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	<b>STUDY COMMITTEE D2</b> INFORMATION SYSTEMS AND TELECOMMUNICATION <b>2015 Colloquium</b> <b>October 15 to 16, 2015</b> <b>Lima – PERU</b>

## D2-02\_04

### **Application of the Disaster Recovery Support System for Disaster Recovery and Business Continuity**

by

**Takashi Haraga\*, Sho Nakazaki**  
**Kyushu Electric Power Co., Inc.**  
**(JP)**

**Tatsu Yamashina**  
**Mitsubishi Electric Corporation**  
**(JP)**

#### **SUMMARY**

Unprecedented large-scale disasters such as unexpectedly large, powerful typhoons, sudden intense, heavy rains and the recent Great East Japan Earthquake have had a serious impact on the social environment in recent years.

While safety measures have been implemented for power supply facilities that serve as a lifeline, such as power-generating, transmission and substation equipment, nevertheless, in the event of power supply facilities sustaining serious damage due to a large-scale disaster, the enormity of information on the damage status and the status of disaster response makes it impossible to respond in time using the conventional method of information sharing. Moreover, problems such as delayed or erroneous information will lead to confusion on site, resulting in consequent delays in disaster recovery.

This paper presents the introduction of a “Disaster Information Sharing System” and “Disaster Recovery Support System” developed to address these issues with the aim of gaining an accurate, real-time understanding of information required to support disaster recovery.

#### **KEYWORDS**

Large-scale Disaster, Speedy Disaster Recovery, Prompt Provision of Information to Customers, Quick Reporting to National and Local Governments

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\* Postal Address of Main Author: 1-82, Watanabe-dori 2-Chome Chuo-ku, Fukuoka-shi, Fukuoka, 810-8720 Japan

Fax: +81-92-761-7749 e-mail: Takashi\_Haraga@kyuden.co.jp

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## 1. Introduction (Background to Development)

Recent years have witnessed a dramatic increase in the number of disasters such as unprecedented large powerful typhoons and unexpected intense, heavy rains. In addition, the recent Great East Japan Earthquake resulted in damage to the power supply facilities that serve as a lifeline, seriously impacting on the social environment. Such events have given rise to an ever-growing demand for the stable supply of electric power and the urgent need to localize damage caused by large-scale disasters and achieve speedy disaster recovery.

While safety measures have been implemented for power supply facilities such as power-generating, transmission and substation equipment, nevertheless, there remains the possibility of damage to such facilities caused by unexpected disasters of an unprecedented scale. More than ever before, effective recovery from such damage requires an accurate understanding of the constantly-changing statuses of damage and disaster response and implementation of appropriate measures. Moreover, effective disaster response and recovery also require the further expediting of decision-making processes related to crucial matters such as high-level management decisions, the prompt provision of information to customers and quick reporting to national and local governments and other entities outside the company.

To address these issues, with the aim of gaining an accurate, real-time understanding of information required to support disaster recovery, we have developed a “Disaster Information Sharing System” and “Disaster Recovery Support System.”

## 2. Issues pertaining to the Sharing of Power Station Information in the Event of Disasters

The conventional approach to collecting disaster-recovery information is implemented mainly by such means as telephone, e-mail and fax. Moreover, information acquired is shared by means of the company-wide disaster information sharing system.

However, in the event of power supply facilities sustaining serious damage as a result of an unprecedented large-scale disaster, the enormity of information on the damage status and the status of disaster response makes it impossible to respond in time using the conventional method of information sharing, leading to confusion on site due to causes such as delayed or erroneous information and consequent delays in disaster recovery.

Therefore, measures for recovery from large-scale disasters in the future will require centralized management of detailed and accurate information and the real-time sharing of necessary information among parties involved in disaster recovery.

## 3. Application of Two New Systems designed for Disaster Recovery Support

To address the above issues, we have developed the two systems described below, details of which are presented on the following pages.

