Current R&D Activities in Disaster-Resilient ICT in Japan

Resilient ICT Research Center
NICT (National Institute of Information and Communications Technology)

September 27, 2016

East Japan Earthquake March 11, 2011

（Kyodo News）http://www.boston.com/bigpicture/2011/03/massive_earthquake_hits_japan.html

Giant Earthquake + Tsunami + Nuclear plants collapse;

Damage areas:

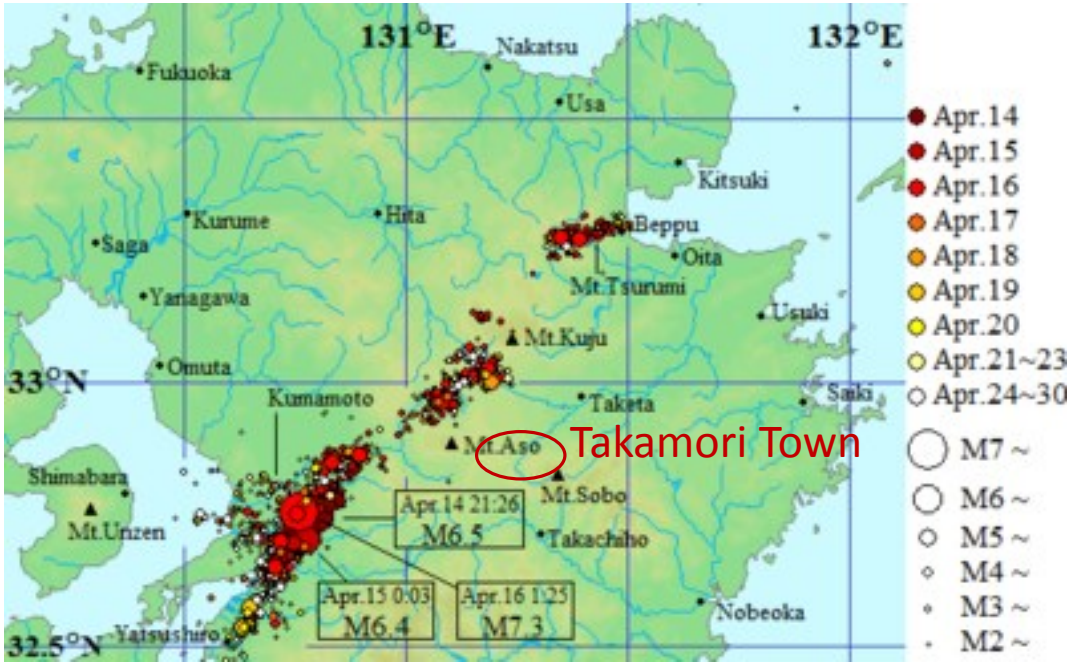
- ICT Infrastructure destroyed

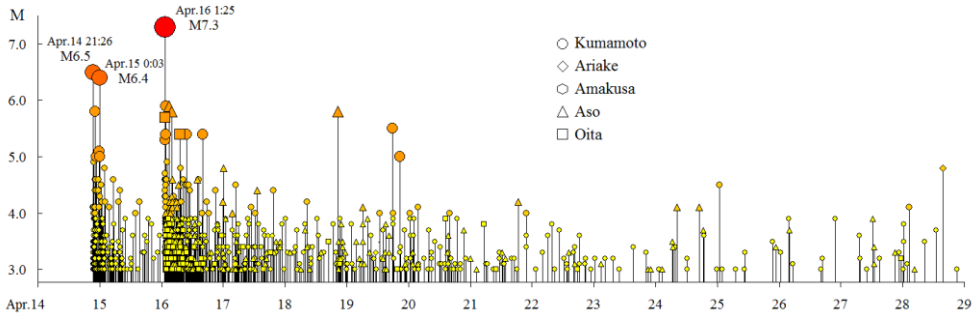
Wider areas:

- Traffic congestion: x50~60 call attempt than usual
- 80~90%(max) call restriction applied
- 29,000 Mobile base stations shutdown (due most to electric power outage)

