Emergency Communications Drills in the Metropolitan Areas

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Disaster drills and Emerging Technologies on Disaster Management

The Great East Japan Earthquake
東日本大震災
March 11, 2011

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

Giant Earthquake + Tsunami + Nuclear plants collapse;

Affected 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 more resilient ICT**

Damages from Great East Japan Earthquake

Service Failure in DOCOMO caused by the Earthquake and Tsunami
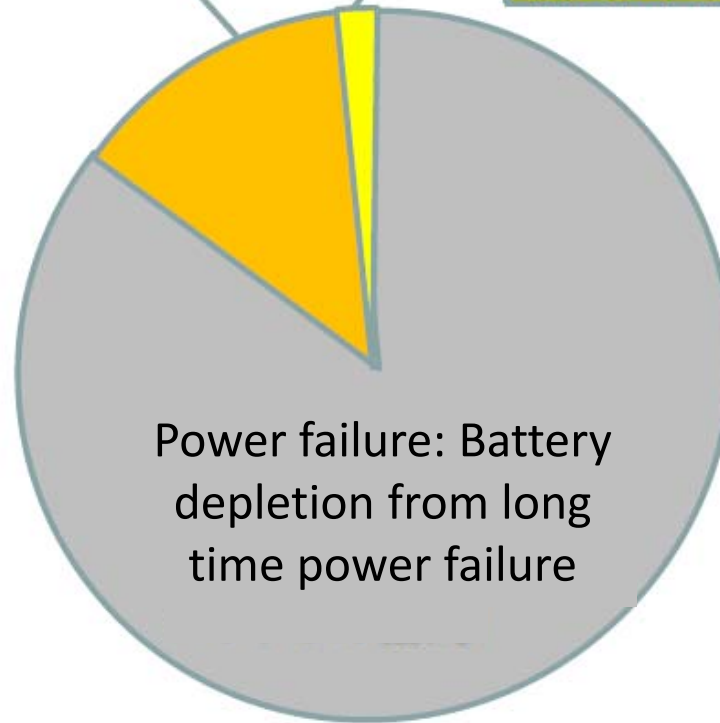
As of March 12, 2011
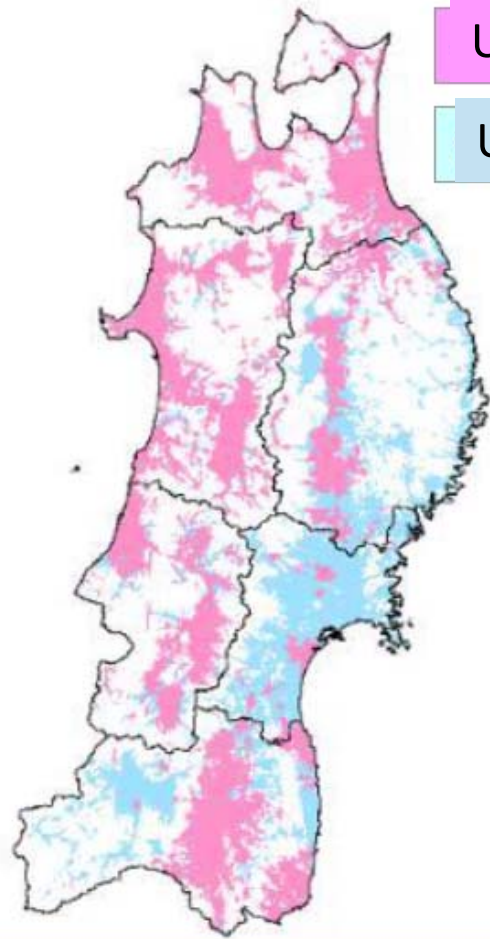
Usable area

Unusable area

Transmission line cutoff

Direct destruction

Lessons learned

Battery deple-tion from power failure

Trandmission Line cutoff

Direct destruction

Power failure: Battery depletion from long time power failure

4,900 base station failure (Tohoku area)

