



Survey on Routing Approaches in VANET

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Abstract: VANET is defined as the adhoc network in which the capabilities of sensor network and mobile network are combined. The open environment of this network also increases the complexities in different environments. In this paper, the exploration to the VANET scenario is defined along with discussion on associated challenges. The paper also discussed the routing approaches and the architectures associated with this routing. The paper discussed various associated challenges and the components of vehicular area network. The movement tracking and communication are the key properties discussed in this paper.

Keywords: VANET, Routing Scenario, Challenging, Routing Approach.

I. INTRODUCTION

Vehicular Ad-Hoc Networks are a form of VANETs used for communication among vehicles and between vehicles and roadside equipments. The vehicular communications using Wireless Local Area Networks (WLAN) technologies are initially intended for improving the road safety, e.g., to avoid potential vehicle collisions through Cooperative Collision Warning among vehicles. Vehicular Ad-Hoc networks represent one of the most promising civil application scenarios for Ad-Hoc networking techniques. By enabling communication between vehicles without need for a third-party cellular networks infrastructure, safety and comfort of driving in a vehicle can be significantly improved. In particular, the exchange of sensor data can support driver assistance systems and, generally, active safety applications

A. I-VANET

In-Vanet Communication capabilities in vehicles are the basis of an envisioned Intelligent Vehicular Ad-Hoc Networks (In-Vanet) or Intelligent Transportation Systems (ITS). The figure 1 shows an ITS. Vehicles are enabled to communicate among themselves (vehicle-to-vehicle, V2V) and via roadside access points (vehicle-to-roadside, V2R). Vehicular communication is expected to contribute to safer and more efficient roads by providing timely information to drivers, and also to make travel more convenient.

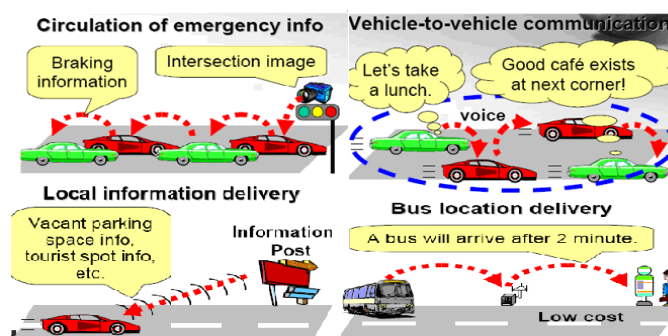


Figure 1: Intelligent VANET Network

Lately, we have seen computerization in the airline industry. Most flight reservation can be done on-line via the web, and booking of flights can be made via credit card transaction performed on-line. However, when we arrive at the airport, we still have to wait at the gate for a boarding pass in such scenario we can deploy VANET which can be connected to the Airline Networks. Since we have a reservation with the airline, a confirmed seat number can then be assumed and conveyed to us. In such situations, we might no longer need to wait for a boarding pass.

B. Routing

The presence of mobility implies that links made and break often and in an in deterministic fashion. The classical distributed Bellman-Ford routing algorithm is used to maintain and update routing information in a packet radio networks. While distance vector based routing is not designed for wireless networks, it is still

applicable of packet radio networks since the rate of mobility is not high. The bulky and heavy construction of these radios makes them less mobile once deployed. However, as mentioned, advanced in microelectronics technology have enabled the construction of small, portable and highly integrated mobile devices. Hence Ad-Hoc mobile networks are different from packet radio networks since nodes can move more freely, resulting in a dynamically changing topology. Existing distance vector and link state based routing protocols are unable to catch up with such frequent link changes in Ad-Hoc networks, resulting in poor route convergence and very low communication throughput. Hence new routing protocols are needed.

C. **Multicasting**

The explosion in the number of internet users is partly attributed to the presence of video and audio conference tools. Such multiparty are enabled through the presence of multicast routing protocols. The multicast backbone (MBone) comprises an interconnection of multicast packets through non multicast routers. Some multicast protocols use a broadcast- and – prune approach to build a multicast tree originates. All such methods rely on the fact that routes are static and once the multicast tree is formed, tree nodes will not move. However, this is not the case in Ad-Hoc wireless networks. The most critical challenge in VANET is the scenario specific decision regarding the controller placement, type of communication etc. These scenarios include the city scenario, highway scenario, riverside scenario, mountain side scenario etc. These scenarios also having the criticality vectors in terms of type of lane. The lane type can be one side, two lane scenarios, four lane scenarios etc. The cross road vectors, traffic lights also increases the criticality. Another vector in the VANET communication is the heterogeneous nodes. These nodes are the vehicle nodes that can be a two vehicle, four vehicular, light weight vehicles, heavy weight vehicles, specialized or the priority vehicles such as ambulance, police van etc. These nodes also having the different communication system incorporated in it such as the GPS system, GPSR systems etc. Based on the type of communication and vehicle nodes, the VANET communication decisions can be carried out. Another challenging phenomenon associated with vehicular network is the mobility vector. A different vehicle moves at different speed as well as the speed of the vehicles changes very frequently. The vehicle speed varies between 20 m/h to 120 m/h. So vast range of vehicle speed is very challenging to handle different associated issues. The vehicle speed also affects with different scenario and the environmental constraints such as the traffic type, road time, lane type etc. An intelligent and fast processing is required to analyze the node speed and the direction so that the effective decision regarding the vehicle moment will be taken.

