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COMPARISON OF MANET REACTIVE ROUTING PROTOCOLS USING OPNET SIMULATOR

SANGEETA MONGA[1], RAHUL MALHOTRA[2]

1. Assistant Professor, ECE Department, DAV University, Jalandhar.
2. Director/Principal, Adesh Institute of Technology, Gharuan.

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Abstract: The highly dynamic nature of mobile adhoc networks results in frequent changes and unpredictability in network topologies, adding difficulty and complexity to routing among the mobile nodes within the network. These added challenges, coupled with the critical importance of routing protocol in establishing communications among mobile nodes, makes the routing area most active research area within the MANET. In this paper comparison of two MANET reactive routing protocols (AODV and DSR) has been done using OPNET Simulator ver.14.5. Comparison is done by measuring throughput, delay, network load, retransmission attempts and data dropped by varying the number of mobile devices. Simulation results shows that DSR is best regarding data dropped and number of retransmission attempts which approaches to zero for less and even more number of nodes. But AODV has upper hand on DSR in terms of throughput which further increases with increase in number of mobile devices.

Keywords: MANET, Routing Protocols, AODV, DSR

Corresponding Author: Ms. SANGEETA MONGA

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INTRODUCTION

A mobile Adhoc Network (MANET) is composed of a collection of independent mobile hosts connected by wireless links without any fixed or centralized administration. MANET is characterized by its dynamic topology, multichip routing , energy limited operation and network scalability. Data transmission between two nodes in MANET requires multiple hops as nodes transmission range is limited. The mobility of different nodes makes the situation more complicated results in frequent changes of network topology makes routing in MANET a challenging task. To solve this problem there are three types of routing protocols for MANET: Proactive Protocol, Reactive Protocol and Hybrid Protocol. Proactive protocols are table driven that constantly updates lists of destinations and routes. Each node needs to maintain its routing table which not only records the adjacent nodes and reachable nodes but also the number of hops. So routes are quickly established and with minimum delay. The examples of proactive protocols are DSDV, OLSR etc. The Reactive protocols respond on demand in which nodes establish the route whenever desired. This overcome the problem of increased overhead as in case of proactive protocols. Two main types of reactive protocols are AODV and DSR. Hybrid protocols combine the features of reactive and proactive protocols.ZRP and TORA comes under this category [1], [2], [3]. The rest of the paper is organized as follows: section 2 represents a detailed description of DSR and AODV protocols section 3 describes the various performance metrics used for the comparison of these protocols section 4 gives the detail of simulation model and parameter used section 5gives the simulation results and their analysis and finally section 6 is about conclusions and future research directions.

2 DESCRIPTION OF DSR AND AODV PROTOCOLS:

2.1 DSR (Dynamic Source Routing) – It is a reactive protocol. It is an on demand routing protocol that is based on concept of source routing. DSR used to update its route cache by finding new routes. When a node wants to transmit data it defines a route for the transmission and then starts transmitting data through the defined route In the DSR protocol source node sends the routing request (RREQ) packets by means of flooding technology. Each RREQ packet includes source node address (Sid), destination address (Did) and the unique request sequence number (Request ID). An advantage of DSR is that nodes can store multiple routes in their route cache, which means that source node can check its route cache for a valid route before initiating route discovery. And if a valid route is found there is no need for route discovery. This is very beneficial in network with low mobility since route stored in the route cache will be valid longer. There are two processes for route discovery and maintenance which are described below [4]

2.1.1 Route discovery process in DSR – when a source node wants to start data transmission with a node in the network it checks its routing cache when there is no route available to destination in its cache or route is expired it broadcast RREQ. When destination is located or any intermediate route that has fresh enough route to the destination node, RREP is generated. When the source node receives the RREP it update its cache and the traffic is routed through the route [4].

2.1.2 Route maintenance in DSR – when the transmission of data started it is the responsibility of node that is transmitting data to confirm the next hop received the data along with the source route. The nodes generate the Route Error Message if it does not receive any conformation to the originator node. The originator node again performs new route discovery process [4].

2.2 AODV (Adhoc on Demand Distance Vector) - It is another routing algorithm which is based on DSDV and DSR. It shares DSR's on demand characteristics hence discovers routes whenever it is needed by a similar route discovery process and sequencing of DSDV. It is a reactive routing protocol in which the network generates routes at the start of communication. AODV arrange a route to a destination only when a node wants to send a packet to that destination. Routes are maintain as long as they are needed by the source. Sequence numbers shows the freshness of route and guarantee the loop free routing. AODV also provides topology for the nodes. AODV builds routes using a route request/route reply query cycle. When a source node desires a route to a destination for which it does not already have a route it broadcasts a route request (RREQ) packet across the network. Nodes receiving this packet update their information for the source node and setup backward pointers to the source node in route tables. In addition to the source nodes ip address, current sequence no., broadcast id the RREQ also contains the most recent sequence no. for the destination of which the source node is aware. A node receiving the RREQ may send a route reply (RREP) if it is either the destination or if it has a route to the destination with corresponding sequence no. greater than or equal to that contain in the RREQ. If this is the case is unicast a RREP back to the source otherwise it rebroadcasts the RREQ. If they receive a RREQ which they have already process they discard the RREQ and do not forward it. As the RREP spreads back to the source nodes setup forward pointers to the destination. Once the source node receives the RREP it may begin to forward data packets to destination. [5]

