ITU Workshop on
"Disaster Relief Systems, Network Resiliency and Recovery"

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Resilient network architecture based on Movable and Deployable Resource Unit (MDRU)

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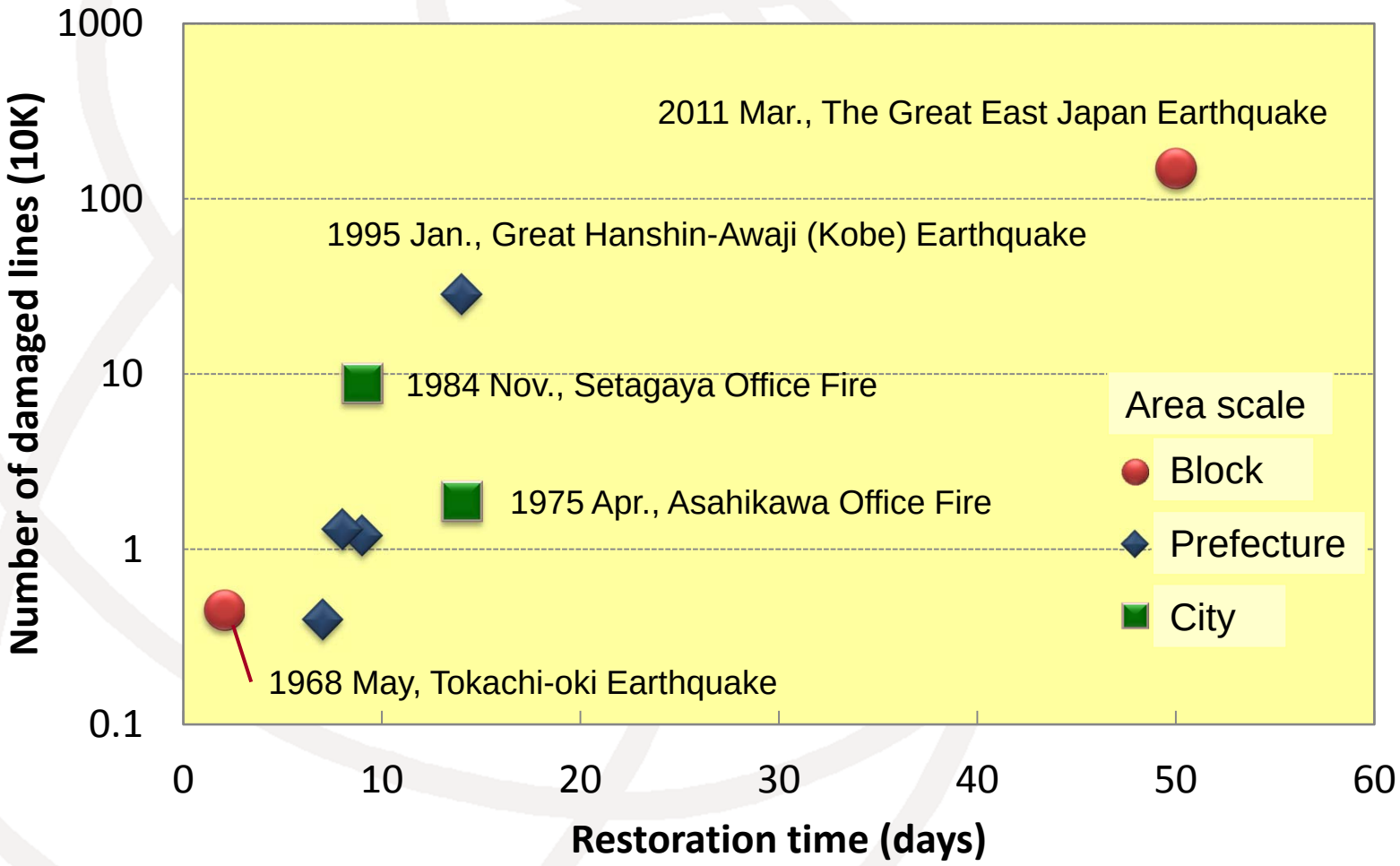
International Telecommunication Union

Contents

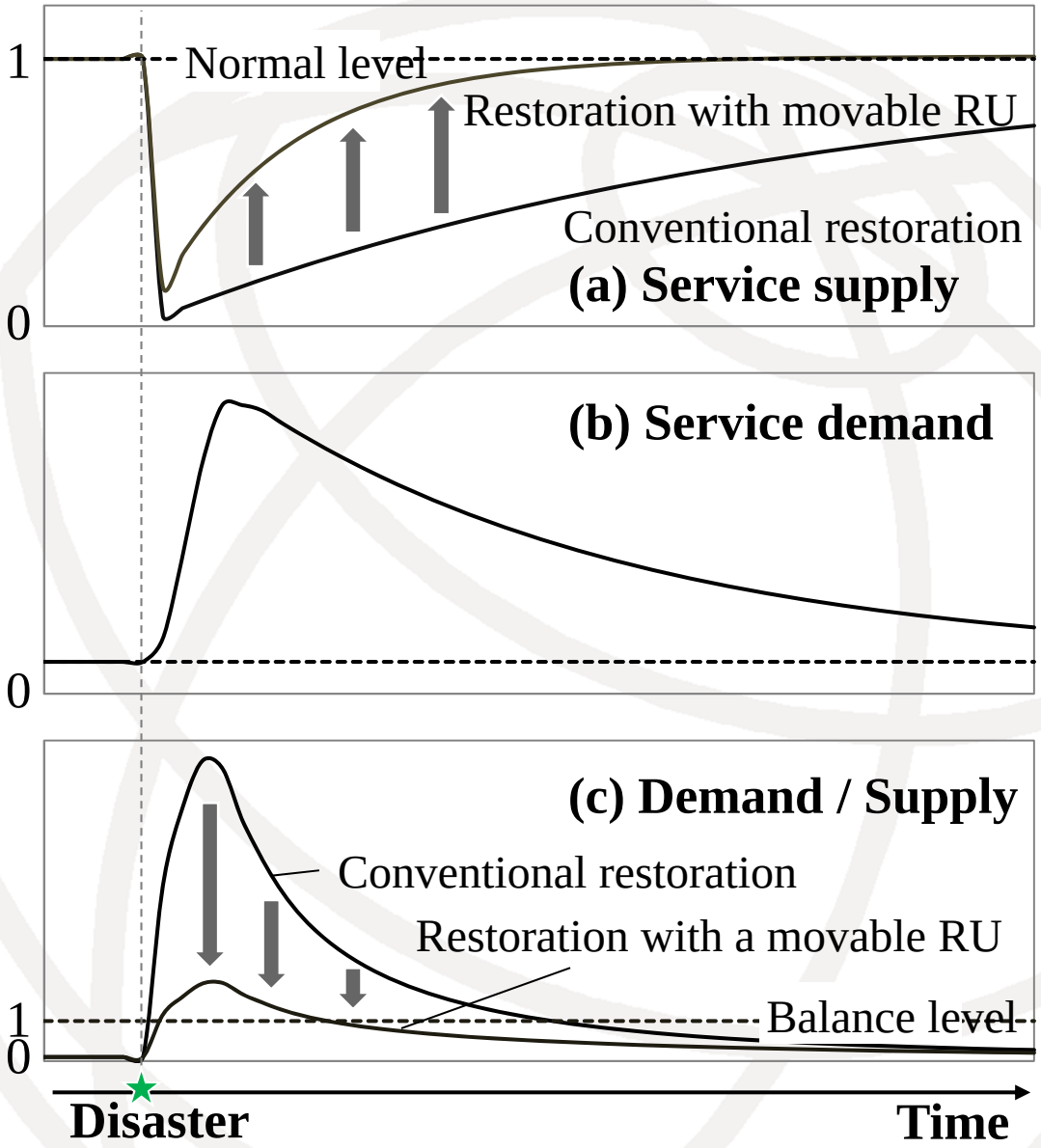
- Resilient network architecture based on MDRU.
- Preliminary concept proof demonstration in Sendai, an update
- Technical issues for the architecture to reach the real society.
- Summary

Scale of damage by the earthquake in March 2011 = Catastrophic

The damage scale of ICT infrastructure due to the Great East Japan Earthquake was catastrophic and the largest in NTT's history.

