Mobile Multimedia Service Model using XML Technology - Utilization of Road Web Markup Language -

Yasuhiko Kajiya, Masaru Matsuzawa, Nobuo Konagai

Hokkaido Development Bureau, Civil Engineering Research Institute
1-3 Hiragishi, Toyohira-ku, Sapporo, 062-8602, JAPAN
Tel: +81-11-841-1111, Fax: +81-11-841-9747, E-mail: ykajiya@ceri.go.jp

SUMMARY

The Hokkaido Development Bureau is currently promoting R&D on ITS technology intended for Hokkaido's cold snowy climates called "**ITS/Win Research Program**." In this program, we conducted open application-based public/private joint research projects, and developed the XML Technology-based **Road Web Makeup Language (RWML)**. This paper discusses the background of this development and the mobile multimedia service model using XML technology. Five service models such as Mobile Sensor Service, Mobile Personnel Support Service, Mobile Support Service, Mobile Edu-tainment Service, Mobile Commerce Service are proposed. In addition, to realize such services, Personalized Mail (PM), Personalized Web (PW) and Data Broadcasting for Personalized Application (DB4PA) are recommended as applications.

INTRODUCTION

The conventional media such as broadcast and telephone are restricted in time or location to obtain selectable information. The Internet has been promoted to provide various types of information to meet the personal needs of users at any time. Mobile multimedia enables Internet users to obtain necessary information from anywhere.

In Japan, Internet-accessible mobile telephone service was commercially introduced in February 1999. The users of these services exceeded 10 million people at the end of May 2000. According to the Mobile Computing Demand Forecast by the Mobile Computing Promotion Consortium, the mobile computing users in Japan are estimated to exceed 52.92 million in 2003.(*1*) Therefore, there will be a need to offer an information service that can adapt to the explosive growth in demand for mobile multimedia service.

DEVELOPMENT OF XML TECHNOLOGY-BASED ROAD WEB MARKUP LANGUAGE "RWML"

XML (**eXtensible Markup Language**) is an extended version of the **Hyper Text Markup Language** (**HTML**) that is popular as a homepage markup language. It has been attracting much attention in the Internet-based data processing field. The W3C

(World Wide Web Consortium), an international body for standardization of Web technology, published a recommendation of standard specifications for XML in February 1998. This language is now widely used in electronic commerce(EC).

The Civil Engineering Research Institute of the Hokkaido Development Bureau has organized a joint research group with Omron Corporation, Nagoya Electric Works Co., Ltd. and Mitsubishi Electric Corp. and other companies and organizations, and has developed RWML (Road Web Markup Language) in order to define a markup language dedicated to road information using XML(*2*).

RWML is defined for the purpose of disseminating road information via Internet in the form of data enabling value addition. RWML data is easy to collect and process, and permits configuration of an information system to provide users with useful value-added information combined with other information such as weather forecast and local event information. RWML is also applicable to all the data that is used by road authorities and related organizations. By introducing RWML into their system, from data collection to provision, road authorities can build a comprehensive road management information system based on Internet technology.

RWML consists of four parts: 1) road information, 2) weather information, 3) disaster information, 4) regional information. As of June 25, 2000, the latest version (Ver. 0.71) of the RWML draft can be accessed at URL (http//www2.ceri.go.jp/eng/its-win/RWML.htm)(*3*).

