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A NEW DESIGN OF ATIS ARCHITECTURE FOR JIANGSU PROVINCE, CHINA

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ABSTRACT
Because of the outstanding performances and features, smart-phones have been developed over the past decade in China. More and more persons take smart-phones along using various applications to process many affairs instead of personal computers. With the sensor technology and multi-media display technology integrated in the smart-phones, the traffic information can be collected and distributed more efficiently. Therefore, the smart-phones play a more and more important role in advanced traveler information system (ATIS) nowadays. Although the smart-phones have changed the people's lives importantly, this potential resource has not been explicitly evaluated for ATIS applications. In this paper, the new ATIS architectures for Jiangsu Province were illustrated with the consideration on the broad usage of smart-phones based on Chinese national Intelligent Transportation System (ITS) architecture and Jiangsu provincial ITS architecture.

General Terms
Intelligent Transportation System

Keywords
ATIS; architecture; smart-phone; ITS

1. INTRODUCTION
Intelligent Transportation Systems (ITS) are those utilizing advanced technologies and system engineering concepts to develop and improve transportation systems of all kinds. Nowadays, the ITS systems are difficult to design, develop and

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deploy because of limit for new infrastructures, complexity and diversity of systems and the problem of non-interaction between novel and existing systems[1]. Consequently, the ITS architecture plays a role in facility related to structural and functional plans and characteristic of interaction between two or more systems[2]. Thus, the efficiency of ITS systems depends on ITS architecture. The U.S. Department of Transport (U.S. DOT) published national ITS architecture first in the world to provide a common framework for planning, defining, and integrating ITS. The architecture keeps improved and reaches the latest version 7.1. Based on the national ITS architecture, McTrans Software Center at the University of Florida has developed a software application Turbo Architecture which supports development of regional and project ITS architectures using the national ITS architecture as a starting point. The software is updated to version 7.1 according to national architecture[3]. One the other hand, there is a short history of researching ITS in China. The National Center of ITS Engineering and Technology (ITSC), which plays an important role in Chinese ITS researches, developed Chinese national ITS architecture in 2003, and a computer-aided ITS architecture development tool called ITSA-CASS[4]. However, the version 2 for the Chinese national architecture has not been published so far. Aided by the Chinese national ITS architecture, some regional ITS architectures have been developed gradually, such as Jiangsu provincial ITS architecture[5].

With the recent development in sensing and communication technology, advanced traveler information systems (ATIS) become the most convenient and economic subsystem in ITS. ATIS contain technological framework that: (1) collects traffic variables in the large traffic networks and with the high temporal frequency; (2) processes the collected data and reveal the meaningful information from it; (3) disseminates the instructive real-time information to the travelers in the form of either colored network maps or suggested trip characteristics such as departure time, mode of transportation and assigned path[6]. The travelers can save their traveling time using applications installed in smart-phones, which embedded GPS or other sensors. In that way ATIS systems reduce the total delay, improve the user's comfort and satisfaction, decrease the pollutions and noises and enhance the overall productivity within a city[7].

More and more people can not be separated from smart-phones, which are usually seen as the most convenient way to deliver real-time information to the users. With the various desktop applications and numerous smart sensors such as GPS, accelerometers, inertial measurements, manometers, microphones and even cameras, smart-phones play an important role in colleting traffic information. Although smart-phones benefit ATIS systems significantly, this potential is not explicitly considered for ATIS architecture in China.

In this paper, a basic ATIS architecture was designed for Jiangsu Province of China, which had fully considered the impact of smart-phones.

2. OBJECTS OF ATIS ARCHITECTURE

The objectives of the ATIS architecture for Jiangsu Province are listed as follows.

The architecture should be adapted to the existing Chinese national ITS architecture and the Jiangsu Provincial ITS architecture.

The architecture can guide ATIS constructions with more efficiency and safety.

The architecture should consider the potential of smart-phones fully.

3. USER SERVICES OF ARCHITECTURE

A survey was conducted to collect the travel information that the travelers needed. The purpose of this survey is to prepare for the user services. The survey results determine the information that the system should provide for the travelers of pre-trip and en-route. The results of the survey can benefit the determination of the user services.

More than 300 questionnaires were sent out to the travelers and the officials in Jiangsu Highway Bureau and 266 effective were recalled. The user services of the ATIS architecture were determined according to the requiring information results.

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The user services are divided into 4 bundles, 19 services and 67 sub-services respectively. The user service bundles and user services are listed in Table 1, while the sub-services are left out for the reason of space.

