Part 1

Information and Communications in the Aftermath of the Great East Japan Earthquake

At 2:46 PM on March 11, 2011, an earthquake of magnitude 9.0 struck with an epicenter off the Sanriku coast of northeastern Honshu. With a seismic intensity of 7 in Kurihara City, Miyagi Prefecture, and 6 upper in Miyagi, Fukushima, Ibaraki, and Tochigi prefectures, it strongly jolted a wide area and triggered an enormous tsunami that struck the Pacific coast, causing severe damage especially in the Tohoku and Kanto Pacific coast regions[1].

The government of Japan established a Government Headquarters in Response to the Great East Japan Earthquake at 3:14 PM, and based on the nation's policy on emergency response to disasters, began collecting information, tracking the scale of damage, dispatching rescue missions, assisting survivors, taking emergency measures such as fighting fires, working to restore basic services to the affected areas, securing the necessary personnel and supplies, and providing clear information to residents of the affected areas.

The Ministry of Internal Affairs and Communications (MIC) established an MIC Response Headquarters at 2:46 PM the same day, and an MIC Emergency Disaster Response Headquarters at 4:00 PM, tracking the extent of damage, taking emergency disaster response measures, and working to restore services.

The information and communications infrastructure, which is essential to the lives of Japanese citizens, underwent tremendous damage in the earthquake and tsunami. The telecommunications infrastructure suffered from interrupted lines and electrical blackouts rendering ICT equipment unusable, primarily in the Tohoku and Kanto regions. In addition, the Great East Japan Earthquake's devastation of the ICT (information and communications technology) industry caused a ripple effect across the entire economy[2].

In the aftermath of the earthquake, private enterprises and others worked to restore infrastructure as quickly as possible, and various measures were taken including allowing use of public telephones free of charge and installation of extra public phones. Information was broadcast, and social media and other new online media allowed people to determine the status of victims and survivors and provide relief to survivors, highlighting the role of new technologies in post-disaster situations. On the other hand, rumors and false information spread via the Internet, and there was a clear disparity in ability to obtain information between Internet users and non-users, making it clear that ICT poses an array of challenges as well.

While the challenges involved with disaster response are constantly evolving, this white paper will examine the role played by ICT in the aftermath of the disaster on the basis of the situation as it stood in May 2011.

Section 1

Status of Telecommunications

1. Telecommunications damage

(1) Damage to the telecommunications network

In the earthquake and tsunami of March 11, equipment inside telecommunications buildings was damaged, submerged in water, or washed away; underground cables and pipes were severed or damaged; electical poles fell, suspended cables were damaged, and mobile phone base stations collapsed or were swept away. In addition, there was an extended disruption of commercial power supply, storage batteries dried up, and service was suspended.

Telecommunications carriers took steps to restore service as quickly as possible, including dispatching several dozen mobile power supply vehicles and 40 or more vehicle-mounted mobile phone base stations to the affected areas, as well as releasing restoration area maps and publicizing areas where telecommunications dam-

age had occurred.

Network infrastructure also suffered severe damage. Damage to telecommunications equipment along the coast included loss of numerous electrical poles and cables in the tsunami, as well as a great amount of equipment inside telecommunications facilities being damaged. Damage to trunk lines and master stations positioned along the coast meant that landline communications were disrupted and inland switching centers temporarily went out of service as well.

(2) Network congestion

The earthquake caused confusion in the transit network and concentration of communications traffic, resulting in relatively prolonged congestion of landline phones over a wide area.

Voice calls on mobile phones saw a surge in traffic, up to 50 or 60 times the normal volume in the case of NTT DoCoMo traffic, causing carriers to impose restrictions of up to 90% (NTT DoCoMo), 95% (KDDI) and 70% (Softbank). On the other hand, text messages (packets) faced much milder congestion, with only a 30% restriction im-

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1 On March 11, the Japanese Meteorological Agency named the earthquake the "2011 earthquake off the Pacific coast of Tohoku." Thereafter, the government renamed it the "Great East Japan Earthquake," in consideration of the scale of the disaster, which caused damage all across eastern Japan. It was determined that considering the size of this unprecedented multiple mega-disaster encompassing an earthquake, tsunami and nuclear power plant accident, it was important to the recovery and reconstruction effort to have a single unified name, and "The Great East Japan Earthquake" was decreed by Cabinet decision on April 1, 2011.

