

External Awards

APNOMS 2013 Best Paper Award

Winners: Naoki Tateishi^{†1}, Mitsuho Tahara^{†1}, Naoyuki Tanji^{†1}, and Hikaru Seshake^{†2}

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Organization: The Asia-Pacific Network Operations and Management Symposium 2013 Committee

For “Method for Visualizing Information from Large-scale Carrier Networks”.

With the increase in services such as telephone, video on demand, and Internet connection, networks now consist of various elements such as routers, switches, and a wide variety of servers. The structure of a network has become more complicated. Therefore, failure diagnosis of an affected area by using many alarms tends to be more difficult, and the time required to detect the causal point of failure

increases. To improve quality of services, reducing the diagnosis time is essential. Alarm browsers and graphs are used to display the collected data from a network to determine the network’s status. An operator manages a network by envisioning the network structure. However, the larger the network becomes, the more difficult it is for operators to do this. Therefore, a topology view with geographical information and a topology view with hierarchical information of equipment are used. However, these views degrade if the scale of the network is even larger and more complex. We propose a method for visualizing network information on space and time axes. This method can help network operators to recognize causal points of failure and affected areas. We also explain a prototype software implementation of this visualization method.

Published as: N. Tateishi, M. Tahara, N. Tanji, and H. Seshake, “Method for Visualizing Information from Large-scale Carrier Networks,” Proc. of the 15th Asia-Pacific Network Operations and Management Symposium (APNOMS 2013), Hiroshima, Japan.

Papers Published in Technical Journals and Conference Proceedings

Wavelength Defragmentation Algorithm for Transparent Multi-ring Networks with Multiple Fibers per Link

A. Kadohata, T. Tanaka, F. Inuzuka, A. Watanabe, and A. Hirano

Proc. of the Optical Fiber Communication Conference and Exposition and the National Fiber Optic Engineers Conference (OFC/NFOEC 2013), OW3A.7, Anaheim, CA, USA.

We propose a scalable and effective wavelength defragmentation algorithm that considers multiple fibers per link. The number of fibers is reduced by more than 14% in multiring-like networks based on numerical evaluation.

posed an ICI mitigation scheme based on coordinated APs, where a transmit beamforming scheme used for multiuser MIMO is applied to avoid the ICI effect. In this paper, we propose a selective beamforming scheme for ICI mitigation in wireless LAN systems. The scheme uses ICI power as a basis for selectively determining whether to perform null beamforming for each station (STA) in overlapping basic service sets (OBSSs) according to the ICI power. Computer simulation results confirm that the achievable rate obtained with the scheme improves and is higher than that obtained with either time resource sharing or conventional ICI mitigation in an OBSS environment.

Selective Beamforming for Inter-cell Interference Mitigation in Coordinated Wireless LANs

K. Ishihara, T. Murakami, Y. Asai, and M. Mizoguchi

Proc. of the 16th International Symposium on Wireless Personal Multimedia Communications (WPMC 2013), Atlantic City, NJ, USA.

In future wireless LAN systems, the transmission bandwidth will become wider and the number of access points (APs) will increase as wireless LAN systems become more widespread. As a result, the number of available frequency channels will decrease and inter-cell interference (ICI) among APs with the same frequency channel will become a serious problem. To address this issue we previously pro-

What is he/she like?: Estimating Twitter User Attributes from Contents and Social Neighbors

J. Ito, K. Nishida, T. Hoshida, H. Toda, and T. Uchiyama

Proc. of the 2013 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM 2013), pp. 1448–1450, Niagara Falls, Canada.

We propose a new method for estimating user attributes (gender, age, occupation, and interests) of a Twitter user from the user’s contents (profile document and tweets) and social neighbors, i.e., those whom the user has mentioned. Our labeling method is able to collect a large amount of training data automatically by using Twitter users

associated with a blog account. Furthermore, we experiment with estimation methods using social neighbors with three adjustable levels of information and show that our method, which uses the target user's profile document and tweets and the neighbors' profile documents (not including tweets), achieves the best accuracy.

Channel State Information Feedback Method for Massive MIMO OFDM

R. Kudo, S. M. D. Armour, J. P. McGeehan, and M. Mizoguchi

Proc. of the 24th IEEE Annual International Symposium on Personal, Indoor, and Mobile Radio Communications (PIMRC 2013), pp. 1239–1243, London, UK.

