ICT responses to The Great East Japan Earthquake

Federal Communications Commission
Earthquake Communications Preparedness Forum

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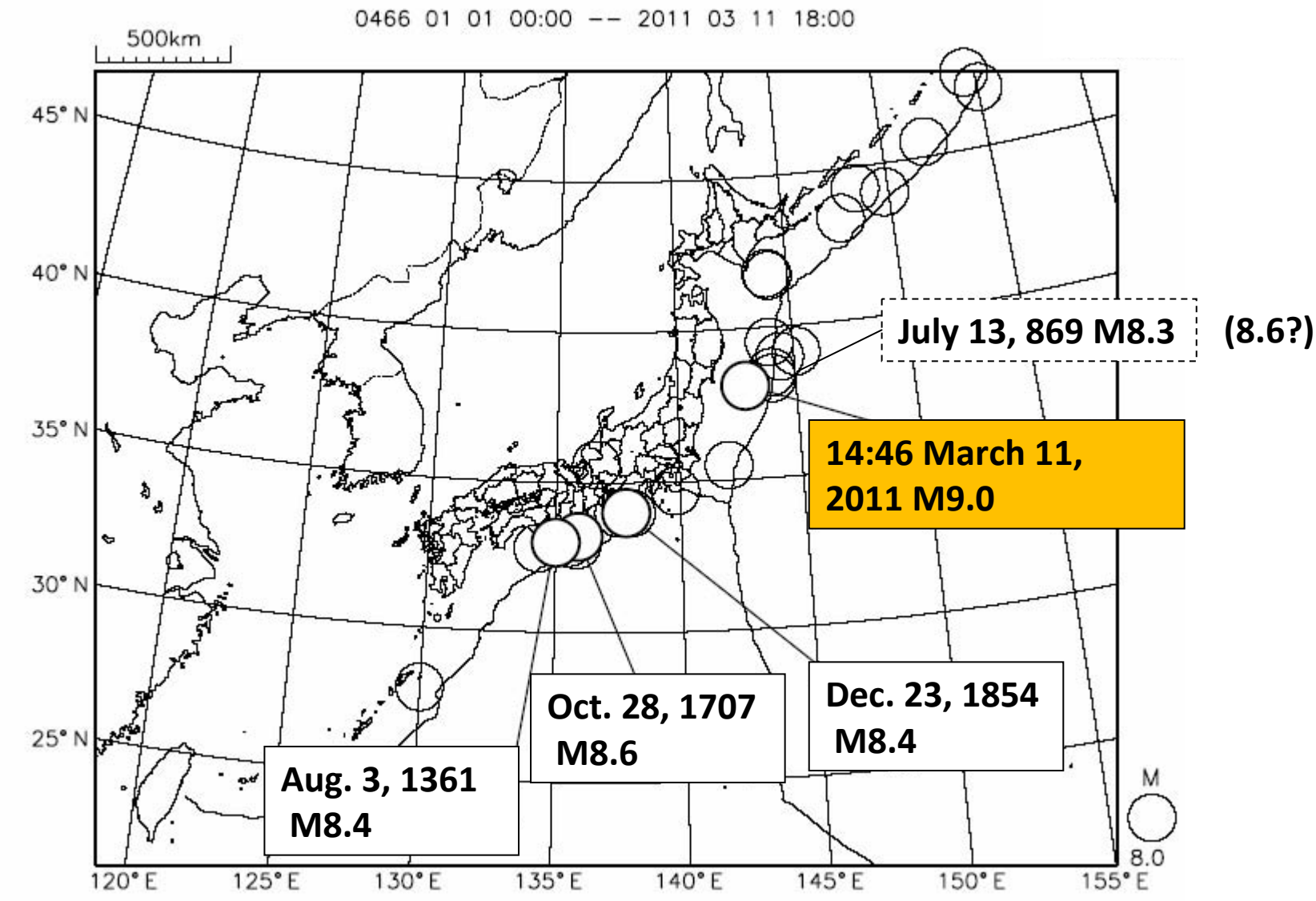
I. What Has Happened?

1. The Biggest Earthquake in Japan, EVER

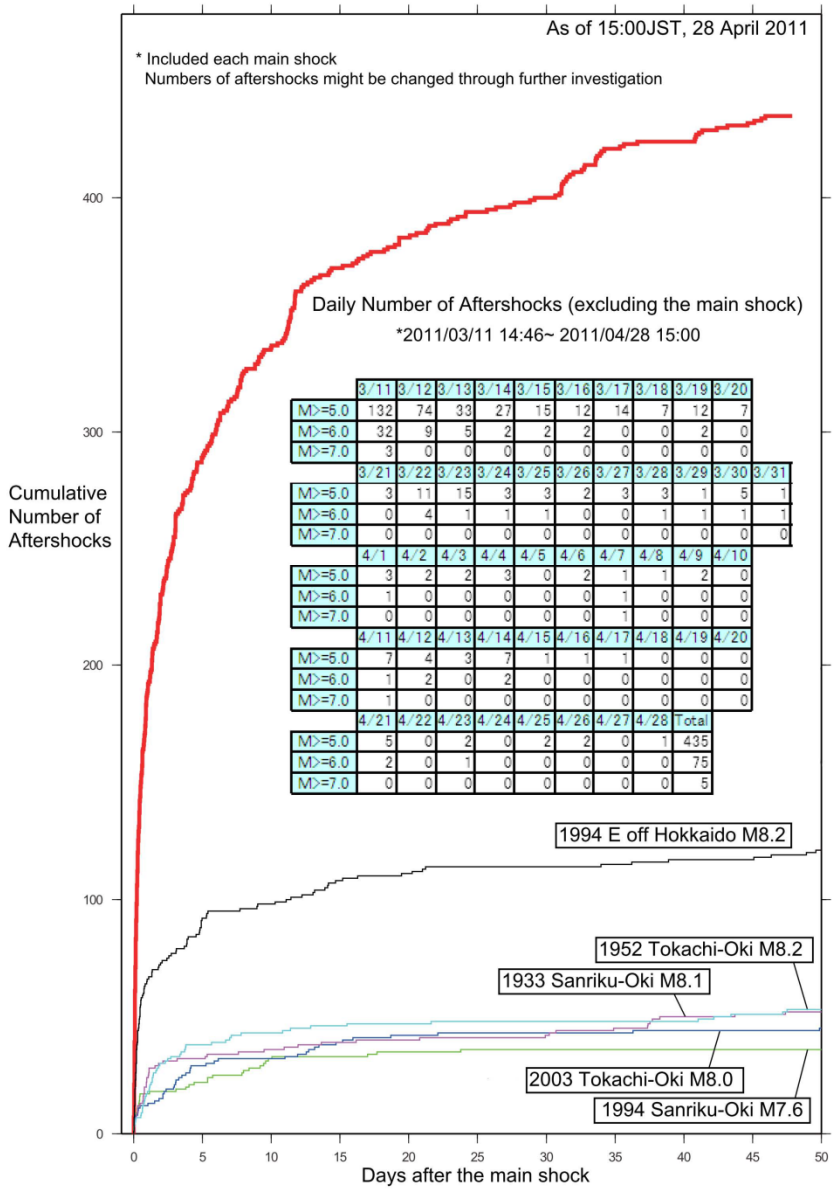
Earthquakes with M 8.4 or above (466 -2011AD)