Major cause of service suspend

DOCOMO, 2017

Enhancement of societal resiliency against natural disasters

Prediction

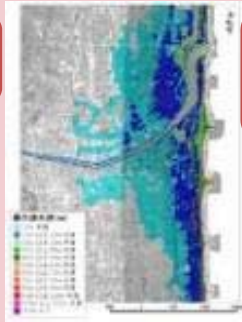**Prevention**

1. Tsunami

Estimation of inundation in three minutes

2. Heavy Rain and tornados

One-hour prior estimation of flooding

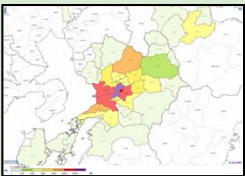**3. Anti-Liquefaction Measures**

Diagnosis and retrofit during operation

Responses

4. SIP4D

Connection among ministry information systems

6. Disaster Information distributions and communications

5. Real-time Disaster and Damage Prediction and Confirmation

Location and severity estimation in 30 seconds

7. Implementation and Enhancement of Disaster Response

Preparation of Evacuation drills in various local areas

Establish communications around 500m area within 10 min.

Portable ICT Unit (NTT Network Innovation lab)

To meet communication needs of response staff and residents in disaster affected areas where the public communication services are disabled.
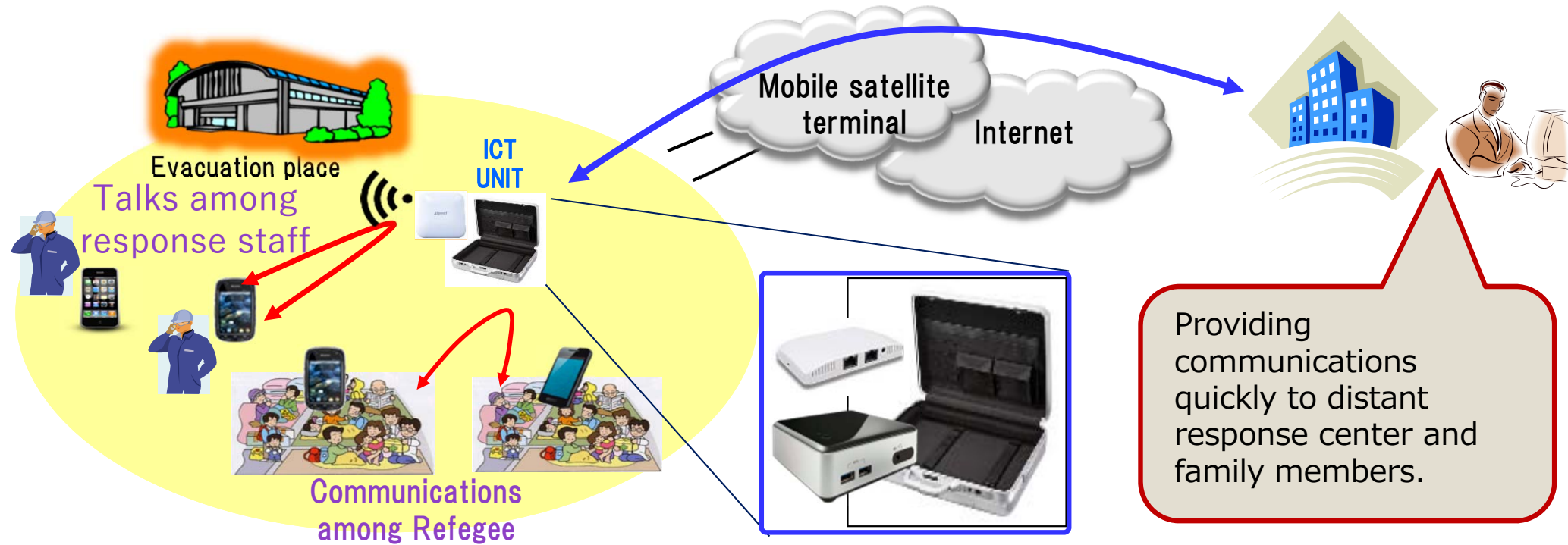

Characteristics:

