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AN IMPLEMENTATION OF SOME ASPECTS IN POSITION TO AWARE HYBRID ADAPTIVE ROUTING IN VEHICULAR AD-HOC NETWORK.

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ABSTRACT: VANET have unique characteristics related to the proprieties of vehicles such as mobility, speed, topology restriction and road traffic; all these characteristics build the task of routing protocols more tedious. Due to the dynamic nature of mobile nodes in these networks, routing and transmitting data is a real challenge in VANET, although the domain of VANET is new. There are several routing protocols that have been proposed, among them AODV is best suited to improve the performance. AOMDV is an extended protocol of AODV. AOMDV is efficient in case of high density of vehicles. We propose a protocol based on AODV and AOMDV to improve the performance in the case of low as well as high density of vehicles. Study covers various existing routing protocols in Vehicular ad-hoc network and their classification and Analysis of Performance of existing protocols in VANET by using the existing papers. Modify the existing protocol AOMDV to improve the packet delivery ratio and to decrease the end to end delay in the area having high density of vehicles.

Keywords: AODV-Ad hoc On-demand Distance Vector **,** NS2-Network Simulator Version 2,VANET-Vehicular Ad Hoc Network, MANET- Mobile Ad Hoc Network, V2V -Vehicle to-vehicle, MPR -Multi Point Relay etc.

I Introduction

Latest research in wireless networks has introduced a new type of networks called Vehicular Ad Hoc Networks (VANET) [1]. VANET have become a large research area with contributions allow between government and industrial enterprises, as well as the academic community. VANET is the special case of Mobile Ad Hoc Networks (MANET) [3]. VANET is mobile ad-hoc networking technologies which provide the facilities such as vehicle-to-vehicle and vehicle-to-roadside communication. A vehicle is assumed to be an intelligent mobile node in VANET which can communicates with its neighbor's node and other vehicles in the network. Vehicular Ad Hoc Network is the new kind of ad-hoc networks that is implemented between vehicles on a road [2]. VANET is self-organizing communities of moving mobile nodes having large numbers of traffic such as trucks, buses, cars and small number of fixed infrastructure nodes such as highway rail grade crossings, traffic lights, and informational signals within radio broadcasting range. VANET is an emerging new technology that uses moving vehicles as nodes for creating a mobile network. A node in VANET uses the same random access wireless channel, cooperating in a confidant manner to conflicting themselves in multi-hop forwarding [24]. There are two types of communications in VANET. First is the infrastructure-vehicle and second is inter-vehicle. The inter-vehicle communication consists of both Vehicle to-vehicle (V2V) and vehicle-to-roadside communication (V2R) known as VANET. These communications provides a large no. of applications for road safety, driver assistance, traffic efficiency and commercial on the roads. This role is more important when traffic accidents or natural tragedy happened in our absence, weakness of network infrastructure. The routing protocol is very important in providing a good communications between vehicles and to ensure that data has delivered to their desired destinations or not.

VANET offers infinite gains to all types of organizations. Automobile high speed Internet access would convert the vehicle's on-board computer from a nifty gadget to an essential productivity tool, making almost any web technology usable in the car. While such a network does affect absolute safety activities (for example, a person can't properly type a mail while driving), this does not limit VANET intensity as a productivity tool. It allows for "dead time" time that is being consumed while waiting for someone to be changed into "live time" time that is being used to complete a task. A computer can change a traffic jam into a profitable work time by having his email downloaded and read these email by the on-board computer, or if traffic stop then read it himself. While waiting in the car to pick up someone, one can browse the Internet. Even GPS systems can benefit, as they can computed with traffic reports for providing the fastest route to work. It would allow for free, VoIP services such as Google Talk or Skype between employees, reducing telecommunications costs [12]. While the Internet can be an effectively productive tool, it can also prove to be quite confusing, resulting in safety and actually time-wasting concerns. Like cellular phones, the Internet can be stimulated and can disturb users from the road. Checking emails, browsing the web or even watching videos on YouTube can engage drivers and lead to accidents.

Similarly, drivers may have the opportunity to do work while driving on the road, they also may use this opportunity to engage in other comfortable tasks, such as VoIP with family, watch news highlights or listen to broadcasts [12].

Vehicular Ad Hoc Networks have a few different characteristics from Mobile Ad Hoc Networks [12].

1. Highly dynamic communication network configuration
2. Patterned Mobility.
3. Propagation Model.
4. Unlimited Storage and Battery Power.
5. On-board Sensors.

