International Journal of Innovative Research in Science and Engineering
Vol. No.2, Issue 07, July 2016
www.ijirse.com
ISSN: 2454-9665

PERFORMANCE ANALYSIS OF DSDV ROUTING PROTOCOL USING ANT COLONY OPTIMIZATION IN MOBILE AD-HOC NETWORK (MANET)

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ABSTRACT

A wireless ad hoc network (WANET) is a decentralized type of wireless network. The network is ad hoc because it does not rely on a pre-existing infrastructure, such as routers in wired networks or access points in managed (infrastructure) wireless networks. Instead, each node participates in routing by forwarding data for other nodes, so the determination of which nodes forward data is made dynamically because of network connectivity. It generally happens for nodes to be dispersed in a wide area than the range of individual nodes. In these conditions there is need to employ routing techniques such that the out of range nodes may communicate with each other via intermediate nodes. QoS based DSDV (QBDSDV) protocol has been used to offer bidirectional connectivity between ad hoc nodes and the hosts in the Infrastructure-based networks. This protocol uses one of the ad hoc hosts known as Mobile Gateway to connect between the two different networks. The main problem of QoS routing is to setup a multicast hierarchy that may meet particular QoS constraint. In order to reduce the constraints of the earlier work a new improved technique is proposed in the given paper. In the proposed technique the issue of multi-cast tree is eliminated using clustering based technique. First of all multi-radio and multichannel based clustering is deployed and these cluster head are responsible for the multicasting. It will diminish the overall energy consumption of nodes and complexity of intelligent algorithms. The path will be evaluated based upon the ant colony optimization. Thus it has produced better results than other techniques. The comparison analysis will be carrying out about this routing using MATLAB.

Key words*: *MANET, QoS, Multicast, Ant colony optimization, Clustering, End to End Delay, MATLAB.

I. INTRODUCTION

Mobile Ad-Hoc Networks are autonomous and decentralized wireless systems. MANETs consist of mobile nodes that are free in moving in and out of the network. Nodes are the systems or devices i.e. mobile phone,

ISSN: 2454-9665

laptop, personal digital assistance, MP3 player and personal computer that are participating in the network and are mobile. These nodes can act as host/router or both at the same time. They can form arbitrary topologies depending on their connectivity with each other in the network. These nodes have the ability to configure themselves and because of their self-configuration ability, they can be deployed urgently without the need of any infrastructure. A Mobile Ad-hoc Network is an accumulation of independent mobile nodes that can communicate together via Radio Lake. Your mobile nodes which has been in radio selection of each various other could right communicate, whereas others needs the aid of intermediate nodes to route his or her packets. The entire node carries a radio user interface to connect jointly. These networks usually are fully distributed, and perform at any place without the aid of any fixed infrastructure as gain access to points or base areas.

Destination-Sequenced Distance-Vector Routing (DSDV) is a table-driven routing scheme for ad hoc mobile networks based on the Bellman–Ford algorithm. The main contribution of the algorithm was to solve the routing loop problem. Each entry in the routing table contains a sequence number, the sequence numbers are generally even if a link is present; else, an odd number is used. The number is generated by the destination, and the emitter needs to send out the next update with this number. Routing information is distributed between nodes by sending full dumps infrequently and smaller incremental updates more frequently. If a router receives new information, then it uses the latest sequence number. If the sequence number is the same as the one already in the table, the route with the better metric is used. Stale entries are those entries that have not been updated for a while. Such entries as well as the routes using those nodes as next hops are deleted. The main disadvantages of DSDV protocol is, the updates

because of broken links direct to an excessive control overhead in high mobility. yet a small network with high mobility or a large network with low mobility can strangle the bandwidth. Another problem is the stale routes, sequentially to obtain data about a specific destination node; a node has to pass the time for a table update message initiated by the same destination node.

In this paper proposed the issue of multi-cast data is eliminated using clustering based technique. First of all multi-radio and multichannel based clustering is deployed and these cluster head are responsible for the multicasting. The nodes in the network are first divided into clusters and then the communication process takes place with the help of cluster head .During the communication process the nodes are checked whether they are alive or not, within the range of the Cluster head or not. After that packet transfer will take place according to the conditions. Each node has a particular weight and id which will help in communication process.

II. METHODOLOGY USED BY RESEARCHERS

[**Khaleel Ur Rahman Khan, et-al, 2008]** has proposed a DSDV Protocol for Ad Hoc networks which overcomes the problem of stale routes and improves the performance of regular DSDV. In DSDV the low packet delivery because it uses stale routes in case of broken links. In DSDV, the existence of stale route does not imply that there is no valid route to the destination. The packets can be forwarded thru other neighbours who may have routes to the destination. The author proposed protocol, which creates a temporary link through a neighbour, which has a valid route to the desired destination. The temporary link is created by sending one-hop ROUTE-REQUEST and ROUTE-ACK messages. Initially the nodes were placed at certain specific locations

ISSN: 2454-9665

then the nodes move towards new locations. The simulations were carried out by varying the number of nodes in multiples of 5, i.e 5, 10, 15,20,25,30 and 35. The proposed protocol has been implemented in the NCTUns Simulator and performance comparison has been made with regular DSDV and DSR protocols. The performance metrics are packet-delivery ratio, end-end delay, dropped packets, routing overhead, route length. In this result find that Eff-DSDV is superior to regular DSDV and sometimes better than DSR in many cases. [13]

