points were scored. Displaying the estimated head pose of players using a fan-shaped marker made it easier to see visually and explain plays in the video in terms of player blind spots.

2.2 Curling Stone-trajectory Display Technology

Here we describe an example of object recognition using machine learning applied to curling stones [4]. In curling, the state of the ice changes when stones pass over it, so players consider the paths of previously thrown stones when estimating ice conditions and deciding strategies and where to throw subsequent stones. However, it is difficult to convey ice state with camera video alone, so we are researching methods to show stone trajectories over camera video using computer graphics (CG). This can be used to support commentary of tactics and other aspects. Machine learning is used to detect the stones in the captured video. As shown in Fig. 3, sweeping with brooms is used to control the progress of the stone, and obstructing brooms (occlusions) can change the features of stone images. This makes it difficult to track stones reliably using methods such as that used for estimating face orientation in section 2.1, which use machine learning and train with particular feature values beforehand. Online machine learning methods for object tracking methods have recently been proposed to handle this issue, by continuing to learn with each successive image, updating the discriminator for each frame of video. One online machine learning tracking method used to track stones uses a Kernelized Correlation Filter (KCF) to handle changes to image features due to sweeping. However, KCF is susceptible

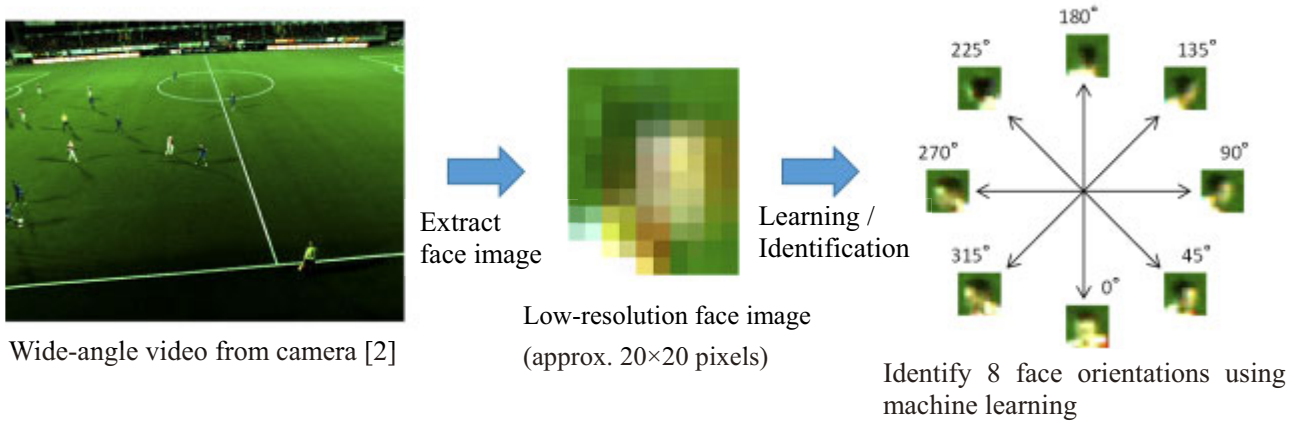


Fig. 1 Face-orientation estimation technology.



Fig. 2 Example of soccer players with face orientation graphics.

to noise when used as-is. We have made improvements and produced a more robust tracking method by extracting stone-region candidates in a pre-processing step.

This technology has been used continuously for coverage of the Japan Curling Championships since January 2017. It has demonstrated the ability to follow the stones reliably in these programs, and to support commentary on the ice conditions and the team’s strategy by displaying the stone trajectories. Examples of trajectories displayed in the broadcasts are shown in Fig. 4. The trajectories in the figure show that many stones have travelled down the right side of the sheet, eliminating pebbling in the surface of the ice, which reduces speed and increases curl.

2.3 Object Spatial Analysis Technology

The ability to visualize the 3D position and motion of the ball in ball sports could provide a new type of visual that could convey the play to viewers in ways that are easier to understand. This type of video could also be used for other purposes, such as supporting players and coaches for training, or to help referees with judgement. We are developing a graphics system [5] for sports coverage, which is able to analyze the spatial position of a ball in video taken by several

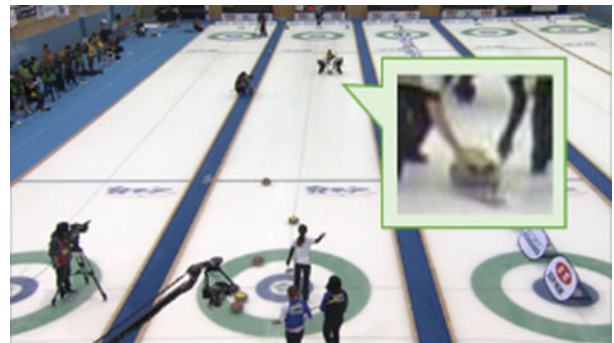


Fig. 3 Occlusions due to sweeping.



Fig. 4 Display of stone trajectories.

cameras, and to display information such as the 3D trajectory and speed using CG in real time.

The graphics system processing is shown in Fig. 5. The multiple robotic cameras in different locations (multi-viewpoint robotic camera) are first calibrated by filming a checkerboard or other calibration pattern [6]. This enables camera parameters such as position and orientation to be derived from rotary encoder data output from the camera mount, such as pan and tilt data. The position of the ball is then detected [7] in the video captured by each of the cameras. Balls with multiple colors, such as tournament balls in volleyball, can be detected over complex backgrounds using machine learning and training beforehand with ball feature values (here we use RGB and HSV color histograms and local binary patterns (LBP)). For detection, ball candidate regions are extracted based on color

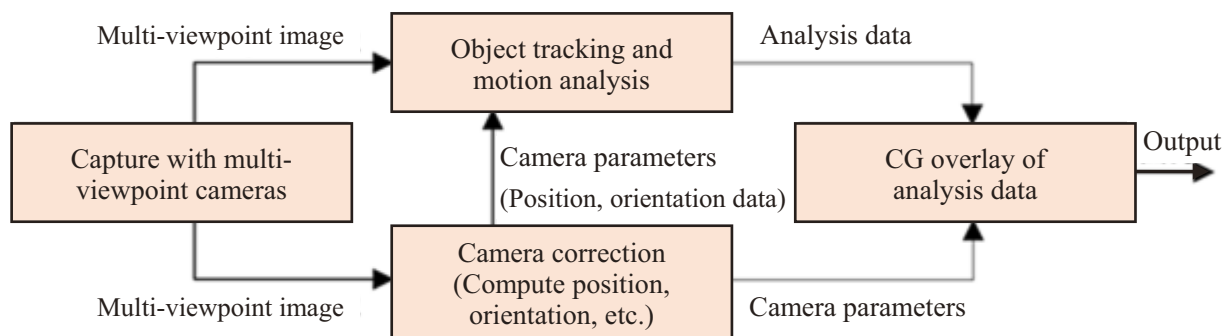


Fig. 5 Graphics system processing.



Fig. 6 Composition of CG ball trajectory on captured video.

information, and then a discriminator trained using feature values is used to decide the ball position. This process is accelerated by adjusting the range of search based on factors such as how far the ball may have moved. The 3D position of the ball in each frame is computed [8] using the position of the ball in each image and camera parameters such as position and orientation. The trajectory and speed are then computed from the derived 3D position of the ball, and CG of the trajectory is composited over the captured video. Composition of the CG requires approximately 0.3 (sec), which is adequate for use in sports coverage replay scenes. Figure 6 gives an example of CG of the ball trajectory composited with captured video.

This graphics system was used for beach volleyball in the sports commentary program, “Sports Innovation,” broadcasted on October 1st, 2017. It was able to derive the 3D positions of the beach volleyball game ball and generate the trajectories. In the program, the commentator used video of ball trajectories to support analysis of tactics.

2.4 Multi-viewpoint Representation Technology

In sports, watching video from a single direction often cannot adequately convey aspects such as plays, performance or technique. In such cases, the ability to present video taken from several directions could more easily convey details of the moment to viewers. We have developed a multi-view image generation system [9], which uses multi-viewpoint images to provide a



(a) Multi-viewpoint robotic cameras



(b) Operation (by cameraman)

Fig. 7 Multi-viewpoint robotic camera system.

multi-viewpoint representation that allows the viewer to move around the subject at a given point in time.

In the past, when capturing multi-viewpoint video, multiple fixed cameras oriented toward the subject beforehand were used. This made it difficult to capture multi-viewpoint video of a player moving on the field, or of multiple players scattered on the field. We have developed a multi-viewpoint robotic camera system (Fig. 7) using several linked robotic cameras. Operating the system, a single cameraman can direct all cameras on the same subject. This has enabled the capture of multi-point video for a single moving object, or objects scattered over a wider area.

However, due to error in control of the mounts that move the cameras and in the camera calibration used to obtain camera position and other parameters of the multi-viewpoint robotic camera system, the optical axes of all cameras do not actually intersect at a single point

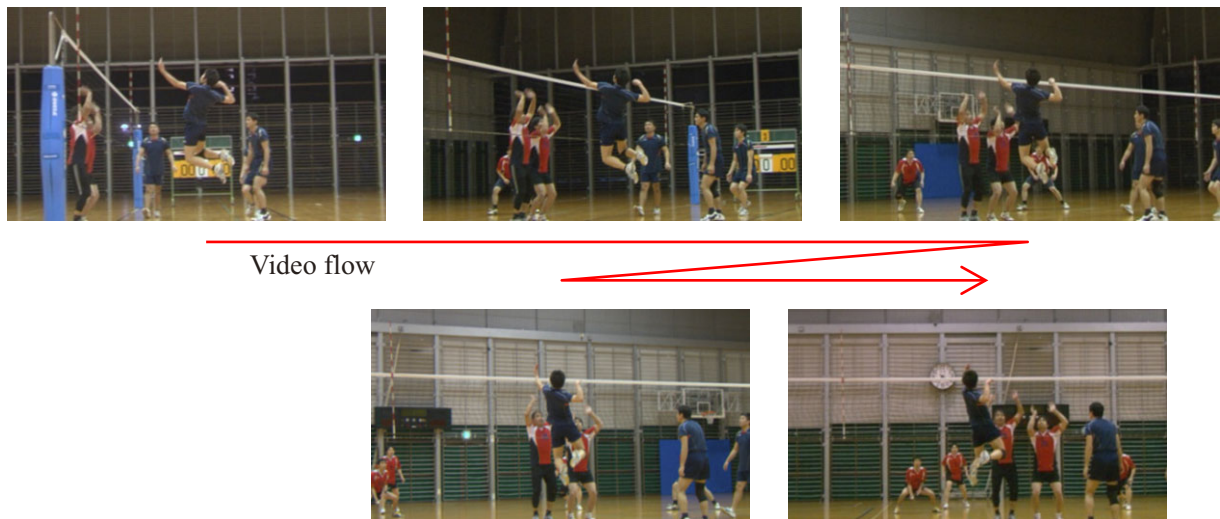


Fig. 8 Multi-view image generation video.

on the object. If the video is used as is, this causes instability in the position of subjects in the center of the multi-point video, moving up, down, left and right when switching between viewpoints. A feature of the multi-view image generation system is that it performs image processing to correct the video, as though the optical axes of all cameras intersected at a single point on the subject. This corrected multi-viewpoint video is able to be switched viewpoints smoothly and rotate the viewpoint around the subject as shown in Fig. 8.