2 For example, InfoCom Research, Inc. and others (2011) have computed the monetary amount of damage to ICT-related industries including communications, broadcasting, and information services as well as the damage to computers and other ICT-related assets belonging to businesses in other sectors, and the impact of this damage. The damage to ICT-related industries was estimated at between ¥1.6 trillion and ¥2.8 trillion, and the damage to ICT-related assets belonging to businesses in other sectors at between ¥0.9 trillion and ¥1.6 trillion, for a total of ¥2.5 trillion to ¥4.4 trillion in damage to ICT capital. Assuming that ¥4.4 trillion in ICT-related assets is generated by the recovery effort, ¥1.0 trillion is seen as coming from imports and the other ¥3.4 trillion from domestic production, with the amount of domestic production generated altogether totaling ¥7.0 trillion in the end, and the number of jobs created totaling 357,000.

posed by NTT DoCoMo and soon removed, and none imposed by other carriers. Meanwhile, NTT East Japan landline phones did not see a rise in traffic like that of mobile phones, and restrictions were removed relatively quickly.

2. Efforts to secure means of communication

(1) Emergency message services

Telecommunications carriers provided various services over landline phones, mobile phones and the Internet, including Disaster Emergency Message Dial 171, disaster message boards, and broadband disaster message boards (Web171), allowing people to check on the wellbeing of relatives and friends or make contact with evacuation areas smoothly, without being affected by network congestion or service disruptions.

(2) Specially installed public phones, etc.

NTT East and West Japan installed approximately 2,300 free public phones in evacuation areas, making use of portable satellite equipment, in order to ensure viable means of communication. Also, immediately after the quake, NTT East made public phone service free throughout the six prefectures of the Tohoku region, afterwards expanding free service to the entirety of East Japan.

(3) The contribution of satellite-based mobile phones

As described in 1, the Great East Japan Earthquake caused ruinous damage to the landline and mobile phone networks, meaning that satellite-based telecommunications, which are not easily affected by earthquakes, had a considerable role to play. MIC lent approximately 340 satellite-based mobile phones in response to requests from local governments etc.

(4) The contribution of mobile telecommunications equipment

MIC lent approximately 1,770 pieces of mobile MCA (multi-channel access) radio and simple radio equipment free of charge in response to requests from local governments etc.

(5) The role of amateur radio

On March 12, MIC requested the cooperation of the Japan Amateur Radio League (JARL) in securing communications in the aftermath of the disaster. The JARL helped with emergency communications and gathering of information from evacuation areas. It also lent 300 pieces of amateur radio equipment for use in the affected areas.

(6) Free Internet connections at evacuation areas

Telecommunications carriers provided special, free Internet connections at evacuation areas.

3. Earthquake Early Warnings

Immediately after an earthquake, Earthquake Early Warnings analyze data from seismographs near the epicenter, instantaneously estimate the epicenter location and scale (magnitude) of the quake, and predict when the primary force of the quake will strike each region and with what seismic intensity, providing forecasts and warnings with the greatest possible speed. After the March 11 quake, Earthquake Early Warnings from the Meteorological Agency were broadcast on TV and radio and transmitted via mobile phones, etc.

4. Support for recovery and relief efforts

The first FY2011 supplementary budget proposal came before the Diet on April 28, 2011, and passed on May 2. It includes budgetary measures for necessary recovery and relief efforts in the near future, including the restoration of ICT infrastructure which suffered severe damage in the unprecedented devastation of the Great East Japan Earthquake.

Section 2
Status of Broadcastings

It has been pointed out in the past that in the event of a disaster, broadcast media that can provide information rapidly utilizing the characteristics of non-congestion prone broadcasting are an effective means of providing information. In the March 11 earthquake, the broadcast infrastructure itself was seriously affected, but even so local broadcasters, etc. made the utmost efforts to provide local residents with the necessary information.

1. Terrestrial TV broadcasting

While terrestrial TV broadcast master stations were not affected by the quake, operations were suspended at up to 120 satellite stations in 11 prefectures, including the six prefectures of the Tohoku region, due to disruption of the power supply and other factors (two of the stations were damaged and the other 118 experienced electrical blackouts.)

Under these circumstances, NHK and local broadcasters interrupted normal broadcasts to provide disaster-related information.

Broadcasting was done with one-seg as well. One-seg broadcasts were a highly valuable means of transmitting information, as they can be viewed easily on portable devices such as mobile phones.

2. Radio broadcasting

With ability to transmit information restricted by the disruption of mobile phone and other phone lines, as well as extensive power outages making television viewing impossible across a wide area, simple and convenient battery-powered radios served as a vital means of access to information.

On March 11, the day of the quake, MIC issued a verbal directive to NHK, the National Association of Commercial Broadcasters in Japan, and all radio stations in the Tohoku region, requesting that they "make the utmost efforts to broadcast disaster information and ensure it reaches residents of the region, as radio is an essential means of transmitting information under the current circumstances." In addition, the MIC procured 10,000 portable radios and progressively distributed them in response to local governments' requests.

3. Cable TV

The cable TV infrastructure was damaged, with three facilities destroyed or washed away by the tsunami. However, cable TV broadcasters were able to utilize the particular ability of the medium to provide local community information, with some broadcasters operating autonomous community channels providing information from local disaster response headquarters and other earthquake-related information.