1. Providing voice and data communication using smartphones and tablets via WiFi;

2. Providing telephone call to outside affected areas via mobile satellite or internet;

3. Packaging in attache-case enables hand-carry, easy set up and operation over 8 hours with battery.
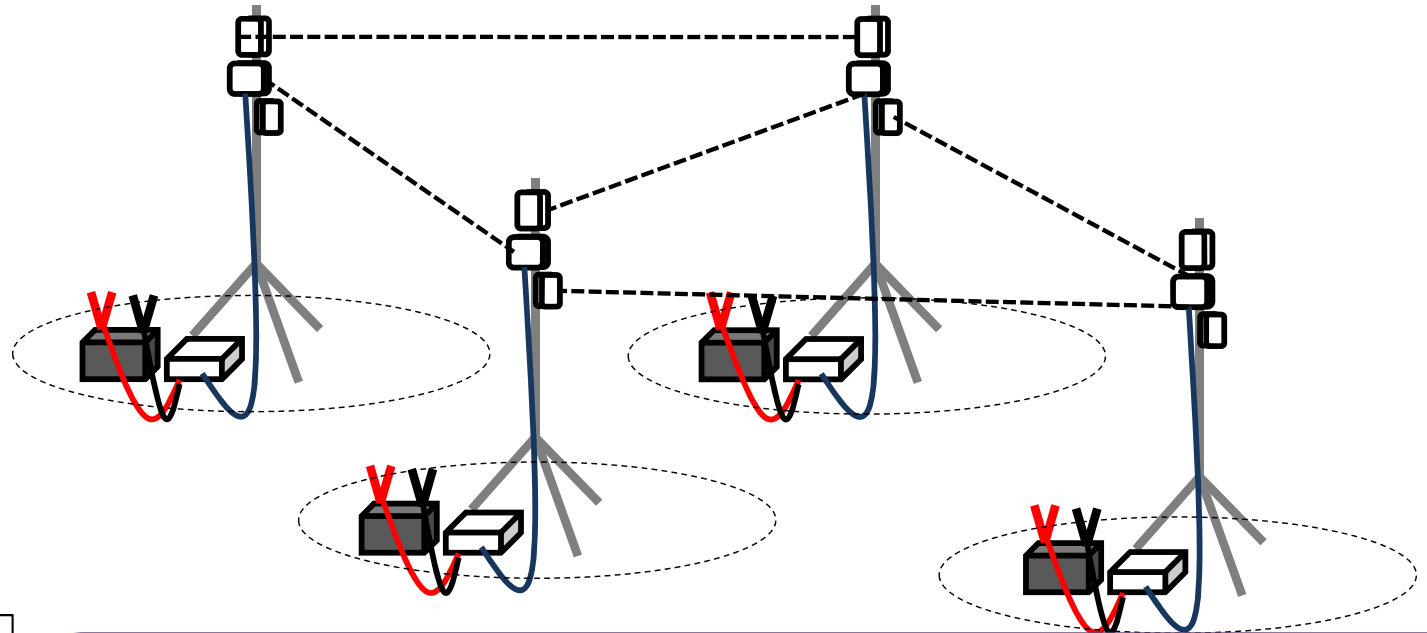
"NerveNet": Rapid Relief Network System

Base station of Mesh network system: "NerveNet"
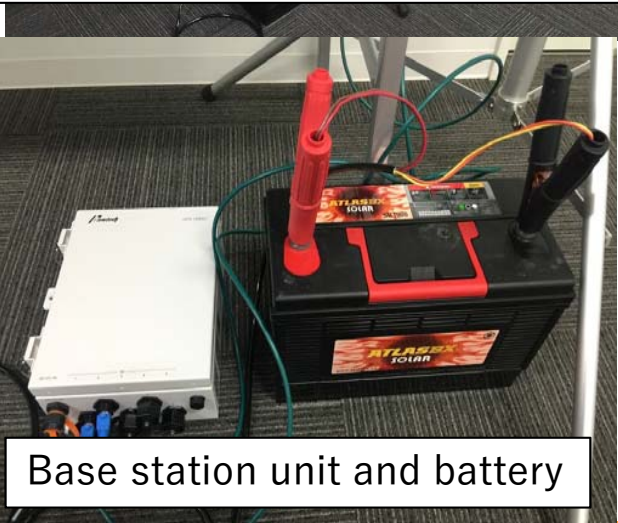
Base station unit and battery

Features:
- Network is installed quickly with portable radio instruments;
- Dependable mesh network with link span more than 1 km;
- Operation with battery for long time;
- Broad band communications available with WiFi access;
- Interconnection with wide are networks with high security;
- Long range mesh network available with LoRA radio.