The multi-view image generation system is being used for programs covering sports such as figure skating. Since the system provides a new type of video representation with a relatively simple configuration, it is also being used for programs other than sports, such as “The 2017 Robocon International Student Tournament,” broadcast on September 18th, 2017, and for promotional video for dramas. We have also developed the Sports 4D Motion system [10], which combines the multi-view image generation system with the graphics system introduced in section 2.3, able to analyze objects such as a ball, and compose CG.

3. FPU for Transmitting Program Contributions

For live broadcasts such as sports coverage or emergency reporting, video and audio program contributions from the site are transmitted by radio using a portable Field Pick-up Unit (FPU) or by communications satellite using a Satellite News Gathering (SNG) system.

Because the video and audio need to be sent in real time, without undue delay or interruption, an FPU system uses one-way transmission at a fixed transmission rate, without retransmissions. Figure 9 illustrates the concept of an FPU system. FPU can use frequency bands from millimeter-wave, microwave, and the 1.2 GHz and 2.3 GHz bands, and these are used for different purposes according to wavelength characteristics. For events in 2020, there is also demanded to use such wireless equipment for transmission of Super Hi-Vision (4K/8K) video materials [11].

This article introduces R&D on FPU transmission technologies utilizing the characteristics of the various frequency bands for 4K/8K program contributions.

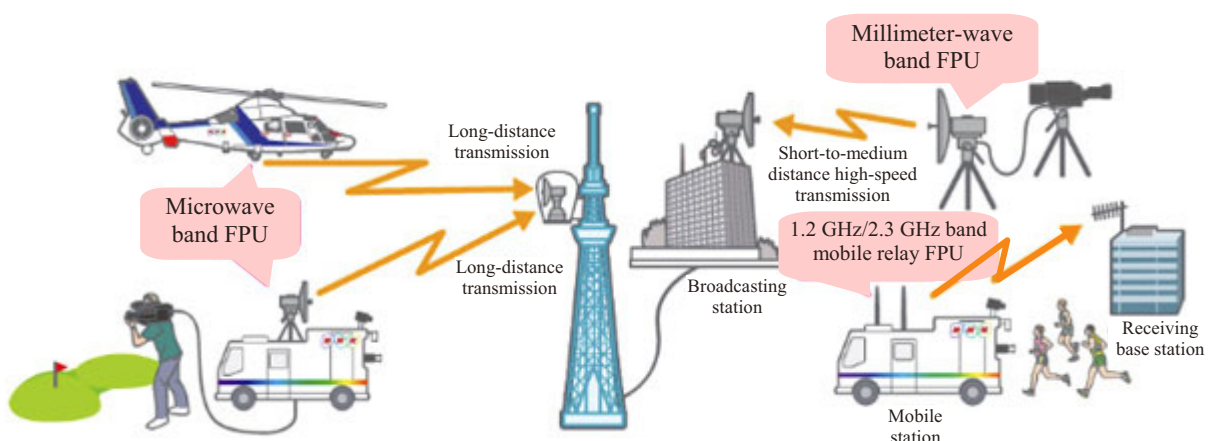


Fig. 9 FPU system concept.

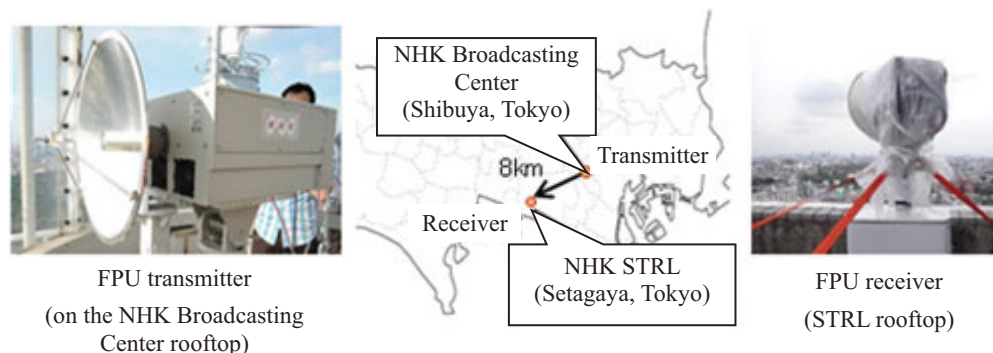


Fig. 10 Millimeter-wave Super Hi-Vision FPU prototype equipment.

3.1 Millimeter-wave Band FPU for High-capacity Transmission

To transmit program contributions for Super Hi-Vision broadcast programs requires bit rates of approximately 300 Mbps for 8K and 150 Mbps for 4K, even when using a High Efficiency Video Coding (HEVC) codec with standard delay time for video compression [12]. For ultra-low-latency transmission of contributions, required bit-rates are expected to be approximately 400 Mbps for 8K. Accordingly, we have developed an FPU for 4K/8K (Fig. 10) [13] that uses the millimeter-wave band (42-GHz band) with wide channel bandwidths, and is capable of transmission up to 600 Mbps using 32QAM (Quadrature Amplitude Modulation) -OFDM (Orthogonal Frequency Division Multiplexing) and an error correction coding rate of 3/4, with a channel width of 125 MHz (occupied bandwidth of 109 MHz) and dual-polarized Multiple-Input Multiple-Output (MIMO) modulation. We tested the system transmitting an 8K signal, encoded using an 8K video codec, from the NHK Broadcasting Center in Shibuya, Tokyo, to the NHK STRL, Tokyo, a distance of 8 km, and confirmed that transmission at 600 Mbps is possible in clear weather. We also developed a high-power amplifier as a countermeasure against rain attenuation, which is a weakness of the millimeter-wave band. We obtained transmitter output of 0.5 W per polarization (1 W in total). From these achievements, we can expect to be able to transmit an 8K signal at the estimated required bit rate of 400 Mbps (encoded with 32QAM-OFDM and error correction coding rate of 1/2) over distances of 5 km during rainfall of 20 mm/h [14].

3.2 Microwave FPU for Long-distance Transmission

In supporting 4K/8K transmission by microwave-band FPUs, we studied using the same channel bandwidth (18 MHz) and transmission power as existing microwave FPUs, so they can coexist. We developed an FPU introducing ultra-multilevel OFDM technology and dual-polarized MIMO to increase transmission capacity, and Low Density Parity Check (LDPC) coding as an error correction code to control the increase in carrier to noise ratio (C/N) required for

the ultra-multilevel modulation (Fig. 11) [15]. A microwave-band FPU can transmit at 200 Mbps (1024QAM-OFDM and error correcting coding rate of 5/6) for distances of 50 km depending on link budget estimation, even when it is raining. Using our prototype with 0.1 W transmitter output per polarization (0.2 W in total), we were able to transmit a compressed 8K signal of approximately 200 Mbps from Tokigawa, Saitama to the NHK Broadcasting Center in Shibuya, Tokyo, a distance of 59 km.

3.3 High-capacity Transmission Technology for Mobile FPUs

Mobile FPUs use the 1.2 GHz and 2.3 GHz bands so they provide stable wireless transmission in mobile environments, such as coverage of road races, because they have robustness in non-line-of-sight transmission, and less subject to Doppler effects than the microwave band.

FPUs transmit in one direction (simplex) at a fixed rate, so to prevent transmission error in mobile environments, modulation levels and error correction coding rate are statically reduced to ensure adequate transmission margin. In order to support 4K and 8K transmission in mobile FPUs, we are also studying introduction of a duplex communication function using time-division duplexing (TDD) and applying it in a 4×4 TDD-Singular Value Decomposition-MIMO (TDD-SVD-MIMO) system [16]. The system controls the transmission beam, the modulation and the error correction coding rate adaptively according to the propagation conditions. In testing with a prototype (Fig. 12), the equipment was able to maintain continuous and stable mobile transmission at rates higher than the target of 100 Mbps. Implementing an FPU using this technology is promising for 4K and 8K coverage of road races.

Research on mobile FPUs was conducted in part under the Ministry of Internal Affairs and Communications contract, “Research and Development on High-efficient Frequency Utilization Technology for Next Generation Video Material Transmission Systems”

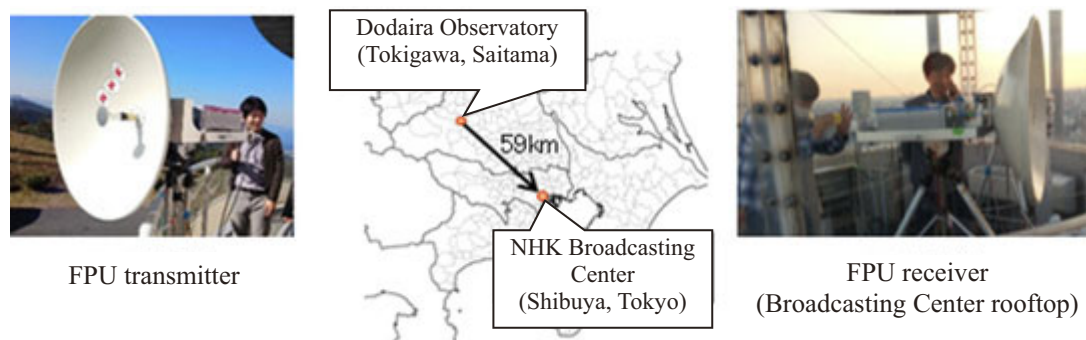


Fig. 11 Microwave band Super Hi-Vision FPU prototype equipment.

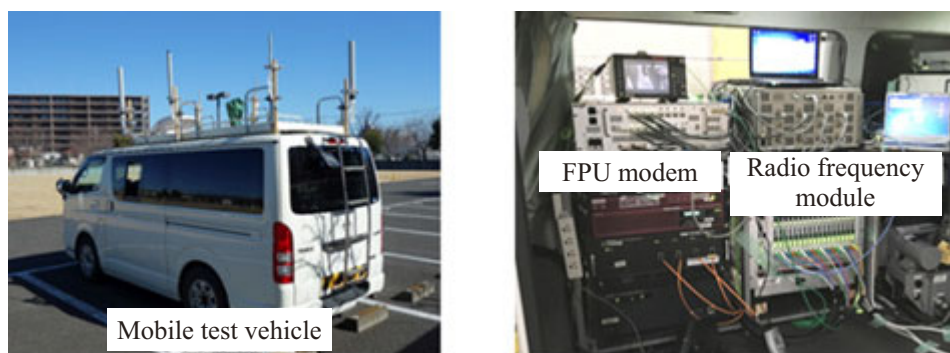


Fig. 12 Mobile coverage Super Hi-Vision FPU prototype equipment.

3.4 Standardization Trends

Standards for FPU are created by the Association of Radio Industries and Businesses (ARIB). Support for 4K and 8K transmission in millimeter-wave band FPU was standardized by adding to ARIB STD-B43 Ver. 2.0 in March 2017 [17]. 4K and 8K transmission by microwave-band FPU was standardized in ARIB STD-B71 [18], released on January 22nd, 2018. Support for 4K and 8K in mobile FPU was standardized in ARIB STD-B75 [19], released on March 18th, 2020.

4. Summary

We have introduced R&D being done by NHK Science and Technology Research Laboratories on video production technologies that will help viewers understand sports scenarios more easily, and on 4K and 8K FPU that will enable live 4K and 8K broadcasts for sports and other programs. We will continue R&D on technologies that contribute to producing exciting sports coverage that conveys a real sense of presence.

