Technology Reports

Disaster Voice Messaging Service

The recent earthquake gave a fresh reminder of the importance of voice communication when checking on the safety of others, so we have developed a new communications service for use in times of disaster, called "Disaster Voice Messaging Service". The service uses the Packet-Switched (PS) network, which is able to connect easily compared with the voice network, and sends a voice message as a sound file, one-way and asynchronously. In this article we describe the service, which was introduced on March 1, 2012. NTT DOCOMO has a mission to provide a communications network that preserves safety and security in all possible situations, and accordingly, this service was implemented to mitigate the effects of disaster and provide improved convenience for users in the event of disaster.

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1. Introduction

After the Great East Japan Earthquake occurred on March 11, 2011, voice calls were unable to connect for extended periods of time because the number of calls by people wanting to confirm the safety of others exceeded expectations. In contrast, packet communication traffic was relatively light at the same time.

The state of the network after this disaster provided a clear reminder of the strong need to hear others' voices, and how voice, which reaches all generations, is the first choice for confirming the safety of others [1]. We also observed the need for better usability and the ability to specify the destination using a phone number from users that attempted to use e-mail instead of voice. Some users who were not accustomed to using e-mail had difficulty and were not immediately successful, or did not know the required e-mail address.

The Disaster Voice Messaging Service was developed as one of NTT DOCOMO's disaster mitigation projects, which cover these and other needs reconfirmed by the recent disaster and arising from network conditions during the disaster. The service uses packet communication, which allows it to connect relatively easily, provides voice communication, and operates similarly to voice calling, which is familiar to most users.

2. Service Overview

An overview of the service is shown in **Figure 1**.

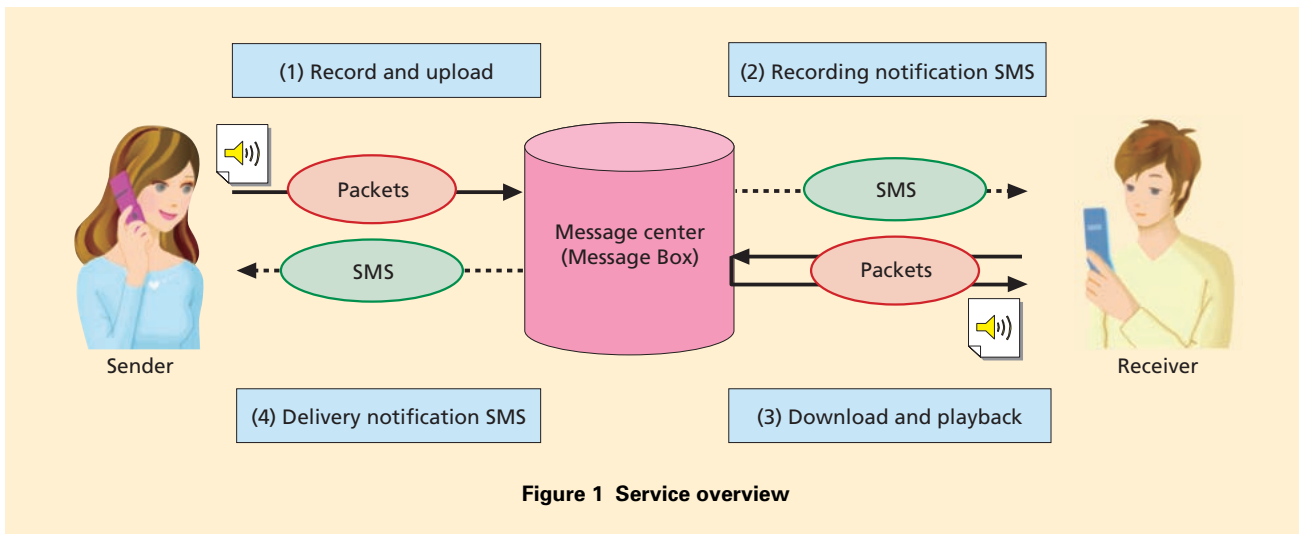The service transmits voice messages between users and consists of four steps implemented using packet

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Figure 1 Service overview

(1) Record and upload

(2) Recording notification SMS

Packets

SMS

Sender

Message center
(Message Box)

SMS

Packets

Receiver

(4) Delivery notification SMS

(3) Download and playback

communications and SMS. In "(1) Record and upload," the voice message sender (hereinafter referred to as "sender") sends a voice message, in "(2) Recording notification SMS," the receiver is notified that a message has been recorded for them, in "(3) Download and playback," the receiver retrieves the sound file, and in "(4) Delivery notification SMS," the sender receives notification that the receiver has retrieved the message.

