

Recent Activities of NICT's Resilient ICT Research Center

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1. Introduction

On April 1, 2012, the National Institute of Information and Communications Technology (NICT) established the Resilient ICT Research Center, a world-leading research establishment in the Katahira Campus of Tohoku University, with the aim of developing information and communications technology that is resistant to disaster and can help to revive economic activity in disaster-affected areas. Building work at the center was completed at the end of last year, and an opening ceremony was held on March 3, 2014, followed by an opening symposium at Sakura Hall in Tohoku University. This article first describes the Resilient ICT Research Center and its research facilities, and then gives an overview of the opening ceremony and symposium, and the plans of this project.

2. Opening of the Resilient Research Center

The Great East Japan Earthquake of March 11, 2011 caused severe disruption of telecommunication networks, and the failure of information gathering and delivery systems. To prevent this from happening again, the Ministry of Internal Affairs and Communications (MIC) established and funded R&D programs aimed at the development of “unbreakable networks” — i.e., disaster-resistant and disaster-resilient information and communication technologies. The participants in these projects consisted of universities and private bodies including Tohoku University, NTT DOCOMO, NTT, NTT DATA, KDDI, NHK, SkyPerfect JSAT, NEC and Mitsubishi Electric. Ten of the projects were initiated in 2012. These were aimed at strengthening current wireless, mobile, broadcasting and core networks, and developing network control technology for traffic congestion avoidance. NICT has been coordinating the cooperative research and development efforts of industry, academia and government bodies, and has been preparing testbed facilities in the disaster-affected parts of the Tohoku region. In January 2012, NICT and

Tohoku University entered into a comprehensive collaboration arrangement and established a Resilient ICT Research Center in the Katahira Campus of Tohoku University.

This research center is a new 4-story steel frame building with a total floor area of 2,200 m², containing testbed facilities for resilient ICT R&D and laboratories for collaborative research by universities, private companies and local governments. It consists of three laboratories: (1) the Information Distribution Platform Laboratory, which aims to implement an information distribution platform to support rapid and adequate assessment of disaster conditions when a disaster occurs, (2) the Robust Network Platform Laboratory, which aims to build photonic network infrastructure to reduce communications congestion by dynamic resource control when a disaster occurs, and (3) the Wireless Mesh Network Laboratory, which aims to implement disaster-resilient wireless networks using terrestrial wireless mesh network and satellite communications. NICT's testbed consists of three platforms designed for these three research subjects and laboratories.

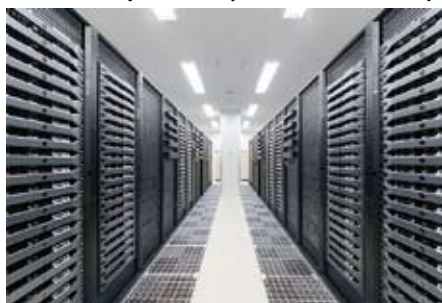
On the first floor of the building, there is a 400-node computer server with 4,800 cores, 38.4 terabytes of memory and 10 petabytes of disk storage for the information distribution platform. This disaster-resilient platform uses information analysis and natural language analysis techniques to collect and organize vast amounts of disaster-related information from cyberspace, including social networking services like Twitter, and can provide information that aids comprehension of the disaster situation, leading to better decision making. The platform's services will become available in autumn 2014.

On the second floor, there is a robust photonic network platform including optical packet/optical path integrated nodes, a reconfigurable optical add-drop multiplexer (ROADM) and portable burst optical signal amplifiers. These technologies ensure that the platform can provide disaster victims with equal access

■ Photo 1: The Resilient ICT Research Center



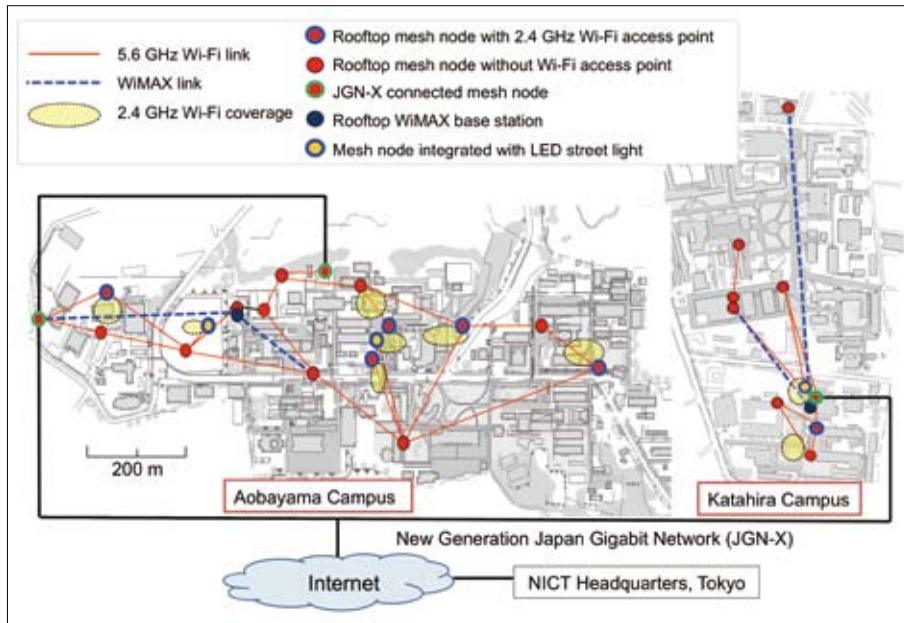
■ Photo 2: Information distribution platform (400-node servers)