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Annual Report of Technical Committee on Network Systems

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Chair Prof. Nakao

1. Introduction

This report covers the annual activities of the IEICE Technical Committee on Network Systems (NS). It describes activities at the monthly technical meetings, recent research topics of the committee, and the research awards for 2019.

2. Technical Meetings

The schedule from April 2019 to March 2020 consists of ten NS technical meetings, one workshop [1], and additionally, three technical meetings of Network Software (NWS) sub-committee (as shown in Table 1). Several meetings are co-located with the ICN (Information-Centric Networking), OCS (Optical Communication Systems), PN (Photonic Network), SeMI (Sensor Network and Mobile Intelligence), RCS (Radio Communication Systems), SR (Smart Radio),

RCC (Reliable Communication and Control), IN (Information Networks), CS (Communication Systems), NV (Network Virtualization), ICM (Information and Communication Management), or CQ (Communication Quality) technical committees. In addition, the technical meeting in May was co-located with the Study Group of “Thinking Network” led by Prof. Akihiro Nakao, the Univ. of Tokyo. This co-location was newly started from 2018. Unfortunately, the technical meeting in March and the workshop were canceled due to concerns about COVID-19.

Recently presented papers mainly focus on technologies that support new generation networks, wireless and mobile networks, IoT, applications, security issues, network virtualization, SDN/NFV, cloud computing, Mobile Edge Computing (MEC), ICN/CCN, blockchain, and Quality of Service/Experience (QoS/QoE). In addition, the number of presented papers

Table 1: Technical meeting schedule for fiscal 2019. (Gray cells indicate technical meetings of NWS sub-committee)

Date	Location	Theme	Co-location with
April 18–19	Tenmonkan Vision Hall. (Kagoshima)	Network Evaluation, Resource Control and Management, Network Reliability and Resilience, Network Intelligence and AI, etc.	
May 16–17	Kogakuin Univ. (Tokyo)	High Level Protocol, Networking Technologies, IP Network Application Technologies, Network System Related Technologies, Security, Blockchain etc.	ICN, The Study Group of “Thinking Network”
June 6–7	Hikone Kinro Fukushi Kaikan (Shiga)	Network Service, Network Software, Software Technology	
June 20–21	MALIOS (Iwate)	Core/Metro System, Photonic Network System, Optical Network Design, Traffic Engineering, Signaling, GMPLS, etc	OCS, PN
July 10–12	Osaka Pref. Univ. I-site Namba (Osaka)	Communication and Networked Control for the Future Radio of the AI Age, etc.	SeMI, RCS, SR, RCC
September 5–6	Tohoku Univ. (Miyagi)	Next Generation Network, Cloud/Data Center Network, SDN/NFV, IPv6, Machine Learning, etc.	IN, CS, NV
October 25	Meisei Univ. (Tokyo)	Network Architecture, Network Software, Software Technology.	
October 10–11	Nagoya Institute of Technology (Aichi)	Network Architecture (Overlay, P2P, Ubiquitous Network, Active Network, NGN, New Generation Network), Grid, etc	
November 21–22	Kobe Univ. (Hyogo)	Network Quality, Network Measurement and Management, Network Virtualization, Security, Network Intelligence, etc.	ICM, CQ, NV
December 19–20	Tokushima Univ. (Tokushima)	Multi-hop/Relay/Cooperation, Sensor/Mesh, Ad-hoc Network, D2D/M2M, Wireless Network Coding, etc.	RCS
January 23–24	Ishigakijima Shoko Kaikan (Okinawa)	Network Software, Network Application, SOA/SDP, NGN/IMS/API, Distributed Control/Dynamic Routing, etc. Network Software for Next Generation Network Service Provisioning	
March 5–6	Royal Hotel Okinawa Zanpa–Misaki (Okinawa)	General, IN/NS Workshop (March 5)	IN

related to AI and machine learning is increasing rapidly in recent years.

At each technical meeting, we host lectures by invited speakers who are experts in their research fields. During this fiscal year, we have had invited lectures on network virtualization and softwarization, applications of AI and machine learning, network design, IoT, and other topics. In fiscal 2019, we had 206 presentations from academia and 73 from industry in the NS technical meetings.

Since June 2003, we foster the works of young researchers who have presented papers at NS technical meetings by inviting them to give a follow-up talk some months later. We call these the “encouragement talk.” We invited 12 young researchers to give such talks in the past year. We will continue this activity.

Moreover, the 5th night session was held to provide an opportunity for an exchange of views on a given topic in January 2020. In this year, issues on engineers in 5G/6G era were discussed among all the participants enthusiastically.

3. Research Awards 2019

The Technical Committee selected the recipients of Network System Research Award from among 220 regular papers that had been presented at monthly NS technical meetings from January to December in 2019. The award is given to each of the authors of the three or four best papers of each year. The abstracts of the four papers that won the award in 2019 are as follows.

- **Masaki Ueno, Go Hasegawa, and Masayuki Murata, “Experimental Evaluation of the Effect of Massive Accesses from M2M/IoT terminals in Mobile Core Networks” [2]**

Due to recent and rapid increase in mobile network traffic, as well as the rapid growth of M2M/IoT services, handling congestion in LTE and 5G cellular networks has become a critical issue. Especially, congestion in control plane becomes serious when accommodating massive number of M2M/IoT terminals into cellular networks due to the difference of communication characteristics.

Various existing works have argued that virtualization technologies such as Software Defined Network (SDN) and Network Function Virtualization (NFV) are possible solutions for improving network capacity of mobile core network. However, most of performance evaluation shown in those studies are based on the mathematical analysis and simulation experiments. Therefore, experimental evaluations with implementation on real network environment are necessary in order to examine the actual performance of those methods.

In this report, we show the experimental evaluation results of the performance of a mobile core network to assess the impact of massive accesses from M2M/IoT terminals. First, we constructed the Evolved Packet Core (EPC) environment based on open-source implementation. The emulators of user terminals and base stations are deployed on a cloud computing

platform. Then, we conducted experiments on simultaneous attach requests from user terminals. We evaluated the performance of mobile core nodes based on the bearer establishment time, the signaling processing time and queue length at the Mobility Management Entity (MME).

The results of our evaluations clarified that the MME becomes a bottleneck of attach procedure as shown in various existing works. When an MME is operated on a virtual machine with 1GHz/1core CPU, simultaneous attach requests from 128 user terminals increases the bearer establishment time by up to around 2.7 [sec]. We also provide possible solutions for avoiding the impact of massive accesses from M2M/IoT terminals: resource enhancement on an MME and distributing attach requests from multiple user terminals on purpose.

- **Noriaki Kamiyama and Akihiro Nakao, “Analyzing Dynamics of MVNO Market Using Evolutionary Game Theory” [3]**

In addition to mobile network operators (MNOs) which own network equipment, e.g., base stations and backhaul networks, to provide mobile network services to users, mobile virtual network operators (MVNOs) which provide network services to users by leasing the wireless bandwidth from MNOs are also becoming popular in many countries. As a new strategy to attract subscribers, some MNOs and MVNOs introduce “zero rating” (ZR) exempting traffic caused by delivering content of specific providers, e.g., YouTube and Google Play Music, from the monthly charge. However, because the ZR exempts traffic of content of just a specific set of content providers (CPs) from monthly fee, it is pointed out that the ZR violates the network neutrality which prohibits differentiating the treatment of traffic in the Internet, and the ZR of MNOs and MVNOs is actually prohibited by governments in Chili and India.

It is desirable to judge the treatment for the ZR based on the benefit and loss of users by investigating the influence of the ZR on the competitive market structure of the mobile network service in which many MVNOs exist. However, no existing works investigated the influence of the ZR on users considering a large number of MVNOs. In this paper, we analyze the competitive market of mobile network service consisting of a large number of MVNOs with multiple strategies by using an evolutionary game to clarify the impact of the ZR on the benefit and loss of users.

We model the environment in which a large number of MVNOs using the low-price (LP) or the ZR strategies exist by the evolutionary game to investigate the dynamics of the number of MVNOs using each strategy. Through the numerical evaluations, we clarify that the MVNO market will be monopolized by MVNOs using either strategy after long time elapses. We also show that a part of users suffer disadvantage when the mobile network market is monopolized by MVNOs using the ZR, and we suggest an appropriate treatment for the ZR which benefits all users.

- **Hayato Shimada, Yuichi Kawamoto, and Nei Kato, “A Study on Allocation of Communication Resources and Computing Resources in Edge Cloud Computing Using UAV” [4]**

In recent years, the Internet of Things (IoT) has become pervasive in everyday life, e.g. through intelligent traffic systems and smart cities. Such next-generation of IoT applications will require intelligent data processing that is performed via edge cloud computing within a short period. In edge cloud computing, the edge server performs data processing; this is expected to reduce service delay and power consumption. However, in existing edge cloud computing research, infrastructure such as radio towers for communication and base stations for installing edge servers is mandatory. Thus, it cannot respond to the demand for computing resources in the event of large-scale disasters and in areas without infrastructure.

In order to meet communication and computation resource requirements in such situations, the provision of resources using unmanned aerial vehicles (UAV) is studied. However, in an UAV-mounted cloudlet system, to provide services within the delay time that the application allows, it is necessary to consider the workload balance and communication range of the UAVs. In other words, when tasks are concentrated on a specific UAV, the delay time increases.

In this paper, we propose a handover solution method considering workload balance and create a corresponding mathematical model. We considered both the Processing Delay in the edge server and the Transmission Delay between the users and the UAVs. Moreover, numerical analyses show the effectiveness of the proposed method. The main contributions of this paper are the following three points. First, people can obtain computation and communication resources and acquire next-generation IoT services even in areas without infrastructure. Second, we clarify the issues in the UAV-mounted cloudlet system. Third, we propose a novel relay system and a workload balance method with handover. In conclusion, this study assumes a complex environment and solves the issues of UAV mobility and workload balance in the edge cloud computing system using UAV.

- **Ryoichi Takahashi, Yosuke Tanigawa, Hideki Tode, “A Study on Uplink OFDMA Transmission in Interfering Wireless LAN Environments” [5]**

Recently, along with the widespread use of portable devices, wireless LANs (WLANs), each of which is composed of one base station (BS) and its associated mobile stations (MSs) like smart phones and tablets, are closely placed while interfering with each other in various places.

In such dense environments, the radio interference frequency at each station, including BS and MS, from

neighboring stations is different depending on its position. In addition, as MSs and their applications become diverse, a frame generation rate from each MS is also becoming various. Thus, it is important to allocate enough transmission opportunities to MSs regardless of their interference frequencies and frame generation rates, while utilizing the channel efficiently by avoiding influences from the interference.

One key technology to deal with this issue is uplink orthogonal frequency division multiple access (OFDMA) transmission adopted in IEEE 802.11ax standard. In this uplink OFDMA transmission, the wireless channel is divided into some resource units (RUs), each of which is allocated to each MS flexibly, and multiple frames are simultaneously transmitted with different RUs. However, existing works do not consider the combined problem on the difference of the interference frequencies and frame generation rates among MSs.

