



COMPARATIVE ANALYSIS OF PROTOCOLS APPLIED IN MANET AND VANET USING QUALNET SIMULATOR

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ABSTRACT

Mobile Ad-hoc Network (MANET) and Vehicular Ad-hoc Network (VANET) plays an important role in wireless communication. MANET comprises of cluster of mobile nodes linked wirelessly in a network without having a fixed architecture. Every node behaves like a router as they send the traffic from one node to the other node in the network. VANET is subset of MANET. It is the upcoming technology due to which vehicles can communicate with each other and road side unit (RSU) to share information in a wireless network. VANET provides dynamic changes in topology and mobility along with high speed. The protocols considered for performance analysis of the networks are Ad-hoc On-demand Distance Vector (AODV), Dynamic Source Routing (DSR), Optimized Link State Routing (OLSR) and Dynamic MANET On-demand (DYMO). The parameters considered for analysing network performance are: throughput, end to end delay, jitter and messages received using QualNet. The comparative analysis of different protocols applied in MANET and VANET is done. It is found that DSR protocol is best suitable for MANET as well as VANET.

Keywords: End to end delay, jitter, MANET, QualNet, throughput, VANET.

1. INTRODUCTION

A communication medium can be a wired network or a wireless network. One type of the wireless network is the MANET and the other type is VANET. MANET consists of nodes linked wirelessly in a network without having fixed architecture. MANET is superset of VANET. The main characteristic of MANET is that topology changes randomly and dynamically. MANET is used for various application where devices can communicate directly to exchange information, in military sector, in commercial sector, in emergency/rescue operations for disaster relief efforts, e.g. in fire, flood, or earthquake, Wireless Sensor Network (WSN), Data Networks etc. [1,3]

The characteristics of VANET are different than MANET that makes it unique. Because of accidents taking place, VANET is used to ensure passenger and road safety. VANET is used in comfort and safety applications like Emergency warning system, Co-operative Message Transfer, Post-Crash Notification, Cooperative Collision Warning, Real-time traffic. [7] Our work focuses on Comparative Analysis of Protocols applied in MANET and VANET using QualNet Simulator.

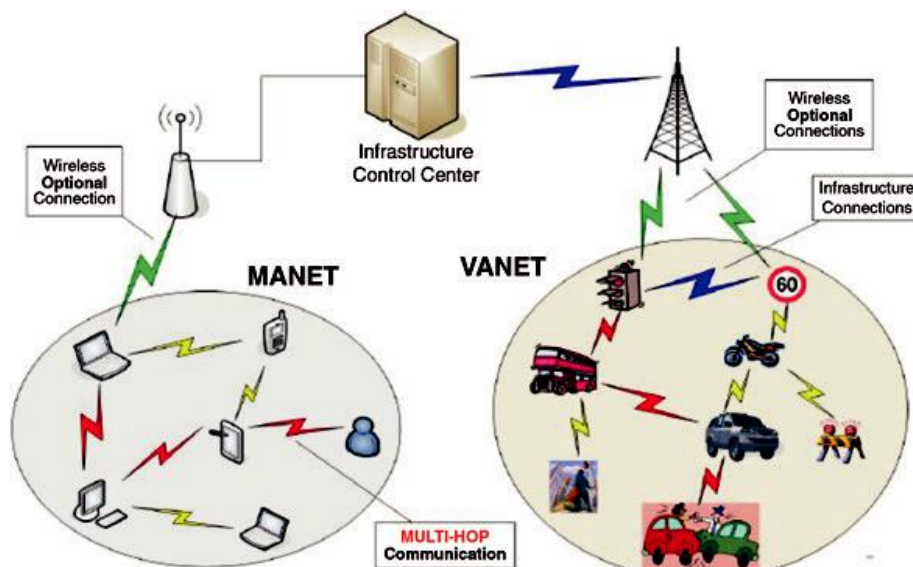


Figure1. Comparison between MANET and VANET

Figure1 shows comparison between MANET and VANET. VANET has very dynamic topology as the vehicles move at a high speeds. The mobility of vehicles is predictable in VANET.

