Performance Analysis of MAC Protocol of EDCA on Common Channel and Reservation on Service Channels for IEEE 802.11p/1609.4 WAVE

Bong Dae Choi* and Yun Han Bae**

*Department of Mathematics, Sungkyunkwan University, Seoul, Korea

**Department of Mathematics Education, Sangmyung University, Seoul, Korea

Abstract

The IEEE 1609.4 for Wireless Access in Vehicular Environment (WAVE) network is designed to support both safety applications (e.g., emergency service) and non-safety applications (e.g., data service) for Intelligent Transportation System (ITS). The Wave operates on multi-channels consisting of one control channel (CCH) and 6 service channels (SCHs).

In this paper, we propose and analyze a MAC protocol consisting of Enhanced Distributed Channel Access (EDCA) on the CCH and reservation on SCHs in IEEE 802.11p/1609.4 WAVE. Specifically, emergency packets and status packets for safety service, and request for service (RFS) packets to reserve a SCH for non-safety service are transmitted on the common channel by contention-based EDCA scheme. Non-safety applications such as information and commercial data file are transmitted on SCHs by contention-free scheme after reserving with RFS packet. We assume that an out-dated safety packet is replaced by the new one and a RFS packet is generated after previous service file is completed successfully. On board unit (OBU) in a vehicle is assumed to have dual radios in order to utilize the full capacity of channels. We assume that only the road-side unit (RSU) sends acknowledgment (ACK) message to the broadcasted packet, to improve the successful delivery probability of safety packets. We present mathematical models of our proposed MAC protocol. From the mathematical model, various performance measures such as successful delivery probability, delay of packet and throughput are obtained. Numerical results show that 98 percent successful delivery probability and less than 100 ms delay of safety packet can be achieved.