3 PERFORMANCE METRICS: The various performance metrics used for the comparison of these protocols are:

3.1 Total Data Dropped: This measures the total size of higher layer data packets in bps dropped by all WLAN MAC in network due to full higher layer data buffer, collisions, congestion and Buffer overflow.

3.2 Average End to End delay: This indicates how long it took for a packet to travel from the source to the application layer of destination. It includes all possible delay caused by buffering during route discovery latency, queuing at the interface queue, retransmission delays at the MAC and propagation and transfer times.

3.3Network Load: This is the ratio between the numbers of routing packets transmitted to the number of packets actually received. Higher value of network load shows that overhead of routing packets is high.

3.4 Retransmissions: It is defined as the resending attempts of packets which has been lost or damaged due to link failure.

3.5 Throughput: it is one of the dimensional parameter of the network which gives information whether data packets are correctly delivered or not. It is defined as the average rate of successful message delivery over a communication channel. This data may be delivered over a physical or logical link, or pass through a certain network node and measured in bps.

4 SIMULATION MODEL: Here we are doing the performance comparison of AODV and DSR Protocols for dense wireless network using OPNET Simulator version 14.5. The performance is evaluated by keeping wireless node speed constant and varying the number of wireless mobile devices. Table 1 shows the simulation parameter used in this evaluation. The simulation is done in four scenario. The scenario 1 and 4 are for AODV protocol with 50 and 75 number of mobile devices respectively. The scenario 3 and 5 are for DSR protocol with 50 and 75 number of mobile devices respectively.

Table1. Simulation Parameters

Simulator	**OPNET 14.5**	**Device Speed**	**5m/s**
Routing Protocols	AODV,DSR	Data rate	11Mbps
Simulation Area	200m*200m	Number of Devices	50,75
Simulation Duration	30min.	Buffer Size	25600

5 SIMULATION RESULTS AND ANALYSIS:

5.1 Data Dropped: The figure 1 shows the Data Dropped graph for AODV and DSR routing protocols. Results show that data dropped is nearly zero for both the protocols at less number of devices but at more number of nodes data dropped is more for AODV than DSR.

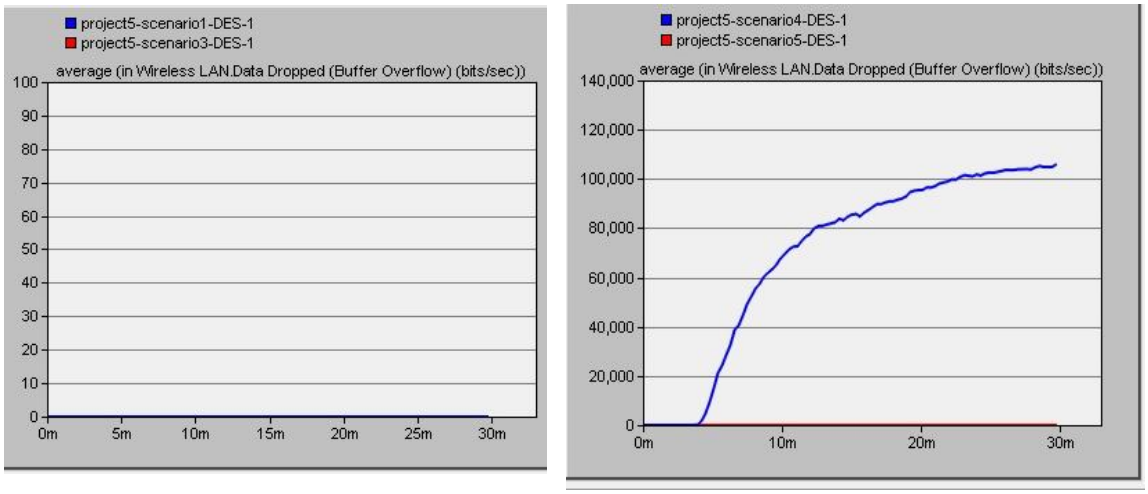


Figure1 Data Dropped (bits/sec)