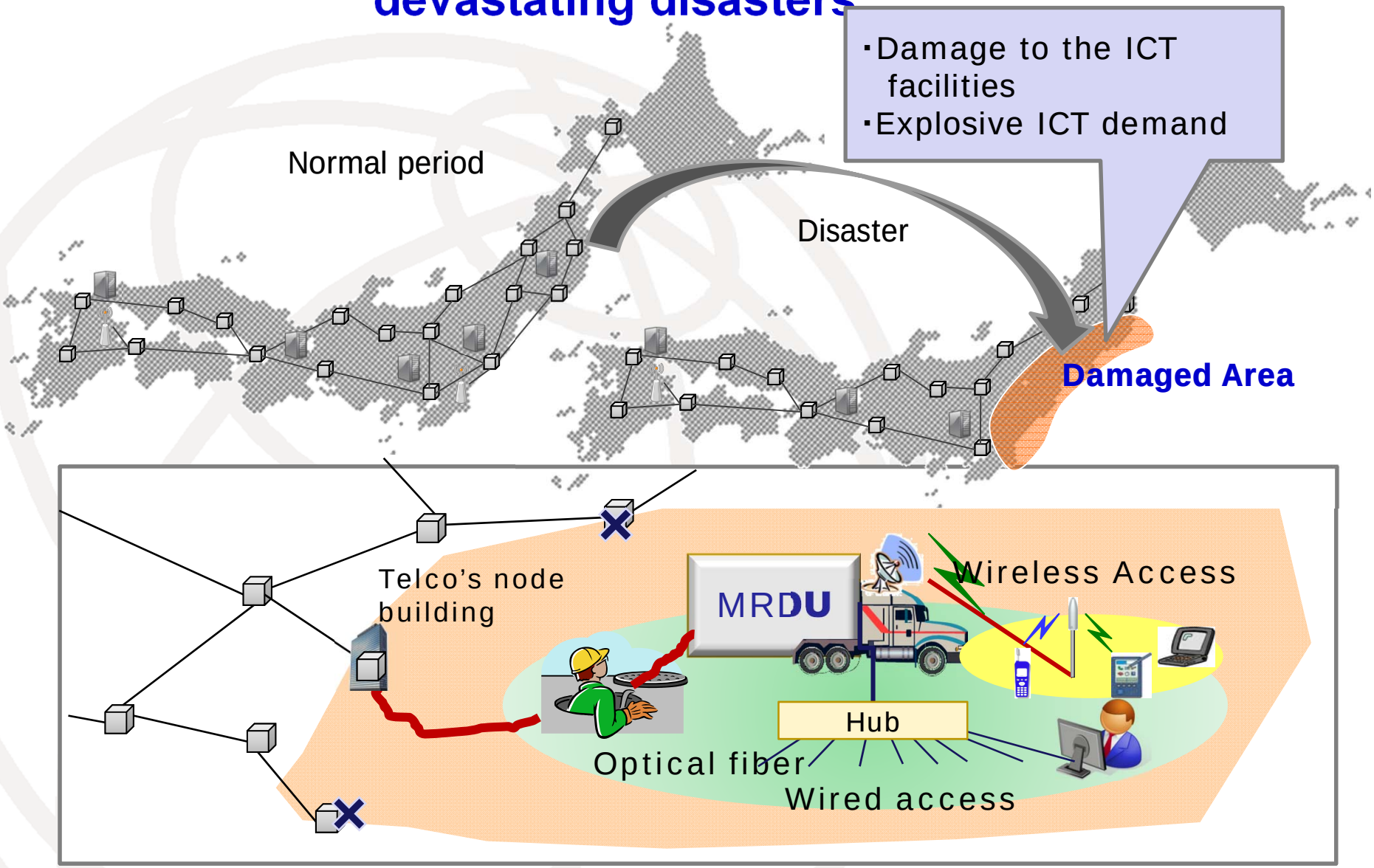


A Measure to show resiliency



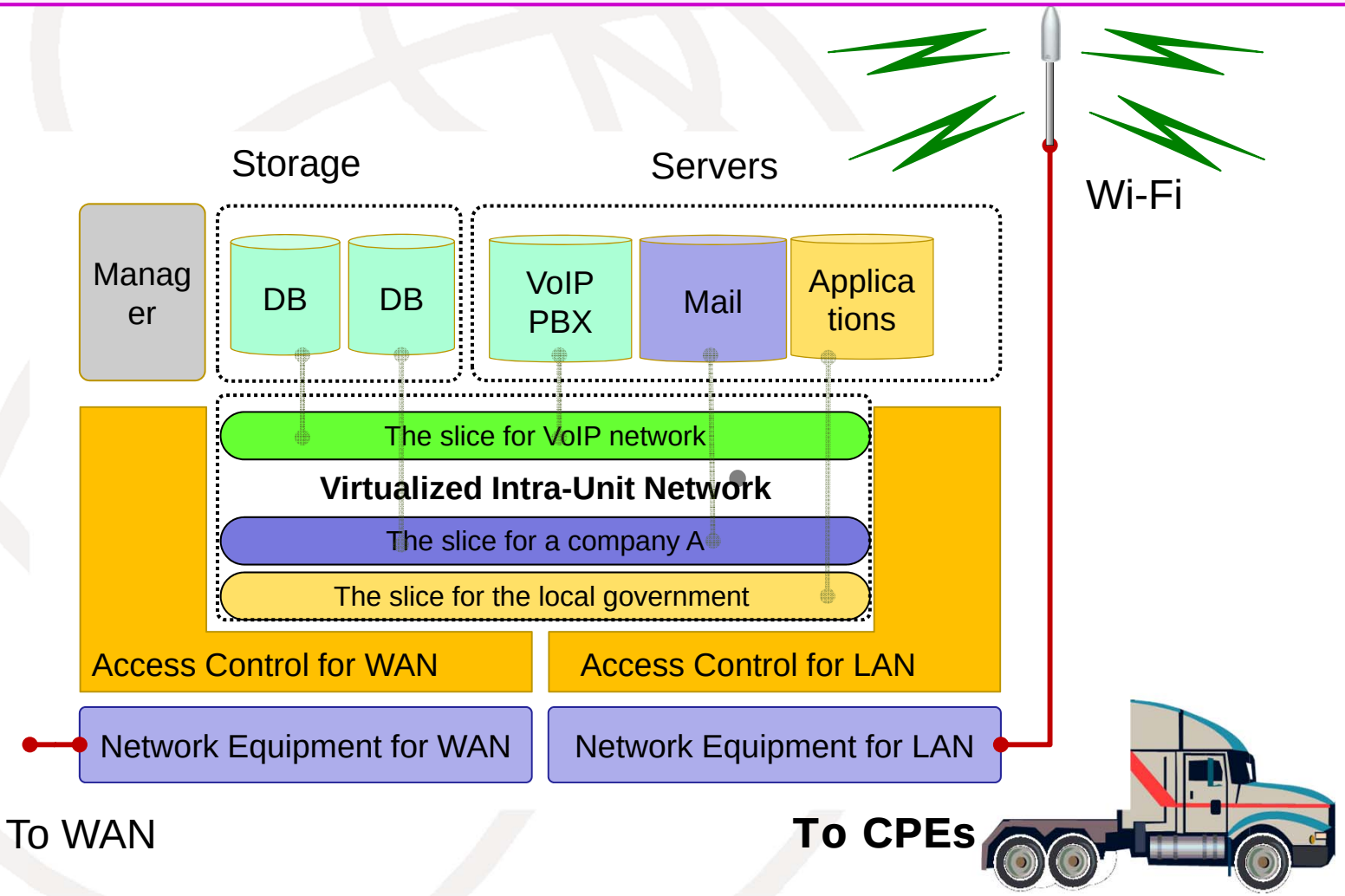
- Two measures; TR and Su well show the resiliency of a network.
- The lesson-learned disclosed the existence of the explosive service demand immediately after the disaster.
- In measuring network resiliency, the service demand/supply gap should be taken into account.
- A movable ICT resource unit must improve this measure.

