Implementation of Density Based Routing Using Proactive and Reactive Routing Protocol in VANET

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ABSTRACT

VANET represent a rapidly emerging and challenging class of MANET. In this type of network, each node operates not only as a host but also as a router; promote packets for other mobile nodes. Communication between nodes i.e. vehicles by means of wireless technology has a large potential to improve traffic safety and travel comfort for drivers and passengers. VANET, being an infrastructure-less networks, vehicle will be expected to cooperate to perform essential networking tasks such as routing.In this work, nodes have been used as vehicles and based on evaluation between four mostly used routing protocols Ad hoc on demand distance Vector routing protocol (AODV), Dynamic source routing protocol (DSR), Optimized link state routing (OLSR) and Geographic Routing Protocol (GRP) in VANET scenario. 30 sec time is taken for simulation with varying nodes i.e. 5 nodes, 20 nodes and 40 nodes. Various mobility have been analyzed here which are 10 m/sec and 28 m/sec and performance has been evaluated on the basis of residual energy, packet delivery ratio, routing overhead, throughput and end to end delay with different environments. The simulation study has been completed using network simulator (NS2) tool. In this work we have carried out the detailed analysis of the routing protocols AODV, DSR, OLSR and GRP and concluded that varying mobility as well as varying node density drastically affects the behavior of the routing protocols. In the analyzed scenario, it is found that the DSR (packet delivery ratio and routing overhead) and GRP (End to end delay and Throughput) have the best all round performance than AODV and OLSR.

Key words- VANET, AODV, DSDV, DSR, IEEE802.11p, Network Simulator-2.35.

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INTRODUCTION:

VANET represent a rapidly emerging and challenging class of MANET. In such networks, each node operates not only as a host but also as a router; promote packets for other mobile nodes [3]. Communication between vehicles by means of wireless technology has a large potential to improve traffic safety and travel comfort for drivers and passengers [4]. VANET, being an infrastructure-less network, nodes will be expected to cooperate to perform essential networking tasks such as routing [5]. VANET presents a new and promising field of research, development and standardization, throughout the world, there are many national and international projects in governments, industry, and academia devoted to the development of VANET protocols

(Appendix B). These projects include consortiums like "The Dedicated Short Range Communications (DSRC)" (USA), the "Car-to-Car Communication (Europe)" and the "Intelligent Transportation Systems" (Japan) and standardization efforts like the IEEE 802.11p "Wireless Access in Vehicular Environment" (WAVE) [1]. The study of Vehicular Ad-Hoc Network (VANET) has attracted attentions recently. By definition, VANET is a form of mobile ad-hoc network (MANET), to provide communication among nearby vehicles and between vehicles and nearby fixed infrastructure. Vehicles may be equipped with on board devices, which can provide them Wireless Local Area Network (WLAN) connectivity through an access point (AP) installed in a road side unit (RSU). With advancement in technology sector, vehicular network is anticipated to be on a high rise and its usage is going to increase manifold on a scale similar to the huge scalable network of World Wide Web. We need to come up with robust techniques to make VANET reliable and at the same time seamless in nature.

VANET and Safe

A major intended uses for VANET regards safety. If a car shot an unsafe road situation, it transmits the report to cars behind it that might be heading in the direction of the danger. A main research area is how to govern such dispense of data. It should not be transmitted to nodes which are treats as a car that are driving away from the danger or to cars on the other side of area. This is the kind of problem that needs to be addressed when choosing the protocol that will be used. The protocol will need to protect the necessary data is transmitted but should also help prevent information overload [6].

VANET and Convenience

There are several ways VANET could aid riders in areas of convenience and comfort. For commuters who line up and drive, VANET could help drivers keep path of arriving trains, roller or buses. This also will be a segment of the protocol that is selected: it must be programmable for individual drivers. Probably a vast use of VANETs is in avoiding traffic congestion. The first car that strife a traffic jam will let others know so the jam can be avoided [1].