The service has the following features:

- It is limited, and only provided during emergency. In ordinary times it is only available on a trial basis at specific times (1st and 15th of each month, January 1-3, Disaster Prevention week and Disaster Prevention and Volunteer week).
- One-way voice messages that are stored on the server can be sent.
- The sender can send voice mes-

sages in the same way that voice calls are made, using the telephone number.

- The sender can send voice messages using simple operations with the "Disaster Kit" application for smartphones, or a dedicated application on i-mode terminals.
- The sender can know whether a message can be sent before recording it, based on a preliminary query to the message center.
- The sender can know that the message has been delivered to the receiver, based on a delivery notification SMS that is sent from the message center when the message has been downloaded.
- The receiver only requires SMS and browser functions (standard devices can use i-motion playback), so a broad range of users can use the service. The Disaster Kit provides simple operations enabling smart-

phone users to receive voice messages.

- Sending messages requires a smartphone with Android[*1] Ver. 2.2 or greater, or a winter 2011 or later model i-mode terminal (with some exceptions), and receiving message requires an Android smartphone or i-mode terminal (with some exceptions).
- Users must subscribe to FOMA or "Xi" (Crossy) with a voice contract, and any of sp-mode, i-mode or mopera U services.
- If the message sender is an NTT DOCOMO subscriber satisfying the above service provision conditions, they can use the service from anywhere in Japan (with some exceptions). Voice messages can be received even while roaming out of Japan.

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*1 **Android[TM]**: An open source platform targeted mainly at mobile terminals and promoted by Google Inc., in the United States. Android[TM] is a trademark or registered trademark of Google Inc., in the United States.

3. Service Implementation

The implementation of this service is shown in Fig. 1 and consists of four main processes. We describe each of these processes below. In these descriptions, we assume that the terminals of the sender and receiver are smartphones with the Disaster Kit application installed.

3.1 Record and Upload

The record and upload sequence is shown in **Figure 2**. In the figure, Message Center refers to the Service Composition Node (SCN)[*2][2][3] and the Media Processing Node (MPN)[*3][4].

To send a message through the Disaster Voice Mail Service, the sender starts the Disaster Kit application on their mobile terminal and enters the phone number of the receiver (Fig. 2 (1)). The Disaster Kit sends a query with the phone number to the SCN in the message center, which controls the service, to check whether a message can be sent (Fig. 2 (2)).