(source: Japan Meteorological Agency)

2. Many Aftershocks

The 2011 off the Pacific coast of Tohoku Earthquake
Cumulative Number of Aftershocks (Magnitude>=5.0)



	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20
M>=5.0	132	74	33	27	15	12	14	7	12	7
M>=6.0	32	9	5	2	2	2	0	0	2	0
M>=7.0	3	0	0	0	0	0	0	0	0	0

	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31
M>=5.0	3	11	15	3	3	2	3	3	1	5	1
M>=6.0	0	4	1	1	1	0	0	1	1	1	1
M>=7.0	0	0	0	0	0	0	0	0	0	0	0

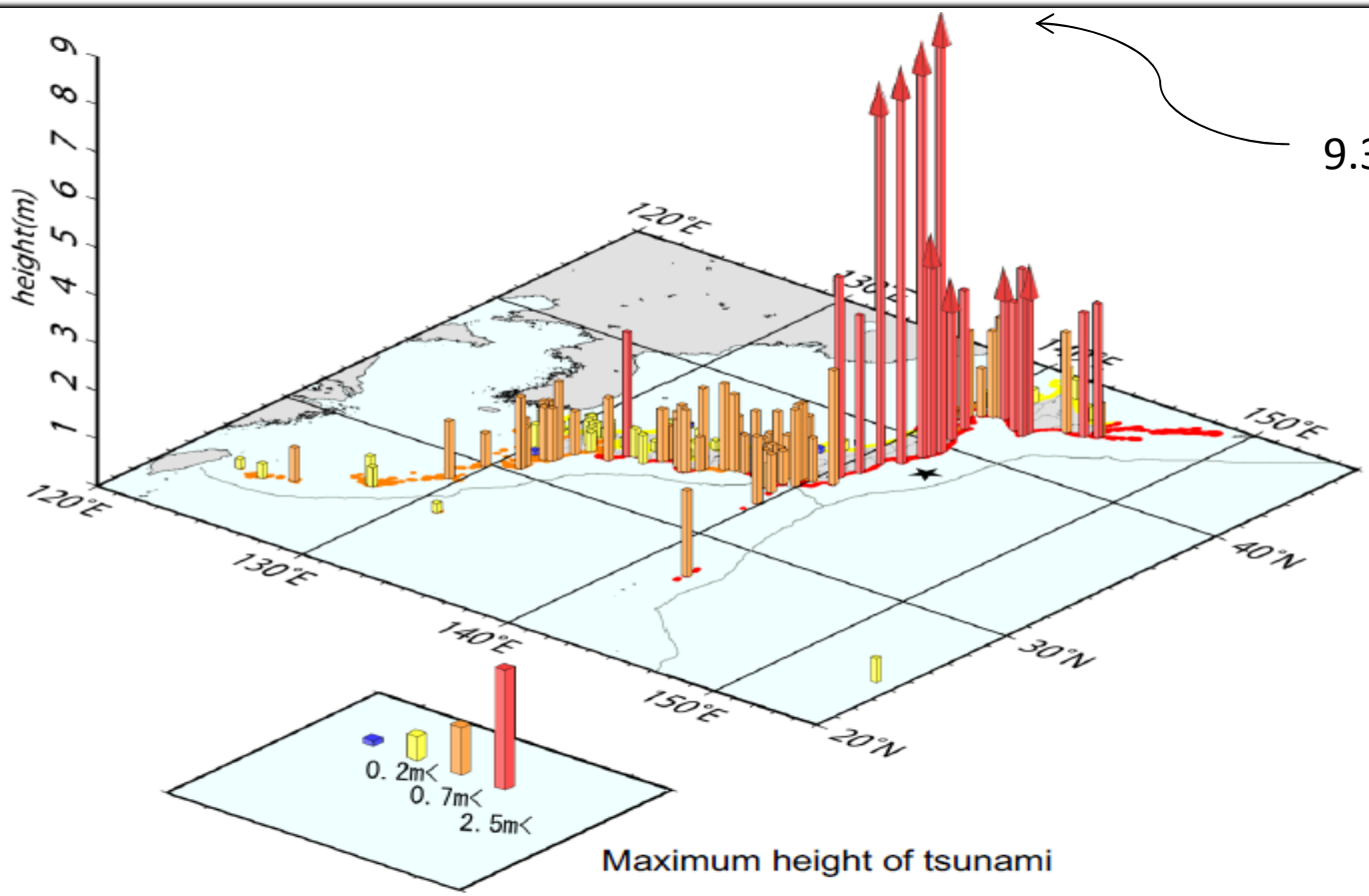
	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10
M>=5.0	3	2	2	3	0	2	1	1	2	0
M>=6.0	1	0	0	0	0	0	1	0	0	0
M>=7.0	0	0	0	0	0	0	1	0	0	0

	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20
M>=5.0	7	4	3	7	1	1	1	0	0	0
M>=6.0	1	2	0	2	0	0	0	0	0	0
M>=7.0	1	0	0	0	0	0	0	0	0	0

	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28	Total
M>=5.0	5	0	2	0	2	2	0	1	435
M>=6.0	2	0	1	0	0	0	0	0	75
M>=7.0	0	0	0	0	0	0	0	0	5

Copyright : Japan Meteorological Agency

3. Higher Tsunami Than Expected



9.3m=30.5feet

	First tsunami	Maximum height of tsunami
Miyako (Iwate)*	March 11, 14:48 JST +0.2m	March 11, 15:26 JST +8.5m<=
Ofunato (Iwate)*	March 11, 14:46 JST -0.2m	March 11, 15:18 JST +8.0m<=
Ishinomaki (Miyagi)*	March 11, 14:46 JST +0.1m	March 11, 15:25 JST +7.6m<=
Soma (Fukushima)*	March 11, 14:55 JST +0.3m	March 11, 15:51 JST +9.3m<=
Oarai (Ibaraki)	March 11, 15:15 JST +1.8m	March 11, 16:52 JST +4.2m
Kamaishi (Iwate)*	March 11, 14:45 JST -0.1m	March 11, 15:21 JST +4.1m<=
Mutsu (Aomori)	March 11, 15:20 JST -0.1m	March 11, 18:16 JST +2.9m
Nemuro (Hokkaido)	March 11, 15:34 JST slight	March 11, 15:57 JST +2.8m
Tokachi (Hokkaido)*	March 11, 15:26 JST -0.2m	March 11, 15:57 JST +2.8m<=
Urakawa (Hokkaido)	March 11, 15:19 JST -0.2m	March 11, 16:42 JST +2.7m

(source: Japan Meteorological Agency)

Actual maximum height might be higher.