MIMO-OFDM with a massive number of transmit antennas (Massive MIMO-OFDM) promises to increase the spectrum efficiency or reduce the transmission energy per bit. The performance of Massive MIMO-OFDM is strongly influenced by the method used to estimate the channel state information (CSI) at the transmitter. Given the massive number of transmit antennas, the many training frames needed for CSI estimation decreases MAC efficiency and increases the cost of estimating CSI at a user station (STA). This paper presents a CSI estimation scheme that reduces the training frame length by using a rank enhancement pilot design. This design assigns a different CSI estimation weight to each subcarrier. The STAs feed unitary matrices, which are obtained by multiplying the left and right singular vectors, back to the AP. The proposed CSI method enables the AP to obtain accurate CSI for limited signal spaces and less-accurate CSI for wider signal spaces for setting data transmission weights and CSI estimation weights, respectively. Simulations of an IEEE802.11n channel show that the proposed CSI estimation scheme with very short training frames obtains greater than 95% of the achievable bit rate of a full CSI estimation in Massive MIMO-OFDM systems with 32 transmit antennas, 2 receive antennas, and 3 STAs.

Angle Selective High Absorption by a Mushroom Metasurface at V-band

S. Nagai, A. Sanada, M. Kawashima, and T. Seki

Proc. of the 27th Asia Pacific Microwave Conference (APMC 2013), pp. 336–338, Seoul, South Korea.

A metasurface consisting of a periodic array of mushroom structures is designed and tested to demonstrate a strong angle selective absorption for TM (transverse magnetic) incident waves from free space at V-band. An absorption as high as 35.6 dB is experimentally obtained with the incident/reflection angle of $\theta = 7$ degrees at 67.3 GHz. Time domain measurements reveal that there exist reradiated waves with a longer decay than that of the direct specular reflection and the absorption is considered to be due to a cancellation of the direct specular reflected waves and the reradiated waves.

Study on Short-range MIMO Transmission Using Interference Cancellation by Antenna Directivities

M. Arai, T. Seki, K. Hiraga, T. Nakagawa, and K. Uehara

Proc. of the 27th Asia Pacific Microwave Conference (APMC 2013), pp. 395–397, Seoul, South Korea.

In this paper, a simple method for canceling interference by using antenna directivities is proposed for short-range transmission systems. For higher data transmission systems the millimeter-wave frequency bands are useful because of their wide bandwidths. Also, Multiple-Input Multiple-Output (MIMO) technology can be applied

to these bands because the application enables channel capacity to be increased by using multiple antennas at the transmitter and receiver without expanding the frequency bandwidth. However, since MIMO transmission schemes are complicated we consider parallel transmission, a simple method for transmitting multiple data streams that is suitable for short-range MIMO transmission. We propose a simple method for canceling interference by using antenna directivities and improving channel capacity in parallel transmission. Numerical analysis shows that the method maximizes channel capacity at the optimal spacing $L_{opt} = 2\lambda_0$. It is also found that the channel capacity of the method is 14% higher than that of Eigenmode beamforming (EM-BF) for two transmission streams and 12% higher for four streams.

Transmit Power Control Suitable for Interference-aware Channel Segregation Based Dynamic Channel Assignment

Y. Matsumura, K. Temma, K. Ishihara, B. A. Hirantha Sithira Abeysekera, T. Kumagai, and F. Adachi

Proc. of the 9th International Conference on Information, Communications & Signal Processing (ICICS 2013), Tainan, Taiwan.

Since the number of available channels is limited, the same channels need to be reused. However, co-channel interference (CCI) limits the transmission quality. The channels should be reused so that the CCI received at all access points or base stations is minimized. Our recently proposed interference-aware channel segregation based dynamic channel assignment (IACS-DCA) can form a stable channel reuse pattern which mitigates the CCI in a distributed manner. An additional use of transmit power control (TPC) can further reduce the CCI. In this paper, we propose a signal-to-interference power ratio (SIR) based TPC scheme suitable for IACS-DCA. We show, by computer simulation, that the IACS-DCA with SIR based TPC forms a stable channel reuse pattern and further improves the outage probability of signal-to-interference-plus-noise power ratio.

