Proposition de recherche doctorale

Design and Optimization of Access Control Protocols in Vehicular Ad Hoc Networks (VANETs)

Mots clés :

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- **Unité de recherche** : Services répartis, Architectures, MOdélisation, Validation, Administration des Réseaux
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- **Domaine scientifique principal**: Divers

Résumé du projet de recherche (Langue 1)

Vehicular Ad hoc NETworks (VANETs) have attracted a lot of attention in the research community in recent years due to their promising applications. VANETs are primarily designed to improve safety on roads. They can also be used to improve traffic management conditions and to provide on-board infotainment on board such as Internet access, video streaming, etc. VANETs are an example of Mobile Ad hoc NETworks (MANETs) but with their own specificities: high node mobility with constrained movements and the mobile nodes have ample energy and computing power (i.e. storage and processing). The VANET applications can be divided into the following three services namely, safety services, traffic management and user-oriented services. Safety services have special requirements in terms of quality of service. In fact, bounded transmission delays as well as low access delays are mandatory in order to offer the highest possible level of safety. At the same time, user-oriented services need a broad bandwidth. Medium Access Control will play an important role in satisfying these requirements. In VANETs, the nodes share a common wireless channel by using the same radio frequencies and therefore an inappropriate use of the channel may lead to collisions and a waste of bandwidth. Hence, sharing the channel is the key issue when we seek to provide a high quality of service. Medium Access Control (MAC) schemes must be designed to share the medium between the different nodes both efficientlyand fairly. However, due to the special characteristics of VANETs, traditional wireless MAC protocols are not suitable for use in VANETs which leads either to adapting these traditional MAC protocols or to designing new mechanisms. In order to provide QoS and reduce collisions in VANET networks, the MAC protocols must offer an efficient broadcast servicewith predictable bounded delays. They must also handle frequent topology changes, different spatial densities of nodes and the hidden/exposed node problem. Moreover, they have to support multi-hop communication and node moving in opposite directions. An emerging area of research in the field of VANET is TDMA-based MAC protocols where the time is divided into slots and only one vehicle can access the channel at each time slot. In TDMA all the vehicles use the same frequency channel without anycode sequence but at a different time. Therefore, by providing collision-free transmission with bounded access delay, in principle, TDMA is better suited to the requirements of VANETs. The main objectives of my thesis is to study how well the TDMA based MAC protocols can satisfy the stringent requirements of VANET safety applications as well as how well they can handle the highly dynamic topology and the various conditions of vehicular density that are often present in VANETs, and then we propose a contention-free Multichannel MAC protocol with an adaptive broadcasting algorithm, which improves data transfer rates for non-safety applications while guaranteeing timely delivery for safety applications in highway scenarios. Finally, the proposed protocol will be evaluated and compared with other existing MAC protocols such as the IEEE 802.11p standard under different traffic conditions.