Chapter 106
Challenges and Opportunities in Vehicular Cloud Computing

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ABSTRACT

Vehicular ad-hoc networks (VANET) have become an important research area due to their ability to allow sharing resources among the users to carry out their application and provide services of transport and traffic management. VANET communication allows exchange of sensitive information among nearby vehicles such as condition of weather and road accidents in order to improve vehicle traffic efficiency through Intelligent Transportation Systems (ITS). Many technologies have been developed to enhance ITS. Recently, vehicular cloud computing (VCC) has been developed in order to overcome the drawbacks VANET. VCC technology provides low-cost services to vehicles and capable of managing road traffic efficiently by using the vehicular sources (such as internet) to make decisions and for storage. VCC is considered as the basis for improving and developing intelligent transportation systems. It plays a major role in people's lives due to its safety, security, trust, and comfort to passengers and drivers. This chapter investigates the vehicular cloud computing. The authors first concentrate on architectures. Then, they highlight applications and features provided by VCC. Additionally, they explain the challenges for VCC. Finally, the authors present opportunities and future for VCC.

INTRODUCTION

For the past few years, Intelligent Transportation Systems (ITS) attracted the attention of many researchers for the purpose of improving the traffic monitor, road safety, and signals utilization. Vehicular Ad-hoc Networks has been proposed as ITS environment due to its ability to managing traffic, enhance road safety using GPS information, computing power, and media. A VANET is communicating among the vehicles by using a wireless network to provide services of transport and traffic management (Whaiduz-

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zaman, Sookhak, Gani, & Buyya, 2014). There are two components of VANET architecture: hardware and software. There are three types of communication in vehicular ad hoc network: 1.) vehicles-to-road infrastructure (V2R); 2.) vehicle-to-vehicle (V2V), and; 3.) vehicles-to-sensors (V2S) communication (Kumar, Singh, Bali, Misra, & Ullah, 2015; Eltahir, & Saeed, 2015). In the V2V, the vehicles communicate with another by using On Board Units (OBU), while the vehicles communicate in the V2R with infrastructure units like road side units (RSUs) (Eltahir, Saeed, Mukherjee, & Hasan, 2016).

Many technologies have been found to enhance Intelligent Transportation Systems (ITS). Some of the solutions to face the challenges of VANET were proposed such as Cloud computing and later than appearance Mobile Cloud Computing and Vehicular Cloud Computing (VCC) (Whaiduzzaman, Sookhak, Gani, & Buyya, 2014). In Cloud Computing, users share resources such as applications, location, and storage over the Internet. The increasing of mobile applications and mobile devices new technique appeared called mobile cloud computing to overcome shortages of Cloud Computing. Vehicular Cloud Computing (VCC) has a big effect on the ITS specially when using the resources of vehicles like computing power for instant decision making, the internet, storage, GPS, and sharing information on the cloud. VCC has many benefits such as low energy, real-time services of software, platforms, and infrastructure with QOS to passengers and drivers. And also VCC prove, better road safety, and secured intelligent urban traffic systems. The list of acronyms which appeared in this chapter is given in Table 1.

Table 1. List of acronyms

CaaS	Cooperation as a Service
CC	Cloud Computing
DaaS	Data as a service
DSRC	Dedicated Short Range Communication
INaaS	Information as a Service
ITS	Intelligent Transportation Systems
MCC	Mobile Cloud Computing
NaaS	Network as a Service
OBU	On Board Unit
PaaS	Platform as a Service
RSU	Road Side Unit
SaaS	Software as a Service
STaaS	Storage as a Service
V2I	Vehicle-to-Infrastructure
V2S	Vehicles-to-Sensors
V2V	Vehicle-to-Vehicle
VANET	Vehicular Ad-Hoc Networks
VCC	Vehicular Cloud Computing
VCN	Vehicular Cloud Network
WAVE	Wireless Access in Vehicular Environment