

Maintaining Communications Capabilities during Major Natural Disasters and other Emergency Situations

16 March, 2012

Hideo Tomioka

Deputy Director

Telecommunications Policy Division,
Telecommunications Bureau

Ministry of Internal Affairs and
Communications, Japan

Overview of Consideration on Maintaining Communications Capabilities¹ during Major Natural Disasters and other Emergency Situations

- Following the Great East Japan Earthquake, communications congestion (overload in telecommunications traffic) and communications blackouts occurred over a wide area. In response, Japan's Ministry of Internal Affairs and Communications (MIC) convened from April to December 2011 a study group to examine ways of securing the means of communication in emergency situations such as large-scale disasters.
- As well as academic experts, the study group included among its members representatives of major ICT-related companies including telecommunications operators and industry associations.
- The study group produced an interim report in July 2011 and a final report in December of the same year.
- Each actor (the government and telecommunications operators, etc.) is now implementing initiatives based on the reports and on the discussions that took place.

Outline of Final Report

Alleviating congestion in emergency situations

Minimizing disruption to communications in the event of damage to base and/or relay stations

Implications of the recent disaster for future network infrastructure

Implications of the recent disaster for future internet usage

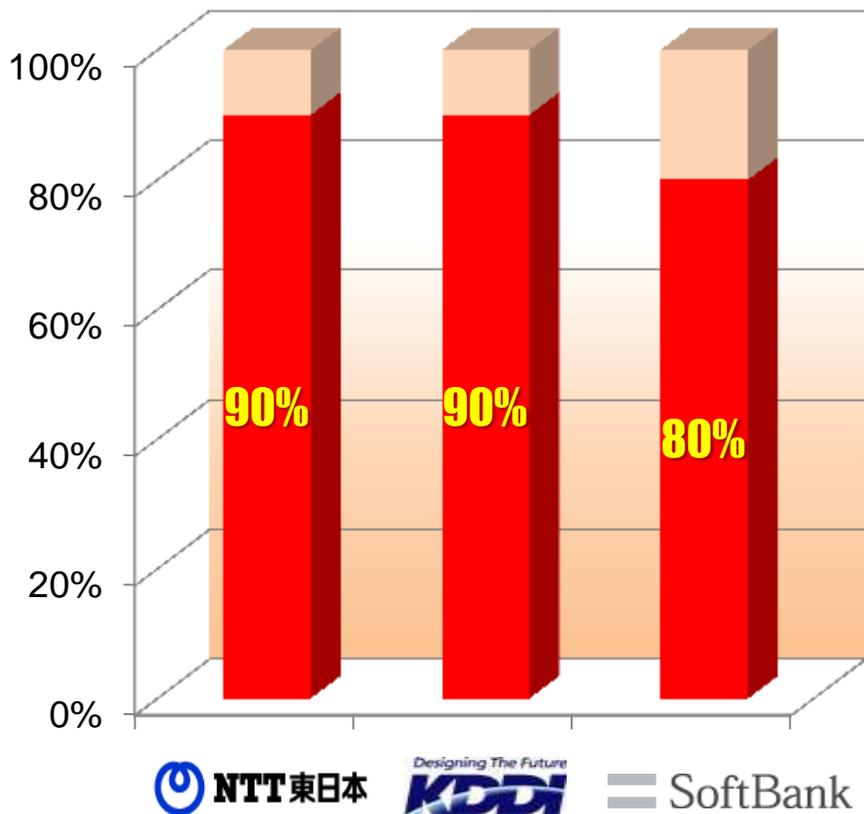
Alleviating congestion in emergency situations

Fixed-line Communications

Carriers restricted phone traffic by as much as 80 to 90 percent.*

* There was 4 to 9 times the normal volume of traffic (NTT East.)

Max. outgoing traffic restrictions



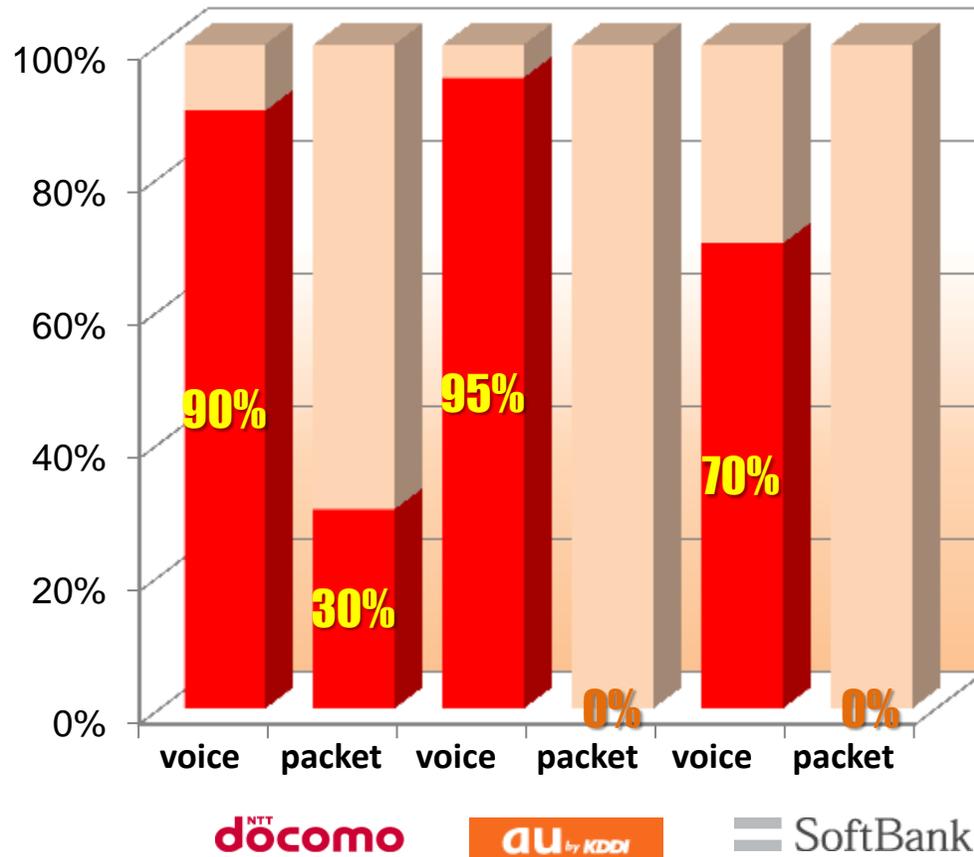
Mobile Communications

Carriers restricted voice traffic by as much as 70 to 95 percent.*

Packet traffic, however, was either not restricted or restricted at a lower rate than voice traffic.

* There was 50 to 60 times the normal volume of traffic (DoCoMo). eMobile was not subject to restrictions.

Max. outgoing traffic restrictions



Planned Revision to Technical Standards on Measures for Countering Congestion and for Ensuring Important Communications 5

● Network design capacity and communications quality reporting, etc.

- Reporting to MIC of basic policy for network capacity and measures for usage restrictions and preferential treatment of important communications.
- Regular actual measurement and reporting to MIC of communications quality (connection quality, etc.).
- Disclosure in appropriate form of information helpful to users on basic policy for network capacity and on measures for usage restrictions.

● Analysis of communications status during usage restrictions

- Preservation and analysis of data on status of important communications and general communications during usage restrictions in the event of disaster, and continuing review of network design capacity and implementation rules for usage restrictions etc. and reporting thereof to MIC.

● Disclosure of congestion status

- Immediate disclosure of status of congestion and usage restriction in the event congestion occurs.
- Announcements and appeals to avoid making inessential and non-urgent calls and to keep call time as short as possible, and to use communication methods other than voice calls, including emergency message services.