There are many real time hardware tools and emulators existing such as NS2, OPNET, OMNet, GloMoSim, QualNet for measurement of the performance and analysis of the networks. But we have chosen QualNet as the simulation tool for our work because it has many advantages over other simulators: 1) rapid Prototyping of protocol, 2) In-built measurement on every layer, 3) layered stack design, 4) scalability via support for parallel execution and also simulation speed is very high as compared to other simulators

2.LITERATURE REVIEW

With the improvements in the wireless technology, the demand for research on VANET and MANET is also taking a peak. Hence study and analysis of both these networks is important.

In [2] it is presented about the analysis and comparison of MANET and VANET considering AODV protocol. NS2 simulator is used. The number of nodes considered are 20,

30, 40, 50 and 60. Throughput is the parameter considered. From the analysis, it is observed that VANET performance is much better than MANET in terms of throughput. In [4] comparative study of MANET and VANET is done. Various applications of MANET and VANET are mentioned. The protocols considered are AODV, DSR, OLSR and DSDV. It is found that reactive protocols are best suitable in MANET as well as VANET. In [7] the simulator used is QualNet 6.1. No. of nodes considered are 50. This paper tells us of the comparison done of MANET, VANET and FANET. Random waypoint mobility model is been used. From the analysis, it is found that performance of FANET is better than MANET and VANET. In [8] MANET and VANET characteristics as well as its applications are mentioned. Protocols suitable for MANET can also be suitable for VANET. Therefore, protocols feasible for MANET and VANET respectively are discussed. The performance of network will vary with changes in the traffic conditions. Reactive protocols can be best suitable for both MANET and VANET. In [9] it presents about the relative study of MANET and VANET. The work focuses on the features and applications of MANET and VANET respectively. Considering the increase in traffic and safety issues in driving, VANET networks are essential nowadays.

Ref No.	Protocols considered	Parameters Considered	Methodology	Remark
[2]	1.AODV	1.Throughput	Simulation based study of MANET and VANET in NS2.Number of nodes considered are20,30,40,50,60. QoS performance on MANET and VANET is analysed.	VANET performance is much better than MANET in terms of throughput parameter.
[4]	1.AODV 2.DSR 3.OLSR 4.DSDV	-	Comparative Study of MANET and VANET is done. Various applications of MANET and VANET are mentioned.	It is found that reactive protocols are best suitable in MANET as well as VANET.
[7]	1.AODV	1.End to end delay 2.Packet loss 3.Throughput	The performance of MANET,VANET and FANET is compared considering the respective parameters using QualNet 6.1 simulator. Number of nodes considered are 50.	From the analysis done it is found that performance of FANET is better than MANET and VANET. Random waypoint mobility model is been used.
[8]	-	-	MANET and VANET characteristics as well as its applications are mentioned in this work.The protocols feasible for MANET and VANET respectively are discussed.	The performance of protocols will vary with changes in the traffic conditions. Reactive protocols can be best suitable for both MANET and VANET.
[9]	-	-	Relative study of MANET and VANET is presented. The work focuses on the features and applications of MANET and VANET respectively.	Considering the increase in traffic and safety issues in driving, VANET networks are essential nowadays.

Table 1. Literature Finding

3.ROUTING PROTOCOLS:

Routing protocols in MANET and VANET are of three types.They are proactive, reactive and hybrid protocols.[5]

3.1 Proactive routing protocols

Nodes in ad-hoc networks get access to paths of every nearby node that try to hold authentic routing data as per the routing *table*. It includes DSDV and OLSR protocols.

3.1.1 OLSR: It is based on Bellman Ford algorithm. Neighbour nodes get the path information shared by each node. Data of each participating node is maintained in full dump

packet. Information about latest updates in position of nodes is maintained in incremental packet. The neighbour vehicular nodes use incremental packet and full dump packet to keep themselves and routing *table* up-to-date. With updated entries in *table*, the paths are named. OLSR is good option for those networks where there is less number of changes in the location of nodes.