⇒ Need resilient ICT

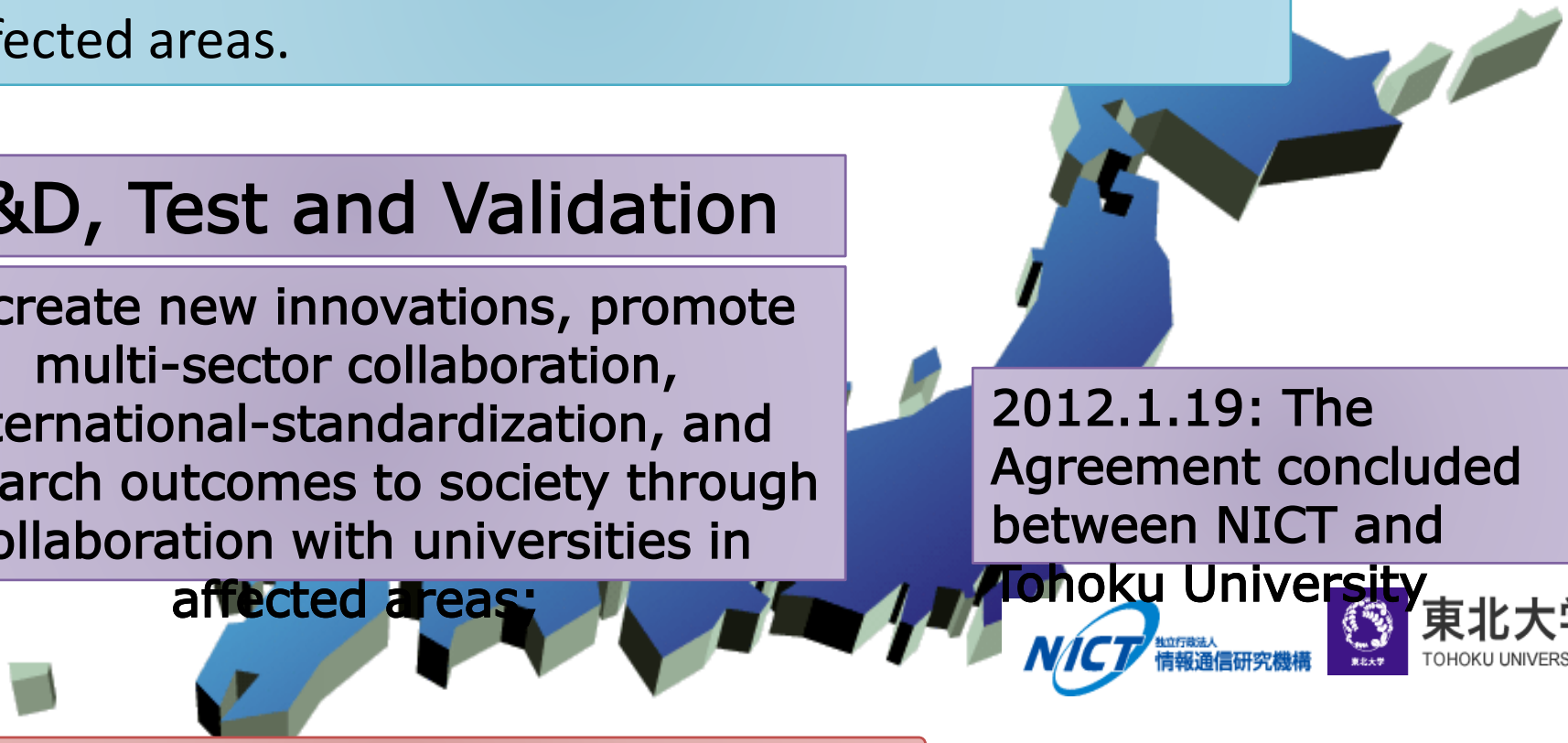
Kumamoto Earthquake April 14, 2016 -





R&D for Enhancement of Resiliency in Communications Network against Disasters (MIC: 2011 - 2012)

- To realize disaster-resilient communications network;
- To help restore local society and economy in the affected areas.



R&D, Test and Validation

To create new innovations, promote multi-sector collaboration, international-standardization, and research outcomes to society through collaboration with universities in affected areas;

2012.1.19: The Agreement concluded between NICT and Tohoku University

NICT 独立行政法人 情報通信研究機構

東北大学 TOHOKU UNIVERSITY

To build a world class of research base.

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Establishment of Resilient ICT Research Center, NICT

◆ To Learn the lesson from the Great Earthquake and Tsunami on March 2011: MIC Initiated National Research Project "Enhancement of Resiliency in Info-Communications Networks" in 2011.