[NileshAnanthanaryanan, 2008] has proposed an Efficient DSDV (Eff-DSDV) routing protocol for ad hoc networks. There is limited range of each host's wireless transmission, to communicate with hosts outside its transmission range, a host needs to forward the packets with the help of nearby hosts to the destination. The author proposed Eff-DSDV protocol, which overcomes the problem of stale routes that improves the performance of regular DSDV. In this method for connecting an immediate link from the host 'S' to the destination say 'T' breaks, the proposed protocol creates a temporary link through a neighbour which has a valid route to the desired destination. The temporary link is created by sending one-hop ROUTE-REQUEST and ROUTE-ACK messages. The author also proposed architecture for integrating the MANET using the Eff-DSDV and the Internet. The proposed framework used to provide full bi-directional connectivity between MANET nodes and the wired hosts. Two of the important issues involved in the integration is reducing the Mobile IP overhead and providing bi-directional connectivity to the Ad hoc nodes. The performance of the Eff-DSDV is superior to regular DSDV.This protocol has been implemented in the NCTUns Simulator and performance comparison has been made with regular DSDV protocol using performance metrics packet-delivery ratio, end-end delay, dropped packets, routing overhead, route length by varying the number of nodes in the network and the mobility speed of the ad hoc hosts. The routing overhead is bound to be higher for Eff-DSDV due to the extra route requests and route reply messages which otherwise is not present in regular DSDV. Eff-DSDV is better than routing protocol in the integration of the mobile network and the Internet. [17]

[Trung-Tuan Luong, 2009] proposed a dual-interface multiple channels Destination-Sequenced Distance-Vector (DSDV-M) routing protocol which is the extension of the DSDV routing protocol to MCMI version. In the network Communications in single channel single interface ad hoc network suffer from channel access contention, which results in bandwidth scarcity. The author Proposed the method to overcome the bandwidth scarcity problem by the use of multiple channels multiple interfaces (MCMI). The objective of the proposed algorithm is to reduce the channel interference so that multiple transmissions can occur concurrently, thus increasing network capacity. The proposed algorithm is evaluated against channel scheduling algorithms the simulation results show that the proposed algorithm is able to exploit the availability of multiple channels multiple interfaces to improve network capacity. This reduces the delays because it can provide simultaneous transmissions. Round Robin channel scheduling helps to reduce the intra flow channel interference; thus leads to reduction in end-to-end delay. Round Robin+ channel scheduling mitigates the effect of interflow channel interference, thus it could further improve the end-to-end delay performance. DSDV-M inherits the advantages of Round Robin+ algorithm, and it can select the shortest path communication. Therefore, DSDV-M has the shortest end-to-end delay time. Its' delay is less than half the average delay of 1-Ch 1-If DSDV. In addition, this

ISSN: 2454-9665

method also able to gain greater than twice the throughput of DSDV with single channel single interface. However there are certain disadvantage of this method is it requires maintaining a routing table. In the MCMI environment we need to maintain multiple routing tables for multiple interfaces; thus the control overhead is slightly higher due to the broadcasting of the routing table at each interface to update network topology. Our future work is using MCMI in a reactive routing protocol. In future there are exploring the possibility of using the route discovery phase to assign channel to a link along the communication path. [28]

[Jia Lu, et-al, 2011] presented an improved DSDV(Imp-DSDV) protocol that overcome the problem of stale routes in DSDV. Links are broken when the mobile nodes move from place to place or have been shut down etc. The broken links may be detected by the communication hardware or be inferred if no broadcasts have been received for a while from a former neighbour. The author proposed the improved DSDV (Imp-DSDV) protocol which can reduce the number of dropped data packets without any new message exchange especially. It maintains and updates a secondary routing table which contains secondary routes for all available destinations. When a node defects a link is broken, the node can quickly find the neighbour which has a valid route to the destination through the secondary routing table. In this method the main routing table is maintained and updated as it has been done in DSDV. A secondary route should obey the following rules that a secondary route is either a valid one or a invalid one, an invalid secondary route has an infinite metric, A valid secondary route should share the same metric and sequence number as the corresponding main route. The next hop of a valid secondary route and a main route is different. These ensure that the secondary route is loop-free Simulation results show that it reduces the number of dropped data packets and has less end-to-end delay and routing overhead than I-DSDV. Compared with DSDV, Imp-DSDV can adapt more quickly to frequent topology changes in MANETs. Imp-DSDV has less end-to-end delay and routing overhead than I-DSDV. We see that Imp-DSDV could realize invalid route reconstruction as in I-DSDV without any new message exchange scheme especially and is more effective than IDSDV. [10]

[**K. Palani, et-al, 2013**] has proposed an integrating mobile ad hoc network running QoS based DSDV routing protocol with the wired network. In previous research paper the Integration approaches (two-tier or three-tier architectures) and gateway switching mechanisms can be dissimilar and various MANET routing protocols are used for integrating Ad hoc Networks and Internet using the Routing Information Protocol (RIP) inside the ad hoc network. To admission the mobile host to Internet using Mobile IP and IP micro-mobility protocols and change points of accessory without broken the connection. So in this paper the author discussed about an improved Quality of service used for modified DSDV protocol, named as QoS based DSDV (QBDSDV) protocol that offer bidirectional connectivity between ad hoc nodes and the hosts in the Infrastructure-based networks. The simulation result is an evaluation between the proposed approach using QoS based DSDV routing protocol, regular DSDV and AODV protocol shows the final results is clearly point out the more performance achieved for QoS based DSDV than other protocols. the packet delivery ratio goes down as the node speed increases from 5 to 25 m/s and throughput is improved than other integration approaches and the packet delivery ratio is higher in the case of QoS based DSDV than the standard DSDV and AODV protocol.[18]