The SCN obtains the receiver's user profile from the IP Service Control Point (IPSCP)[*4], in order to check whether a message can be sent to the receiver's number (Fig. 2 (3) (4)). For example, if the receiver subscribes to a different operator, the user profile cannot be obtained, so a message cannot be sent and an error is displayed to the sender. Next, the SCN obtains the
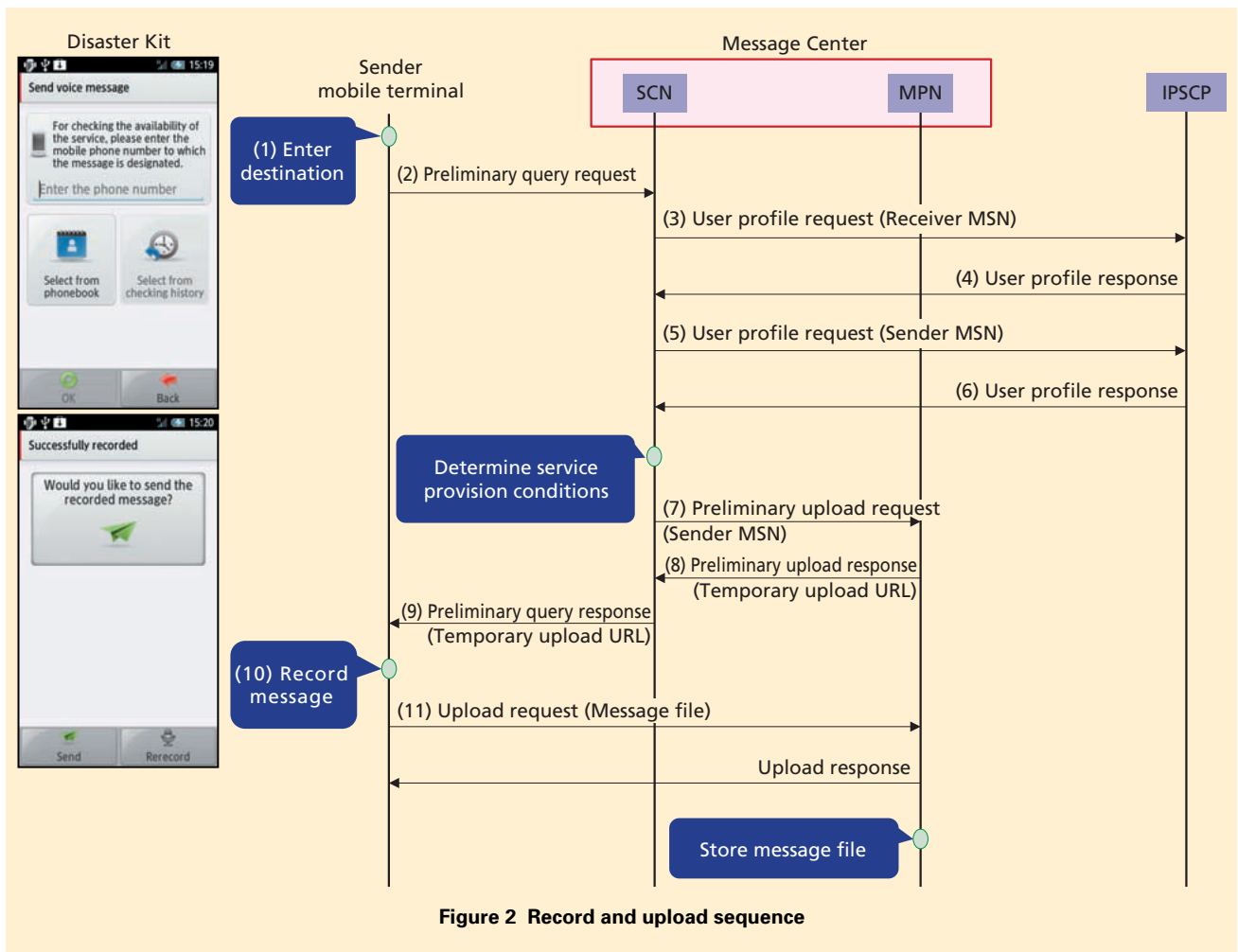

Figure 2 Record and upload sequence

sender's user profile from the IPSCP to determine whether the sender can send a message (Fig. 2 (5) (6)). For example, if the sender does not subscribe to voice services, he/she cannot use the Disaster Voice Messaging service, because it is intended as an alternate to voice services. After checking the above service provision conditions to confirm that a message can be sent, the SCN sends a preliminary notification to the MPN that a voice message will be sent, to secure the necessary resources (Fig. 2 (7)). At the same time, it also sends the senders Mobile Subscriber Number (MSN) and receives a temporary upload URL in the response (Fig. 2 (8)). The temporary URL can only be accessed by the sender, and only for a fixed period of time. The SCN forwards this temporary upload URL to the Disaster Kit (Fig. 2 (9)).

If the Disaster Kit receives the response from the SCN normally, it accepts operations to record the message (Fig. 2 (10)) and stores the message in a file. It then completes the message upload by sending the file to the temporary URL (Fig. 2 (11)).