▲ Resilient ICT Research Center

◆ Role of Resilient ICT Research Center, NICT

- Organize Industry-Academia-Government Collaboration Hub in the Damaged Area (Sendai)
- Develop Test bed for research promotion.

▲ Access Point of wireless mesh Network (left); Mobile Earth Station (right)

- 2012.1 Agreement with Tohoku University;
- 2012.4 Establish Resilient ICT Research Center NICT;
- 2012.5 Establish Resilient ICT Research Forum;
- 2014.3 Center Building Completion and Opening
- 2015.3 UN World Conference on Disaster Risk Reduction Held at Sendai.

▲ Cluster Server for disaster information processing (left); Packet-Circuit integrated node (right)

Activity Overview of Resilient ICT Research Center

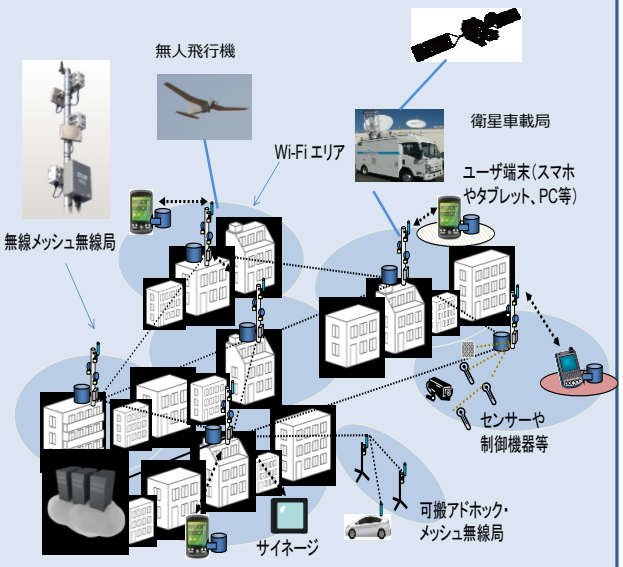
Lessons learned from the East Japan Great Earthquake and Tsunami (2011.3.11), Research in resilient ICT was initiated by MIC. NICT has been working in this project to organize a collaboration hub among academia, industry, and government sectors. Under collaboration with Tohoku University, NICT Intends to be a world top-class resilient ICT research center. Through collaborations with other sectors, quick implementation of the research outcomes to society is strongly encouraged.

①Resilient Optical Network Technology

Development of Elastic network by integrating packet and circuit optical network to mitigate congestion in disaster. Technology to restore optical network quickly and flexibly.

② Resilient Wireless Network Technology

Development of wireless network technology with disaster-resilient capability; in which distributed wireless system to work autonomous way to restore network function; also to combine mobile terminals such as on cars and airplanes and satellites.



③Realtime Social Wisdom Analysis

Development of information technology to provide information to help support decision making for rescue action through collection analysis of huge volume of SNS using technique NICT has developed.

Information provider

Twitter

DISAANA

Open for public (test)
http://disaana.jp

Promote societal implementation of Resilient ICT and utilization in society

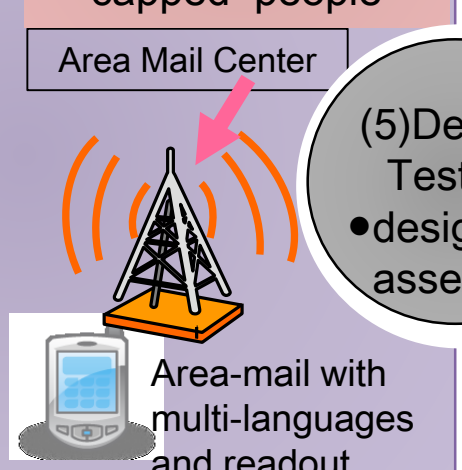
Information Disseminations and Communications in Disasters

NICT serves as the Principle Research Institution of the National Project (SIP)

Information Dissemination

(1)Alert message sending on a new V-Low multimedia broadcast service

(2)Enhancement of Emergency Area-mail capability, to foreign and handi-capped people

