

External Awards

MTRAJ Award

Winner: Akira Ito, NTT Access Network Service Systems Laboratories; Hiroyuki Saito, Tokyo Denki University; Takanobu Suzuki, Toyo University

Date: April 20, 2015

Organization: Material Testing Research Association of Japan (MTRAJ)

For “Quantification of Seismic Performance Deterioration Caused by Corrosion on a Telecommunication Conduit.”

Published as: A. Ito, H. Saito, and T. Suzuki, “Quantification of Seismic Performance Deterioration Caused by Corrosion on a Telecommunication Conduit,” *Journal of Material Testing Research Association of Japan*, Vol. 59, No. 4, pp. 188–193, Oct. 2014.

2014 LOIS Research Award

Winner: Shigeki Takeuchi and Goro Inomae, NTT Service Evolution Laboratories; Manabu Okamoto, NTT Media Intelligence Laboratories; and Hiroyuki Tate, NTT Service Evolution Laboratories

Date: April 22, 2015

Organization: Institute of Electronics, Information and Communication Engineers (IEICE), Information and Systems Society, Technical Committee on Life Intelligence and Office Information Systems (LOIS)

For “The Tourist Information System for the Route Bus with Smartphone—the Evaluation Result Report on the Bus Line—.”

Buses for tourists are used in tourist resorts. We are developing a system that provides passengers with route sightseeing information so that buses do not need a guide on board or special digital signage equipment. In this paper, a tourist information system is proposed that is integrated with the location of a bus and shows users necessary details from a large amount of sightseeing information. An evaluation using an experimental system is also described.

Published as: S. Takeuchi, G. Inomae, M. Okamoto, and H. Tate, “The Tourist Information System for the Route Bus with Smartphone—the Evaluation Result Report on the Bus Line—,” *IEICE Tech. Rep.*, Vol. 114, No. 150, LOIS2014-15, pp. 23–28, Jul. 2014.

45th Senken Gousen Prize New Frontier Award

Winner: Nippon Telegraph and Telephone Corporation and Toray Industries, Inc.

Date: April 24, 2015

Organization: Senken Shimbunsha

For the development of conductive fabric called *hitoe* that enables continuous measurement of the biological signals of the person wearing it.

IEICE Communications Society Best Tutorial Paper Award (Japanese edition)

Winner: Yusuke Asai, NTT Network Innovation Laboratories; Koichi Ishihara, Tomoki Murakami, Riichi Kudo, Takeo Ichikawa, Yasushi Takatori, and Masato Mizoguchi, NTT Access Network Service Systems Laboratories

Date: May 15, 2015

Organization: IEICE, Communications Society

For “Overview of Very High Throughput Wireless LAN Standard IEEE 802.11ac and Experimental Evaluation of Multiuser-MIMO Transmission.”

Published as: Y. Asai, K. Ishihara, T. Murakami, R. Kudo, T. Ichikawa, Y. Takatori, and M. Mizoguchi, “Overview of Very High Throughput Wireless LAN Standard IEEE 802.11ac and Experimental Evaluation of Multiuser-MIMO Transmission,” *The Transactions of the Institute of Electronics, Information and Communication Engineers*, B, Vol. J97-B, No. 1, pp. 1–18, Jan. 2014.

ITU-AJ International Corporation Award

Winner: Atsushi Takahara and Toshikazu Sakano*, NTT Network Innovation Laboratories

* Currently, he is with Advanced Telecommunications Research Institute International (ATR).

Date: May 15, 2015

Organization: The ITU Association of Japan (ITU-AJ)

For the development of the information and communication technology (ICT) architecture called the movable and deployable ICT resource unit (MDRU) that enables instant recovery of telecommunications services in damaged areas. In addition, they conducted a feasibility study on the effectiveness of MDRUs in disaster-stricken areas in the Philippines under an International Telecommunication Union (ITU) project. They also actively worked on standardization efforts within ITU in order to promote broad use of MDRUs.

ISCIE Encouragement Prize

Winner: Masaya Murata, NTT Communication Science Laboratories

Date: May 21, 2015

Organization: Institute of Systems, Control and Information Engineers (ISCIE)

For “Gaussian Unscented Filter.”

Published as: M. Murata, H. Nagano, and K. Kashino, “Gaussian Unscented Filter,” *Proc. of the 46th ISCIE International Symposium on Stochastic Systems Theory and Its Applications (SSS’14)*, Kyoto, Japan, Nov. 2014.

Papers Published in Technical Journals and Conference Proceedings

A Spectrum- and Energy-efficient Scheme for Improving the Utilization of MDRU-based Disaster Resilient Networks

T. Ngo, H. Nishiyama, N. Kato, T. Sakano, and A. Takahara
IEEE Transactions on Vehicular Technology, Vol. 63, No. 5, pp. 2027–2037, June 2014.

