Suresh Gyan Vihar University, Jaipur
International Journal of Converging Technologies and Management (IJCTM)
Volume 2, Issue 2, 2016
ISSN: 2455 - 7528

PERFORMANCE BASED EVALUATION OF DSDV, AODV AND DSR ROUTING PROTOCOLS IN MANET

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Abstract:A Mobile Ad hoc Network (MANET) is a self configuring network of mobile routes connected by wireless links. MANET is an infrastructure-less network. It is an autonomous system of mobile nodes connected by wireless links. In MANET, Routing is considered as a very challenging task due to network topology's unpredictable changes. In this work, an attempt has been made to compare the performance of three well known Routing protocols: DSDV, AODV and DSR as a function of number of nodes. The performance of these routing protocols is evaluated with respect to various performance metrics such as end-to-end Delay, Packet Delivery Fraction and Dropped Packet Ratio by varying number of connections and pause time. The comparison has been done by using simulation tool NS2 (ns-2.35 version) and gnuplot which is used for preparing the graphs. Simulation results verify that AODV gives better performance as compared to DSR and DSDV.

Keywords: MANET, Routing Protocols, AODV, DSDV, DSR, NS-2.

1. Introduction

MANETs are wireless networks where nodes communicate with each other using multi-hop links. Mobile Ad-hoc Networks (MANETs) are self configuring and infrastructure-less networks consisting of mobile nodes that are communicating through wireless links. Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Due to arbitrary movement of nodes, the network may experience unpredictable topology changes. Hence, it is said that an ad-hoc wireless network is self organizing and adaptive. Routing in mobile ad-hoc networks has been a challenging task ever since the wireless networks came into existence. Due to mobility presence, the routing information will have to be changed to reflect changes in link connectivity. The routing protocols find a route from source to destination and deliver the packet to specified destination. The performance of MANETs is related to efficiency of the MANETs routing protocols.

2. Description of Used Routing Protocols

In this paper AODV, DSR and DSDV protocols are considered based on reactive and proactive routing protocols.

2.1 Ad-Hoc on-Demand Distance Vector (AODV)

AODV works in mobile scenario. AODV finds the route only when it is demanded by a node and hence is demand driven and the link is broken as soon as the packet is transferred. Looping problem is eliminated by providing a sequence number to the packets. The routing table in AODV contains destination address,

next hop, and number of hops, destination sequence number, the number of neighbors that are active and the life time. In this method control messages are sent to the neighbor, these control messages are in the form of route request, route reply, route error, and hello messages route request. When a route is not available for the destination, a route request packet is sent by using of flooding technique throughout the network. The fields contained in the route request packet contains source address, request id, source sequence number, destination address, destination sequence number and hop count. The request ID is incremented each time the source node sends a new route request packet. Source address and request is used for recognizing a route request. On receiving a route request message each node checks the source address and the request ID. If the node has no route entry for destination or it has one but this is not updated for long time the route request will be re broadcasted and the hop count is increased. There is limitation on the number of route requests that can be sent from a node (C. E. Perkins et al. 1999).

2.2 Dynamic Source Routing (DSR)

Dynamic Source Routing Protocol is a reactive on demand routing protocol. DSR is a source routing simple and efficient protocol. This protocol can be used in multi hop wireless ad hoc network. And the network of this protocol is totally self-organizing and self-configure. This protocol regularly updates its route for the availability of trouble-free routes. When new routes were found the node will directs the packet to that route. Then the packet has to know about the route was set in the packet to reach its destination from its sender. The whole information was kept in the packet to avoid periodic findings. It has two mechanisms for its operation i.e. Route Discovery and Route Maintenance. Route Reply would only be generated if the message has reached the intended destination node. To return the Route Reply, the destination node must have a route to the source node. If the route is in the Destination Node's route cache, the route would be used. Otherwise, the node will reverse the route based on the route record in the Route Reply message header.

2.3 Destination Sequence Distance Vector (DSDV)

The Distance Sequenced Distance Vector (DSDV) is a proactive routing protocol . As it is a proactive protocol so all the nodes present in this network maintains routing information before it is needed. The main contribution of this protocol is to solve the routing loop problems that occur frequently in link state protocols. This protocol adds a new parameter, sequence number to each route table at each node. Sequence number helps the mobile node in keeping difference between stale routes and new routes so there does not occur a problem of loop routing in this protocol. The count to infinity problem is also solved by use of DSDV protocol. Each mobile node in this network maintains the routing table which contains the number of possible destination present in the network and the number of hops required to reach the destination. Routing table which is maintained at each node and with this table, node transmits the packets to other nodes in the network (Charles E. Perkins et al.).