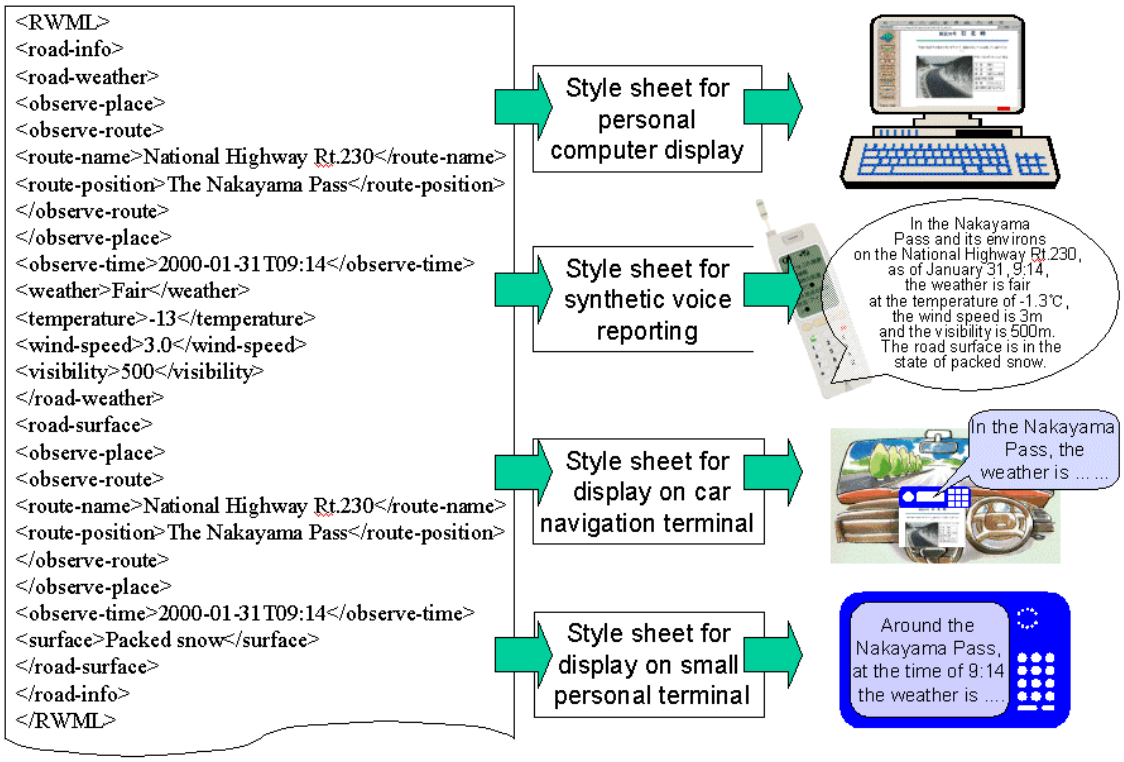

Fig.1 Examples of RWML and Stylesheets for Information Devices

The Drive Advice Server (DAS) is an information system to store the data accessible via Internet in a database as an information source and transmit the most adequate data from the database as requested by users. Its data form uses RWML.

Users of DAS are drivers during traveling or before departure and can access the database via Internet from data terminals such as home or office personal computers, kiosk terminals at road stations or on-vehicle data terminals. (See reference(*2*) for details.)

MOBILE MULTIMEDIA SERVICE MODEL USING XML TECHNOLOGY

The RWML can be used in 7 stages: Collection, Sharing, Exchange, Providing, Distribution, Value Addition and Commerce. The stages of Collection through Exchange are mainly intended for data owners and related organizations to use data on intranet or extranet. The stages of Providing and Distribution are mainly used by data owners to provide general and public information. The stages of Value Addition and Commerce are used for data provision for needs and commercial purposes. For these stages of use, 5 types of service have been devised as described below.

In Collection through Exchange, the efficiency of road management and information sharing among related organizations are assumed:

(1) Mobile Sensor Service: Moving road maintenance vehicles transmit operational information to the center based on location and time information of the vehicles, and receive necessary information by RWML.

(2) Mobile Personnel Support Service: Moving road maintenance personnel can get adequate information from the center based on location and time, in the case of disasters such as heavy snowfall, thereby enabling joint use and quick access of information among road authorities.

In Provision and Distribution, it is intended that road users be provided with adequate information, including information that supports the elderly and people with impaired mobility:

(3) Mobile Support Service: The movement of vehicles and people is supported by selective provision to traveling vehicles and pedestrians of necessary user information on destinations, time and purposes. This is done to support safe driving by warning of danger in case of snowstorm and to provide pedestrians with information on “barrier-free” facilities. For example, not all cars are equipped with studless snow tires when the road is partially covered with snowfall and frozen and weather conditions are considerably changeable, such as at a mountain pass in early winter. The service aims to support safe driving by providing drivers with voice information on the conditions of icy and frozen roads on the route, an optimal place to attach and remove tire chains, and the location of a gas station where the driver can attach chains to tires in accordance with the destination and tires of the vehicle.

In Value Addition and Commerce, it is intended that higher value-added information be used and exchanged:

(4) Mobile Edu-tainment Service: Local sightseeing information integrated with administrative information is provided to traveling drivers, depending upon their interests;

(5) Mobile Commerce Service: Tourists in traveling cars are provided with the opportunity to purchase local music and images related to sightseeing spots. This value-added information is of more use than conventional sightseeing information. In the case of the road in a mountain pass in early winter, the service will provide users who need to obtain winter tires and chains with information on where these are sold along the route and how much they cost. Availability will be given according to tire size and the driver's driving ability. The users will be able to make purchases and payment electronically.

