

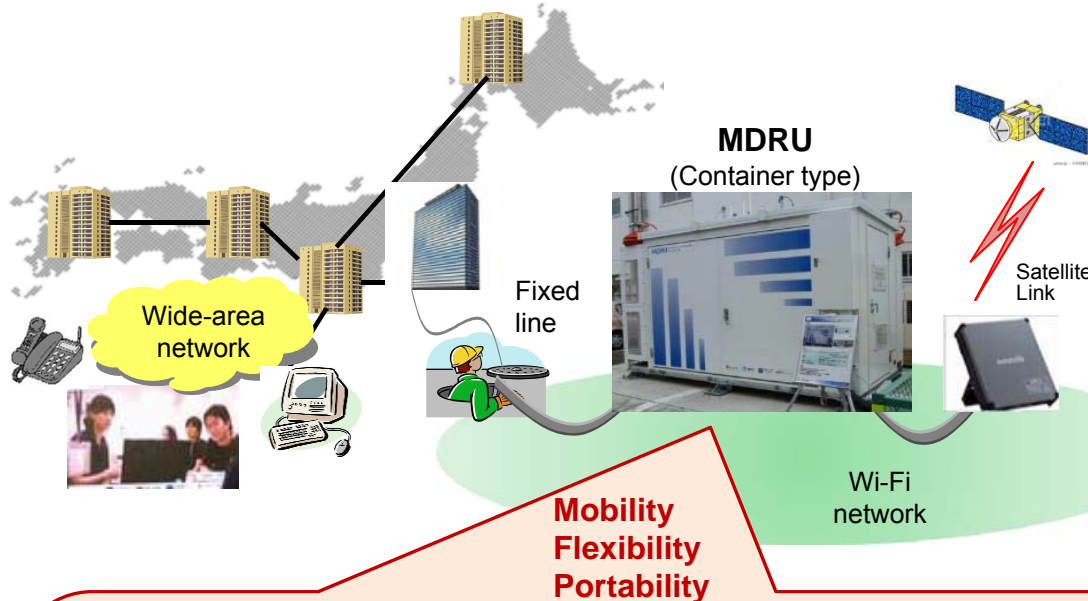
Result Report on MDRU Joint Project

March, 2016

1. MDRU Overview.....	2
2. Joint Project Background.....	3
3. Joint Project Overview.....	4
4. Feasibility Study Activities.....	6
5. Conclusion.....	15

Movable and Deployable ICT Resource Unit (MDRU)

Communications equipment to be carried to a disaster-stricken area in order to immediately restore a communications network. The Ministry of Internal Affairs and Communications (MIC) did research and development of the MDRU (from the fiscal 2012 through 2013), in response to the lessons learned from the Great East Japan Earthquake. The MDRU has been put to a practical use in 2014.



Key Features of MDRU

- The MDRU can easily provide a Wi-Fi network and a server in a disaster-stricken area. Communications with outside areas are also possible by connecting to a landline and a satellite link.
- Voice and data communications (email, file sharing, and the Internet) are available using the smartphone and the phone number same as usual.
- The equipment was downsized to that of a compact car type or a portable attache case type. They are battery driven in case of no power.
- The equipment also serves for daily use.

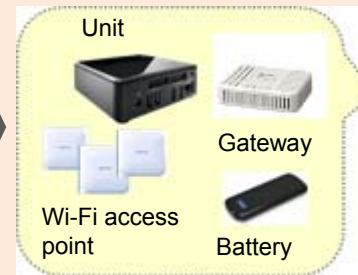
Car type MDRU



Equipped with a main unit (server/PBX), Wi-Fi base station, FWA equipment, and generator.

More small (install basic functions)

Attache-case type MDRU



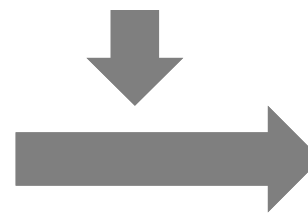
2. Joint Project Background

- In November 2013, the MDRU won a prize of the contest* organized by ITU.
*ITU-MCMC Contest to Promote the Transformational Power of Broadband—Connecting at the Roots
- In the same period, Super Typhoon Haiyan (Yolanda) hit Philippines and caused a large-scale damage. The damage of municipality of San Remigio, located in the north of Cebu Island, was the worst, and the communications network infrastructure suffered from catastrophic damage.
- The Philippine government paid attention to the MDRU, and requested test installation of the MDRU for the emergency restoration of the typhoon-affected area of Cebu Island. Following the request, ITU, MIC, and the Department of Science and Technology (DOST), Philippines, agreed to conduct a feasibility study of the MDRU. (May 2014)