[Amandeep Kaur, 2014] has presented the behaviour of DSDV mobile ad hoc routing protocol by varying the underlying mobility models. In this author discussed the behaviour of DSDV mobile ad hoc routing protocol by varying the underlying mobility models like Random Based Mobility Models, Manhattan Grid Mobility Model and Random Direction Model. Manhattan Grid Mobility model is used to imitate the movement pattern of mobile nodes on horizontal and vertical streets defined by maps it is proven to be useful in attribution of the movement in an urban area where various mobile devices are accessing a ubiquitous computing service. In this protocol DSDV simulation in nsallinone- 2.35 simulation package which was installed on Ubuntu Linux version 12.04. In this method result shows that DSDV protocol using Manhattan Grid model gives better throughput and packet delivery ratio. This exhibits lesser average end to end delay & Routing overhead than by using Random Waypoint and Random Direction model Random Direction model performed well in terms of Average End to End delay and routing overhead. Therefore it has been concluded through this study that DSDV protocol gives best overall performance with Manhattan Grid mobility model over the other two models under the chosen simulation environment. However, it has been observed that the packet delivery ratio and hence the throughput declines with the increase in the number of nodes. In future, more mobility models like Gauss-Markov, Random Walk, Reference Point Group mobility etc can be included to analyse the behaviour of DSDV as well as other reactive and proactive MANET protocols using different simulation environment. [11]

[S.Vanthana, et-al, 2014] has compared the performance two on demanding routing protocol namely AODV and DSR routing protocol and the DSDV routing protocol. In this paper the author take three scenarios and three parameters are taken for the comparison of the ad hoc routing protocols. In this result the AODV shows the best performance with its ability to maintain connection by periodic exchange of information required for TCP network. AODV perform best in case of packet loss and DSDV outperform others in case of throughput and in varying pause time, DSDV outperform others in case of packet loss and throughput, but overall AODV outperforms DSDV and DSR as in high mobility environment topology change rapidly and AODV can adapt to the changes but with taking everything into account DSDV is better than others. For real time traffic DSDV is preferred over DSR and AODV. In all the parameters AODV outperforms other two DSDV and DSR protocols. The limitation of this method is that in this research work only three scenarios and three parameters are taken for the comparison of the ad hoc routing protocols. In future many scenarios and parameters can be used to compare the performance of the Ad Hoc routing protocols used in the TCP network. Simulation tools other than NS2 can be used and the windows platform can be used for implementing the simulation instead of Linux. In future many scenarios and parameters can be used to compare the performance of the Ad Hoc routing protocols used in the TCP network. [29]

[**Qutaiba Razouqi, et-al, 2014**] has compared routing protocols which are widely used in MANET, Destination Sequenced Distance vector (DSDV), Dynamic Source Routing (DSR) and Ad hoc On demand Distance Vector (AODV) routing protocols that are widely simulated using different scenarios in terms of different Traffic types, constant bit rate(CBR), variable bit rate(VBR) then combining both classes in one scenario to scrutinize the impact of this combination. Routing protocols are analysed against several performance metrics, Average energy consumption, Average throughput, Normalized routing load (NRL),

packet delivery fraction (PDF) and total dropped packets (TDP). For energy consumption, DSDV shows potent response over other protocols when CBR and VBR applied separately 80% and 20%, while for shared traffic scenario it shows better performance for lower nodes mobility. AODV and DSR maintained a high PDF almost 100% most of the times due to their on demand nature and their fast recovery when the nodes move at moderate and high speeds. Combined traffic results pronounce that DSR and AODV exhibit better behaviours overall the performance metrics examined. In future, it can be considered by carrying out simulation to analyse and compare the performance of TORA protocol as an example of a hybrid routing protocol with the routing protocols analysed in this work where different scenarios could be inspected while introducing randomness to the packet size and rate. [22]

III. PROPOSED TECHNIQUE

The ant colony optimization algorithm is a probabilistic technique for solving computational problems which can be reduced to finding good paths through graphs. The main goal of the ant algorithm here is to continuously create routes in the attempt to reduce the end-to-end delay and the network latency, increasing the probability of finding routes more quickly.

There are following steps to simulate the proposed algorithm: First create ad-hoc network in MANET and define cluster heads having multi-radio and multichannel dimensions in network. Senders send its data to defined nodes and hand over its data to nearest cluster head .Cluster head will multicast data to available cluster heads depends upon the Ant Colony Optimization based Shortest path. Calculate the QoS features which is better improved then previous approaches.

IV. SIMULATION MODEL

In this simulation a MANET with 100 nodes in a dense 1000 x 1000 meter square area. There are CBR/UDP source generated packets are used which are 1000 bytes with different data rates. The Random Waypoint Mobility Model is used as the nodes mobility Model. The pause time is set to 0. To evaluate the performance of modified routing scheme compared to standard OLSR. The common simulation parameters of the variations are summarized in table below.

