Poster: Searching for Efficient V2X Communication in Intelligent Transportation Systems

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ABSTRACT

We propose to use communication technologies based on the existing infrastructure such as Wi-Fi or cellular network services available at drivers' or passengers' smartphones, to offer safety-critical applications. This proposal briefly describes (1) our idea to address the connection time issue and other problems of Wi-Fi Direct, (2) preliminary results, and (3) remaining challenges and the future work.

1. INTRODUCTION

The Dedicated Short Range Communication (DSRC) has rapidly developed in order to support communication-based safety applications on the road. Unfortunately, it may not be useful in the near future because of the slow deployment rate. In addition, drivers prefer to use the unlicensed Wi-Fi with a smartphone at potentially reduced cost. A smartphone supports various network technologies for wireless communication. Among them, we use Wi-Fi Direct (WFD) because it provides data rates up to 250Mbps, cost-free and certainly fits into creating an ad-hoc network locally. However, utilizing WFD for Vehicle-to-Everything (V2X) still has several issues that need to be addressed. First, initial connection establishing time is too long as 5s to 15s [1]. Second, transmission range is short (200m). Third, it demands human intervention. Finally, it does not consider an inter group communication. To address these problems, we adopt a cooperative approach by using WFD and cellular networks.

2. COOPERATIVE SYSTEM

We propose a cooperative approach to use WFD and cellular communication of a smartphone for V2X communication. Legacy WFD starts with the discovery phase in order to find neighboring devices. After each node (device) finishes the discovery phase, it enters the Group Owner Negotiation (GON) phase to select the group owner. Finally, authentication is provided through Wi-Fi Protected Setup (WPS) to establish a secure connection during the provisioning phase. According to the existing WFD performance
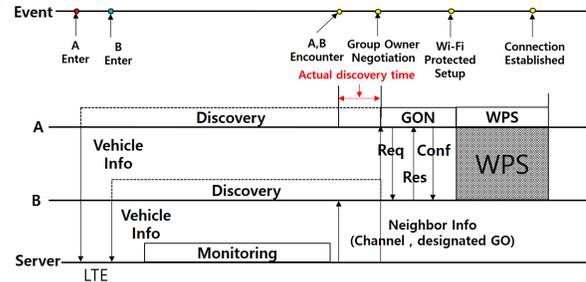
Figure 1: Operation of proposed system.

analysis, it takes approximately 4s to 10s during discovery phase, and 1s to 5s during provisioning. To reduce the long connection time, we virtually perform the device discovery in the distributed server via cellular, where the information of a smartphone is updated periodically (Figure 1). In this way, when two vehicles meet, they can skip discovery phase and start GON immediately. After WPS is performed, a connection is established and they could exchange safety message via WFD. This prototype is evaluated by driving vehicles with smartphones. The results of our prototype show that our cooperative approach takes under 250ms during discovery phase, whereas legacy WFD needs 1s to 5s.

3. PLAN OF OUR WORK

We plan to (1) reduce the provision time, (2) enable inter group communication, (3) evaluate the effectiveness of our cooperative approach with a large number of smartphones. We expect that this work will enable smartphones to be used as V2X terminals, as an alternative of DSRC.

4. ACKNOWLEDGMENTS

5. REFERENCES

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