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3. Simulation

The simulation of reactive and proactive routing protocols has been done on the simulation tool Network Simulator (NS2-2.35). NS is a discrete event simulator targeted at networking research. NS provides substantial support for simulation of TCP, routing, and multicast protocols over wired and wireless (local and satellite) networks.

Table 1. Network Parameters

Parameters	Values
Simulator	NS-2.35
Channel type	Wireless channel
Netif	Phy/wireless phy
Mac protocol	Mac/802_11
Simulation Area	1300 X 700 m^2
Mobile nodes	50, 75 and 100
Routing Protocol	DSDV,AODV & DSR
No. of connections	5,10,15
Packet size	512 Bytes
Simulation Time	100 sec
Mobility Model	Random Way Point
ANTENNA	Omni antenna
Pause Time	3

Simulation Result

Simulation results are presented for the performance comparison between AODV, DSR and DSDV for different performance metrics. These results are represented with the help of graphs. The simulation results are summarized as below:

a) Comparison w.r.t. End to end delay

End-to-end delay is a time a data packet takes in traversing from the time it is sent by source node till the point it is received at the destination node. This metric is a measure of how efficient the underlying routing protocol is, because the lower value of end-to-end delay means better performance of any protocol. From fig. 1, it is observed that DSDV has least Delay in comparison of AODV and DSR. In Fig. 2, Delay slightly increases as the number of nodes increases in case of DSDV and AODV, but in DSR delay increases for moderate number of nodes and it increases rapidly for higher number of nodes. Fig 3 shows that Delay for DSDV is least and almost constant for varying number of nodes. DSR has much more delay as compared to AODV and DSDV. Overall DSDV has least delay. By analyzing all figures, it is observed that DSDV and AODV perform better than DSR in terms of end-to-end Delay. Delay of DSDV is slightly less than AODV. For large number of connections i.e. 15, DSR performs very badly as the traffic load increases.

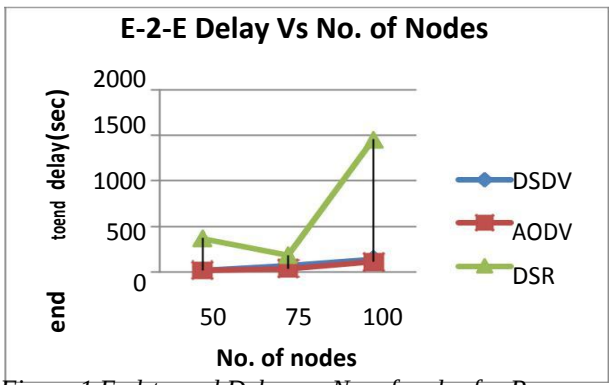
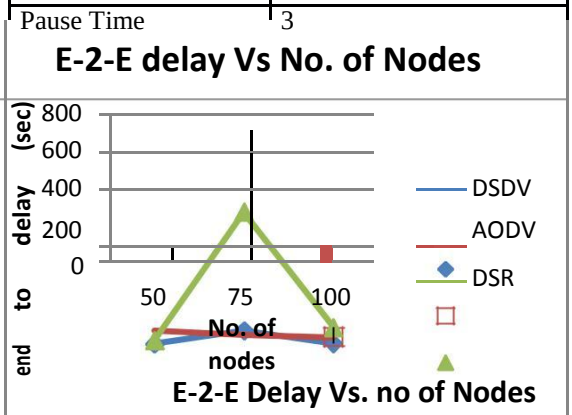
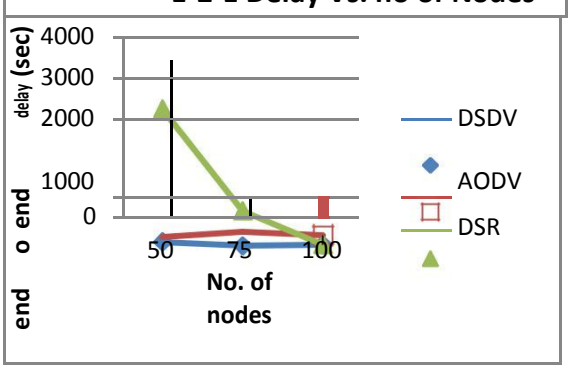


Figure 1 End-to-end Delay vs. No. of nodes for Pause





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time 3 and no. of connections 5.

