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Comparative Performance in Routing Protocols for VANET

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Abstract— A vehicular Ad-Hoc network is a new technique of MANET (Mobile Ad-hoc Network) which is used for establishes the communication linkage between road vehicles or located roadside infrastructure. . In this paper we have compared the throughput performance of three VANET routing protocol DSDV, AODV and DSR by using NS-2 Simulator. DSDV is proactive or Table driven routing Protocol whereas DSR and AODV share similar On Demand behaviour, but the different protocols shows the performance difference. NS-2 is a simulator which contains the OTCL and C++ languages. VANET environment provided the higher performance value of throughput CBR and VBR. The Performance evaluation has been done by using simulation tool NS2 (Network Simulator) which is the main simulator. So, Network Simulator is best simulator.

Keywords— Vehicular Ad hoc Networks, Mobile Ad-hoc Network, constant-bit -rate, variable-bit-rate.

I. INTRODUCTION

A VANET is Vehicular Ad-hoc Network, is a type of MANET that allows communicating with roadside equipment. While the vehicles may not have Internet connection direct, the roadside wireless equipment may be connected to the Internet, the vehicles sent to allowing data from over the Internet. The vehicle data be used to measuring the traffic conditions or keep track of trucking fleets. Rapidly network partitions, higher error rates, collision interference, changing connectivity and power constraints and bandwidth together pose new problems in network control—particularly in the design of higher level protocols such as routing and in implementing applications with Quality of Service requirements. A first attempt to cope with the mobility is to use the specific techniques aimed to tailoring the conventional routing protocols to the vehicular environment while preserving their nature. For that such techniques designed around the protocol are referred to as proactive protocols or table driven. To guarantee that are reflect the actual network topology, routing tables and up to date , nodes running a protocol continuously exchange route updates and re calculate paths to all possible destinations. The advantage of the table driven protocols is that a route is immediately available when is needed for data transmissions. However, if the traffic users are not generated, then wastage of resources are update by the proactive route mechanism.A different approach in the design of the routing protocol is to calculate a path only when it is necessary for transmission of data. These types of protocols are known as the on-demand routing protocols or reactive protocols. A reactive protocol is characterized by a maintenance procedure and a path discovery procedure. Path discovery is deals with a query reply cycle that adopts queries of flooding. The destination is eventually reached by the query and one reply is at least generated. Path discovery procedure is called when there is a need for transmission data and the source does not the path to the destination. Discovered paths are maintained by the procedure of route maintains until they are no longer in used. It has two important phases, route maintenance and route discovery. AODV protocol combines the mechanisms of DSDV and DSR for routing. For each destination, AODV creates a routing table like DSDV and using mechanism of routing route discovery and maintenance as DSR.In this paper we have evaluate routing performance of DSDV,AODV and DSR routing protocol in cluster based VANET environment where number of mobile node increases the cluster size. The performance evaluation is based on the metric of end to end delay, packet delivery ratio and throughput of the network. The rest of the paper is organized as: section 2 discuss about the overview of DSDV, DSR and AODV routing protocols. Work Related to this is present in section 3. The performance metric and simulation setup is discussed in section 4. The results are shows in section 5 and paper is concluded in the section 6.

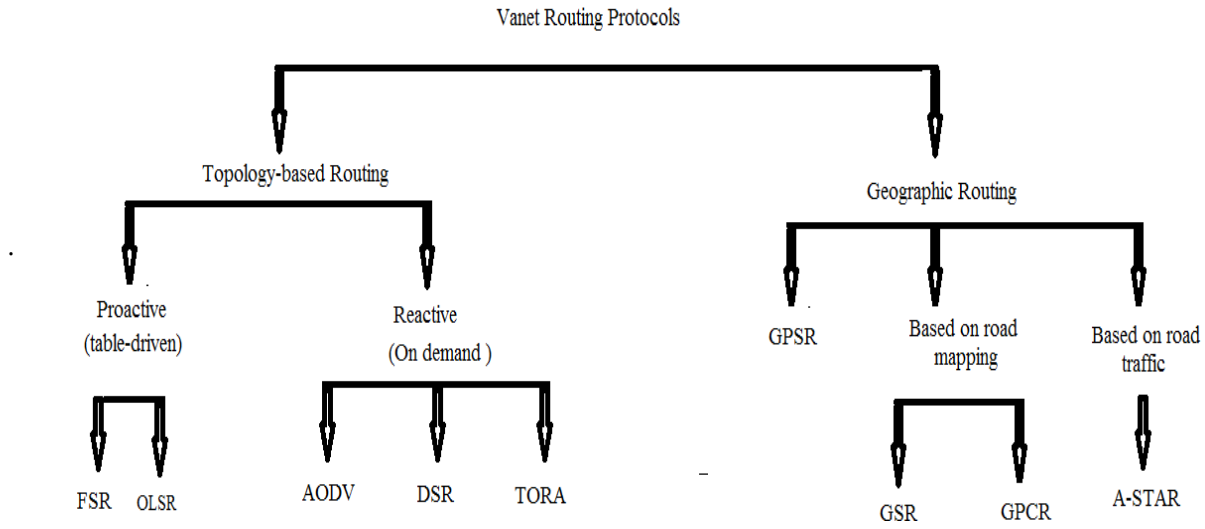
II. THE OVERVIEW OF AODV, DSDV AND DSR ROUTING PROTOCOLS