In this paper, in interfering WLANs' environments, we propose an uplink frame transmission method that effectively uses the OFDMA transmission to allocate enough transmission opportunities to MSs regardless of their own interference frequencies and frame generation rates, while efficiently using the channel resource. This proposed method allocates RUs to MSs by considering the combined problem. In addition, based on a mathematical analysis, the uplink OFDMA transmission is controlled to be triggered only when its efficiency is better compared with the case of using CSMA/CA.

We confirmed from computer simulation that the proposed method improves network throughput and throughput fairness among MSs while improving the channel utilization efficiency.

4. Future Plans

The Technical Committee will have ten NS technical meetings in this fiscal year. Although on site meetings in some months may be impossible due to concerns about COVID-19, the meetings will be held online. The open Symposia in the IEICE Conferences, one of which will be on “AI technologies and their applications for future network systems and services” will also be organized at the IEICE General Conference in March 2021.

(For more information, please see our home page.

URL: <https://www.ieice.org/cs/ns/eng/index.html>)

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The Technical Committee on Smart Radio: FY2019 Activities

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IEICE Technical Committee on Smart Radio



1. Introduction

The Technical Committee on “Smart Radio” (TCSR) discusses advanced wireless communications technologies including software radio, cognitive radio, wireless distributed network, and wireless transceiver implementation. The TCSR also focuses on other emerging technologies such as exploitation of machine learning into wireless communications. The TCSR annually organizes five technical meetings, and one of them is held as an international workshop called as SmartCom. This report overviews activities of the TCSR in FY2019.

2. Activity Summary

In FY2019, the TCSR organized five technical meetings including an international workshop, SmartCom and a special symposium celebrating the 20th anniversary of the TCSR. Some of them were co-organized with other technical committees in IEICE: RCS, SeMI, NS, RCC, and SRW. A number of researchers not only from academia but industry participated our technical meetings and had fruitful discussions. Venues and topics of each meeting is listed in Table 1. Clearly, the TCSR is significantly active as a technical committee in responsible for research and development of wireless communications. Besides regular technical meetings, the TCSR held panel discussions at IEICE Society Conference and at IEICE General Conference which will be reported in Section 5.

In FY2019, the TCSR honored one excellent paper as the Best Paper Award, three young researchers as the Young Researcher of the Year Award, and one paper as the Special Technical Award.

- Best Paper Award: T. Maehata, M. Motoyoshi, S. Kameda, and N. Suematsu, “A study on self-interference suppression in digital RF front end”
- Young Researchers of the Year Award: Hiroki Iimori, Takanori Hara, and Mitsukuni Konishi
- Special Technical Award: T. Okuda, S. Ishikawa, D. Ammen, M. Umehira, S. Takeda, X. Wang, and H. Kuroda, “Development and demonstration of FMCW radar to mitigate inter-radar interference”

3. SmartCom 2019

Since 2014, the TCSR has organized the international workshop, SmartCom, in collaboration with several IEICE Technical Committees and technical key players outside Japan. It was the 6th

SmartCom in its history and jointly hosted with the Wireless Information Network Laboratory (WINLAB), Rutgers, the State University of New Jersey. The workshop targeted on smart wireless communications, and provided a great opportunity to realize better and smarter wirelessly-connected world in the future.

The number of participants of the first day was 83, and that of the second day was 54. The poster sessions had a lively and exciting discussion with many participants and presenters. In the third day, the WINLAB tour was taken place for excursion. 29 participants joined the tour and visited WINLAB's state-of-the-art test bed.

SmartCom selected two papers as the Best Paper Awards and two papers as the Best Student Paper Awards.



Fig. 1 Participants and Committee Members.

- Date: November 4th - 6th, 2019
- Venue: Rutgers University Inn & Conference Center, NJ, USA
- Topics: Cognitive radio, Dynamic spectrum management, Heterogeneous wireless networks, Communication theory, Flexible hardware, Data science and AI for wireless systems, etc.
- URL: <http://ieice-smartcom.info/2019/>

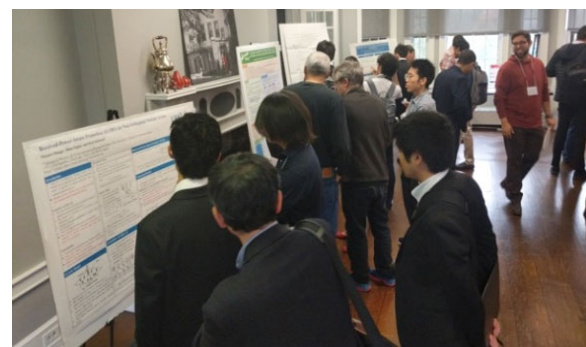


Fig. 2 Poster session in SmartCom 2019.

4. 20th Anniversary Symposium for the TCSR

The TCSR was started in 1989 under the leadership of Prof. Ryuji Kohno and reached the 20th anniversary. The TCSR held a symposium to celebrate this anniversary on 23 January 2020 in The University of Electro-Communications. Prof. Kiyomichi Araki, Prof. Masahiro Umehira, Dr. Doohwan Lee, and Prof. Yasuo Suzuki gave their special talks. Besides those inspiring talks, two panel sessions were held. First panel session was “Toward further development of Technical Committee on Smart Radio”. Second panel session was “Wireless technologies for Smart Society - The next 20 years -”. At the beginning of this panel, Prof. Ryuji Kohno gave a talk entitled “My emotion of founding SR study group and suggestion to activate future attractive academic activities and business promotion in global”. Prof. Hiroshi Harada and Prof. Kei Sakaguchi also gave presentations encouraging researchers in the TCSR. All attendees had discussions actively not only in the symposium but also a party after the event.

5. Other Remarkable Activities

5.1 Society Conference

A session entitled “Latest advances in resource management technologies for private wireless network – expectations and perspectives of local 5G and dynamic spectrum access -” was organized by the TCSR during 2019 Society Conference held in Osaka University. In 2019, 5G technologies are realized and discussion of local 5G, which is expected to be used for revitalization of local communities, is started.

Therefore, recent advances in local wireless network and its business are recognized as hot topics. In this session, five researchers engaged in dynamic spectrum access and local 5G discussed the current research trends. We also discussed future possibilities and deepened our understanding of applications for his technology. There were many questions from the audience, and it was a great success.

5.2 General Conference

Unfortunately, IEICE General Conference 2020 was canceled due to COVID-19 pandemic. Some TCSR events will be re-arranged in IEICE Society Conference in 2020.

6. Reference

- [1] Website of the technical committee on Smart Radio: <http://www.ieice.org/cs/sr/eng/>



Fig. 3 Participants and Committee Members of the 20th Anniversary of the TCSR.

Table 1 Summary of Smart Radio Activities in FY2019.

Category	Date	Venue	Topics	Num. of Participants
Regular	30, 31 May 2019	Tokyo Big Sight	Technical Exhibition, LPWA, General Topics	37 (only countable on 30 th)
Regular	10, 11, 12 July 2019	I-Site Osaka	Communication and Networked Control for the Future Radio of the AI Age, General Topics (with SeMI, NS, RCC, and RCS)	83
Society Conference	10,11,12,13 Sep. 2019	Osaka Univ.	-	-
International Workshop	4, 5, 6 Nov. 2019	Rutgers Univ., USA	SmartCom 2019	137
Regular	5, 6 Dec. 2019	Ishigaki City Hall	Cognitive Radio, Machine Learning, Heterogeneous Network, SDN, IoT, General Topics	55
Symposium	23 Jan. 2020	Chofu Creston Hotel	The 20 th Anniversary Symposium for the TCSR	64
Regular	Canceled	Tokyo Inst. of Tech.	Mobile Communications Workshop (with RCS and SRW)	-
General Conference	Canceled	Hiroshima Univ.	-	-

2019 Activity Report of Technical Committee on Communication Systems

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Web page: <https://www.ieice.org/cs/cs/>



1. Introduction

Technical Committee on Communication Systems (CS) is one of origins of technical committee in IEICE Communications Society and has a long history. We organized seven technical conferences and one special workshop every year at various cities in Japan. The technical interests include wide topics in wireless/wired communication systems and technologies from Physical layer to Application layer. In particular, our topics of interest include (but are not limited to) the following:

- Network control
- Transport
- Modulation, coding and signal processing
- Network architecture and implementation
- Network application

In this report, we summarize the 2019 activities of CS technical committee. In FY2019, we actively held totally seven technical conferences, two annual conferences (IEICE Society Conference and IEICE General Conference), one technical workshop

(Communication Systems Workshop (CSWS)). In addition, we introduce the winners of 2019 CS Technical Committee Awards in the report. It should be noted that the latest information, including the technical conference schedule and members of CS committee, are shown on our web site (<https://www.ieice.org/cs/cs/>), and we welcome your contributions and discussions in our conference.

2. Summary of CS Technical Committee in FY2019

In Table 1, we summarize the annual activities of CS Technical Committee in FY2017, FY2018 and FY2019. As shown in Table 1, in recent years, more than 100 papers were presented in the technical conferences. The total number of presented papers on IEICE Society and General Conferences was around 80 on average. Special sessions on IEICE Society conferences were very attractive because there were timely technical topics of ICT, such as IoT, 5G and Society 5.0. Unfortunately, IEICE General Conference was cancelled because of COVID-19.

We had many interesting special invited talks from

Table 1 Summary of CS Technical Committee annual activities.

	Number of presented papers		Special session on IEICE Society Conference (Number of participants)	Special session on IEICE General Conference (Number of participants)	Number of participants of CSWS
	Technical Conferences	IEICE Society/General Conferences			
FY2017	114	29/55(84)	Promotion of research and development toward future ICT (60)	- History and Challenge in optical access network (54) - IoT over All (56)	28
FY2018	113	32/44(76)	ICT x SPORTS: Applications and Technologies (27)	- Innovative evolution of network technologies for efficient radio resource utilization in 5G and IoT (32) -Applications of communication technologies in various areas (47)	33
FY2019	117	35/45(80)	- Innovative evolution of network technologies for efficient radio resource utilization in 5G and IoT (54) - Communication technologies for manufacturing in Society 5.0 (50)	- Extreme-Environments Communications --- Communication Technologies in Various Areas	27

communication theory to ICT services by outstanding speakers in every technical conference. One of the most impressive talks was presented by Prof. Takefumi Hiraguri, Nippon Institute of Technology, on 4th of July 2019 in Amami-Oshima Island [1]. He talked about “Challenge to Smart Agriculture with IoT and ICT.” He proposed new cultivation systems to solve the problems of abnormal weather utilizing IoT. On February 2019 at Sojo University, Prof. Takashige Hoshiai, Sojo University, talked about “Social Community Brand for Emerging Local Innovation,” and introduced a unique theory using P2P connectivity to create local innovations [2].

Through the FY2019, we had totally 22 valuable special invited talks, including CSWS. To refer them, please visit our archive web page (<https://www.ieice.org/cs/cs/jpn/special.html>).

CS technical committee organized Student-Session Presentation Award. The session was held on July conference with twenty-one presenters. CS committee, decided to give Student-Session Presentation Award for three presenters as follows: Sho Shibita, Osaka University [3], Eisuke Fukuyama, Nippon Institute of Technology [4] and Yamato Yoshikawa, Kyoto Institute of Technology [5].