Table 1: Simulation Parameters used in Experiment Scenario

Parameter	Value
Size of Network	**1000 * 1000**
Simulator	**MATLAB**
Pkt interval	**1/sec**
Mobility Model	**Random Waypoint Mobility Model**

ISSN: 2454-9665

Routing protocol	**DSDV**
Traffic type	**CBR**
Packet Size	**1000 Bytes**
No of Packets	**10-100**
Nodes Speed	**5-25**

IV RESULT

An experiment is performed using MATLAB in the network with the size of 1000 x 1000 m. All the nodes in experiment use the DSDV protocol and evaluate the performance of QoS based DSDV using ant colony optimization. After the execution time, the results are recorded for all sets of mobile nodes. The comparison is performed ant DSDV with respect to the QoS DSDV and AODV and simple DSDV. Below Figures show the simulation graph for different scenarios that are following:

4.1. Comparison by varying the speed of nodes: we measure these parameters by varying the nodes speed

Packet Delivery Ratio

End to End Delay

Routing Overhead

4.2. Comparison by varying packet load (m/sec): We measure these parameters by varying the packet load (m/sec).

Packet Delivery Ratio

End to End Delay

Routing Overhead

4.1. Comparison by varying the Speed of Nodes

In the first comparison we measure the Packet Delivery Ratio, End to End Delay and Routing Protocol Overhead with the respect to the Nodes Speed in DSDV Ant, QoS DSDV, DSDV and AODV routing protocol.

Fig. 1 and **Fig. 2** show the impact of node speed on the packet delivery ratio which prove that PDR is enhanced in the Ant Colony Optimization then predefined Approach. The reason is that Ant Colony Optimization find shortest path with temporary routes in the case of link failures and send data faster than DSDV.

International Journal of Innovative Research in Science and Engineering
Vol. No.2, Issue 07, July 2016
www.ijirse.com
ISSN: 2454-9665

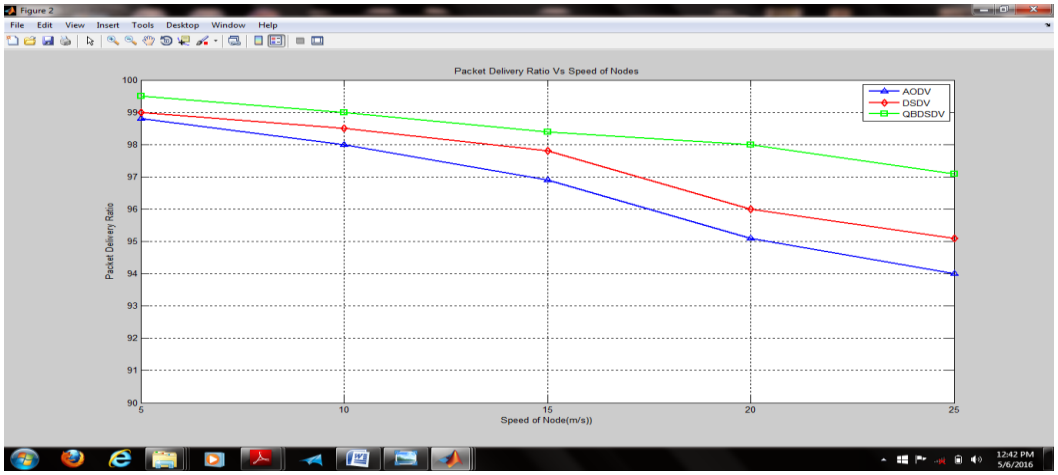

Fig. 1 Packet delivery Ratio v/s speed of nodes without Ant DSDV

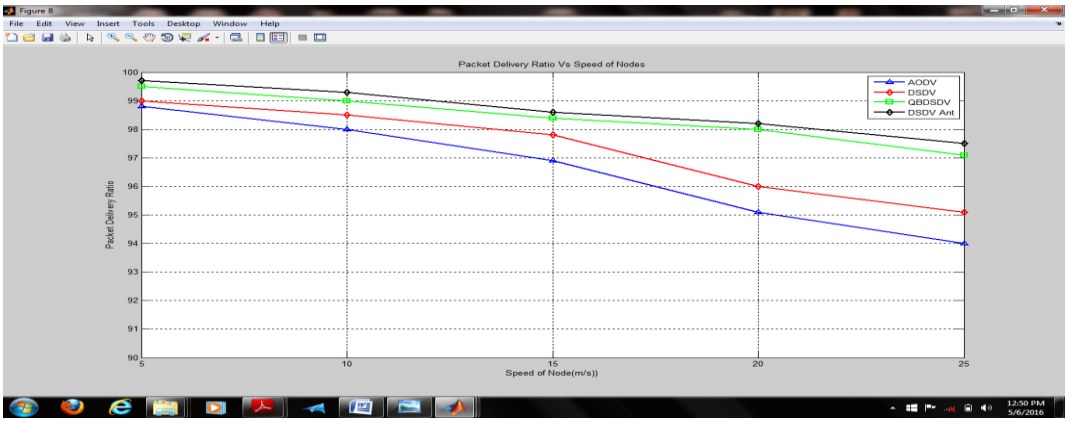

Fig. 2 Packet delivery Ratio v/s speed of nodes with Ant DSDV

Fig. 3 and **Fig. 4** show the comparison speed of the nodes with the End to End Delay. The graphs show that the End to End Delay in the DSDV Ant protocol is less than the others approach like QoS DSDV, DSDV and AODV routing protocol.