Modular Network Architecture for recovery from devastating disasters



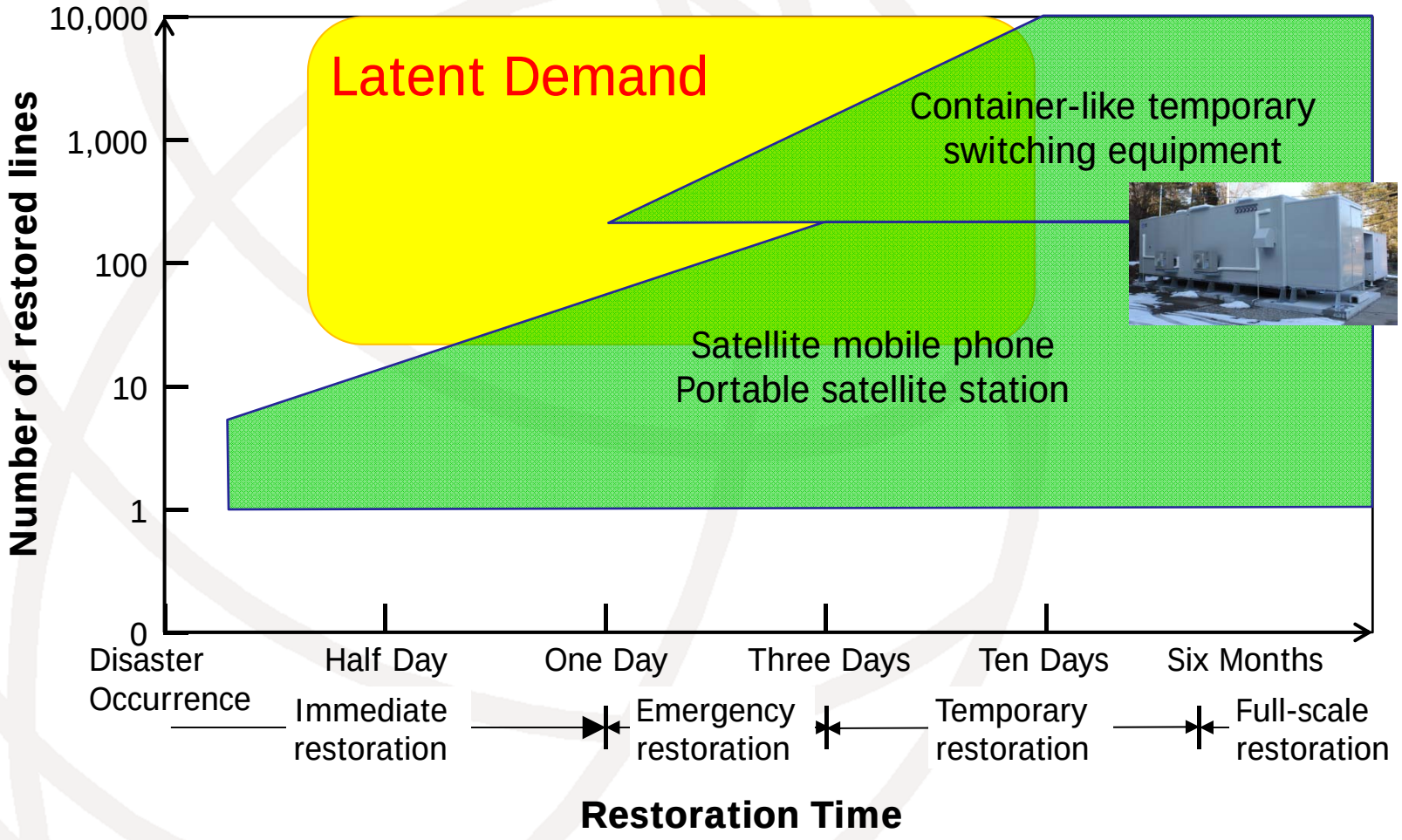
Configuration of an MDRU

MDRU accommodates equipment needed both to supply ICT services locally and to act as a remote station of a current ICT infrastructure.



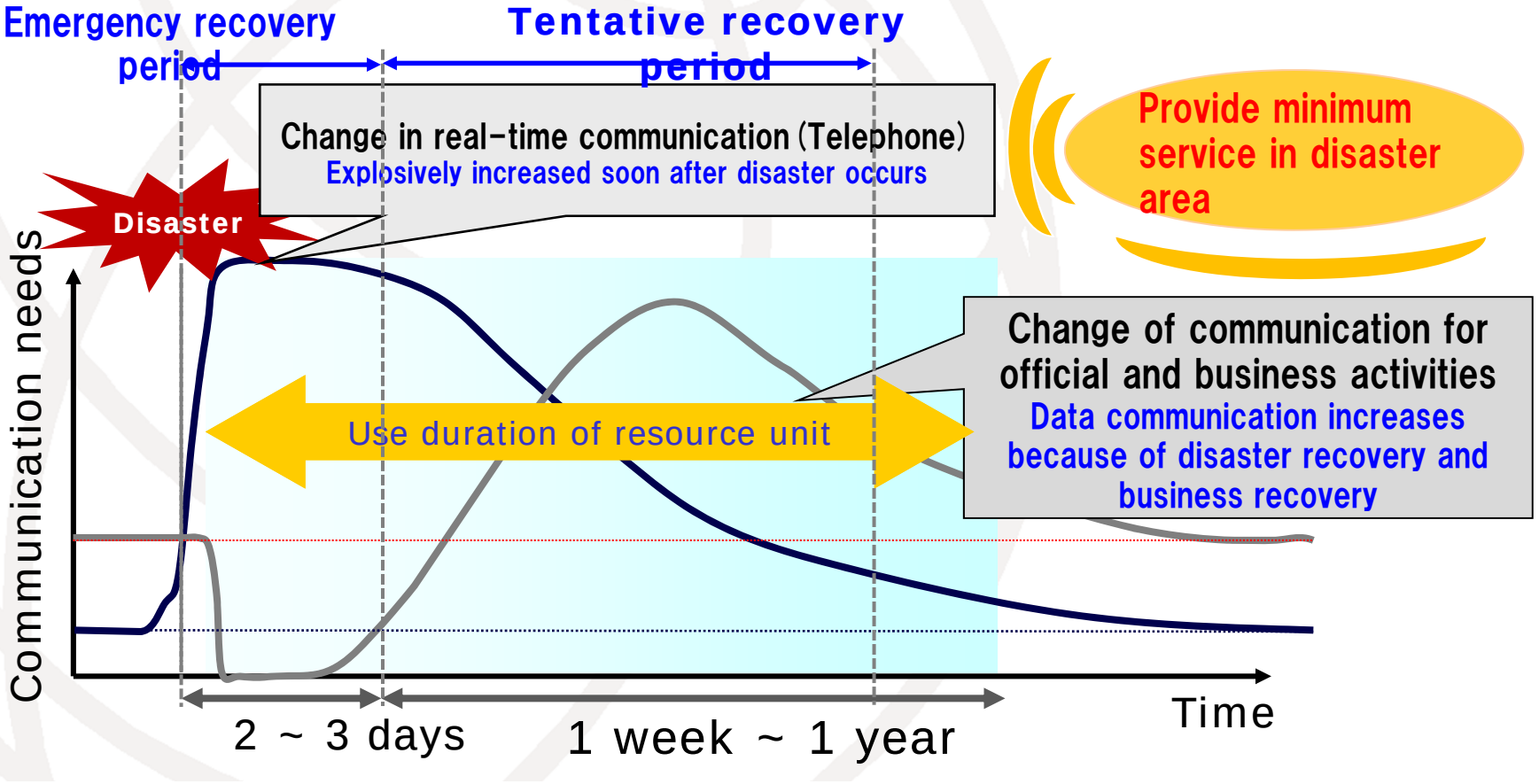
Latent demand recognized by the disaster

Restoration time needs to be further reduced to bridge the gap between service demand and supply which appears immediately after the disaster.



