

# Disaster Prevention Administrative Radio System in Municipality (Broadcast via PA Systems) - Achievement of Greater Diversity in Disaster Information Transmissions

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## Abstract

Since experiencing the Great East Japan Earthquake, an even greater range of media is tending to be employed in disaster information transmissions. When a disaster occurs, municipal offices are expected to provide administrative disaster prevention information both to staff members and to local residents. This paper introduces a system that enables information transmission more promptly and widely while using a Disaster Prevention Administrative Radio System in Cities, Towns and Villages as a core communications system. It also describes case studies that have been conducted of trials for "diversity of disaster information transmission," as well as the results of studies regarding DTN (Delay/Disruption Tolerant Networking) that support information transmission procedures in the event of natural disasters.



disaster prevention administrative radio system, broadcast via PA system, municipality disaster prevention, disaster information, transmission, diversity, safety & security, DTN

## 1. Introduction

On 11th March 2011 at 14:46 (JST), the magnitude 9.0 Great East Japan Earthquake occurred, which was the largest earthquake ever recorded in Japan. Moreover, the earthquake triggered an unexpectedly large tsunami that resulted in a greater number of casualties. One cause of the high number of casualties was their misunderstanding of the disaster warnings and also their delay in evacuating.

In Japan, a local municipality decides to issue an evacuation recommendation or instruction and it transmits disaster warnings to local residents. A Disaster Prevention Administrative Radio System in Cities, Towns and Villages (broadcast via PA systems: public address systems)" (hereinafter referred to as a Disaster Prevention Administrative Radio System) is the main method of transmitting disaster information. The Disaster Prevention Administrative Radio System is free from any transmission restrictions so that it can avoid communication congestion, even in a natural disaster situation. Therefore, it was

widely used to transmit disaster information during the Great East Japan Earthquake. However, in the coastal areas that were hit by the *tsunami*, many local radio systems were damaged. This event has revealed an issue for information communications systems, including the public networks. These events showed how difficult it is to transmit essential information to local residents who have been evacuated to different locations. In addition, such issues happened not only during the disaster but also after its occurrence.

One of the countermeasures to be applied this issue is to employ various innovative information communications media, such as simultaneous mail distribution system<sup>\*1</sup>, Area Mail Disaster Information Service, Emergency Email Service<sup>\*2</sup> and Twitter<sup>\*3</sup>, besides the TV and radio broadcasts. The countermeasure of choice is to distribute the information contents broadcast via the Disaster Prevention Administrative Radio System to modern devices that incorporate latest information transmission mechanisms and services so that disaster information can reach local residents quickly and with certainty.

\*1 Simultaneous mail distribution system: A mechanism to simultaneously distribute emails of disaster and crime-prevention information at high speed.

\*2 Area Mail Disaster Information Service, Emergency Email Service: Services to distribute emergency information to mobile phones located in the mobile phone base station areas via the mobile phone networks of each mobile phone company.

\*3 Twitter: An online social networking information service for sending messages of up to 140 characters. Such messages can be shared via the Internet.

However, when employing such communications media to transmit information, it is necessary for the staff members of municipal offices to get used to different operational procedures for each of the different media or services. This may present yet another burden for staff members to become familiar with several different media and service operations; especially in a situation in which various disaster countermeasures have to be applied by a limited number of staff.

## 2. The System that NEC Aims at

In considering such issues, NEC has developed a system that distributes information simultaneously to various information transmission media, as well as to the Disaster Prevention Administrative Radio System. Our system sends disaster information to a range of information transmission media in addition to the existing Disaster Prevention Administrative Radio System; included are outdoor loudspeakers and indoor receivers that distribute information by “audio.” This means that our system unifies various disaster information distribution systems and transmits information more rapidly. It can also enable transmission of information to areas that the Disaster Prevention Administrative Radio System cannot cover.

Moreover, people can check the details of information transmitted by the Disaster Prevention Administrative Radio System on TV or on their mobile phones, so that they can easily acquire detailed information that may be hard to understand just by listening. They can also access administration information that is only applicable for local residents in certain areas.

NEC has developed a disaster prevention contents management system (hereinafter referred to as Disaster CMS) that upgrades and expands the Disaster Prevention Administrative Radio System, thereby achieving “diversity of disaster information transmission” and “automatic information distribution systems.”

## 3. Disaster CMS

When attempting to transmit information via various information transmission procedures, the challenging issue is to prepare the various kinds of external system to be connected satisfactorily; especially when it is necessary to expand the system in order to connect it with more stations or devices. In this case the system becomes more complicated in most cases and imposes a greater burden on the staff members that operate it.

Since experiencing the Great East Japan Earthquake, the issues that municipalities have to solve are, how rapidly they may distribute information when they receive information to be transmitted, and also how much can they reduce the burden on the staff members in performing the requisite information transmission operations.

NEC has developed Disaster CMS, a system designed to reduce such burdensome operations and has thereby improved operational efficiencies.