Table 1. User services for ATIS architecture

User Service Bundle	User Service
Traffic management	Real-time traffic data detection
	Vehicle detection with location based service (LBS)
	Traffic violation punishment
	Traffic control device management
	Traffic incidents management
	Weather detection
	Security control
	Road construction and maintenance management
Traffic information service	Pre-trip information service
	En-route information service
	Individual information service
Smart-phone information service	Static navigation with smart-phone apps
	Dynamic navigation with smart-phone apps
	Peripheral life service information
ATIS data management	Data access and storage
	Dada processing
	Data exchange and share
	Data application support
	Data security

4. ARCHITECTURE FOR ATIS

The purpose of the ATIS architecture is to guide the system construction on the macro-level in Jiangsu Province. The architecture usually includes logic architecture and physical architecture.

4.1 Logic architecture

Logic architecture is the key step from use services to physical architecture. The logic architecture consists of logic function hierarchy, logic function element definition, data flow diagram and data flow description. The emphasis of these four divisions is the data flow diagrams that illustrate the relations between the logic function elements and terminals by defining the original, destination and direction of each data flow. The data flow diagrams are organized hierarchically from the top level to the lowest level. The top level data flow diagram is illustrated in Figure1.

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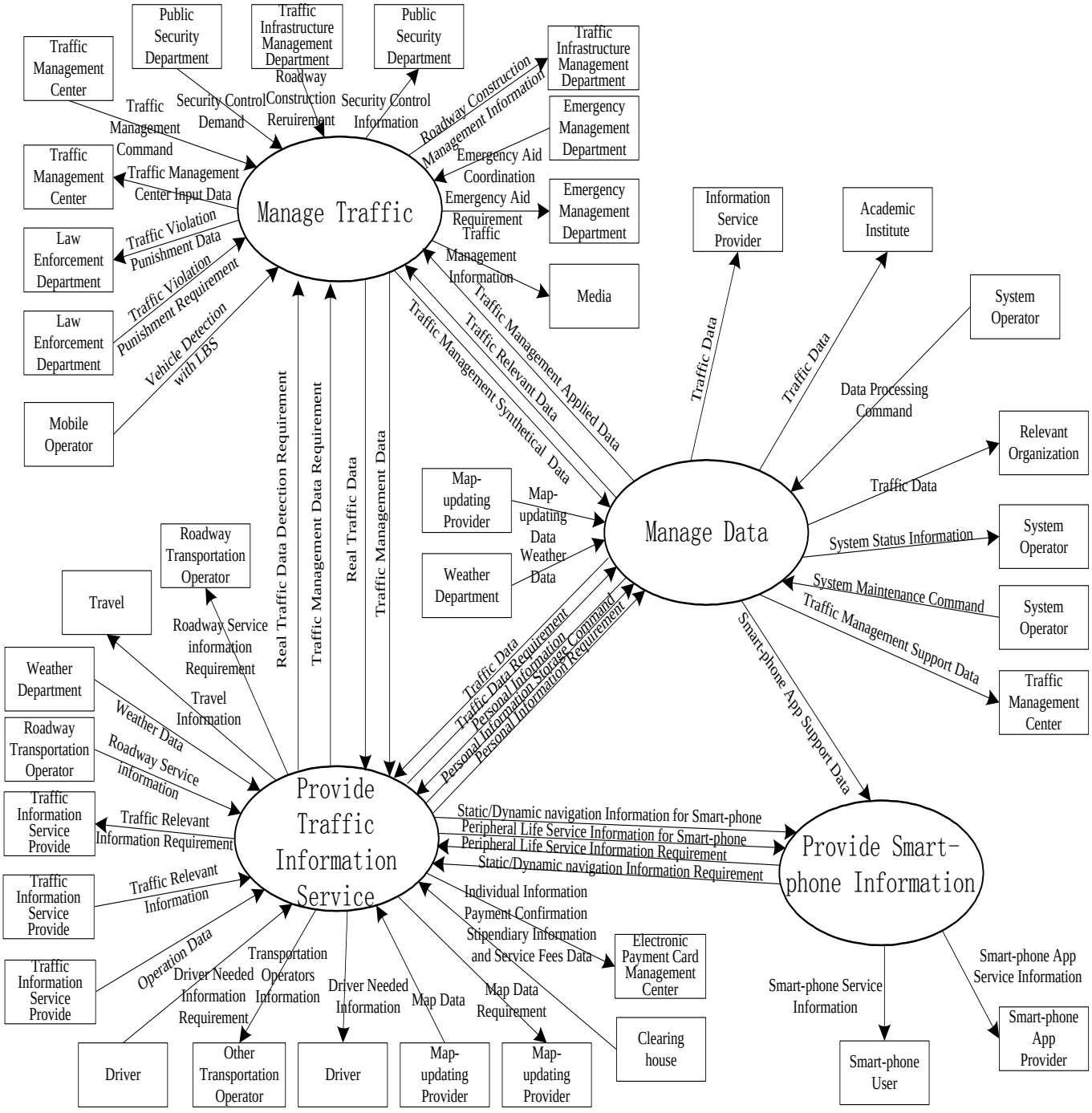

Fig 1: Top level logic data flow diagram of ATIS

4.2 Physical architecture

Physical architecture, which is built by concretizing logical architecture, consists of physical system hierarchy, physical element definition, physical flow diagram and physical flow description. The concentration of the physical architecture is the physical flow diagrams, which determine the relations between physical elements and terminals. Figure 2 shows the top level physical flow diagram.