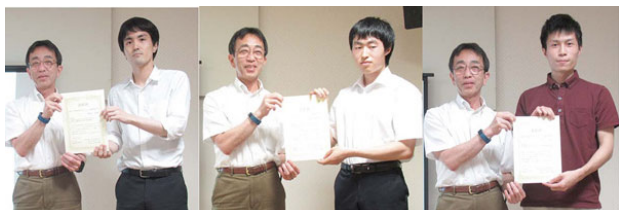


Fig. 1 Student-Session Presentation Award recipients with Chair Prof. Nakazato.

The award ceremony was held on the same conference including CS awards’ winner in FY2018 (Figs. 1 and 2).



Fig. 2 Chairman’s award for FY2018 recipients with Chair Prof. Nakazato.

3. Future Activities of CS Technical Committee in FY2020

3.1 Technical Conferences

In FY2020, we have a plan to hold seven technical conferences, two annual conferences and one technical workshop as well as FY 2019 (and summarized on Table 2). On July, we plan to hold a technical conference at Rishiri Island, one of attractive islands in Japan, and will invite a special tutorial speaker related to open source technologies for mobile network equipment.

3.2 Special Sessions on IEICE Society and General Conferences

In the next annual conference, we will organize one special session related to next generation optical communication technology for Beyond 5G/6G era.

Table 2 Technical conference schedule, July 2020 - April 2021.

Date	Venue	Joint committee	Topics
Jul. 11 th – 13 th	Rishiri Island, Hokkaido	–	Next Generation Networks, Access Network, Broadband Access System, Power-Line Communications, Wireless Communication Systems, Coding System, etc.
Sep. 10 th – 11 th	TBA	NS, IN, NV	Post IP networking, Next Generation Network (NGN) / New Generation Network (NWGN), Contingency Plan / BCP, Network Coding / Network Algorithms, Session Management (SIP/IMS), Internetworking / Standardization, Network configuration, etc.
Nov. 5 th – 6 th	TBA	CSWS	Broadband Access Systems, Home Networks, Network Services, Applications for Communications, etc.
Nov. 25 th – 26 th	TBA	IPJS-AVM, IE, ITE-BCT	Image Coding, Communications and Streaming technologies, etc.
Jan. (TBA)	TBA	OCS	Network Core / Metro Systems, Submarine Transmission Systems, Optical Access Systems / Next Generation PON, Ethernet, Optical Transport Network (OTN), Transmission Monitoring and Supervisory Control, Optical Transmission System Design / Tools, Mobile Optical Network
Mar. (TBA)	TBA	CAS	Network Processor, Signal Processing Circuits for Communication, Wireless LAN / PAN, etc.
Apr. (TBA)	TBA	CQ	Optical / Wireless Access and Their Integration, QoS and QoE, Assessment / Measurement / Control / Optimization of Communication Quality, Network Services, etc.

The annual conference will be held online on September 15th – 18th. In 2021, we are also planning to have a highly motivated symposium session.

3.3 CS Workshop

CS Workshop in 2020 will be announced soon. Please visit to the web site for the latest update (<https://www.ieice.org/cs/cs/jpn/cs/ws/index.html>).

3.4 CS Committee Awards

Finally, we introduce 2019 CS Technical Committee Awards. The awards are for authors or speakers who made good presentations and excellent papers in CS technical conferences in FY2019. The detailed information on the committee's awards is summarized in Table 3.

Table 3 CS committee's awards.

Chairman's award	Summary: The aim of the chairman's award to the superior papers is activating investigations on communication systems engineering.
	Candidates: The paper must be submitted to the IEICE committee on communication systems.
Encouraging award	Summary: The aim of the encouraging award to the excellent speakers is encouraging young researchers who are engaged in communication systems engineering.
	Candidates: The speaker must be under 33 years of age at the time of the conference in which the speaker made a presentation. His/her paper must be submitted to the IEICE committee on communication systems.
Student-session presentation award	Summary: The aim of the student-session presentation award is promoting presentations in the field of communication systems to students. The committee gives this award to students who made distinguished presentations in the student-sessions.
	Candidates: The speaker must be a student under 28 years of age at the time of the student session of the conference in which the speaker made a presentation. His/her paper must be submitted to the IEICE technical committee on communication systems.

The winners of the chairman's award in 2019 are the authors of three papers [6-8]. The speakers of the papers are Dr. Hikaru Kawasaki [6], Prof. Takahiro Matsuda [7] and Prof. Masaya Ohta [8].

The winners of the encouraging award in 2019 are the speakers of three papers [9-11], Mr. Sho Kakuwa [9], Mr. Koichiro Yamanaka [10] and Mr. Ryo Igarashi [11].

The above six papers are remarkably contributed to the promotion of the promising ICT technologies, and we, CS committee, decided to give the 2019 CS Technical Committee Awards.

4. Conclusion

In the report, we summarized 2019 activities of Technical Committee on Communication Systems. Any comments and feedbacks are appreciated to improve our activities. We wish your contributions to IEICE Communication Society and CS Technical Committee (<https://www.ieice.org/cs/cs/>).

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Report on the 14th International Symposium on Medical Information and Communication Technology (ISMICT 2020)

Shinsuke Hara
Osaka City University



1. Introduction

The 14th International Symposium on Medical Information and Communication Technology (ISMICT 2020) was supposed to be held at Nara Kasugano International Forum IRAKA, Nara, Japan, from the 20th to the 22nd of May 2020, but due to the outbreak of COVID-19, it was virtually hosted by Nara Institute of Science and Technology (NAIST) on the same dates. This symposium was technically co-sponsored by IEICE Communication Society (CS) and IEEE Engineering in Medicine and Biology Society (EMBS).

2. Organization

The organizing committee of ISMICT 2020 was formed mainly by the members of the IEICE CS Technical Committee on Healthcare and Medical Information Communication Technology (MICT) and the IEICE Engineering Sciences Society (ESS) Technical Committee on Wideband System (WBS) with General Co-Chairs: Prof. Shinsuke Hara (Osaka City University, Japan) and Prof. Minoru Okada (NAIST, Japan). In addition, the technical program committee (TPC) was formed with Co-Chairs: Prof. Tetsushi Ikegami (Meiji University, Japan), Prof. Shintaro Izumi (Kobe University, Japan) and Prof. Hiroyuki Yomo (Kansai University, Japan).

3. Conference Program

The first day of the symposium started with the opening ceremony and was followed by the first keynote speech on Ultraflexible and Stretchable Integrated Circuit System for Comprehensively Monitoring Brain Activities by Prof. Dr. Tsuyoshi Sekitani (Osaka University, Japan). Then, three regular sessions were held. The second day started with one regular session, and after another one regular session, Medical Device Regulatory Science (MDRS) & ROVER Workshop was held, which was chaired by Prof. Dr. Ryuji Kohno (Yokohama National University, Japan). Then, the symposium was recessed by the second keynote speech on Integrating Health Monitoring into Daily Activities through Smart Wearables and Assist Devices by Prof. Dr. Ing. Georg Fischer (Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany). The last day started with the third keynote speech on Wearable Textile Electrodes for Long-term Vector ECG monitoring “Tensor Cardiography” by Dr. MD. Shingo Tsukada (NTT Corporation, Japan). After two regular sessions, the

symposium ended with the closing ceremony. All attendees were remotely connected, so there were no entertainment events in the program.

4. Statistics

Symposium had three keynote speeches, twenty-nine presentations in six regular sessions, and seven short presentations/one technical discussion in one workshop. Attendees were from eight different countries, such as Japan, China, Russia, France, Germany, Italy, Finland, and Norway. Maximal number of simultaneous remote connections was 54.

5. Awards

The technical program committee awarded the following two papers:

- Best Paper Award: “Automatically Generated Neural Networks for Human Condition Detection Using Non-Contact Vital Sensing,” presented by Prof. Dr. Shakhnaz Akhmedova (Reshetnev Siberian State University of Science and Technology, Russia),
- Best Student Paper Award: “Fabrication and Mechanical Study of a Titanium Micro-Membrane for in Vivo Pressure Monitoring,” presented by Mr. Gwenaël Bécan (C2N-CNRS & MISTIC SAS, France).

6. Conclusion

In early May 2020, we still had a little hope to have a combined face-to-face and virtual conference, but on the 7th of May 2020, the Government decided to extend emergency declaration to ask people to quarantine themselves until the end of May, so we reluctantly shifted to a fully virtual conference.

Due to the COVID-19 pandemic over the world, a lot of papers were withdrawn for presentation, so the size of the symposium was shrunk against our will. However, this year’s ISMICT was very successful. The qualities of technical presentations were relatively high and audience was enthusiastic in Q&A. The three keynote speeches were excellent, and hot discussion was made in the workshop. We were able to see a glimpse of the future direction on medical ICT, such as from “wearable” to “contactless.”

Finally, I would like to thank all committee members for their kind supports for the success of ISMICT 2020. Next year’s ISMICT is scheduled to go for China, but the dates have yet to be determined.

Report on International Workshop on Technology Trials and Proof-of-Concept Activities for 5G Evolution & Beyond 5G 2020 (TPoC5GE 2020)

Yukitoshi Sanada
Keio University



1. Introduction

International Workshop on Technology Trials and Proof-of-Concept Activities for 5G Evolution & Beyond 5G 2020 (TPoC5GE 2020) was organized in conjunction with IEEE Vehicular Technology Conference (VTC) 2020 Spring. TPoC5GE 2020 is technically cosponsored by IEEE VTS Tokyo Chapter and IEICE Communication Society. It is also supported by the Technical Committee on Radio Communication Systems (RCS), IEICE. IEEE VTC 2020 Spring was originally planned to be held in Antwerp, Belgium, from May 25th to May 28th. However, owing to COVID-19 pandemic, it was held in on-demand style as a virtual conference through ON24 platform from May 25th to July 1st. TPoC5GE workshops were held at IEEE VTC 2017 Spring, 2018 Spring, 2019 Spring, and 2019 Fall. Thus, it was the fifth time to be held. The workshop focused on the latest trials and evaluation results for 5G and the proof-of-concept activities for beyond 5G.

2. Conference Program

There were eight presentations including a keynote presentation. The keynote presentation was provided by Dr. E. Dahlman from Ericsson Research. His keynote presentation was titled “5G evolution and beyond”. His talk gives the overview and the latest information of 3GPP standardization activities. It is now discussing for release 16 that includes the issues such as new radio (NR) operation in unlicensed spectrum, integrated access and backhaul, vehicular-to-everything/NR sidelink, NR based positioning, and enhancements for URLLC. He also explains some of the contents of release 17, which includes beyond 52.6 GHz (up to 71 GHz), non-territorial network, and reduced-capability devices (RedCap). He also presented his expectations regarding beyond 5G at around 2030. He said that trustworthiness and sustainability were key factors and it should support new applications. He also said that more flexibility in a network, further spectrum extension, joint communication and sensing, and more use of AI were the potential technology components in 6G.

3. Technical Session

In the technical session, there were seven presentations. The followings are the focuses of those presentations.