The Disaster CMS controls various information transmission media both in distributing and receiving information. It allows users to set operational details, for example, “What sort of information is to be registered and sent to which media in which format, etc.” Moreover, users are allowed to change the conditions of the auto distribution functions. When users are required to dispatch information manually, all that they have to do is to enter common messages to be distributed so that optimum distribution formats will be prepared automatically for different media.

Even if more devices are expected to be connected in the future, the Disaster CMS will provide a flexible system infrastructure so that an integrated control for managing all sorts of input and output information is achieved.

## 4. Case Study 1: Minami Soma City in Fukushima Prefecture

Transmitting information by converting broadcast contents into text data

The Disaster Prevention Administrative Radio System located at Minami Soma city in Fukushima prefecture is capable of broadcasting an evacuation recommendation and instruction, and it is also capable of simultaneously dispatching details of the evacuation recommendations and instructions to different media such as the web site of a municipality, a disaster prevention email service or a Disaster Prevention Administrative Radio System (mobile disaster prevention devices) (Fig.1).

Details of the broadcast content are displayed on the first page of the municipality web site, and a disaster prevention email is transmitted simultaneously. This procedure will allow residents in areas where the administrative broadcast cannot cover to receive information in a text format. Moreover, people can check information on the municipality web site if they were not able to listen to the information via the PA (Public Address) broadcast or radio systems. By employing such a system, local residents will be able to acquire disaster information more quickly and securely.

## 5. Case Study 2: Nakatsugawa City in Gifu Prefecture

Transmitting information by converting text data into contents for broadcast and various media

The municipal office in Nakatsugawa city in Gifu prefecture has introduced NEC’s disaster prevention information system and Disaster CMS to work alongside their existing Disaster Prevention Administrative Radio System. Our disaster prevention information system collects and stores acquired

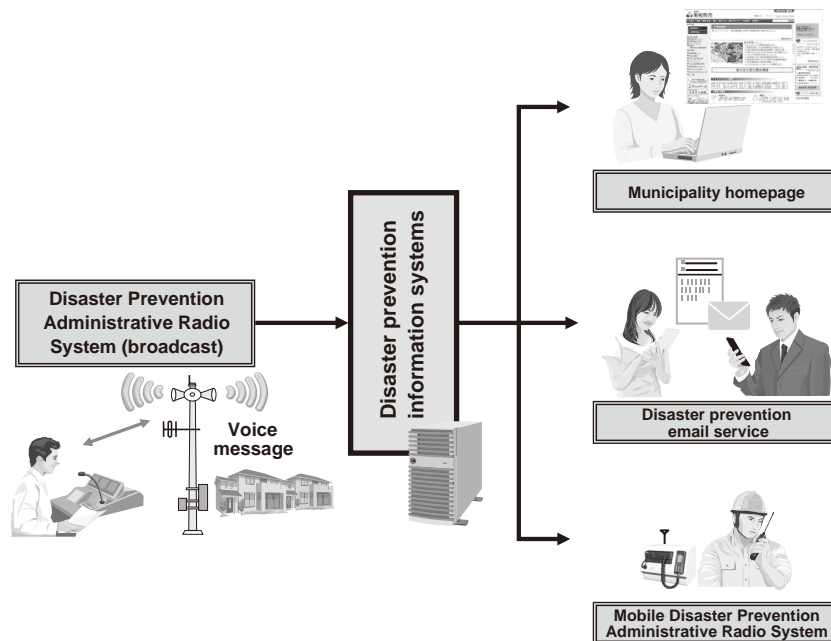


Fig. 1 Information distribution example at Minami Soma city.

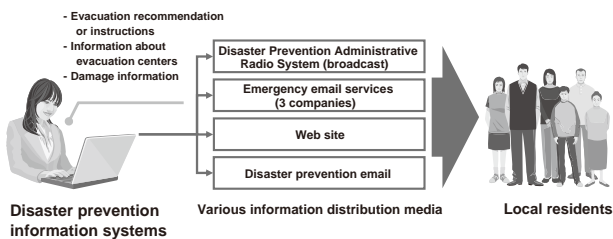


Fig. 2 Information distribution example at Nakatsugawa city.

information inside the system. The main feature of our system is to broadcast this information via the Municipal Disaster Prevention Administrative Radio System, which is the first such test ever done in Japan. Moreover, information collected by the system is not only dispatched via the Disaster Prevention Administrative Radio System but is also distributed simultaneously via an Area Mail Disaster Information Service, an Emergency Email Service, the web site of the municipality, and by Citizen Safe Network Email (Fig. 2).

This system allows users to dispatch information simultaneously to multiple media in a single operation. In addition to this feature, the system automatically converts text information into audio data so that the information can be broadcast via the Disaster Prevention Administrative Radio System. This is the most significant advantage acquired by introducing our system. Without our system, all of the procedures, from broadcasting received information with a microphone to distributing it to various media had to be processed in series by operating the console of the Disaster Prevention Administrative Radio

System. However, with the introduction of our system, users were allowed to complete all procedures in a single operation.

