Chapter 4
Vehicular Networks in the Eyes of Future Internet Architectures

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ABSTRACT

The challenging characteristics of the vehicular environment such as high mobility, diversity of applications, dynamic topologies, unreliable broadcast channels, and short-lived connectivity call into the need to extend the IP-based network to fulfill the user and VANETs requirements. Researchers are developing new network communication models to transfer the future internet. The information-centric networking (ICN) paradigm is a promising solution that may overcome the issues mentioned above. ICN involves a named content, name-based routing, in-network caching, and content-based security, which make it a suitable architecture for VANET applications. In this chapter, the authors present recent advances in VANET solutions that rely on named-data networking (NDN), which is the most active ICN implementation. The issues of the current host-centric model, mapping between NDN and VANET, is also discussed along with future research directions.

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1. INTRODUCTION

During the past two decades, Vehicular Ad hoc Networks (VANETs) (Al-Sultan, Al-Doori, Al-Bayatti, & Zedan, 2014) have attracted a vast number of research efforts and projects funding with a dedicated aim to provide a comfortable life, efficient transportation & safety services, and secure data sharing. However, ensuring such requirements in a vehicular environment which is characterized by a high and dynamic mobility of vehicles, that affects the network topologies and the reliability of communication, especially in case of very short-lived wireless connections i.e. vehicles moving so fast and rapidly changing their positions on the roads that it is hard to predict the long-term possible connectivity among nodes. Moreover, today's Internet users and applications requirements are shifting from the connectivity-oriented communications towards the data-oriented paradigm (Koponen et al., 2007). End-users are more related about the requested data regardless of the address of the network host.

Having said that, the Internet Protocol (IP) was initially developed over more than forty years ago to allow communication between two end-users using IP addresses. Altering this model to fulfill users' requirements ends by developing numerous protocol patches and add-ons on top of IP stack, tending to support and enhance security, mobility, management and other networking aspects (Campista, Rubinstein, Moraes, Costa, & Duarte, 2014). Hence, the research community is exploring new architectures for the future Internet (Pan, Paul, & Jain, 2011) that may satisfy the users' demands with a clean and straightforward state design.

In the recent years, Information-Centric Networking (ICN (Ahlgren, Dannewitz, Imbrenda, Kutscher, & Ohlman, 2012) appears as a promising paradigm to replace the current host-centric model and overcome the aforementioned issues. The communication in ICN is based on the content name without using any IP/host addresses. Thus, the content is decoupled from its original location, that by consequence allows the network to cache the content and serves it for future requests. Also, all security related-information are traversed with the content itself, which make the network more distributed and responsible for users' needs. However, due to the characteristics of vehicular networks from both networking and application perspectives, bringing ICN in VANET is a challenging task, that needs tweakings and customization in the networking level.

In this chapter, we aim to discuss the Internet model and its limitations to reply to today's needs, overview the existing architectures for future Internet, and present one of the very actively investigated projects known as Named Data Networking (NDN) in the context of vehicular networks. Also, we tend to discuss the mapping of VANET with NDN, from the requirement perspectives, existing solutions and efforts, and highlighting the existing issues and providing future directions. Table I lists all the acronyms and their explanations used in this chapter.