4. Community broadcasts and special emergency broadcasts

Community broadcasting via FM radio is familiar to community residents as a source of information for everyday living, administrative information, disaster information, welfare and medical information, and other local information. In the event of a disaster, however, it plays a greatly increased role as a key source of detailed, up-to-the-minute disaster-related information for survivors.

On March 14, 2011, MIC issued a verbal request to 27 community broadcasters in the Tohoku region to broadcast information that would assist with relief, recovery and restoration efforts.

As of June 8, 2011, MIC had granted permission to operate special, emergency-broadcast FM stations providing earthquake-related information to residents of 24 communities in the Tohoku and North Kanto regions, taking a flexible approach to licensing by allowing the broadcasters to submit paperwork to the Tohoku / Kanto Bureau of Telecommunications at a later date.

Section 3

Status of Postal Service

1. Status of damage and restoration efforts

As of march 14, Japan Post Network Co., Ltd. closed 583 post offices, or 53%[3] of the total for the three most heavily damaged prefectures (151 in Iwate, 323 in Miyagi, and 109 in Fukushima Prefecture), due to total or partial destruction or flooding of buildings, but as of May 12, only 94 post offices constituting 9% of the total remained closed.

Japan Post Service Co., Ltd. was unable to deliver mail in 44 areas (nine in Iwate, 21 in Miyagi, and 14 in Fukushima Prefecture), or 15% of the three prefectures' areas, including those served by 17 of the totally or partially destroyed post offices and eight of the flooded ones[4]. However, operations were transferred to provisional facilities and recommenced, and as of June 23, mail is being collected and delivered everywhere except the no-go zone (seven areas) around the crippled Fukushima Daiichi nuclear power plant.

2. Measures

Japan Post Network dispatched mobile post offices to the affected areas, accepted requests for reissuing of passbooks and cards lost in the disaster, advised people on savings and insurance matters, took emergency measures to handle savings accounts, etc. of survivors who lost passbooks, identification or personal seals, accepted mail forwarding requests and provided free postcard mailing for affected people.

In addition, Japan Post Service worked with local governments to ascertain the whereabouts of evacuees and deliver mail addressed to them. Other measures included waiving of postal fees for registered postal cash envelopes containing disaster relief donations, waiving of postal fees for mail sent by people affected by the disaster, and free delivery of postcards (distributed in stages from post offices to evacuation areas).

Section 4

Role Played by ICT and Emerging CShallenges

The Great East Japan Earthquake caused enormous

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3 The number of post offices in the three most heavily damaged Tohoku prefectures (Iwate, Miyagi and Fukushima) is 1,103 (excluding small satellite offices).

4 As of March 14, the number of delivery areas in the three most heavily damaged Tohoku prefectures (Iwate, Miyagi and Fukushima) is 301.

damage to the communications infrastructure, and immediately after the disaster large areas of Japan were left without access to information, but efforts were made to reduce such areas to a minimum. The damage wreaked by the earthquake and tsunami was devastating and covered a wide area, and in the wake of the disaster new media such as social media helped to spread detailed information beyond the scope of the mass media. The Internet and other media were used to disseminate all sorts of information starting immediately after the quake, and volunteers provided logistical support.

On the other hand, as described in Chapter 1, the Internet in times of disaster poses various problems including susceptibility to telecommunications disruptions and the spread of false rumors and chain e-mails.

Here, we will outline and consider some characteristics of the post-disaster ICT environment.

1. Media usage trends in the wake of the disaster

According to a Nomura Research Institute survey of Internet users aged 20 to 59 living in the Kanto region, conducted on March 19 and 20, 2011, NHK television broadcasts were seen as an important source of earthquake-related information by 80.5% of people, and commercial broadcasts by 56.9%, making these the top two sources of information. Among information obtained through the Internet, the most cited source was "portal sites" at 43.2%, making this the third most valued source of information. "Social media" at 18.3% (#7) was nearly on a par with "newspaper companies' online information" (18.6%, #6), indicating that social media had considerable importance as a source of post-quake information.

2. Examples of new initiatives utilizing ICT

(1) Diversification of content distribution methods

All segments of the ICT infrastructure were severely impaired by the quake and tsunami, and as a result attempts were made to get information to as many affected people as possible by disseminating information through multiple media.

A. Diversification of information dissemination by broadcasters

As described in Chapter 2, in the aftermath of the disaster, broadcasters attempted to convey information over the airwaves, but also supplemented this with other methods in order to reach as wide an audience as possible.

B. Information made available via social media by public institutions

In light of the growing use of a wide range of online social media, public institutions including the national government and local governments have been making increasing use of such services to strengthen information distribution efforts. In particular, many public institutions used social media after the Great East Japan Earthquake to inform people about disaster relief and recovery measures.