Extending the list of target institutions for emergency priority calls

Careful consideration based on a review of network design capacity

Introducing call length limits

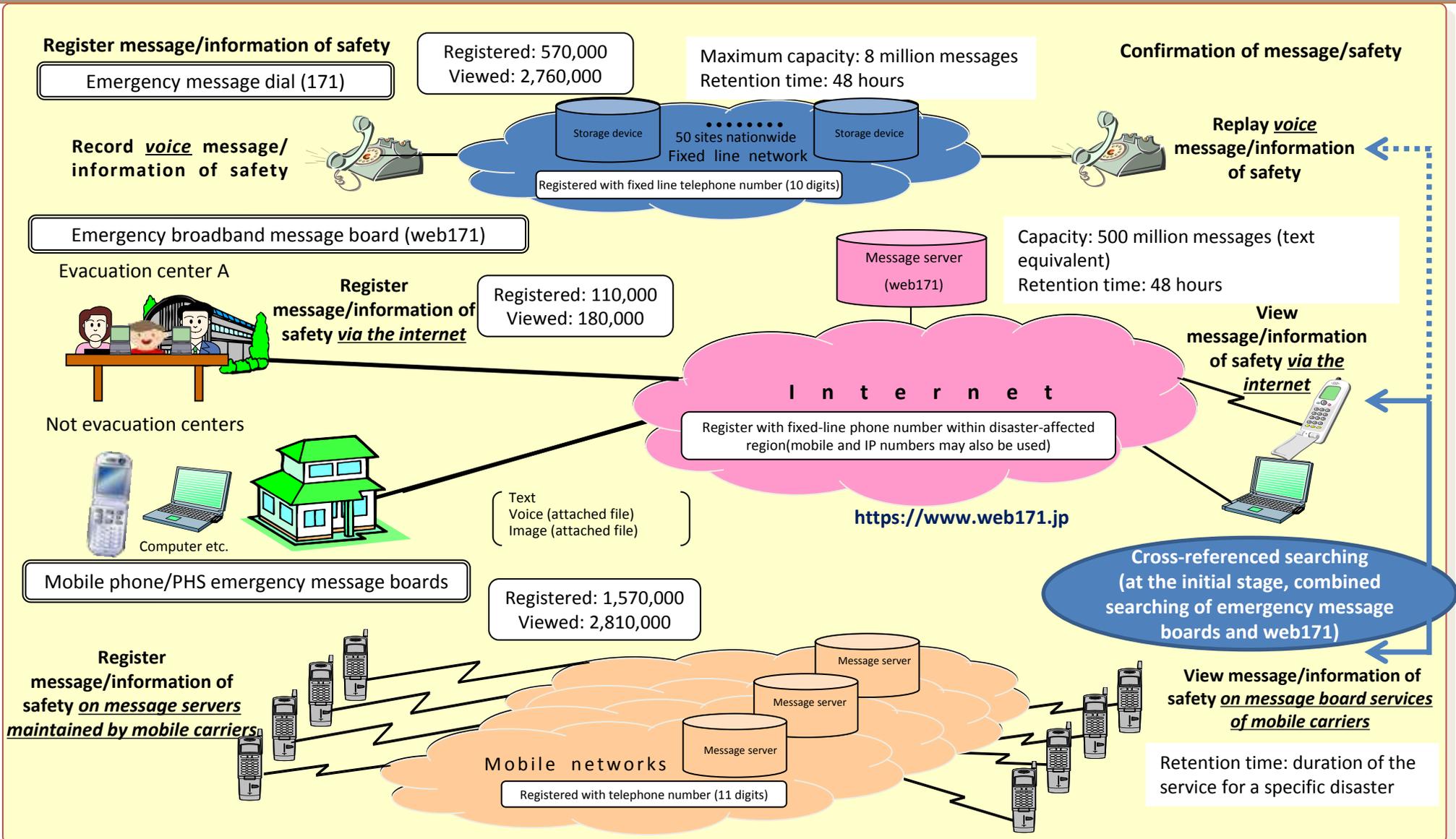
Issue for future study

Introducing phone calls with reduced sound quality

Issue for future study

Upgrading Emergency Message Services (cross-referenced searching) 6

Upgrading emergency message services is now under consideration to allow cross-referencing (i.e. searching) of different emergency message services.

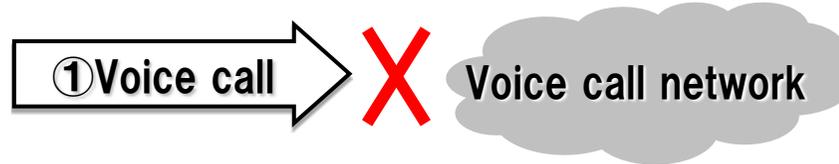


Designing a Service to Convert Voice Messages into Data Files

- Mobile carriers are introducing emergency voice message services for sending voice messages via the packet network at times of disaster. (NTT DoCoMo introduced in March 2012 and KDDI plans to introduce in and after the spring of 2012.)
- A set of guidelines has been prepared that includes interface specifications for interconnection between mobile carriers to enable cross-communication among carriers.

How the service works

It is difficult to make contact because there is congestion after disaster



Send voice messages by means of packet communications

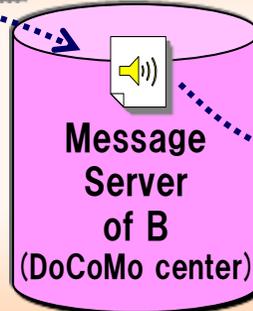


Send voice messages

Message replay notifications

(4)SMS notifications to A
Notice that B received the message automatically

Packet network



(2)SMS notifications to B
Notice that B received the message

Message receipt notifications

Receive voice messages

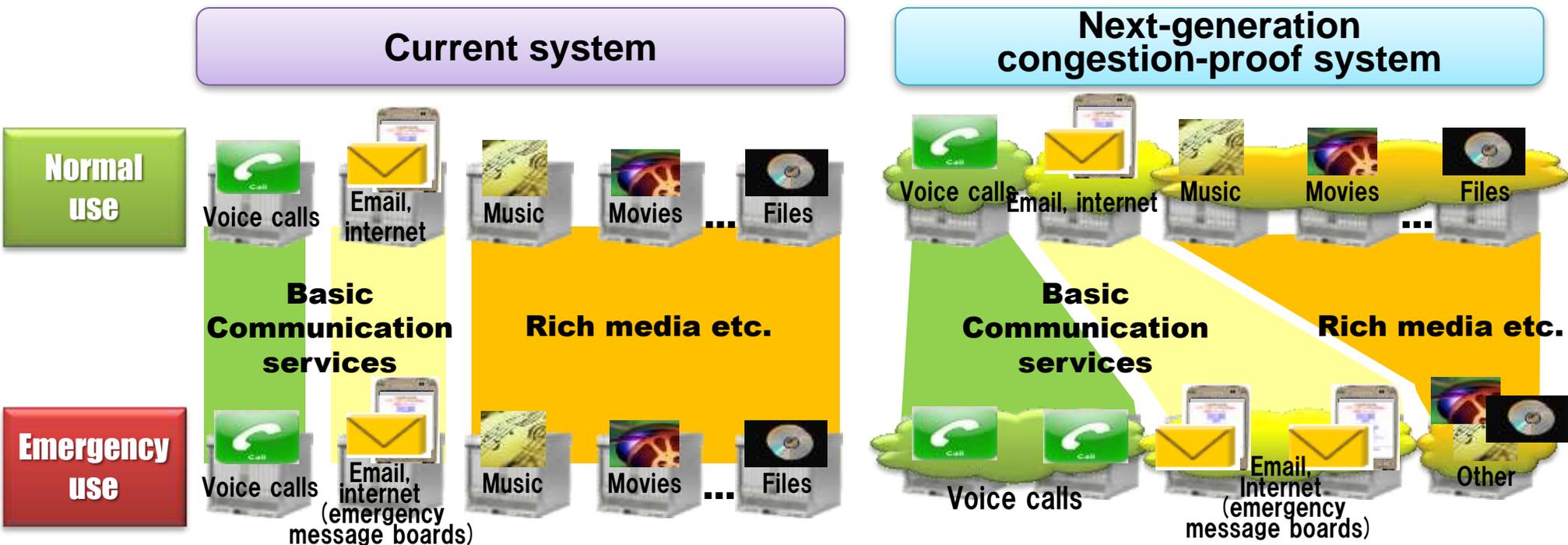
(3)Replay messages
Download and replay voice messages



R&D into Congestion-proof Mobile Networks

- Mobile phones currently use static, dedicated servers and function sets for basic communication services (such as voice calls and emailing) and for rich media (such as movies). R&D will be conducted based in Tohoku-region into the potential for next-generation systems to provide dynamic control allowing flexible reconfiguration of communication processing resources so that the maximum possible resources can be directed to basic communication services during a major disaster.

【Third FY 2011 supplementary budget】



Communication services (voice calls, Email, and rich media, etc.) are separated into fixed, dedicated systems. This means that communication processing resources cannot be reconfigured or redirected in the event of a major disaster.

Greater flexibility with communication processing resources allows optimized allocation of resources during normal use and in the event of a major disaster, when maximum resources would be directed to basic communication services needed for rescue operations and confirming the safety of others.

1 Ensuring voice call capability

- Upgrade the design capacity of facilities such as switches to improve overall communication capacity
- Ensuring the stable viability of emergency priority calls

2 Expanding/improving means of communication other than voice calls

- Boosting the sophistication of emergency message services
- Voice-based services not employing the telephone network
- Addressing delays in mobile phone text message transmission



3 Keeping users informed of available means of communication during emergency

- Effective information distribution via emergency notifications to mobile phones and broadcast media
- Sharing and supplying of congestion and communications restrictions information through cooperation between the government and carriers
- Education and distribution of information on communication methods during states of emergency in ordinary times