<Damages caused by Typhoon Haiyan (San Remigio, Cebu Island)>



<MDRU won the prize of the contest>



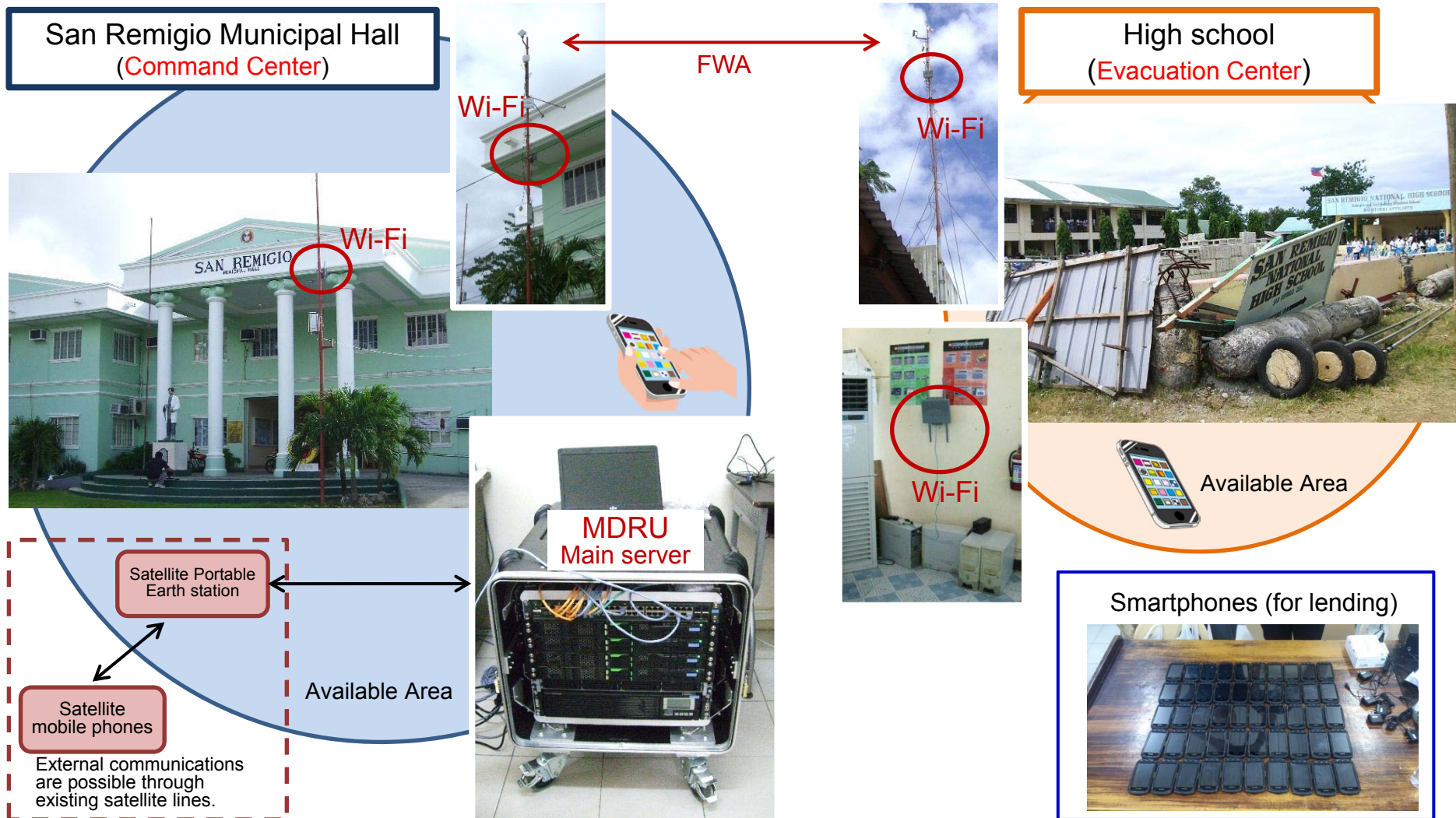
ITU, MIC and DOST
concluded an
cooperation agreement.

**Concluded an agreement of
MDRU joint project**



3. Joint Project Overview – ① Feasibility Study System –

- Carried out the Feasibility Study. (Term: December 2014 ~ March 2016)
- Installed the MDRU in the typhoon-stricken area of Cebu Island, Philippines. (Location: San Remigio)
- Tested voice and data communications using Wi-Fi networks at the Command Center and Evacuation Center. (Approximately 500m)