Ad Hoc on-Demand Distance Vector Routing (AODV) It is an on demand routing protocol, in this protocol the network is silent until a connection needed. At that position the network node that needs a connection flooded a request for connection. Other AODV nodes onward this message, and record the node that they overhear it from, creating an explosion of short-lived routes back to the needy node [4]. When a node receives such a message and already has a route to the covet node, it sends a message backward through a temporary route to the requesting node. The destitute node started using the route that has the least number of hops through other nodes. Unused node in the route tables is recycled after some time. When a link fails, a routing error is passed back to a transmitting node, and the action repeats. Much of the complexity of the protocol is to lower the number of messages to safeguard the capacity of the network. For example, each desire route has an array. Nodes use this sequence number so that they do not repeat route requests that they have earlier passed on.

Dynamic Source Routing Protocol (DSR)

The Dynamic Source Routing Protocol (DSR) is one of the most reliable and effective protocols in the VANET. in this protocol when a source node wish to transmit a packet to a destination host, the source check its route cache in order to determine, if it already knows a source to the destination that it has learned, If an unexpired route to the destination is found in its route cache, then it sends the packet through this route by placing in the packet"s header the source route addresses of each node through which the packet is forwarded until reaching the destination (complete sequence of hops).

Salvaging: If an transitional node discovers that the next hop in the source route is unreachable, it can replace the source route in the data packets with a route from its own cache.

Gratuitous Route Repair: A source node notified error of the packets it originates propagates the error notice to its neighbors by piggy-backing it on its further route request. This helps clean up the cache of other nodes in the network that may have the failed link in one of the cached source routes.

Promiscuous Listening: When a node overhears a packet that is addressed to another node, it adds the source route information into its own route caches. The node also checks if the packet could be repulse via itself to gain a shorter route.

Destination Sequenced Distance Vector (DSDV)

Destination-Sequence based Distance-Vector Routing (DSDV) is a table-driven routing scheme for ad hoc mobile networks based on the Bellman-Ford algorithm. Packets are transmitted between the stations of the network by using routing tables which are gathered at each station of the network. Each routing table, at every station, lists all available terminals, and the number of hops to each. Each route table entry is identified with a sequence number which is originated by the destination terminal. To maintain the consistency of routing tables in a dynamically varying topology, each station periodical transmits updates immediately when significant new information is available, since we do not assume that the mobile hosts are maintaining any sort of time synchronization, we also make no assumption about the phase communication of the update duration between the mobile hosts. These packets indicate which stations are accessible from each station and the number of hops necessary to reach these accessible stations, as is often done in distance-vector routing algorithms [8].

SIMULATION SETUP

The simulation setup is a reliable scenario for AODV and DSR that was especially designed for an optimum performance of public-safety related applications and compare it with DSDV.

There are three ideas implemented in this work:-

- Cluster based scenario
- Choosing the adjoining following node as the network probe node
- Headway-based distribution, non-uniform segmentation and application adaptive

The alliance of these ideas results in a protocol that possesses:-

- Minimum latency
- Minimal probability of collision in the acknowledgment messages
- Unique meat at different speeds

Dedicated Short Range Communications (DSRC) is a protocol that has been specificallyused for VANET. DSRC has several advantages: it already is operating at 5.9 GHz, it is easy to individualize and it is oriented to the idea of transmitting along a street grid framework--as opposed to the omni directional transmission, which is standard for most wireless protocols. During implementation a routing protocol in ns-2 the type of queue and its adaptability criteria are carefully considered. In the simulation work, the available standard and data units are followed. Ns-2 produces output in the form of trace file which is further processed by shell scripting to calculate the desired parameter. Shell scripting and awk are widely used to process trace files. Requirements are to use this document as a template and simply type your text into it.

PERFORMANCE METRICS & SIMULATION RESULTS

The following metrics are used in this work for the performance evaluation of AODV, DSR, OLSR & GRP routing protocols.