4. Second Highest Casualties from Natural Disaster, EVER

Casualties

Killed	14,728
Missing	10,808
Injured	5,278

As of May 2, 2011

(Source:
Emergency Disaster Countermeasures Headquarters,
National Police Agency of Japan)

* Numbers of killed or missing in past earthquakes:

21,959 - June 15, 1896 (Meiji Sanriku earthquake, M8.2)
105,000 - Sept. 1, 1923 (The Great Kanto earthquake, M7.9)
6,437 - Jan. 17, 1995 (The Great Hanshin-Awaji earthquake M7.3)

(source: Japan Meteorological Agency)

5. ICT Infrastructures Damaged

- Facilities were destroyed by the earthquake and/or the tsunami.
- The commercial electricity shortage was long and batteries were drained.

FIXED NETWORKS

Lines out of service
(because of the nodes out of service)

NTT Onagawa Bldg
(Source NTT East)

PSTN+ISDN(NTT East)	1,000,000 (March 13) <MAXIMUM>
FTTH (NTT East)	500,000 (March 13) <MAXIMUM>

MOBILE NETWORKS

NTT DoCoMo transmission facilities in Iwate
(Source NTT DoCoMo)

Base Stations Damaged (4 carriers)

14,800 (March 12) <MAXIMUM>

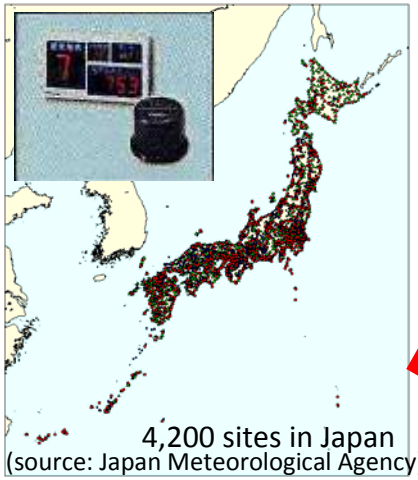
NTT DoCoMo	6,600
KDDI (au)	3,800
SoftBank Mobile	3,800
eMobile	600

II. ICT for Detection & Warning

1. Detection

Seismic Intensity Stations

□□□□□□□□



Seismic Stations□□□□□□□□

1,000 Sites in Japan

Earthquake Phenomena Observation System
(□□□□□□□□□□□□□□□)

- □Real time Process & Analysis of collected data
- □Provision of Tsunami/Earthquake/Intensity to Agency
- □Central Monitoring of "Premonitory Phenomena" in Tokai Area

(source: Japan Meteorological Agency)

Other Facilities

Including Concerned Institutes, University, etc.

Advanced info for Disaster Prevention

Earthquake Early Warning Info

Estimated Seismic Intensity Info

Prompt & Accurate Announcement

Tsunami Forecast

Seismic-Intensity info

Reference : Website of Meteorological Agency
http://www.jma.go.jp/jma/kishou/intro/gyomu/index919sys.html

2. Earthquake Early Warning (1)

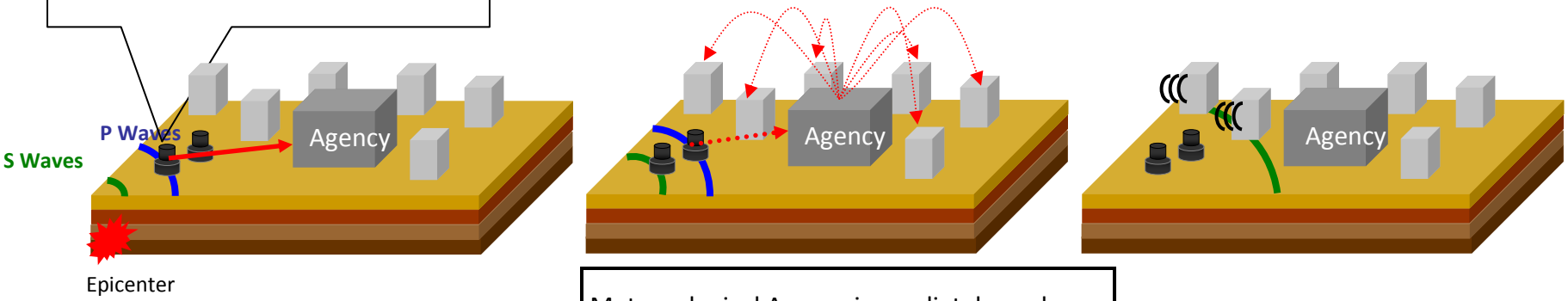
Earthquake Early Warning (□□□□□□):

Applying technology that

i)detects the epicenter and calculates the scale of the earthquake from the Primary Waves (P-waves), and

ii) sends the warning a certain time (between several seconds and several tens of seconds) ahead of the arrival of the Secondary Waves (S- waves), which causes the most damage.

When earthquake occurs, the minor initial tremor □Primary Wave□ is detected first, then a large shake □Secondary wave□ spreads.



Seismograph near the epicenter detects the tremor (P-waves) and sends signal to Meteorological Agency.

Meteorological Agency immediately analyzes the signal and forecasts the arrival time of main tremor & seismic intensity of each area, based on the epicenter and scale of the earthquake, and sends warning

The other seismographs detect the tremor (P-waves) and sends signals to Meteorological Agency one after another. It makes a more accurate prediction

Shake after reaching S Waves or thereabout

2. Earthquake Early Warning (2)

Provision to the public through:
-TV & Radio
-Cell phone services (NTT DoCoMo, KDDI, SoftBank Mobile)
-Municipal Disaster Management Radio Communication Network (via J-Alert (MIC FDMA))
-Other facilities

-TV (sample display)

(source: NHK)

-Cell phone (sample display)

1 待受画面に緊急地震速報表示
→[○](センターキー)