- Interference coordination and radio resource management for 5G advanced ultra-dense RAN; the proposed scheme applies K-means based UE clustering layering and scheduling for interference coordination.
- Millimeter-wave base station cooperation in high-mobility environments; the proposed scheme combines inter-baseband unit and intra-baseband unit cooperation technologies.
- 28 GHz-Band Experimental Trial at 283 km/h Using the Shinkansen; the experimental trial achieved the throughput exceeding 1.0 Gbps.
- Field experimental trial of dynamic mode switching for 5G NR-V2X sidelink communications towards application to truck platooning; the prototype with sidelink dynamic mode switching was presented.
- Field experimental evaluation on latency and reliability performance of 5G NR V2V direct communication in real express highway environment; the prototype system equipped with V2V direct communication radio interface was presented.
- Performance of FDE using partial LDPC coding with double gray mapping for single-carrier LOS-MIMO; the proposed scheme applies LDPC coding partially only to the limited lower significant bits of each constellation point associated with double Gray mapping.
- Interference cancellation considering processing delay for uplink URLLC: the proposed scheme can efficiently suppress the negative impact of inter-user interference while keeping the similar processing delay as the conventional scheme.

4. Acknowledgement

The TPoC5GE 2020 committee members would like to give thanks to authors, speakers, participants, and staff.

IEICE-CS Related Conferences Calendar

Date	Conference Name	Location	Note
9 Jun. - 11 Jun. 2021	International Symposium on Extremely Advanced Transmission Technologies (EXAT2021)	Matsue, Japan	TBD
25 Jan. - 28 Jan. 2021	2020 International Symposium on Antennas and Propagation (ISAP2020)	Osaka, Japan	Submission due: 14 Sep. 2020
21 Oct. - 23 Oct. 2020	International Conference on Information and Communication Technology Conference 2020 (ICTC 2020)	Jeju Island, Korea	Submission deadline Closed
19 Oct. - 26 Oct. 2020	The 23 rd International Symposium on Wireless Personal Multimedia Communications (WPMC2020)	Virtual Edition	Submission deadline Closed
Postponed to 2021	The 26 th Asia-Pacific Conference on Communications (APCC2020)	Kuala Lumpur, Malaysia	TBD
4 Oct. - 8 Oct. 2020	2020 Opto-Electronics and Communications Conference (OECC2020)	Taipei, Taiwan	Submission deadline Closed
27 Sep. - 30 Sep. 2020	International Conference on Renewable Energy Research and Applications 2020 (ICRERA 2020)	Glasgow, UK	To be held soon
23 Sep. - 25 Sep. 2020	Asia-Pacific Network Operations and Management Symposium (APNOMS2020)	Daegu, Korea	To be held soon
22 Sep. - 24 Sep. 2020	International Telecom Congress ITC 32 (ITC32)	Osaka, Japan	To be held soon
13 Jul. - 15 Jul. 2020	2020 IEEE Photonics Society Summer Topicals Meeting Series (IEEE Summer Topicals 2020)	Cabo San Lucas, Mexico	Done
22 Jun. - 26 Jun. 2020	The 19 th International Workshop on Assurance in Distributed Systems and Networks (ADSN2020)	Calgary, Canada	Done
17 Jun. - 19 Jun. 2020	8th International Conference on Smart Grid (icSmartGrid2020)	Paris, France	Done
7 Jun. - 11 Jun. 2020	IEEE ICC Workshop on Information-Centric Networking Solutions for Real-world Applications (ICN-SRA)	Virtual Conference	Done
25 May 2020	Technology Trials and Proof-of-Concept Activities for 5G Evolution & Beyond 5G 2020 (TPoC5GE 2020)	Antwerp, Belgium	Reported on this issue
20 May - 22 May 2020	The 14 th International Symposium on Medical Information and Communication Technology (ISMICT 2020)	Nara, Japan	Reported on this issue

Please confirm with the following IEICE-CS web site for the latest information.
<https://www.ieice.org/cs/conf/calendar.html>



ISAP2020

Updated Call for Papers

2020 INTERNATIONAL SYMPOSIUM ON ANTENNAS AND PROPAGATION January 25-28, 2021, Osaka, JAPAN

The 2020 International Symposium on Antennas and Propagation (ISAP2020) will be held at Knowledge Capital Congrès Convention Center in Osaka, Japan, from January 25 (Monday) through 28 (Thursday), 2021. This Symposium, the 25th ISAP, is sponsored and organized by the Communications Society of the Institute of Electronics, Information and Communication Engineers (IEICE), and is technically co-sponsored by the Antenna Measurement Techniques Association (AMTA), the Antennas and Propagation Society of the Institute of Electrical and Electronics Engineers (IEEE/AP-S), the Antennas Society of the Chinese Institute of Electronics (AS-CIE), the Electrical Engineering/Electronics, Computer, Communications, Information Technology Association of Thailand (ECTI), the European Association on Antennas and Propagation (EurAAP), the Institute of Antenna Engineers of Taiwan, the Korean Institute of Electromagnetic Engineering and Science (KIEES), and the Taiwan Microwave Association.

VENUE

Osaka is located on the main island of Honshu, roughly in the center of Japan. Once known as the Nation's Kitchen, Osaka still holds the title of Food Capital of Japan. Osaka provides a lot of shopping sites with an irresistible experience. The historical capital city of Kyoto, and Nara, an ancient city with numerous World Heritage sites, are all accessible in less than 40 minutes from Osaka.

Knowledge Capital Congrès Convention Center is directly linked via a connecting walkway to JR Osaka Station, the hub of the Kansai rail network.



OBJECTIVE

ISAP2020 is intended to provide an international forum for the exchange of information on the progress of research and development in antennas, propagation, electromagnetic-wave theory, and related fields as shown in the SCOPE. It is also an important objective of this meeting to promote mutual interaction among participants.

SCOPE

This symposium will treat a wide range of subjects on antennas, propagation and electromagnetic-wave theory as suggested below. Papers concerned with other aspects of these subjects will also be considered. In addition, special topics treating emerging technologies heralding a new era in wireless communications and applications are invited for consideration.

A. Antennas

- A1. Small Antennas and RF Sensors
- A2. Antennas for Mobile and V2X Applications
- A3. Broadband and Multi-band Antennas
- A4. Active, Adaptive, On-Chip and Smart Antennas
- A5. Tunable and Reconfigurable Antennas
- A6. Planar/Printed Antennas and Arrays
- A7. Antenna Theory and Design
- A8. Antenna Measurements
- A9. Millimeter-wave, Terahertz and Optical Antennas
- A10. Metamaterials and Metasurfaces for Antennas

B. Propagation

- B1. Indoor and Mobile Propagation
- B2. Millimeter-wave, THz and Optical Propagation
- B3. Propagation for V2X and IoT
- B4. Channel Sounding and Channel Estimation
- B5. Radar, DOA, localization and Sensing
- B6. Remote Sensing
- B7. Terrestrial, Earth-Space and Ionospheric Propagation
- B8. Propagation Fundamentals
- B9. Propagation Measurement Techniques

C. Electromagnetic-wave Theory

- C1. Computational Electromagnetics
- C2. Time-Domain Techniques
- C3. Scattering, Diffraction and RCS
- C4. Inverse and Imaging Techniques
- C5. Optimization Methods in EM Problems
- C6. Passive and Active Components
- C7. Frequency Selective Surfaces and Filters
- C8. EBG, Metamaterials and Periodic Structures
- C9. Multiscale and Multiphysics Techniques

D. AP-related Topics

- D1. Antenna Systems for Mobile Communications
- D2. MIMO and Array Signal Processing
- D3. AP Related Topics for 5G and Beyond
- D4. Wireless Power Transfer Technologies
- D5. Wearable Device Networks and Medical Applications
- D6. OAM and Near Field Communications
- D7. RFID and Its Applications
- D8. EMC/EMI Technologies

IMPORTANT DATES

Deadline for paper submission:	September	14, 2020
Notification of accepted papers:	October	27, 2020
Deadline for early registration:	November	30, 2020



PREPARATION OF PAPERS

Original papers are solicited that have not been presented previously and that describe new contributions in the area suggested in the SCOPE. Each author is requested to prepare a 2-page camera-ready paper in 2-column format written in English, including all text, references, figures and photographs. The authors are requested to refer to the ISAP2020 Web page (<http://www.isap2020.org/>) for the detailed paper preparation instructions and the IEICE Copyright Transfer Form.

SUBMISSION OF PAPERS

Authors are requested to send their papers in IEEE Xplore-compliant PDF format electronically. Presented papers of ISAP2020 are planned to be included in ISAP Archives and IEEE Xplore.

WORKSHOP

Several workshops will be scheduled to be held on January 25 (Monday), 2021.

AWARDS

Several outstanding papers will be awarded for ISAP2020 Paper Awards. ISAP2020 also hosts Student Paper Awards in order to foster activities of students toward highly qualified researchers.

STUDENT DESIGN CONTEST

Student Design Contest (SDC) will be held for the first time in the history of ISAPs during the ISAP2020. The aim of ISAP SDC is to promote student innovation and creative activities in antennas, propagation, and the related research fields. The following three contest categories are prepared; A. Antenna Design, B. Localization of RF Sources, and C. EM Analysis and Observation Competition. Excellent designs will be awarded at the buffet party of the ISAP2020 and will receive cash awards! Detailed information will be announced at the ISAP2020 SDC Web page: <http://www.isap2020.org/sdc.html>

SPECIAL SECTION ON IEICE TRANS.

The Special Section on ISAP2020 will be planned in the IEICE Transactions on Communications.

ISAP ARCHIVES

ISAP Archives currently opens as a trial service. You can search and read the conference papers from the ISAP1971 to 2016 at the ISAP Archives Web page: http://www.ieice.org/cs/isap/ISAP_Archives/index.html

EXHIBITION

Spaces for demonstration of software, books and products are also available with charge.

WIE (WOMEN IN ENGINEERING)

It is our pleasure to inform that ISAP2020 will launch WIE. WIE is providing opportunities to make global networks and collaboration for ALL ISAP2020 PARTICIPANTS through special sessions. The detailed information of ISAP2020 WIE will announce in the Web site. Our understanding and cooperation will develop AP technologies and community!