3.2 Recording Notification SMS

The recording notification SMS sending sequence is shown in **Figure 3**.

When the message upload has completed, the MPN sends an upload-complete notification to the SCN (Fig. 3 (1)).
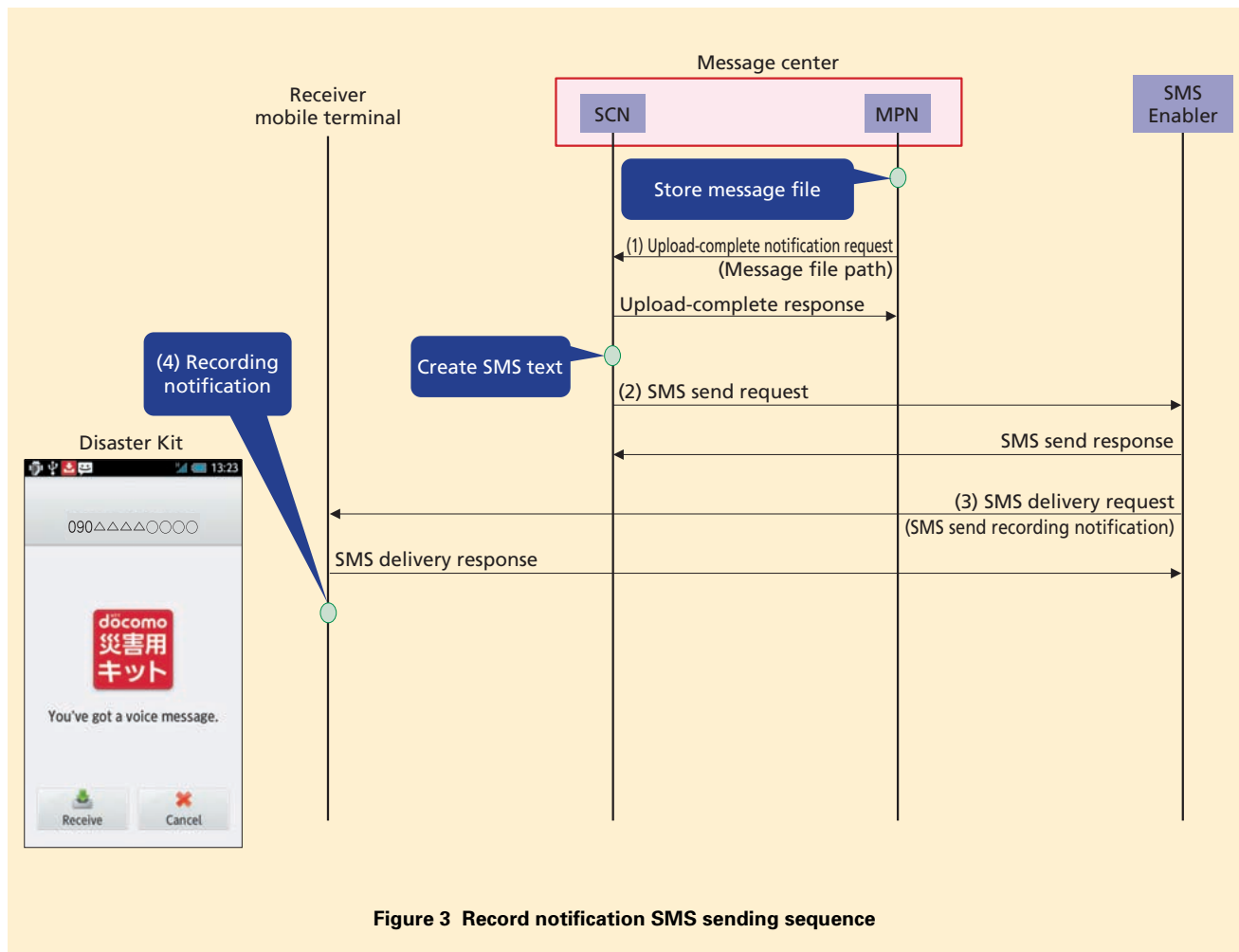
After receiving the upload-complete

Figure 3 Record notification SMS sending sequence

notification, the SCN creates an SMS text, based on mobile terminal type indicated in the receiver's profile, notifying of the recording and sends an SMS send request to the SMS enabler[*5] (Fig. 3 (2)).