II. EXISTING WORK

Lot of work is already done by different researchers respective to the performance analysis for a mobile network. Different researchers have considered different parameters in their research work. Here the small review of the work provided by different researchers is presented. In year 2012, Chirag Kumar has defined a work on “Towards Realistic Performance Evaluation of Mobile Ad hoc Network”. The author has performed the performance analysis of mobile network under different parameters as well as in different simulators. The work is checked for different scenarios, shapes of the network. Node movement is also taken for the analysis as well as analysis in case of obstacles is also considered. The work is beneficial to identify the limitation of the network and to decide the improvement in future[1]. In year 2009, R. Lakshmi Priya, presented a brief study on different issues related to the Mobile Adhoc Networks respective to QOS. The author presented a review based work to study and present novel ideas regarding the QOS with the help of implementations. The work also includes the limitations and the restrictions followed by the network are also defined. The work also include the qualitative evaluation respective to comparative analysis as well the future aspects relative the QOS issues are discussed[16]. In year 2006, Patrick Stuedi presented a throughput analysis on multihop mobile network respective to the network capacity. The capacity is the major property to perform the analysis based on network strength estimation on physical parameters such as propagation, unidirectional links, scheduling etc. The work is based on the probabilistic capacity calculation by performing the graph scheduling over the network. The capacity analysis is defined under the realistic network model under different configuration model. The analysis is performed in ns2 environment based on throughput analysis on sink node[9]. In year 2007, J Abdullah presented a GA based QOS routing approach for the mobile network under the mobility constraint. The work is to analyze and improve the route quality under the random mobility model. The work also defined respective to the fitness variable and the GA based QOS optimization. The work is performed on the DSR protocol. The GA is the intelligent optimization tool that is used to achieve the efficiency as well as reliability over the network [6]. In year 2006, Dijiang Huang has explored a work on the traffic analysis under the unlinkability measure for a mobile network. The work is based on two major analytical approaches called statistical approach and the evidence based approach. These two approaches are used in a series to identify the unlinkability over the network as well as its effect over the network. The network transmission model respective to channel definition and analysis is presented in this work. The analysis is performed on the receiver side based on the evidence theory to obtain the maximum throughput over network[2]. In year 2009, A Simulation based analysis is

performed on AODV protocol by Md. Monzur Morshed. The author has analyzed the network under the protocol specification for the different parameters. The parameter includes the efficiency, reliability, loop free routing etc. The Author has defined different network scenarios and performed the variation in terms of network delay, jitters etc and the relative effective is analyzed and presented in the form of graphs. The work is the verification of performance of AODV protocol under different network formations as well as the parameters [8]. In year 2008, Quan Le-Trung presented a work to analyze the effect of load balancing on mobile network. Mobile network is one of the busy networks. The author is includes the hyprid metric discussion based on quantitative analysis in terms of packet transmission ratio over the network under adhoc routing protocol. The work is about to perform analysis to get better performance in terms of packet delivery ratio and transmission delay at the cost of signaling overhead [15]. In year 2006, Moussa Ayyash presented a work on the performance analysis respective to the network infrastructure. The author has perform the analyze the network based routing protocol optimization under different metrics and the behaviors. The author has proposed a QOS virtual backbone to achieve the robustness for routing and monitoring. The QOS is basically selected based on routing and monitoring. The work also includes the stability and availability analysis respective to the bandwidth analysis [9].

In year 2009, Patrick Sondi has defined the protocl based service optimization for the voice commuication in mobile adhoc netork. The author has presented a network Extended OLSR protocol that will work on voice communication and provide the best effort roting and the high quality of service in the real time environment. The work also includes the confirmation for end to end delay analysis and and the jitter constraint for the network formulation. The author has discussed the delivery ratio with better perspective [11]. In same year Thomas J. Sapienza has provided an evolutionary mechanism to optimize the quality of service for the wireless network. The work presented by the author includes the network design under parameter specification with wireless communication effects such as power control, routing failures, erratic development model etc. The work also includes the real world scenario specification under the scalability and some other parametric models. The author has presented a polynomial complete model using the evolutionary programming to overcome the network delay and to improve the network effectiveness and teh quality of service. The author also suggested the use of associative memories and the genetic algorithm during the QOS analysis phase [13].

