Adoption of WAP in ITS services

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Summary – Wireless telecommunications systems are the key enablers of the Intelligent Transport System (ITS) services. As a recent industry standard, Wireless Application Protocol (WAP) has been developed independently of ITS functional requirements and ITS systems architecture. The paper considers the basic requirements and suitability of WAP to provide different ITS services through hand-held telephones and on-board computers. WAP layered architecture and concrete modal services are associated with transport networks (GSM, UMTS, etc.). The existing and the new WAP-based ITS applications in different transport models are evaluated.

I. INTRODUCTION

Intelligent Transport Systems (ITS) have potential to radically improve traffic process in road urban traffic and other transport modes (railway, air traffic, sea and river traffic). Although wireless is the key enabler of the most ITS applications, the existing system development was not fully harmonised.

As a recent industry standard Wireless Application Protocol (WAP) has been developed independently of ITS requirements. New WAP releases (version 1.3) include functions which would support the same ITS services such as Traffic and Travel Information, Route Guidance, Public Transport Information, etc. [3], [7].

In this paper the system requirements are considered as well as the suitability of WAP to provide concrete ITS services in different transport modes.

II. WAP CONCEPT AND ARCHITECTURE

The task of the information system in ITS is to collect and process information that are relevant in achieving efficient and ecologically acceptable functioning of the traffic system. The gathered traffic information need to be saved and distributed according to traffic entities based on the client/server technology. It is precisely the Wireless Application Protocol (designed by WAP Forum) which has enabled mobile approach to the Internet based on the widespread GSM technology (Global System for Mobile communications). Here WAP (the new version of the protocol – 1.3) has proven as the feasible support to a series of ITS services and applications supplied to the end user by means of wireless communication network. WAP telecommunication system is based on the client/server technology and in the exploitation sense, it supports telecommunications towards the mobile user in the intelligent transport system.

WAP determines two essential elements of wireless communications:

- ▹ application framework based on the client browser,
- ▹ network protocol for wireless devices such as mobile telephones, pagers and portable computers [6].

Network communication is based on the layered protocol, thus having the possibility of division into simpler elements, interconnection between communication devices of different manufacturers and maintaining of integrity of each layer [7]. The WAP system architecture in its six layers is graphically represented in Figure 1.

The server component of the WAP system takes on the role of directing the users' requests towards the application server. Such server for directing can be physically located at the telecommunication service provider or in the area of a private computer network, creating thus s link between two networks.

The safety and privacy during the information exchange are very important elements of every telecommunication system, including the WAP environment. Important roles belong to the third and the fourth layer (WTSL and WTP). These layers are designed as modules allowing thus the applications to self-select the protected or unprotected protocol modality depending on the users' needs. Their

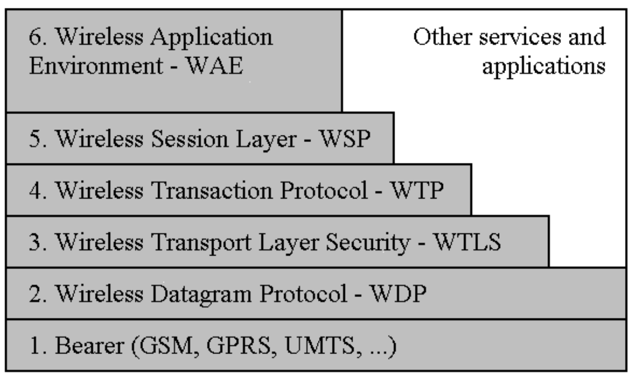

Fig. 1 – The layered architecture of WAP [7]

purpose is to take care of the following aspects of communication.

- privacy,
- data integrity,
- authenticity and
- denial-of-service (DoS) protection [1].

III. Possibilities of Using WAP Applications in ITS Services

WAP service forms part of the interactive integral ITS and it is intended for mobile users. This includes the time component of the WAP application which needs to be accessible to the users with minimum information lag.

Due to the different ways of transferring the goods, and the specific features of managing a certain transport branch, each traffic system mode provides the end user with special traffic service, characteristic only for the respective transport branch. The overview of the characteristic applications is given in Table III. The characteristic features of traffic services of each transport branch are illustrated by the example of WAP application in water transport, where information on port services is not necessarily linked to the application intended to inform the users on free car parking addresses.

In order for WAP application to enable the WAP service provider to determine as accurately and simply as possible the demands set by the users, the services have been divided into groups. According to the level of the user's need for traffic service the groups are as follows:

- enquiry,
- reservation, and
- charging.

The first level of the user's demand for traffic service is the demand for the maximum volume of available information about the traffic branch. In order to be able to provide the users (possible future passengers) with relevant information, one must know what is happening on the traffic routes. Therefore, the communication and information infrastructure of ITS is of utmost importance, because it allows gathering and processing of traffic data and informing of the users. The user should be motivated through the supplied information which are updated in real-time and by those that are not subject to frequent changes. The examples are the variable congestions on the traffic routes and the long-term fixed locations of petrol stations.

