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COORDINATION BASED MEDIUM ACCESS CONTROL WITH SPACE RESERVATION FOR WIRELESS AD HOC NETWORKS

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Abstract:

At the same time as the emergence of multimedia in mobile Ad hoc networks, research for the introduction of the quality of service (QoS) has received much attention. However, when designing a QoS solution, the estimation of the available resources still represents one of the main issues. This paper suggests an approach to estimate available resources on a node. This approach is based on the estimation of the busy ratio of the shared canal. We consider in our estimation the several constraints related to the Ad hoc transmission mode such as Interference phenomena. This approach is implemented on the AODV routing protocol. We call AODV with QOS our new routing protocol. We also performed a performance evaluation by simulations using NS2 simulator. The results confirm that AODVwithQoS provides QoS support in ad hoc wireless networks with good performance and low overhead.

Keywords : Mobile Ad hoc networks, QoS, Available resources, Estimation, Constraints, Shared canal, Interference phenomena.

1. INTRODUCTION

Nowadays, there is a great interest in developing systems to assist drivers on the road, providing them with different types of relevant information. VANETs rely on the use of short-range networks (about a hundred meters), like IEEE 802.11 or Ultra Wide Band (UWB) standards for vehicles to communicate [9] and provide bandwidth in the range of Mbps. Using such communication networks, the driver of a car can receive information from its neighbors. Many pieces of information can be exchanged in the context of inter-vehicle communications, for instance to warn drivers when a potentially dangerous event arises (an accident, an emergency braking, an obstacle on the road, etc.) or to try to assist them (with information about traffic conges- tions, real-time traffic conditions, etc.). Particularly, dif- ferent works have addressed the advertisement of available parking spaces. Finding an available parking space is indeed stressful, time-consuming and contributes to increasing traffic. Besides, it leads to fuel consumption and environment pollution due to the emission of gases. Some works, such as [3], emphasize the costs of searching for park- ing spaces. According to that work, nearly one out of two vehicles on the move are searching for a parking space. The work presented in this paper is an extension of VESPA1 (Vehicular Event Sharing with a mobile P2P Architecture), which is a system developed to share information about events in inter-vehicle ad hoc networks. In such environ- ments, data is received from other vehicles and stored lo- cally in a data cache. Then, query evaluation techniques are used to sift through the stored information to deter- mine what is relevant for that time and location, and is- sue a warning or transmit information to the driver when necessary. Data about the events occurring on the road or available resources such as parking spaces have

to be com- municated to a potentially large set of vehicles, depending on the relevance of the data to the drivers. In this paper, we focus on the exchange of information about available parking spaces using VESPA. As opposed to other types of events, it is not enough to indicate the presence of the event to the driver. Indeed, if the same infor- mation (i.e., the same available parking space) is presented to several interested drivers, this will lead to a competition between the vehicles and only one of them will be able to take that parking space. It is so crucial to propose a solution for parking spaces to be "reserved" and so communicated to a single driver. The fully decentralized environment imposed by vehicular networks makes that reservation process partic- ularly challenging since vehicles keep moving and no reliable link or central server can be used. Although other solu- tions have been proposed to disseminate information about available parking spaces using short range communications.

2. RELATED WORK

One of the major problems in inter-vehicle applications is how to estimate the relevance of the events received. The classical approach is to define a relevance function used to determine whether an event received should be considered or ignored. The relevance function used in VESPA, called Encounter Probability (EP), is used to verify whether an event is relevant for a vehicle or not. Thus, when an event is received by a vehicle, the EP for this event is computed. If the EP reaches a certain threshold, the event is relevant and has to be communicated to the driver if s/he is interested in that type of event. In order to compute the Encounter Probability between a vehicle and an event, two movement vectors are defined for a vehicle (computed by sampling the vehicle's locations periodically): the direction vector and the mobility vector.