Pedro Garcia Lopez has presented a topology specific approach to perform the service optimization for mobile network. The author has performed work on multicast network for the OLSR protocol. The work includes the improvement over the communication efficiency over the work with the change in network topology [12].

III. ROUTING APPROACHES

In this section, different routing approaches associated with vehicular area network are discussed in detail. As the vehicular adhoc network requires the geographical information of nodes to identify the position of the nodes and the node neighbors because of this instead of topological information identification, it requires the position identification to take the routing decision based on traffic analysis, accident analysis and the neighbor vehicle type analysis. The another aspect considered in VANET for routing decision is the node movement analysis. The third and the important aspect of the routing decision is the map based routing. These routing aspects are shown in figure 3

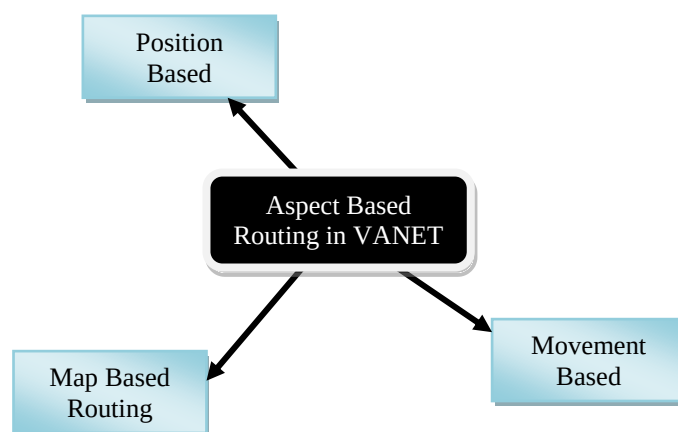


Figure 3: Aspect Based Routing in VANET

These three aspects of VANET communication are explored here under

A. Position Based Routing

The position based routing takes the routing decision based on the geographical information of the nodes. This routing approach also handles the mobility issue of the vehicular mobile network. This routing approach does

not requires any global information about the network topology because the decision is taken for each node and its direction towards the destination node. The routing approach analyzed the position vectors of current node, neighbor nodes and the destination nodes. Based on these three positional analysis, the decision regarding the communication and routing is taken. This routing approach is based on the location oriented services. GPSR (Greedy Perimeter Stateless Routing) is one of the most common protocols that comes under the position based routing. This approach assumes the position vector of current node and performs the neighbor node analysis to take the decision regarding the destination node[8][11].

B. Movement Based Routing

Most of the VANET protocols works on position based routing. But because of the data loss problem some more approaches associated with positional analysis are identified. One of such approach is movement based analysis that overcomes the problem of position based analysis. This routing approach works on three main vectors called position, direction and the speed. Directional Greedy Forwarding (DGR) and Movement Aware Greedy Forwarding (MAGF) protocols are the movement based routing protocols. These protocols assign the priority to neighboring nodes based on these three vector analysis and best node selection is done to identify the next forwarder. The position based scheme along with mobility prediction pattern improves the effectiveness of the route. This routing approach is very effective for highway scenarios where the topology of road determines the movement as well as the behavior of vehicles.

C. Map Based Routing

This routing approach is the hybrid approach that combines the position based routing along with movement analysis. In this routing approach, the vehicles nodes are having the knowledge about the roads and the surroundings. It is represented as a scenario based topological definition and the routing path that integrates the street information and the other map points. The crossroads, traffic lights and the important points are also known and highlighted. This information is provided by performing the analysis on current position of vehicle node. As the node position changes the road information and the surrounding positional object information. Node or the infrastructure points also keep the routing information in terms of distance, speed limits, travel time etc. With the node position change and speed change, this all information is updated. Based on this information, a statistical routing information is presented as the prior knowledge phase so that the entire communication will be performed in controlled manner. To perform this routing, the hybridization of GSR (Geographic Source Routing) and spatial Aware Routing (SAR) is used.

IV. CONCLUSION

In this paper, an exploration to the VANET architecture is defined along with associated issues and the challenges. The challenges include the exploration of VANET in critical network architecture. The paper has categorized the routing approaches under different aspects called movement based, map based and position based routing. These all aspect based routing are explored in this paper.

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