Technology transfered to Hirakawa Hewtech Inc.
https://www.hewtech.co.jp/device/environment/NerveNet/NerveNet/

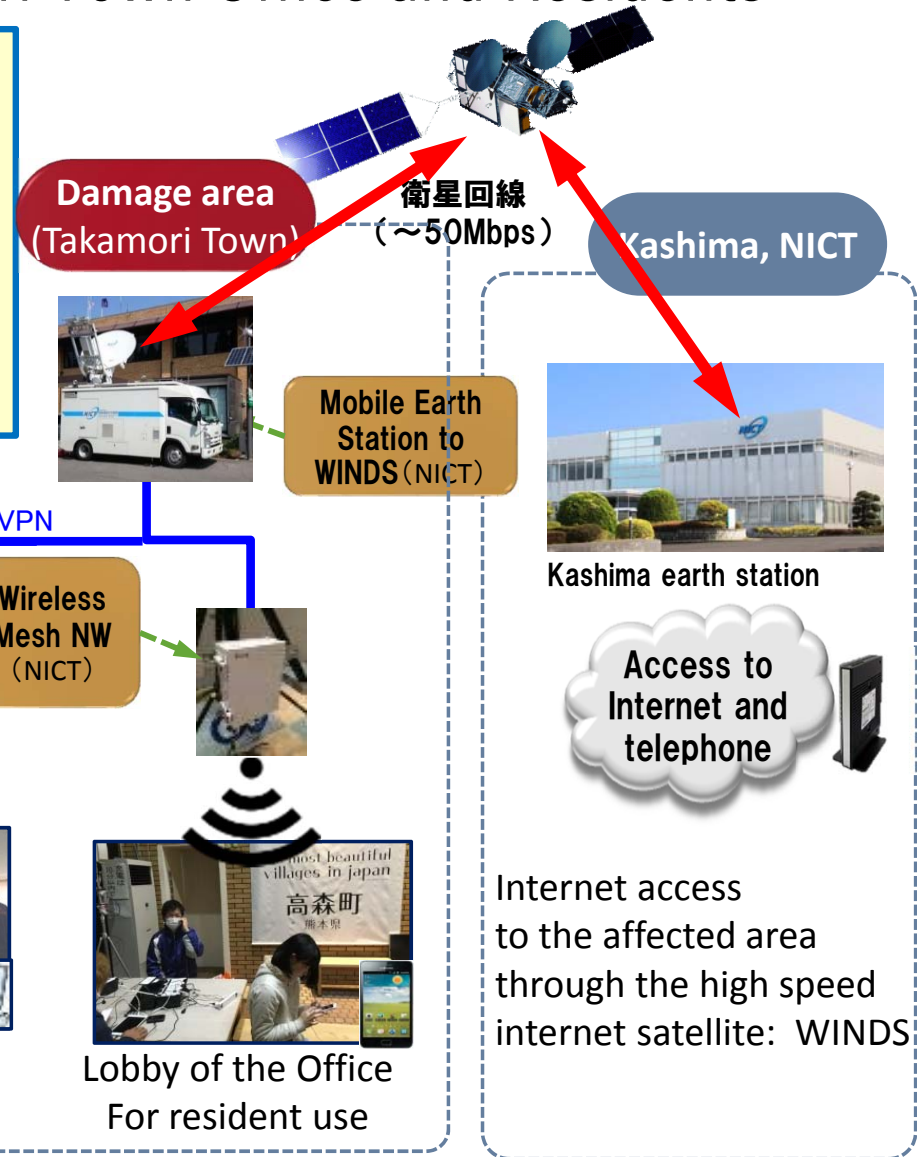# Proposed decentralized mesh-network architecture "NerveNet"