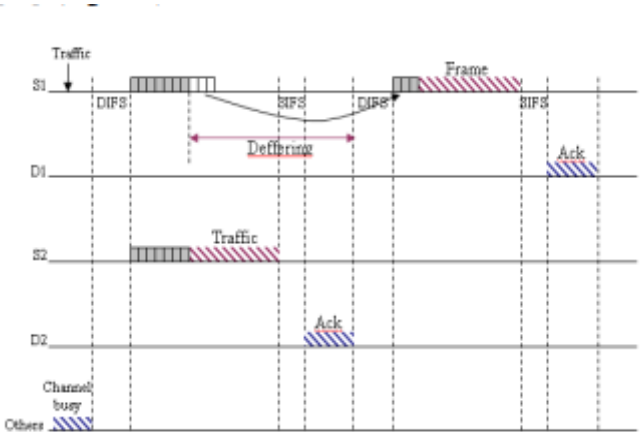

Fig.1.Work flow

The direction vector allows estimating future positions of the vehicle on a short term, whereas the mobility vector captures an overall impression of the vehicle's direction and allows to estimate future positions on the long term. Each vehicle can compute its direction vector and its mobility vector easily. Similarly, each vehicle can compute the mobility and direc- tion vectors of the events it receives. To present only relevant information to the driver, the driver's interests are stored in a vehicle in the form of queries which are re-evaluated continuously, by a Continuous Query Processor module, to retrieve relevant events. At least one continuous (implicit) "background" query is used to detect all the events relative to dangerous situations which have to generate a warning for the driver (events characterized by a high value in the Importance

attribute). This query con- tinuously retrieves the events with both a high encounter probability and a high value of the Importance field. The information extracted by executing the query is then used to warn the driver. Other continuous queries may be eval- uated concurrently to satisfy the driver's needs. Thus, a query can be in charge of retrieving relevant parking spaces, that is, events whose EP exceeds the relevance threshold and whose description field is "Available Parking Space". In the experiments that we have performed in real environments, the query processing overhead is not high.

3. PROPOSED SYSTEM

Interferences could decrease the applications rates. This can be a real problem for applications that need guarantees. We study, in this subsection, the impact of interferences. At first, it was imperative to us to prove if the environment of simulation that we considered NS2 supports this phenomenon. In effect, we undertook a series of simulation in which we put two mobile nodes within reach communication. The flow of data initiated CBR is 400Kb/s. The metric that we offer to measure is PDR (Packet Delivry Ratio). The rate of issued packets PDR measures the percentage of success of the protocol. It is expressed by the number of packets of data correctly accepted by destinations wanted (Received Packet) in comparison with the packets of data issued by the sources of useful traffic (Emitted Packet).