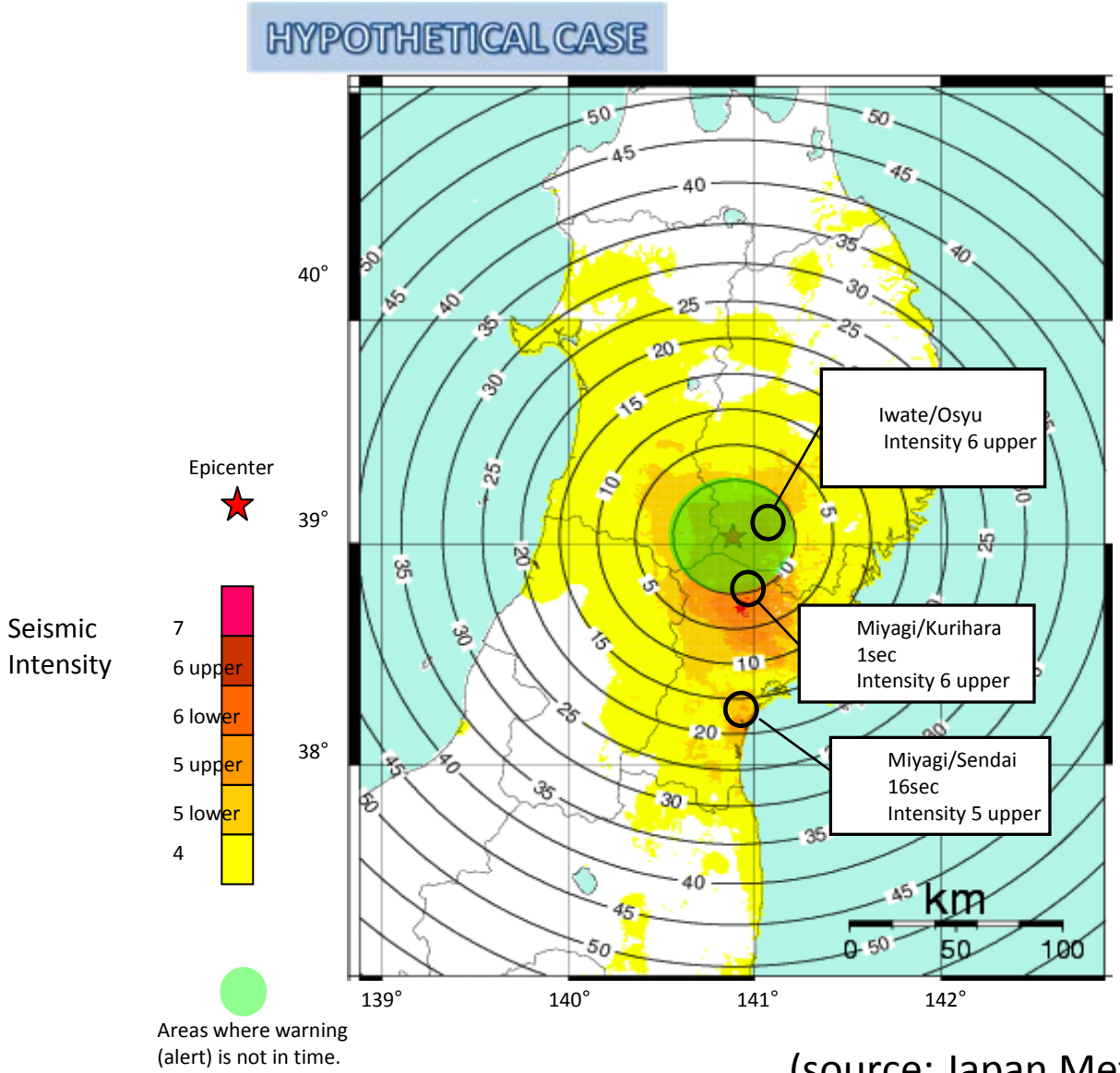
2 [○](センターキー)

(source: KDDI)

-Speakers for residents
(Municipal Disaster Management Radio Communication Network)

2. Earthquake Early Warning (3)

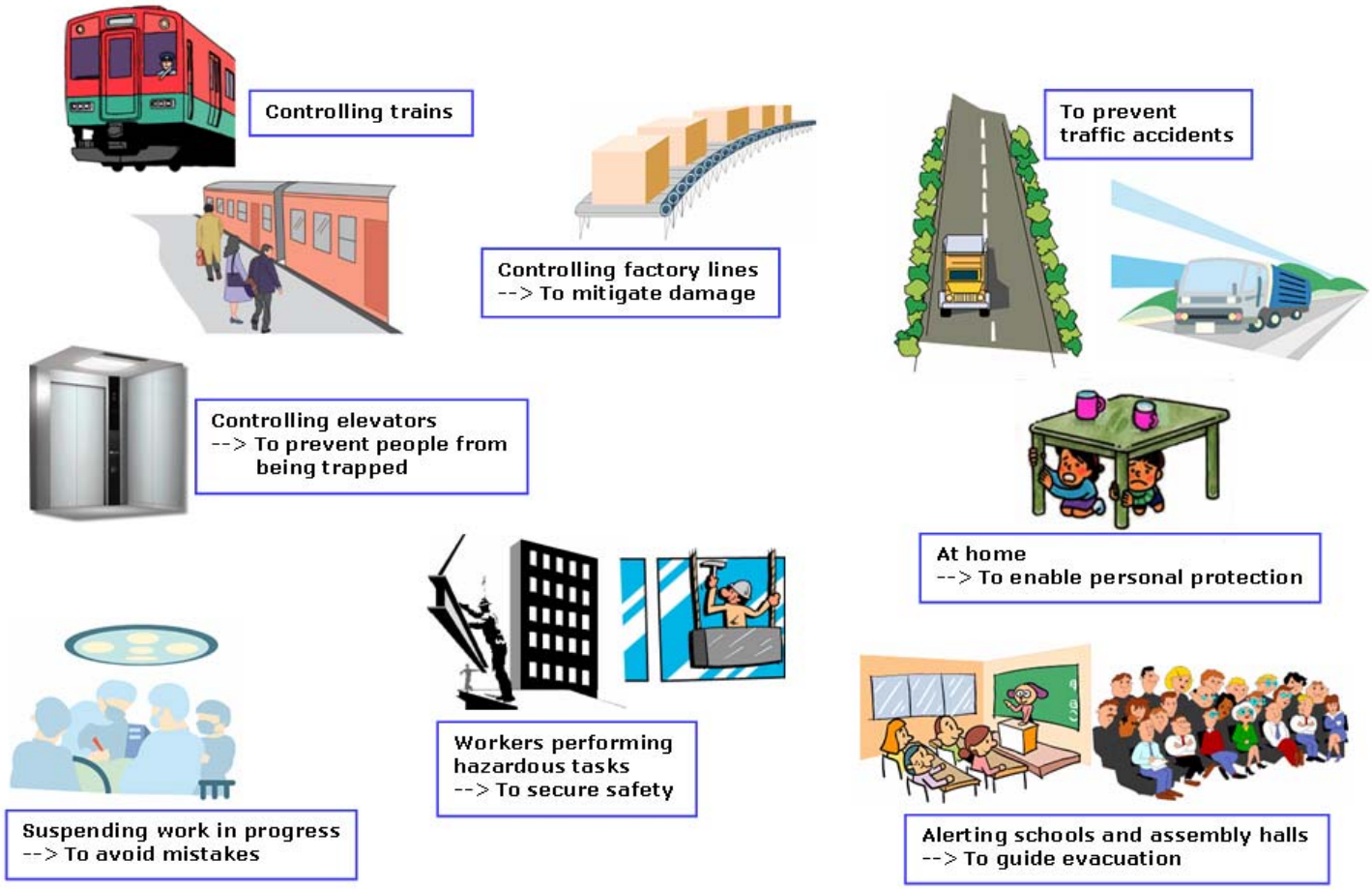
Time (seconds) after a warning is provided until a large tremor reaches