- ◆ tree to mesh networking in access network
- ◆ client-server (cloud) to local servers providing applications
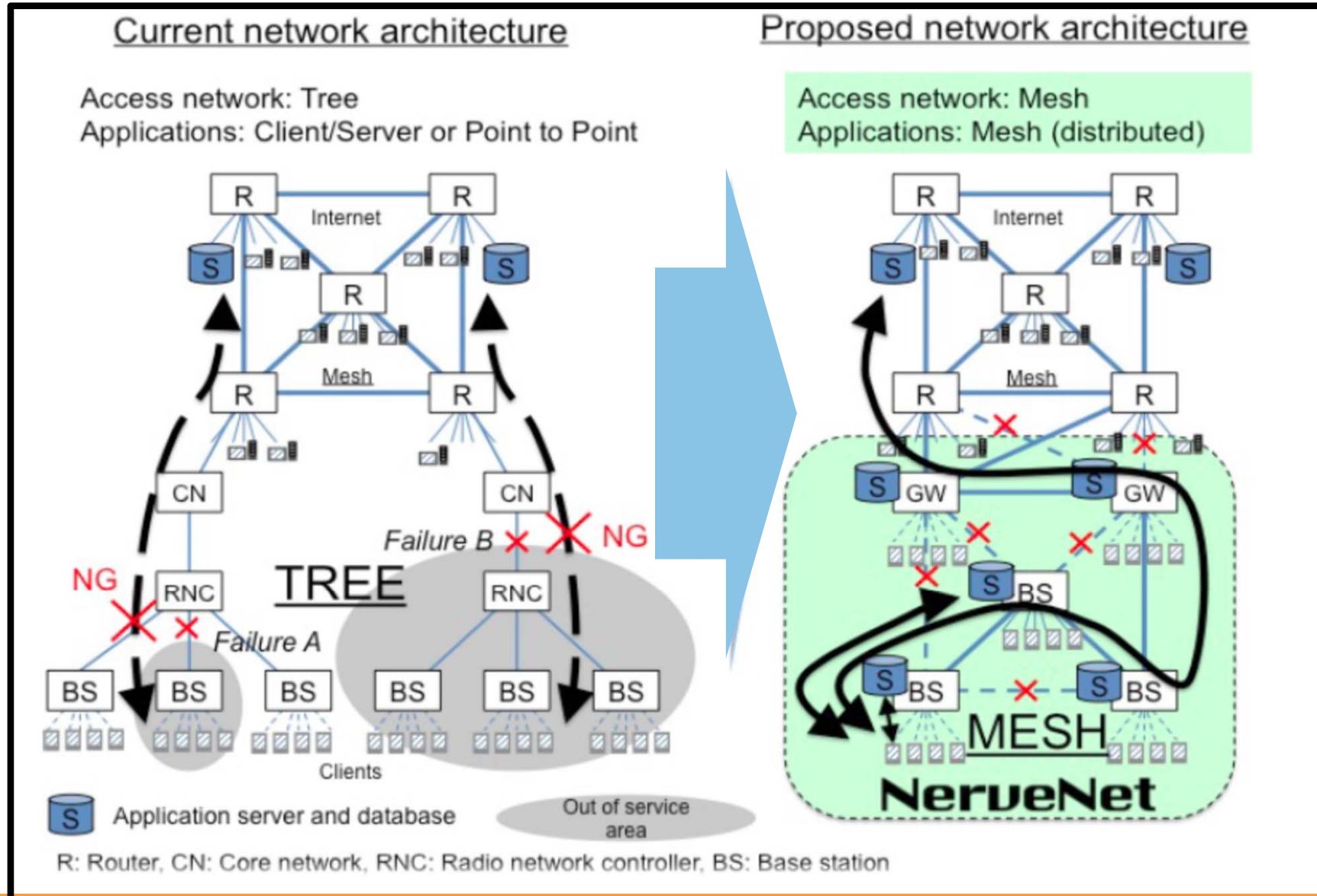
Immediate Network Relief activity in Kumamoto Earthquake Affected Area by NICT and NTT-Lab (Apr. 2016)
To make WiFi available for Takamori Town Office and Residents

□ NICT and NTT-Lab deployed to Takamori-town Office, and conducted immediate restoration of communications infrastructure between April 19-21,2016.