The lack of spectrum and energy resources is a major problem in movable and deployable resource unit (MDRU)-based networks, where the throughput requirement is very high. In this paper, we propose a scheme to improve the utilization of both spectrum and energy resources to increase performance in the gateway portion of the MDRU-based network.

Attenuators Enable Inversely Proportional Setting Transmission Power and Carrier Sense Threshold in WLANs

D. Okuhara, F. Shiotani, K. Yamamoto, T. Nishio, M. Morikura, R. Kudo, and K. Ishihara

Proc. of the 25th International Symposium on Personal Indoor and Mobile Radio Communications (IEEE PIMRC 2014), pp. 986–990, Washington DC, USA, September 2014.

The insertion of attenuators between transceivers and antennas is proposed in order to improve spatial channel reuse in carrier sense multiple access with collision avoidance based wireless local area networks (WLANs). Using attenuators enables the access points or stations to reduce the power levels of transmission signals and received signals, which results in an increase in the carrier sense threshold. Thus, the attenuation value control enables inversely proportional setting of the transmission power and carrier sense threshold, which is known to provide a novel solution for the unfairness problem caused by variable transmission power or variable carrier sense threshold. We first derive a simple and effective condition such that the aggregate spectral efficiency is higher when attenuators are used than they are when using some approximations. Through a numerical evaluation as well as a testbed for using attenuators, the condition is shown to be valid despite using the approximations, and throughput improvement is verified. The result from the testbed also disclosed a new unfairness problem due to individual differences in transmission power or carrier sense threshold.

AP Cooperative Diversity in Wireless Network Using Interference-aware Channel Segregation Based Dynamic Channel Assignment

M. T. H. Sirait, Y. Matsumura, K. Temma, K. Ishihara, B. A. H. S. Abeysekera, T. Kumagai, and F. Adachi

Proc. of IEEE PIMRC 2014, pp. 1185–1189, Washington DC, USA, September 2014.

Recently, we proposed interference-aware channel segregation based dynamic channel assignment (IACS-DCA) which forms a channel reuse pattern with low co-channel interference (CCI) in a distributed manner. The transmission performance of a wireless station (STA) located far from access points (APs) degrades due to path loss and shadowing loss. AP cooperative diversity is a well-known technique to improve the transmission performance. Since IACS-DCA operates so as to assign different channels to different APs

located nearby each other, it is not an easy task to introduce AP cooperative diversity to a wireless network using IACS-DCA. In this paper, we propose an AP grouping and channel selection method for AP cooperative diversity in a wireless network using IACS-DCA. By computer simulation, we show that the proposed AP cooperative diversity can improve the transmission performance.

Broadband Spectrum Sensing Platform Based on Received Waveform Cross-correlation Using Distributed Sensors

T. Yamada, D. Lee, H. Shiba, Y. Yamaguchi, T. Kaho, T. Nakagawa, and K. Uehara

Proc. of SmartCom (Singapore - Japan International Workshop on Smart Wireless Communications) 2014, Singapore, October 2014.

The rapid increase in mobile traffic due to the spread of smartphones is expected to cause a frequency shortage. The frequency range from 400 MHz to 6 GHz has been allocated to various wireless systems in Japan. Therefore, the use of white space technology is expected, and many studies on it have been reported. We present a broadband spectrum sensing platform for a white space system that covers a frequency range from 400 MHz to 6 GHz. In our platform, we elaborated and implemented a cooperative sensing method that exploits cross-correlations of received signals among distributed sensors to estimate the received signal strength. This method enables us to detect signals under the noise floor (e.g., -114 dBm/6 MHz according to Federal Communications Commission rules), to identify transmitters, and to recognize the border of radio coverage. We developed a prototype of our platform and successfully verified its performance.

An Advanced Wi-Fi Data Service Platform Coupled with a Cellular Network for Future Wireless Access

R. Kudo, Y. Takatori, B. A. H. S. Abeysekera, Y. Inoue, A. Murase, A. Yamada, H. Yasuda, and Y. Okumura

IEEE Communications Magazine, Vol. 53, No. 11, pp. 46–53, November 2014.

Wireless LAN (local area network) devices are now everywhere because of the rapid spread of smart wireless devices. Demand for far richer content services is also driving the expansion of mobile traffic. Converging the cellular network with Wi-Fi is a reasonable way to support the increasing mobile traffic because most mobile user terminals already have Wi-Fi interfaces. Creating more opportunities for Wi-Fi use will require further enhancement of system capacity and manageability, especially in the high-density Wi-Fi network. This is because the chronic depletion of system resources is becoming a significant problem in the Wi-Fi network given the increases in Wi-Fi density and traffic. This article introduces a Wi-Fi data service platform coupled with cellular networks, which strengthens the synergy of two networks. Enhanced monitoring and performance prediction are essential to provide a high-grade user experience in high-density Wi-Fi environments.