4 Designing robust networks to cope with congestion

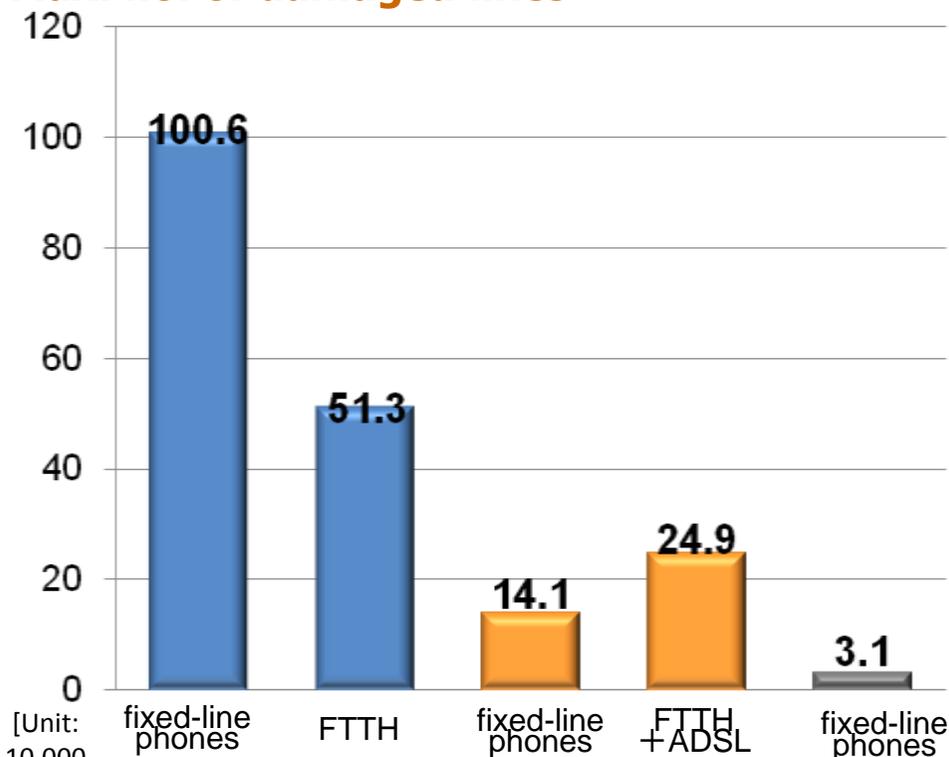
- Development and demonstration of new technologies that emphasize congestion resistance

**Minimizing disruption to
communications in the event of
damage to base and/or relay stations**

Fixed-line Communications

A total of approx. 1.9 million communication lines were damaged.

Max. no. of damaged lines



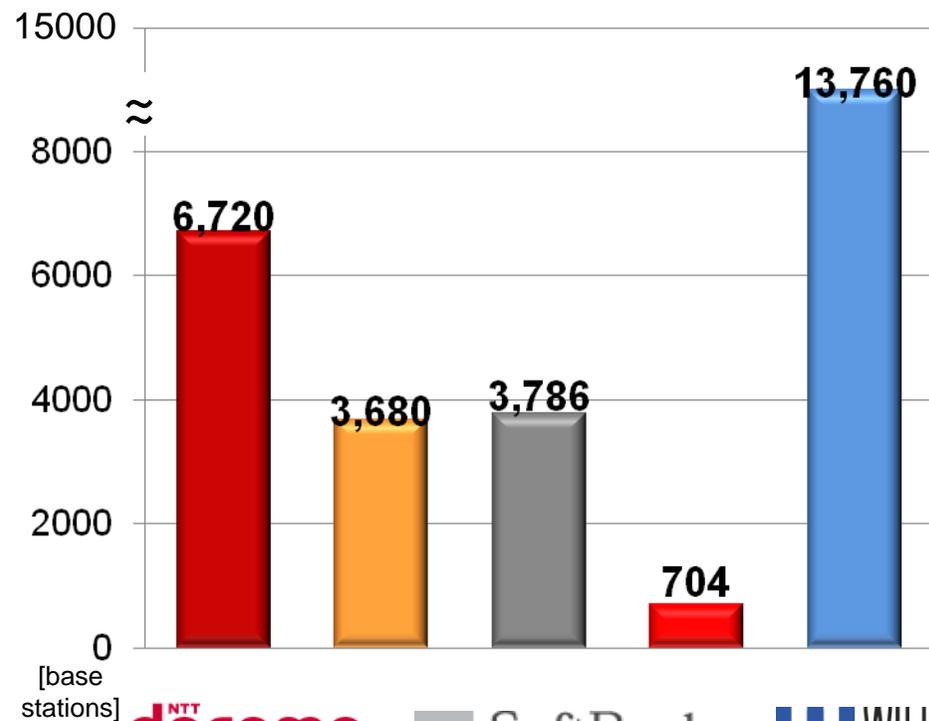
[Unit: 10,000 Lines]



Mobile Communications

A total of about 29,000 base stations were damaged.

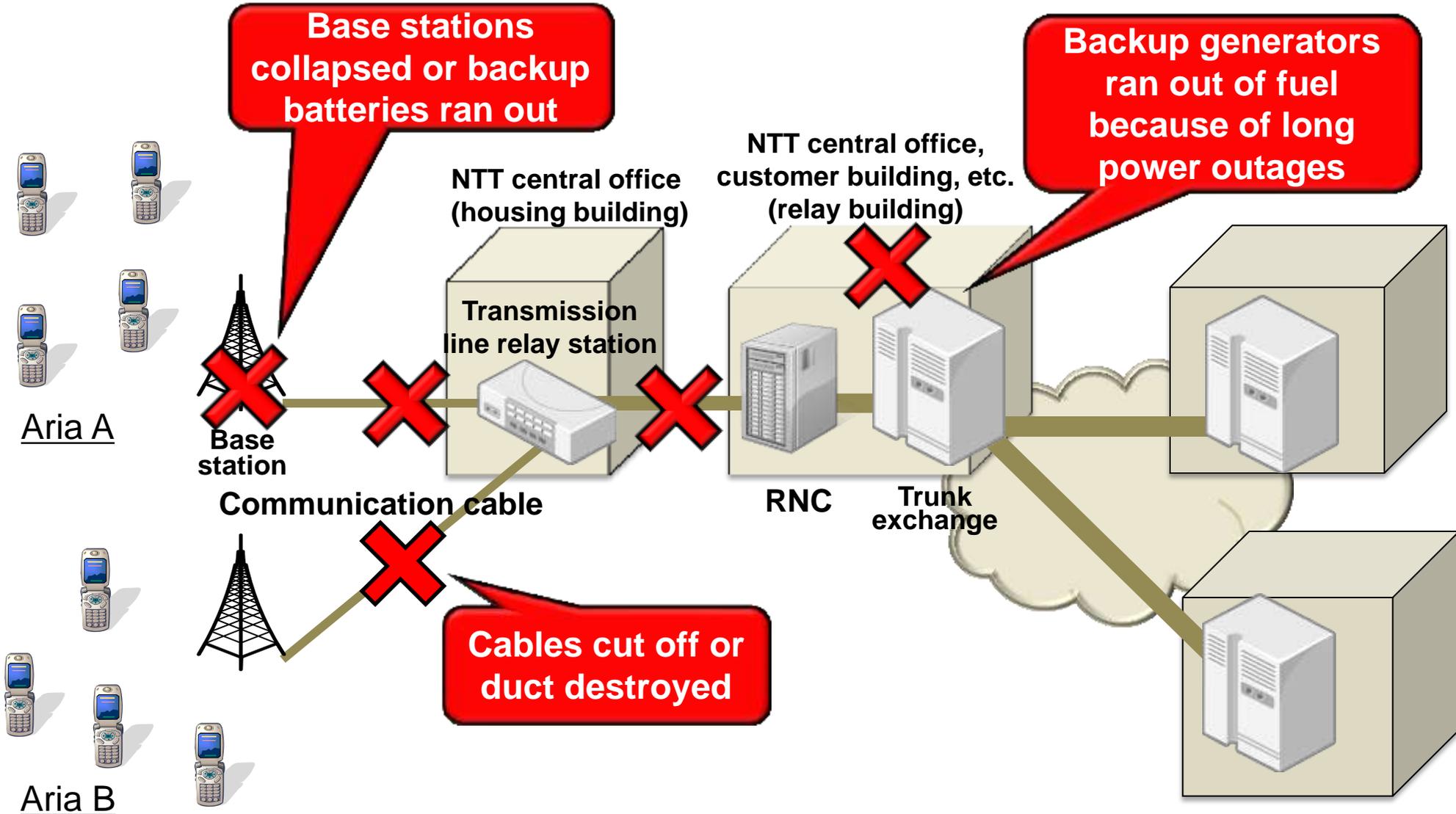
Max. no. of damaged base stations



[base stations]



