Chapter 2

Architecture of Vehicular Ad Hoc Network

Debika Bhattacharyya
Salt Lake Electronics Complex, India

Avijit Bhattacharyya
Salt Lake Electronics Complex, India

ABSTRACT

Over the last few years Vehicular Ad hoc Networks (VANETs) have gained much attention within the automobile industry and the research applications. Vehicular Ad hoc networks (VANETs) are a subgroup of mobile adhoc networks (MANETs) with the distinguishing property that the nodes are vehicles like cars, trucks, buses and motorcycles. Nodes are expected to communicate by means of North American direct short-range communication (DSRC) standard [1] that employs the IEEE 802.11p standard for wireless communication and describes a MAC and PHY specifications for wireless connectivity. This chapter deals with the basic architecture of VANET and wired and wireless technology for intra-vehicular communication. Two prominent networking technologies such as Local Interconnect Network (LIN) and the Controller Area Network (CAN) for wired intra-vehicular communication have also been discussed. The objective of this chapter is to explain inter-vehicular communication and the components of a smart vehicle.

INTRODUCTION

A Vehicular Ad hoc Network (VANET) is a special type of short-range wireless communication mobile ad hoc network (MANET) in which all nodes are vehicles that move generally at high speed. The VANET is a decentralized, self organizing and infrastructure less network unlike Wi-Fi, Wimax, GSM technology.

Modern vehicles are often designed as local area networks, with the ability to connect multiple embedded computers which can communicate among themselves as well as with other vehicles via multiple wireless connections. The VANET is thus being used in many commercial applications like providing efficient routing information to the other vehicles, informing the drivers about the
traffic conditions, accidents, road conditions etc. For this purpose the VANET uses sensor devices to monitor the network conditions such as vibration, pressure, motion, pollution, temperature and sound. Each sensor is capable of collecting relevant information and transmits the data to others. These sensor devices are very small, low cost and can be deployed in large numbers in the network. Federal Communications Commission (USA) has recently allocated 75MHz in 5.9GHz band for short range communication for vehicle-to-vehicle and vehicle-to-infrastructure communications.

In VANET, radio communication among vehicles is complex [4] for three main reasons:

1. The environment in which the vehicles move has many radio reflective surfaces.
2. Vehicles travel at a wide range of speeds, resulting in disruption of radio communication.
3. Radio frequency (RF) interference is common from both in-car sources and other nearby transmitters.

Generally, Vehicular communication in VANET can be of two types:

1. Inter-vehicle communication
2. Intra-vehicle communication.

The *intra-vehicle communications* is used to describe communications within a vehicle, whereas the term *inter-vehicle communications* represents communications between vehicles or vehicles and sensors placed in or on various locations, such as roadways, signs, parking areas, and even the home garage. Inter-vehicle communications can be considered to be more technically challenging because in this case the vehicle communications need to be supported both when vehicles are stationary and when they are moving.

Figure 1 illustrates an example of a Vehicular Ad Hoc Network. In the figure we see three cars
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