3.2 Reactive routing protocols

It is recognised as on-demand routing protocols. Process of route detection is on demand. Route request packet (RREQ) is used for path initiation and Route reply Packet (RREP) gives

the route reply. Route Error (RERR) packet is received when link cannot be accessed. This type includes protocols such as AODV, DSR and DYMO. [2]

3.2.1 AODV: Here each node contains path data of every other node. Sequence number is used to update the *table*. The value from the *table* that is not utilized within a certain time will get faded away and that path is detached from the nodes. For updating the route in the routing *table*, RERR packet is forwarded. [6]

3.2.2 DSR: This protocol is based on link state routing. Route discovery request is initially sent to the node that requests data transfer. Data sending node assigns a route request packet in network and pass on this route request by updating their position as source. The destination node acknowledges a path response message to source node. If the path response is not acknowledged, the source node retraces the path till the target node is reached. [2]

3.2.3 DYMO: DYMO works in multi-hop wireless networks. DYMO is a successor to AODV. DYMO has three communication messages throughout the direction-finding task namely RREQ, RREP and RERR.

1. RREQ is utilized by means of source node to determine a path to a specific target node.
2. RREP is utilized to create a path between target node, source node and the midway nodes.
3. RERR is to point an invalid path between source and target node.

4. SIMULATION SCENARIOS AND PARAMETERS APPLIED

VANET and MANET is simulated with QualNet. QualNet supports thousands of node and has 64 bit OS. It works on Unix-OS, Linux-OS, Mac-OS. [7]

4.1 MANET

MANET is infrastructure less and self-configured network of mobile devices. In this

work the simulation area considered is 2000 sq. m with 40 nodes. Random waypoint mobility model is used. In these types of models, nodes are permitted to travel and discover their destination. Min and Max speed considered is 30 km/hr and 40 km/hr. IEEE 802.11 is the MAC layer used.

4.2 VANET

VANET network provides dynamic changes in topology and mobility along with high speed. We have considered 40 nodes and the simulation area of 2000 sq. m. Min and Max speed considered is 40 km/hr and 60 km/hr. The MAC layer used is IEEE 802.11b. Random waypoint mobility model is used.

4.3 PARAMETERS APPLIED

For the analysis of the MANET and VANET following parameters are taken into consideration:

a. Throughput: It is the rate of successful message delivery over a communication channel. It is a measure of efficiency. Unit is bits per second.

b. Total Unicast Messages Received: It is the number of data packets that are successfully delivered from source to destination. It must be as high as possible.

c. Delay: Time needed for packets to travel in a network from source node to destination node measured in seconds.

d. Jitter: It is the change in latency from packet to packet. It occurs when some packets take longer time to travel from one system to other. It is the variation in the arrival times (seconds) between two consecutive packets received.

5. DESIGN SPECIFICATIONS

MANET and VANET

The protocols AODV, OLSR, DSR and DYMO are analysed and compared. Analysis is done considering the parameters: message received, jitter, throughput and end to end delay

	MANET	VANET
Simulation area	2000 m * 2000 m	2000 m * 2000 m
Simulation time	90 mins	90 mins
Number of nodes	40	40
MAC layer	IEEE 802.11	IEEE 802.11b
Speed	Min: 30 km/hr Max: 40 km/hr	Min: 40 km/hr Max: 60 km/hr

Table 2. MANET and VANET design specifications

6. SIMULATION RESULTS ON QUALNET

Performance of protocols in graphical manner is shown below in which Y axis represents

respective parameters and X axis represents node id. (figure 2 to 9)