The second level of users' services include reservations of traffic services, where the user shows that s/he is satisfied with the available information obtained from the enquiry to the WAP application and decides to use the selected traffic service. Since this refers to a reservation, the user still has the possibility of changing or cancelling the reserved traffic service. From the marketing point of view, the reservation should be free of charge, especially during the initial phases of commercial use of the WAP applications. It is possible to charge an advance payment or, even, in extreme cases, the whole amount of the price for the traffic service. In case of advance payment, the amount (which is not repayable to the user in case of possible cancellation) should be determined according to the actual reservation expenses. In case of charging the whole amount of the traffic service, the user's possibility of cancelling the reservation should be taken into consideration, allowing for part repayment of the charged services reduced by the amount referring to the reservation expenses. In case of this type of charging, the introduction of the group of services entitled "reservations" from Table III is not necessary. From the technical and safety aspect, the charging i.e. money transaction is carried out in the wireless network by standardised transport security layer (WTLS, Wireless Transport Layer Security), whereas the wired network infrastructure (the Internet) to which the transport services provider is connected uses SSL (Secure Socket Layer) [7].

TABLE III

OVERVIEW OF USING WAP APPLICATIONS PER TRAFFIC BRANCHES

Traffic branches	Groups of services	WAP applications and services
1. ROAD TRAFFIC	Enquiries	Road conditions (standstills, works, etc.), weather forecast (regional), parking lot addresses, locations of petrol stations
	Reservations	Parking spaces, car renting
	Charging	Tolls, parking spaces, fuel quantities, car renting
2. RAILWAY TRAFFIC	Enquiries	Locations of stations, timetables (standstills, forecast)
	Reservations	Tickets
	Charging	Tickets
3. AIR TRAFFIC	Enquiries	Locations of runways, scheduling (standstills, forecast)
	Reservations	Tickets
	Charging	Tickets
4. WATER TRAFFIC	Enquiries	Locations of ports, timetables (standstills, forecast)
	Reservations	Tickets, taxis, renting vessels
	Charging	Tickets, taxis, renting vessels
5. PUBLIC URBAN TRAFFIC	Enquiries	Timetables of bus, trolley-bus, and railway (under- and ground) vehicles, and locations of their stations, addresses of taxi stands
	Reservations	-
	Charging	Tickets, taxis

The third level of services enables the user to carry out the payment, so that the traffic service provider could perform the offered traffic service at the reserved time and place. In this case, when the user has paid for the traffic service, there is no possibility of user's cancellation nor can the money be returned, since the traffic service provider has already made the necessary preparations to carry out the agreed traffic service.

In the actual implementation of WAP applications in ITS, the interaction between elements of the traffic system i.e. between traffic modes is expected. For the end user, WAP applications will simplify the multidisciplinary aspect of traffic into basic elements, maximising the efficiency of the user's request, reservation and charging in participating in the traffic system.

IV. THE EXISTING WAP APPLICATION IN TRAFFIC

Telecommunication infrastructure is necessary for undisturbed exchange of information between the user and the service provider in the traffic system based on the existing GSM technology throughout the world, and in the Republic of Croatia as well. Therefore the initial investments are minimal as well as the costs of WAP application maintenance. On the other hand, the information base of the traffic data today is becoming the crucial and unavoidable part of the subsystem of any traffic branch.

In Germany, in 1999, in the towns of Hofheim and Bad Soden a network infrastructure was built between the local and regional bus companies and the German railways. The data on scheduling, and co-ordination between railway station in Hofheim and Bad Soden is performed at the local control centre which is one of the essential prerequisites for introducing ITS. In Germany, this is the first such co-ordinated dynamic system in the railway and public urban transit. An important subsystem of this project is providing users' (passengers') information via mobile telephones with WAP browsers. To display timetables on the users' GSM mobile phones, communication links are used between the local control centre and the GSM services provider in Germany [5].

Fig. 2 - An example of WAP application in ITS [5]

Public urban transit, along with other traffic branches, forms the backbone of the traffic infrastructure in every urban area. Proportionally to the expansion of the city, the public urban transit system is becoming increasingly complex regarding the organisation of this traffic branch. The management of public urban transit companies has realised that the old system of communicating with the users needs to be abandoned as soon as possible and that they should integrate into the modern systems determined by ITS.

The improvement of public urban transit can be enabled only by means of detailed and safe informing of the system users – the passengers. Passengers should be informed interactively and on time. This means that not only should the in-advance-announced timetables be available to passengers at any time and any place, but that also the actual current data on traffic routes should be available as well.

V. CONCLUSION

WAP specification defines the network and application protocols that support the approach to information via mobile telephones, PDA (Personal Data Assistant) and other devices. Although WAP has been developed independently of the ITS architecture (both physical and logical), successful application in numerous ITS applications is possible. Therefore in the development of the national ITS architecture and the development program of ITS services, it is necessary to systematically analyse the concept and the possibilities of WAP.

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