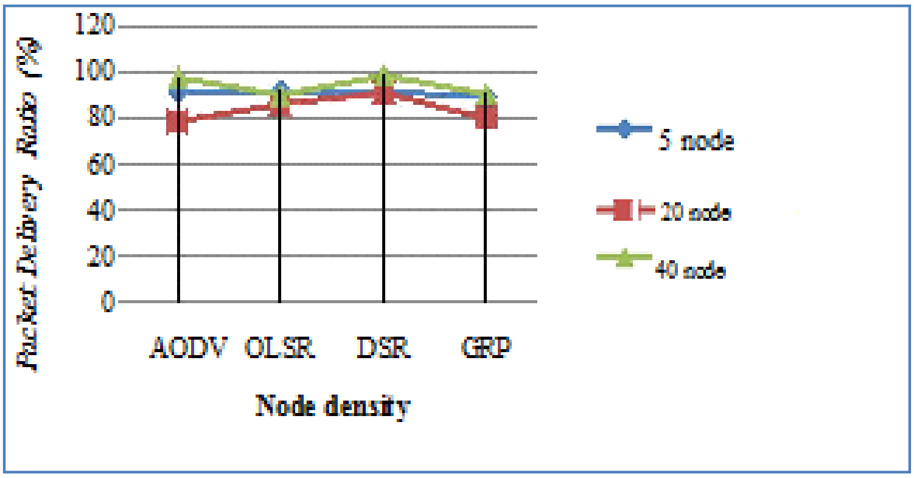
Packet Delivery Ratio:

This is the fraction of the data packets generated by the sources to those delivered to the destination. This classifies the ability of the protocol to discover routes.

Packet Delivery Ratio for the speed of 10m/sec:

Following graph is plotted between number of nodes which are represented on Y axis and routing protocols on X axis to calculate packet delivery ratio on mobility of nodes taken as 10 m/sec. Number of nodes taken are 5, 20 and 40 nodes while protocols are AODV, DSR, OLSR and GRP.

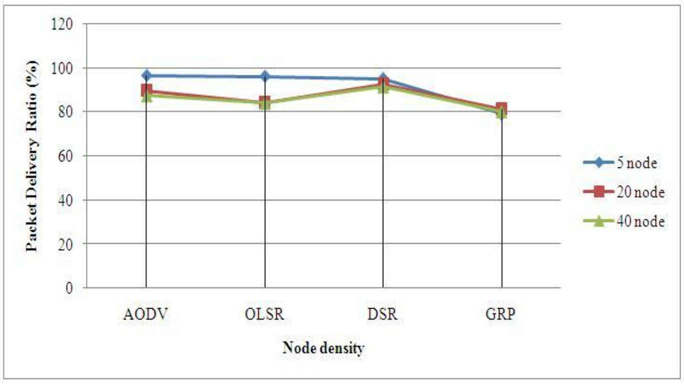
Packet Delivery Ratio for the speed of 10m/sec



Packet Delivery Ratio for the speed of 28m/sec:

Following table and graph is plotted between number of nodes which are represented on Y axis and routing protocols on X axis to calculate packet delivery ratio on mobility of nodes taken as 28 m/sec. Number of nodestaken are 5, 20 and 40 nodes while protocols are AODV, DSR, OLSR and GRP.

Packet Delivery Ratio for the speed of 28m/sec



Analysis of Packet Delivery Ratio:

In this case we have analyzed packet delivery ratio with 10 m/sec speed that with increasing number of nodes packet delivery ratio is best in DSR protocol as it is significantly other three protocols. From the above results it is analyzed that for the high node density the packet delivery ratio decreases with increasing mobility while packet delivery ratio is increasing for the moderate node density as compared to low and high node density at low mobility.

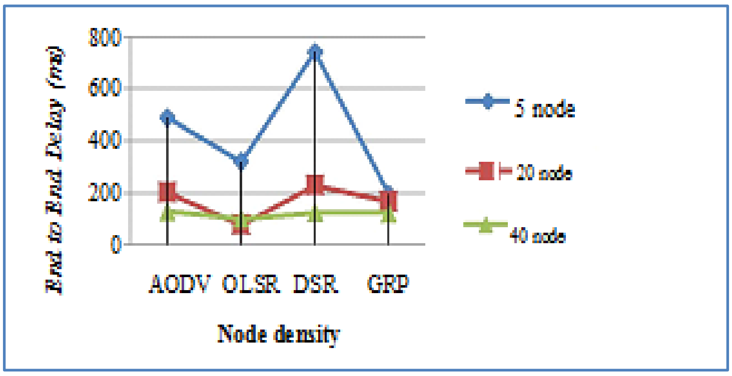
End to End Delay

This is the average delay between the sending of the data packet by the source and its receipt at the corresponding receiver. This includes all the delays caused during route acquisition, buffering and processing at intermediate nodes.

