

## **Joint Research Project on Disaster Reduction using Information Sharing Technologies**

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### **Abstract**

It is well known that the lack in information led to an enlargement of damages in the past notable disasters like Hyogoken-nanbu earthquake of 1995 in Japan. This lesson has not been necessarily reflected on disaster response activities even in recent disasters. For the purpose of reducing disaster damage by applying information sharing technologies, the research on disaster reduction using crisis-adaptive information sharing technologies was commenced in July, 2004, as a three year joint project composed of a government office and agency, national research institutes, universities, lifeline corporations, a NPO and a private company. In this project, the disaster mitigating information sharing platform which is effective to disaster mitigation activities especially for local governments was developed. The platform is composed of a framework of both information contents and information systems. The development of the information sharing protocol, database and various information systems and tools was conducted. The research on standardization of information items and spatial data processed through the platform also was successfully performed. Then, the research went into the stage of constructing a prototype of the platform by integrating an individual system and tool. Finally, the prototype of the platform was applied to Mitsuke City in Niigata Prefecture, Japan as a field test and was proved to be effective to disaster response activities for not only the city but the Cabinet Office, the Fire Defense Agency and Ministry of Land, Infrastructure and Transport as central government agencies, Niigata Prefecture as local government and lifeline companies, etc.

**Keyword:** *information sharing platform, local government, disaster response, heavy rainfall*

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## **1 Introduction**

The central disaster prevention council of Japan decided a fundamental principle on the preparation of disaster information systems in March, 2003. Since every disaster response is carried out based on information, an information sharing is indispensable in every disaster response activity. Thus, the principle proposed the building of disaster information sharing platform among disaster prevention organizations. The Cabinet Office started an examination on the introduction of disaster information sharing platform among central government agencies in 2004 and continuous operation has been conducted for building such a platform.

For the purpose of reducing disaster damage by applying information sharing technologies, the research on disaster reduction using crisis-adaptive information sharing technologies was commenced in July, 2004, as a three year joint project [1]. In this project, the disaster mitigating information sharing platform which is effective to disaster mitigation activities especially for local governments was developed. The platform built in this project is in mutually complementary relationship with the platform among central government agencies built by the Cabinet Office. The project aimed that the platform built in this project could form the disaster information platform of Japan, in coordination with another platform. The paper describes the results of the three year project, focusing on the framework of the platform and its application to a local government.

## **2 Definition of the DiMIS**

In this project, the DiMIS platform is defined as the framework for establishing liaison among different information systems in different governmental agencies and public institutions at the time of disaster response [2]. The framework is furthermore divided into two different frameworks, i.e., frameworks on information engineering basis and on social science basis. The former is represented by communication protocol, information sharing database and application software in conformity to the protocol. The latter, on the other hand, is represented by contents of information and their distribution method. Thus, the DiMIS platform constitutes of frameworks regarding both information systems and information contents.

## **3 Framework as Information Systems**

The communication protocol of the DiMIS platform is the communication procedure to access to the DiMIS database. As a prototype of the DiMIS platform, MISP (Mitigation Information Sharing Protocol) was established in the project. XML is used as data expression

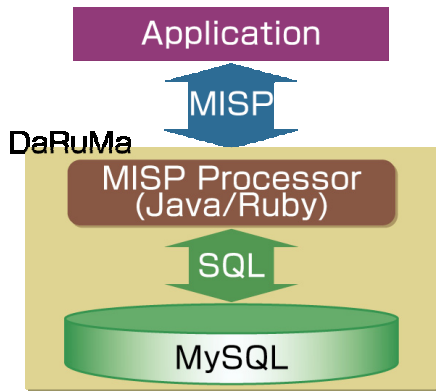


Figure 1 Schematic view of DaRuMa



Figure 2 Framework as the information system

and GML is adopted as geographical data expression in MISP. WFS is adopted as the protocol for database searching and management. SOAP is used as a standardized form of the Web service. Thus, MISP is mainly composed of international standards. The dynamic registration for a new data structure is added to MISP as an extensive function.