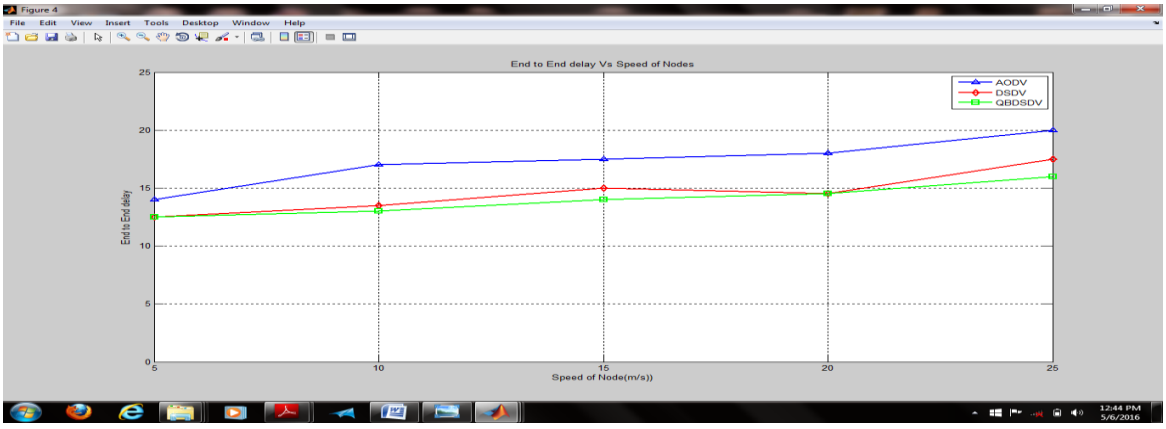

Fig. 3 Speed of nodes v/s End to End Delay without DSDV Ant

International Journal of Innovative Research in Science and Engineering
Vol. No.2, Issue 07, July 2016
www.ijirse.com
ISSN: 2454-9665

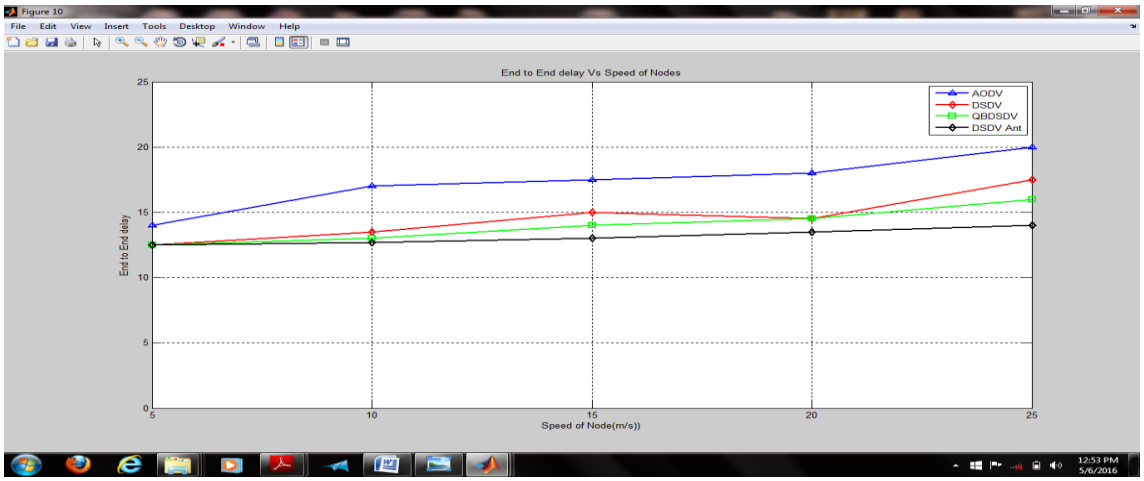

Fig. 4 Speed of nodes v/s End to End Delay with DSDV Ant

Fig 5 and **6** show the graph between Speed of Nodes and Routing Overhead by Comparing the DSDV Ant with the other routing protocol like QoS DSDV, Simple DSDV and AODV routing protocol. The graph show the routing overhead in DSDV Ant is less than the QoS based DSDV and DSDV and AODV.