The character of the services will gradually change from stage 1 (Collection) to stage 7 (Commerce), and the service character will change from public services to private services based on the partnership between the public and private sectors.

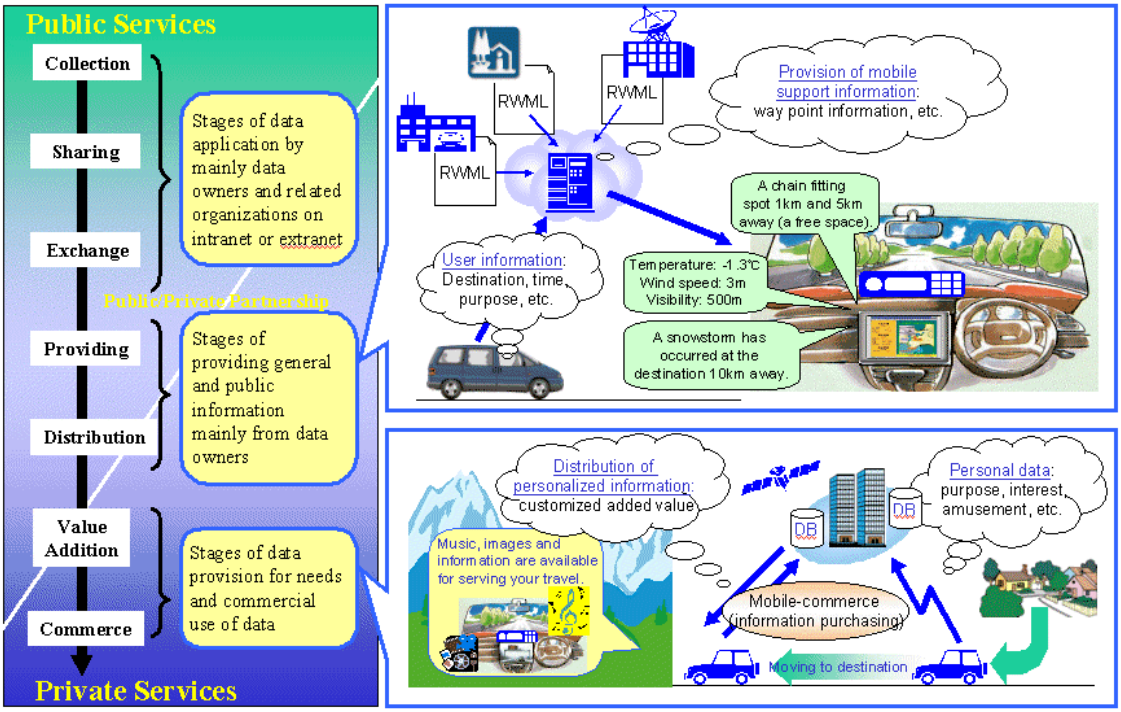

Fig.2 Seven Stages of RWML's Use and some Services

Possible kinds of technologies to realize such services are **Personalized Mail (PM)** and **Personalized Web (PW)**, which provide users with information via Internet based on their interests and personalized needs; and **Data Broadcasting for Personalized Application (DB4PA)**, which transmits a wide range of data to users via digital broadcasting. When considering the realization of the functions for "data utilization at any time from anywhere to meet personalized needs" and XML's features such as platform independence and easy multimedia compatibility, the environment for

realization of mobile multimedia will be PM and PW capable of handling low volumes of data. DB4PA is an appropriate tool for handling high volumes of data for a feasible environment of mobile multimedia in view of the distribution volume of information in network.

TOWARD REALIZATION OF "SMARTWAY-XML"

The above services are difficult to realize with information collected by the road authorities alone. Moreover, combining the data collected by the road authorities with other types of data has been considered. Such information will be provided by public organizations and commercially-oriented ITS service providers as well as the road authorities in "Mobile Edu-tainment Service" and "Mobile Commerce Service."

The standardization of XML in various fields has been promoted in Japan. For example, making G-XML the XML standard for geographical information has been investigated. Japanese society is entering an era of "advanced information telecommunications," where data from diverse fields are distributed via Internet. It is necessary to build an environment that allows drivers and passengers traveling along the road to access such data easily and safely.

The SmartWay-XML (hereafter: SW-XML) Concept is designed to achieve such an environment. The Concept has been proposed by the authors and is started to investigate by the Highway Industry Development Organization in Japan. SW-XML is a general term for a new XML standard and utilization environment that enables users to convert and share data described by various types of XML related to road traffic. The SW-XML's role is not limited to specifying the form of data description. It also aims for the construction of a comprehensive architecture that includes these rules: a content provision rule concerning the information provision priority such as information on accidents ahead, a rule on prioritization of data such as information on obstacles occurring on the road ahead of the driver, a rule on safe provision of information to the driver at the wheel, and a rule on information provision related to the utilization method of SW-XML. The core technology is the above-mentioned RWML.