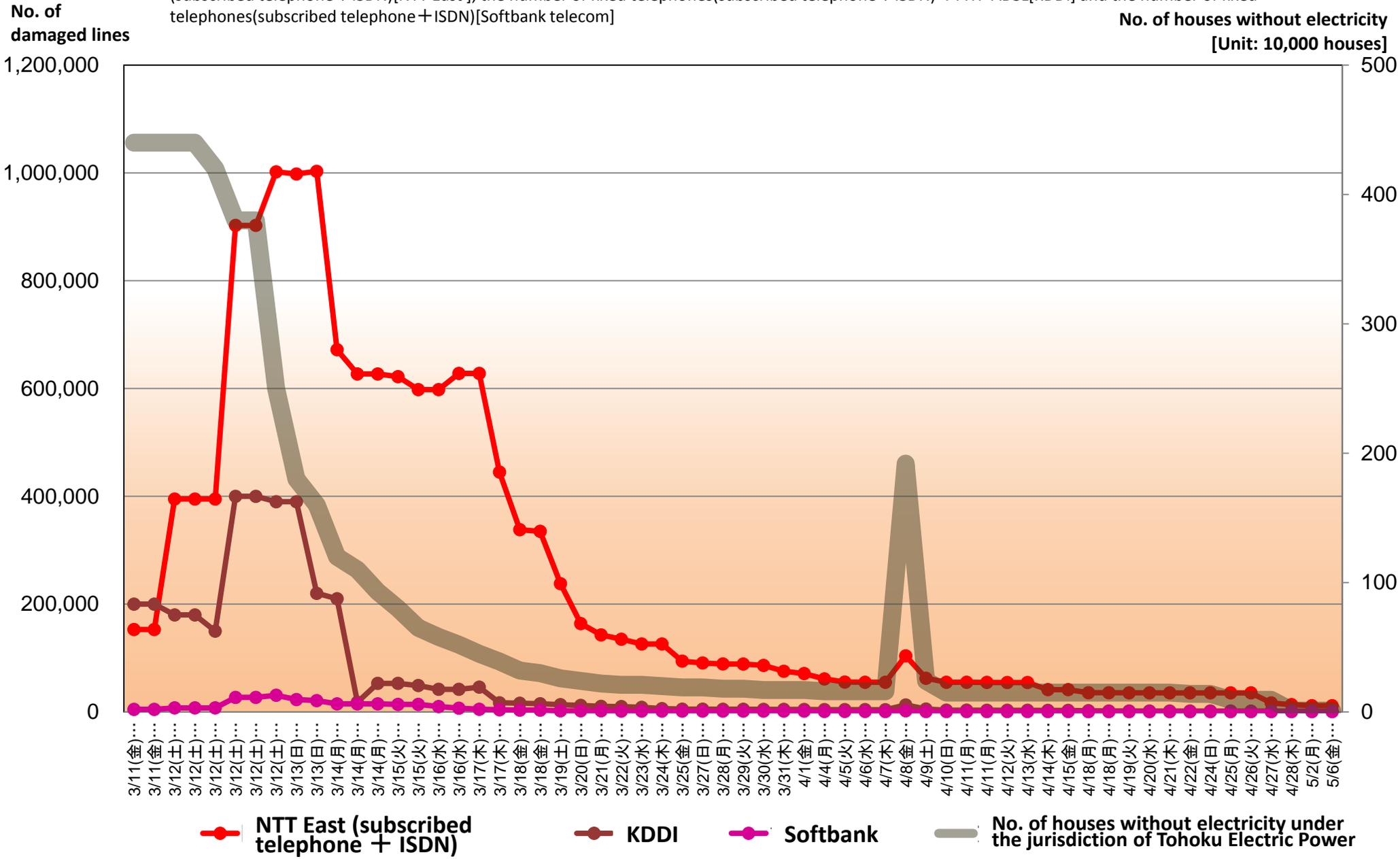
Locations of Damage to Mobile Networks



Changes in No. of Damaged Fixed Phone Lines

※ This graph is made by MIC on its own accord based on reports from telecommunication carriers and shows the number of fixed telephones (subscribed telephone + ISDN)[NTT East], the number of fixed telephones(subscribed telephone + ISDN)・FTTH・ADSL[KDDI] and the number of fixed telephones(subscribed telephone + ISDN)[Softbank telecom]

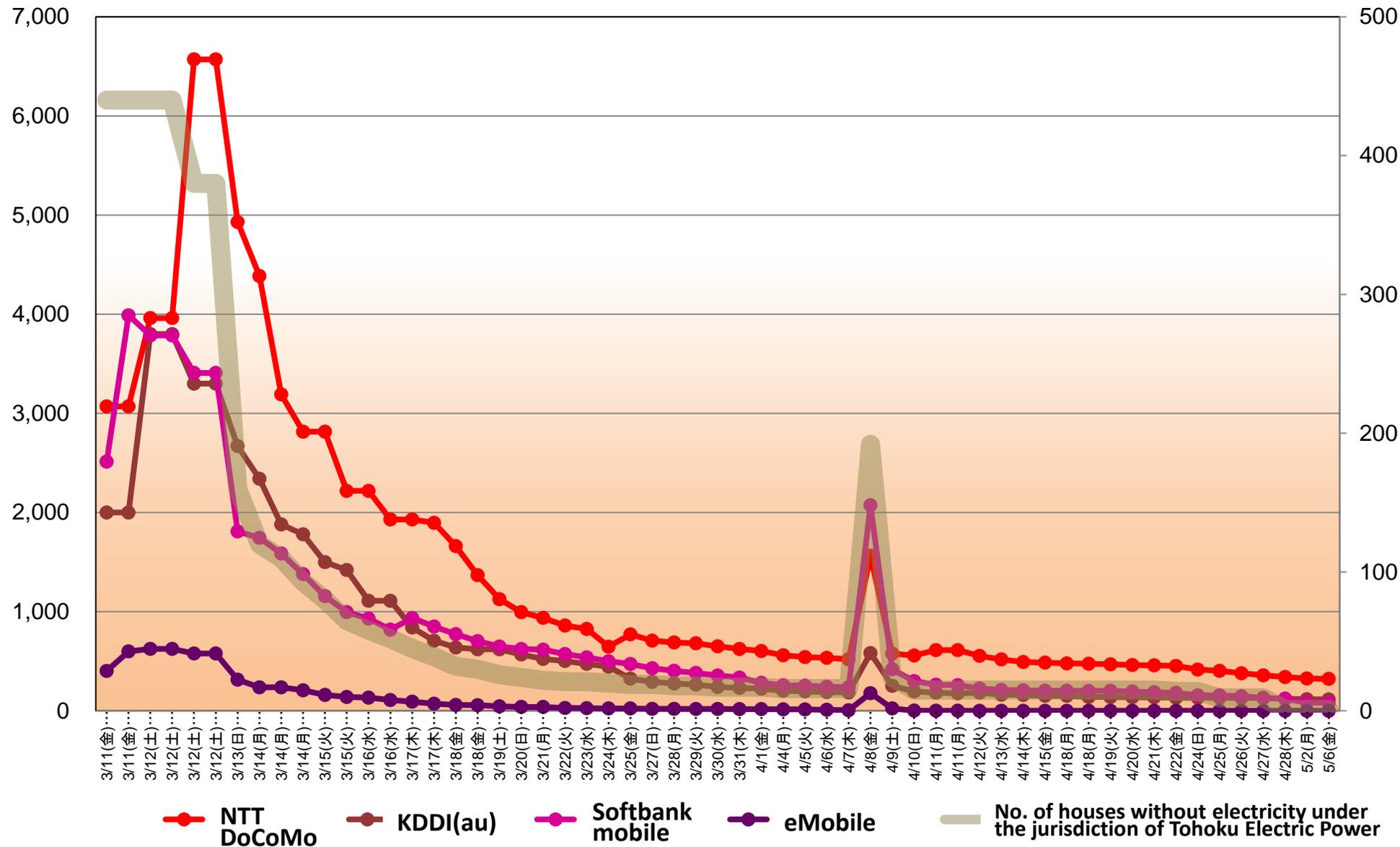
No. of houses without electricity
[Unit: 10,000 houses]



Changes in No. of Disabled Mobile Base Stations

No. of disabled base stations

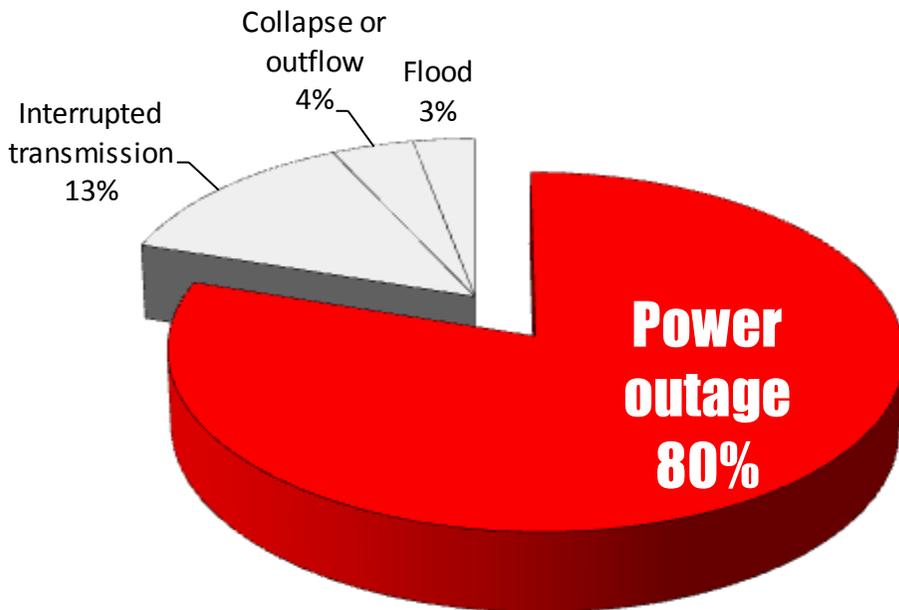
No. of houses without electricity
[Unit: 10,000 houses]