STEERING COMMITTEE

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Further information can be found on the Website ► ISAP2020 Web Page : <http://www.isap2020.org>

Special Section Calendar of IEICE Transactions on Communications

Issue	Special Section	Note
Jun. 2022	Special Section on Recent Progress in Antennas and Propagation in Conjunction with Main Topics of ISAP2020	Submission due: 15 Jun. 2021
May 2022	No special section this issue	
Apr. 2022	No special section this issue	
Mar. 2022	No special section this issue	
Feb. 2022	No special section this issue	
Jan. 2022	No special section this issue	
Dec. 2021	Recent Progress in Networking Science and Practice in Conjunction with Main Topics of ITC32	Submission due: 15 Jan. 2021
Nov. 2021	No special section this issue	
Oct. 2021	Special Section on Dynamic Spectrum Sharing for Future Wireless Systems	Submission due: 2 Nov. 2020
Sep. 2021	Special Section on Technology Trials and Proof-of-Concept Activities for 5G Evolution and Beyond	Submission due: 1 Oct. 2020
Aug. 2021	No special section this issue	
Jul. 2021	Future Directions of Research and Development on Communication Quality	To be issued
Jun. 2021	ICT for Medical, Healthcare and Welfare Applications in Conjunction with Main Topics of ISMICT 2020	To be issued
May 2021	No special section this issue	
Apr. 2021	No special section this issue	
Mar. 2021	Network Virtualization/Softwarization and Artificial Intelligence towards Beyond-5G Innovative IoT Services	To be issued
Feb. 2021	No special section this issue	
Jan. 2021	No special section this issue	
Dec. 2020	IoT Sensor Networks and Mobile Intelligence	To be issued
Nov. 2020	Opto-electronics and Communications for Future Optical Network	To be issued
Oct. 2020	New Era of Satellite Communication / Broadcasting / Application Technologies	To be issued
Sep. 2020	Electromagnetic Compatibility in Conjunction with EMC Sapporo and APEMC 2019	Vol. E103-B, No. 9
Aug. 2020	No special section this issue	
Jul. 2020	No special section this issue	

Please confirm with the following IEICE web site for the latest CALL FOR PAPERS
<https://www.ieice.org/event/ronbun-e.php?society=cs>

— Special Section on Technology Trials and Proof-of-Concept Activities
for 5G Evolution and Beyond —

IEICE Transactions on Communications announces that it will publish a special section entitled “Special Section on Technology Trials and Proof-of-Concept Activities for 5G Evolution and Beyond” in the **September 2021** issue. The 5th generation (5G) cellular communication systems are just launched in 2019 and it is expected to provide various services utilizing 5G technology such as enhanced mobile broadband (eMBB), ultra-reliable and low latency communications (URLLC), and massive machine type communication (mMTC). In the 5G standardization, key enabling technologies such as massive MIMO, beamforming, access technology, and frame designs are specified and related advanced technologies are still being developed. Meanwhile, new technology concepts for the next generation mobile communications including 5G evolution and beyond 5G (B5G) are about to be investigated in many research entities. On top of that, research and development activities of key technologies for next generation mobile communications are about to be initiated. In these regards, this special section is aiming to provide opportunities to present the latest trials and the proof-of-concept activities for next generation mobile communications.

1. Scope

This special section aims at timely dissemination of research in the following areas. Possible topics include, but are not limited to:

- Advanced interference coordination and mitigation techniques
- Advanced MIMO technologies
- Advanced modulation and coding schemes
- Advanced multiple access technologies
- Advanced multiple radio access technologies
- Advanced relay
- Advanced retransmission control
- Advanced technologies for flexible duplex
- Capacity/coverage split system design
- Device to device (D2D) communications
- Energy-efficient radio access technologies
- Hardware implementation issues of the 5G evolution and B5G systems
- Heterogeneous access networks
- Massive MIMO techniques
- New waveform design
- Proof-of-concept activities for the 5G evolution and B5G systems
- Radio interface design
- Small cell technologies
- System concept and architecture
- Technologies for higher frequency bands
- Technologies for massive connectivity
- Technologies for small packet transmission
- Technologies for ultra-low latency
- Validation of technology for the 5G evolution and B5G systems
- Wireless fronthauling and backhauling

2. Submission Instructions

The standard number of pages is 8. The page charges are considerably higher for extra pages. Manuscripts should be prepared according to the guideline in the "Information for Authors." The latest version is available at the web site, https://www.ieice.org/eng/shiori/mokuji_cs.html. The term for revising the manuscript after acknowledgement of conditional acceptance for this special section could be shorter than that for regular issues (60 days) because of the tight review schedule.

This special section will accept papers only by electronic submission. Submit a manuscript and electronic source files (LaTeX/Word files, figures, authors' photos and biographies) via the IEICE Web site https://review.ieice.org/regist/regist_baseinfo_e.aspx by **1st October 2020 (JST)**. Authors should choose the “Technology Trials and Proof-of-Concept Activities for 5G Evolution and Beyond” as a “Journal/Section” on the online screen. Do not choose “Regular EB”.

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3. Special Section Editorial Committee

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* At least one of the authors must be an IEICE member when the manuscript is submitted for review. Invited papers are an exception. We recommend that authors unaffiliated with IEICE apply for membership. For membership applications, please visit <https://www.ieice.org/eng/join/member.html>

* The accepted papers will be published online soon on the web site of Transactions Online after the payment of page charges has been completed. For detailed information, please visit https://www.ieice.org/eng/shiori/page2_cs.html#8

Special Section on Dynamic Spectrum Sharing for Future Wireless Systems

The IEICE Transactions on Communications announces that it will publish a special section entitled "Dynamic Spectrum Sharing for Future Wireless Systems" in the **October 2021** issue.

To satisfy increasing demands for wireless communications as infrastructure of IoT, flexible operation of variety of wireless systems is necessary. New wireless systems, such as 5G, support detailed management of radio resources in frequency and time domains. Some of such systems downscale the cell sizes which consequently increases the number of base stations and requires allocation of more frequency. On the other hand, self-operation of wireless systems is recently getting attracted along with the diversification of use cases for wireless communications. For the future of wireless communications, the way to secure more radio resources and utilize them flexibly are the key issue. One of the solutions is dynamic spectrum sharing (DSS), where vacancy of frequency is identified by sensing and database analysis so that other wireless system reuses the frequency. Since R&D activities and experimental demonstrations are now ongoing in the world to establish the technologies including radio regulations, it is the best opportunity at this point of time to share the research results on DSS, investigate its feasibility widely and look for further academic issues. For these reasons, a special section on DSS was planned scheduled to appear in the October 2021 issue.

1. Scope

This special section aims at timely dissemination of research in these areas. Possible topics include, but are not limited to:

- (1) **Principle theories and their application to DSS** (Architectural concept, Machine learning, Artificial intelligence)
- (2) **Sensing technologies of DSS** (Distributed sensing, System recognition, Direction measurement, Monitoring system)
- (3) **Radio database management of DSS** (Radio resource management, Radio database management, Radio environment recognition, Interference control, Transmission power control)
- (4) **Radio system and operation for DSS** (Dynamic spectrum access, Software defined radio, Spectrum shaping, Traffic control, Beam-forming, Interference cancellation, NOMA, Self organized networks, Local 5G, Massive MIMO)
- (5) **Experimental demonstration of DSS** (Feasibility experiment, Field test, Application to 5G, Experimental testbed)

A submitted paper should be related to DSS. Otherwise, the editorial committee decides it as out of scope in this special section.

2. Submission Instructions

The standard number of pages is 8. The page charges are considerably higher for extra pages. Manuscripts should be prepared according to the guideline in the "Information for Authors." The latest version is available at the web site, https://www.ieice.org/eng/shiori/mokuji_cs.html. The term for revising the manuscript after acknowledgement of conditional acceptance for this special section could be shorter than that for regular issues (60 days) because of the tight review schedule.

This special section will accept papers only by electronic submission. Submit a manuscript and electronic source files (LaTeX/Word files, figures, authors' photos and biographies) via the IEICE Web site https://review.ieice.org/regist/regist_baseinfo_e.aspx by **November 2, 2020 (JST)**. Authors should choose the Dynamic Spectrum Sharing for Future Wireless Systems as a "Journal/Section" on the online screen. Do not choose [Regular EB].

Contact point:

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3. Special Section Editorial Committee

Guest Editor-in-Chief: Yasushi Yamao (UEC)

Guest Editors: Osamu Takyu (Shinshu Univ.) Kentaro Ishizu (NICT)

Guest Associate Editors: Atsushi Nagate (Softbank), Atsushi Yamaoka (Toshiba Wireless Lab), Doohwan Lee (NTT), Khanh Tran Gia (TiTech), Mai Ohta (Fukuoka Univ.), Minseok Kim (Niigata Univ.), Suguru Kameda (Tohoku Univ.), Taichi Ohtsuji (NEC), Takayuki Nishio (Kyoto Univ.), Toshiyuki Saito (Hitachi)

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* Upon accepted for publication, all authors, including authors of invited papers, should pay the page charges covering the partial cost of publication around April 2021. For detailed information, please visit https://www.ieice.org/eng/shiori/page2_cs.html#5

* At least one of the authors must be an IEICE member when the manuscript is submitted for review. Invited papers are an exception. We recommend that authors unaffiliated with IEICE apply for membership. For membership applications, please visit <https://www.ieice.org/eng/join/member.html>

* The accepted papers will be published online soon on the web site of Transactions Online after the payment of page charges has been completed. For detailed information, please visit https://www.ieice.org/eng/shiori/page2_cs.html#8

Call for Papers

----- Special Section on Recent Progress in Networking Science and Practice in Conjunction with Main Topics of ITC32 -----

The IEICE Transactions on Communications announces that it will publish a special section entitled "Special Section on Recent Progress in Networking Science and Practice in Conjunction with Main Topics of ITC32" in the **December 2021** issue.

The international teletraffic congress (ITC) is the first international conference in networking science and practice. Since 1955, ITC has established a multi-decade tradition as the primary forum for presenting and discussing the latest technical advances in teletraffic models, network systems, and measurements. The ITC32 is the 32nd edition of this congress and will be held in Osaka during September 22-24, 2020. The research on the network science and practice, especially on the modelling, design and performance of communication systems, networks and services will be presented at ITC32.

This special section aims at timely dissemination of progressing research fields in networking science and practice. Submission of the paper presented at ITC32 is strongly encouraged. However, presentation of the paper at ITC32 is not mandatory for its inclusion in this special section.

1. Scope

This special section aims at timely dissemination of progressing research fields in networking science and practice, especially researches on the modelling, design and performance of communication systems, networks and services. We encourage original contributions which bridge the gap between performance modeling and real-life operational aspects, including works which leverage measurement data to provide a better understanding of the wired and wireless networks' operation under realistic conditions.

The topics covered by this special section include the following topics.

- Performance evaluation, control, and optimization based on network science and model
- Network measurement and analysis
- Modeling and design of network architectures
- Modeling and design of wireless and cellular networks

2. Submission Instructions

The standard number of pages is 8. The page charges are considerably higher for extra pages. Manuscripts should be prepared according to the guideline in the "Information for Authors." The latest version is available at the web site, https://www.ieice.org/eng/shiori/mokuji_cs.html. The term for revising the manuscript after acknowledgement of conditional acceptance for this special section could be shorter than that for regular issues (60 days) because of the tight review schedule.

This special section will accept papers only by electronic submission. Submit a manuscript and electronic source files (LaTeX/Word files, figures, authors' photos and biographies) via the IEICE Web site https://review.ieice.org/regist/regist_baseinfo_e.aspx by **January 15, 2021 (JST)**. Authors should choose the **Recent Progress in Networking Science and Practice in Conjunction with Main Topics of ITC32** as a "Journal/Section" on the online screen. **Do not choose [Regular EB]**.

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3. Special Section Editorial Committee

Guest Editor-in-Chief: Hideyuki Shimonishi (NEC)

Guest Editors: Yuichi Ohsita (Osaka Univ.), Chisa Takano (Hiroshima City Univ.)

Guest Associate Editors: Masaki Aida (Tokyo Metropolitan University), Keisuke Ishibashi (ICU), Megumi Kaneko (NII), Ryoichi Kawahara (Toyo University), Leibnitz Kenji (NICT), Zhisheng Niu (Tsinghua University),

* Authors must agree to the "Copyright Transfer and Page Charge Agreement" via electronic submission.