Next Generation Wi-Fi: High Efficiency Wireless LANs

Y. Inoue

Proc. of IEEE GLOBECOM 2013, Vol. IF29, No. 4, Atlanta, GA, USA.

In order to support the increasing demands for mobile data communications with cellular systems, the wireless local area network (WLAN) needs to be improved to offer high performance in densely deployed environments. The IEEE802.11 Working Group has created a new study group called High Efficiency WLAN SG for the purpose of improving the spectrum efficiency and area throughput. Assumed scenarios include both indoor and outdoor deployment. Both 2.4- and 5-GHz bands are included in the scope.

Report on the 3rd International Symposium on Network Virtualization

T. Kinoshita and M. Kiyokawa

IEICE Communications Society—GLOBAL NEWSLETTER, Vol. 37, No. 4, pp. 2–3, 2013.

The 3rd International Symposium on Network Virtualization was held on September 6, 2013, at the University of Tokyo. This year's symposium introduced the latest research activities in the areas of Software Defined Networking (SDN), Network Functions Virtualization (NFV), etc. In the symposium sessions, future directions of

research on programmability within networks were discussed from the viewpoints of various stakeholders from academia and industries across the world.

Implementation Method for Over 50-Gbit/s PC-cluster Based Stream Server System

H. Kimiyama, T. Ogura, and M. Maruyama

IPSJ Journal, Vol. 54, No. 12, pp. 2413–2426, 2013.

Recently, video production sites often exchange video data for video-production in which there are many sub-processes (e.g., 3D modeling, color conversion) since each sub-process requires unique high-level skills. Video production sites use general file servers to exchange their video data via high-speed networks. However, these servers do not have sufficient performance to smoothly handle such high-quality video such as uncompressed HD (high definition) and uncompressed 4K videos, which have rates of over 1 Gbit/s. Therefore, we researched a personal computer (PC)-cluster-based video stream server system to handle such high-quality video streams. We have developed a video server system with 24-Gbit/s maximum throughput by combining 16 PCs, 8 general storage systems, and a 20-Gbit/s InfiniBand inter-cluster network. To respond to demands for delivering video data streams to more video production sites, we propose a new communication method over an inter-cluster network that offers higher total throughput. We implemented the new communication method on a PC-cluster-based server system prototype and evaluated system performance. By combining 24 PCs, 12 storage devices, and one InfiniBand switch, we realized a 54-Gbit/s throughput video server system. In this paper, we describe the proposed communication method, the hardware and software implementation method on the PC cluster, as well as the evaluation results.

An SDM Method Utilizing Height Pattern Due to Two-ray Fading Characteristics

K. Hiraga, K. Sakamoto, M. Arai, T. Seki, T. Nakagawa, and K. Uehara

Antennas and Wireless Propagation Letters, IEEE, Vol. 12, No. 1, pp. 1622–1626, 2013.

A spatial division multiplexing transmission method utilizing the characteristics of two-ray fading without relying on the narrow beam of the antennas is introduced. This paper formulates the optimized array antenna arrangements and channel capacity as functions of the transmission distance and shows achievable channel capacity for two- and three-element antenna arrays. The paper also describes bandwidth dependency up to 15 percent bandwidth based on an assumed application to 60-GHz-band gigabit wireless systems. The proposed method provides increased capacity comparable to multiple-input and multiple-output (MIMO) transmission without the extra signal processing cost incurred when using conventional MIMO.

Experimental Demonstration of Simultaneous SPM and XPM Mitigation Using Combined Techniques of Optical Compensation and Multichannel Single-stage DBP

H. Kishikawa, T. Kawai, K. Shibahara, and M. Fukutoku

Electronics Letters, Vol. 49, No. 25, pp. 1627–1628, 2013.

A novel system mitigating self-phase and cross-phase modulation effects simultaneously using optical dispersion compensation at optical nodes and multichannel single-stage digital backward propaga-

tion (DBP) is proposed. Experiments demonstrate 2.4 dB Q-factor improvements with both self-phase modulation and cross-phase modulation compensation.