II Proposed Work

AODV is a reactive routing protocol phases. It work in two level namely route discovery and route maintenance. Route finding is one of the most essential features of any protocol in wireless communication network. It uses route discovery by transmitting RREQ to all its neighboring nodes. Route Maintenance in AODV comes into play when a link or a node fails. We propose, as an extension of the AODV protocol, the introduction of MPR (Multi Point Relay) mechanism. MPR is a flooding mechanism help in reducing the number of broadcasted messages for the control, in order to control the flow in the network by selecting a small number of nodes which will be the only ones allowed disseminating messages on the network. MPR set is a subset of a node's one-hop neighbors, such that this subset of nodes together is able to reach all the two-hop neighbors. This selection is done according to a well-defined algorithm selecting a minimum number of nodes with optimal service; once this mechanism used, we expect that the number of messages circulating on the network will drastically decrease and therefore alleviates the network.

Ad-hoc On-demand Multipath Distance Vector Routing (AOMDV) protocol is an extension to the reactive routing protocol i.e. AODV protocol. Various characteristics are shared to AODV by AOMDV. AOMDV uses hop-by-hop routing approach and is based on the distance vector concept. Using a route discovery procedure AOMDV also finds routes on demand. The main difference between AODV and AOMDV is due to the number of routes found in each route discovery.

We make three changes on the AOMDV protocol.

First is hello message function, here one-hop neighbors are determined by a node, and then regroups them in a table to be used once it wants to send a message, so a small program is used to calculate two-hop neighbors. When a node adds a neighbor, it must insert the neighbors to that neighbor table to represent these two-hop neighbors. Also, the node uses HELLO message to inform other node which are elected as MPR.

Second is send request function, here we introduce the IMPR algorithm. This algorithm is performed just before sending the route discovery request. When a node needs to obtain a route to a destination, first we have to calculate its own MPR points then we can launch the request by following the steps:

Step 1: Assume N1(x) denote the set of one-hop neighbors of x, and N2(x) denote the set of 2nd-hop neighbors of x.

Step 2: Start with an empty MPR.

Select those neighbor nodes in N1(x) as multipoint relays which are the only neighbor of some node in N2(x) and present at one-hop from N1(x) (in case of low level density), then add these one-hop neighbor nodes to the multipoint relay set MPR(x).

In case of high density of vehicles neighbor at any hop distance can be selected.

Step 3: While there still exist some nodes in N2(x) which are not covered by the multipoint relay set MPR(x):

Step 4: For each node in N1(x) not in MPR(x) compute the number of the nodes that it covers among the uncovered nodes in the set N2(x). Add that node of N1(x) in MPR(x) for which this number is maximum.

Last one is Forwarding request block; in this a small change is done by adding a simple condition in the block transmission request. Once a node receives a route discovery request, it will check if it is the requested destination or not. If it isn't the destination, and there is not direct route in its possession to the destination, it will first check if it is MPR node or not. It will broadcast if and only if it is MPR node.

We have added a filed named MPR in the packet format of AOMDV. This field can have either 1 or 0. The value 1 denotes that the MPR is working and 0 represents that MPR is not working. If the area is low density vehicle area then the MPR is set to 0 in the send request function otherwise MPR is set to 1.If the MPR is set to 0 then AOMDV works normally otherwise it works by using the MPR algorithm. The MPR algorithm basically works during the route request time.

This protocol can be work for low density area as well as for high density area. A hybrid protocol is constructed to work on both type of area. This protocol will adapt according to the density of the area to enhance the performance.

III SIMULATIONS

NS2: Network Simulator (Version 2) known as NS2, is an event driven simulation tool that has proved effective in studying the dynamic nature of wireless communication networks. Result of wired and wireless network functions (e.g., routing algorithms, TCP, UDP) can be done using NS2. NS2 offers users a way of defining such network protocols and simulating their corresponding behaviors.

BASIC ARCHITECTURE OF NS2

NS2 provides users with executable command ns which take on input argument, the name of a Tcl simulation scripting file. Users are feeding the name of a Tcl simulation script (which sets up a simulation) as an input argument of an NS2 executable command ns. In most cases, a simulation trace file is created, and is used to plot graph and/or to create animation.

NS2 consists of two key languages: C++ and Object-oriented Tool Command Language (OTcl). While the C++ defines the internal mechanism (i.e., a backend) of the simulation objects, the OTcl sets up simulation by assembling and configuring the objects as well as scheduling discrete events (i.e., a front-end). The C++ and the OTcl are linked together using TclCL. TclCL (Tcl with classes) is a Tcl/C++ interface used by Mash, vic, vat, rtp_play, ns, and nam. It provides a layer of C++ glue over OTcl. Mapped to a C++ object, variables in the OTcl domains are sometimes referred to as handles. Conceptually, a handle (e.g., n as a Node handle) is just a string (e.g. o10) in the OTcl domain, and does not contain any functionality. Instead, the functionality (e.g., receiving a packet) is defined in the mapped C++ object (e.g., of class Connector). In the OTcl domain, a handle acts as a front-end which interacts with users and other OTcl objects. It may define its own procedures and variables to facilitate the interaction. Note that the member procedures and variables in the OTcl domain are called instance procedures and instance variables (instvars), respectively. Before proceeding further, the readers are encouraged to learn C++ and OTcl languages.