Upon receiving the SMS send request, the SMS enabler sends the recording notification SMS to the receiver (Fig.3 (3)). The Disaster Kit receives the recording notification SMS, and indicates on the screen that a message has been delivered (Fig. 3 (4)).

3.3 Download and Playback

The download and playback sequence is shown in **Figure 4**.

When the receiver clicks the "Receive" button on the record notification screen displayed by the Disaster Kit, the Disaster Kit sends a download screen request to the SCN (Fig. 4 (1)).

When the SCN receives the download screen request, it sends a preliminary download request to the MPN to obtain a temporary download URL (Fig. 4 (2) (3)). It then sends a download screen response containing the

temporary URL to the Disaster Kit, which displays a download screen on the receiver's screen (Fig. 4 (4)).

When the receiver clicks the play button on the download screen, the Disaster Kit downloads the message file from the MPN and plays it with the media player (Fig. 4 (5) (6)).

3.4 Delivery Notification SMS

The delivery notification SMS sending sequence is shown in **Figure 5**.

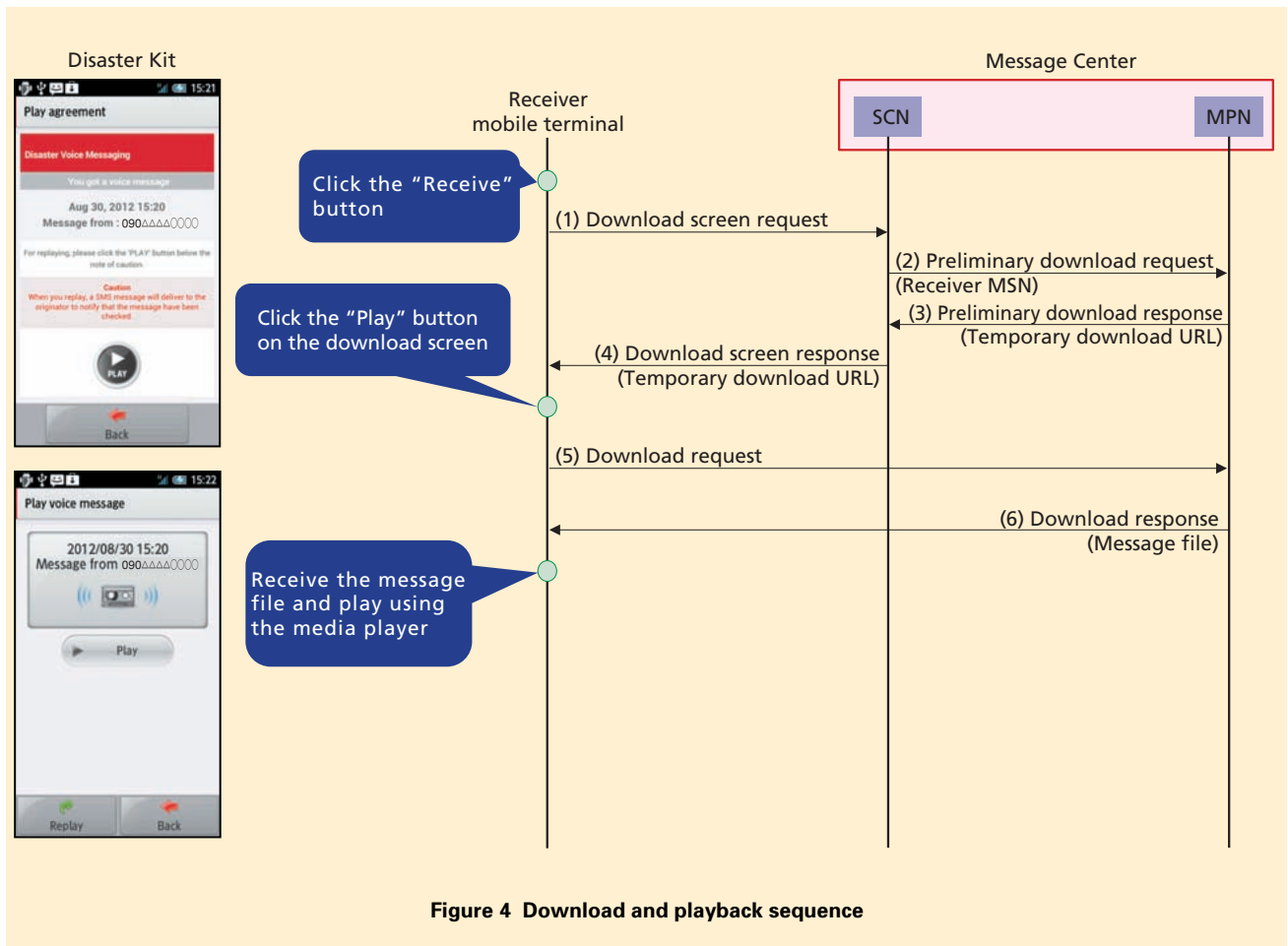When the message file has been downloaded by the receiver, the MPN

