

# Self-Organizing Communication in Vehicular Ad Hoc Networks

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**ABSTRACT:** In vehicular ad hoc networks (VANETs), different types of information can be useful to drivers. Such networks are highly dynamic due to both the movements of the vehicles and the short range of the wireless communications. Due to the stern trouble of the to be had bandwidth in ad hoc networks, it's miles probably that during many situations the channel potential isn't enough to meet all transmission requests of all motors. However, a scenario adaptive and self-organized utilization of the advert hoc network can optimize the general utility of the deployed programs in the collaborating vehicles. Thereby, channel get access to is coordinated in a way that those data packets can access the channel first that provide the biggest predicted application for other vehicles in a particular situation.

**KEYWORDS-** VANETs, Characteristics; Component; Protocols; Applications; Challenges

## I. INTRODUCTION

Mobile Ad-hoc network (MANET) is emerging globally as a communication mechanism [6]. A MANET is generally defined as a network that has many free or autonomous nodes often composed of mobile devices or other mobile pieces that can arrange themselves in various ways and operate without strict top-down network administration [18]. Mobile Ad-Hoc Networks is integrated with wireless nodes that can communicate anywhere. MANET are categorised into three types: VANET, InVANET and iMANET. Vehicular Ad Hoc Networks (VANETs) is technology that integrates the capabilities of new generation wireless networks to vehicles. VANET builds a robust Ad-Hoc network between mobile vehicles and roadside units. It is a form of MANET that establishes communication among nearby vehicles and adjacent fixed apparatus, usually described as roadside apparatus. VANET can achieve affective communication between moving node by

using different ad-hoc networking tools such as WiFi IEEE 802.11 b/g, WiMAX IEEE 802.10, Bluetooth, IRA, [22].

VANET is mainly aimed at providing safety related information and traffic management. Safety and traffic management entails real time information and directly affect lives of people travelling on the road. Simplicity and security of VANET mechanism ensures greater efficiency. Safety is realized as prime attribute of Vehicular Ad Hoc Network (VANET) system. The majority of all nodes in VANET are vehicles that are able to form self organizing networks without prior knowledge of each other. VANET with low security level are more vulnerable to frequent attacks. There are wide range of applications like commercial establishments, consumers, entertainment where VANET are deployed and it is very necessary to add security to these networks so that damage to life and property could not occur [28]. VANET inculcate sufficient potential in vehicles to transmit warnings about environmental hazards, traffic and road conditions and regional information to other vehicles. The major intend of VANETs is to absolute the user's choice on the road and build their drive safe and snug. Vehicles move at such a high speed that it is harder to maintain a seamless handoff and a steady connectivity to the Internet.

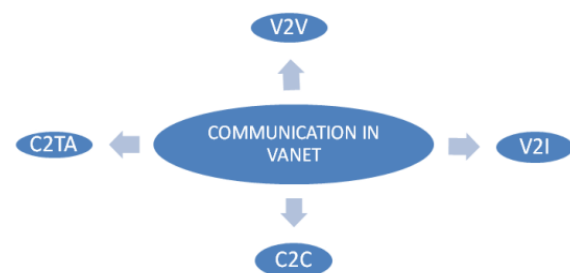


Fig.1 Communication in VANET

## II. BACKGROUND WORKS

A variety of broadcasting schemes exist such as simple flooding, probability based approaches, area based approaches etc. In this section we will briefly discuss all the broadcast schemes and their pros and cons. Flooding is a simple broadcast technique (Zhang & Jiang, 2006) for communication. Vehicles send information to other vehicle and this process continues until all vehicles get same information. It works fine in sparse network but in dense network it produces collision, contention and redundant messages. Probabilistic scheme (Ryu et al., 2004) reduces the collision, contention and redundant messages in dense network as it broadcast the messages with some fixed probability. But in sparse network, all the vehicles can't receive the same packets with small probability. If the probability is increased it works much like flooding (Brad & Tracy, 2002). Hence, its performance becomes greater in dense network as compare to sparse network. Counter based technique is used to analyze the redundant messages. We use counter to record the redundant message. Whenever the redundant message is received, we increment the counter by one. We compare the counter with certain threshold value if it is less than it we forward the packet otherwise the packet is discarded (Zhang & Jiang, 2004).