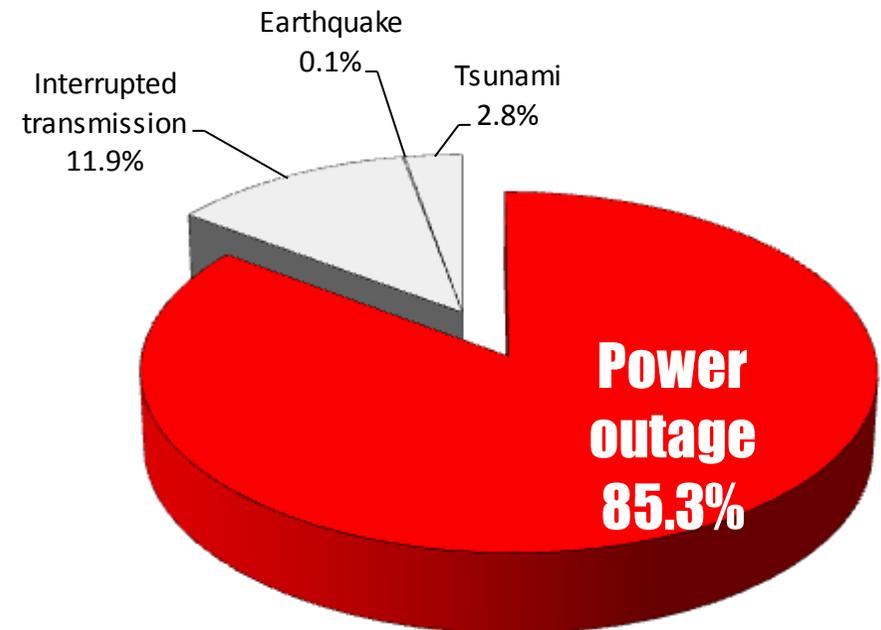
Causes of Damages Resulting from the Great East Japan Earthquake 15

■ The Great East Japan Earthquake of 11 March, 2011 rendered unusable approx. 1.2 million fixed telephone lines and approx. 15,000 base stations for mobile telephones. Over 80% of communications breakdown in either case was caused by widespread and prolonged power outages.

Fixed telephone



Mobile telephone



Planned Revision to Technical Standards on Measures against Trunk Lines Cutoff

● Use multiple transmission routes between exchanges

- Installation of multiple transmission routes between exchanges in principle.

● Measures for duplicate routes using loop structures

- Installation of backup routes (e.g. crossing loops in ladder formation), deployment of equipment for installation of temporary lines to prevent widespread and prolonged service outage due to damage in multiple locations. .

● Measures for base stations servicing core emergency response facilities

- Installation of backup lines and multiple routes on entrance links to mobile base stations that service core emergency response facilities such as prefectural and municipal government offices.

● Reporting and disclosure on measures against trunk lines cutoff

- Reporting to MIC of measures against trunk lines cutoff (e.g. basic policy for backup of equipment in a disaster, and information on main backup equipment, including large zone base stations and micro-entrance links, and the coverage area thereof) and status of deployment of equipment for emergency restoration (e.g. truck-mounted base stations).
- Disclosure in appropriate form of information helpful to users including coverage areas of large zone base stations with extra disaster protection.

● Geographical dispersion of mission-critical telecommunications equipment

- Geographically dispersing mission-critical equipment such as authentication systems and servers.

Planned Revision to Technical Standards on Measures against Tsunami/Flooding , Equipment Damage/Failure and Power Outage

【Measures against Tsunami/Flooding and Equipment Damage/Failure】

●Consideration of hazard maps

- Taking measures with reference to anticipated damage outlined on the hazard maps produced by local governments in installing equipment, buildings that house equipment and exterior equipment and adequate protection thereof.

【Measures against Power Outage】

●Longer operation times for backup power generators and storage batteries

- Taking necessary measures, including stockpiling of sufficient fuel and securing means of supplement, considering a possibility of widespread and prolonged power outage that affects operation times for backup power generators and storage batteries, with respect to equipment that provide communications functionality to core emergency response facilities such as prefectural and municipal government offices..

●Reporting/disclosure of backup power systems and procedures

- Reporting to MIC of measures against power outage (e.g. basic policy for operation times of communications functionality during a power outage, information on equipment with added protection against power outage and corresponding coverage areas, fuel reserves and supply systems) and status of deployment of equipment for emergency restoration (e.g. mobile power generator trucks).
- Disclosure in appropriate form of information helpful to users including coverage areas of mobile base stations with backup power.

Public Telephones as an Effective Means of Communication in Disasters

Number of permanent public telephones (Type I)

- Current 109,000 public telephones should be maintained so as not to reduce the level of their provision as “minimal means of outdoor communication”, including their role in disasters and other emergencies.



Ad-hoc public telephones

- It is hoped that NTT East & West promote measures for ex-ante installation of ad-hoc public telephones at evacuation points and in convenience stores, as well as ex-post installation.



Measures for improving convenience

Providing information on where public telephones are located

- NTT East & West should, using Web pages and other media, at an early stage disclose widely the locations at which permanent and ad-hoc public telephones are installed without confusing users.



Caller ID for ad-hoc public telephones

- NTT East & West should act to resolve the situation whereby telephone users who have disabled their incoming caller ID notification are unable to receive calls made from ad-hoc public telephones.

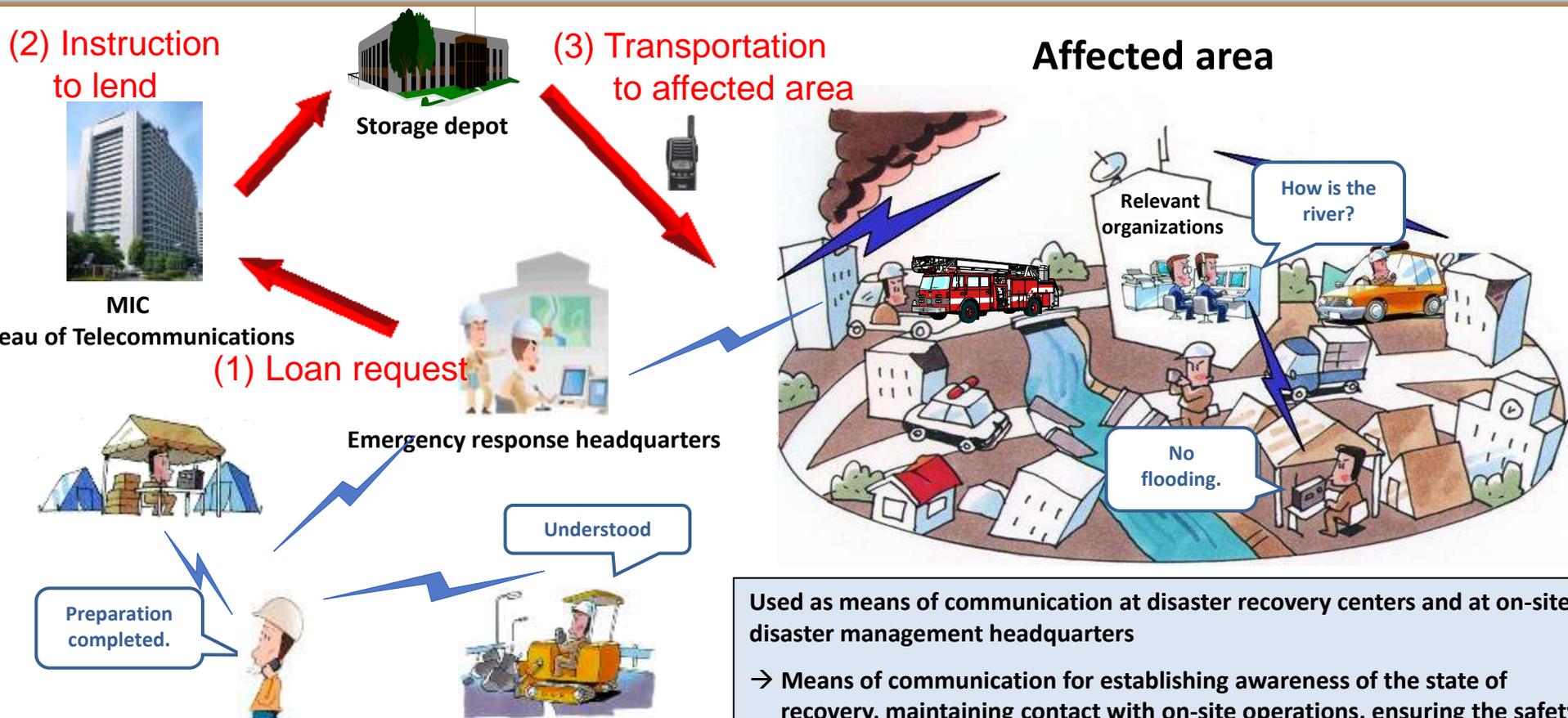


Announcements to users

- NTT East & West should make efforts to publicize the necessary instructions on methods of use for when call charges are to be waived during a disaster or other emergency.
- Japan’s Telecommunications Carriers Association(TCA) and MIC should make efforts to publicize this information as well as publicizing the universal service system.

Distribution or Gratis Loan of Satellite-based Mobile Phones

- Such equipment is provided when communications facilities have been damaged due to disaster and local residents' communications have been interrupted. As a support measure for securing means of communications for local governments in a time of disaster, MIC maintains reserve stores of satellite-based mobile telephones and simple radio communication devices and is formulating a system for prompting lending these terminals free of charge to affected local governments.
- In the Great East Japan Earthquake, the Ministry loaned 214 satellite-based mobile telephones, 230 multichannel-access (MCA) radio communication devices, and 1,355 simple radio communication devices.