5.2 Delay: The figure 2 shows the Delay graph for AODV and DSR routing protocols.

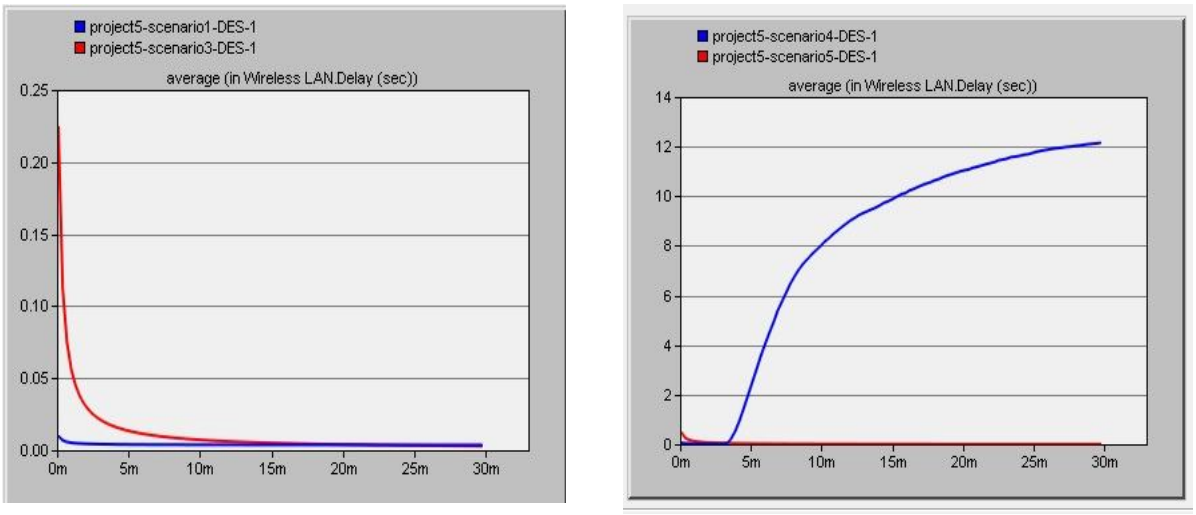


Figure2 Wireless LAN Delay (sec)

Simulation results shows that delay offered by AODV is less than DSR at less number of nodes. But as the number of devices increases the delay of AODV is increasing.

5.3 Network Load: Simulation results show that network load of AODV is much high as compared to DSR at less and even number of nodes. Also with in the same protocol network load increases with increase in the number of devices. Figure 3 shows the network load graphs for AODV and DSR.

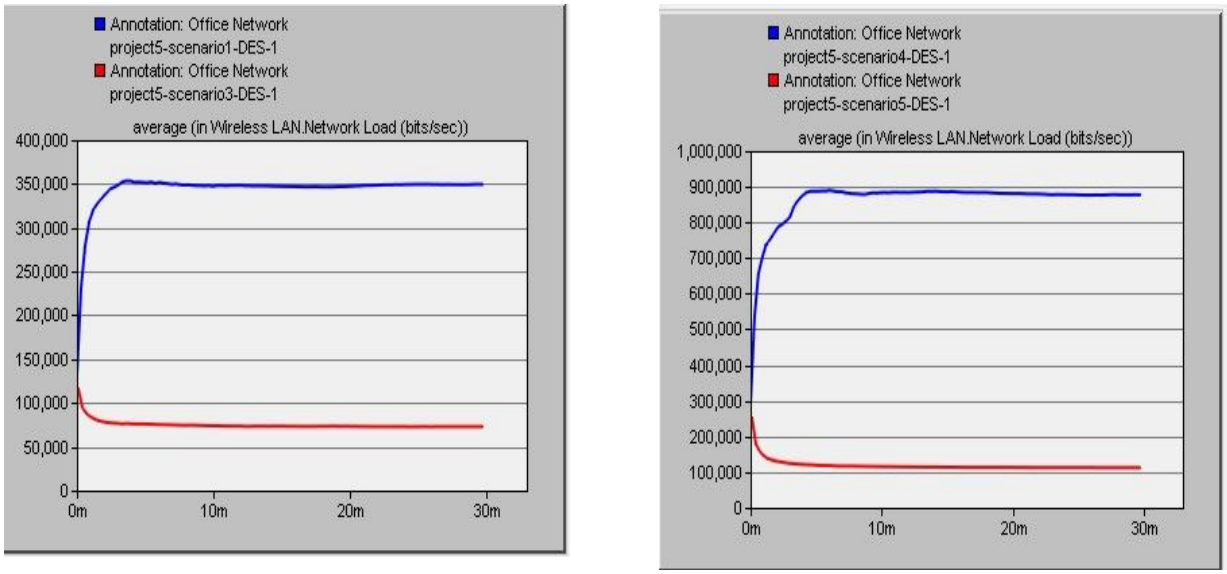
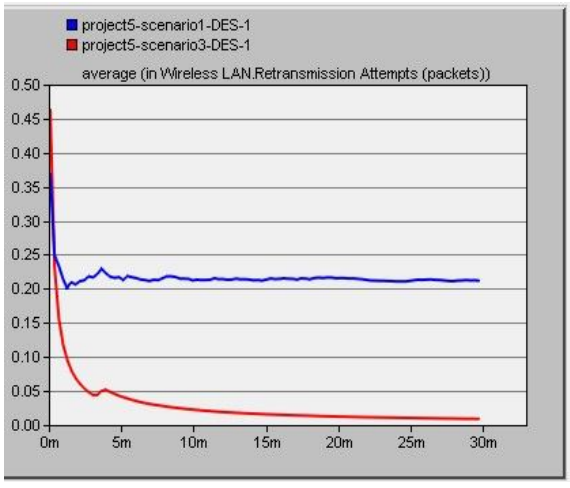