The routing protocols basically perform the three main functionality maintenance,route discoveryand Selection of the efficient path from the various paths available. In the VANET environment the routing protocols are characterized on the basis of area / application where they are most suitable and are classified into two categories can be seen in figure 1. In this paper we have selected DSDV,AODV and DSR routing protocol for our simulation purpose.

2.1 Dynamic Source Routing (DSR):-

The Dynamic Source routing protocol (DSR) is a on demand routing protocol based on a method known as source routing that are designed specifically for use in multi-hop wireless ad-hoc network to reduce the amount of bandwidth consumed by control packets by eliminate the requirement of periodic table update message.

This algorithm provides the route on-demand and the sender node knows the complete hop by hop route to the destination. In route cache the routes are store. Route discovery and maintenance are major phases of this protocol. When node wants to send message at the time, its route cache check it for searching the availability of



Unexpired route up to from that node to the destination. If route is found than node start transmission of packet else start the route discovery process for searching new route in between source and destination node. The source node address carries each route request packet ,the destination node id and a new sequence number . The entire node that receiving route request packet checks the rebroadcast and sequence number that packet to it neighbours if it has not forwarded it already or that node is not the destination node after adding its address information in packet. The main advantage of this protocol is that it provide on-demand routing path and does not require periodic packet that are used by a node to inform its presence to its neighbours. The control overhead is reduced by using the information efficiently from route cache by node to access the route for packet transmission that is already discovered.

2.2 Destination-Sequenced Distance-Vector Routing (DSDV):-

The C. Perkins and P. Bhagwat developed this routing protocol in 1994. It is table driven routing scheme for mobile ad-hoc network based on classical Bellman Ford routing algorithm with some improvements. Solving to reducing control overhead message, increases convergence speed and routing looping problem was the main contribution of this algorithm.. DSDV routing protocol maintain a routing table that store cost metric for address of next hop up to the destination, routing path and the destination sequence number assigned by the destination node. Whenever the network changes the topology, a new sequence number is necessary before the network recon verges and the node changed routing table information into event triggered style and send updates to its neighbour nodes. The "full dump" and "incremental update" is two ways in DSDV for sending information of routing table updates. As like name "full dump" the complete routing table is send in update message while incremental update contains only the entries with metric that have been changed since last update was sent.

2.2 Ad-hoc On-Demand Distance Vector (AODV):-

This protocol combines some property of both DSR and DSDV routing protocols differences with significant. In AODV when a node sends a packet to the destination then data packets only contains destination address. On the other hand in DSR when a node sends a packet to the destination the full routing information is carried by data packets which causes more routing overhead than AODV. A route establishes by AODV when a node requires sending data packets i.e. on-demand. In AODV for finding path from source to destination node algorithm the source node sends a route request packet to its neighbours and this process is repeat till the destination node path is not found.

The sequence number of packet is check at every intermediate node to produce a free loop path. If a node finds that number in its routing table than node discard the route request packet otherwise store record in its table. It has the ability of uncast & multicast routing and uses routing tables for maintaining information about the route. It doesn't need to maintain routes to nodes that are not communicating. AODV use only symmetric links between neighbouring nodes because the route reply packet follows the reverse path of the route request packet. When one of the intermediate node realize path broken than it send information to its upstream neighbour and this process is execute until source node not get this message and after it again source node transmit the route request packet to neighbours node for finding new path.