6.1 Manet Results

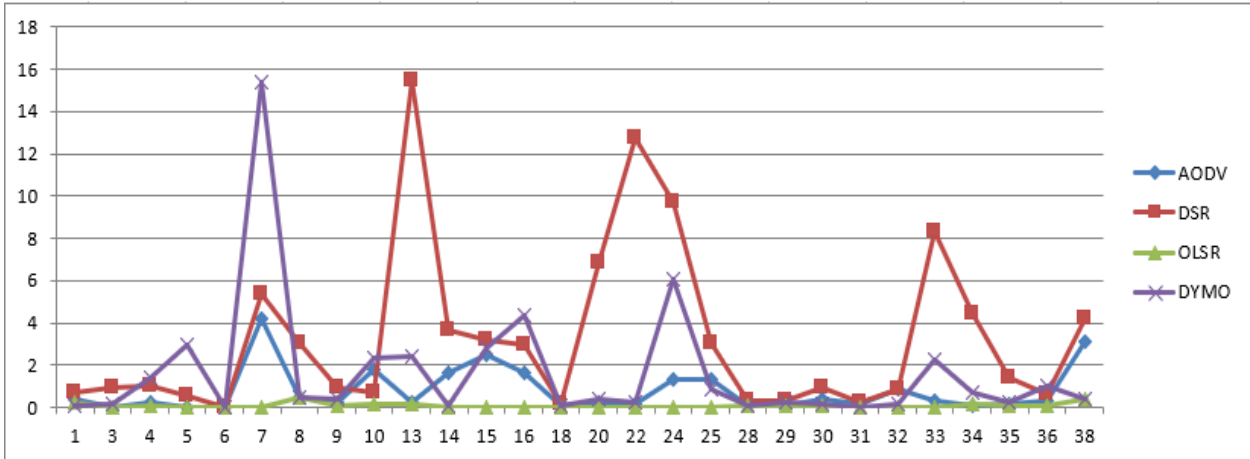


Figure 2: End to End delay performance in MANET scenario.

The end to end delay required should be as less as possible. Figure 2 shows end to end delay for OLSR is less than DYMO, AODV and DSR

whereas DSR has more delay. For Node Id 13 and Node Id 22, the delay value is highest for DSR. It is found that OLSR is better.

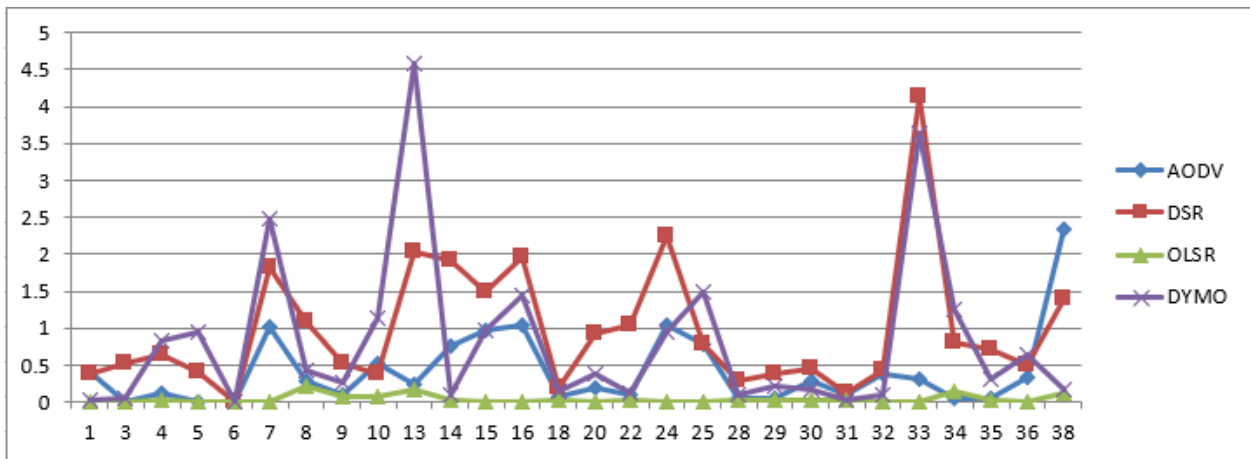


Figure 3: Jitter performance in MANET scenario.

Jitter should be less for better performance. Figure 3 shows jitter for OLSR is very less in comparison with DYMO, AODV and DSR

whereas DSR gives very high jitter than other protocols in MANET.