Figure 2 End-to-end Delay vs. No. of nodes for Pause time 3 and no. of connections 10.

Figure 3 End-to-end Delay vs. No. of nodes for Pause time 3 and no. of connections 15.

b) Comparison w.r.t. Packet Delivery Fraction

Packet Delivery Fraction is a ratio between the numbers of packet sent by constant bit rate source to the number of received packets by the CBR sink at destination. Greater value of packet delivery fraction results in better performance of any routing protocol. It is observed from fig. 4 that PDF of AODV and DSR are almost 99% and 90% respectively while DSDV performs very badly. Fig. 5 depicts that PDF of AODV is high for less nodes and for higher number of nodes performance of AODV degrades. Performance of DSR for low traffic is good but its performance degrades rapidly as the traffic load increases. Overall performance of AODV is best. Figure 6 depicts that AODV has highest PDF as compared to DSR and DSDV. By analyzing all the graphs it is observed that PDF of AODV is high for varying number of connections and number of nodes. But PDF of DSR is good for low traffic and its performance degrades as the traffic load and number of connections grows. Performance of DSDV is very poor in all cases. Finally best performance is shown by AODV routing protocol.

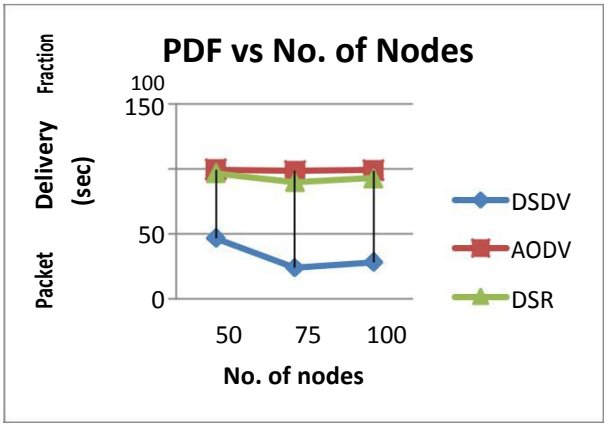

Figure 4 PDF vs. No. of nodes for Pause time 3 and no. of connections 5.

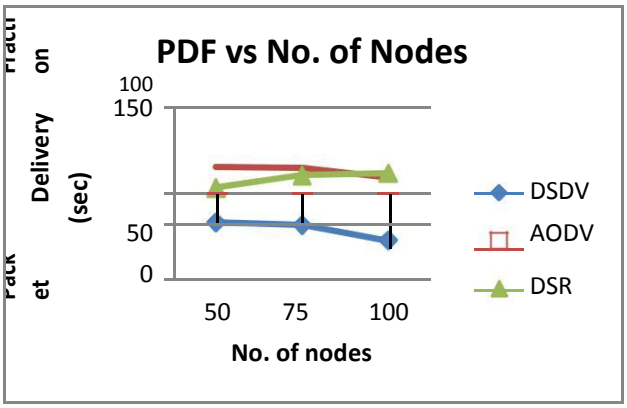

Figure 5 PDF vs. No of nodes for Pause time 3 and no. of connections 10.

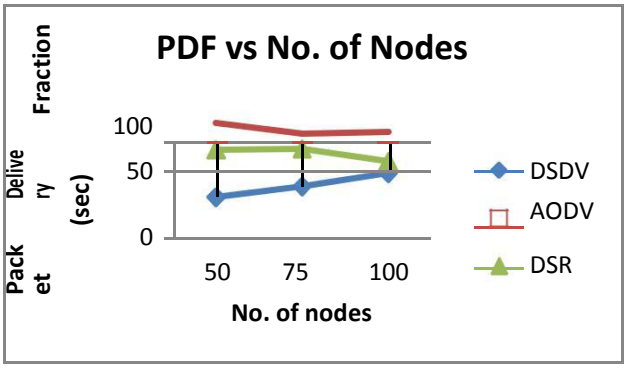

Figure 6 PDF vs. No. of nodes for Pause time 3 and no. of connections 15.

c) Comparison w.r.t. Drop Packet Ratio (DPR)

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Drop Packet Ratio is the ratio calculated by dividing the number of packets that never reached the destination through the number of packets originated by the CBR source. DRP can be used for the indication of congestion in the network. Fig.7 shows that DPR of AODV and DSR is very less as compared to DSDV, but AODV's performance is best. Figure 8 shows that DPR of AODV is lesser than other two protocols. Figure 9 shows that DPR of AODV is lesser than DSR and DSDV. By analyzing all the graphs, it is observed that AODV performs more efficiently than DSR and DSDV, as it is dropping least no of packets.