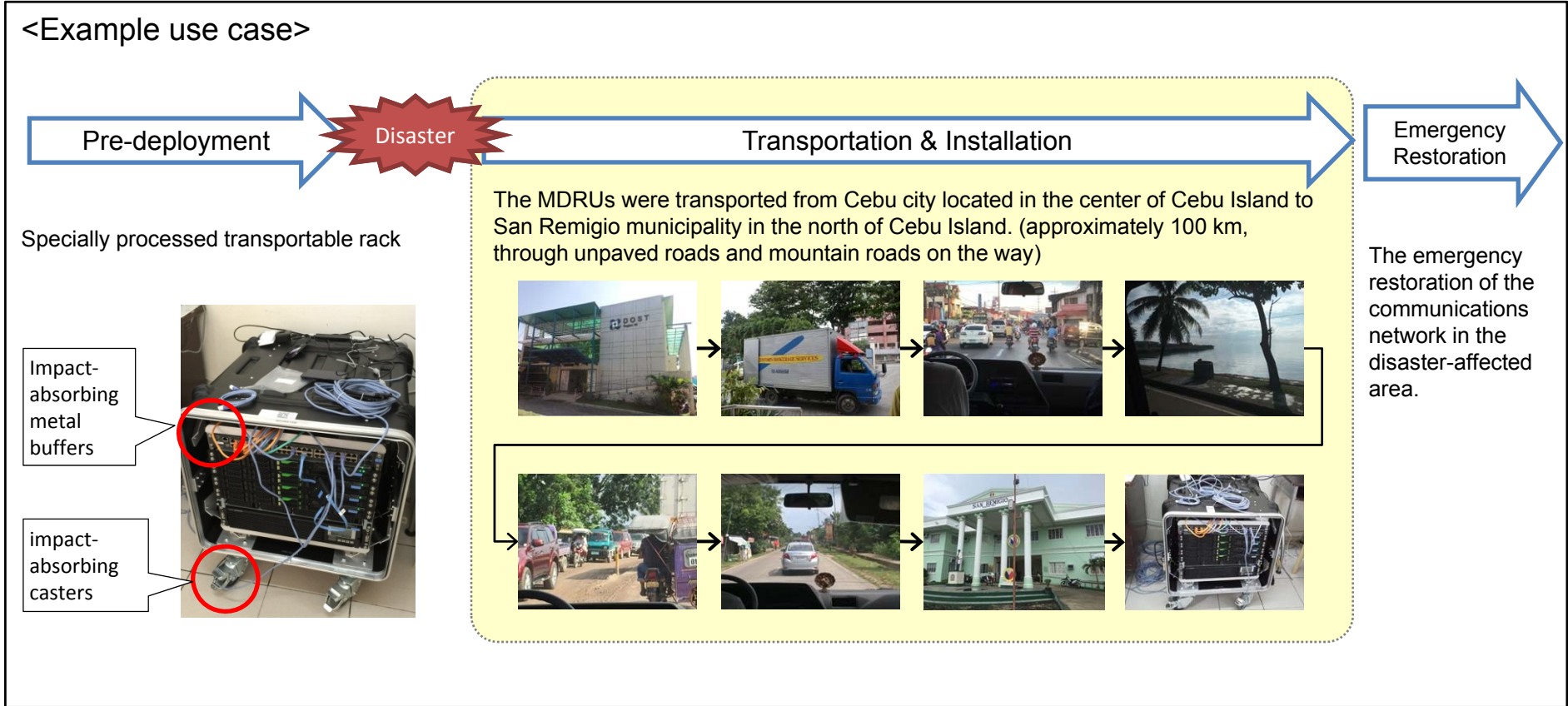


3. Joint Project Overview – ② Feasibility Study Item –

Item	Description
① Transportation & Installation	The MDRU was transported from the Cebu city to San Remigio. The startup of MDRU was confirmed after the MDRU was installed.
② Server Functions Verification	Server functions of MDRU were confirmed and local staffs with no technical expertise could startup MDRU's server function easily. Effects of the environmental conditions(different temperature and humidity environment from Japan) were taken into account..
③ Wi-Fi Wireless Access Verification	Wireless networks were built at the municipal hall and the high school for voice and data communications. Wi-Fi signal levels and throughputs were measured and analyzed.
④ Call Testing	Voice communications using smartphones within the municipal hall and the high school, between them, and between the municipal hall and the disaster affected area were verified. A usability for local staffs was also verified.
⑤ Data Communications (File Sharing) Testing	The file sharing function well worked to share images (where a state of damage shows up), videos (video message of the mayor), and lists of disaster victims and relief supplies.
⑥ Technical Training	A training for local staffs on the operation and the maintenance of the MDRU and a training for local residents on the use of the MDRU were both delivered.
⑦ Disaster Drill	A disaster drill was conducted to prepare for a huge typhoon and some lessons have been learned. With this, the disaster management plan of San Remigio municipality has been revised.
⑧ Demonstration	A demonstration was held to share the overview of the project, and to have a talk on such topics as how to use the MDRU in case of a disaster and how much it would effectively work.