### (1) Disaster Information Sharing System

The purpose of the “Disaster Information Sharing System” is to centrally manage detailed information on damage sustained by power supply facilities during a large-scale disaster and information relating to the status of consequent damage to power stations and recovery planning, thereby further expediting decision-making processes relating to crucial matters such as high-level management decisions and enabling the prompt provision of information

to customers and quick reporting to national and local governments and other entities outside the company.

**(2) Disaster Recovery Support System (Disaster Recovery Support Materials Information Management System)**

The purpose of the “Disaster Recovery Support System” is to support rapid disaster recovery by centrally managing information on the transportation and delivery of disaster recovery support materials and equipment required for recovery efforts in the event that power supply facilities sustain damage due to a large-scale disaster.

**3.1 Construction of Disaster Information Sharing System**

**(1) System Requirements**

The requirements for the Disaster Information Sharing System necessary to realize the real-time sharing of information among the disaster countermeasures headquarters that issues disaster-recovery commands and instructions and power stations in the event that power supply facilities sustain damage due to a large-scale disaster are listed below.

- Ability to perform centralized management of information relating to large-scale disasters
- Availability for independent use by individual power stations
- Ability to provide, in real time, information on matters such as the damage status of power plant equipment and recovery planning to all relevant entities including the head office and branch offices
- Ability to provide customers with information and realize quick reporting to relevant entities outside the company such as national and local governments