End to End Delay for the node mobility of 10m/sec:

Following table and graph is plotted between number of nodes which are represented on Y axis and routing protocols on X axis to calculate end to end delay on mobility of nodes taken as 10 m/sec. Number of nodes taken are 5, 20 and 40 nodes while protocols are AODV, DSR, OLSR and GRP.

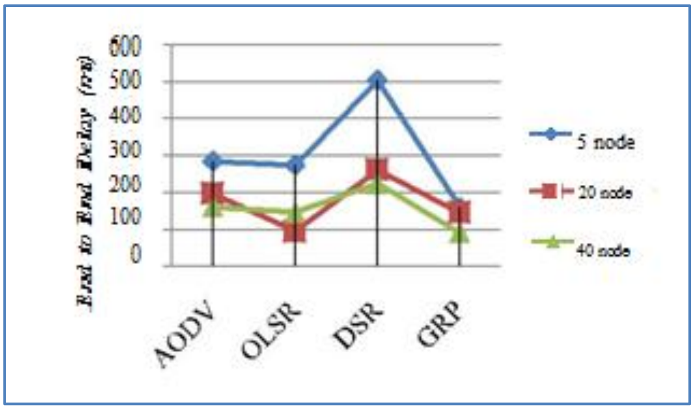
End to End Delay for the speed of 10m/sec



End to End Delay for the node mobility of 28m/sec:

Following table and graph is plotted between number of nodes which are represented on Y axis and routing protocols on X axis to calculate end to end delay on mobility of nodes taken as 28 m/sec. Number of nodes taken are 5, 20 and 40 nodes while protocols are AODV, DSR, OLSR and GRP.

End to End Delay for the speed of 28m/sec



Analysis of End to End Delay:

In this case we have analyzed end to end delay for mobility 10 m/sec in which GRP has better performance out of all other protocols in which end to end delay is decreasing with increasing number of nodes whereas when we have taken mobility 28 m/sec under consideration in which also GRP has best results in which also end to end delay is decreasing with increasing number of nodes. So overall GRP has better performance at both the mobility model.

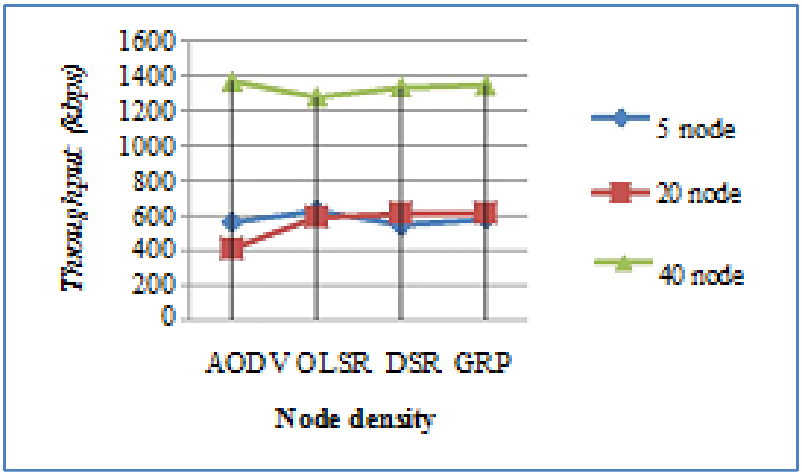
Throughput

The average rate at which the data packet is delivered successfully from one node to another over a communication network is known as throughput. The throughput is usually measured in bits per second (bits/sec). a throughput with a higher value is more often an absolute choice in every network.

Throughput for the node mobility of 10m/sec:

Following table and graph is plotted between number of nodes which are represented on Y axis and routing protocols on X axis to calculate throughput on mobility of nodes taken as 10 m/sec. Number of nodes taken are 5, 20 and 40 nodes while protocols are AODV, DSR, OLSR and GRP.

