Open Innovation

ICT Testbed Research and Development Promotion Center

Director General Hiroaki Harai

At the ICT Testbed Research and Development Promotion Center, we are building and operating an integrated testbed that is compatible with various IoT demonstration experiments, including an ultra high speed R&D network testbed (JGN), a wide area SDN testbed (RISE), a large scale emulation facility (StarBED), and a large scale sensor and cloud facility (JOSE).

We are also researching and developing infrastructure technology for the implementation of a large scale actual infrastructure testbed for highly realistic technical verification of cutting-edge ICT deployed on actual infrastructure, and a large scale emulation infrastructure testbed for performing technical verification in diverse environments partially combined with simulated infrastructure.

Construction of NICT's integrated testbed

At the ICT Testbed Coordination and Planning Office, we are integrating multiple testbeds and developing services for an NICT integrated testbed. As a result, we are constructing and operating a testbed that supports diverse IoT demonstration experiments including both emulated and real infrastructure. In FY2017, with the aim of increasing the number of users, we started on new initiatives including a caravan testbed (a set of portable communication equipment that supports the last mile of IoT), and an LPWA testbed (a demonstration field where it is possible to test and verify multiple LPWA communication schemes). In collaboration with the ICT Testbed Research, Development and Operations Laboratory, we are developing and verifying the underlying technologies of each testbed, installing these technologies in testbeds, and offering them to users. Figure 1 shows an outline of the NICT integrated testbed.

Cooperation with external organizations

In November 2017, NICT constructed Asia's first wide-area international demonstration environment in collaboration with SingAREN and NSCC based on a 100 Gbps line between Tokyo, Hong Kong, and Singapore. In the following month, NICT and SingAREN formed a project with the other five organizations, including SINET and Internet2, and entered into a Memorandum of Understanding for cooperation on a 100 Gbps network for research and education use across the Asia-Pacific region. At SC17 held in Denver, USA, an international demonstration environment was constructed using three 100 Gbps international routes between Japan and the United States, and we successfully conducted ultra high speed data transmission tests at rates of up to 270 Gbps in cooperation with the National Institute of Informatics. We also established an international demonstration environment at the Sapporo Snow Festival with two 100 Gbps lines between Japan and Singapore, and collaborated with some 50 organizations from industry, academia, and government to conduct successful multicast distribution of uncompressed 8K video streams. Furthermore, the Himawari satellite real-time imaging Web site, whose technology was transferred to domestic weather agencies in FY2017, is now serving 400,000-page views per year (a 25% increase) to clients outside Japan. To improve the usability and convenience of this service, a mirror site has been set up at NECTEC in Bangkok. In FY2017, we transferred technology to domestic corporations by using a high-speed file transfer tool based on the HpFP protocol developed prior to FY2016, and we also used this tool to transfer data to the mirror sites. As a result, we were able to transmit files at up to 700 Mbps on JGN/APAN.

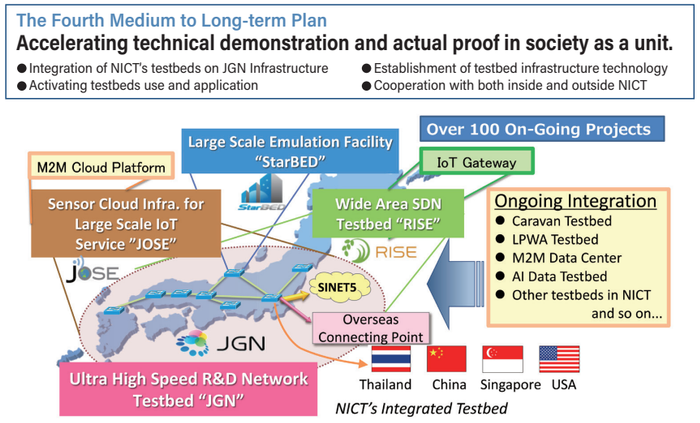

Fig.1 : NICT's integrated testbed

Demonstration of ultra wideband network applications

In addition to R&D on testbed infrastructure, we have also been working on demonstrations of ultra wideband network applications on the JGN ultra high speed network testbed. In particular, with a view to the forthcoming era of 8K broadcasting, we have been conducting experimental long-distance transmission of uncompressed 8K video streams, which will be required for content creation systems. During the Sapporo Snow Festival in FY2017, we built an extremely large multipath network using the Asia Pacific Ring (APR), which consisted of the JGN Asia 100 Gbps line and the 100 Gbps lines of other organizations in the Pacific Rim region. On this network, we successfully performed multicast transmission of uncompressed 8K video streams (Fig.2). This experiment was performed with the cooperation of 53 organizations, including the National Institute of Informatics, the WIDE Project, Kanagawa Institute of Technology, TransPAC, Pacific Wave, Internet2 and other national and overseas research institutes and network equipment vendors.

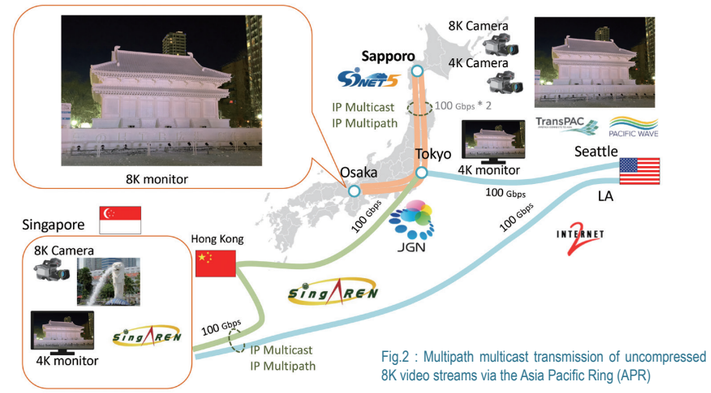

Fig.2 : Multipath multicast transmission of uncompressed 8K video streams via the Asia Pacific Ring (APR)

Verifying the operation of virtual IoT devices

At StarBED, we have been promoting R&D of wireless emulation technology to model the characteristics of wireless networks in wired networks and validate software used for wireless environments. In FY2017, we expanded the range of cases that can be verified by building a new Bluetooth Low Energy (BLE) emulation platform called BluMoon to provide compatibility with the BLE system used by IoT devices.

Demonstration of community-based IoT service infrastructure using vending machines and taxis in Tokyo

The creation of a unique community-based IoT service infrastructure, which functions as a cost-effective local information sharing network, has been challenged in Tokyo area since June 2017, utilizing NICT's large scale sensor and cloud facility "JOSE." The infrastructure can help with sharing socially-valuable data among the community in a cost-effective way based on a technology combining the multi-hop communications and the opportunistic network principle using multiple unlicensed-band wireless interfaces such as Wi-Fi, Bluetooth, and Wi-SUN. We have achieved to deploy more than 100 wireless IoT routers on vending machines and taxis that are actually operating in Tokyo by the end of October in 2018, and we have performed the proof-of-concept of some applications that would be effective as the use cases for the IoT service infrastructure; such as an alert system for car drivers to avoid a traffic accident, a support system to search for a missing elderly, and a support system for taxi drivers to effectively find new passengers.