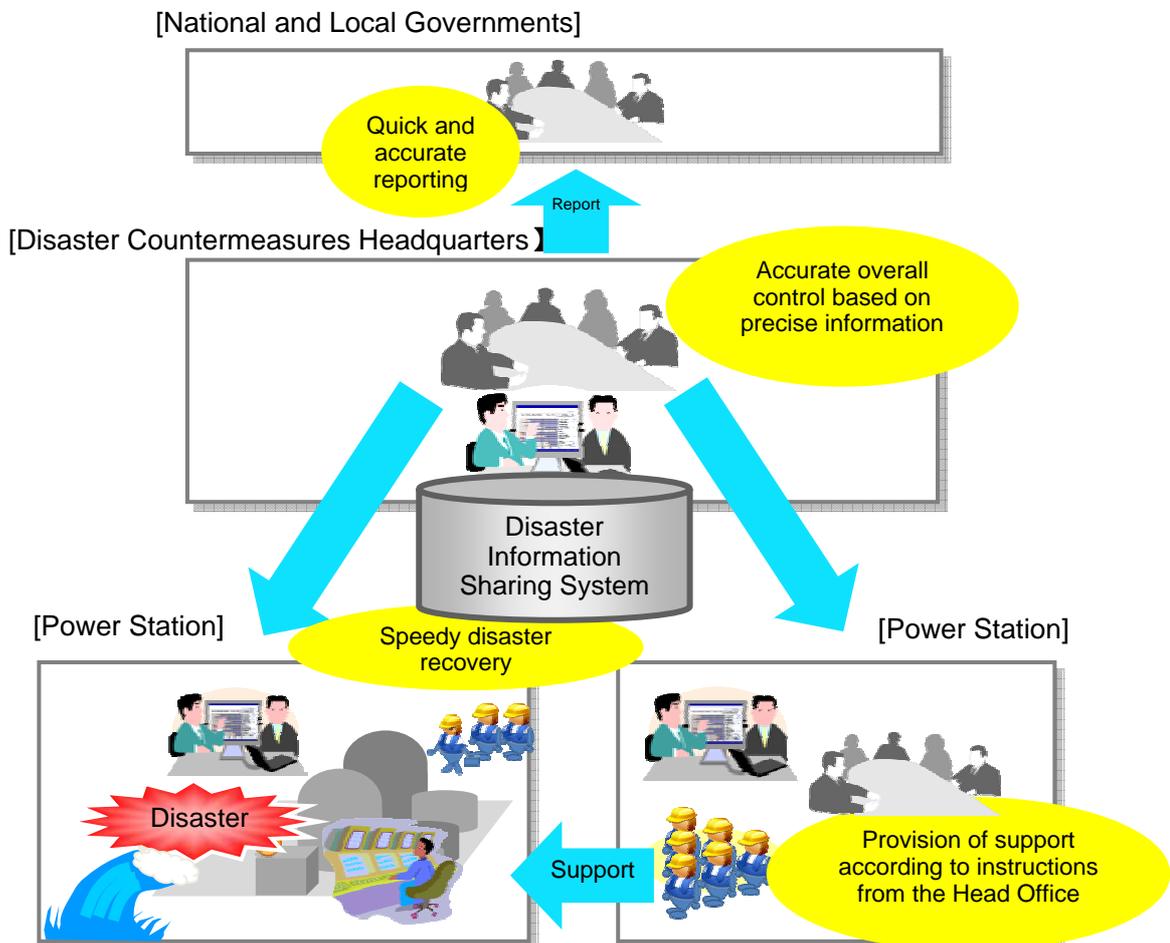


Fig. 1 System Overview

## (2) System Configuration

The system configuration necessary to fulfill the above system requirements is detailed below.

- Installation of information processing equipment such as servers at the Data Center to enable centralized management of information
- In addition to information processing equipment such as servers, installation of a data backup environment at power stations
- Synchronization with the Data Center whenever required to update data in the backup environment

In line with the above, the system configuration has been realized to enable individual power stations to independently continue disaster recovery activities even if a failure occurs in information processing equipment such as servers installed at the Data Center or networks.

