A New Channel Assignment Scheme for Interference-Aware Routing in Vehicular Networks

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Abstract—**Mobile computing and vehicular communications are becoming a very important paradigm for wireless communications, mainly because of their ability to adapt to different mobile applications. In this paper, we propose a new scheme for reducing the interference level during mobile transmissions in the VehiculAr inter-NETworking (VANET) environment, taking the advantage of the multi-channel nature of IEEE802.11p standard. In order to relieve the effects of the co-channel interference perceived by mobile nodes, transmission channels are switched on a basis of a periodical Signal-to-Interference Ratio (SIR) evaluation. The attention is focused on the routing level of VANET and we propose an interference aware routing scheme for multi-radio vehicular networks, wherein each node is equipped with a multi-channel radio interface. A new metric is also proposed, based on the maximization of the average SIR level of the connection between source and destination. Our solution has been integrated with the AODV routing protocol to design an enhanced Signal-to-Interference-Ratio-AODV (SIR-AODV). NS-2 has been used for implementing and testing the proposed idea, and significant performance enhancements were obtained, in terms of throughput, packet delivery and, obviously, interference.**

Keywords-Multi-channel routing, VANET, Interference Aware Routing, 802.11p, WAVE, DSRC, SIR.

I. INTRODUCTION

Nowadays, distributed vehicular communications are considered a promising technology when improving efficiency and comfort of everyday road travel. Due to the higher signaling burden than the one of infrastructure systems, communication protocols become very complex and, sometimes, signaling overhead may waste bandwidth availability. VANETs are able to provide wireless networking capability in situations where the communication among nodes can be either direct or made via relaying nodes, as in classical ad-hoc networks. The overall perceived Quality of Service (QoS) strongly depends on how the routing protocol overhead affects the available bandwidth and on how different channels are selected in order to minimize interference levels. In this work, the availability of different communication channels is considered in order to improve the system performance. QoS routing in multi-hop wireless networks is very challenging due to interferences among different transmissions, but VANETs offer the chance to reduce them since multiple simultaneous transmissions are possible. In this paper a new interference-aware routing protocol for VANET environments is proposed, taking the advantage of a dynamic allocation of the Dedicated Short Range Communications (DSRC) spectrum, in order to reduce interference level among mobile nodes. In a distributed multi-hop architecture, a mobile node may potentially find multiple routes for all the destinations. When evaluating network topology through its routing table and, in the considered case, the availability of different available channels, a protocol may enhance the quality of communication. So, in this scenario, each node should select the best route in terms of QoS, not only considering a typical cost metric (bandwidth, delay, traffic load or a combination of them), as in the classical multi-hop architecture, but taking into account the benefits that can be obtained if different interference levels, i.e. different channels, are considered. The proposed idea is mainly based on the AODV [5] protocol, which has been properly modified to take into account the chance of dynamically changing the channel used for data transmission. In particular, a new metric has been defined, based on the Signal-to-Interference (SIR) evaluation on the different available channels; the proposed routing protocol aims to choose different channels, one for each hop on the path, in order to obtain a global SIR maximization for the connections between sources and destinations. This paper is organized as follows: Section II introduces an in-depth overview on the related work about routing in VANETs; Section III introduces the considered scenario and the proposed protocol. Then Section IV offers a deep description of the obtained results. Finally Section V concludes the discussion.

II. STATE OF THE ART AND RELATED WORKS

There are many recent works in the literature on VANETs, focusing mostly on investigating new approaches to enhance routing operations. The behavior of the routing protocols is mainly triggered by events like timeouts and the reception of routing messages, and the impact that these events have on them is different. For instance, in AODV, which is a representative reactive routing protocol, timeouts have a great influence on the route establishment and maintenance process. The one and two hop neighbor lists of OLSR are affected by timeouts, which results in inefficient flooding of topology control messages as a consequence of errors in the multipoint relay set calculation. In [1] the authors evaluated the