Chapter 7

Software-Defined Vehicular Adhoc Network: A Theoretical Approach

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ABSTRACT

Vehicular adhoc networks (VANETs) and software-defined networking (SDN) are the key enablers of 5G technology in developing intelligent vehicle networks and applications for the next generation. In recent years, many studies have been concentrated on SDN and VANET incorporation, and many researchers worked at various architecture-related issues along with the advantages of software-defined VANET services and features to adapt them. This chapter discusses the current state of the art of SD-VANET with the directions of future research work. This chapter presents a theoretical approach of architectures of software-defined VANET for its networking infrastructure design, functionalities, benefits, and challenges of future generation networks.

The evolving of the fast-cellular network such as LTE, 5G, WiMax, etc. makes networks more readily available for new network applications and business models. The application of IoT with conventional Vehicular Ad-hoc Network (VANET) using these cutting-edge technologies give a promising paradigm for future automobiles in the form of IoV (Internet of Vehicles). The tremendous market demands in IoV motivates the researchers to develop more generalized IoT. Many efforts have been taken in recent years to acknowledge different challenges like performance analysis, data dissemination, mobility, routing, etc. Despite these efforts, there still exist many challenges which must be tackled like handling the

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heterogeneous network, diverse requirements of QoS (low latency and high reliability for safety-related services, high-speed connection for streaming services, bandwidth consumption, etc.).

Software Defined Networking (SDN) is an emerging technique which has the capability to separation of data and control plane. Control Plane performs the processes of Routing protocols. Data Plane performs the processes like Layer 2 switching, Layer 3 (IPv4 | IPv6) switching, MPLS forwarding, VRF Forwarding, QOS (Quality of Service) Marking, Classification, Policing, Netflow flow collection, Security Access Control Lists.

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1. INTRODUCTION

In recent years, traffic safety has been major concern. Not even traffic safety, the manufactures are concerning to provide many applications which could make travelling effortlessly and conveniently. In order to achieve these, road safety and other application, it is necessary to have a network which is capable of providing all the data efficiently to the vehicles. A network with the capability of mobile ad-hoc network in vehicles can give the solution of required network such type of network is Vehicular Ad-hoc Network. The nodes in VANET is equipped with the Wireless communication system. The nodes in VANET are fast moving hence, unlike the conventional network, each node has the capability of routing and end system working. To achieve the proper communication among vehicles, all vehicles are equipped with OBU (On Board Unit) by which vehicles can directly communicate with the vehicles. There is another infrastructure, RSU (Road Side Unit), installed along road side to communicate vehicles.

To standardise these communications, IEEE communication society has approved a standard 802.11p for DSRC (Dedicated Short-Range Communication) / WAVE (Wireless Access in Vehicular Environment) Protocol. The 802.11p facilitates the communication between high speed vehicles and between road side infrastructure and vehicles i.e. V2X.

The IEEE defines the architecture and standardizes the services and interface in 1609 family for WAVE Protocol stack, for high speed, short range and low latency wireless communication in the vehicular environment. The WAVE protocol stack along with the standards is given in figure.

1.1 Network Architectures of VANET

The architecture of VANET falls within three categories first a pure wireless ad hoc network where vehicle to vehicle without any support of infrastructure. Second a wired backbone network with wireless hops that give an impression of wireless vehicular network and third is hybrid structure, the communication between the roadside units (RSU), a fixed infrastructure.