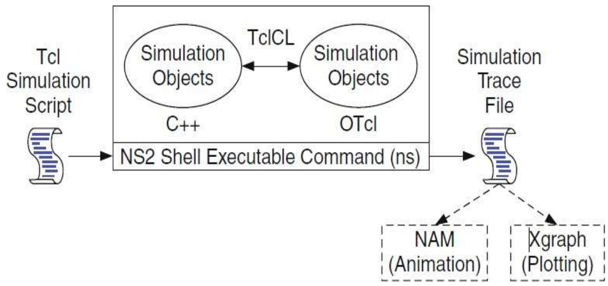


Figure : Architecture of NS2

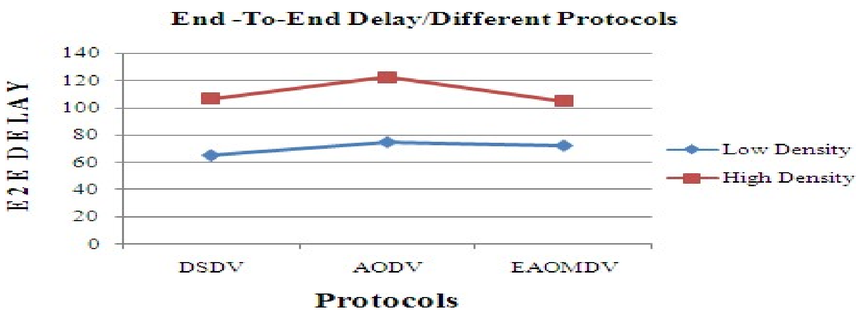
NS2 provides a large number of built-in C++ objects. It is advisable to use these C++ objects to set up a simulation using a Tcl simulation script. However, advance users may find these objects insufficient. They need to develop their own C++ objects, and use a OTcl configuration interface to put together these objects.

After simulation, NS2 outputs either text-based or animation-based simulation results. To perform these results graphically and mutually, tools like NAM (Network Animator) and XGraph are used. To study a specific behavior of the network, users can acquire a applicable subset of text-based data and change it to a more conceivable presentation.

IV. SIMULATION RESULT

Whole simulation includes the creation of scenarios using the vanetmobisim. vanetmobisim generates vehicles having mobility and roads. This mobility is parsed to NS-2 and it generates various nodes as NS-2 output. It's called NAM (Network Animator) file, which shows the nodes movement and communication occurs between various nodes in various conditions or to allow the users to visually appreciate the movement as well as the interactions of the mobile nodes. And another one is graphical analysis of trace file (.tr).

Trace files contain the traces of event that can be further processed to understand the performance of the network. Depicts the overall process of how a network simulation is conducted under NS-2. Output files such as trace files have to be parsed to extract useful information. The parsing can be done using the awk command or perl script. A software program which can reduce the process of analyzing trace files (Xgraph and Trace Graph) has been used. However, it does not work well in large trace file. To generate trace file and nam file, we call tcl script in terminal of ubuntu. By varying the simulation parameter, we can see the graphical variation between various performance metrics like packet generated, packet received etc.



Graph 4.1: End-to-end delay Vs different protocols

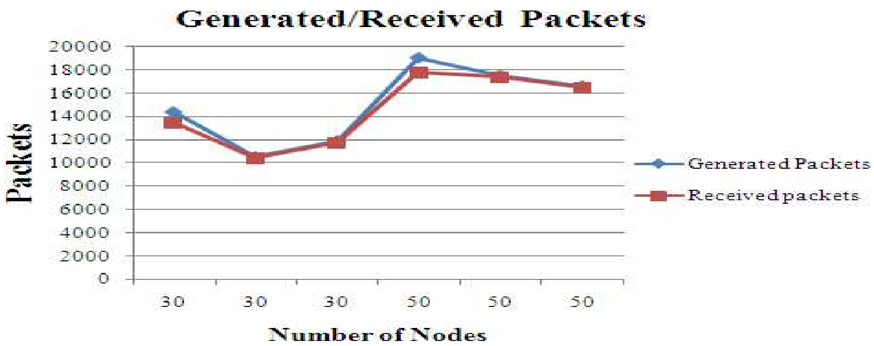
From graph 4.1, It is observed that end-to-end delay decreases in EAOMDV in low traffic area as well as in high traffic area as compare to AODV because in EAOMDV MPR doesn't work in low traffic area. When end-to-end delay decreases performance of the protocol increases i.e. performance is inversely proportional to end-to-end delay.