III. RELATED WORK

Many of the researchers evaluate the performance of routing protocol like AODV, DSDV and DSR in the VANET environment using different evaluation methods means on the basis of different performance metric or using different simulators for this purpose. In [1] Yi wang. Krishnamachari and Konstantinos Posunis, proposed about QoS metrics for unicast routing in VANETs, what specific characteristics VANET routing protocols should possess. He shed light on the issues-proposed solutions achieves optimum performance in both urban and highway, as well as sparse and dense

environment. Analyze some of the most important QoS metrics in VANET. Namely, the upper performance bound for connection duration, packet delivery ratio, end-to-end delay, and jitter for unicast communication in typical highway and urban VANET environments. According to its results, delay and jitter in VANET would be adequate for most of the envisioned unicast-based applications, whereas the packet delivery ratio and connection duration might not meet the requirements for most unicast-based applications. In [2] Bo Xu, Aris Ouksel and Ouri Wolfson discussed about Performance evaluation of a application for VANETs using IEEE 802.11p. WAVE (wireless access in vehicular environment) is described in IEEE 80.11p and VANETs follow them. Equipped with WAVE communication devices, cars units form a highly dynamic network called a Vehicular Ad Hoc Network (VANET), which is a special kind of Mobile Ad-Hoc Networks (MANETs). In [3] Mohammad Al-Shurman et. al they present two possible solutions. The first is to find more than one route to the destination. The second is to exploit the packet sequence number included in any packet header. Computer simulation shows that compared to the original ad hoc on-demand distance vector (AODV) routing scheme, the second solution can verify 75% to 98% of the route to the destination depending on the pause times at a minimum cost of the delay in the networks. The NCTU ns 4.0 simulator use to compared the performance of AODV, DSDV and DSR routing protocol and in the same fashion of work MOVE and NS-2 simulator used to analyzed performance of AODV, OLSR and DSR routing protocol on basis of PDR and end to end delay.

III. SIMULATION SETUP AND PERFORMANCE METRIC

4.1 Simulation Tool & Parameters:-

There are many network simulators available in the market but the most frequently used are Qualnet OP-NET , and NS2. Both Qualnet and OPNET are also best network simulators, but these are not opens source tools and having the more cost for purchasing for such kinds of education studies. Hence the NS2 the best choice is to use simulator which is completely free and open source tool for all kinds of researches and network simulations . There are many versions of NS2 available ranging from ns-2.26 tons-2.35. The performance of VANET protocols on different traffic rates i.e. constant bit rate (CBR) and variable bit rate (VBR) will be carried out using simulator NS2.NS uses two languages because simulator has to deal with two things: i) detailed simulation of protocols which require a system programming language which can efficiently implement algorithms , packet headers and manipulate bytes, ii) research involving quickly exploring a number of scenarios or slightly varying parameters. Simulation Parameter shown in figure.4.1.

Simulation Parameter Table 4.1

CHANNEL	**CHANNEL/WIRELESS CHANNEL**
Propagation	Propagation/TwoRayGround
Network Interface	Phy/WirelessPhy
NS Version	NS-allinone-2.35
MAC	MAC/802-11
CBR Packet Size	280 KB
VBR Packet Size	280 KB
Interface Queue	Queue/DropTail/PriQueue
Antena	OmniAntena
Interface Queue Length	60
Number of Nodes	7
Simulation Area Size	1200×1200
Simulation Duration	18 Seconds
Routing Protocol	AODV, DSDV, DSR
Performance Metrics	Throughput

4.2 Performance Metric:-

There are several performances metric at which routing protocols can be evaluated for network simulation. We use the performance metrics in our simulation purpose are: Packet delivery ratio, Throughput and End to End delay. But here we discus only throughput.

- Throughput: It is the sum of data to all the nodes in the system during a period. In a time interval the throughput reflects the bandwidth utilization. Through this we takes the throughput values for DSR , AODV,DSDV as shown in Figure1.2 for AODV ,figure 1.3 for DSDV,figure1.4 for DSR throughput as shown below:

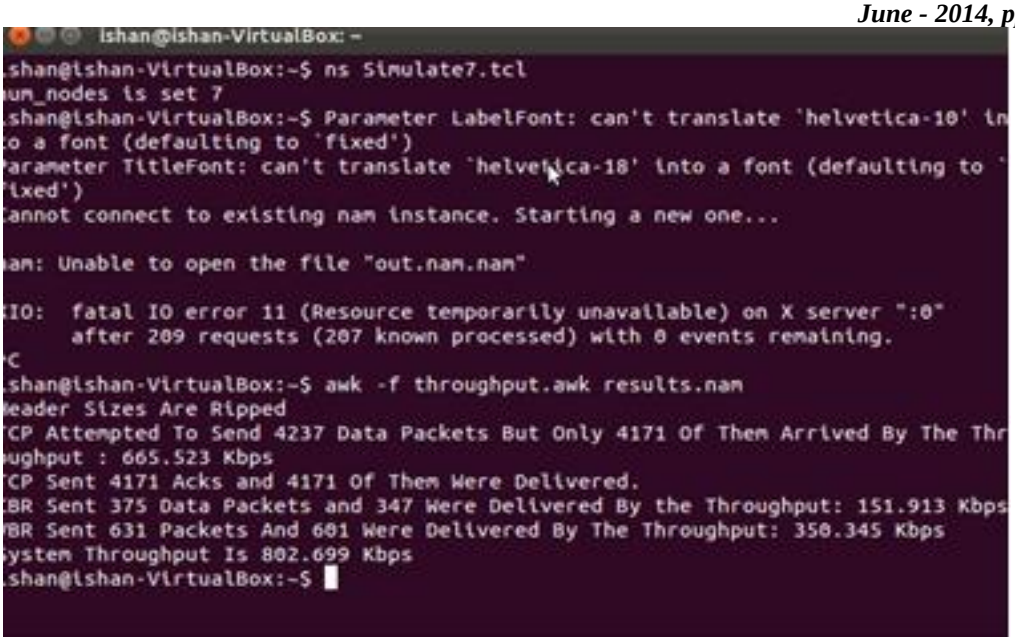


Figure 4.1 Show AODV throughput For Simulate7

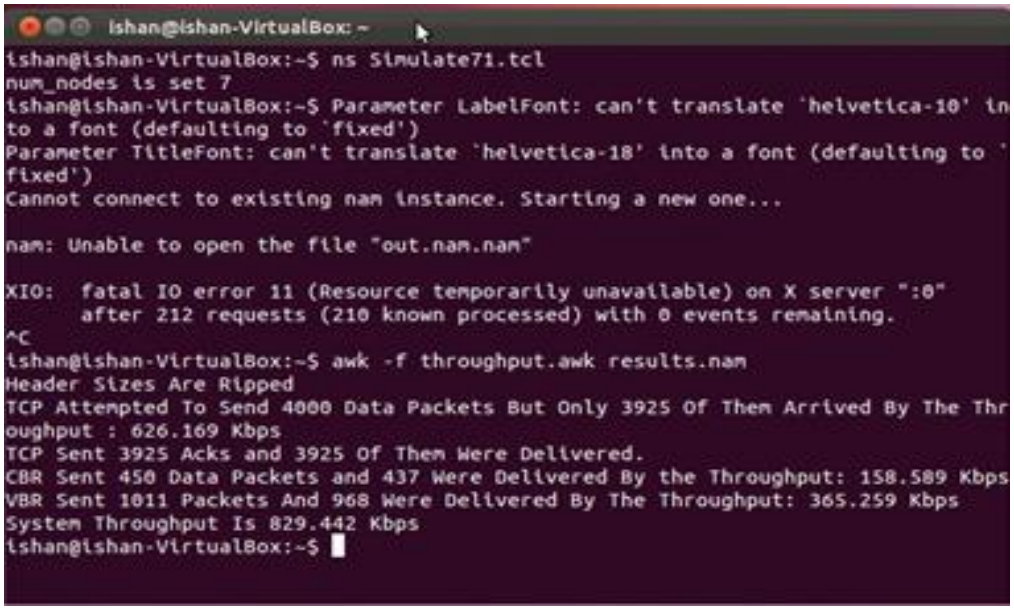


Figure 4.2 for DSDV Throughput for Simulate71

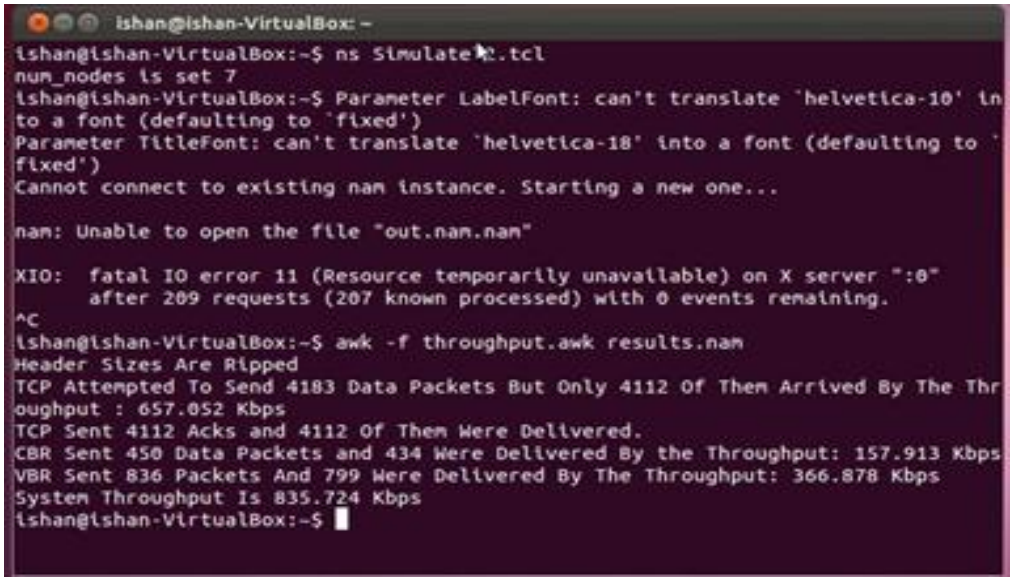


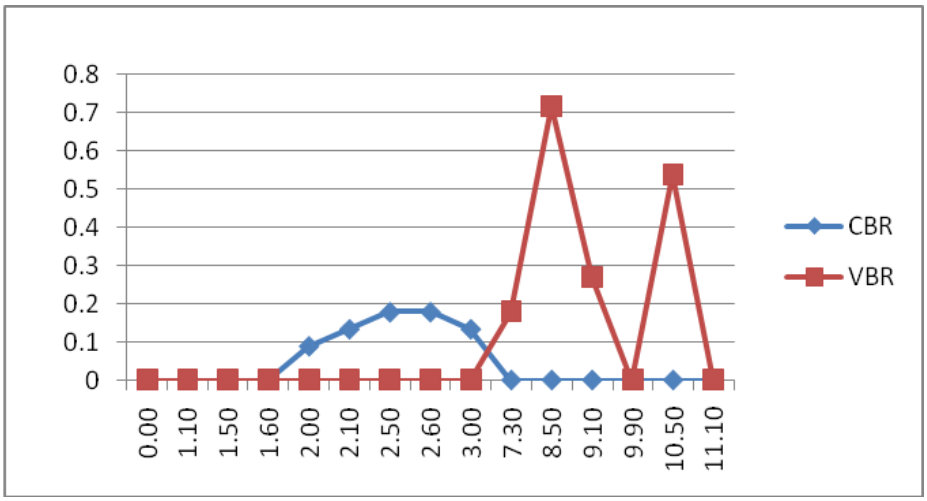
Figure 4.3 for DSR Throughput for Simulate 72

V. SIMULATION RESULTS

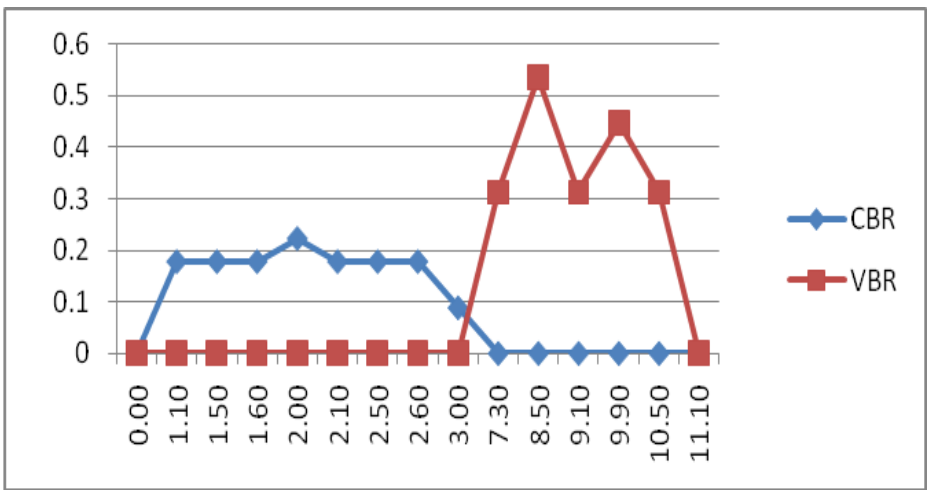
Figure shows throughput of all three AODV, DSDV and DSR routing protocol in the cluster based VANET environment in CBR (Constant Bit Rate) application that generates constant packets throughput for the UDP connection, and VBR (Variable Bit Rate) application that generates variable packets throughput for the UDP connection. NS2 (Version 2.35) tool is used for the simulation which can be installed on Linux platform. Using VM virtual Box, Linux can be used on windows platform which the author is using in the dissertation. Below Graph showing simulation for 7 nodes in routing protocols.