4. Feasibility Study Activities – ① Transportation & Installation –

- The MDRUs were transported from Cebu city to San Remigio municipality and its functionality was immediately checked on arrival so the MDRU got ready for use.
- A transportable rack with a special built-in feature was developed for protection against mechanical vibration over a predictable bad road condition in a disaster-affected area to secure a good condition of computer servers.



4. Feasibility Study Activities – ②Server Functions Verification–

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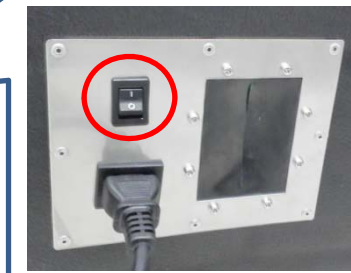
- The startup procedure was revised so local staffs with no technical expertise could startup MDRU's server function easily.
- Effects of the environmental conditions (different temperature and humidity environment from Japan) and the power cut were taken into account. No trouble of the server function was accordingly observed during the feasibility study.

<Startup MDRU server>

UPS(Uninterruptible Power Supply),
servers, storage devices, etc.



(Power switch)



- The original startup procedure was complicated for local staff, i.e., manually starting the UPS first, followed by subsequent manual operation of each storage devices and servers.
- It is important that local staff with no technical expertise can use MDRU easily in case of emergency.

- Therefore, the startup sequence was revised so that the MDRU can start automatically just by turning on the main switch of the rack.
- Voice communication using smartphone got ready within approximately 15 minutes after the startup the MDRU.

<Environmental Conditions Results>

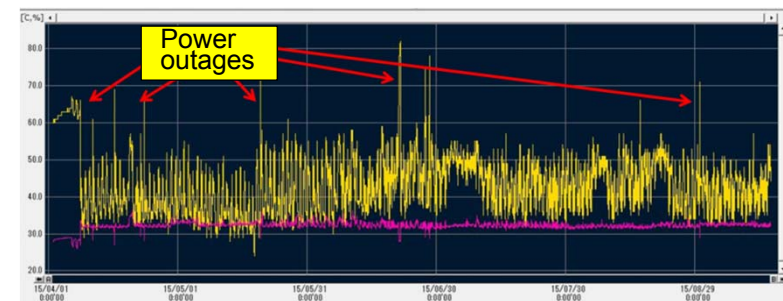
Period: April 1 to September 16, 2015

Temperature: MAX 36.4°C, MIN 26.0°C, Average 32.2°C

Humidity: MAX 82%, MIN 24%, Average 43.1%

- When a power outage occurred, the humidity rose rapidly (up to 82%).
- Although power outages occurred regularly, the MDRU server had been working without problems because it has an automatic startup function, in addition to an UPS.

(Temperature, Humidity)



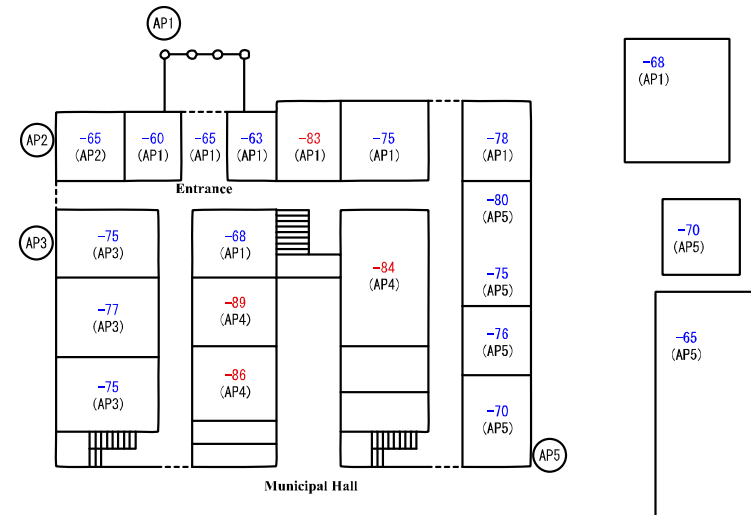
4. Feasibility Study Activities – ③ Wireless Access Verification(Wi-Fi) –

- Wireless networks were built at the municipal hall and the high school for voice and data communications.
- Wi-Fi signal levels and throughputs were measured and analyzed, so we confirmed that a stable communication can be provided in most of the rooms facing the outer walls of municipal hall and the outdoor premises of high school.