* Upon accepted for publication, all authors, including authors of invited papers, should pay for the page charges covering partial cost of publications around June 2021. For detailed information, please visit https://www.ieice.org/eng/shiori/page2_cs.html#5

* At least one of the authors must be an IEICE member when the manuscript is submitted for review. Invited papers are an exception. We recommend that authors unaffiliated with IEICE apply for membership. For membership applications, please visit

<https://www.ieice.org/eng/join/member.html>

* The accepted papers will be published online soon after notification of acceptance on the web site of Transactions Online. For detailed information, please visit https://www.ieice.org/eng/shiori/page2_cs.html#8

Call for Papers

----- Special Section on Recent Progress in Antennas and Propagation in Conjunction with Main Topics of ISAP2020 -----

The IEICE Transactions on Communications announces that it will publish a special section entitled "Special Section on Recent Progress in Antennas and Propagation in Conjunction with Main Topics of ISAP2020" in **June 2022**.

The objective of this special section is to discuss the antenna and propagation technologies related to progressing technologies for 5G mobile communication systems, MIMO, PAN/BAN, and wireless power transmission and so on. The 2020 International Symposium on Antennas and Propagation (ISAP2020) will be held in Osaka, Japan during January 25 – 28, 2021, which aims at providing an international forum for exchanging information on such progress of research and development in antennas, propagation, electromagnetic wave theory, and the related fields. By taking this opportunity the special section has been planned to publish papers on advanced technologies in antennas, propagation and the related fields. The special section seeks for submission particularly from, but not limited to, the authors of ISAP2020.

1. Scope

This special section aims at timely dissemination of research in these areas. Possible topics include, but are not limited to:

Antennas

- Small Antennas and RF Sensors
- Antennas for Mobile and Wireless Applications
- Broadband and Multi-band Antennas
- Tunable and Reconfigurable Antennas
- 2D and 3D Printed Antennas and Arrays
- Millimeter-wave, THz and Optical Antennas
- Active and On-Chip Antennas
- Adaptive and Smart Antennas
- Antenna Theory and Design
- Antenna Measurements
- Other related topics

Propagation

- Indoor and Mobile Propagation
- Millimeter-wave, THz and Optical propagation
- Machine-to-Machine/Infrastructure Propagation
- Channel Sounding and Channel Estimation
- Propagation Measurement Techniques
- Terrestrial, Earth-Space, and Ionospheric Propagation
- Propagation Fundamentals, DOA Estimation
- Remote Sensing and Radar
- Other related topics

Electromagnetic-wave Theory

- Computational Electromagnetics
- Optimization Methods in EM Problems
- Frequency Selective Surfaces and Filters
- EBG, Metamaterials, and Applications
- Time-Domain Techniques
- Scattering, Diffraction, and RCS
- Inverse and Imaging Techniques
- Passive and Active Components
- Nano-Electromagnetics
- Other related topics

AP-related Topics

- MIMO and Its Applications
- Antenna Systems for Mobile Communications
- Broadcasting and Receiving Technologies
- Wireless Power Transfer Technologies
- Wearable Device Networks and Medical Applications
- Sensor Networks and Adhoc Systems
- RFID and Applications, EMC/EMI Technologies
- Other related topics

2. Submission Instructions

The standard number of pages is 8. The page charges are considerably higher for extra pages. Submissions of "letters" are not accepted. Manuscripts should be prepared according to the guideline in the "Information for Authors". The latest version is available at the web site, https://www.ieice.org/eng/shiori/mokuji_cs.html. The period for revising the manuscript after acknowledgement of conditional acceptance for this special section could be shorter than that for regular issues (60 days) because of the tight review schedule.

This special section will accept only papers by electronic submission. Submit a manuscript and electronic source files (LaTeX/Word files, figures, authors' photos and biography) via the IEICE Web site https://review.ieice.org/regist/regist_baseinfo_e.aspx by **June 15th, 2021 (JST)**. Authors should choose the Recent Progress in Antennas and Propagation in Conjunction with Main Topics of ISAP2020 as a "Journal/Section" on the online screen. Do not choose [Regular-EB].

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3. Special Section Editorial Committee

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Guest Editors: Manabu Yamamoto (Hokkaido Univ.), Kunio Sakakibara (Nagoya Inst. of Tech.)

Guest Associate Editors: Michitaka Ameya (AIST), Koichi Ichige (Yokohama Natl. Univ.), Shinichi Ichitsubo (Kyushu Inst. of Tech.), Minseok Kim (Niigata Univ.), Yuichi Kimura (Saitama Univ.), Keizo Cho (Chiba Inst. of Tech.), Toshihiko Nishimura (Hokkaido Univ.), Kentaro Nishimori (Niigata Univ.), Takafumi Fujimoto (Nagasaki Univ.), Naoki Honma (Iwate Univ.), Naobumi Michishita (Natl. Defense Acad.)

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From Editor's Desk

●A New Member of Editorial Staff Joined

A new member Yokoo-san joined the editorial staff in June this year and has been engaged in publication operations from this issue. Through the publication of GLOBAL NEWSLETTER (GNL), we are continuously trying to share information between overseas/foreign members and other members in IEICE-CS. We welcome your contribution of article submissions to GNL. For article submission, please refer to the Submission Guideline of IEICE-CS GLOBAL NEWSLETTER: https://www.ieice.org/cs/pub/global_howto.html

●Introduction to IEICE Communications Society

A new leaflet and slides were published to introduce IEICE-CS. There is a leaflet in this GNL (Next page). Also, you can get the slides following URL.

[ENG] https://www.ieice.org/cs/jpn/aboutcs/IEICE_CS_intro_eng_20190709.pdf

●IEICE Society Conference 2020

IEICE Society Conference 2020 will be held online due to the spread of new coronavirus infection. The date will not be changed and will be scheduled from 15th to 18th September 2020. English sessions are scheduled in the conference. Please check out the latest conference information on the IEICE web site.

<https://www.ieice-taikai.jp/2020society/en/index.html>

●Condolences

Prof. Hara contributed the report of ISMICT to this GNL Vol.44, No. 3 passed away in early August. We express our deepest sympathies to him.

IEICE-CS GLOBAL NEWSLETTER Editorial Staff

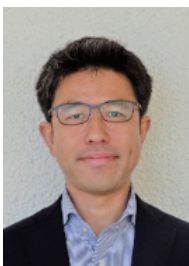
Editorial Staff of this issue

No special order is observed.



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Nippon Telegraph and Telephone Corporation
Access Network Service Systems Laboratories
Director, Planning and Member Activities, IEICE Communications Society



Kaoru YOKOO

Fujitsu Laboratories, Ltd.
Digital Innovation Core Unit
Director, Planning and Member Activities, IEICE Communications Society



Yohei KOGA

Fujitsu Connected Technologies, Ltd.
Platform Development Div.
Director, International Publication, IEICE Communications Society



The Institute of Electronics, Information and Communication Engineers (IEICE) Communications Society

About Communications Society

IEICE Communications Society shall endeavor to facilitate research and investigation activities in the field of communications, and to contribute to research activities through cooperation with other societies, in order to promote the development of science and technology in this field.

◆ Technical Committees

Twenty regular technical committees, seven ad hoc technical committees and one special ad hoc technical committee carry out research activities. The following is a list of the technical committees.

Regular Technical Committees

- Antennas and Propagation (AP)
- Internet Architecture (IA)
- Space, Aeronautical and Navigational Electronics (SANE)
- Satellite Telecommunications (SAT)
- Electromagnetic Compatibility (EMCJ)
- Communication Quality (CQ)
- Information and Communication Management (ICM)
- Information Networks (IN)
- Smart Radio (SR)
- Short Range Wireless Communications (SRW)
- Communication Systems (CS)
- Energy Engineering in Electronics and Communications (EE)
- Network Systems (NS)
- Optical Communication Systems (OCS)
- Optical Fiber Technology (OFT)
- Photonic Network (PN)

- Healthcare and Medical Information Communication Technology (MICT)
- Radio Communication Systems (RCS)
- Wireless Power Transmission (WPT)
- Sensor Network and Mobile Intelligence (SeMI) (Joint committees of ASN/MoNA)

Ad Hoc Technical Committees

- Standardization & Innovation in ICT Technologies (SIIT)
- Extremely Advanced Optical Transmission (EXAT)
- Network Virtualization (NV)
- Photonics-applied Electromagnetic Measurement (PEM)
- Information-Centric Networking (ICN)
- Networked Digital Service Platform (DPF)
- Underwater Wireless Technology (UWT)

Special Ad Hoc Technical Committees

- Multiple Innovative Kenkyu-kai Association for wireless communications (MIKA)

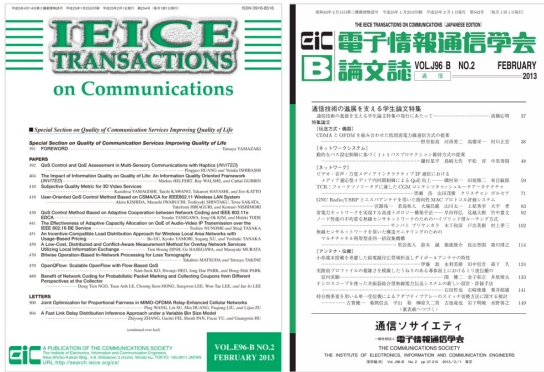
◆ Publications

IEICE Transactions on Communication

The IEICE Transactions on Communications (English and Japanese editions) are published monthly.

The impact factor of IEICE Transactions on Communications (English edition) was 0.580 in 2018.

<https://www.ieice.org/cs/jpn/EB/index.html>



➤ **Communications Society Magazine “B-plus”**

The Communications Society Magazine (Japanese edition only) “B-plus” provides technical reviews, surveys, practical topics, etc. “B-plus” is published quarterly in Japanese. The electronic version has been accessible free of charge since March 2015.

<https://www.ieice.org/~cs-edit/magazine/>



IEICE Communications Express (ComEX)

IEICE Communications Express (ComEX) is an online letter journal, where researchers can exchange new topics easily and in a timely manner.

You can download PDF files from the ComEX site.

<https://www.ieice.org/publications/comex/>



Magazines

➤ **GLOBAL NEWSLETTER (GNL)**

GLOBAL NEWSLETTER (GNL) exchanges information on global activity between overseas/foreign members and other members in IEICE-CS.

GNL is published every March, June, September, and December.

https://www.ieice.org/cs/pub/global_news.html



◆ **Membership Services**

Technical Report Archives

Technical Report Archives is an archive of all the technical reports of IEICE-CS published more than one month ago. It is part of the IEICE Technical Report Online System.

Email News

We call for papers of transactions and international conferences, as well as technical workshops from CS members by email.

◆ **Sister Societies**

Communications Society has sister-society agreements with the following six overseas societies.

- IEEE Communications Society (ComSoc)
- Informationstechnische Gesellschaft within The Verband Der Elektrotechnik Elektronik Informationstechnik (VDE/ITG)
- Korean Institute of Electromagnetic Engineering and Science (KIEES)
- The Korean Institute of Communications and Information Sciences (KICS)
- China Institute of Communications (CIC)
- IEEE Electromagnetic Compatibility Society (EMCS)

To Probe Further and Keep Up-to-date with Communication Technologies

IEICE Communications Society



IEICE Society Conference 2020

15-18 September 2020

Online Conference

Every autumn, each Society organizes a Society Conference to provide a forum where members can present their study results and exchange views. At present, four of the Societies -- the Engineering Sciences Society, the NOLTA Society, the Communications Society, and the Electronics Society -- hold their Society Conferences as a joint event. The Communications Society Conference includes English-language sessions in addition to the Japanese-language sessions.

Please check out the latest information on the IEICE web site at:

<https://www.ieice-taikai.jp/2020society/en/index.html>

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