□ Support activities and instruments:
 - Mobile satellite station of WINDS (Kizuna);
 - Wireless mesh network system to restore ground based NW;
 - ICT unit enabling voice communications and access to internet.

Damage area (Takamori Town)

衛星回線 (～50Mbps)

Kashima, NICT

Mobile Earth Station to WINDS (NICT)

Kashima earth station

Access to Internet and telephone

Internet access to the affected area through the high speed internet satellite: WINDS

VPN

Portable satellite phone

Wireless Mesh NW (NICT)

ICT−Unit in attache case (NTT)

Portable IP−PBX

Wi-Fi AP

Provide voice communication with smart-phone via Wi-Fi

Smart Phones

Town Office

Lobby of the Office For resident use

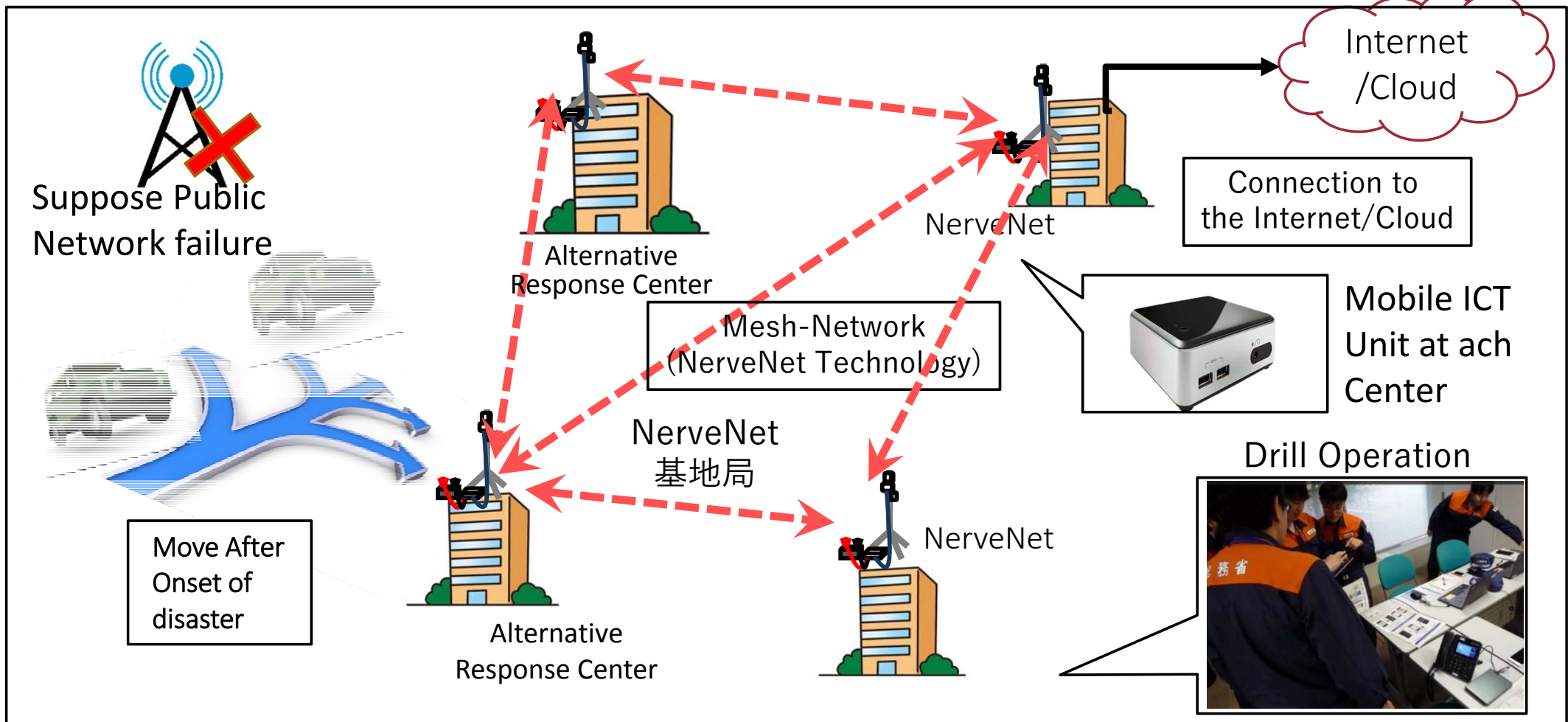# Disaster Drill to Set up Alternative Response Centers in Suburban Area