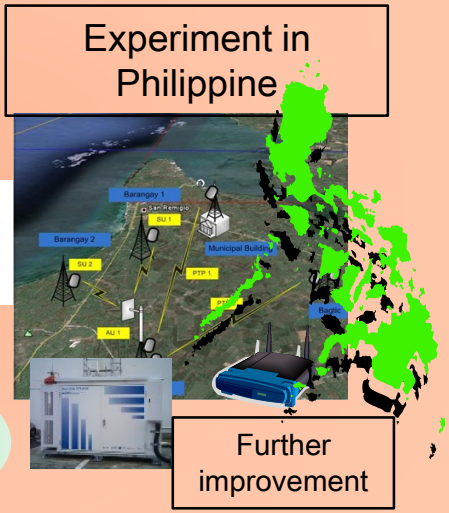


(5)Develop Testbed
- design and assemble

Recovery of Communications

(3)Immediate rescue of communications between command office and refuges

(4)Global deployment of the R&D outcomes



Targets in three years

- Demonstrate to send alert messages to indoor house and shopping areas;
- Install and test Multi-language and readout functions to the Area-mail.
- Rapid recovery of communications networks with 5 km distant and 500m area.
- Standardization and global deployment of the R&D outcomes.

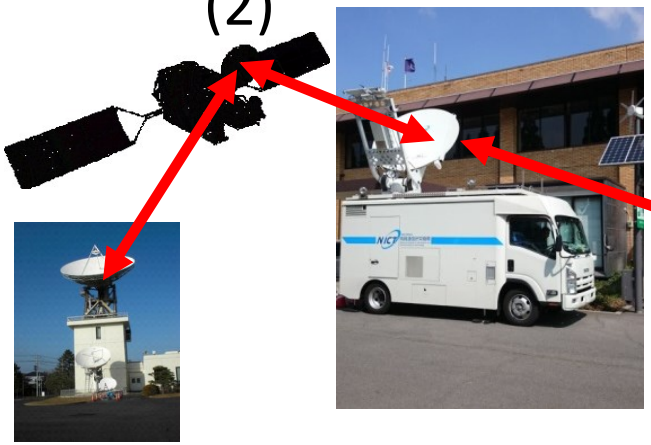
Support Activities for Kumamoto Earthquake Affected Area:
Immediate Recovery of Communication Link using Attache-case MDRU (ICT-Unit)

(1)**Attache-case MDRU (ICT-Unit: developed by NTT Innovation lab) was brought to** and made use of immediate recovery of communication link in the affected area.

(2)An Internet connection service and voice call service were provided by ICT-Unit connected to **Ultra-high-speed Internet Satellite** via mobile earth stations.

(3)A voice call service and data communication service were provided by the ICT-Unit connected to **satellite mobile phones**.

(2)