Used as means of communication at disaster recovery centers and at on-site disaster management headquarters

→ Means of communication for establishing awareness of the state of recovery, maintaining contact with on-site operations, ensuring the safety of victims, and procuring essential supplies

Main opinions given in study group

- It is necessary to establish at state level a set of rules or a system for securing and transporting fuel in emergencies.
- Agreements on fuel provision are needed between telecommunications operators and oil companies and between local governments and oil industry organizations.
- It is necessary for information on securing and transporting fuel and supplies in emergencies to be provided rapidly, and for the information to be shared and coordinated between the parties involved.
- For emergencies are required deregulation in the transport of fuel and supplies and swifter, more flexible procedures.
- It is necessary to prioritize fuel supplies for vehicles involved in emergency-response recovery activities.

Partial amendment of Japan's Basic Disaster Management Plan (Decision by the Central Disaster Management Council, 27 December, 2011)

Disaster
preparedness

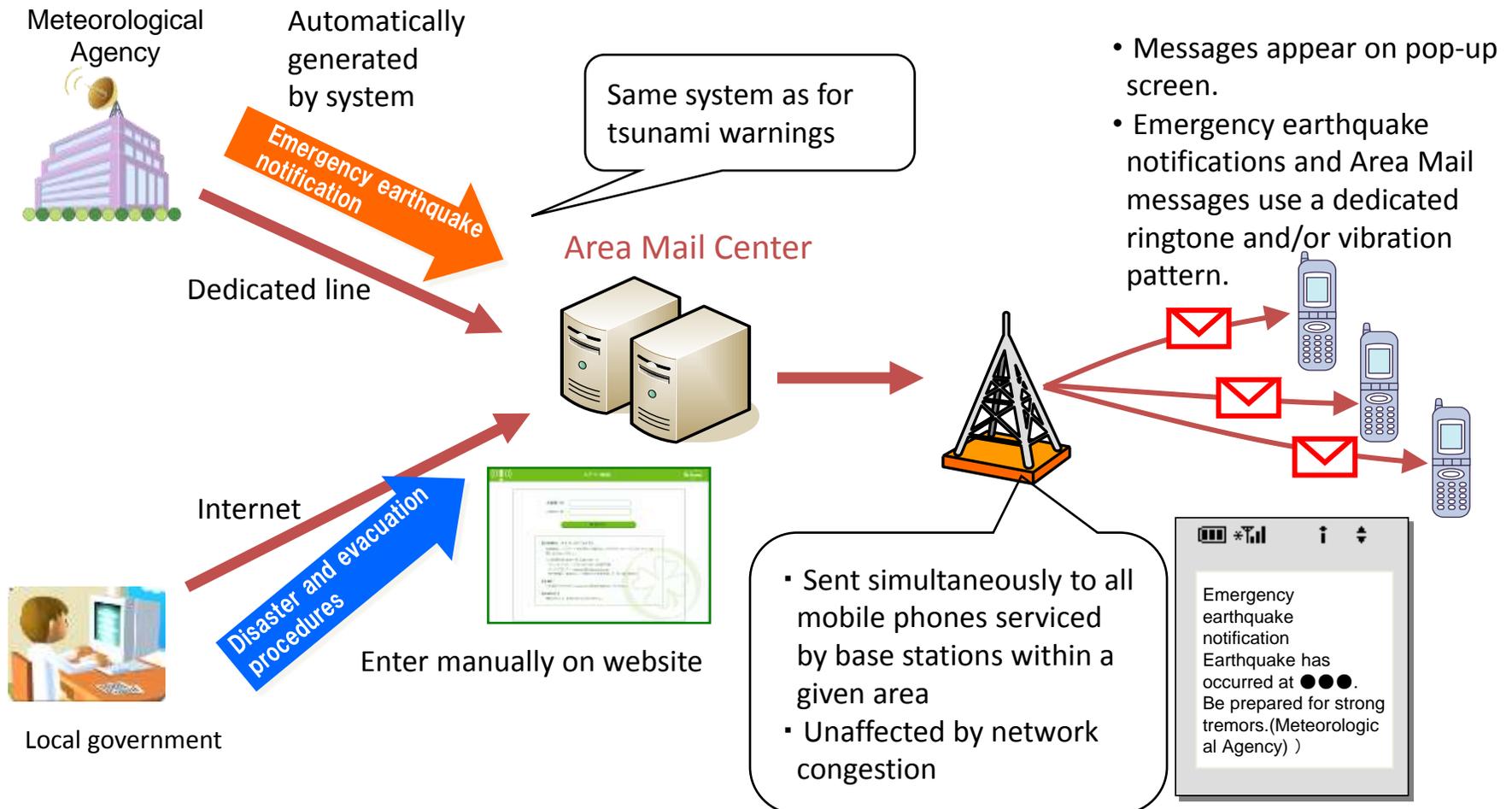
- Added is the obligation of business operators to make efforts to respond to shortages in essential supplies of fuel and electricity.
- Added is the obligation of the state, public bodies, local authorities, and disaster-prevention organizations to make efforts to develop appropriate systems for the reserve storage, procurement, and transportation of fuels and other essential supplies.
- "Fuels" have been added to the list of items for which the state shall develop systems of reserve storage and procurement.

Disaster
response

- Provisions have been added to the effect that the Agency for Natural Resources and Energy (ANRE) shall, as necessary, or if requested to do so by emergency headquarters, the relevant ministries, or local authorities in affected regions, arrange to ensure fuel supplies by gaining the cooperation of the relevant industry associations.
- Provisions have been added to the effect that the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) shall, in cases deemed exceptionally urgent, assist affected local authorities by assuming responsibility for the traffic flows and check points necessary for the passage of emergency vehicles, where the identity of persons carrying out relief operations in the aftermath of a large earthquake may be difficult to verify.

Using Mobile Phones Effectively for Emergency email Notifications ²¹

- Along with NTT DoCoMo, which has already provided an emergency email notifications (e.g. Area Mail service), KDDI and SoftBank Mobile introduced the service in January 2012.
- They are also widening the scope to include tsunami warnings as well as emergency earthquake notifications, in conjunction with the Meteorological Agency.



Overview of Minimizing Disruption to Communications in the Event of Damage to Base Stations and/or Relay Stations

1 Emergency repairs to damaged telecommunications infrastructure

- Emergency repairs to base stations, local stations and transmission routes (Application of satellite communications network)
- Network sharing and collaboration between carriers during states of emergency

2 Providing communications capability to disaster-affected regions and evacuation centers

- Securing and providing communications capability based on the length of time elapsed since disaster struck
- Advance deployment of effective means of communication in evacuation centers, etc.

3 Ensuring stability of power supplies

- Ensuring emergency generators (including ensuring fuel) suited to the type and size of telecommunications facilities
- Dissemination of information on the availability of fixed-line phones during electrical blackouts, and promotion of the use of battery powered fixed-line phones

4 Providing emergency information and disaster damage reports

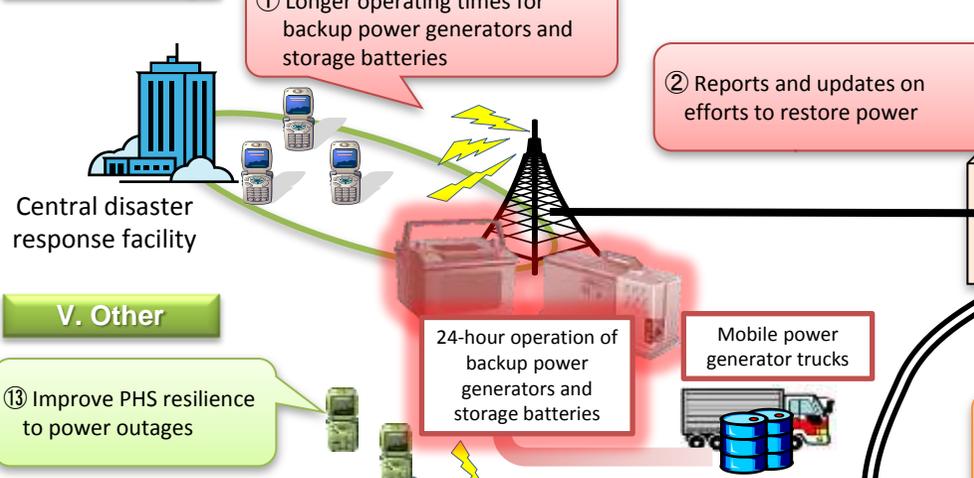
- Effective use of emergency notification text messages on mobile phones
- Enhancement and improvement of restoration area maps