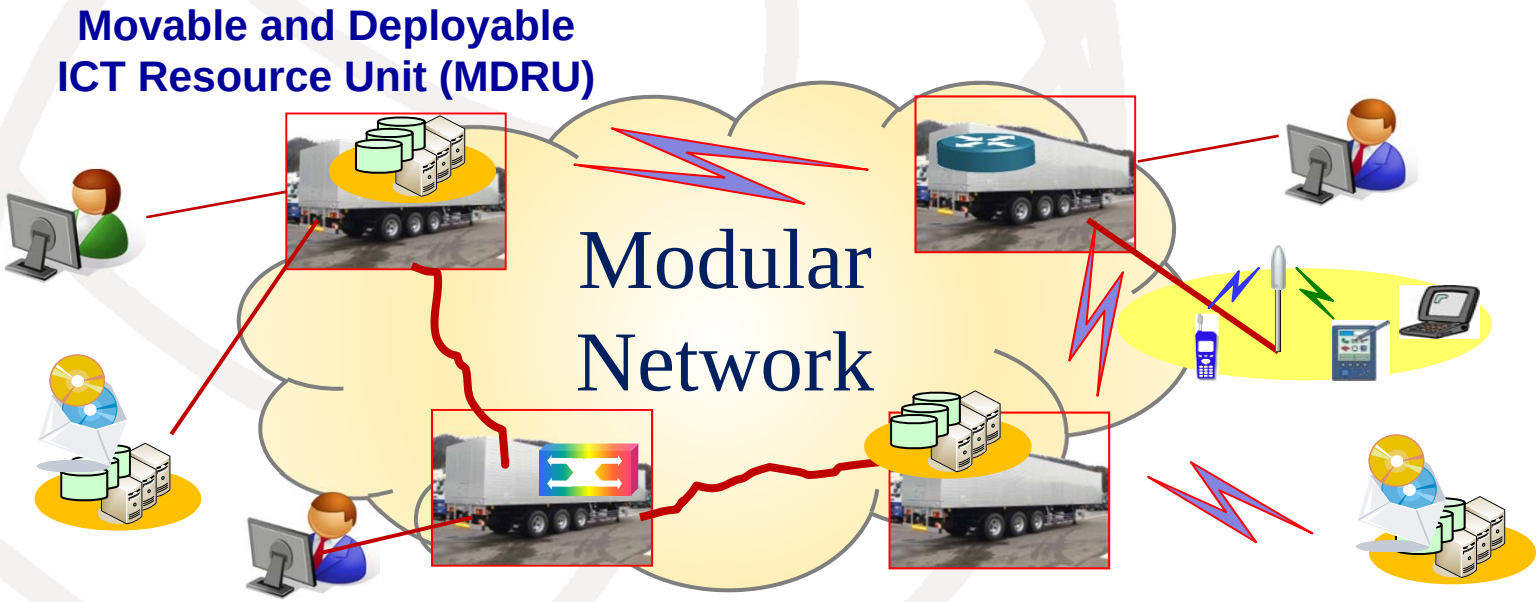
Application concept of MDRU

- MDRU provides minimum ICT service to meet communication demand in a disaster area soon after a disaster occurs.
  - Emergency recovery period: Real time communication demand increases explosively because of need to confirm status.
  - Tentative recovery period: Data communication demand increases because of information gathering by local governments and enterprises.



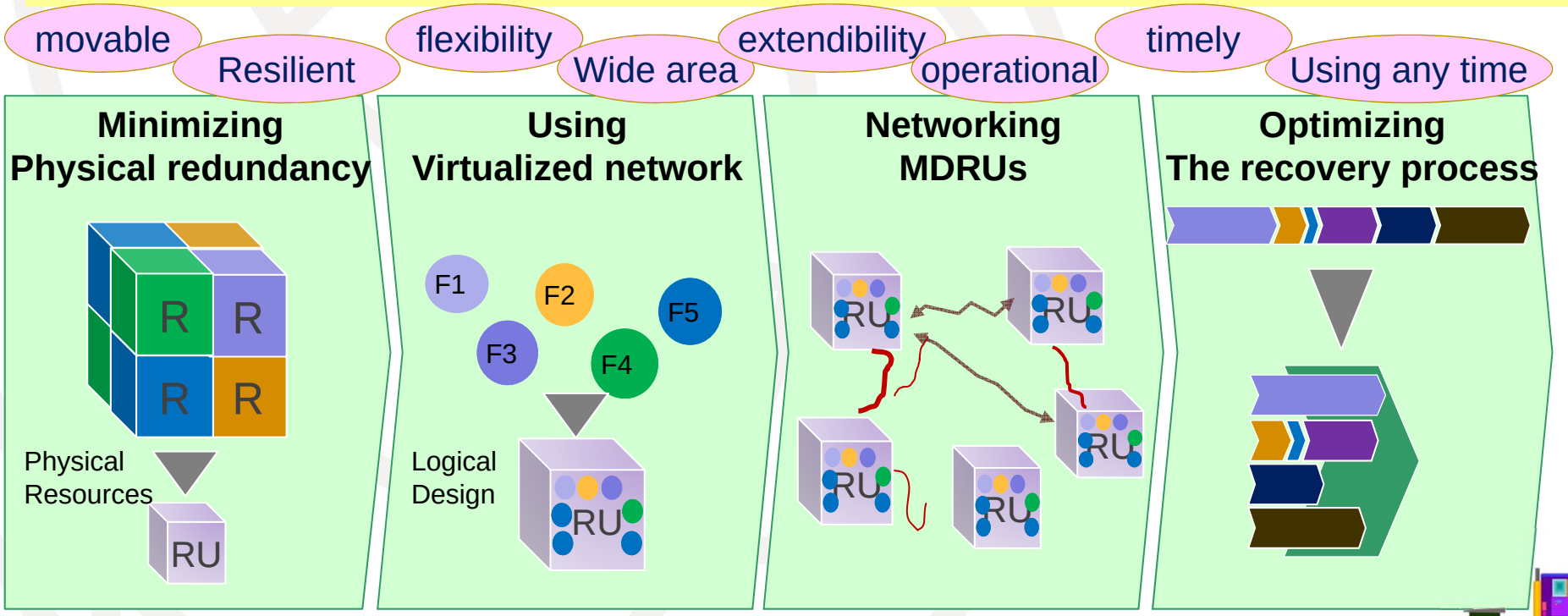
R&D project aiming at reducing the gap

- An R&D project aiming at reducing the ICT service demand/supply gap was launched in March 2012 with a support of the Ministry of Internal Affairs and Communications of Japan..
- Member organizations are NTT Network Innovation Labs., NTT Communications, Tohoku University and Fujitsu.
- The goal of the project is to establish the network and services for disaster area fast and flexible.
- A movable and deployable ICT resource unit (we call it MDRU) provides missing resources.
- Modular Network is organized using these MDRUs as building blocks in the flexible way with resource virtualization technologies.