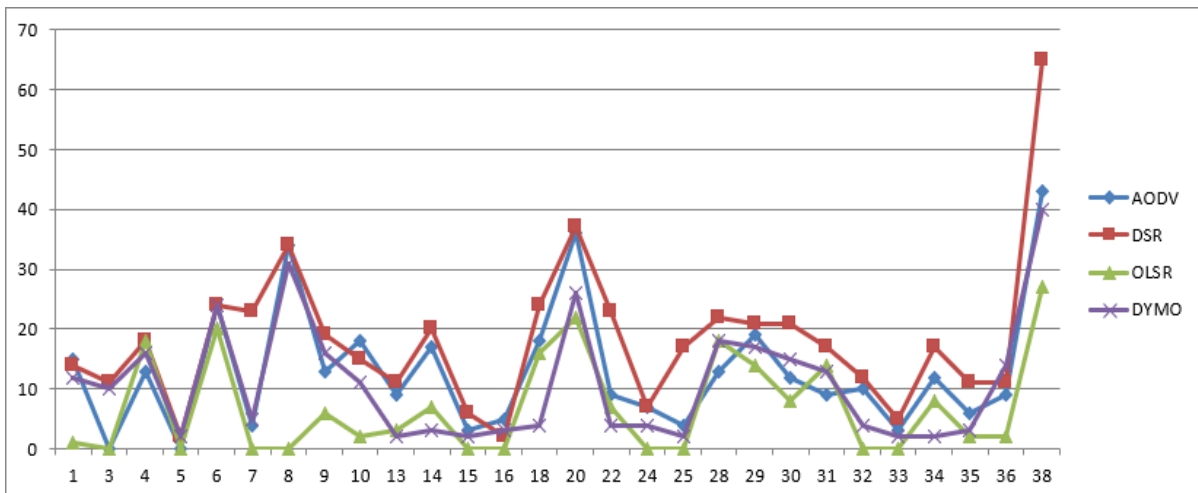


Figure 4: Total unicast message received in MANET scenario

Total unicast message received must be highest for better quality. DSR has better quality than other protocols for MANET scenario. The number of packets dropped for AODV rises as

the speed increases. AODV's and DYMO's performance is similar for few nodes. Performance reduces as the number of nodes and speed increases.

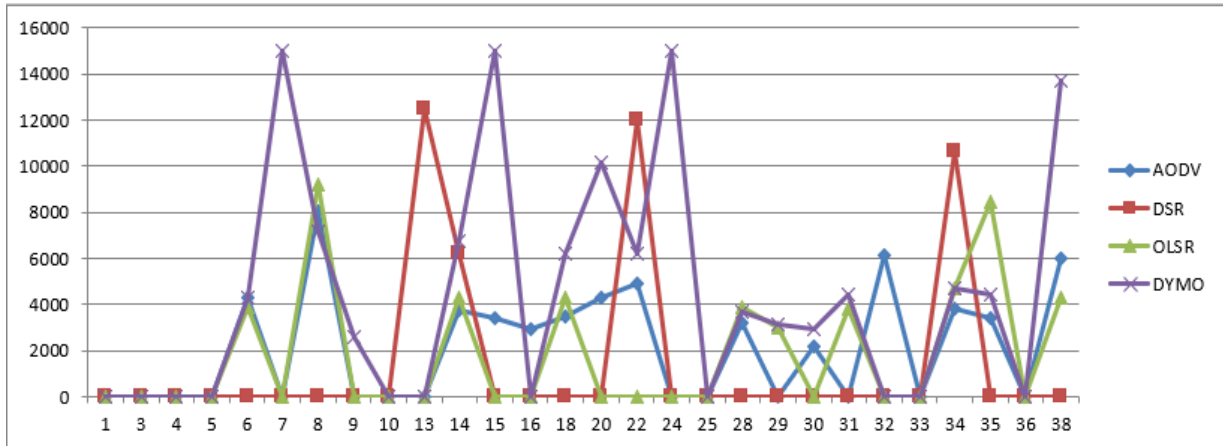


Figure 5: Throughput in MANET scenario

Throughput must be high. It is analysed from the above graph that the throughput of DYMO is higher than others. When speed is increased

then AODV performance reduces and performance of OLSR also suffers.