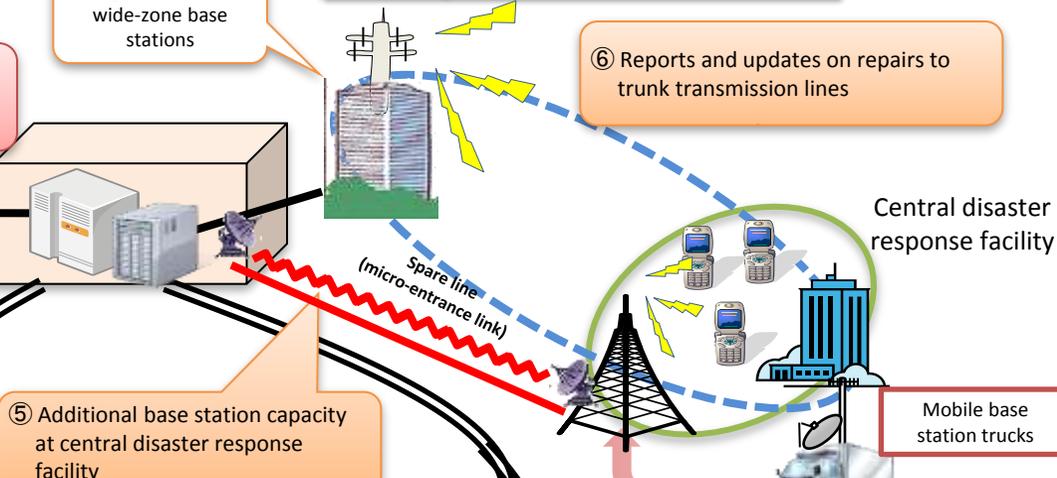
Implications of the recent disaster for future network infrastructure

Overview of Planned Revisions to Technical Standards on Safety and Reliability

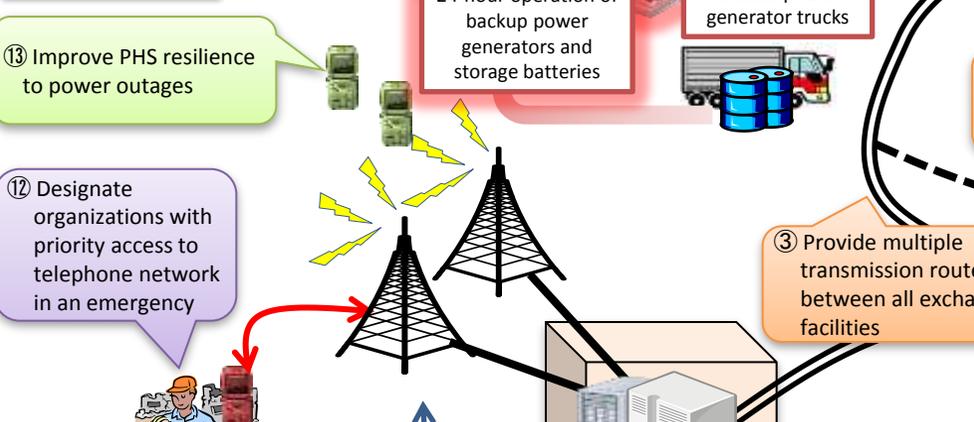
I. Power outage



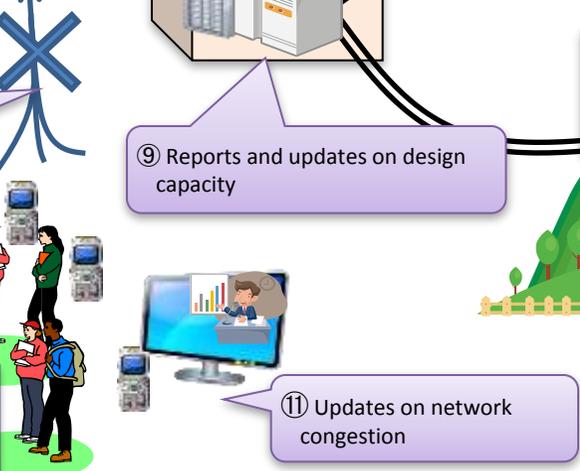
II. Damage to trunk transmission lines



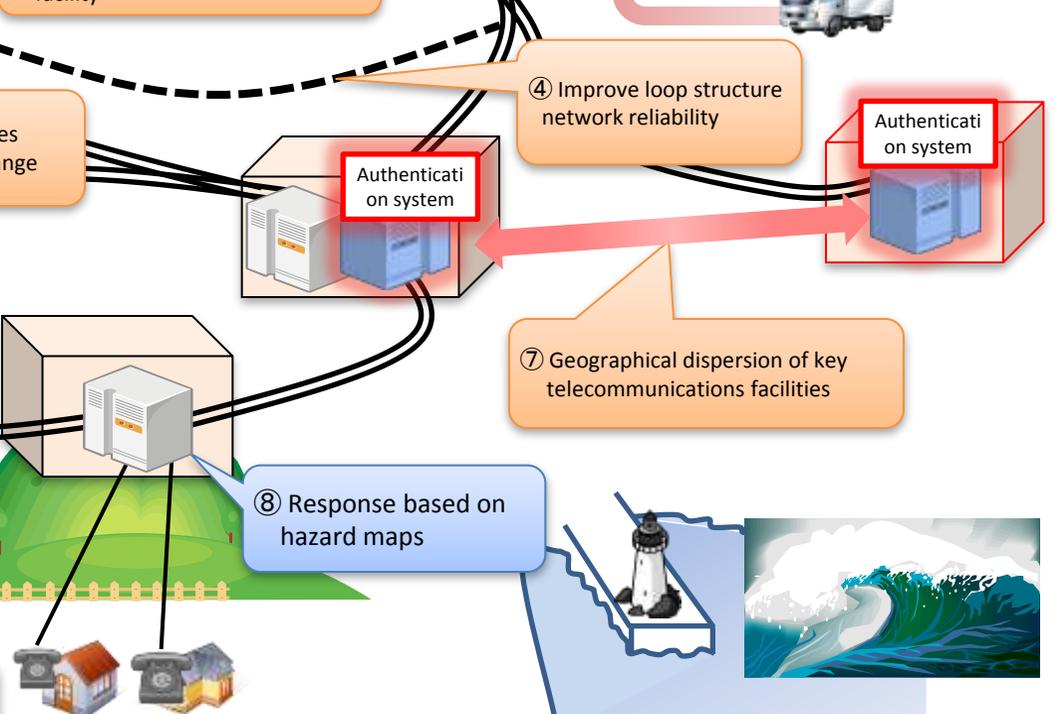
V. Other



IV. Network congestion and priority communication services



III. Tsunami/flooding



Burial of Communication Cables

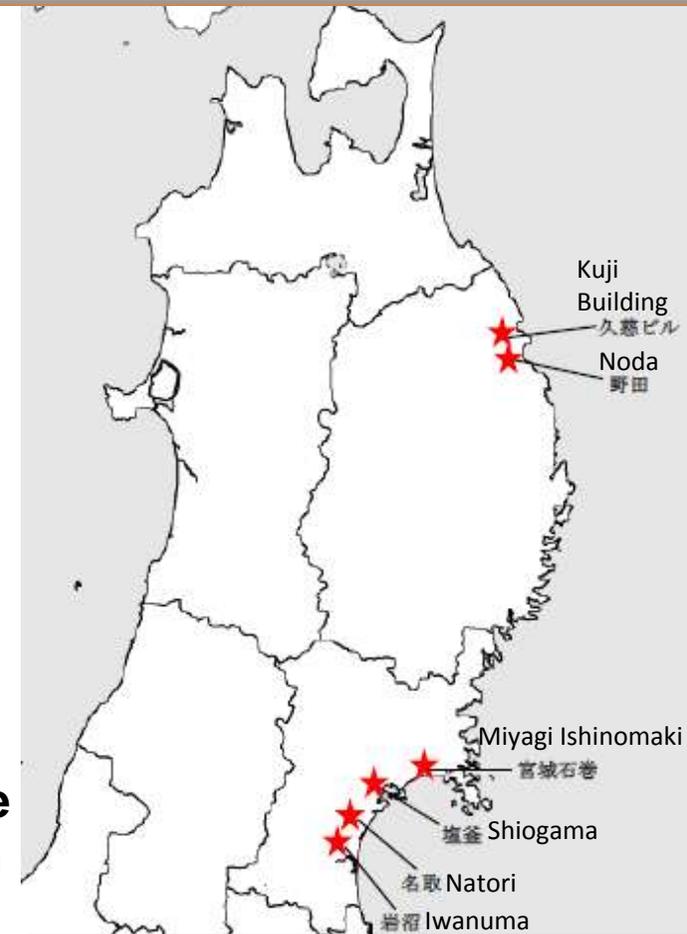
- In the Great East Japan Earthquake, buried communication cables were damaged less than aerial cables.
- According to sample data from tsunami-hit areas (Noda and Kuji Building in Iwate Prefecture, Shiogama, Iwanuma, Miyagi Ishinomaki, Natori in Miyagi Prefecture*), the damage rate for aerial cables was approx. 26 times that for buried cables.
- In the Great Hanshin-Awaji Earthquake of 1995, the damage rate for aerial cables was approx. 8 times that for underground cables according to the final macro data.