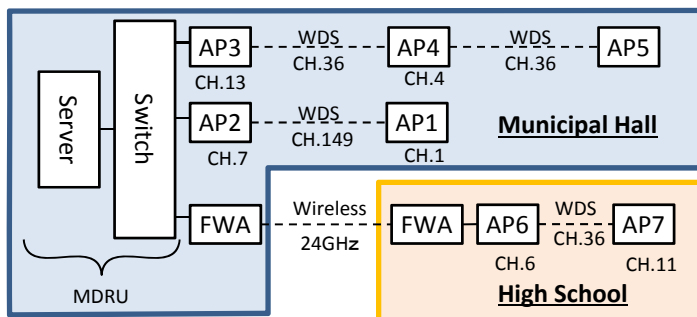
<Locations of Wi-Fi access points and FWA equipment>



<Radio signal levels in the municipal hall>



<System Configuration>



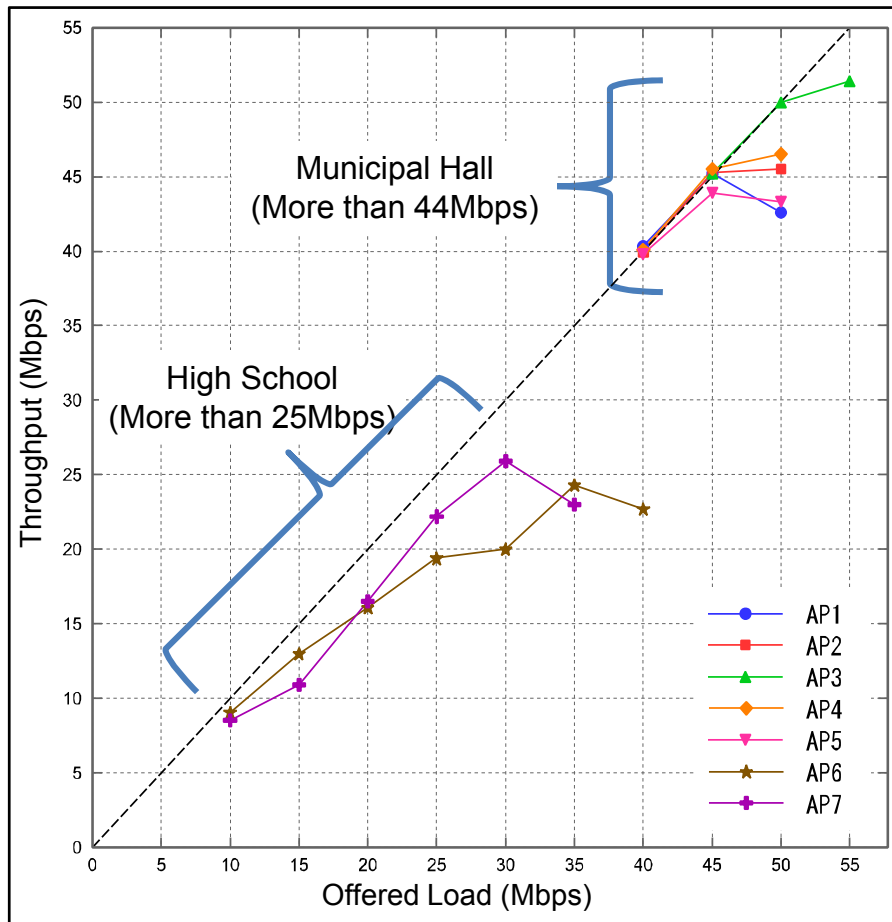
AP: Access point; CH: Channel number; WDS: Wireless distribution system; Dotted line: Wireless connection; Solid line: Wired connection,

Figures show radio signal levels (in dBm).
 Blue figures show Wi-Fi accessible areas (-80 dBm or over).
 Red figures show areas that have difficulty in Wi-Fi access (owing to radio wave attenuation due to the presence or absence of windows, concrete walls, and in-room installations).
 It is possible to expand the available area by adding access points.