(source: Japan Meteorological Agency)

2. Earthquake Early Warning (4)

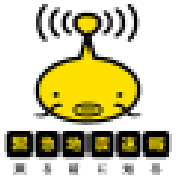
Examples of Response to an Earthquake Early Warning



(source: Japan Meteorological Agency)

2. Earthquake Early Warning (5)

Limitations of the Earthquake Early Warning



Timing

The window of time from the announcement of an Earthquake Early Warning until the arrival of the main tremors is very short, i.e. a matter of seconds (or between several seconds and a few tens of seconds).

In areas that are close to the focus of the earthquake, the warning may not be transmitted before strong tremors hit.

False alarms

When using data from only one seismograph, false Earthquake Early Warnings may occur as a result of noise from accidents, lightning or device failure.

Magnitude estimation

There are limits to the accuracy of estimating magnitude, especially for large earthquakes.

It is difficult to separate earthquakes and provide accurate warnings when multiple earthquakes occur almost simultaneously or in close proximity to each other.

Seismic intensity estimation

There are limits to the accuracy of estimating seismic intensity by statistical attenuation formula, as well as limits to the prediction of land surface amplification.

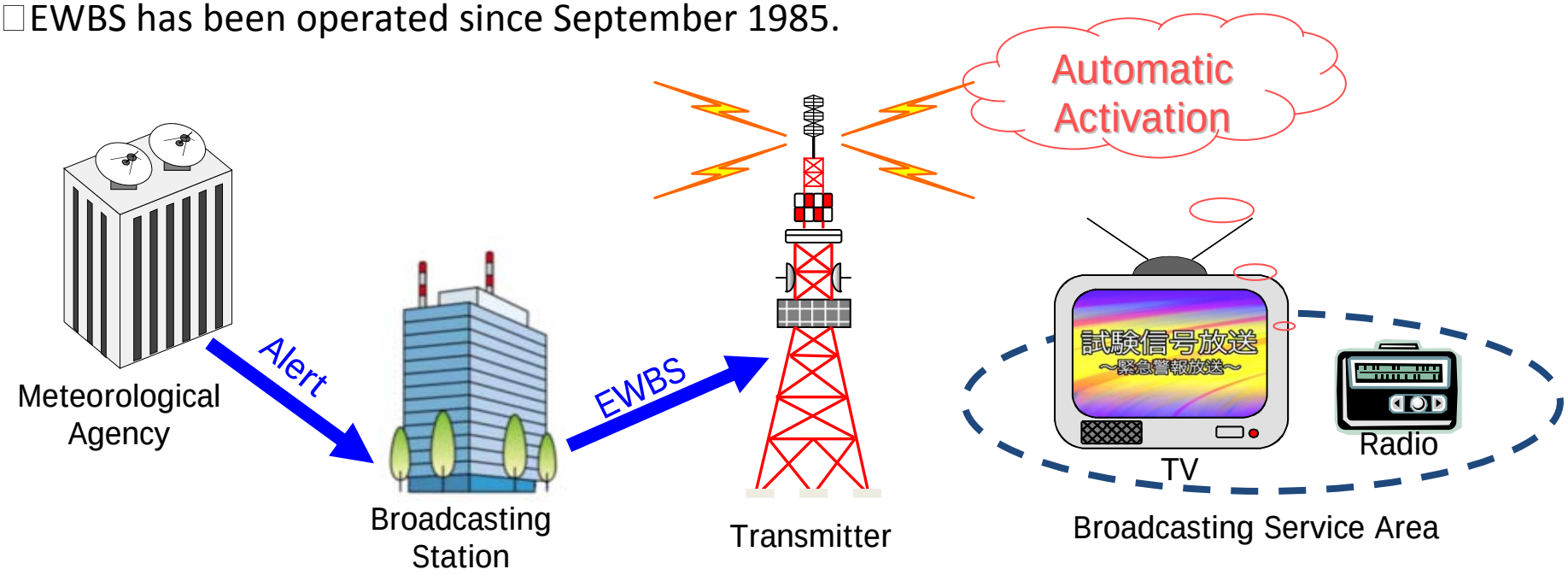
The Japan Meteorological Agency plans to continue improving the accuracy and timing of the Earthquake Early Warning through joint research with the National Research Institute for Earth Science and Disaster Prevention, and also intends to make further efforts toward publicizing the Earthquake Early Warning.

3. Emergency Warning Broadcasting System

□EWBS (Emergency Warning Broadcasting System) is remote activation system for Radio & TV, which transmits alert/warning information to viewers and listeners about disasters
even if those devices are switched off .

□EWBS is operated in response to large-scale earthquake warnings, Tsunami Alerts and broadcast requests from local governors.