* Locations given in parentheses () refer to the names of buildings of NTT East

	A Total facilities (span)	B Tsunami-hit facilities (span)	Damage rate = B/A (%)
Aerial facilities*	25,814	2,048	7.9%
Underground facilities*	16,455	53	0.3%

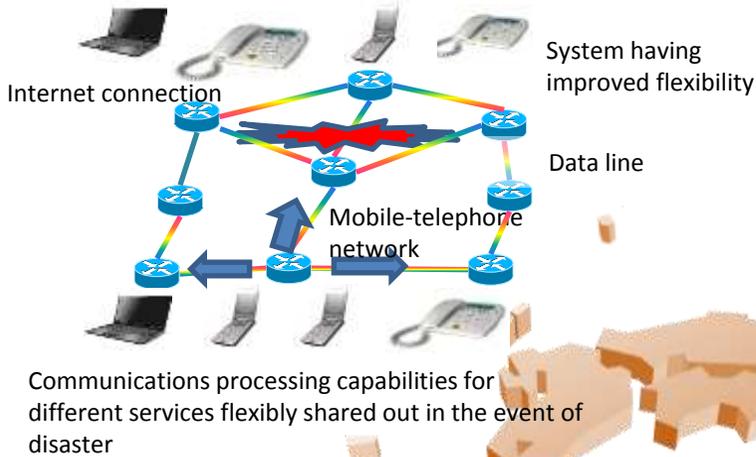
*Facilities are communication cables

Introduction of local government common duct should be promoted in order to encourage burial of communication cables and strengthen network disaster-resistance.



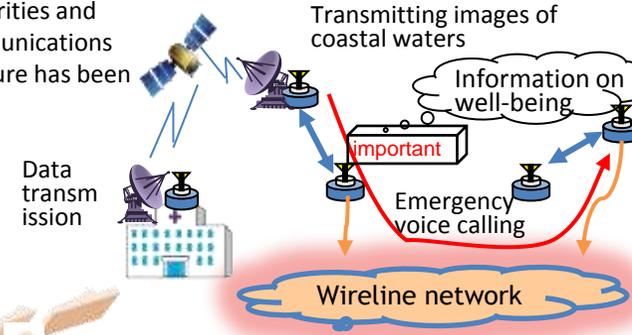
(1) Research and development of technologies for reducing the incidence of mobile-telephony congestion during disasters

This project establishes communication technologies for maintaining the use of voice calling during disasters, when voice communication increases dramatically as users make safety confirmation calls. The technologies make intensive use of non-voice communication-processing capabilities and of communications equipment located outside the affected regions.



(2) Research and development of technologies for autonomous recovery of disaster-damaged infrastructure

This project establishes radio communications technologies for ensuring autonomous access by local authorities and public facilities to the Internet and other communications even if the regular communications infrastructure has been damaged by disaster.



Research and development, testing/verification/evaluation

Forming a world-leading research center

Fostering innovation, strengthening collaboration between industry, academia, and government, and promoting standardization and developing results through joint research with universities in the affected regions



(3) Provision of research center at Tohoku University, etc.



- Achieving information and communications networks that are robust in disasters
- Reviving local economic activity in affected regions

Japan's National Institute of Information and Communications Technology (NICT) has provided Tohoku University with test bed facilities for testing, verification, and evaluation supported by the NICT facilities-improvement fund.

→ Provided are communications network testing equipment introducing the world's most advanced optical transmission technology, used in testing technologies for reducing network congestion; field-portable radio network equipment, used in testing autonomous recovery technologies; and field-portable satellite earth station equipment.

Revisions of the Emergency Communications Council

The Emergency Communications Council

- Established for the purpose of smoothly securing radio communications in emergencies, in accordance with the provisions of the Radio Act, which require ensuring smooth operation of emergency communications necessary to enable lifesaving, disaster rescue and transportation communications, and maintaining order
- Total membership: some 2,000 bodies (comprised of disaster-prevention related organization such as the national government, local governments, and telecommunications carriers)
- Examine and train on emergency communication routes and structure assuming an interruption in communications networks used in ordinary times



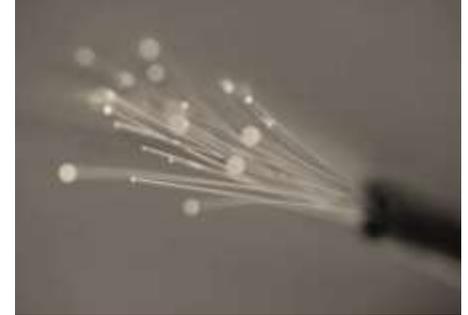
Revisions

- Promoting the participation of critical infrastructure-related bodies, not all of which participate at present
- Establishment and operation of a new system for gathering and sharing of information on disaster conditions provided by members
- Strengthening of liaison and coordination and of mutual support systems based on disaster information
- Enhancing training that includes countermeasures for large-scale, wide-area disasters and prolonged power outages
- Using new disaster-preparedness ICT and fostering improved durability of government radio systems for disaster preparedness

Overview of Implications of the Recent Disaster for Future Network Infrastructure

1 Improving the disaster resilience of networks

- Ensuring network safety and reliability
- Infrastructure deployment to suit the recovery plan of the affected area
- R&D to improve network disaster-resistance



2 Setting up systems and structures for responding to disaster

- Verification/review of structure for responding to disasters at relevant telecommunications carriers
- Information sharing/conveyance structure between the national government, relevant enterprises and local governments



Implications of the recent disaster for future Internet usage

Review of Bandwidth-Control Guideline

Background to bandwidth control

- Internet traffic has increased dramatically with the spread of broadband. In particular, situations in which heavy users occupied too much network bandwidth existed.
- Some ISPs applied bandwidth control to deal with the occupation of bandwidth by heavy users.

Formulating the guidelines for bandwidth-control operating standards

- In May 2008, an association of telecommunications operators (with MIC participating as observer) formulated a guideline for bandwidth-control operating standards (partly revised in June 2010). The purpose of the guideline is to establish minimum-requirement rules for operating standards, so avoiding arbitrary bandwidth controls.

Overview of guideline for bandwidth-control operating standards

- Categories of bandwidth control
 1. Control of communications bandwidth by heavy users exceeding a set traffic volume
 2. Control of communications bandwidth targeting specific applications (e.g., P2P)
- Organizing issues related to the Telecommunications Business Law: secrecy of communications, non-discrimination between users, and information disclosure

A review of the guideline is due at the end of the current fiscal year, which will focus on traffic control for temporarily restricting users' access to bandwidth across the board with a view to preventing entire network congestion during disaster.

Promoting the Publication in Digital Format of Data on Recovery/Reconstruction

- Given the need for access by mobile phones, for reducing the burden on networks, and for the secondary use of information, it is recommended that information be provided not only in such formats as PDF, Word and Excel, but also in HTML and CSV formats.

Title	Summary
<p>File formats for disclosing important information to the public (18 March, 2011: LASDEC → all local governments)</p>	<ul style="list-style-type: none"> Publish information in HTML format, not in PDF alone. Use JPEG format, instead of PDF, as to scanned paper documents. Use CSV format, instead of Excel format, as to tabular data.
<p>Request for cooperation in providing disaster-related information (22 March, 2011: Cabinet Public Relations Secretary → every ministry)</p>	<ul style="list-style-type: none"> Listings on each ministry's Web site should provide the necessary information in a timely manner and in a form easily understood by citizens. Promptly make Web pages accessible by mobile phones. Change PDF Web content to HTML format.
<p>File formats for providing information on earthquakes occurring off the Tohoku coast (29 March, 2011: MIC → every ministry)</p>	<ul style="list-style-type: none"> As far as possible, use file formats, such as HTML and CSV, that place a relatively light burden on communication lines, rather than using only the more data-heavy file formats, such as PDF.
<p>Data formats for publishing information on earthquakes occurring off the Tohoku coast (30 March, 2011: METI → Keidanren)</p>	<ul style="list-style-type: none"> As far as possible, use data formats suited to automated processing, such as HTML and CSV, rather than using only data formats that are difficult to process automatically, such as PDF. Develop a separate open API for information dissemination

Issues on Relation between Information Sharing on the Internet and Personal-Data Protection

Principle of rules for personal-data protection

- In principle, prior consent of a person is necessary in providing personal data of the person.

Measures taken during the Great East Japan Earthquake

- In some affected regions, the local governments applied the provisions on exemption in their personal data protection ordinances to disclose evacuee information to portal-site managers.
- Other local governments listed on their Web sites only the names of evacuees who had consented to the disclosure when asked to complete their evacuee's card on entering the evacuation shelter.

It is necessary to organize the relation between the important information (e.g. information on personal safety) in the time of disaster and the requirement of personal-data protection.

Consideration by the Central Disaster Management Council*

*Central Management Council

- Consists of Prime Minister (Chairperson), all ministers, heads of major public institutions and experts.
- Formulate Basic Disaster Management Plan and deliberate important issues on disaster reduction.

This issue is on the table in Committees of the Council (e.g. Committee for promoting measures to cope with disaster, Committee on the state of earthquake disaster prevention in small cities).

Overview of Implications of the Recent Disaster for Future Internet Usage

1 Maintaining the viability of Internet connections

- Safeguarding Internet access and functionality
- Approaches to network construction underpinning the Internet



2 Effective use of the Internet

- Information sharing over the Internet
- Use of social media services



3 Application of cloud services

- Active use of cloud services

4 Building collaborative frameworks among telecommunications operators to prepare for disaster

- Operator collaborations to secure communications in the event of a disaster