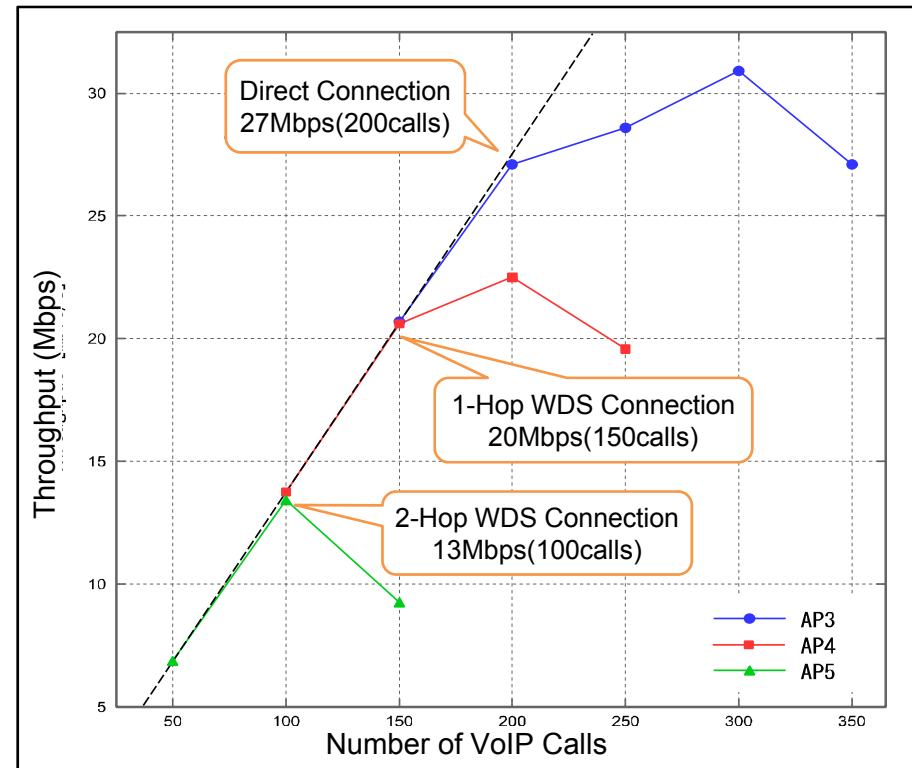
4. Feasibility Study Activities – ③ Wireless Access Verification(Wi-Fi) –

- The throughput of any AP installed at Municipal Hall and High School was achieved Broadband class throughput (more than 25 Mbps).
- The throughput of VoIP traffic streams was achieved 13 Mbps even in the 2-hop AP relay network, so that we confirmed that more than 100 calls can be established simultaneously.
- The total number of calls that can be established simultaneously in the whole network (7APs) is about 140.

<Down-link throughput near the APs>



<VoIP packet throughput near the APs >

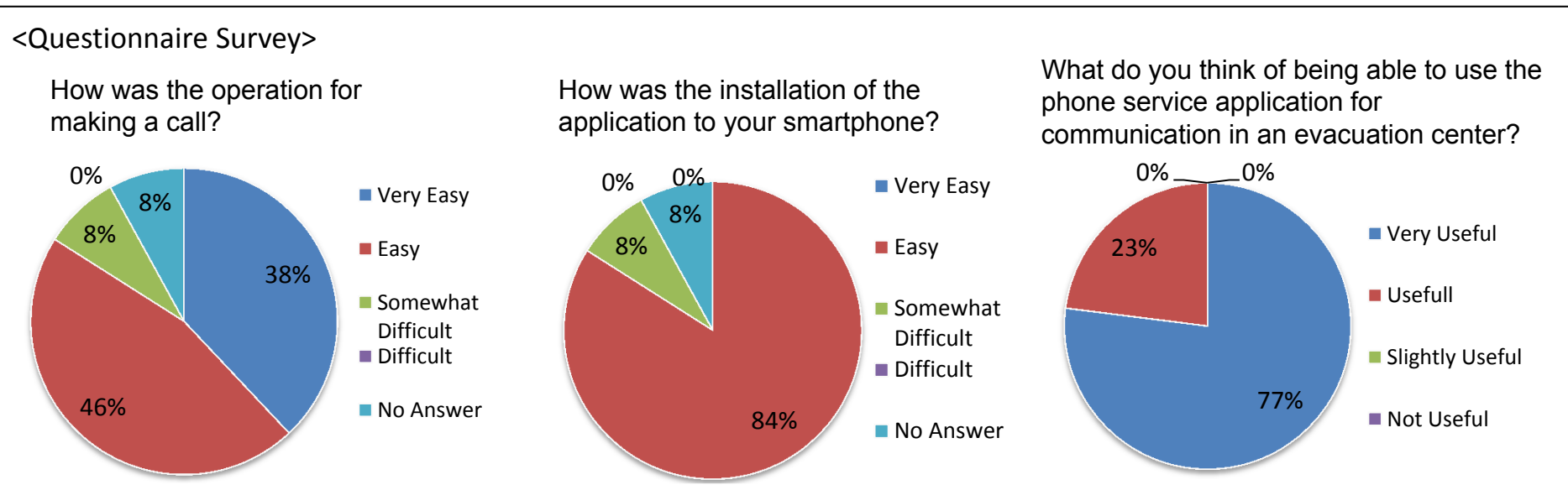


In the whole network, every AP has access limit of 20 terminals due to the HW constraint. Therefore total number of calls is limited by 140 (7 APs).

4. Feasibility Study Activities – ④ Call Testing –

- Voice communications using smartphones within the municipal hall and the high school, between them, and between the municipal hall and the disaster affected area were verified.
- The questionnaire survey result indicates that the municipal staffs and residents in San Remigio were able to use the voice communication capability without problems. The respondents felt that the introduction of a MDRU system were useful.