Distance based scheme first calculates the distance between itself and its neighbor vehicles. Then it compares the distance with threshold. If the distance is greater than threshold it forward the packet otherwise it ignore the message (Brad & Tracy, 2002). Location based scheme first calculates the coverage area with help of sender location. The vehicle will ignore the packet if area is smaller than a threshold value, otherwise the packet will be broadcast (Brad et al., 2004). Neighbor knowledge methods (Joon et al., 2003) maintain a table that contains the information of its neighbor node. A vehicle decision depends upon this information to forward message or not. All vehicles share hello packets with their neighbors to get current information. They store this information in their table for future use. Neighbor knowledge methods totally rely on the exchange of hello packet. Contention and collision can be happen if the interval is short and large interval degrades the performance of network due to mobility. Broadcast can also be done by using trees. But it is not fit for ad hoc networks,

due to the dynamic nature. An efficient and reliable tree based broadcasting technique was proposed which is stable in dynamic network (Korkmaz et al., 2006). It first maintains a spanning tree in the network, and then forwards the messages with help of it.

Urban MultiHop Broadcast Protocol (UMB) is proposed to resolve the reliability, broadcast storm and hidden node problems, without sharing information among the vehicles. Directional broadcast and intersection broadcast are the two main steps of UMB (Korkmaz & Ekici, 2004). Source vehicle selects the furthest vehicle for communication in direction broadcast where as in intersection broadcast installed repeaters at road segments forward the packets to destinations.

## III. PROPOSED WORK

### A. Medium Access

We proposed two ways of modifying the medium access functionality: First, one may consider starting defer-and backoff timers only once and transfer remaining timers (e.g., in case another node transmits on the channel) into the next so called contention periods. In this case, timers are counting down until they expire and trigger their respective nodes' transmissions. As a second possibility, the timers are newly set in each contention period according to the current CW size, thereby ensuring a total benefit-orientation of the medium access functionality: Not the time a packet has already been waiting for access to the shared medium, but solely its current relevance for the adjacent nodes defines its likelihood to get medium access.

Fig. 2 shows the results of a related simulation, where a typical VANET scenario has been applied: 300 wireless enabled vehicles are driving around in a 8 km<sup>2</sup> urban area. The network load was set to 10 new packets being generated per second. Each node is assumed to have a bandwidth of 0.3 Mbits available to simulate a highly loaded network. To differentiate data traffic with regard to its current relevance, the sizes of the CWs are adapted (in the range between CW<sub>min</sub> (31 slots) and CW<sub>max</sub> (1023 slots)). As a consequence, defer-and backoff timers are on average longer than in case no differentiation is applied (CW<sub>min</sub> is mostly applied then). If timers

are longer, the rate of data packets getting access to the medium is smaller, since the average time spent for backing off is increased. Simulations show that the global aggregate utility achieved with the help of each of the two different medium access strategies is significantly higher than without any MAC-level traffic differentiation. Moreover, the graphs representing the global utility are rather similar for different parameter settings.

However, due to space restrictions, we do not further elaborate on these results. To examine the channel utilization in the cases of no traffic differentiation, per-packet timer adaptation and per-period timer adaptation, the global number of successfully received packets in the whole network has been tracked. As one can see in Fig. 2, the modification of the MAC functionality as introduced above always leads to a degradation of net data throughput due to the on average timer prolongation. The per-period timer adaptation shows the minimum throughput of the two modified MAC schemes, since timers are newly started in each contention period. In this way, the inter-vehicular packet schedule can be improved in comparison to the per-packet timer adaptation, but at the significant expense of data throughput. Note that although the net data throughput is lower due to the increased timer sizes in both cases (per-packet and per-period timer adaptation), the global network utility is significantly higher than without traffic differentiation. Both schemes are able to compensate for the decreased data throughput and considerably improve the global utility provided to the network.

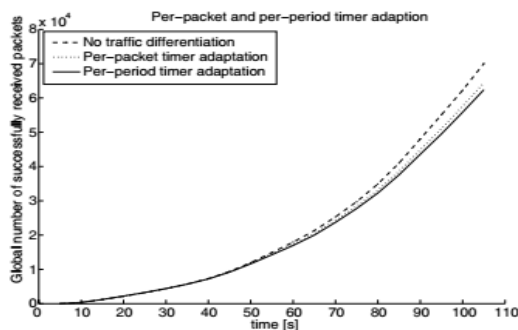


Fig. 2. Comparison of the number of successfully received packets when applying per-period and per-packet timer adaptation

An explicit determination of the dissemination area of a message is hard to realize, regarding a

permanently changing situation in VANETs. Therefore, a self-organizing and context-adaptive form of dissemination areas is necessary, so that it adjusts itself to the current situation. Fig. 3 shows a plot of all message transmissions, during 300s of simulation time, on a map containing two hazards with the same impact. As it can be clearly seen, the dissemination areas of the two messages are aligned around the corresponding hazard. This is due to the weight of the distance parameter. Under the assumption that messages are more relevant the closer a vehicle is to the described hazard, Fig. 3 illustrates a reasonable formation of dissemination areas. However, a parameter incorporating the last transmission of a message ensures that both messages are sporadically distributed in both dissemination areas.