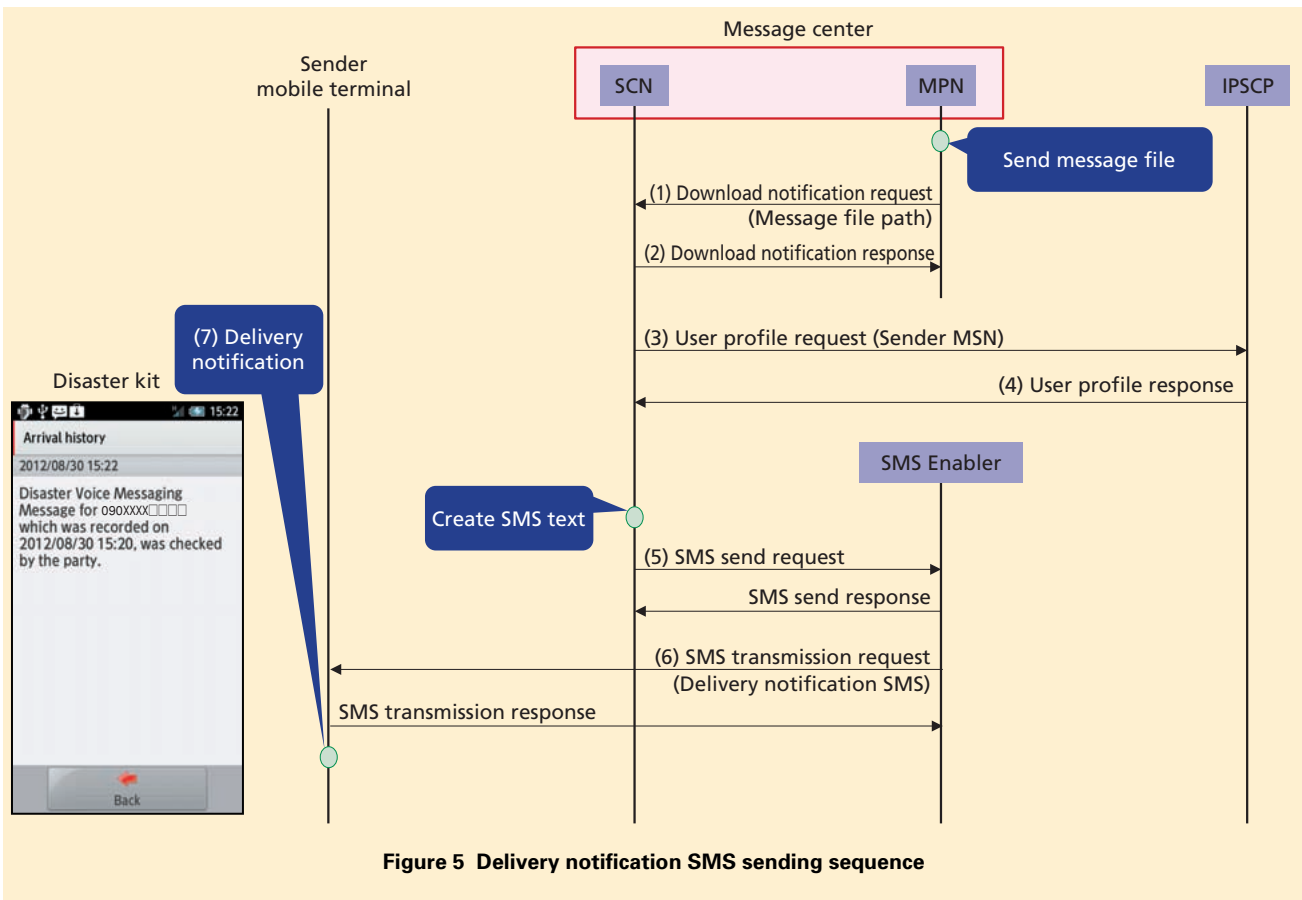**Figure 4 Download and playback sequence**