Ultra-high-speed Internet Satellite "Kizuna" and Mobile Earth Station

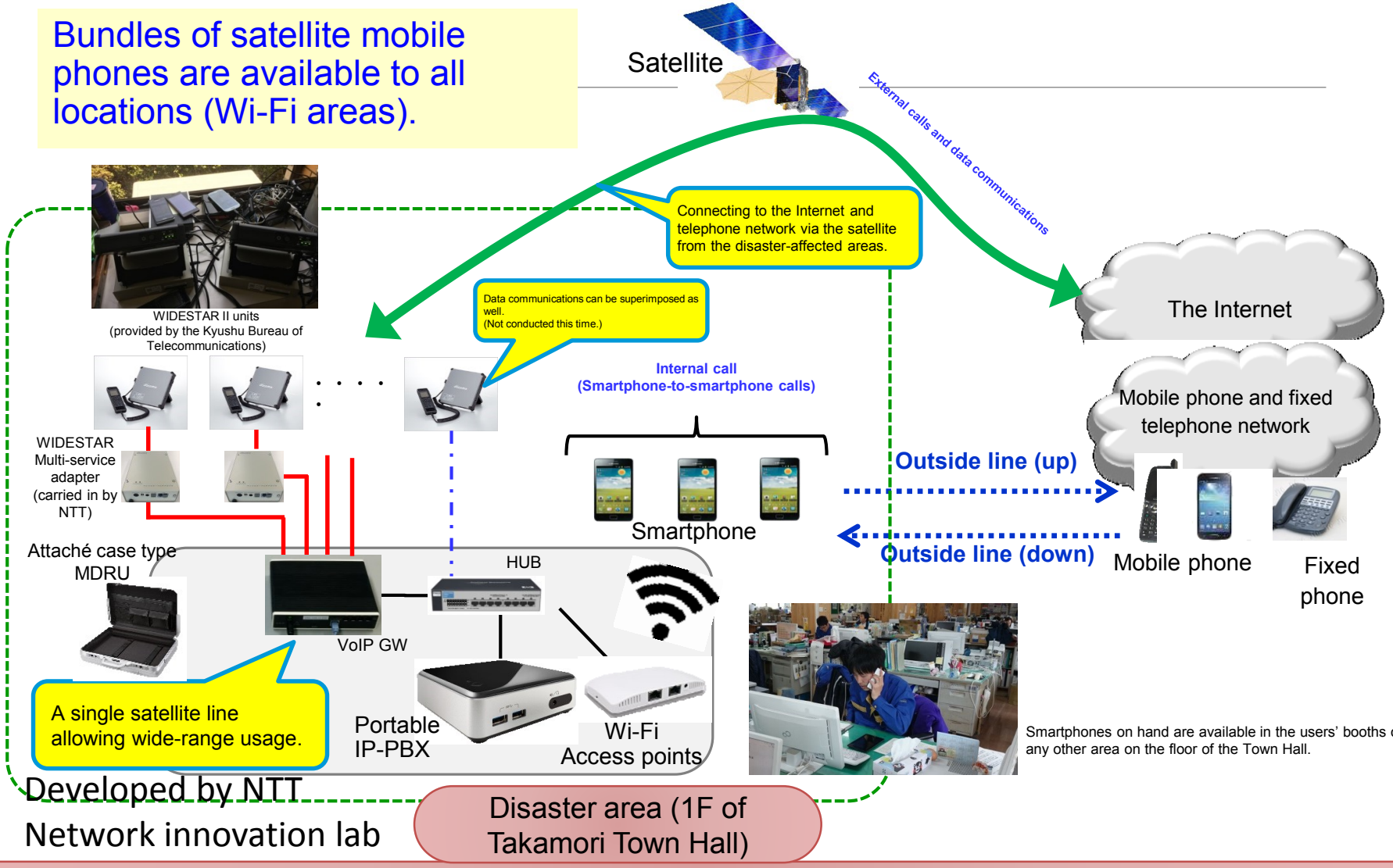
Attaché case MDRU (ICT-Unit) and Smartphones

(3)

Satellite mobile phone

Support (3):
Attache-case MDRU with Satellite Mobile Phones

Bundles of satellite mobile phones are available to all locations (Wi-Fi areas).



Support Activities for Kumamoto Earthquake Disaster Area (Immediately after Disaster through Recovery Phase)

In response to the huge earthquakes that hit Kumamoto Prefecture, we transported MDRUs to Takamori Town and provided an Internet-access service and a voice call service at the town office and a shelter.

MDRU with NICT's mobile satellite earth station

Internet-access service

Residents using the Internet to collect information in the lobby

MDRU with satellite-based mobile phones

Voice call service

Staff member using his smartphone to make a call via satellite at his desk

Local Cellular System for Emergency Response

This Model is temporary installed by the government at a disaster site when external power sources and commercial cellular networks are damaged at a time of disaster.
This Model contributes to understand the disaster situation for the determination of countermeasure policy, rapid lifesaving and recovery work, and dispelling the anxiety of victims and their families.

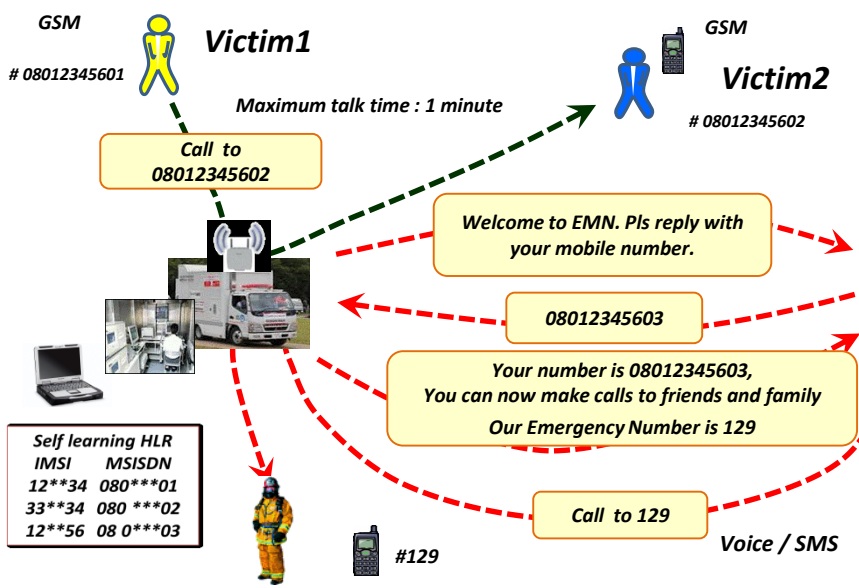
Local Telephone Service
Data Transport Service