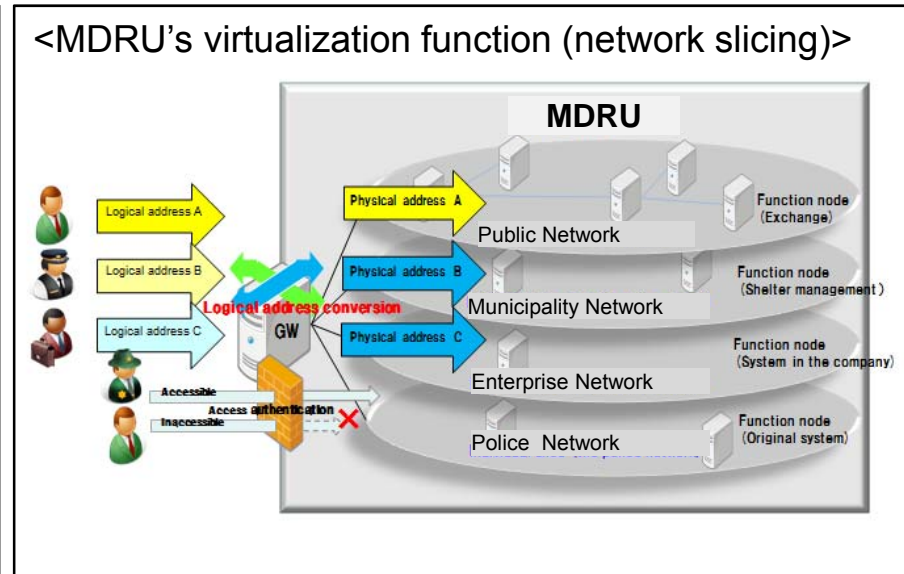
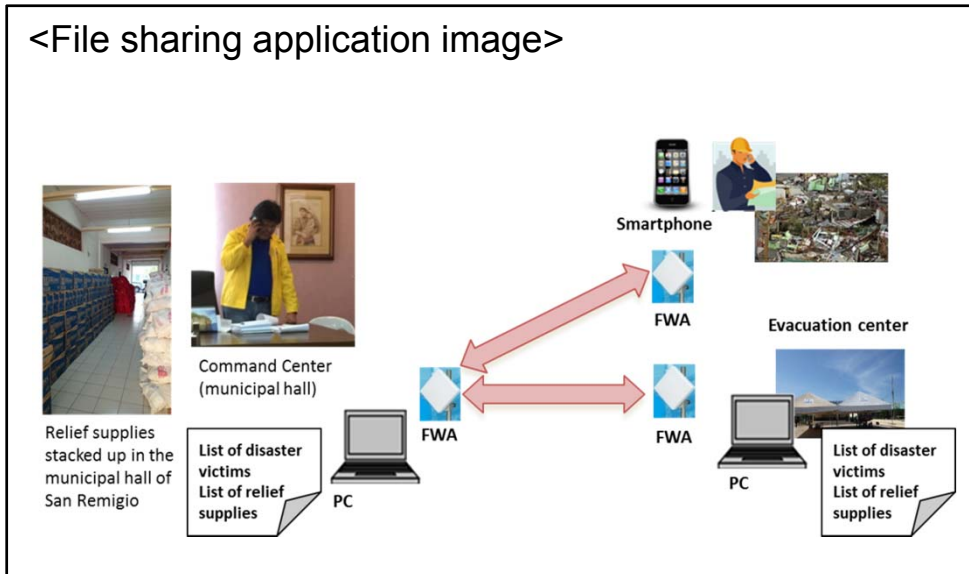
Test Item		Results
Voice communications within the municipal hall, within the high school, between the municipal hall and the high school.	Voice communication within the Municipal Hall	OK (Good-quality call, Smooth communication)
	Voice communication between the Municipal Hall and the high school	
	Voice communication within the high school	
Voice communications from the municipal hall to outside the disaster affected area	Voice communication from the Municipal Hall to outside the disaster area	
	Voice communication from the Municipal Hall to outside the disaster are using a satellite phone	



4. Feasibility Study Activities – ⑤Data Communications(File Sharing) Testing–

- The file sharing function well worked to share images (where a state of damage shows up), videos (video message of the mayor), and lists of disaster victims and relief supplies.

	Test Item	Results
Use the file sharing application to check damage visually from photos taken in affected areas.	<ul style="list-style-type: none"> Taking pictures by smartphones and saving pictures into MDRU. Getting pictures by another smartphones. 	OK
Video message of the mayor will be created, and delivered to evacuation centers using the file sharing application.	<ul style="list-style-type: none"> Taking videos by smartphones and saving them into MDRU. Getting videos by another smartphones. 	
The date about disaster victims and relief supplies will be tallied, recorded, shared using the file sharing application.	<ul style="list-style-type: none"> Creating a Excel file with PC and saving into MDRU. Getting a Excel file with another PC. 	