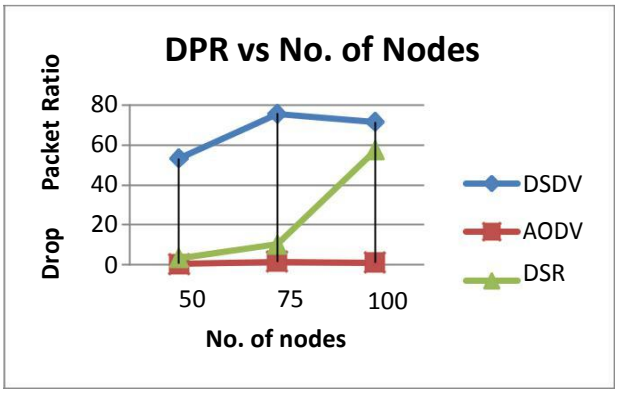

Figure 7 Drop Packet Ratio vs. No. of nodes for Pause time 3 and no. of connections 5.

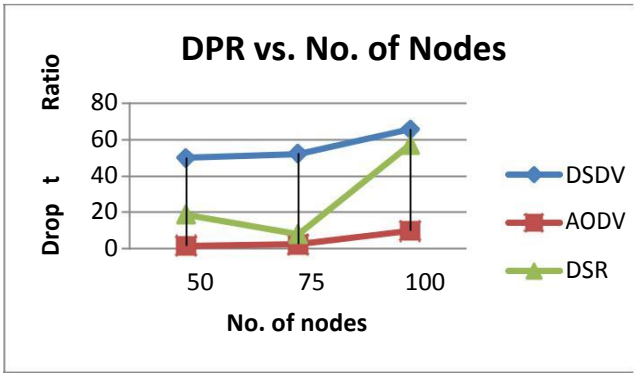

Figure 8 Drop Packet Ratio vs. No. of nodes for Pause time 3 and no. of connections 10.

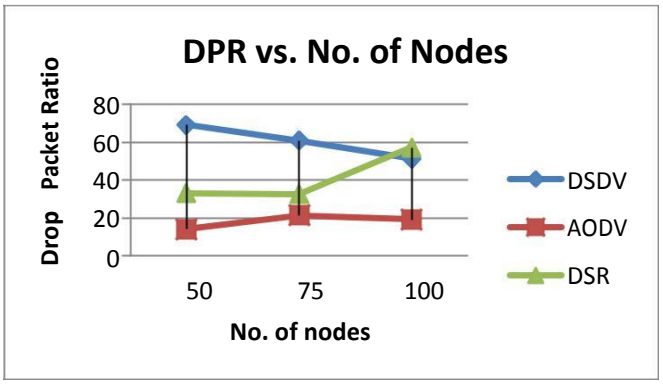

Figure 9 Drop Packet Ratio vs. No. of nodes for Pause time 3 and no. of connections 15.

4. Conclusion

In this paper, from the simulation result we can interpret that DSDV and AODV perform better as compared to DSR in terms of end-to-end Delay. Delay of AODV is slightly greater than DSDV. We have examined PDF for DSDV, AODV and DSR and from our simulation we conclude that PDF of AODV is high for varying number of connections and number of nodes. While the PDF of DSR is good for low traffic and its performance degrades as the traffic load and number of connections grows. Performance of DSDV is very poor in terms of PDF. By analyzing the DPR of the three routing protocols, it can be concluded that AODV performs more efficiently than DSR and DSDV, as it is dropping least no of packets. DSR's performance is also good with less connections and traffic load but its efficiency degrades as traffic load and number of connections increases. Finally, it can be concluded on the basis of our simulation study that AODV is the best performer among the three Routing protocols.

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