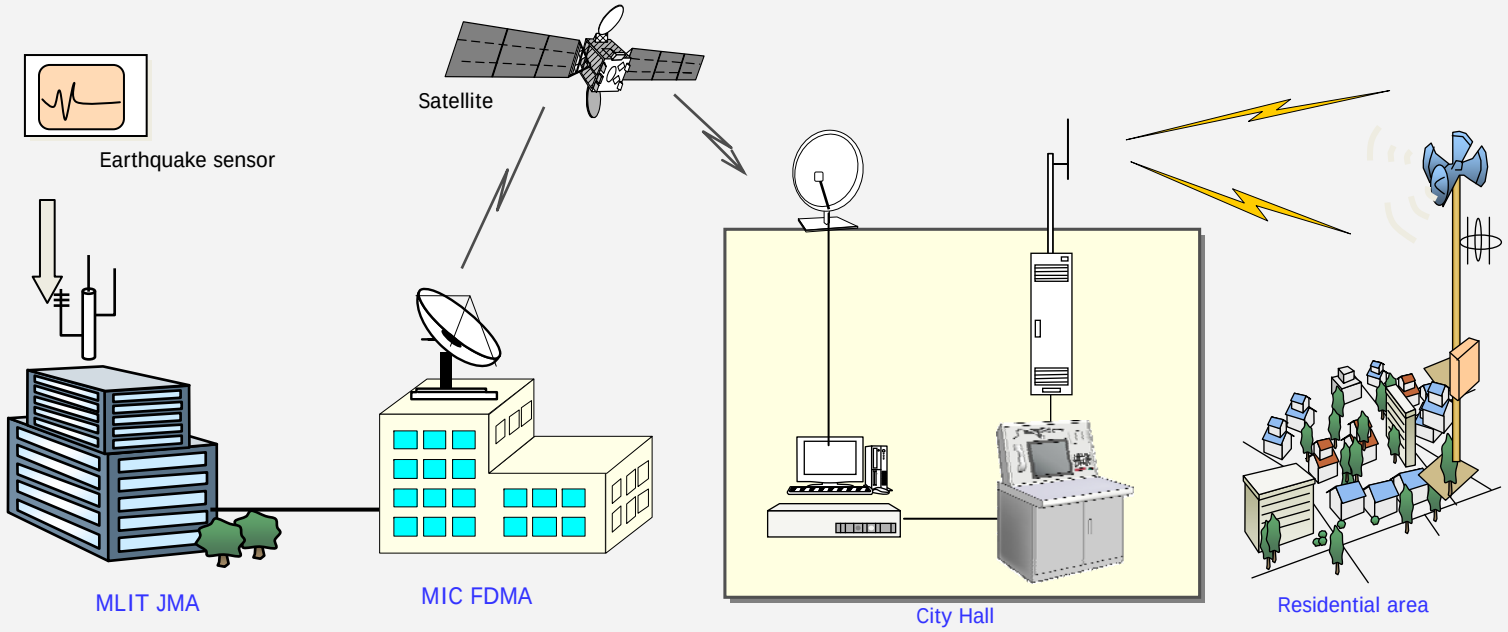
□EWBS has been operated since September 1985.



4. Municipal Disaster Management Radio Communication Network (1)

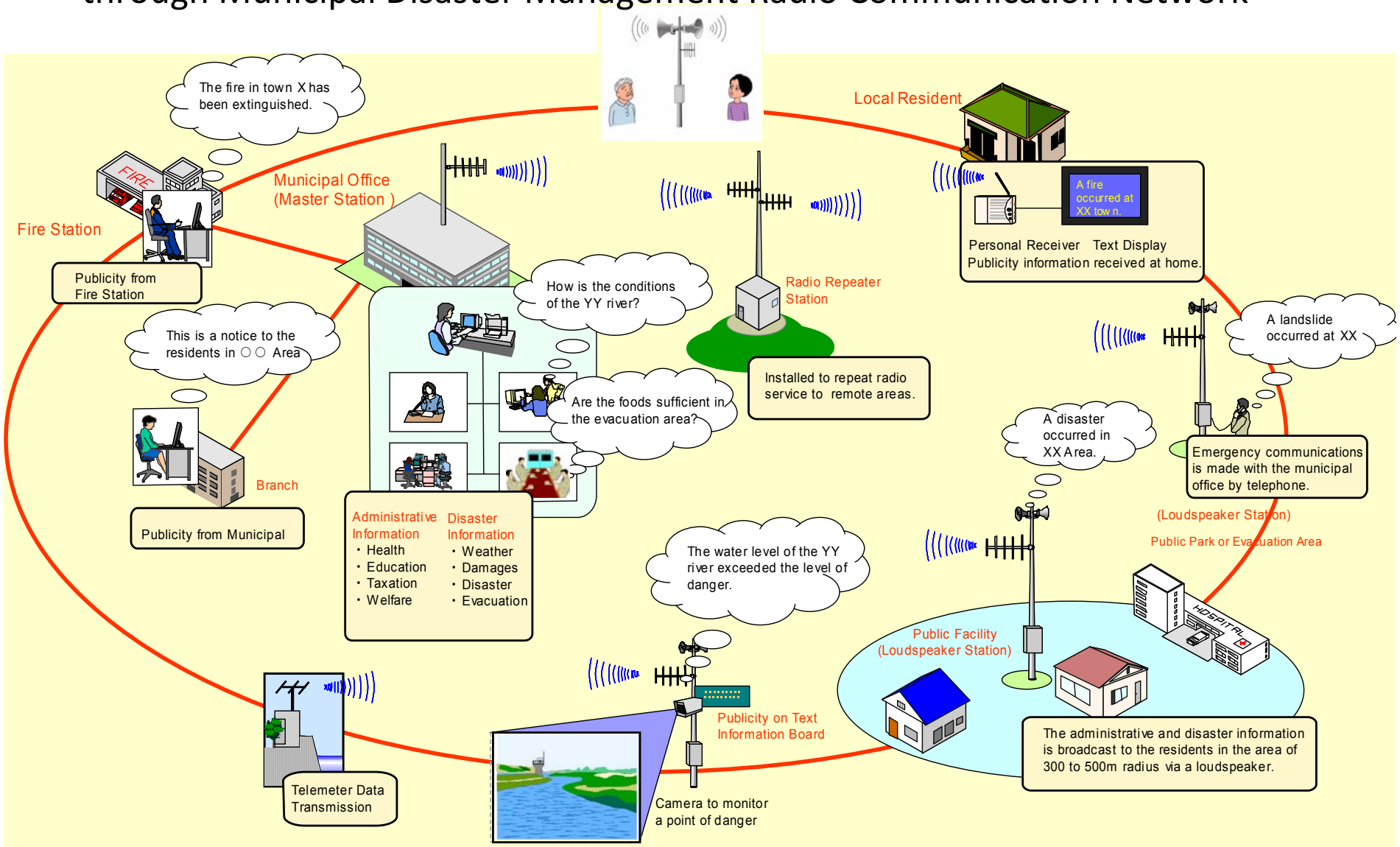
Earthquake Early Warning
Earthquake Forecast
Tsunami Forecast

- Earthquake/Tsunami info is sent to city gov by satellite.
- The system automatically transmits the info.
- Residents hear info through loudspeakers.