C. Distribution of community information via social media by local newspapers in the affected region

Local newspapers in the affected region distributed information for everyday living, news items and reports from the affected areas, and other community information and disaster information in formats other than the conventional newspaper, such as social media.

D. Release of information held by public institutions, corporations, etc. in a user-friendly format

Immediately after the earthquake, procedures such as API[5] were standardized so that information in the possession of public institutions, corporations, etc. could be jointly shared. Using this data, a large number of websites and applications for PC or smartphone, modified for easy participation by private businesses, were developed, and the majority was provided free of charge.

(2) Information made available immediately after the quake

Immediately after the March 11 earthquake and tsunami, individual citizens posted updates on the disaster and requests for aid on social media, and images of the affected zone were displayed in real time on video-sharing sites, keeping people in other areas abreast of the events in real time via a wide range of image and word-based media.

(3) Information disseminated by ordinary citizens

In addition to news made available by the mass media, a large amount of earthquake-related information was distributed by individuals and groups using platforms such as social media. In the cities of Kesennuma and Miyako, special emergency broadcast stations were established to provide valuable information in areas where sources were limited. Also, various groups joined forces to launch a wide range of activities on the Internet aimed at providing aid to those in the disaster-hit region.

(4) Extraction, organization and redistribution of information

With a vast amount of information available, there were efforts made to extract, organize and redistribute it.

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5 Application Program Interface: a type of program interface coded so as to facilitate easy programming of applications.

A. Appearance of "matome" (summary) sites that sort through the abundance of information on the Net

In the aftermath of the earthquake, all sorts of information was available via social media and elsewhere on the Internet. However, this vast volume of data was in varying degrees of organization. In response, a large number of "matome" (summary) sites were launched to sort through the information by purpose or by region, etc.

B. Information from a range of media integrated and information on wellbeing of missing persons drawn from diverse sources

Due to severe and extensive damage, it was often difficult to ascertain the safety and whereabouts of missing persons. A wide variety of methods were used to address this situation, including an online service through which users could browse written notices about the wellbeing of missing persons, integrated NHK / Google search engine for information on wellbeing of missing persons, and other media both analog and digital, incorporating mass media and social media, aimed at making such information widely available.

C. Internet used to make disaster information and relief / recovery information available to the information-challenged

Disaster information was broadcast in sign language via video call and video-sharing sites and other online media. A disaster relief community for the information-challenged was also launched on SNS.

D. Cloud services provided free of charge for a limited time

Private enterprises provided cloud services free of charge for a limited period of time so as to aid local governments and companies damaged in the quake. Also, private enterprises constructed mirror sites[6] to avert congestion on websites with heavy traffic.

3. Emerging challenges

In the aftermath of the earthquake and tsunami, a wide variety of initiatives utilizing ICT were implemented. However, while the disaster struck amid an environment in which ICT infrastructure, particularly mobile phones and the Internet, have already become indispensable to people's lifestyles, a wide variety of challenges have come to light.

(1) The need for a highly disaster-resistant ICT infrastructure

The vital telecommunications infrastructure suffered from congestion and disruption over a wide area in the wake of the disaster. Of the wide variety of initiatives utilizing ICT, the majority are cannot realize their potential without ICT infrastructure (or electricity).

Henceforth, steps must be taken to construct a highly disaster-resistant ICT infrastructure, including networks that can withstand major earthquakes. With this in mind, MIC established the Committee on Ensuring Viability of Communications During Major Earthquakes and Other States of Emergency to deliberate on future measures.

(2) Analog-to-digital and digital-to-analog conversion of data

After the March 11 quake, paper-based analog information on the wellbeing of survivors, status of stricken areas and everyday living information was converted to digital form and shared via the Internet and other electronic means. However, the question arose of whether digital data was converted to analog form for the benefit of those unable to use the Internet. In the future, steps must be taken to boost the technological literacy of the information-challenged and develop devices and services that can easily be used by the elderly and other challenged individuals.

(3) Countermeasures against chain e-mails and fraudulent e-mails related to the disaster

Information flooded the Internet after the earthquake struck, but no small amount of this was data with no clear basis in fact. In the future, ongoing measures must be taken to combat chain e-mails and other sources of false rumors, as well as to raise levels of media literacy.

(4) Informing as many people as possible of information dissemination initiatives

Information is now being made available from an ever wider variety of sources, but it is questionable whether these information sources are widely known and used to the greatest possible extent. In particular, not all relevant information is offered in one package, and it is not always easy for disaster survivors and other related people to obtain the necessary information. Future measures must be considered, possibly including construction of a framework for integration of information from multiple sources, and reexamination of standard operating procedures so as to facilitate smooth and effective utilization even under extraordinary conditions.

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6 A website containing either all or some of the contents of another website. It is created in order to diffuse server load.