Different information systems for supporting disaster response activities, with various database systems and GIS engines, have been already introduced to local governments or public institutions in Japan. A rigorous standardization of information systems, therefore, cannot be an expedient approach to establish liaison among different disaster information systems. Thus, in the research project, a generous unification of various disaster information systems through MISP, the information sharing protocol was proposed.

The DiMIS database is the information sharing database in conformity to MISP. A prototype of this database is built on MySQL, an existing relational database, and it was named as DaRuMa (Database for Rescue Utility Management). When an application program accesses this database using MISP, it can access MySQL through the protocol processor. It has both functions of a database server and a communication server. The concept of the database is illustrated in Figure 1 and the framework as information systems is summarized as Figure 2.

#### 4 Framework as Information Contents

A local government such as a city or a town needs to share various information with local inhabitants, lifeline utilities, disaster prevention organizations such as the police station, the fire station, the Self-Defense Force, hospitals, and the upper local government (prefecture), when a large disaster occurs. The investigation was carried out based on a questionnaire and an interview to local government personnels who have experienced disaster response activities in an actual disaster.

The result of the investigation was arranged and summarized as the database for shared information necessary for disaster response activities. Such information is correspondent with the disaster mitigating information. Based on the database, the information flow diagram was drawn for individually classified information group. In addition, the information processing flow for individually classified information group was also summarized.

Figure 3 shows the schematic diagram to demonstrate the research on the framework as information contents. The table for shared information in which information items are classified systematically, was made first. Then, XML schema for each shared information datum was built. It describes the structure of information datum and every information system can access to DaRuMa to register, acquire or search datum using the schema through the DiMIS protocol, MISP.

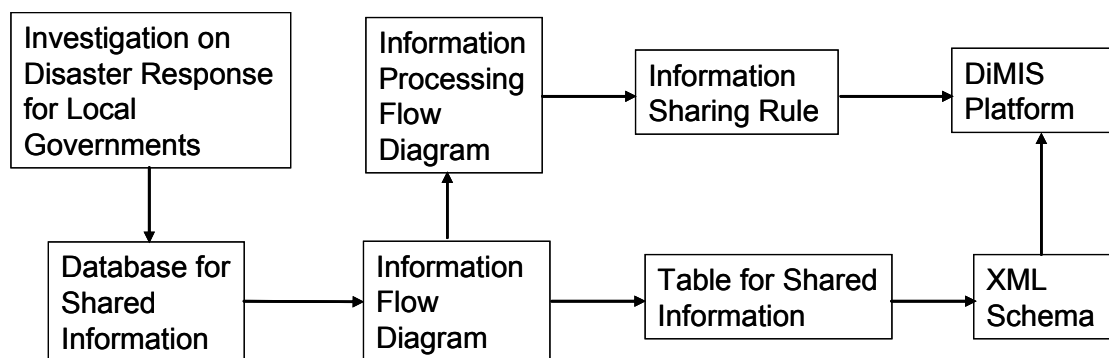


Figure 3 Approach to the framework of information contents

## 4 Field Test on the Application of the DiMIS Platform to a Local Government

### 4.1 Outline of Field Test

Mitsuke city in Niigata Prefecture, featuring a rural district with rice fields with the population of about 44000, was selected as the test field. The city was attacked by two notable disasters, i.e., the Fukushima-Niigata heavy rainfall and the central Niigata prefecture earthquake in 2004. The city employees in Mitsuke were well trained by response activities due to the above-mentioned actual disasters. They can take part in the field test as players and can evaluate the effectiveness of the platform.