Supposed Disaster Damage in the Metropolitan area	⇨	Move to Set up Alternative Response Center In Suburban Area	⇨	Drill Conducted Using Communications Capability with own Mesh-Network

Internet /Cloud

Suppose Public Network failure

Alternative Response Center

NerveNet

Connection to the Internet/Cloud

Mesh-Network (NerveNet Technology）

Mobile ICT Unit at ach Center

NerveNet 基地局

NerveNet

Move After Onset of disaster

Alternative Response Center

Drill Operation

A base station accommodates many participant groups via Portable ICT Unit

Drill conducted

Base station of the mesh network

BS

Portable Mesh Network Base station
- Mesh NW easily constructed;
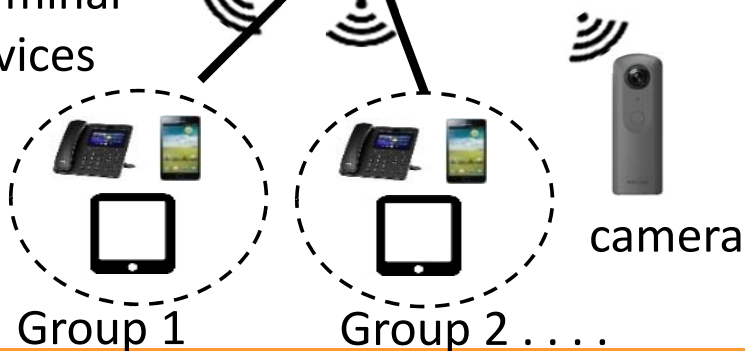- Internet connection via gateway
- Operational with battery.

Portable ICT Unit (MDRU)

Portable ICT Unit (MDRU)
- 8 ICT-Units work in coordination making an extension network

Terminal devices

Group 1

Group 2 . . . .

camera

- Rapid relief system for disaster communication, composed of NerveNet and Mobile ICT Unit;
- Telephone, Tele-conference, document, and video exchange available among participant groups under 8 base centers;
- Private own smart phones and commodity instruments are used as terminal devices;
- Interconnection with the Internet, mobile satellite terminal, MCA radio system available;

Disaster Drill for Medical Information Sharing (Shibuya city)