5.1Table show the routing protocols used CBR and VBR values.

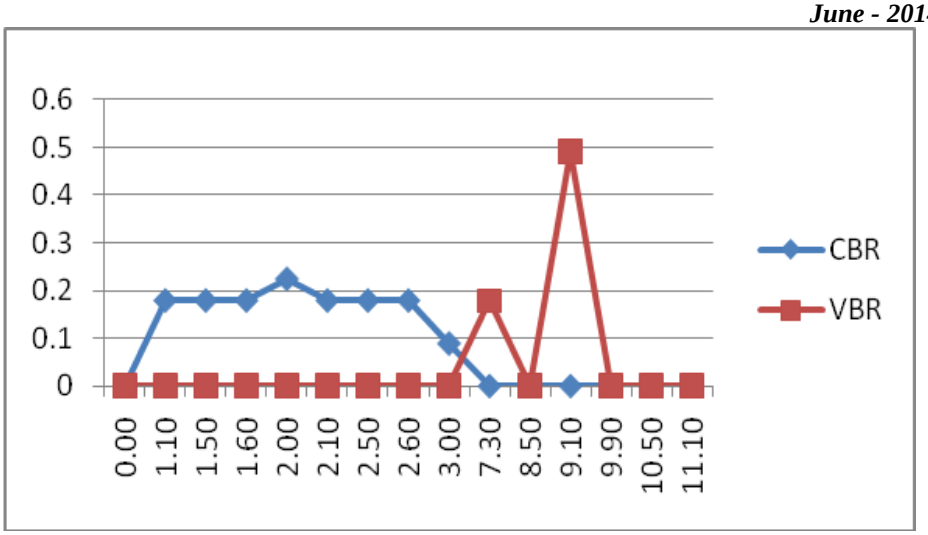
Standard Time	AODV		DSDV		DSR	
	CBR	VBR	CBR	VBR	CBR	VBR
0.00	0	0	0	0	0	0
1.10	0	0	0.179	0	0.179	0
1.50	0	0	0.179	0	0.179	0
1.60	0	0	0.179	0	0.179	0
2.00	0.089	0	0.224	0	0.224	0
2.10	0.134	0	0.179	0	0.179	0
2.50	0.179	0	0.179	0	0.179	0
2.60	0.179	0	0.179	0	0.179	0
3.00	0.134	0	0.089	0	0.089	0
7.30	0	0.179	0	0.313	0	0.179
8.50	0	0.716	0	0.537	0	0
9.10	0	0.268	0	0.313	0	0.492
9.90	0	0	0	0.448	0	0
10.50	0	0.537	0	0.313	0	0



Graph 5.1 AODV Throughput value for simulation7



Graph 5.2 DSDV throughput value for simulation71



Graph 5.3 DSR throughput value for simulation 72

VI. CONCLUSIONS

Following graphs show the performance in cluster based VANET environment with varying the number of nodes in terms of throughput. Figure1.2 to 1.3 shows throughput values of all three AODV, DSDV and DSR routing protocol in based on VANET.Here we compare the routing Protocols AODV, DSDV and DSR performance in the vehicular system of VANET environment with their higher performance value of throughput CBR and VBR. The comparison has been done by using NS2 simulation tool which is the main simulator, NAM i.e. Network Animator and excel graph which is used for preparing the graphs from the trace files based on CBR and VBR. In our Finding indicates that any single protocol is not suitable for efficient routing throughput in different environment. DSR protocol is provided more suitable value in throughput based on Constant-bit-rate and Variables-bit-rate values as compare to another protocol i.e. AODV and DSDV. So it is concluded that overall performance of DSR is superior to DSDV and AODV.In the area of VANET research, there is always scope for further works; Analyze the performance for Developing simulations to the proposed solution.For Effective study measure the value bit rates for performance analysis.

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