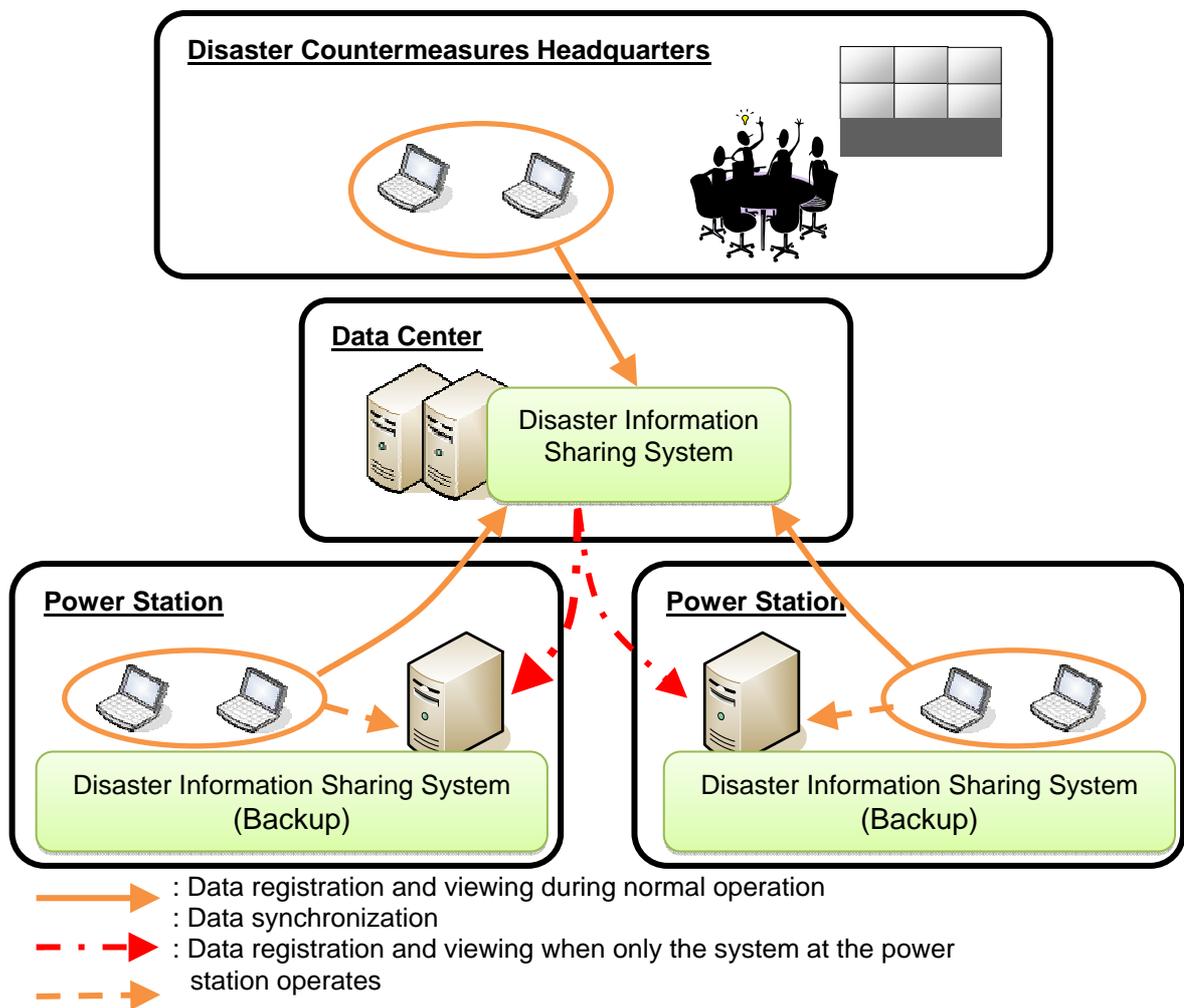


Fig. 2 System Configuration

### (3) System Development

The system functions necessary to fulfill the above system requirements are detailed below.

- Registration and viewing of the disaster status and details of the resulting operating statuses of power supply facilities as well as disaster response systems for recovery
- Specialization in the handling of information on damage to power supply facilities, and registration and viewing of recovery plans and details of the status of response according to the plans
- Management of the history of the status of response to customers and entities such as national and local governments
- Coordination of data with the company-wide disaster information sharing system to enable the sharing of information throughout the entire company as well as with system users at power stations

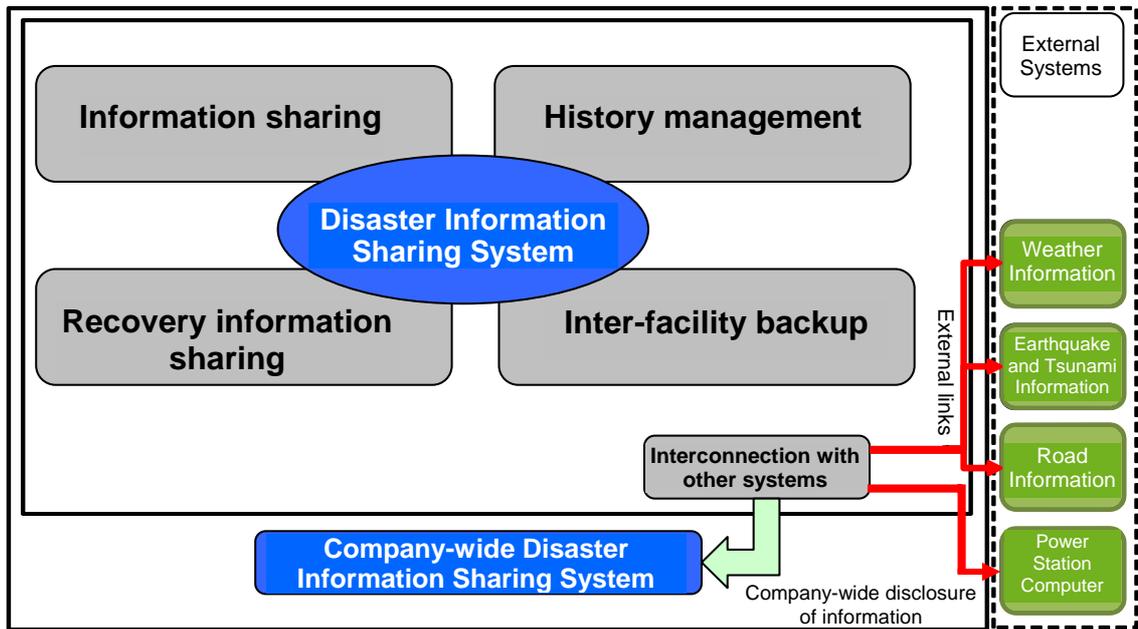


Fig. 3 Overview of Disaster Information Sharing System

Details of each of the above functions are set out below.