6.2 VANET Results

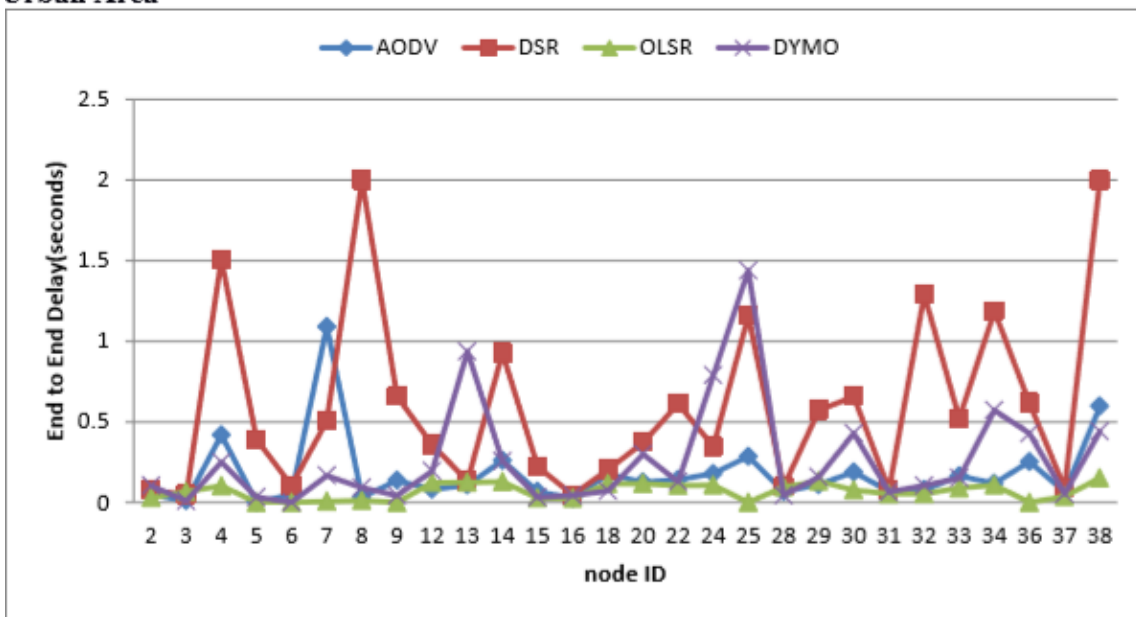


Figure 6: End to End delay performance in VANET scenario.

Figure 6 states that delay of DSR is maximum in VANET scenario. OLSR has minimum

delay. While AODV and DYMO has average delay.

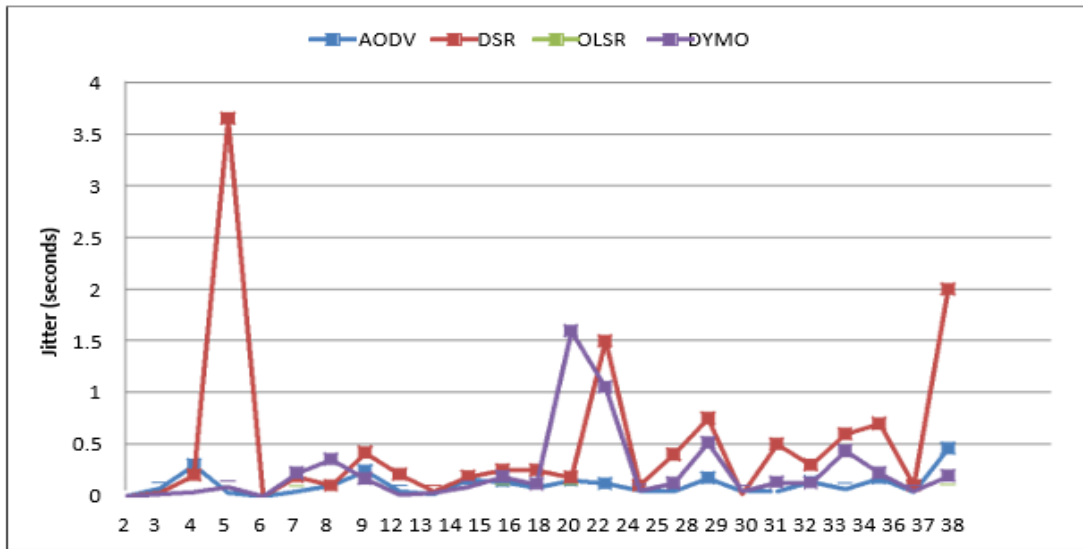


Figure7: Jitter performance in VANET scenario.

In figure 7, the jitter is found to be highest in DSR. OLSR is lowest than other protocols.