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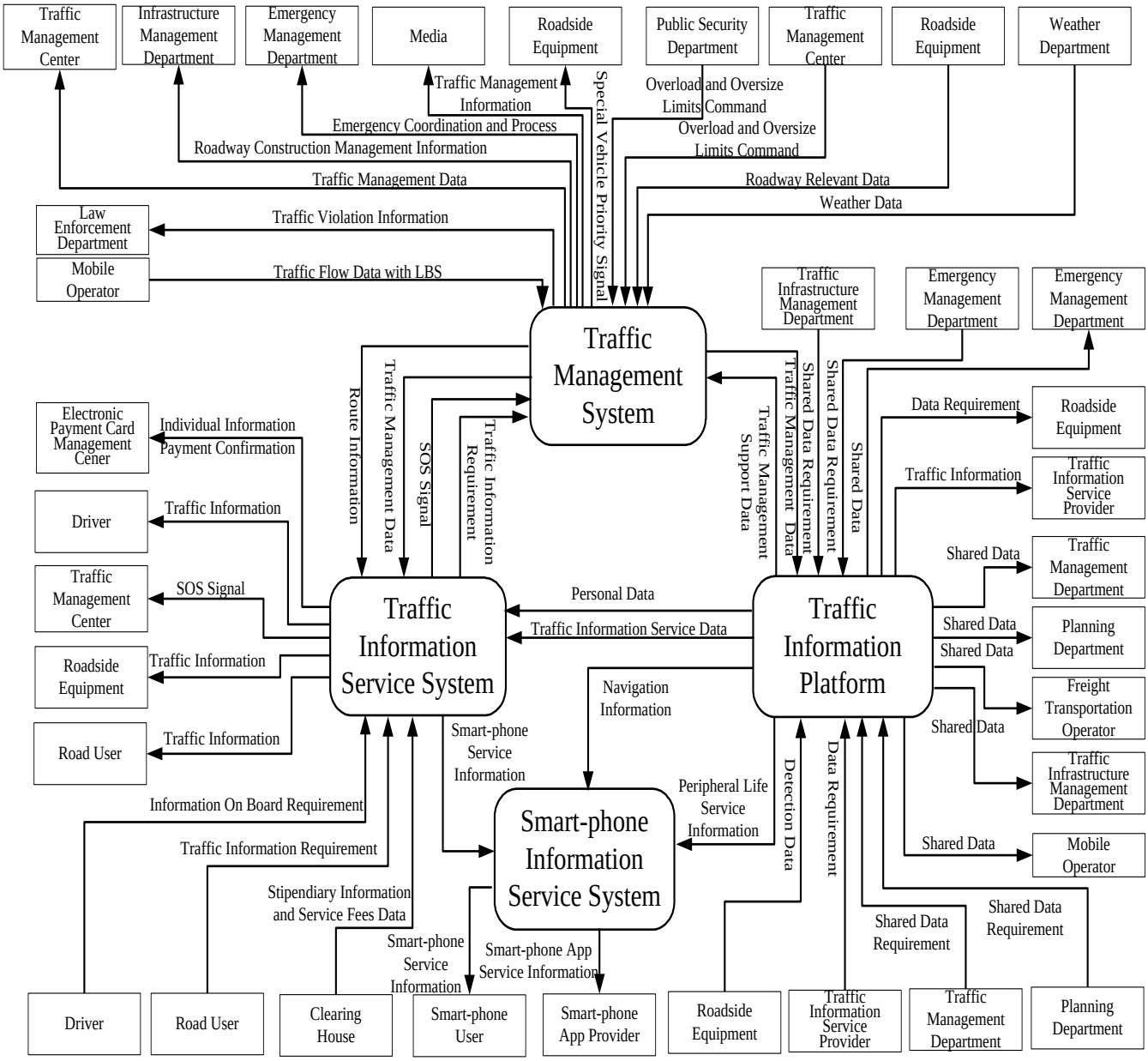

Fig 2: Top level logic data flow diagram of ATIS

5. CONCLUSIONS

A new design of ATIS architecture for Jiangsu province in China was proposed with the consideration of the great impact of smart-phones. The main parts of the architecture, user service, top level logic data flow diagram and top level physical flow diagram were illustrated. This experience can be shared by the other designers to construct the architectures of ITS or its subsystems in China.

6. ACKNOWLEDGMENTS

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