#### (a) Information Sharing

We have developed a function that accumulates information on the disaster status and the resulting operating status of equipment and various events taking place at all power stations. This has made it possible to instantaneously share information on the damage status among relevant entities including the head office, branch offices and power stations to ensure rapid response.

- Time Series Information Sharing

Events taking place at sites struck by disasters and details of responses by relevant locations are input and displayed in chronological order.

Date and time of occurrence of event	Place of occurrence	Classification	Details of event	Place of data input	Attachment
2014/10/07 17:13	XX Unit No. 2	Internal report			Attached
2014/10/07 17:11	XX Unit No. 2	Disaster information	Tsunami struck (Off XX, 4 meters in height)		
2014/10/07 17:01	XX Unit No. 2	Emergency report	Reactor No. 2 tripped		
2014/10/07 17:01	XX Unit No. 1	Emergency report	Reactor No. 1 tripped		
2014/10/07 17:00	XX Unit No. 1	Disaster information	Large-scale earthquake occurred (Intensity 6 upper)	Head Office	

- Plant Parameter Sharing

Information on parameters of plants in facilities such as power stations is input and displayed in chronological order.

<List of Measurement Dates and Times>			<Details as of October 7, 2014, 17:30 >				
Measurement date and time	Remarks	N o	Parameter name	Measured value	Value measured last time	Unit	Remarks
2014/10/07 17:30	Regular report	1	YY Monitor A	100	103	x x	
2014/10/07 17:00	Regular report	2	YY Monitor B	105	110	x x	
2014/10/07 16:30	Regular report	3	YY Monitor C	103	120	x x	
2014/10/07 14:30	Regular report	7	Wind speed (Point A)	5.0	6.0	m/s	
2014/10/07 14:00	Regular report	8	Wind speed (Point B)	4.0	5.0	m/s	
2014/10/07 13:30	Regular report	9	Wind speed (Point C)	4.0	5.0	m/s	

(b)Recovery Information Sharing

We have developed a mechanism that specializes in the handling of information on the statuses of response to and recovery from damage to power supply facilities and accumulates information on the status of recovery work. The disclosure of this accumulated information throughout the entire company in a timely and appropriate fashion makes it possible to promptly issue disaster response instructions and support recovery activities.

- Sharing of information on damage to equipment and the status of recovery  
Information including the status of damage to equipment and the status of recovery at power stations is input and displayed.

Date and time of occurrence	Classification	Event name	Classification	Accident
2014/10/07 20:20	Accident		Event name	
2014/10/07 20:10	Maintenance	1 1 1 1 1 1 1 1 1 1	Status	
2014/10/07 20:00	Others	2 2 2 2 2 2 2 2 2 2		
2014/10/07 19:55	Accident	3 3 3 3 3 3 3 3 3 3		
2014/10/07 19:40	Others	4 4 4 4 4 4 4 4 4 4		
2014/10/07 19:20	Others	5 5 5 5 5 5 5 5 5 5		

(c)History Management

This function records the track record of the transmission of information relating to disaster recovery by accumulating information on details of reports and instructions to relevant locations.

- Record of Information Transmitted and Received  
Items such as the history of faxes sent and received and records of their content are accumulated and displayed.