Drill exercise in a base hospital

A screen shot of car location monitor
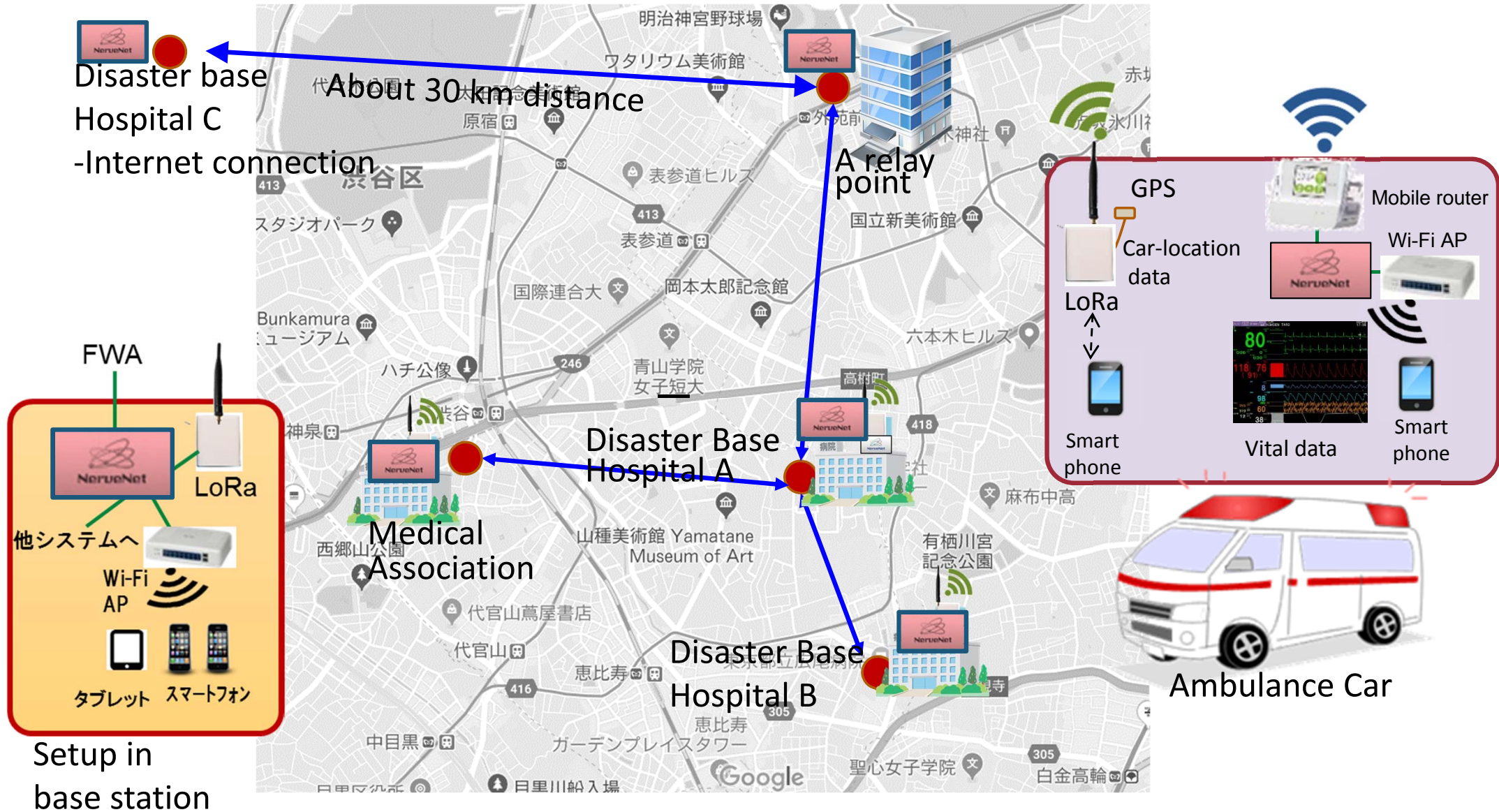
Drill for Disaster Medicine

1. Drill conducted to share medical information among disaster base hospitals not depending on public network.

2. The internet connection is made through remote stations outside affected area.

3 Information sharing regarding patient transportation; sending patient vital data and vehicle locations.

CONCLUSION

- Lessons learned from the Great East Japan Earthquake and Tsunami;
  - Necessity in keeping communications capability among base stations (as Response Centers, Hospitals), independent from public networks;

- Proposed new technologies of Mobile ICT Unit and mesh network for this purpose;
  - Drill exercises conducted to utilize these technologies for realizing broadband communications among base stations in affected area;
  - Drill conducted by government in preparation for the Tokyo-Inland Earthquake;
  - Disaster medical drill conducted exchanging information among hospitals;
- Societal implementation of these technology is in progress;
  - Mobile ICT Unit is going to be introduced to ITU-D;
  - Many organizations (Government, hospital, private sector) introduced it in Japan;
  - Mesh-network "NerveNet" is also used for networks of IoTs.