A Load Balancing and Replica Partitioning Method for Consistent Hashing

M. Irie, E. Iwasa, M. Kaneko, T. Fukumoto, and K. Ueda

IEICE Trans. on Communications, Vol. J97-B, No. 1, pp. 31–40, 2014 (in Japanese).

We choose session control servers as the objects of our studies on massively distributed systems. Systems such as session control servers must have a good load-balancing scheme. Characteristics such as scalability and fault-tolerance are also required. We propose a load-balancing method that fulfills these requirements. We apply consistent hashing as the load-balancing scheme for the session control servers. Existing node-ID allocation methods for consistent hashing have a wide range of load distributions, so they are not suitable for the load balancer of session control servers. We propose a node-ID allocation method that selects the longest range of ID space and allocates an ID to divide that range. In addition, we propose a technique to prevent conflicts between replicas of the virtual nodes. Lastly, we confirm the characteristics of our proposed method from the results of computer simulations and an experimental evaluation.

Proposal and Consideration of the Securitter which Tweets Behavior of Information Security

S. Hara, H. Miura, Y. Seki, and H. Suwa

IPSJ Journal, Vol. 55, No. 1, pp. 210–220, 2014 (in Japanese).

To increase the security level of the information society, it is important that end-users perform certain security actions. We think that if users can share information about familiar persons who carried out a certain action, they will be aware of security information and will act in a way that is related to their own behavior. In this paper, we propose Securitter, which is an information sharing method using Twitter. Securitter automatically extracts the logs that are left when users have carried out information security behavior. We consider the requirements and the functions of the Securitter and implement an application program in order to validate the feasibility of the system including the linkage with Twitter. We built a network environment using Twitter and conducted an experiment in which 47 users followed the tweets of 3 co-workers for a week. The results indicated that 30 users read the information about performing an information security related action, and 5 users actually did the action. Furthermore, we confirmed the effectiveness and acceptability of receiving tweets from the Securitter from structured interviews and questionnaires.

Using Phrase End Context to Predict Phrase Boundary Rise Labels from Text for Expressive Text-to-speech Synthesis

H. Nakajima, H. Mizuno, O. Yoshioka, and S. Takahashi

IPSJ Journal, Vol. 55, No. 1, pp. 553–562, 2014 (in Japanese).

Expressive speech shows a phrase boundary rise of fundamental frequency (F0) even if it is not an interrogative sentence. To synthesize expressive F0, tone labels such as phrase boundary tone label are known to be useful. Though conventional label prediction mainly uses many numerical features such as phrase length and phrase location in a sentence, conventional phonetic analysis reveals a complex

relationship between phrase semantics and phrase boundary tone label. Instead of using semantic processing, this paper proposes the use of phrase end context, which consists of several word surface strings and their part-of-speech in the phrase and the existence or non-existence of a pause at the phrase-final position. Experiments on Japanese expressive speech, Tokyo dialects, that target phrase boundary rise label prediction show that the proposed phrase end context attains performance equal to or better than that of conventional features, confirming the usefulness of the phrase end context proposal.

Editor's Message to Special Issue on Technologies and Network Services to Cooperate with Social Activities

Y. Seki

Journal of Information Processing, Vol. 22, No. 1, p. 18, 2014.

In this special issue, the editorial committee of the journal sought paper submissions on technologies and network services to cooperate with social activities. The editorial committee members are mainly from the Special Interest Group on Groupware and Network Services.

Theoretical and Experimental Analysis of Spatial Division Using Antenna Directivities in Short-range MIMO Transmission

M. Arai, T. Seki, K. Hiraga, T. Nakagawa, and K. Uehara

Electronics Letters, Vol. 50, No. 2, pp. 65–67, 2014.

A simple method is proposed for achieving short-range multiple-input multiple-output (MIMO) transmission without complicated signal processing. This is achieved by a spatial division that cancels interference between signal streams by using π -phase-shifted antenna directivities in high speed parallel transmission systems at 60 GHz. The method achieves spatial division transmission without MIMO detection even for antenna elements with wide beamwidths. This makes it easy to design antenna elements and reduces signal processing costs in the transmitter and the receiver. Moreover, the method provides almost the same channel capacity as that of the complicated MIMO transmission methods. The optimal antenna array length is derived to maximize the capacity, and the validity of the proposed method is confirmed through numerical and experimental analyses at 4.85 GHz.