Date and time of occurrence	Classification	Event name	Details	Confirmation by phone
2014/10/07 20:20	Sent	Abnormal event report (The 5th report)	A fax was sent.	Display attachment
2014/10/07 20:10	Sent	Abnormal event report (The 4th report)	A fax was sent.	Display attachment
2014/10/07 20:00	Sent	Abnormal event report (The 3rd report)	A fax was sent.	Display attachment
2014/10/07 19:55	Received	Abnormal event report (The 2nd report)	A fax was sent.	Display attachment
2014/10/07 19:40	Received	Abnormal event report (The 1st report)	A fax was sent.	Display attachment
2014/10/07 19:20	Sent	Emergency event occurrence report	A fax was sent.	Display attachment

FAX received by	Details of response			Remarks
	FAX transmission	Confirmation by phone	Date and time of confirmation by phone	
	Sent		2014/10/07 20:25	
x x x x	Sent		2014/10/07 20:26	
	Sent			
	Sent			
	Sent		2014/10/07 20:24	

### 3.2 Construction of Disaster Recovery Support System (Disaster Recovery Support Materials Information Management System)

#### (1) System Requirements

The requirements for the Disaster Recovery Support System to check the statuses of arrangements for and delivery of disaster recovery support materials at the disaster countermeasures headquarters and the materials department in the event that power supply facilities sustain damage due to a large-scale disaster are listed below.

- Ability to perform secure centralized management of data because of the sensitive nature of information handled on matters such as power plant equipment recovery materials
- Availability of the system for use by different types of terminals
- Ability to provide real-time identifiable information on the positions of vehicles transporting recovery support materials on a constantly updated map in the event of a disaster
- Ability to provide an understanding of the types and quantities of materials loaded on the above vehicles and the expected times of arrival at destinations
- Ability to provide identifiable information on routes to the destinations of the above vehicles on a map
- Ability to provide identifiable information on damage to roads (e.g., road closures, congestion) on routes to the destinations of the above vehicles on a map
- Ability to give instructions to drivers of vehicles transporting materials on detour routes in the event that damage to roads on routes have rendered roads impassable

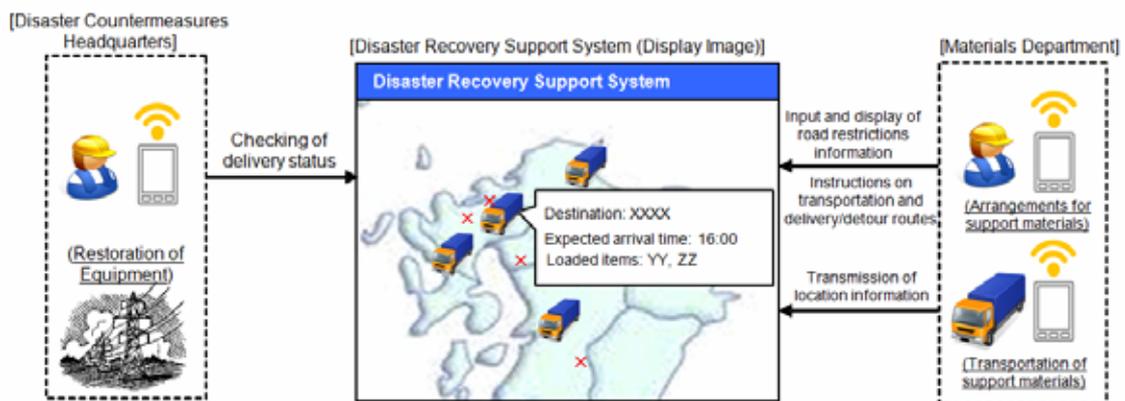


Fig. 4 Overview of Disaster Recovery Support System

## (2) System Configuration

The system configuration necessary to fulfill the above system requirements is detailed below.

- Centralized management of data at the Data Center in a private environment because of the sensitive nature of data handled such as equipment-related information
- Use of general-purpose terminals (multi-device) such as tablets and smartphones to register and view information to respond to emergencies
- Use of general-purpose smartphones to transmit information on the positions of vehicles to eliminate the need to install dedicated terminals in vehicles
- Use of cloud map services in the public environment to enable the real-time use of the latest map information

In line with the above, the system configuration has been realized to enable speedy disaster recovery support even in an emergency such as an unexpected disaster.