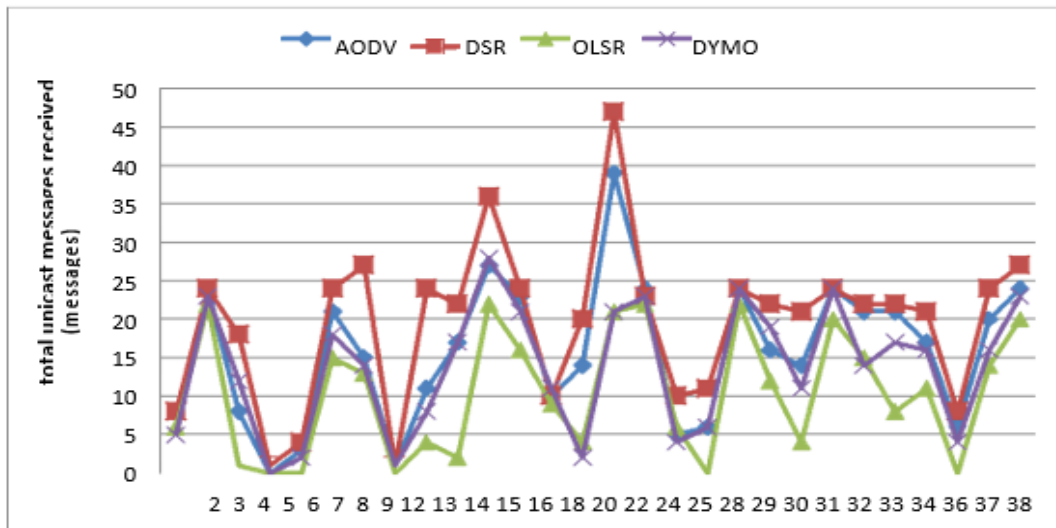


Figure 8: Total unicast message received in VANET scenario

Figure 8 shows that in DSR total unicast message received is much higher than AODV, OLSR and DYMO. The amount of packet drop for AODV increases as the speed rises. The performance of OLSR and DYMO is not good for VANET scenario. Performance degrades as the number of nodes increases with increase in speed.

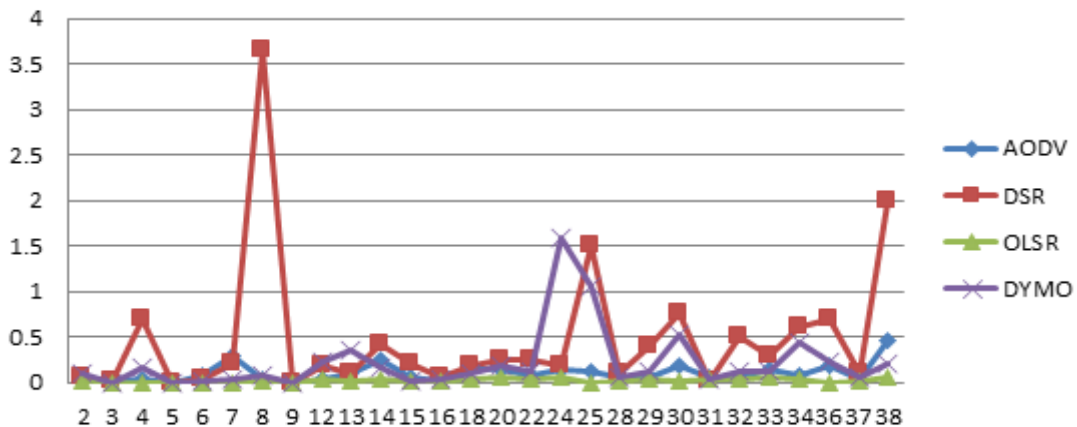


Figure 9: Jitter performance in VANET scenario

Figure 9 shows throughput is higher for DSR, whereas OLSR has the lowest one. AODV and DYMO show the average throughput.

CONCLUSION AND FUTURE WORK

DSR's performance is better in both MANET and VANET in terms of message received. But DSR has more delay and jitter. In OLSR the delay and jitter is found to be lowest in both the scenarios which is the necessity in any real time systems. While OLSR lacks in terms of throughput and message received. It is found that reactive protocols are best suitable for both the MANET and VANET. Based on comparative analysis, DSR shows better results than any other reactive protocol for both MANET and VANET.

The research work can be performed by varying the network in terms of speed, number of nodes and other protocols. The effect of these changes on the performance of MANET and VANET can be studied. Further the real time implementation can be simulated and tested using different simulation tools like NS2, OPNET.

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