■ Photo 3: Optical packet/optical path integrated nodes



■ Figure 1: Wireless mesh network testbed



■ Photo 4: Opening Symposium for the Resilient ICT Research Center



of the same day. After two keynote speeches, representatives from industry, academia and government delivered lectures relating to the direction of the research center and the promotion of collaboration between industry, academia and government. Results of the ten resilient ICT projects mentioned above (which were directly commissioned by

to information about the disaster situation, and are necessary for confirming and ensuring the wellbeing of victims and mitigating the effects of disasters.

The third floor consists of collaboration laboratories with capacity for more than 30 people from universities, industries, and local governments.

A wireless mesh network testbed aimed at robust, dependable, disaster-resilient wireless networks is located on the fourth floor and outside the building. It consists of a terrestrial wireless mesh network, which can achieve flexible control of communication traffic by bridging communication links through satellites and unmanned aerial vehicles (UAVs). The testbed includes outdoor wireless mesh access points located on the building roofs, and digital signage equipment that was constructed in the Aobayama and Katahira campuses of Tohoku University. It also includes three Ka-band vehicle-mounted earth stations for satellite communications using Japan's experimental WINDS satellite (short for "Wideband InterNetworking engineering test and Demonstration Satellite"). Details of these studies and facilities can be found in previously published articles^{1,2}.

At the opening ceremony, held in the Resilient ICT Research Center on March 3, 2014, the attendees expressed a common resolve for the center to promote the R&D of resilient ICT technologies to meet the growing needs of the society through its research facilities, and to promptly expand its achievements with the aim of becoming a world-leading research center. The ceremony ended with closing remarks by Dr. Yoshiaki Nemoto, the Director General of the NICT's Resilient ICT Research Center, in which he set forth the Center's policies and mission. There were 60 attendees in the ceremony, including people from Tohoku University, government agencies, local governments, the private sector and NICT.

3. Opening Symposium

The Opening Symposium of the Resilient ICT Research Center (hosted by the MIC and NICT) was held in the afternoon

the MIC) were also presented. Activities for further practical applications of the research results were also introduced. In this symposium, it became clear that we all share the same perceptions of the situation of resilient ICT research, the formation of a base and the importance of collaboration between industry, academia and government. An exhibition of research results also took place on the first floor of Sakura Hall. There were 187 participants in total for both the symposium and the exhibition.

4. Future work

For the early implementation of resilient ICT in society, the Resilient ICT Forum was established in May 2012 with members from universities, private sector organizations who are participating in MIC-funded projects, and NICT. This year, we have established two working groups in the Forum: One is for promoting standardization and public relations of resilient ICT technologies and the other is for investigating local disaster management models to promote introduction of research results to local governments. In the Shikoku Island of Japan, some members of the Forum have carried out demonstrative experiments for rapid information transfer to residents and the reinstatement of adequate communications infrastructure in disaster-hit areas.

NICT is committed to the establishment and early practical application of resilient ICT by extending collaborative relations in the Forum and with local governments, and by accelerating research and development based around the NICT Resilient ICT Research Center established in cooperation with Tohoku University. We will also strive to implement the resilient ICT in areas that are thought to be vulnerable to a Nankai trough earthquake, such as Shikoku Island, and in other Asia-Pacific countries.

References

- 1 H. Wakana, Y. Awaji, K. Hamaguchi, M. Inoue, R. Miura, B. Jeong, and K. Ohtake, "Report on Resilient ICT Research Symposium and Demonstration," *New Breeze*, 2013 summer, pp. 16-19.
- 2 Y. Nemoto and K. Hamaguchi, "Resilient ICT Research Based on Lessons Learned from the Great East Japan Earthquake," *IEEE Communications Magazine*, March 2014, Vol. 52, No. 3, pp. 38-43.