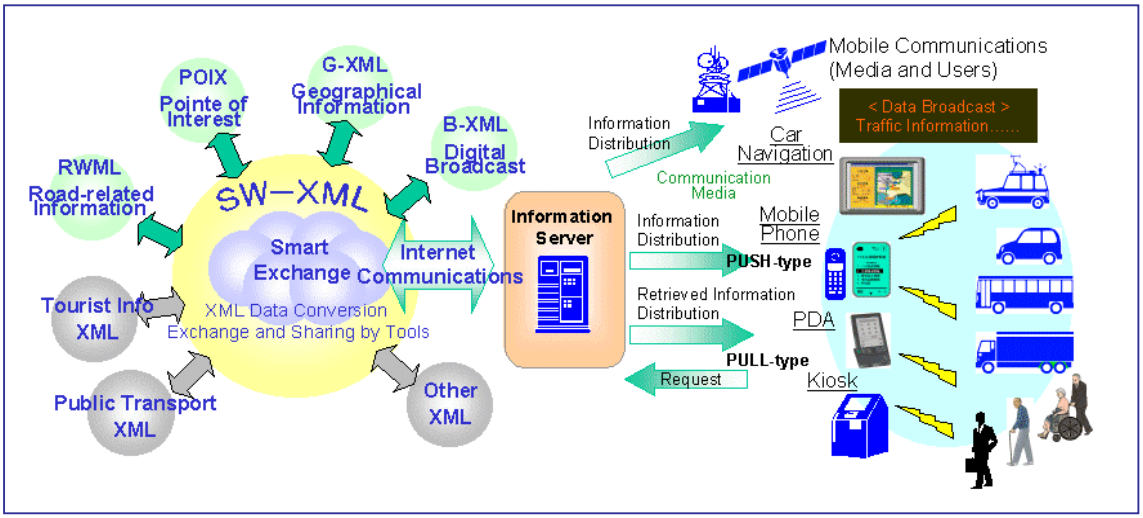

Fig.3 SmartWay-XML Concept

The roadside space is provided with facilities such as traffic signs and variable message signs built by the road authorities and billboards installed by local communities. Commercial signs are installed on private land outside the roadway. Although these signs are intended to convey information to drivers traveling along the roads, they have caused the following problems and needs for drivers.

(1) Traffic signs and variable message signs and billboards installed in great numbers at the roadside sometimes adversely effect the traveling safety of drivers and spoil the road landscape.
(2) Because the numbers of variable message signs that can be installed are limited, as are the numbers of letters and characters that can be indicated on the signs, it is difficult to provide information to users according to individual physical abilities and traveling conditions.
(3) A variable message sign cannot indicate multilingual information or meet the needs of non-Japanese users.
(4) The data directly concerning traveling safety (obstacles, traffic accidents and disasters on the road ahead) should be provided to users at the highest priority of any data. In fact, these data are transmitted to drivers in a lump.

Just as roadside space needs to be used orderly or according to definite rules so that drivers may be provided with a safe traveling environment, driving-related information needs to be provided orderly or according to definite rules. Herein lies the significance of examining the XML standard concerning road traffic by the road authorities. The following effects can address the above-mentioned problems and needs of drivers, when we define the SW-XML with the direction of the road authority.

(1) Information provided in physical space can be supplemented by provision of information in virtual space of the Internet. In other words, Internet information can help to reduce information facilities and billboards along the road and improve traveling safety and road landscape.
(2) Provision of information in virtual space via Internet is not spatially limited. Moreover, because it is possible to provide users with information according to their individual interests and needs, the reliability of information recognition and driving safety are improved.
(3) Since multilingual indication of information is feasible by provision of information in virtual space via Internet, the needs of non-Japanese users can be met.
(4) It is possible to construct a system that supplies information directly concerned with driving safety as an overriding priority. Moreover, the creation of new industries is expected by allowing information such as commercial billboards that are installed along the road to be provided on the network.