Cooperative Inter-cell Interference Mitigation Scheme with Downlink MU-MIMO Beamforming for Dense Wireless LAN Environment

K. Ishihara, T. Murakami, Y. Asai, Y. Takatori, and M. Mizoguchi
Wireless Personal Communications, DOI: 10.1007/s11277-014-2220-2, December 2014.

A cooperative inter-cell interference (ICI) mitigation scheme with transmit beamforming for dense wireless LAN systems is proposed. The proposed scheme applies transmit beamforming used for downlink multi-user multiple-input and multiple-output (MU-MIMO) in order to mitigate the effect of ICI and selectively determines whether an access point (AP) performs null beamforming for each station (STA) in overlapping basic service sets (OBSSs) according to the ICI power. Null beamforming is used to suppress ICI if its power exceeds a threshold; otherwise, it is not carried out and the transmit antenna is used to obtain a diversity gain for STAs associated with the AP. Computer simulations confirmed that the achievable rate obtained with the proposed scheme is superior to that obtained with either time resource sharing or conventional ICI mitigation in an OBSS environment.

A Novel Application of Massive MIMO: Massive Antenna Systems for Wireless Entrance (MAS-WE)

K. Maruta, A. Ohta, S. Kurosaki, T. Arai, and M. Iizuka
Proc. of ICNC (International Conference on Computing, Networking and Communications) 2015, Anaheim, USA, February 2015.

This paper proposes a practical application of Massive MIMO technology, Massive Antenna Systems for Wireless Entrance (MAS-WE), and its related inter-user interference (IUI) cancellation and scheduling techniques. MAS-WE, on which the entrance base station (EBS) employs a large number of antennas, can effectively provide high capacity wireless entrance links to a large number of Wi-Fi access points (APs) distributed in a wide coverage area. The proposed techniques have been ultimately simplified to have less impact on their practical implementation in order to spatially multiplex more than 16 signal streams with around 100 antenna elements on the EBS side. The SIR (signal-to-interference ratio) performance was evaluated by system level simulation considering imperfect channel state information (CSI), and the results showed that the proposed MAS-WE with simplified techniques can achieve high spectral efficiency with high level space division multiplexing.

Experimental Validation of Digital Pre-distortion Technique for Dual-band Dual-signal Amplification by Single Feedback Architecture Employing Dual-band Mixer

I. Ando, G. K. Tran, K. Araki, T. Yamada, T. Kaho, Y. Yamaguchi, and T. Nakagawa

IEICE Transactions on Electronics, Vol. E98-C, No. 3, pp. 242–251, March 2015.

In this paper, we propose and experimentally validate a dual-band digital predistortion (DPD) model that takes account of the intermodulation and harmonic distortion produced when the center frequencies of input bands have a harmonic relationship. We also describe and experimentally validate our proposed novel dual-band power amplifier (PA) linearization architecture consisting of a single feedback loop employing a dual-band mixer. Experiment results show that the DPD linearization the proposed model provides can compensate for intermodulation and harmonic distortion in a way that the conventional two-dimensional (2-D) DPD approach cannot. The proposed feedback architecture should make it possible to simplify analog-to-digital converter (ADC) design and eliminate the time lag between different feedback paths.

Different Roles of the COMT and HTR2A Genotypes in Working Memory Subprocesses

H. M. Kondo, M. Nomura, and M. Kashino
PLOS ONE, Vol. 10, No. 5, e012651, May 2015.

The present study used an imaging genetics approach to examine the interaction between neurochemical functions and working memory performance. We focused on functional polymorphisms of the catechol-O-methyltransferase (COMT) Val158Met and serotonin 2A receptor (HTR2A) -1438G/A genes, and devised a delayed recognition task to isolate the encoding, retention, and retrieval processes of visual information. The COMT genotypes affected recognition accuracy, whereas the HTR2A genotypes were associated with response times.

Dense Space Division Multiplexed Transmission Technology

T. Mizuno, H. Takara, A. Sano, and Y. Miyamoto
CLEO (Conference on Lasers and Electro-Optics) 2015, SW4M. 1, San Jose, USA, May 2015.

We review recent progress in ultra-high capacity transmission based on dense space division multiplexing (DSDM) for future scalable optical transport networks and present the latest multi-core multi-mode fiber, spatial multi/demultiplexers, and MIMO signal processing technique.