Figure 5 Delivery notification SMS sending sequence

notifies the SCN of the fact (Fig. 5 (1) (2)).

Once notified of the download, the SCN obtains the sender's user profile from the IPSCP (Fig. 5 (3) (4)), creates a delivery-notification SMS text based on the sender's mobile terminal type, and sends an SMS send request to the SMS enabler (Fig. 5 (5)).

The SMS enabler, upon receiving the SMS send request, sends the delivery notification SMS to the sender (Fig. 5 (6)), and upon receiving it, the Disaster Kit displays the notification (Fig. 5 (7)).

4. Special Features of This Service

We next describe some of the special features of this service.

4.1 Notification under Congested Conditions

This service provides a function that can indicate to the user a target for when a voice message will be delivered under congested conditions when sending a voice message.

When the preliminary query for voice message recording is sent, the SCN estimates when the recording noti-

fication SMS will arrive (when notification of the voice message arrives at the user) based on a recording notification SMS arrival rate value maintained by the SCN. For the recording notification SMS arrival rate, standard values from the network state during the Great East Japan Earthquake were used to derive the state of congestion in three levels. The sender is notified of the congestion state in the preliminary query response. These standard values are maintained as system data and can be modified. The application receiving the congestion state displays text adjusted to indicate the congestion state according to one of

the three levels.

4.2 Sending and Receiving Voice Messages with a Mobile Terminal

Mobile terminal functions for the sender are provided by an Android application (Disaster Kit Ver. 3.0.0 or greater) for Android Ver. 2.2 or greater on a smartphone, and by a dedicated application installed on winter 2011 and later models of i-mode terminals. The mobile terminal first queries the SCN whether the service can be used, and then records a message up to 30 s long, generates a message file and uploads it to the MPN. The service can only be used during emergency, and since many users will be using it for the first time, it has been created with a very easy to understand user interface.

The Disaster Kit application provides voice guidance with interactive instructions, many illustrations, and suggestions prompting the next operation (**Figure 6**). The number of operation steps has also been minimized, so users can upload voice messages easily and smoothly.

On i-mode terminals, the destination can also be selected from the address book or call history. We also assumed i-mode terminal users would record their voice messages holding the phone to their ear, so audio instructions are given in the same way as for recording answering machine messages.

The voice messages generated on mobile terminals are encoded in a format compatible with audio-only i-motion files. This allows them to be received, stored and played-back on (as of February 2012) 48 smartphone models and over 280 i-mode terminal models.

Voice message files can be retrieved and played back by accessing the URL given in the recording notification SMS message received on the receiver's mobile terminal. The voice message can also be stored in either the device's main memory or in external memory.

On smartphones with the Disaster Kit installed, when the recording notification SMS arrives, the application is launched automatically and the user is notified immediately with a special incoming-message screen (**Figure 7**) and ringtone. The voice message can be retrieved from the incoming-message screen, or it can be retrieved, played-back or stored (including storing on an SD card) from the Disaster Kit application.