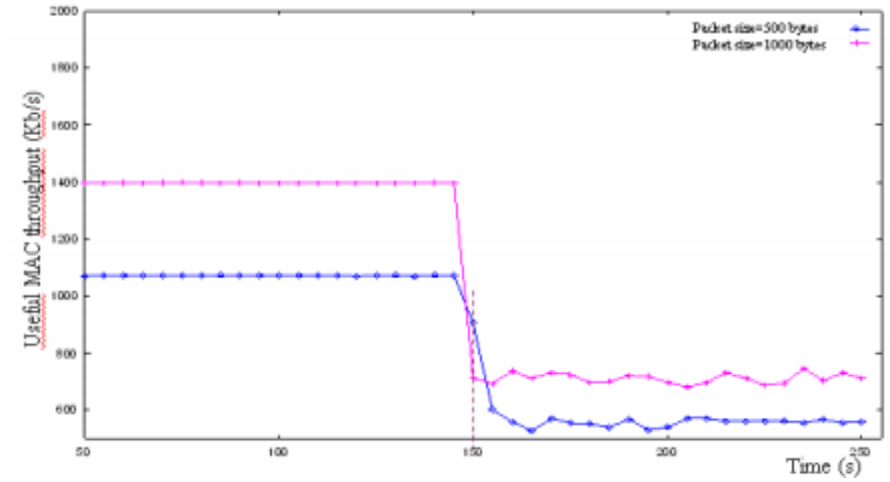

Fig.2.Analysis

The purpose of this section is to introduce the method which we offer to estimate the factor of occupation of the medium radio in network. We define the factor of occupation of the medium as the percentage of use of the channel by traffic generated by mobile nodes being in the same zone of interference. In purpose to provide accurate available bandwidth estimation, it is necessary to be able to consider correctly the maximum throughput which every intermediate mobile node can transmit. Besides, the nature of radio between nodes in network Ad hoc provokes a new decisive point for the reliability of evaluation of the available bandwidth: the phenomenon of interferences. It is for it that our approach takes into consideration the metrics already detailed in the previous section. The model that we offer suggests the observation of the activity of the channel radio shared, by continuous listening, to assess on a local level the occupancy rate of the medium radio and therefore the available bandwidth. Every mobile node network is capable of determining the temporal periods during which the medium is occupied and conclude as for the availability of bandwidth which is of a critical importance for QoS in Ad hoc networks. To determine the occupation

rate of the medium, every mobile node holds the temporal periods of occupation during an equal latency in Δt seconds (called observation period).

4. ANALYSIS

In this section, we offer to introduce our new routing strategy referring to the result provided since the mechanism of evaluation of the occupancy rate of the radio medium. We have used our MAC layer bandwidth estimation scheme as an essential component in (a) Admission control and (b) reservation of resources for the construction of routing algorithm with QoS.

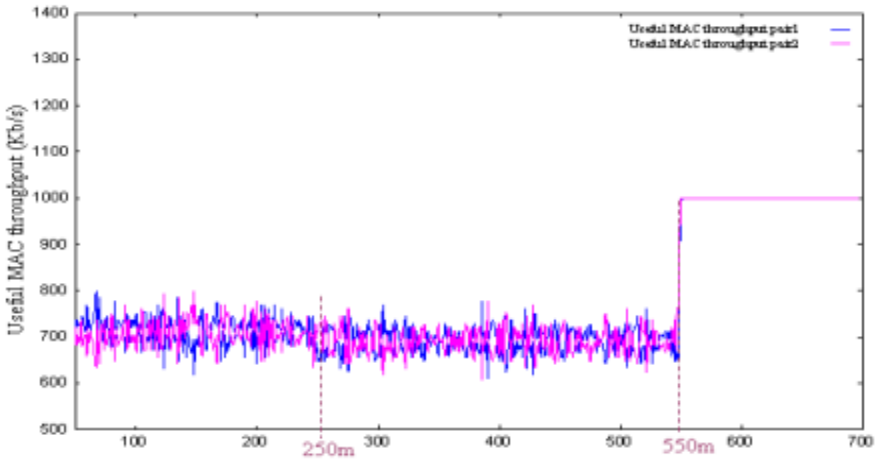

Fig.3.Output Wave

We describe both of these in this section. Providing QoS guarantees in an Ad hoc network requires very important component admission control to ensure that the total resource requirements of admitted flows can be handled by the network. If there are not enough resources for all real time flows, some real time flows must be rejected to maintain the guarantees made to other real time flows. Our proposal is an enhancement of reactive routing protocol AODV (Ad hoc On Demand Outdistances Vector).

CONCLUSION

This paper is interested to a critical point on Ad hoc mobile networks: the QoS routing. To assure a routing QoS, we offered a mechanism of determination of the occupation factor of the medium radio. In order to do that, we studied the possible metrics that can influence the estimate of the residual bandwidth to know the phenomenon of interference, RTS/CTS exchanges etc. Our technique exploits the fact that a node can estimate the channel occupancy by monitoring its environment. The aim of available bandwidth estimation is to serve as a basis for admission control of flows sharing the network. In fact, routing strategy is based on admission control for data flows. This admission control is joined to a mechanism of reservation bandwidth during the answer of path if ever the flow being discussed is accepted.

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