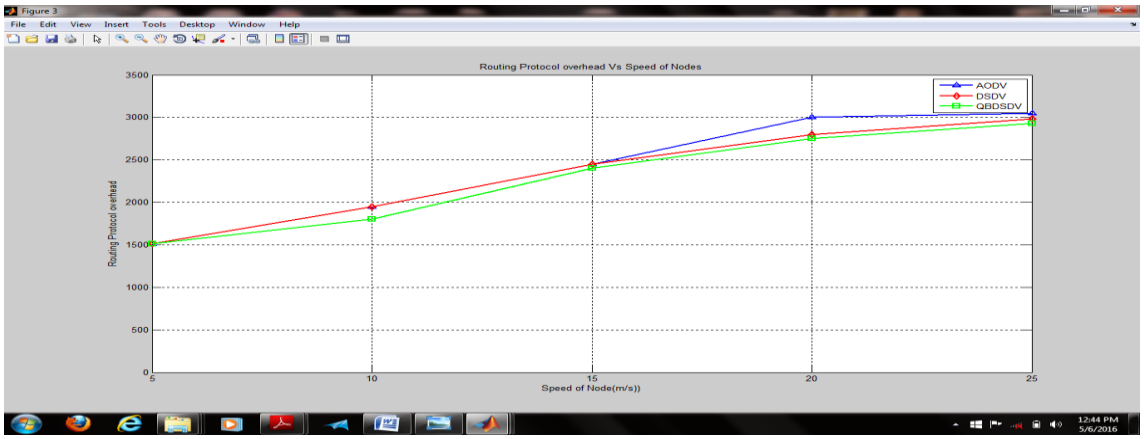

Fig 5 Speed of Nodes v/s Routing Protocol Overhead

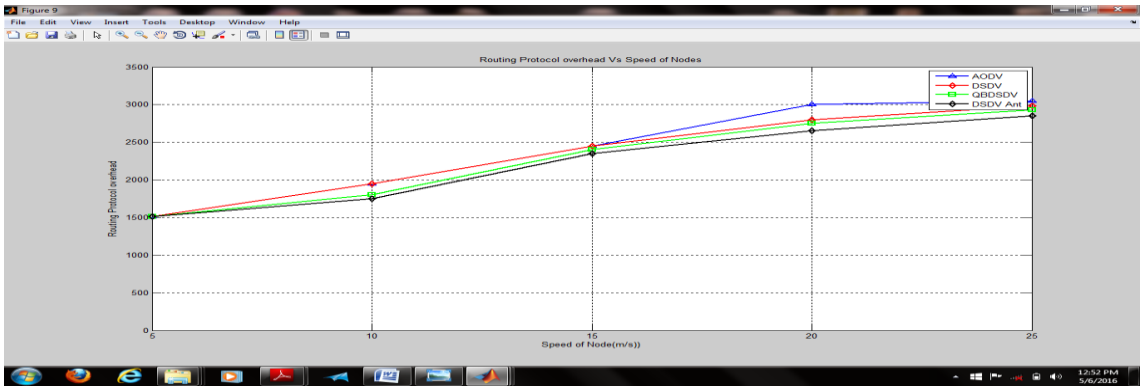

Fig 6 Speed of Nodes v/s Routing Protocol Overhead

International Journal of Innovative Research in Science and Engineering
Vol. No.2, Issue 07, July 2016
www.ijirse.com
ISSN: 2454-9665

4.2. Comparison by varying the Packet Loads (m/sec):

In the first comparison we measure the Packet Delivery Ratio, End to End Delay and Routing Protocol Overhead with the respect to the Nodes Packet Loads(m/sec) in DSDV Ant, QoS DSDV, DSDV and AODV routing protocol. The packet load is the number of packets transmitted per second per source.

Fig. 7 and **Fig. 8** show the impact of packet load on the packet delivery ratio which prove that PDR is enhanced in the Ant Colony Optimization then predefined Approach. The reason is that Ant Colony Optimization find shortest path with temporary routes in the case of link failures and send data faster than DSDV, QoS DSDV, DSDV and AODV routing protocol. the packet delivery ratio is slightly higher for low packet load but it decreases with increase in the traffic load