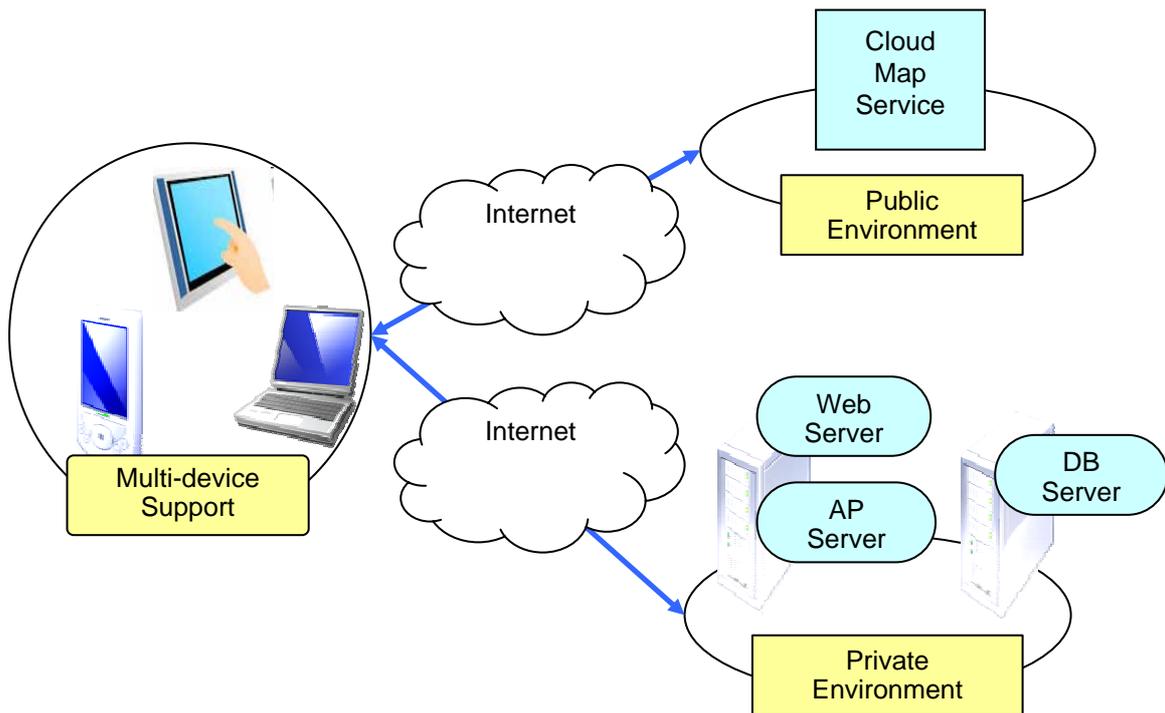


Fig. 5 System Configuration

## (3) System Development

The system functions necessary to fulfill the above system requirements are detailed below.

- Automatic transmission of information on the positions of vehicles to the system whenever necessary using the location information function furnished in drivers' terminals such as tablets and smartphones
- Visual confirmation of information on the current positions of vehicles on a map using geographical information system (GIS) services to provide an understanding of the latest map information and information on damage to roads (e.g., road closures, congestion)
- Registration and viewing of information including the types and quantities of materials loaded on vehicles and the expected times of arrival at destinations
- Registration and map display of information on the routes of vehicles to their destinations and damage to roads (e.g., road closure, congestion) on the routes
- Registration and map display of information on detour routes in order to provide instructions on detours to drivers transporting materials in the event that damage to roads on routes renders roads impassable

#### **4. Conclusion and Future Undertakings**

The introduction of the systems detailed in this paper has enabled realization of speedy disaster recovery by centralized management of information on the statuses of damage and recovery even in the event that power supply facilities sustain serious, extensive damage caused by an unexpected, unprecedented large-scale disaster.

In order to fulfill the mission of electric power companies such as ours of ensuring a safe and stable supply of the lifeline of electricity, we intend to put these systems to use in large-scale disaster response drills envisaging a wide range of events to gain an understanding of and resolve problems with the goal of being prepared to respond with speed to disasters, thereby realizing early recovery.