Figure3: Network Load (bits/sec)

5.4 Retransmissions: Simulation results show that number of retransmission attempts in AODV is more as compared to DSR at less and even more number of devices. The figure 4 shows the graph for Retransmissions.



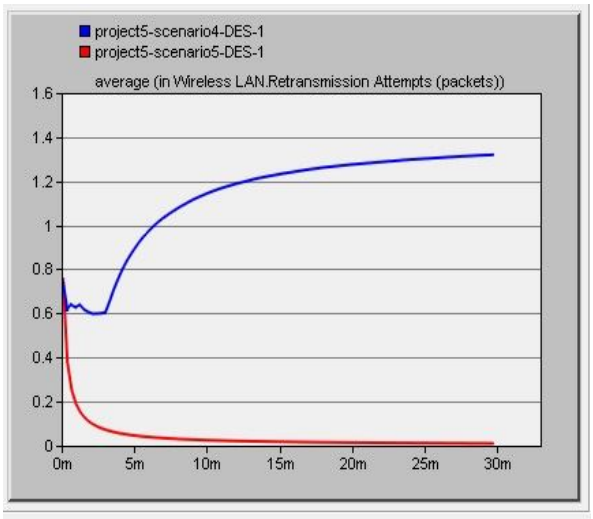
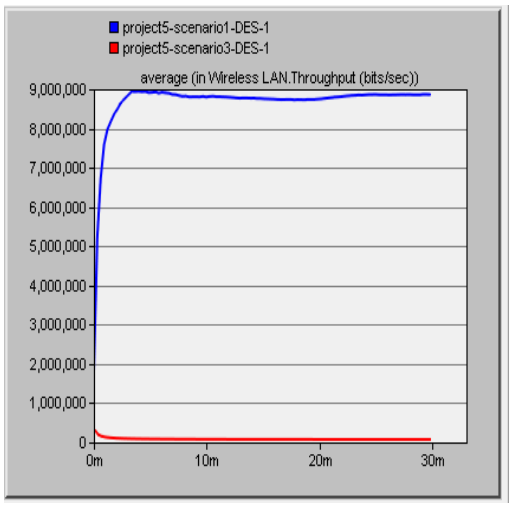


Figure4: Retransmission Attempts (packets)

5.5 Throughput: The figure 5 shows the graph for throughput for both the protocols. Results show that throughput of AODV is much high as compared to DSR in both the cases. Also with in the same protocol throughput increases with increase in number of devices.



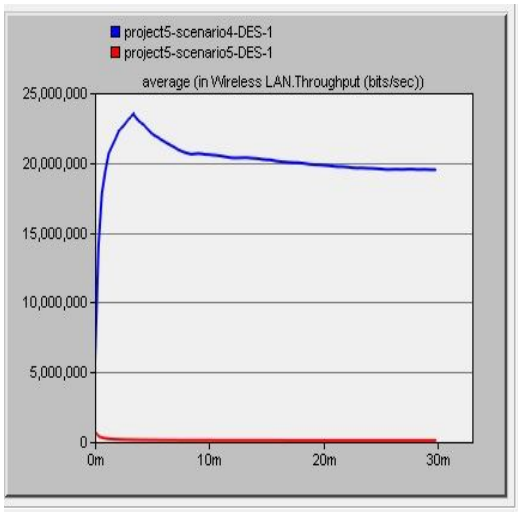


Figure5 Wireless LAN Throughput (bits/sec)

6 CONCLUSION AND FUTURE SCOPE: As a result of this study we can conclude that DSR is best regarding data dropped and number of retransmission attempts which approaches to zero for less and even more number of nodes. But AODV has upper hand on DSR in terms of throughput which further increases with increase in number of mobile devices. AODV offers less delay than DSR at less number of devices but with more number of devices DSR shows better result.

Network load of AODV is high. In future research work can be extended for comparison with other types of protocols and for different metrics.

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