Basic strategy for the quick service recovery

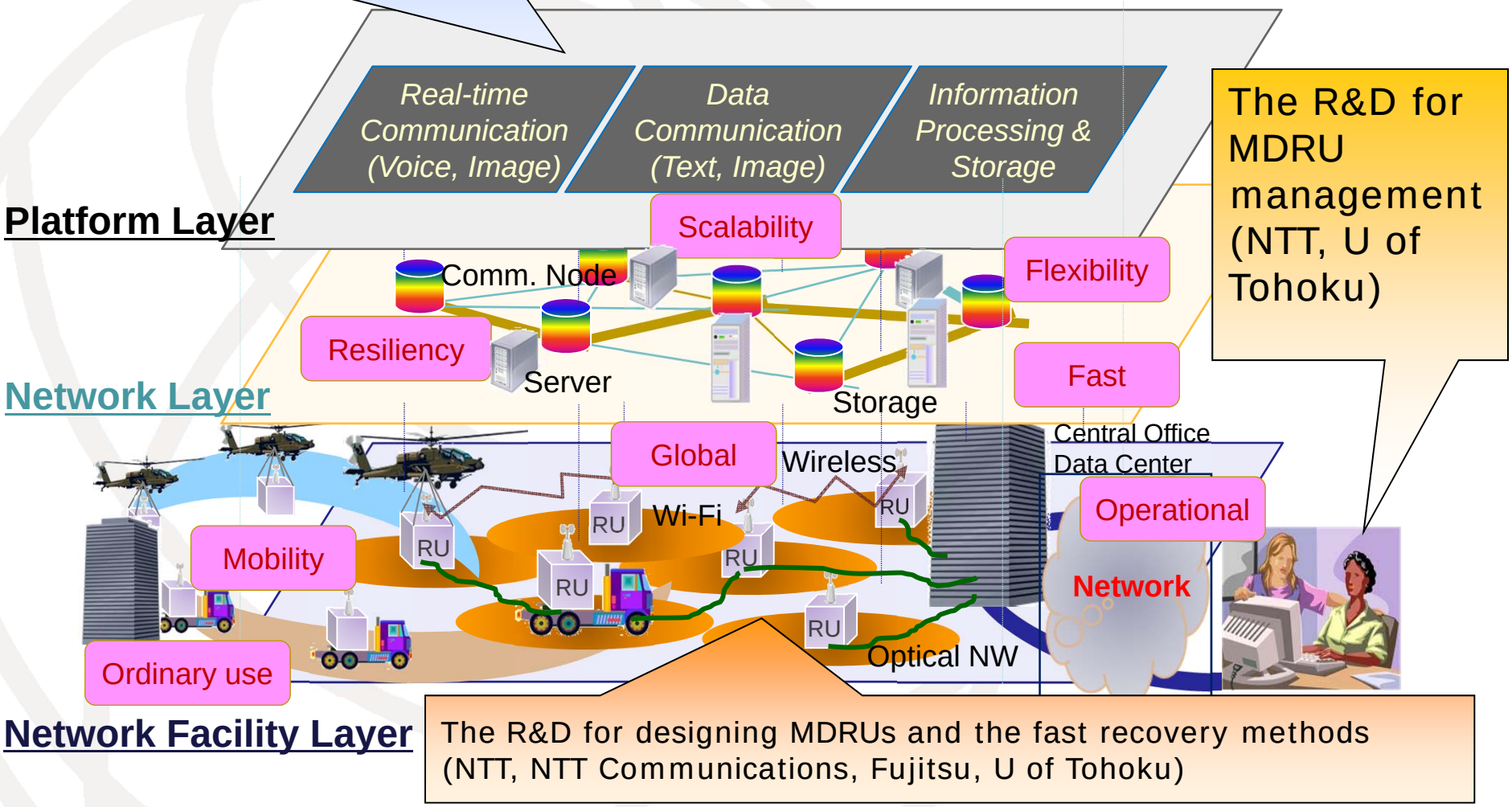
- Minimize the physical redundancy and re-using/re-programming of ICT resources for supporting the various requirements
- Logical redundancy for resilient and flexible ICT resources
- Networking movable/temporal resources (MDRUs) and existing resource in order to expand the coverage, resiliency, and support the operation of the recovery
- Optimizing the process of the recovery



RU: Movable and Deployable ICT Resource Unit

Project overview

The R&D for the configuration method for fast and flexible ICT functions recovering with MDRUs(Fujitsu, NTT)

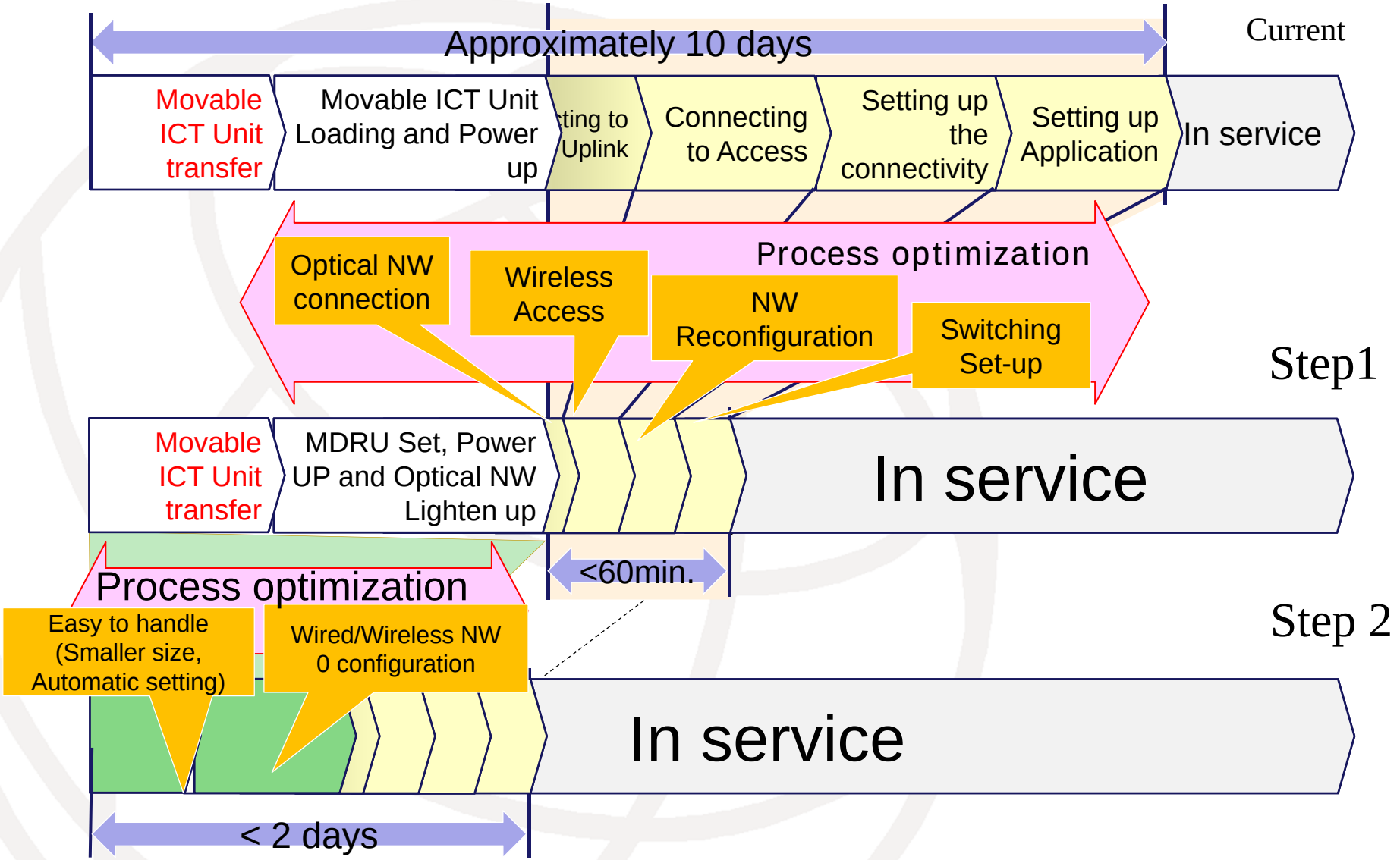


The R&D for MDRU management (NTT, U of Tohoku)

The R&D for designing MDRUs and the fast recovery methods (NTT, NTT Communications, Fujitsu, U of Tohoku)

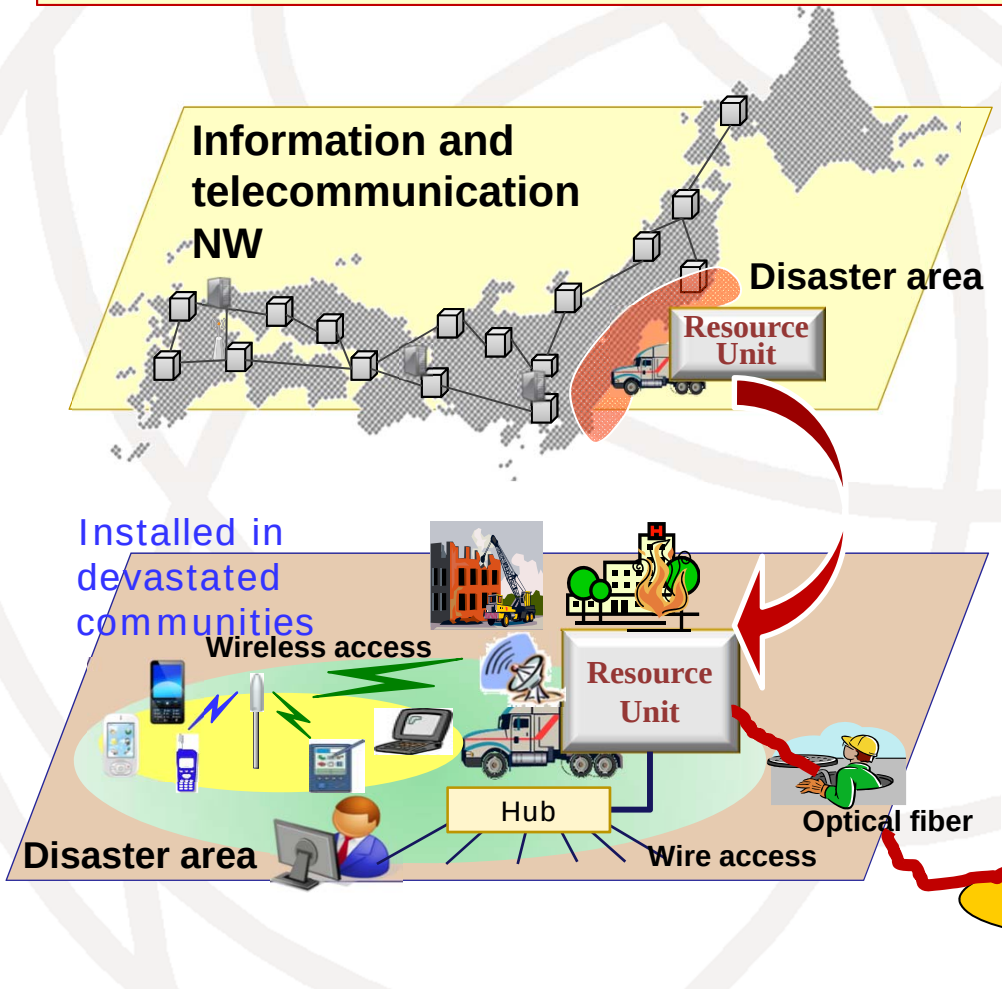
RU: Movable and Deployable ICT Resource Unit (MDRU)