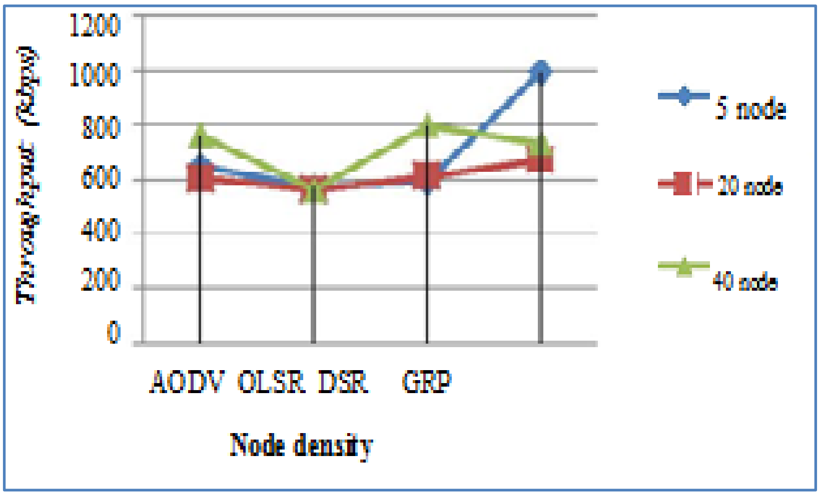
Throughput for the speed of 10m/sec



Throughput for the node mobility of 28m/sec:

Following table and graph is plotted between number of nodes which are represented on Y axis and routing protocols on X axis to calculate throughput on mobility of nodes taken as 28 m/sec. Number of nodes taken are 5, 20 and 40 nodes while protocols are AODV, DSR, OLSR and GRP.

Throughput for the speed of 28m/sec



Analysis of throughput:

From the above figure it is analyzed that at higher node density throughput is good. When we analyzed about the varying mobility throughput is increasing with increasing mobility but only at the low and moderate density while decreasing at high node density.

Overall when considering both the parameters i.e. node density and mobility GRP is giving better performance than others.

CONCLUSION

This work has been carried out with the detailed analysis of AODV, OLSR, DSR and GRP routing protocols theoretically and through simulation by NS-2 for VANET on the basis of different performance metrics viz. packet delivery ratio, residual energy, end to end delay, routing overhead and throughput. These performance metrics are investigated for the four routing protocols by varying the node mobility for variable number of nodes. Simulation results show that, as the mobility of nodes increases in the network from 10 m/sec to 28 m/sec, the performance of the routing protocols decreases. Nodes mobility affects the performance of routing protocols most as frequent path break increases with the mobility. According to the results as the mobility of nodes increases from 10m/sec to 28 m/sec, the end to end delay and routing overhead of routing protocol increases whereas throughput and packet delivery ratio decreases.

We can summarize the conclusion as follows:

- The behavior of routing protocols was analyzed and the calculation show that GRP has least packet delivery ratio and it is enhanced by 4% in OLSR, 6% in AODV and 12% in DSR. So performance of DSR is found to be best for packet delivery ratio.
- In case of residual energy, it was analyzed and calculated that it is least for DSR while it is enhanced by 4% in AODV, 6% in GRP while 7% in OLSR. So OLSR has best performance for residual energy.
- In case of end to end delay it is analyzed and calculated that GRP has least end to end delay while it is been increased by 18% in OLSR, 55% in AODV while has maximum value that is 120% in DSR. So GRP has best performance as end to end delay must be low.
- In case of routing overhead it is analyzed and calculated that DSR has least value for routing overhead while its value is increased by 55% in AODV, 70% in OLSR while maximum in case of GRP that is 120%. So DSR is performing best out of all routing protocols as routing overhead also must be low.
- In case of throughput it is analyzed and calculated that OLSR has worst results out of all the protocols while it‟s been.

FUTURE WORK

- We see many areas for future work that can expand this research. We pinpoint different ranges for more research and where existing research can be integrated into ours
- As mobiles are familiar and used by us in our day to day life, similarly the future of VANETs is undoubtedly secure. It has become the part of the government projects. In India, National Highways Authority of India (NHAI) is planning to replace manual toll collections at plazas with electronic toll collection (ETC) systems across the country. The ETC system will be based on radio frequency identification (RFID), which will be complemented by a wireless on-board unit (OBU) on a vehicle, as well as a stationery roadside unit (RSU) at the toll plaza.
- Complex traffic modeling and driving behaviors (mobility models) that incorporate lane changing and multiple entry and exit points can be integrated to our simulation framework to validate and evaluate our algorithm in more.

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