- A training for local staffs on the operation and the maintenance of the MDRU were delivered. A special Technical training was delivered for system administrators as well as a training on the daily management and operation of the MDRU.

<Technical Training>



<Training Contents>

List of Documents

1. Overview

1.1 Overview of MDRU

2. How to start the ICT Unit

2.1 How to start the ICT Unit

3. Operation guide for IP-PBX

3.1 MDRU IP-PBX UserGuide Introduction

3.2 MDRU IP-PBX UserGuide

3.3 MDRU IP-PBX UserGuide Attached sheet

3.4 MDRU Phone service usage guide

3.5 Verification items for smartphones

3.6 Instruction manual for IP-PBX administrators

4. Operation guide for individual slice

4.1 MGW Manager user's guide

5. Operation guide for wireless access

5.1 Instruction manual for waterproof case

5.2 Wi-Fi AP (DAP3690) instruction manual

5.3 FWA instruction manual

6. Network configuration

6.1 Physical network configuration chart

6.2 Rack layout chart

6.3 Table showing correspondence between VLAN and IP addresses

6.4 List of IP addresses

6.5 L2 switch settings

7. Others

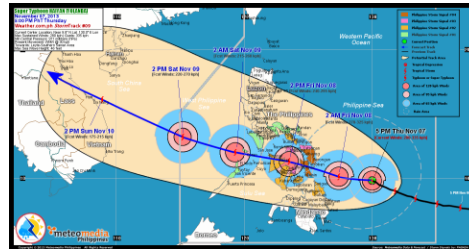
• System requirements and implementation requirements for feasibility test in the Philippines

4. Feasibility Study Activities – ⑦ Disaster Drill –

• A disaster drill was conducted to prepare for a huge typhoon and some lessons have been learned. With this, the disaster management plan of San Remigio municipality has been revised.

<Disaster Drill>

- A huge typhoon is approaching San Remigio.
- The disaster command center is opened in the municipal hall.
- The disaster cause power outage and no fixed telephone or mobile phones are available.



(source: Meteomedia Philippines)



<Scenario>

1. Starting the power generator.
2. Starting the MDRU installed in the municipal hall.
3. Installing Wi-Fi access point in the high.
4. Taking photos in affected areas and browse the file.
5. Directions from the Mayor through a voice call
6. Making a list of victims and browse the file.
7. Providing relief supplies

(3. Installation of Wi-Fi access points)



(5. Voice Communications)



San Remigio mayor



(6. Confirmation of victims)



(7. Providing relief supplies)



- On February 10, MDRU Joint Project Demonstration was held. It was attended by 120 people, including Mr. Mario G. Montejo, Secretary, DOST, Philippines, representatives from ITU and MIC, Japan, the mayor and residents of San Remigio.
- The demonstration included the following presentation and demonstrations of the MDRU. The MDRU drew interest as a new disaster recovery technology.

<MDRU Joint Project Demonstration>

(Comments from representatives)

- Quick recovery of communications is important in times of disaster, and the MDRU is an enabling tool. (ITU)
- Improvements are necessary in the living standards of people in remote areas through the use of ICT applications, including disaster prevention applications, and MDRUs are expected to play important roles in disaster-affected areas. (DOST)
- Japan and the Philippines have a close relationship on the cooperation in the ICT field, and the MDRU accounts for the important part of that. Japan hopes to advance its cooperation with both Philippines and ITU for disaster prevention and the resolution of global issues by use of ICT. (MIC)

(Demonstration and Simulation)

- Voice communications with such the sights as the Municipal hall and a high school and with Manila via a satellite link
- File sharing for monitoring state of damages and victims, and video conference with a high school (an evacuation center)


(Demonstration view)



Summary of Joint Project

The Feasibility Study constructed Wi-Fi networks with MDRU installed in a number of places, including the San Remigio Municipal Hall, for the functional verification and efficacy confirmation of phone calls and data communications (including photo and video data files sharing) between the Disaster Response Headquarters of the area and emergency shelters.

Training and disaster drill were given to San Remigio Municipal officials and residents for the utilization of MDRU for both disaster-affected period and normal time. The San Remigio Municipality upgraded disaster management plan respond to benefit from the feasibility study.

- 
- DOST, Philippines and San Remigio Municipality started practical operation of the installed MDRU.
 - The San Remigio Municipality decided to install additional MDRUs.

Future plan

MIC are sharing the results of the Joint Project with countries with specific needs and entities in Japan. MIC will promote activities for the introduction and popularization of MDRU and continue working on initiatives as natural disaster countermeasures contributing to the Philippines and other countries in collaboration with international organizations, such as the ITU.