Chapter 7.7
On Peer-to-Peer Location Management in Vehicular Ad Hoc Networks

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ABSTRACT
Vehicular ad-hoc networks (VANETs) have been gained importance for the inter-vehicle communication that supports local communication between vehicles without any expensive infrastructure and considerable configuration efforts. How to provide light-weight and scalable location management service which facilitates geographic routing in VANETs remains a fundamental issue. In this paper we will present a novel peer-to-peer location management protocol, called PLM, to provide location management service in VANETs. PLM makes use of high mobility in VANETs to disseminate vehicles’ historical location information over the network. A vehicle is able to predict current location of other vehicles with Kalman filtering technique. Our theoretical analysis shows that PLM is able to achieve high location information availability with a low protocol overhead and latency. The simulation results indicate that PLM can provide fairly accurate location information with quite low communication overhead in VANETs.
INTRODUCTION

Vehicular Ad-hoc Networks (VANETs) have received considerable attention in recent years due to its potential in supporting vast value-added and customized applications. By leveraging low cost and high bandwidth wireless interface installed on each vehicle, a VANET can be deployed quickly and economically. It provides high data rates, and is more cost-effective than systems that need pre-installed infrastructures (e.g. cellular networks). Hence a wide-range of applications such as increasing road safety, providing passengers with business information and entertainment, and improving traffic flow and efficiency on the roads, can be provided using VANETs as the communication infrastructure (Riva, O., Nadeem, T., Borcea, C., & Iftode, L., 2007; Morris, R., Jannotti, J., Decouto, D., Karger, D., & Morris, R., 2000; Xue, Y., Li, B., & Nahrstedt, K., 2001; Kiess, W., Fler, H., Widmer, J., & Mauve, M., 2004; Basagni, S., Chalamtac, I., Syrotiuk, V. R., & Woodward, B. A., 1998; Sasson, Y., Cavin, D., & Schiper, A., 2005) and most of them are grid-based. That is: they divide the network area into ordered grids and select location servers based on a particular grid mapping algorithm. As all these schemes adopt the client-server architecture, they usually involve two phases: location update and location query. In the location update process, mobile nodes periodically send their up-to-date location information to one or more location servers to update their locations. In the location query process, a node queries target node’s location servers for target node’s location information.

However, in a VANET where vehicles are highly dynamic, how to efficiently select proper location servers for a node turns out to be extremely difficult (if possible). Moreover, updating a node’s location frequently and explicitly makes the client-server architecture inefficient in terms of communication overhead. Therefore an efficient location management protocol in VANETs should have the following characteristics. First, it is able to be adaptive to high mobility in VANETs. Second, since the diameter of a VANET can be large, the location management protocol should be scalable. To satisfy these two requirements, in this article we propose a novel location manage-