A quantitative goal of the project



The target of the R&D project

- Locally re-establish communication & information processing in local government buildings, hub hospitals and evacuation centers by deploying resource units.
- Provide minimum ICT service, such as telephone using wire/wireless access system within a 500m radius within 1 hour after installing the resource unit.



■Concept of service as

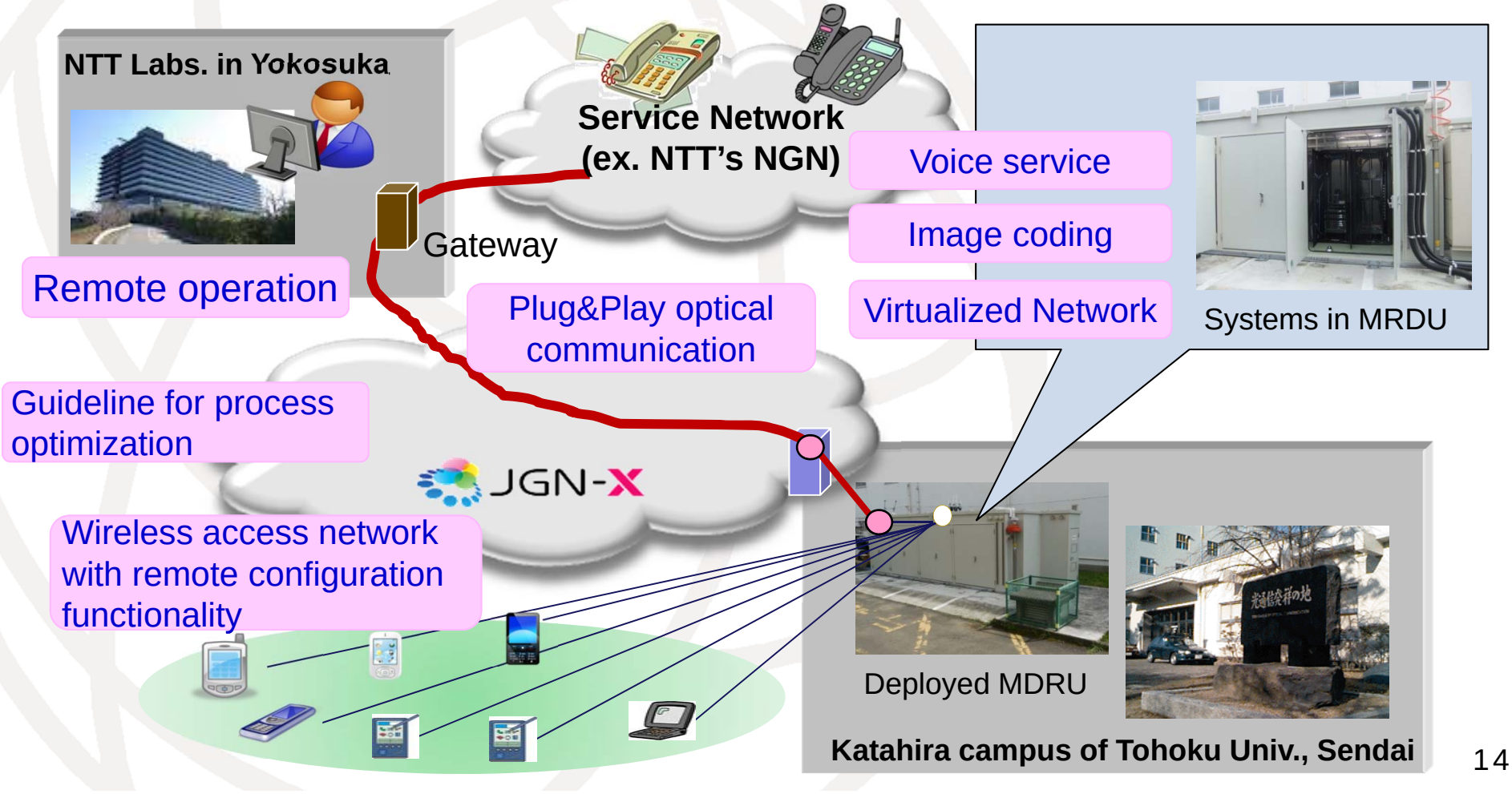
Item	Contents
Service	・Voice, Internet connection, Virtual NW for local governments and enterprises.
Capacity	・Single unit covers an area within 500 m radius and 5,000 people. ・100 concurrent user connections for telephone.
Terminal	・Private terminals for Wi-Fi or Ethernet, such as smart phone or PC.
Expandability	・Broad area service realized by using optical fibers under ground for reaching broad area NW.

Current status of the project

We completed in developing a prototype MDRU.

It is deployed in a campus of Tohoku University in Sendai to form a testbed.

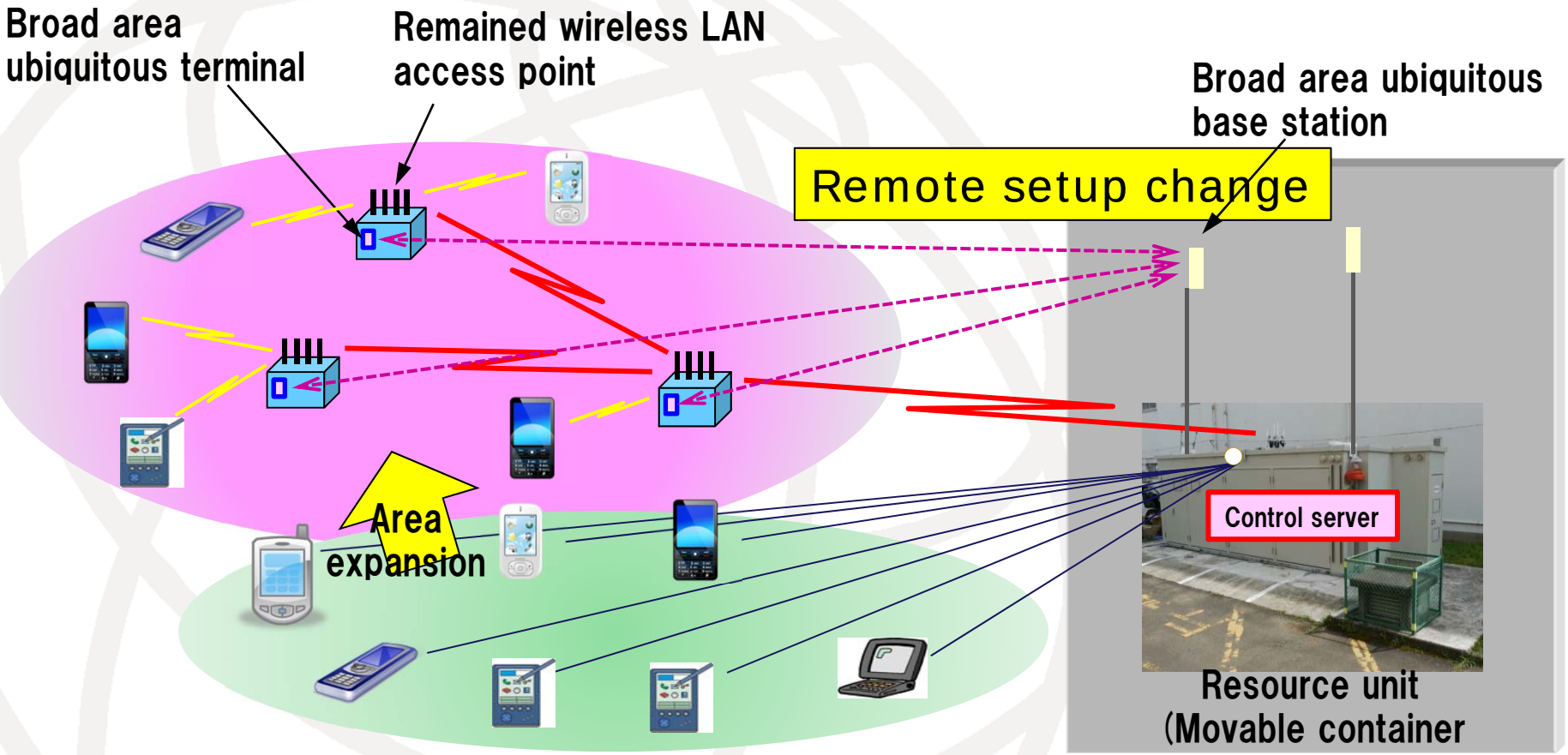
It is then connected to NTT Labs., in Yokosuka and to an existing service network.