Besides receiving messages from the incoming message screen as described above, they can be retrieved and played back from the received voice message list (**Figure 8**) in the Disaster Kit application. Messages in the list that have not yet been retrieved appear with a "Receive" button, and this is replaced by a "Play" button when they have been retrieved. Received messages can be played back any number of times, and up to 40 messages can be stored in the received message history. They can also be stored on an SD card from this screen.

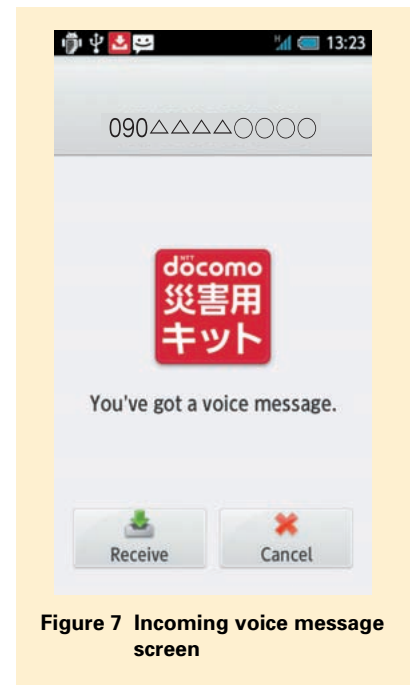
Figure 6 Startup screen

Figure 7 Incoming voice message screen

When a voice message has been delivered to the receiver, a delivery notification SMS is sent to the sender. The state of sent voice messages can be checked in the sent voice messages list.

Note that in addition to the Disaster Voice Messaging service, the Disaster Kit application also provides the Disaster Message Board Service (**Figure 9**).

5. Conclusion

We have developed services that enable users to check on the safety of others using their voice in times of disaster. In the future, we will work to spread these services more broadly, providing more users with a means of contacting others during disaster. We will also work to improve and strengthen the service, integrating input obtained from users through a trial service.

Figure 8 Received voice message list
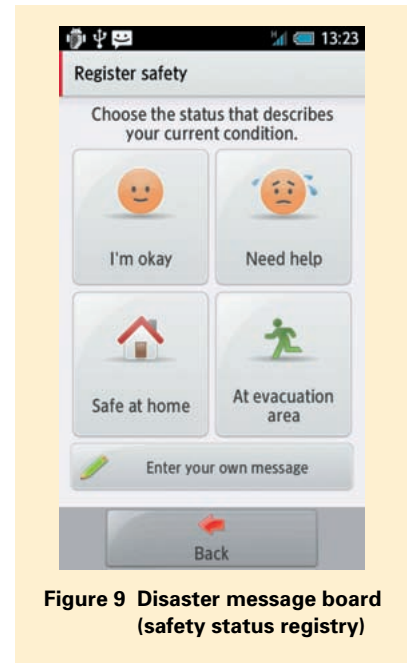
Figure 9 Disaster message board (safety status registry)

REFERENCES
[1] NTT DOCOMO Technical Journal Editorial Office: "Measures for Recovery from the Great East Japan Earthquake Using NTT DOCOMO R&D Technology," NTT DOCOMO Technical Journal, Vol. 13, No. 4, pp. 96-106, Mar. 2012.
[2] K. Inoue et al.: "SCN: Providing Service Scenario Execution Infrastructure Using Abstract APIs —Koe-no-Takuhaibin—," NTT DOCOMO Technical Journal, Vol. 13, No. 2, pp. 20-28, Sep. 2011.
[3] S. Biswas et al.: "Service Enabler Network (SEN) Infrastructure for Configuring a Network Cloud," NTT DOCOMO Technical Journal Vol. 14, No. 2, pp. 4-13, Oct. 2012.
[4] A. Miyata et al., "Media Processing Node for Providing Value-added Media Services," NTT DOCOMO Technical Journal, Vol. 11, No. 1, pp. 4-12, Jun. 2009.