End-to-end delay = total no of end-to-end delay / count

Graph 4.2: Packet delivery ratio Vs Different protocols

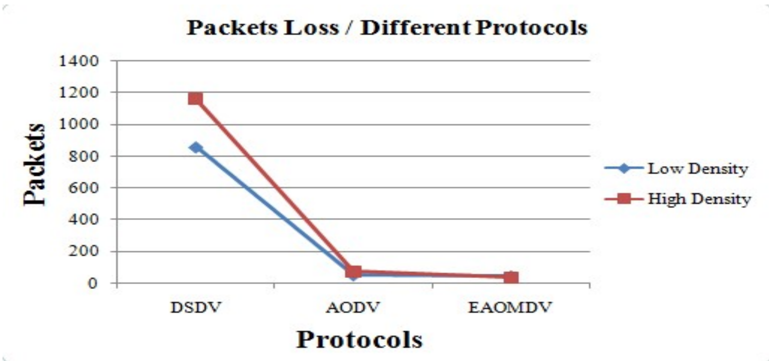
From graph 4.2, It is observed that packet delivery ratio of AODV and EAOMDV is almost same i.e. 99%. But packet delivery ratio of both AODV and EAOMDV protocols is more than DSDV protocol. Maximum the packet delivery ratio, Maximum will be the performance. Means performance is directly proportional to packet delivery ratio.

Packet delivery ratio = Received packets / Generated packets *100;



Graph 4.3: Generated and Received Packets Vs Different Nodes

From graph 4.3, It is observed that packets generate in DSDV, AODV, and EAOMDV are 14396, 10558, and 11909 respectively in low traffic area and 19039, 17499, and 16594 respectively in high traffic area and packets received in DSDV, AODV, and EAOMDV are 13485, 10469, and 11790 respectively in low traffic area and 17795, 17386, and 16510 in high traffic area.



Graph 4.4: Packet Loss Vs Different Protocols

From graph 4.4, It is observed that packets loss in DSDV, AODV, and EAOMDV in low traffic area and high traffic area are 859, 50, 44 and 1161, 72, 36 respectively. Packets loss in DSDV and AODV are high as compared to EAOMDV. So the performance of EAOMDV is high as compared to these two protocols. Lower is the packet loss higher will be the performance.

Packets loss = Generated packets - Received packets - Dropped packets

Table 4.1: Comparison of Results of Different Protocols

Protocols	DSDV		AODV		EAOMDV	
Type of area	Low Density	High Density	Low Density	High Density	Low Density	High Density
Generated Packets	14396	19039	10558	17499	11909	16594
Received Packets	13485	17795	10469	17386	11790	16510
Packet Delivery Ratio	93.6719	93.466	99.157	99.3542	99.0008	99.4938
Total Dropped Packets	52	83	39	41	75	48
Avg. End-To End Delay	65.403 ms	106.926 ms	74.7054 ms	122.495 ms	72.2257 ms	105.011 ms
Packets Loss	859	1161	50	72	44	36

VI. CONCLUSION & FUTURE WORK

VANETs have grown out of the need to support the growing number of wireless products that can now be used in vehicles. These products include remote keyless entry devices, personal digital assistants, laptops and mobile telephones. As mobile wireless devices and networks become increasingly important, the demand for Vehicle-to-Vehicle (V2V) and V2R or Vehicle-to-Infrastructure (V2I) Communication will continue to grow.

As in VANET, nodes (vehicles) have high mobility and moves with high speed. Proactive based routing is not suitable for it. Proactive based routing protocols may fail in VANET due to consumption of more bandwidth and large table information. AODV is a reactive routing protocol, which operates on hop-by-hop pattern. The Ad hoc On-Demand Distance Vector (AODV) [3] algorithm enables dynamic, self-starting, multi-hop routing between participating mobile nodes wishing to establish and maintain an ad hoc network. AODV allows mobile nodes to obtain routes quickly for new destinations, and does not require nodes to maintain routes to destinations that are not in active communication.

We have discussed several routing protocols, among them AODV is best suited to improve the performance. As AOMDV is an extended protocol of AODV. AOMDV is performed better in case of high level density. Proposed a hybrid protocol performs better in case of low level density as well as in case of high level density. Packet delivery ratio remains same i.e. above 99% and end-to-end delay gets decreased.

In future, real world implementation can be done on the proposed protocol. It can be analyzed for different mobility models. Proposed protocol can be analyzed for the real world mobility models using Tiger Map. The performance of the proposed protocol can be adjusted according to distance between the RSU's.

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