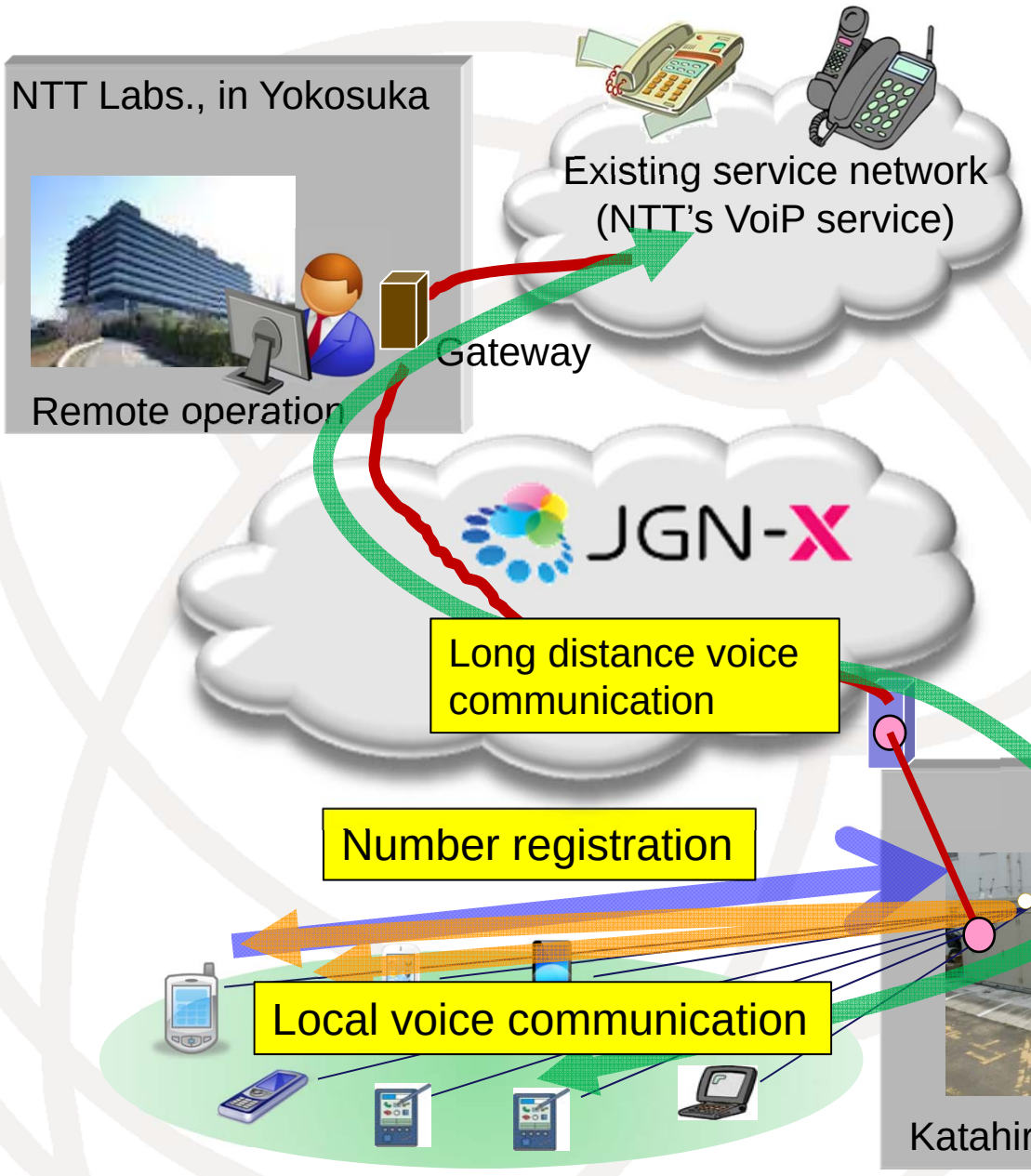
Deployment of MDRU to form a testbed

Medium-size MDRU - a prototype -

Wireless access Network construction



Voice service restoration



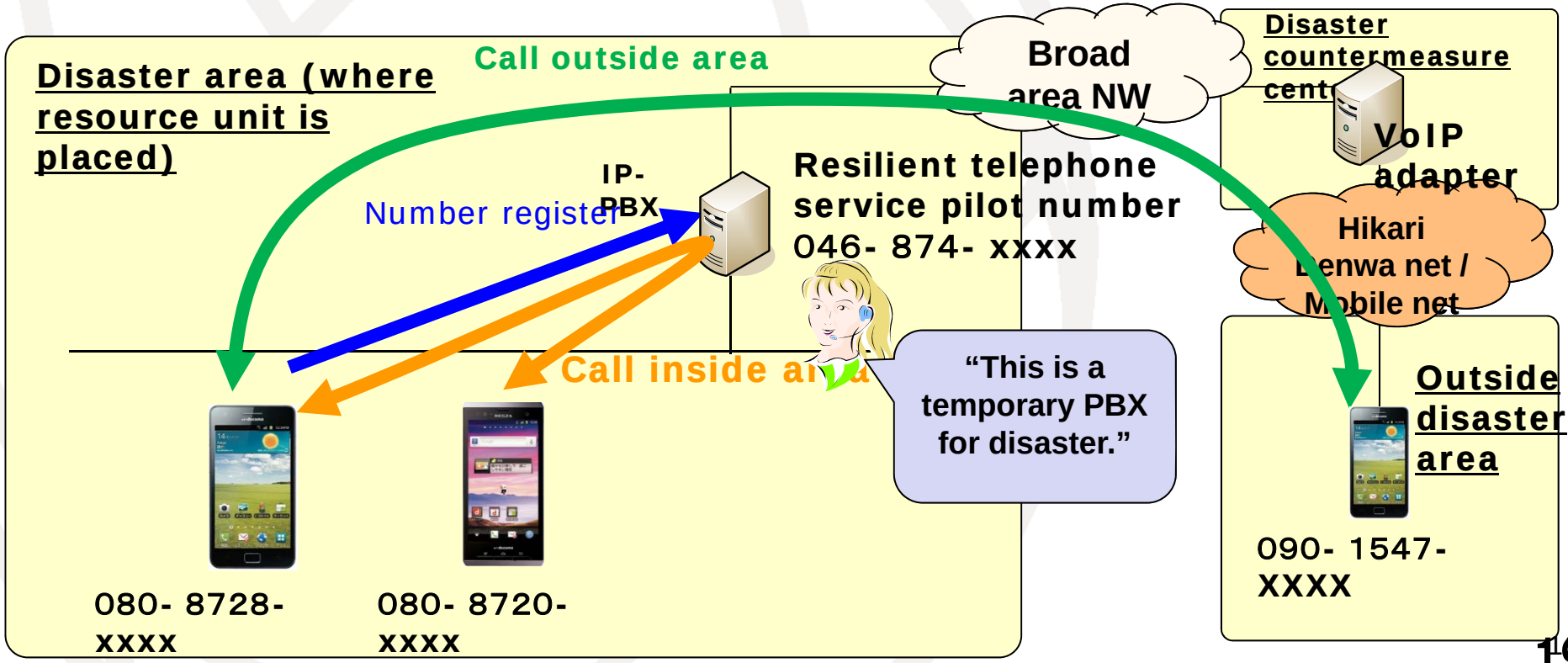
[Step 1]
People's IP-connectable devices like smart phones and PCs are used as CPE.
People first register their devices and phone numbers to MDRU.
They then can use voice service though its coverage is limited to local area.

