Chapter 10

Communication Architectures and Services for Intelligent Transport Systems

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ABSTRACT

Current challenges in mobility and sustainable development are closely related to increasing travel safety, optimizing the use of transport infrastructure, reducing operating and maintenance costs and making public transport more attractive. The proposed solutions to these major challenges depend to a high extent, on political decisions, development of good practices, and also on the innovation and technology introduced through on-going Intelligent Transport Systems (ITS) programs and initiatives. This chapter provides an overview on the communication architectures able to support these ITS programs. In order to do so, this chapter presents the current standardization initiatives in the vehicular environment, a description from the telecom point of view of the different ITS services, and finally, a survey on the radio access technologies capable of dealing with such a demanding scenario.

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INTRODUCTION

Current challenges in mobility and sustainable development are closely related to increasing travel safety, optimizing the use of transport infrastructure, reducing operating and maintenance costs and making public transport more attractive. The proposed solutions to these major challenges depend at a high extend, on political decisions, development of good practices and also on the innovation and technology introduced through on-going Intelligent Transport Systems (ITS) programs and initiatives.

Intelligent Transport Systems refers to those efforts to devise how to involve information and communication technologies (ICT) to improve safety, efficiency and competitiveness in cars, buses, railways and mass transportation systems (goods & persons).

These Intelligent Transport Systems rely on communication architectures, computation, databases and geo-location information. This chapter covers a taxonomy of these Intelligent Transport Systems and their communication architectures underneath. In order to do so, this chapter is structured as follows.

The second section presents an overview on the most relevant communication frameworks for the vehicular environment. It introduces the current standardization initiatives (Communication Access for Land Mobiles from International Organization for Standardization, ISO CALM, the Intelligent Transport Systems initiative from the European Standard Institute, ETSI ITS and the Wireless Access in Vehicular Environment initiative from the Institute of Electrical Electronic Engineers, IEEE WAVE) and other innovative ones.

The third section provides a taxonomy on Intelligent Transport Services and introduces for each service its key performance indicators. The fourth section describes the current telecom context. It provides a survey and comparison on current radio access technologies able to cope with the extremely demanding vehicular scenario and the high mobility scenario with regard to vehicular to infrastructure communications.

To conclude, the fifth section presents a thorough survey of the current radio access technologies to be applied in vehicle-to-infrastructure communications.

COMMUNICATION ARCHITECTURES FOR THE VEHICULAR SCENARIO

Standardization Initiatives

One of the most significant characteristic of the ITS context is the amount of agents that have to cooperate in the definition of a communication architecture. These agents embrace vehicle manufacturers; ISPs (Internet Service Providers) with a large heterogeneity in the access network; Internet mobility operators that aim at managing the mobility of the ongoing communications; governmental organizations that are expected to legislate the infrastructure deployment and its utilization; and standardization bodies who are in charge of defining standardized protocols and procedures. Having such a variety, the introduction of Information and Communication Technology (ICT) in the ITS context requires strong mutual effort for decision taking and best solution design.

Due to its major role in the design of communication architectures, this section focuses on the standardization initiatives that have been undertaken throughout standardization organizations like the ISO, ETSI or the IEEE. It is worth pointing that having detected that ITS is an essential technology, standardization organizations have established ad-hoc working groups between the ETSI, IEEE, IETF (Internet Engineering Task Force), ISO and ITU (International Telecommunication Union) for joint development of specifications. We next describe the communication architectures that are currently being standardized.