Search

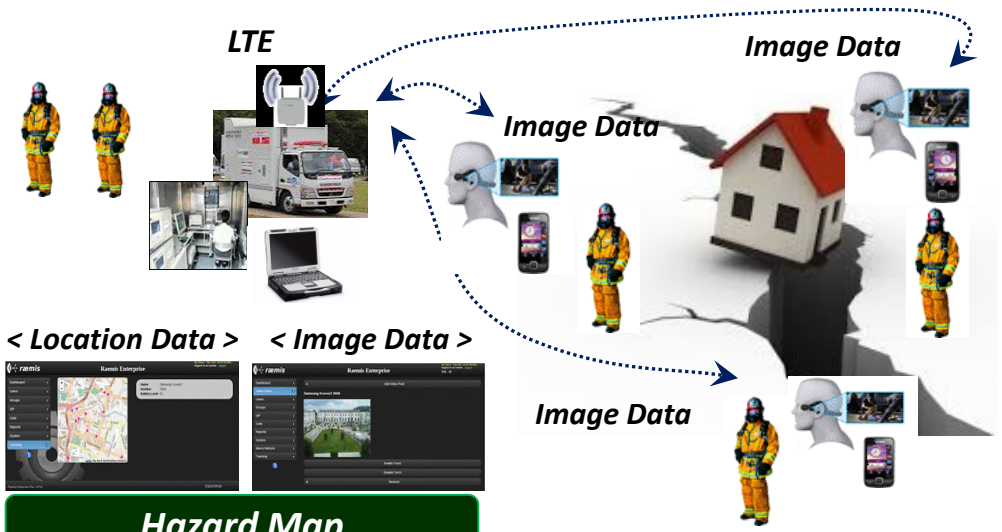
Rescue



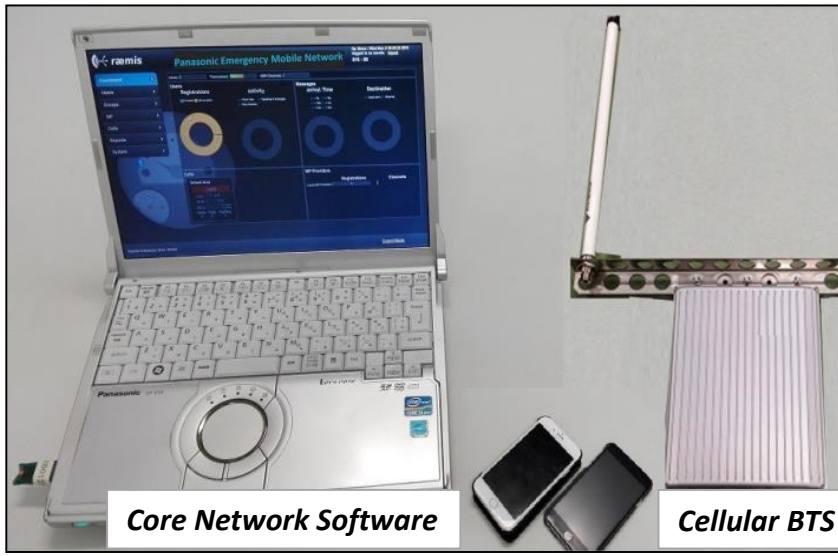
= GSM Telephone Service and Emergency Telephone S