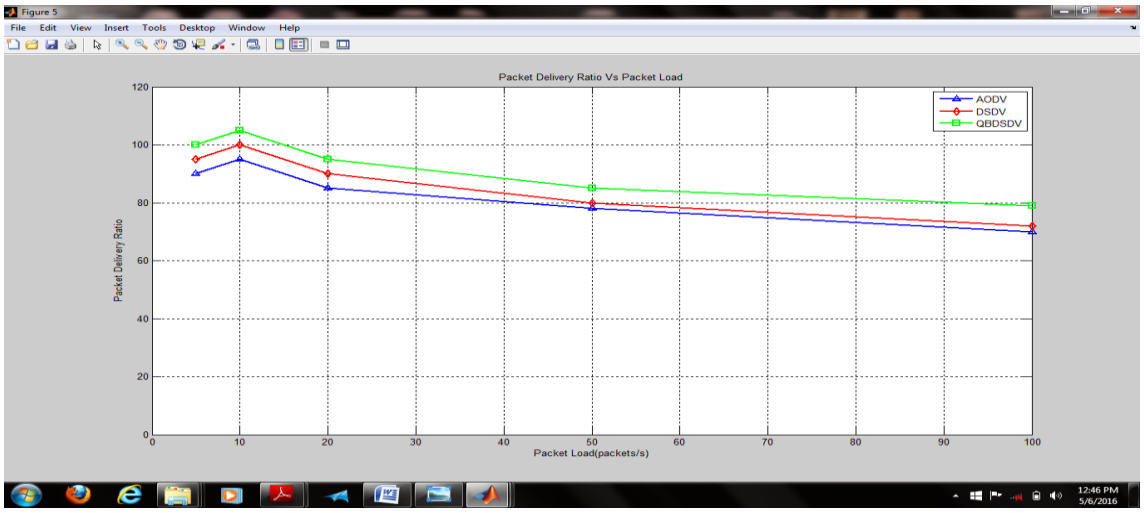

Fig.7 Packet delivery Ratio v/s packet loads without Ant DSDV

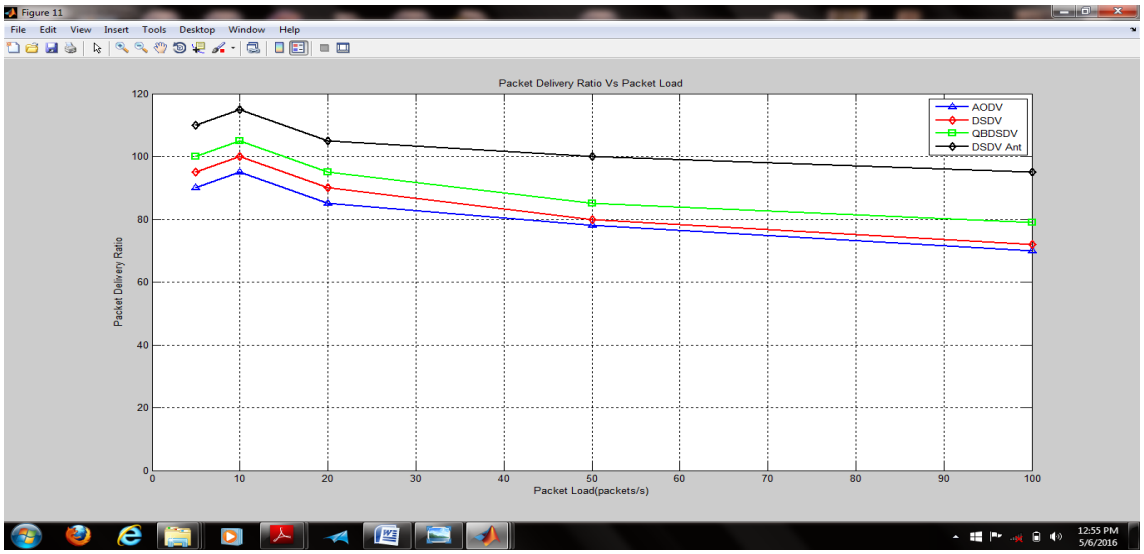

Fig.8 Packet delivery Ratio v/s packet loads with Ant DSDV

International Journal of Innovative Research in Science and Engineering
Vol. No.2, Issue 07, July 2016
www.ijirse.com
ISSN: 2454-9665

Fig. 9 and **Fig. 10** show the comparison packet load and the End to End Delay. The graphs show that the End to End Delay in the DSDV Ant protocol is less than the others approach like QoS DSDV, DSDV and AODV routing protocol.

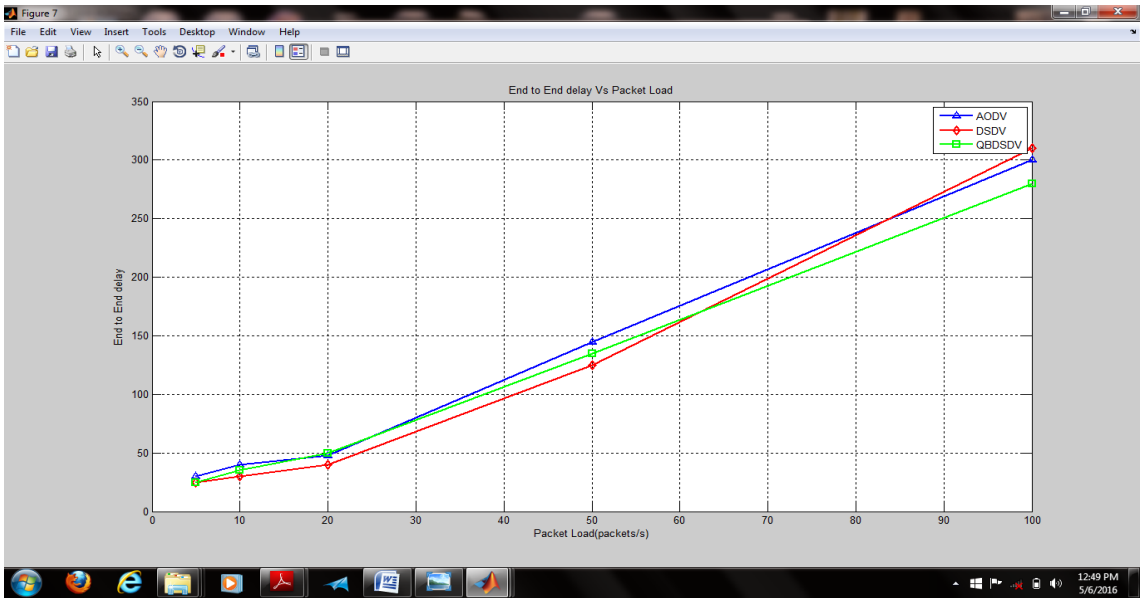

Fig.9 End to End Delay v/s packet loads without Ant DSDV

Fig. 11and **Fig. 12** show the graph between Packet load and Routing Overhead by Comparing the DSDV Ant with the other routing protocol like QoS DSDV, Simple DSDV and AODV routing protocol. The graph show the routing overhead in DSDV Ant is less than the QoS based DSDV and DSDV and AODV.