The disaster response drill was executed in an environment where the DiMIS platform was established. The city employees of construction department and fire department in Mitsuke collected disaster information and responded using the disaster response management system, according to the scenario which we had drawn up [3]. After the drill, they evaluated the effectiveness of the platform by comparing their response activities with and without the

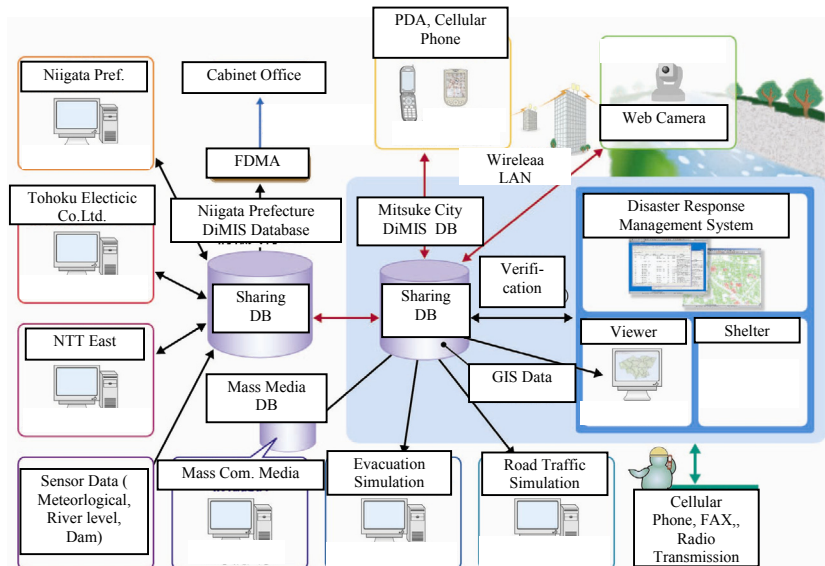


Figure 3 Prototype of the DiMIS platform applied to Mitsuke City

platform in dependence upon their experience.

Figure 3 illustrates a schematic diagram to describe the prototype of the DiMIS platform applied to the field test. The DiMIS database was allocated inside and outside Mitsuke city, respectively. The database inside Mitsuke city is the information sharing database server for Mitsuke city and it was connected with such client systems as the disaster response management system, simulators, information collection systems and tools (PDA, cellular phone) and a viewer system. The viewer system is the system to display the content of information registered on the database. In addition, the database is connected with the information sharing database set outside the city (Niigata Prefecture) and the database for mass communication media.

The DiMIS database outside Mitsuke city was supposed to be located in Niigata Prefecture Government. The database was connected with information sharing systems of lifeline utilities such as Tohoku Electric Power Co., Ltd. and NTT East, Niigata prefecture (including the river and dam information center of Niigata Prefecture), and the Fire and Disaster Management Agency in Tokyo.

#### 4.2 Evaluation of Field Test

The evaluation of the platform was made by collaborators in both forms of questionnaire and interview. Then, the platform was evaluated highly effective to disaster response activities. As closing remarks, Mr. Kusumi, Mayor of Mitsuke city expressed his



Figure 5 Field test conducted in Mituke

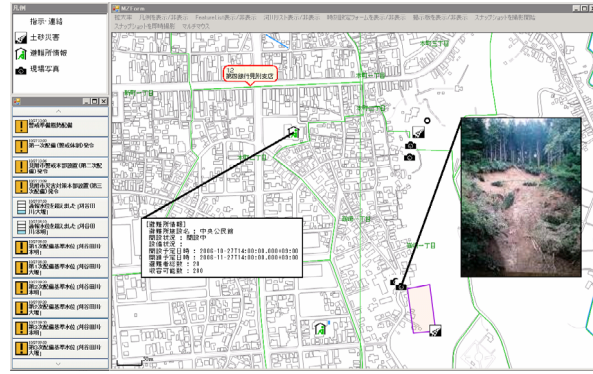


Figure 6 Snapshot of the viewer system

gratitude to us and he indicated that he wanted to introduce the platform to Mitsuke city for the safe of citizens.

### Concluding Remarks

This paper presented an outline of the three year joint research project on the disaster mitigating information sharing platform. The framework of the platform was built and various information systems and tools were developed as a prototype of the platform. The prototype was applied to the field test and the platform was evaluated as highly effective to disaster response activities.

Researchers who participated in this project have set up incorporated non-profit organization named as ADMiRe (Agency for Promoting Disaster Mitigation and Damage Reduction) in order to realize the platform and started their activities in various fields.

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