## 6. DTN Technology

Information transmission function to compensate for damage to telecommunications infrastructures

Much telecommunications infrastructure was damaged by the Great East Japan Earthquake. Municipal offices had to announce their messages, including local residents' safety confirmation, requests from local residents, etc. by posting notices on walls, or with voice announcements by staff members in the evacuation centers. Such restrictions hampered smooth exchange and gathering of information between municipal offices and the refugees.

In order to solve such issues, it is required to create conditions that enable intimate communication and secure information provision between municipal offices and local residents as well as among local residents. NEC is occupied in establishing a data transmission system with a highly reliable performance in a disaster situation, by employing the DTN technology to be vehicle mounted. DTN (Delay/Disruption Tolerant Networking) is a technology that enables data exchange between communications devices, even in the situation that the telecommunication infrastructure is damaged. A vehicle mounting a communications unit is driven around the evacuation centers and disaster countermeasures head offices and a DTN system for the exchange of data is set up. Information collection

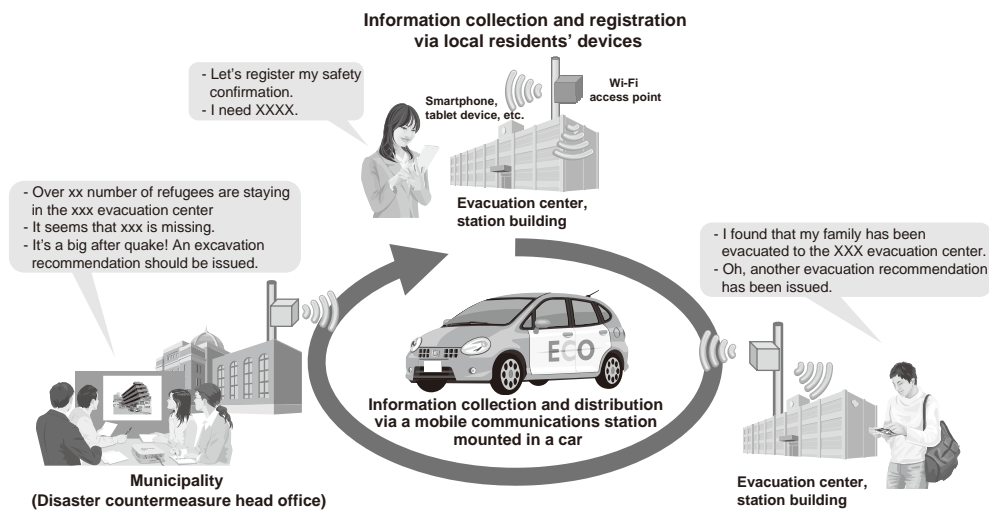


Fig. 3 Example of information transmission using DTN.

and distribution is then enabled without having to rely on the telecommunications infrastructure. This technology has been advanced since 2011 as a part of the project “Research and development of the disaster-resistant information communications network - network management and control technologies to ensure communications methods even in a large-scale disaster situation” conducted by MIC (Ministry of Internal Affairs and Communications).

This system stores information transmitted via the DTN at Wi-Fi access points first and then provides other communications devices. Therefore, it will provide a means of collecting and distributing information using refugees’ smartphones, tablet devices, etc. even when the public telecommunication network is not working. It also supports refugees’ self-help and co-help activities. Various information such as local resident’s safety, goods required, etc. is thereby collected and dispatched. Moreover, there is another advantage that is gained by introducing the system. Municipalities used to transmit information such as safety confirmations, the number of refugees, goods required, etc. by circulating paperwork or sending manpower to deal with emergency situations. However, our proposals allow municipal offices to reduce such burdensome activities so that better services and support procedures may be provided to their residents (Fig. 3).

## 7. Conclusion

While considering communications in terms of disaster information transmission, this paper described above a system to conduct secure information transmission regionally by employing multiple communications procedures as well as the Disaster Prevention Administrative Radio System. NEC will continue to study and develop various disaster prevention

systems in order to achieve “diversity of disaster information transmission” and “visualization of disaster damage.” At the same time, we intend to contribute to preparing a disaster prevention information infrastructure to support people’s safe and secure everyday lives by providing efficient disaster prevention systems.

\* Area Mail is a registered trademark of NTT DoCoMo, Inc.

\* Twitter is a registered trademark or trademark of Twitter, Inc.

\* Wi-Fi is a registered trademark of Wi-Fi Alliance.

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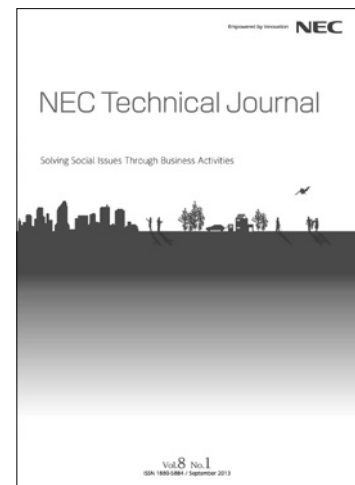
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