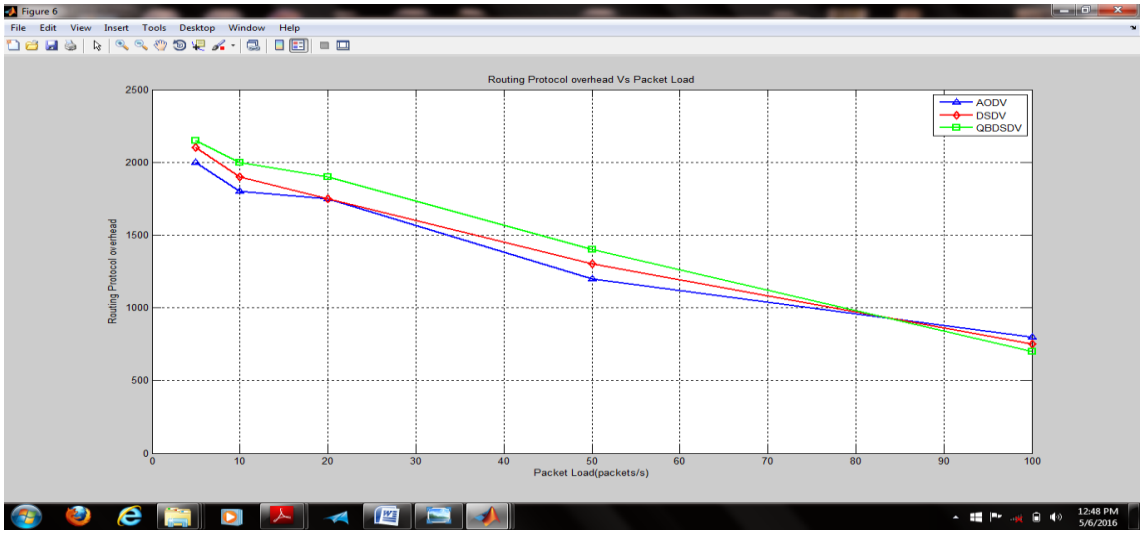

Fig.11 Routing Protocol Overhead v/s packet loads without Ant DSDV

International Journal of Innovative Research in Science and Engineering
Vol. No.2, Issue 07, July 2016
www.ijirse.com
ISSN: 2454-9665

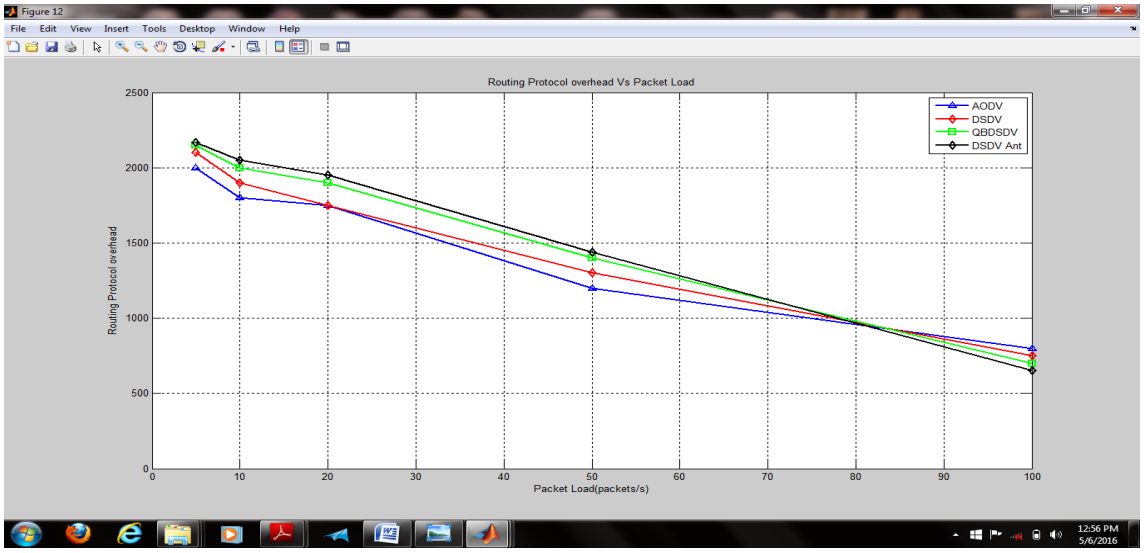

Fig.12 Routing Protocol Overhead v/s packet loads with Ant DSDV

All the graphs show that the DSDV Ant is performed much better than the QoS based DSDV, DSDV and AODV Routing Protocol in all scenarios. DSDV Ant increases the PDR ratio and less routing protocol overhead and less end to end delay over the network.

VI. CONCLUSION

The main intention of all paper is to provide better packet delivery Ratio less end to End Delay and less routing over head by using many techniques. The problem of QoS routing is to setup a multicast hierarchy that may meet particular QoS constraint. Nevertheless, the situation of making a multicast tree below several constraints is available to be NP Complete. Therefore, the issue is often settled by heuristics or smart optimization. Lately, some meta-heuristic algorithms including the ant colony algorithm, genetic algorithm and compound swarm optimization have been employed by the analysts to eliminate the multi-constrained QoS routing problem. In order to reduce the constraints of the earlier work a new improved technique is proposed in this paper. In the proposed technique the issue of multi-cast tree is eliminated using clustering based technique. First of all multi-radio and multichannel based clustering is deployed and these cluster head are responsible for the multicasting. It will diminish the overall energy consumption of nodes and complexity of intelligent algorithms. The path will be evaluated based upon the ant colony optimization. Thus it has produced better results than other techniques. This work has not considered the effect of node failures on the network. Therefore in near future we will evaluate the node failures while data communication is in progress.

VII ACKNOWLEGDEMENT

I would like to express my deep gratitude and thanks to **Prof. Mahesh Bundele (Coordinator, Research), Poornima University** for giving me an opportunity to work under his guidance for review of research papers and his consistent motivation & direction in this regard. I would also express my sincere thanks to **Mr. Prashant Hemrajani (Asst.Professor, PCE), Poornima University** for their guidance and support.

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