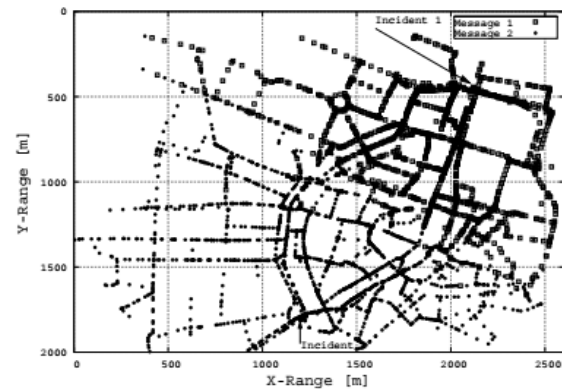


Fig. 3. Dissemination areas in a scenario with two hazards, each with an equal impact

The graph in Fig. 4 represents a different view of the prioritization character of the self-organizing diffusion. Due to its higher impact, the dissemination area of message 2 swells, and therefore, reduces the dissemination area of message 1. This points out the context-adaptive character of the dissemination approach. Fig. 5 illustrates descriptively how the formation of dissemination areas adapts to the situation. In a scenario with five hazards, the corresponding messages are distributed within their properly delimited dissemination areas.

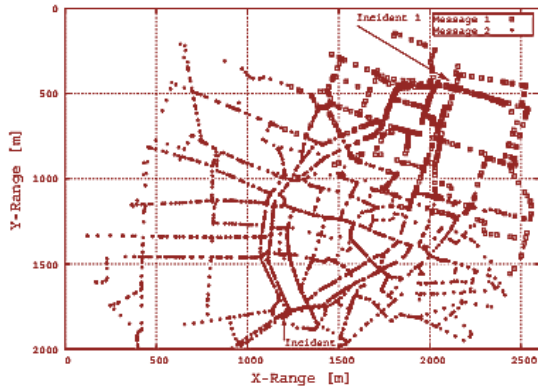


Fig. 4. Dissemination areas in a scenario with two hazards, each with a different impact

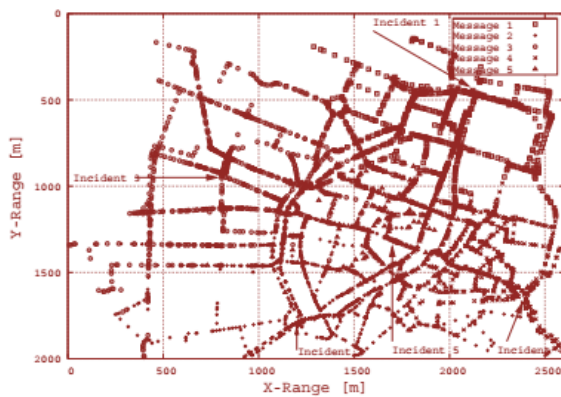


Fig. 5. Dissemination areas in a scenario with five hazards, each with an equal impact

### C. Message Lifetime

It is very important that a relevant message is not only flooded through the VANET once, but that it circulates within the areas of importance as long as necessary. Long message lifetimes assure that vehicles entering these areas are also informed later in time. As a result, it is necessary to rebroadcast a message from time to time. Because there will always be a high amount of messages for rebroadcast, the dissemination mechanism has to coordinate the message rebroadcast, depending on the context. A static re-transmission interval will not take into account the changing context. In addition, it does not allow for changing relevance, according to the message age and distance to the reported hazard. Within the benefit function, a parameter incorporating the age of a message makes sure that vehicles transmit messages with higher relevance, if they are more up-to-date and more likely to be unknown to other vehicles due to their younger age.

As a result, the context-adaptivity of the message lifetime is increased.

### IV. CONCLUSION

In this paper we offered our concept for self-organized and context-adaptive data diffusion in VANETs. Due to the numerous possible threat events many exceptional caution messages will be broadcast concurrently in future VANETs. Since records-charge and channel ability is very confined in multi-hop networks, new strategies to reduce flooding intensity and message numbers need to be advanced, to ensure the most applicable messages will be disseminated as fast as feasible. In our idea we use software assessment for message content to pick out the messages maximum applicable to the general network. By adapting the traditional medium get access to of 802.11, thereby influencing the channel get right of access to contention technique, messages with better relevance have a higher chance of being dispatched. Our simulation effects confirmed that this method is able to increasing the overall advantage.

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