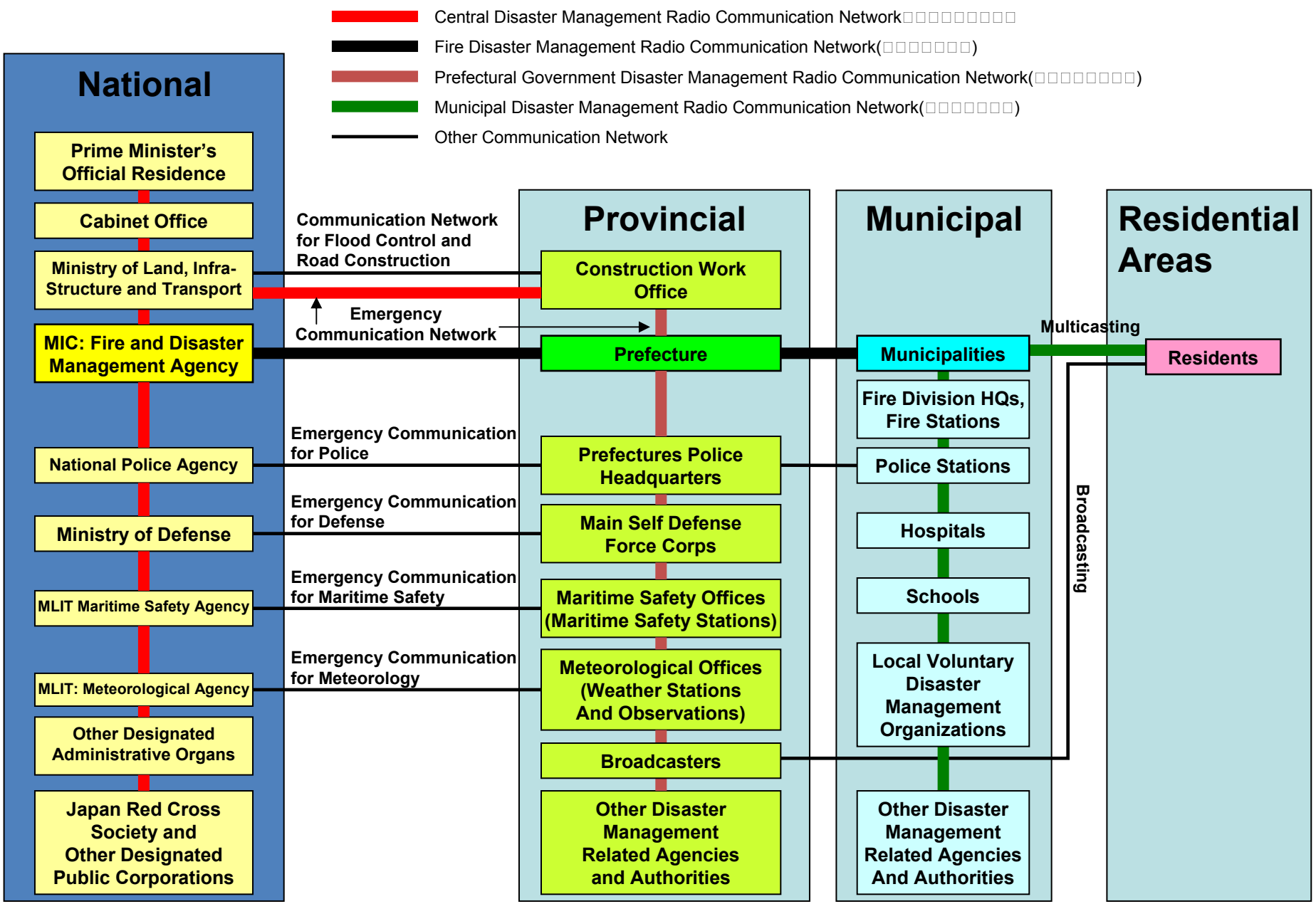
4. Municipal Disaster Management Radio Communication Network (2)

Information sharing with residents through Municipal Disaster Management Radio Communication Network

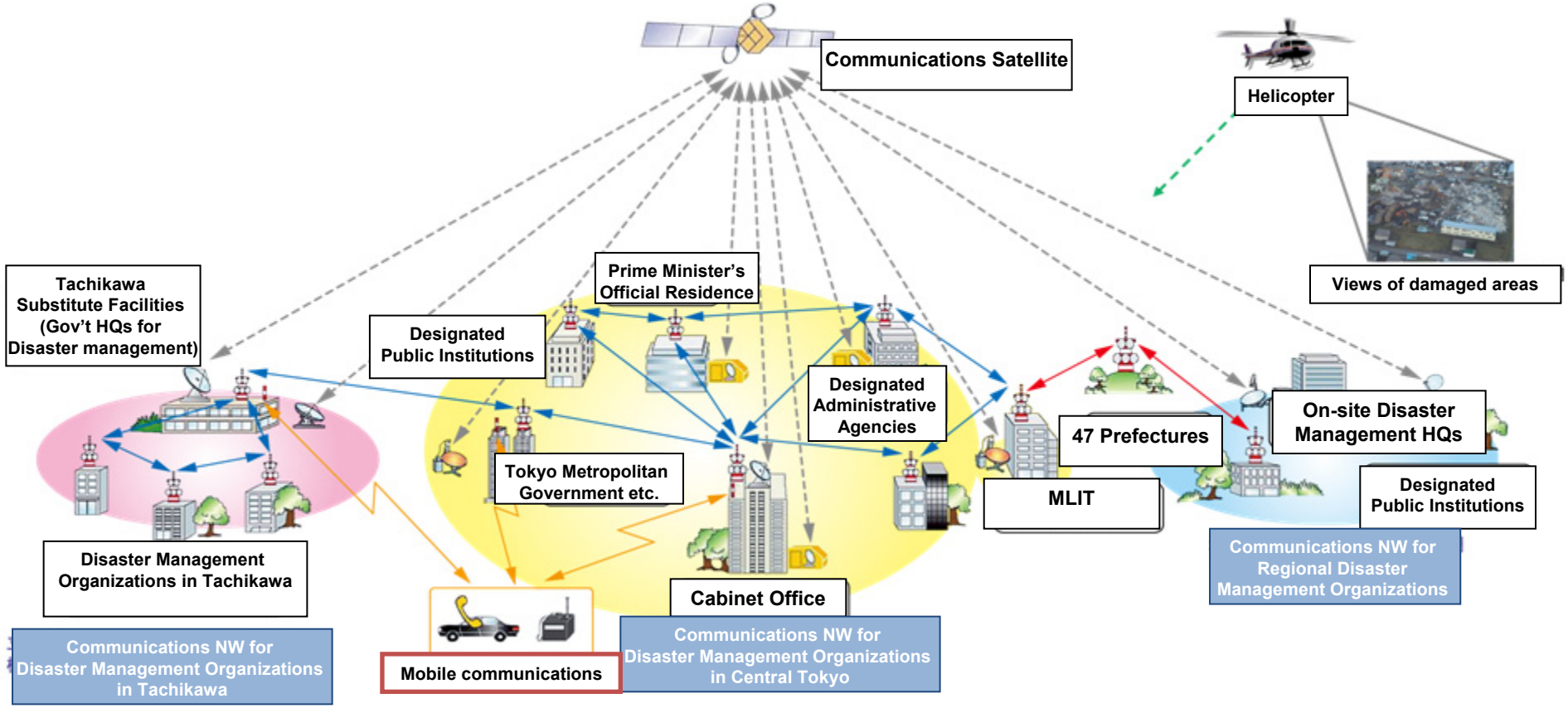


III. ICT for Rescue & Support

1. Networks for Information Sharing



2. Central Disaster Management Radio Communication Network (1)



2. Central Disaster Management Radio Communication Network (2)

(source: Cabinet Office)

