Activities

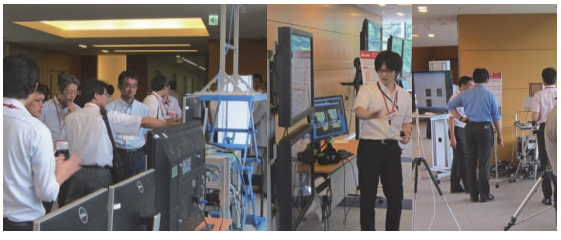
5G Tokyo Bay Summit 2015

On the 22 and 23 of July 2015, the 2-day event "5G Tokyo Bay Summit 2015" [1] was held in the DOCOMO R&D center in Yokosuka, Kanagawa prefecture. This was an open event presented by NTT DOCOMO on the 5th generation of mobile communications systems (hereinafter referred to as "5G"), and was attended by representatives of businesses, universities and media organization, both from within Japan and overseas.

To make 5G a reality, NTT DOCOMO has been researching radio communications technologies in consideration of the various frequency bands anticipated for future use, and by May of 2014 had agreed to perform experiments in partnership with six major Japanese and global vendors [2]. NTT DOCOMO added a further two partner vendors in March of 2015 [3], and has been continuing a range of laboratory and field experiments. This event brought together major global vendors under one roof, and presented details of 5G technologies and the latest experimental results. The event was held with the aim of actively promoting further research into 5G technologies and various 5G initiatives through discussions and information exchange among industry insiders.

The 2-day event featured 24 talks and 26 exhibits and demonstrations [1]. These talks and exhibits were enacted through the participation of NTT DOCOMO, and five more companies who agreed to cooperate in experimen-

Outdoor banners


Exhibit/demonstration corner (NTT DOCOMO)

Exhibit/demonstration corner (experiment partners)

Lecture venue (main venue)


Lecture venue (broadcast venue)

tation in addition to the eight partners mentioned above, bringing the total number of companies partnering with NTT DOCOMO to 13. Announcements were made on the first day of the event [4].

Lectures on the first day included a special talk presented by Mr. Junya Inoue, Senior Director of ICT Solutions, the Tokyo Organising Committee of the Olympic and Paralympic Games, who spoke of the importance of the communications platform required for the Olympics. Following, a lecture was given by Mr. Seizo Onoe, Managing Director of R&D Innovation Division, NTT DOCOMO, who discussed policies for commercialization of 5G by 2020. After that, key persons from major Japanese and global vendors delivered introductory talks, which were followed by an enthusiastic panel discussion on the world of networking and its expectations for 5G. The second day presentations featured a panel session and a technical lecture session called "5G technology workshop." The panel session was chaired by Professor Fumiyuki Adachi of Tohoku University, and featured panelists from the Ministry of Internal Affairs and Communications, universities and leading vendors discussing the role of Japan in realizing 5G. The technical lecture session included introductions by each of the global vendors partnering with NTT DOCOMO in these ongoing 5G experiments. These sessions were well attended.

Under the theme of partnering for experimentation, the exhibits and demonstrations introduced 5G signal waveform design, 5G large-scale radio technology testing, ultra-high-density distributed antenna coordinated control tech-

Special Lecture
Tokyo Organising Committee of the Olympic and Paralympic Games
Mr. Inoue

Keynote lecture
NTT DOCOMO
Mr. Onoe

Invited lecturer
Ericsson
Dr. Dahlman

Invited lecturer
Huawei
Mr. Wang

Invited lecturer
NEC
Mr. Hashimoto

Invited lecturer
Nokia
Mr. Oksanen

Invited lecturer
Qualcomm
Dr. Tiedemann

Panel discussion (first day)

Panel discussion (second day)

Invited lecturer
Tohoku University
Prof. Adachi

Invited lecturer
Ministry of Internal Affairs and Communications
Mr. Fuseda

Invited lecturer
University of Tokyo
Prof. Morikawa

Invited lecturer
Osaka University
Prof. Sampei

Invited lecturer
Fujitsu
Mr. Nakamura

Invited lecturer
NEC
Mr. Tanoue

Lecture
NTT DOCOMO
Mr. Nakamura

nology*1, 5 GHz band Massive MIMO*2, a 15 GHz band radio access transmission experiment, ultra wide-band mobile communications using the 28 GHz band, 44 GHz band ultra large-capacity Massive MIMO transmission, and ultra-wide band millimeter-wave radio communication*3. NTT DOCOMO presented a 5G real-time simulator, a 5G service image, a Non-Orthogonal Multiple Access (NOMA)*4 transmission experiment, the future core network, ultra-thin front-end and 5G radio wave propagation technologies etc.

Drawing on the momentum of this event to further accelerate joint experimentation and research into key 5G technologies in partnership with major Japanese and global vendors, the results of which will be discussed in international conferences and organizations involved in 5G research, and used in 5G standardization discussions due to commence in the Fall of 2015, NTT DOCOMO intends to continue its research initiatives to bring about the cutting-edge, 5G communications network.

References

[1] NTT DOCOMO: "5G Tokyo Bay Summit 2015," (in Japanese). http://5gs.idc.nttdocomo.co.jp/

[2] NTT DOCOMO Press Release: "DOCOMO to Conduct 5G Experimental Trials with World-leading Mobile Technology Vendors," May 2014. https://www.nttdocomo.co.jp/english/info/media_center/pr/2014/0508_00.html

[3] NTT DOCOMO Press Release: "DOCOMO's 5G Outdoor Trial Achieves 4.5Gbps Ultra-high-speed Transmission - Aiming at 5G launch by Tokyo 2020 Olympic and Paralympic Games -," Mar. 2015. https://www.nttdocomo.co.jp/english/info/media_center/pr/2015/0302_03.html

[4] NTT DOCOMO Press Release: "DOCOMO to Collaborate on 5G with Five Additional Vendors - Expands 5G collaborations to 13 world-leading vendors -," Jul. 2015. https://www.nttdocomo.co.jp/english/info/media_center/pr/2015/0722_00.html

*1 **Ultra-high-density distributed antenna coordinated control technology:** Technology that entails setting up many compact antenna units (base stations) in extra-high density in areas where high traffic volume can occur so that base stations can be configured flexibly by combining multiple antenna units to suit the radio propagation environment. Then, by coordinating between base stations in different areas, the areas covered by the base stations (virtual cells) can be dynamically changed so communications environments that are comfortable to use can be constantly provided.

*2 **Massive MIMO:** In Multiple-Input Multiple-Output (MIMO) systems that transmit radio signals overlapping in space by using multiple antenna elements for transmission and reception, these Massive MIMO systems aim to achieve high-speed data communications with greater numbers of simultaneous streaming transmissions while securing service areas by using antenna elements consisting of super multi-element arrays to create sharply formed radio beams to compensate for the radio propagation losses that accompany high-frequency band usage.

*3 **Ultra-wide band millimeter-wave radio communications:** Called "millimeter-wave" because the wavelengths of the Extra High Frequency (EHF) (30-300 GHz) band are between 1-10 millimeters. Using these higher frequencies than those used with conventional cellular systems enables ultra-wide bandwidth in the several hundred MHz to 1 GHz range, and thus enables super-high-speed data communications in the Gbps class.

*4 **NOMA:** When a base station connects to multiple users (multiple access), these systems adjust user radio signal transmission power to suit the size of the propagation loss, and transmit signals at the same time and frequency (i.e. non-orthogonally). These differences in power between user signals are used for reception to cancel interference and separate individual user signals.