[Step 2]
Once the MDRU grasps the connectivity to existing service network, people can enjoy long distance voice communication.

Voice service overview

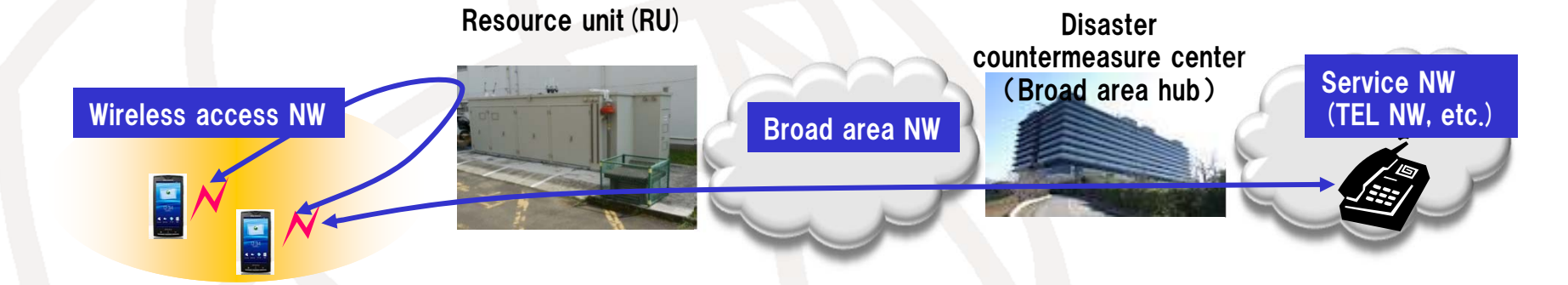
Features

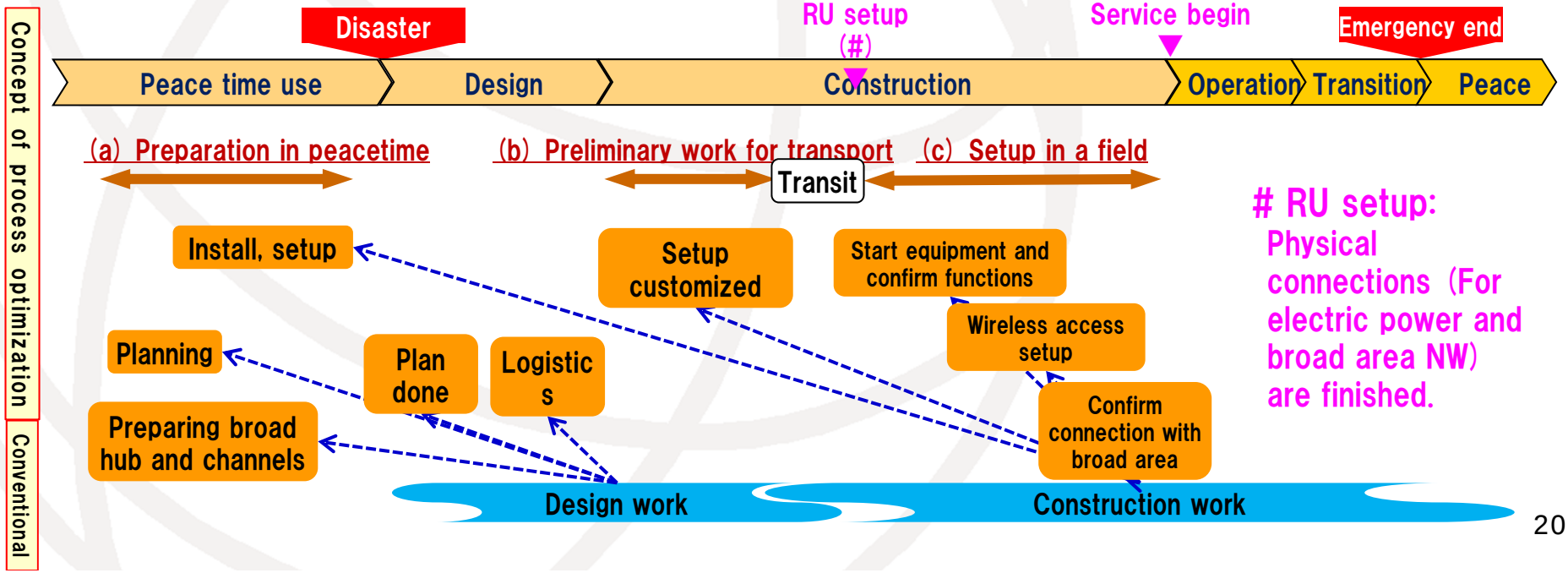
- Provide phone service using a smart phone or a PC via Wi-Fi or Ethernet.
- Easy to resister your account for phone service.
- Your own telephone number is available for sending and receiving.



Shortening time to begin service

- By marshaling (a) Preparation in peacetime, (b) Preliminary work for transport, (c) Setup in a field, optimizing the process and implementing parallel works, the time for beginning the service from the resource unit setup (#) can be shorten.





RU setup:
Physical connections (For electric power and broad area NW) are finished.

Resource unit usage guideline

It is necessary to study how to use MDRU, what to prepare, and how to stock disaster area as well as develop the system in order to effectively satisfy actual disaster needs. Therefore, we are producing resource unit guidelines in which the above study results are marshaled and systematized.

Features of the guideline:

- It shows the design concept and the standard implementation process of MDRU.
- It consists of two documents, “Design part” and “Opertion part”.

Guideline, design part:

Architecture based on the required spec for each MDRU. Concept of MDRU design and construction. Examples of configuration of equipment and system construction.

Guideline, operation part:

Things to do in three phases, “Preparation in peacetime”, “Preliminary work for transport” and “Setup in the field” are marshaled and optimized to show concrete directions to resource unit users.

Input to the ITU-T FG DR&NRR

- We introduced the basic cncept of improving network resiliency with MDRU at FG's Tokyo meeting in February 2013.
- In the same week, we conducted the demonstration of MDRU's application using the constructed test bed in Sendai, for the meeting participants as a part of damaged-area tour to Sendai.
- As a result, the meeting agreed to insert the following description into the overview document.

"In addition to the scenarios (or use cases) of strengthening existing networks in operation, it is required to consider a complementary scenario which mobilizes ICT facilities survived around the devastated area, connect them with instantaneously-deployable-and-configurable ICT resources, and then builds local networks to satisfy urgent and explosive needs for local communication among rescue team and with local citizens in the area."

Technical issues to be further discussed

- Typical scenarios using MDRUs with potential targeted disasters
- Design principles for the concept of MDRU.
- Requirements on external appearance and interface of MDRU from outside.
- Requirements from specific-service viewpoints to be provided for customers.
- Requirements from deployment, operation, and maintenance viewpoints to be available for providers.
- Key technologies and other considerations unique to the concept of MDRU.

Summary

In this presentation, the concept of a resilient network architecture based on MDRU(Movable and Deployable Resource Unit) was overviewed.

The latest status our R&D project on the architecture was then reported.

The technical issues to be further discussed were pointed out.

Thank you for your kind attention.

Acknowledgement:
A part of the work is from "the R&D on the reconfigurable communication resource unit for disaster recovery," and "the R&D on "Movable ICT Units" for emergency transportation into disaster-affected areas and multi-unit connection," both supported by the Ministry of Internal Affairs and Communications of Japan.

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