2. Central Disaster Management Radio Communication Network (3)

(Source: Cabinet Office website)

IV. ICT for Residents

1. Safety Confirmation Services (1)

The safety confirmation services support,

Safety confirmations between the people inside/outside the stricken area

by **recording/playing back** **voice/text messages, etc.**

(source: NTT East)

1. Safety Confirmation Services (2)

Disaster Emergency Message Dial

- Provided by NTT Communications (System operation: NTT EAST/WEST)

(source: NTT East & West)

Basic Operation Method for Disaster Emergency Message Dial (171)

Dial 171 and follow the voice prompts to record or play back a message.

*Actual voice prompt is played back in Japanese.

Operation procedure		Record		Playback	
①	Dial 171	1 7 1			
②	Select record or playback.	[Prompt] This is the Disaster Emergency Message Dial Center. To record, please dial 1, to play back, please dial 2, to record using a PIN number, please dial 3, and to play back using a PIN number, please dial 4.			
		(No PIN number)	(With PIN number)	(No PIN number)	(With PIN number)
		1	3 [Prompt]Please dial a 4-digit PIN number. X X X X	2	4 [Prompt]Please dial a 4-digit PIN number. X X X X
③	Enter the telephone number of the person in the disaster-stricken area.	[Prompt] If you are inside the disaster-stricken area, please dial the telephone number of your house or the telephone number of a person inside the disaster-stricken area that you want to contact, starting with the area code. If you are outside the disaster-stricken area, please dial the telephone number of a person inside the disaster-stricken area that you want to contact, starting with the area code.			
		0 X X X X X X X X X			
Connected to the Message Dial Center.					
④	Record the message Play back the message	[Prompt] A message will be recorded for telephone number 0XXXXXXXXX (, PIN number XXXX). If you are using a touch-tone telephone, please press number 1 and then press pound(#). If you are using a dial telephone, please wait. If you entered the incorrect telephone number, please hang up and call again.			
		Dial telephones	Touch-tone telephones	Dial telephones	Touch-tone telephones
		(Please wait until the prompt is played.)	1 #	(Please wait until the prompt is played.)	1 #
		[Prompt] Please record your message. Please leave a message within 30 seconds after the beep. After you finish talking, please hang up the telephone.	[Prompt] Please record your message. Please leave a message within 30 seconds after the beep. After you finish talking, please press number 9 and then press pound(#).	[Prompt] The messages will be played back, starting with the newest.	[Prompt] The messages will be played back starting from the new message. To repeat a message, please press number 8 and then press pound (#). To play the next message, please press number 9 and then press pound (#).
		Message recording		Message playback	
		(Please wait until the prompt is played.)	After finishing recording 9 # [Prompt] The message will now be repeated. To re-record the message, please press number 8 and then press pound(#). The contents of the recorded message can be checked.	[Prompt] All the messages have been played back.	[Prompt] All the messages have been played back. To record an additional message, please press number 3 and then press pound(#). (Please wait until the prompt is played.)
		[Prompt] Your message has been saved.			[Prompt] All the messages have been played back.
⑤	Finish	The call is ended automatically.			

Please remember the emergency voice message board: Disaster Emergency Message Dial (171)

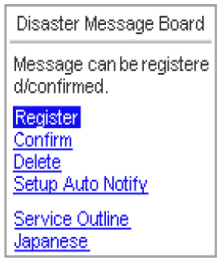
1. Safety Confirmation Services (3)

Disaster Message Board (source: SoftBank Mobile Corp.)

■ How to Post a Message

Follow this procedure using a Yahoo! Keitai compatible handset.

Choose "**Disaster Message Board**" from the Yahoo! Keitai Top menu.



Choose "**Register**" from the Disaster Message Board top menu.

From the four selections shown, choose the status that describes your current condition. You can also enter a message containing up to 100 double-byte characters.After you have finished composing the message, select "**Register.**"

The message has been posted.

Notification sent

2. Supplying Temporary Capacities

(as of April 7)

◻ Telecommunications carriers

- Over 100 portable power generators and 37 mobile base station trucks have been provided.

- Public telephone calls are not charged; approximately 2,300 new public telephones have been specially installed.

- Free internet connections have been set up at evacuation centers.

- Basic telephone rates have been reduced or waived altogether, and payment deadlines have been extended.

◻ Broadcasters and manufacturers

- In cooperation with various manufacturers, NHK has been installing 750 televisions and 760 radios in evacuation centers. Manufacturers such as Panasonic and Sony have been supplied over 40,000 radios.

(source: MIC)

3. Restoration of Capacities

•NTT group and KDDI announced respectively their plan to restore their capacities for services by the end of April.

FIXED NETWORKS

Lines OUT of service
(because of the nodes ouf of service)

PSTN+ISDN(NTT East)	1,000,000 (March 13) >>>	11,600 (May 2)
FTTH (NTT East)	500,000 (March 13) >>>	4,400 (May 2)

MOBILE NETWORKS

Base Stations Damaged (4 carriers)

	14,800 (March 12) >>>	527 (May 2)
NTT DoCoMo	6,600	326
KDDI (au)	3,800	117
SoftBank Mobile	3,800	84
eMobile	600	0

4. Resiliency Requirements

- The technical requirements for the measures against the damage or the failure of the telecommunication circuits facilities:

Technical requirements \ Intended facilities	Facilities for Analog Telephones, ISDN, VoIP (interconnected with PSTN) and mobile phone	Other facilities for telecommunication circuits facilities
(1)Backup equipment	□	N/A
(2)Detection of failure	□	□
(3)Protection	□	□
(4)Test equipment and emergency restoration equipment	□	□
(5)Abnormal congestion Measures	□	□
(6)Earthquake counter-measures	□	□
(7)Power-supply facilities	□	□
(8)Power failures measures	□	N/A
(9)Induction measures	□	□
(10)Fire prevention measures	□	□
(11)Outdoor facilities	□	□
(12)Building to install facilities	□	N/A

fn.1□Some requirements are inapplicable in the case of facilities installed in user's building and minor facilities etc.
fn.2□The "□" sign in the above table shows that all items of each technical requirement should be required.
The "□" sign shows that some items of each technical requirement should be required.

Thank you!