One can think of information that is obtained visually from conventional roadside traffic signs and variable message signs as being revealed by a “headlight.” Analogously, one can think of variable message sign that is obtained in virtual space (cyberspace) via Internet with SW-XML as being revealed by a “Net-light.” A headlight illuminates an area about 40 m ahead of the vehicle at night. Traffic signs such as those to warn the

driver of a curve in the road ahead, variable message signs and billboards, and even hotel signs along the road appear one after another in the limited area lit by a headlight. In contrast, the "Net-light" can reveal information related to the route ahead on the network. From the obtained information, data pertinent to one particular user is automatically extracted from the data described by the SW-XML standard and is provided in the form of sorted voice information without hindering traveling safety.

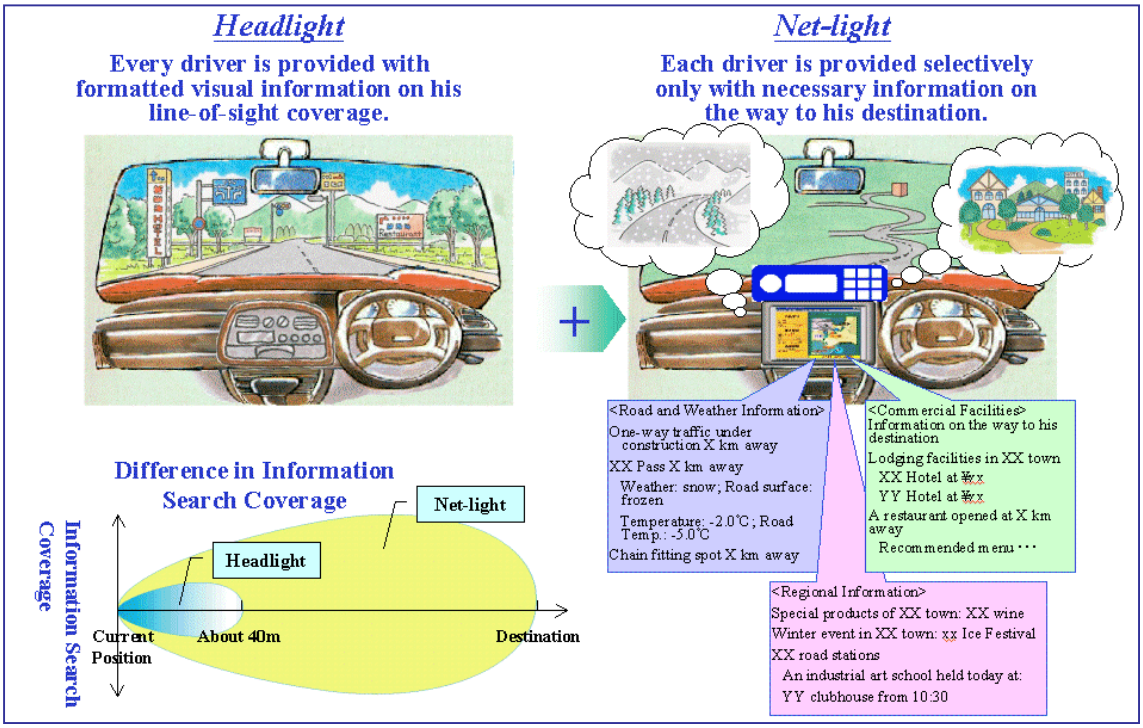

Fig.4 From Headlight to Net-light

When we compare the ranges at which each of these lights reveals information and the content of this information, we find that a “headlight” reveals one-way information on the route ahead and illuminates the limited area around the road. In contrast, the “Net-light” provides particular information on the route and the surrounding area according to the interests and needs of the driver.

CONCLUSION AND FUTURE PROSPECTS

By combining rapidly developing mobile multimedia with the XML technology, various forms of ITS service from the “Mobile Sensor Service” to the “Mobile Commerce Service” can be realized. Moreover, the revitalization of local industries and the creation of new industries are expected, as is the improvement of road safety and smooth traffic. These potentials are expected to expand beyond our imagination.

The Internet is growing explosively, and its use is the key to the future of ITS. XML technology is particularly promising, because it is platform-independent, affords ease of conversion into various media, and can combine time information and position

information organically. Therefore, XML will play a very important role in the future use of ITS technology. In addition, Internet technology will be very effective as a solution for configuring a regional ITS in a rural area that lacks special ITS infrastructure.
We are planning to work toward the technological improvement of the RWML and the realization of the SW-XML, to conduct feasibility research on service models and to test these models by field experiment.

In 2002, the XIth PIARC International Winter Road Congress will be held in Sapporo. We would like to more actively promote information exchange with all cold, snowy countries and regions of the world with whom we can share the knowledge and experience for safety and efficiency improvement of winter transport.

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