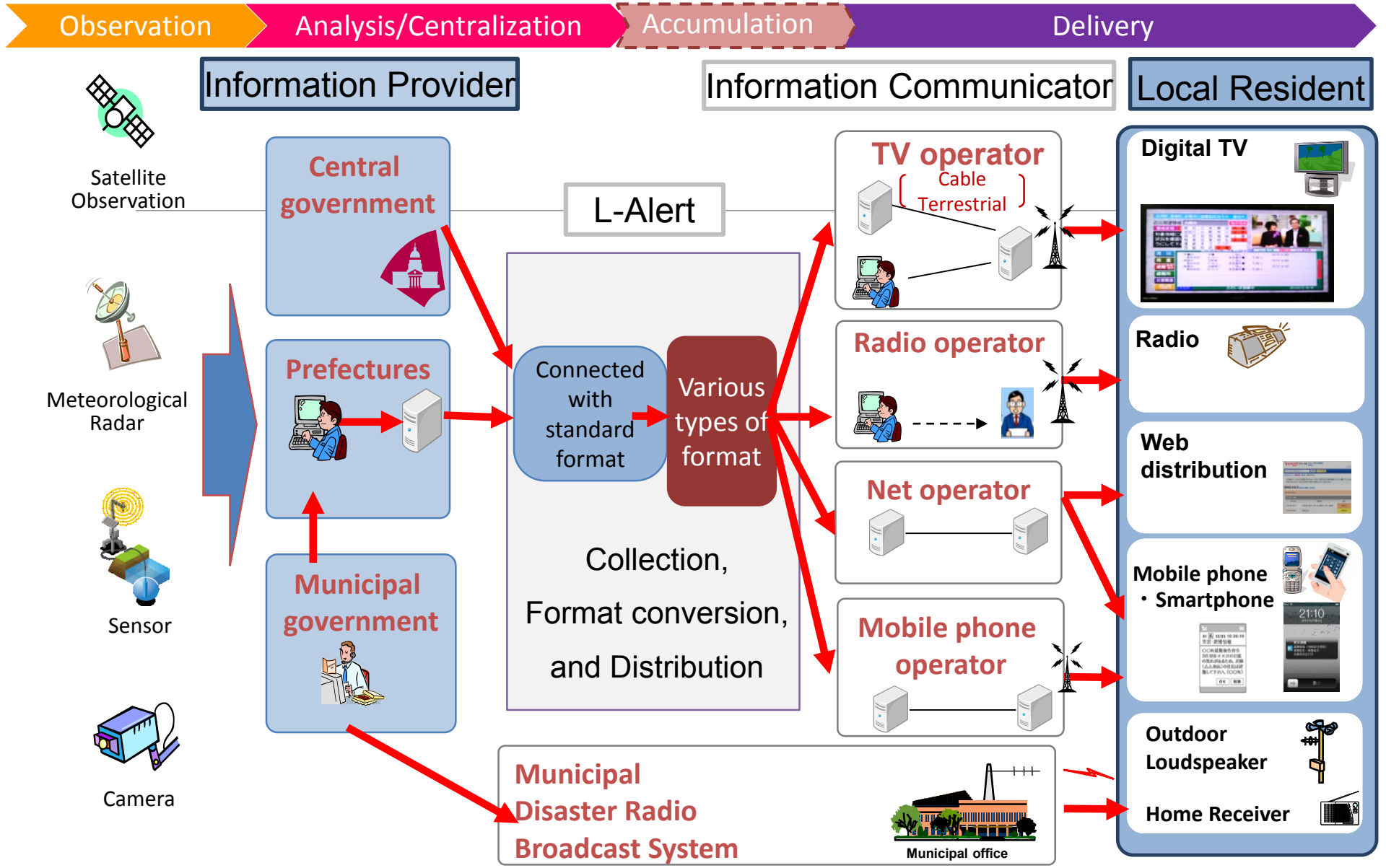
= LTE Data Transport Service =



= Equipment（GSM Package）=



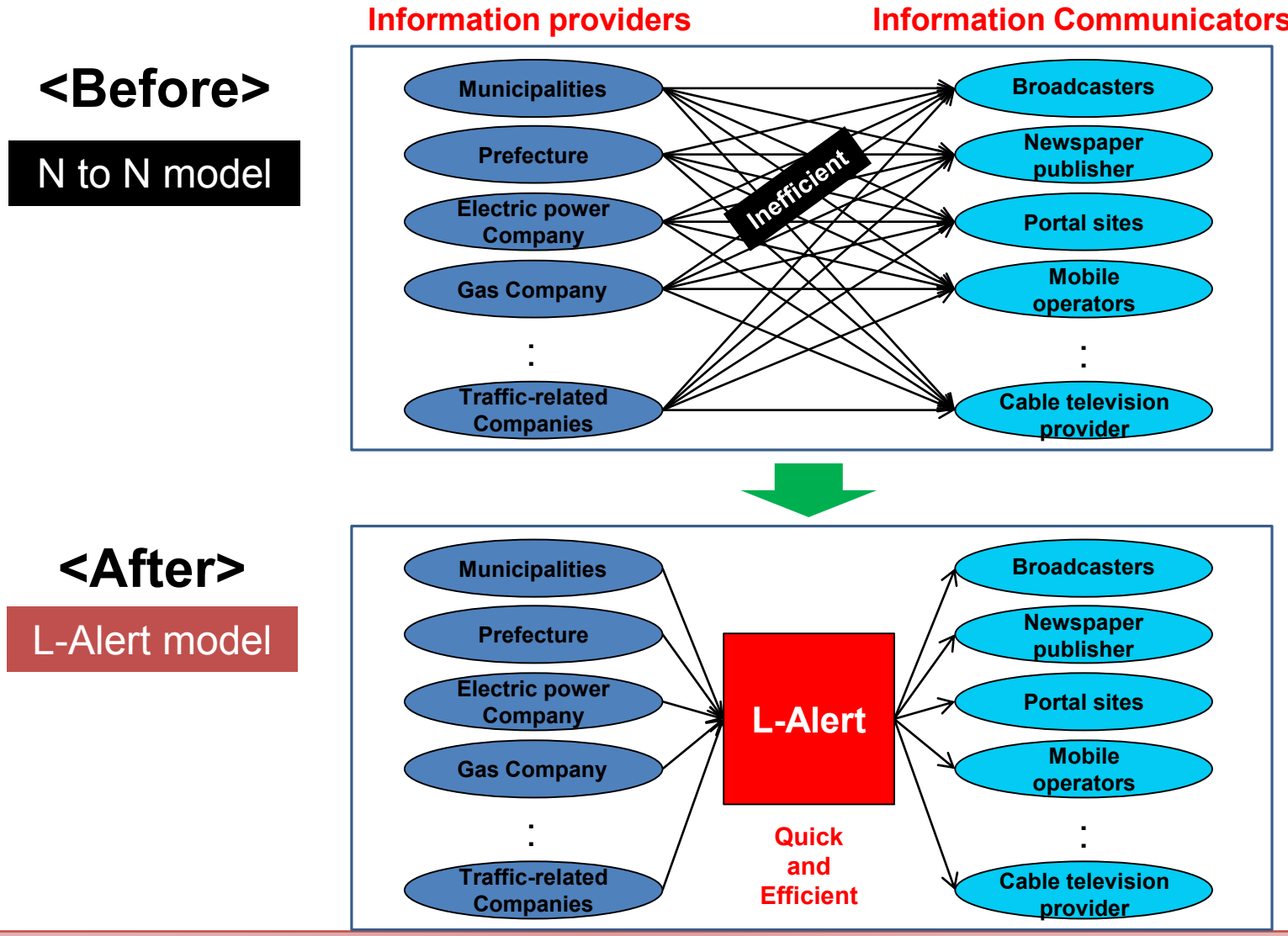
Distribution of Disaster-Related Information to Residents



※L-Alert : 832 groups including 47 prefectures are participating. (33 out of 47 prefectures distributes information in practice)
Direct information distribution without L-Alert from information provider also existed.

Background of Development of L-Alert in Japan

➢ Communication path



Summary and Future

- ICT infrastructures and services experienced serious damages in the East-Japan Earthquake in March 2011;
- To learn the lesson of this experiences, MIC initiated a research project to enhance resiliency in ICT networks under the framework of multi-sector collaboration among academia, industry, and government.
- Resilient ICT Research Center was established in 2012 and works as a collaboration hub in this project.
- An R&D result of the attache-case sized ICT-Unit (selected functions of MDRU installed) was deployed to Kumamoto Earthquake site and utilized as support for immediate recovery of communication infrastructure in this April.
- Another activity is to test and utilize a system for immediate communication recovery even in local areas by applying small instrument to cellphone system of GSM or LTE.
- The disaster-related information distributing system has been developed and operated on the basis of the importance of distribution of required information.
- Results developed in the Resilient ICT Project are usable not only for immediate recovery after disaster but also for easy setup and operation to create new communication links in the field in many situations (solution for digital divide, for example) and ready for deployment.