nodes, which is considered as an advantage. However this may require additional resources form the intermediate nodes, which is the negative side of AODV.

This routing protocol uses an on-demand approach for finding routes, that is, a route is established only when it is required by a source node for transmitting data packets. It employs destination sequence numbers to identify the most recent path. The major difference between AODV and Dynamic Source Routing (DSR) stems out from the fact that DSR uses source routing in which a data packet carries the complete path to be traversed. However, in AODV, the source node and the intermediate nodes store the next-hop information corresponding to each flow for data packet transmission. In an on-demand routing protocol, the source node floods the RouteRequest packet in the network when a route is not available for the desired destination. It may obtain multiple routes to different destinations from a single RouteRequest. When an intermediate node receives a RouteRequest, it either forwards it or prepares a RouteReply if it has a valid route to the destination. All intermediate nodes having valid routes to the destination, or the destination node itself, are allowed to send RouteReply packets to the source. When a node receives a RouteReply packet, information about the previous node from which the packet was received is also stored in order to forward the data packet to this next node as the next hop toward the destination.

3. Performance evaluation of routing protocols

The simulation experiments are performed with the help of Network Simulator-2 which is a freely available networking tool. The traffic sources are CBR (continuous bit – rate). The source-destination pairs are spread randomly over the network. The data packet size is 512 bytes. The mobility model selected is *random waypoint model* in a square filed of 1000m x1000m with 50 nodes. In this mobility model, each node starts its journey from a random chosen location and to a randomly chosen destination. The pause time of nodes is varied between 0 to 500 seconds. Different network scenarios for different numbers of source, pause time are generated. Simulation is performed for 500 seconds. Table 1 shows the simulation parameter setting for the protocol evaluation.

Table 1: Simulation parameters

Number of Nodes	20/30/40
Traffic Pattern	CBR (Constant Bit Rate)
Network Size	1000 x 1000
Mobility Model	Random Way Point
Simulation Time	500 s
Pause Time	0/50/100/200/300/500 s
Routing Protocol	DSR/AODV
MAC Protocol	802.11

Following performance metrics are considered for evaluation:

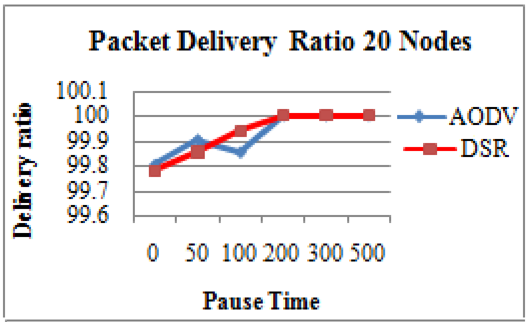
- *Packet Delivery Ratio (PDR)*: The ratio of the data packets delivered to the destination to those generated by the sources.
- *End-to-end delay:* This includes all possible delays caused by buffering during route discovery latency, queuing at the interface queue, retransmission delays at the MAC, propagation and transfer times.
- *Routing overhead:* The number of extra routing packets "transmitted" per data packet "delivered" at the destination.

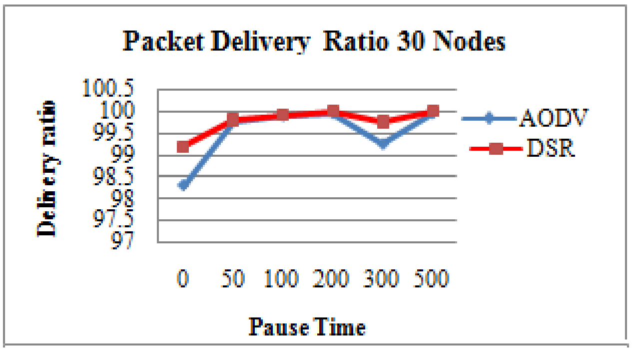
4. Simulation Results

Below are the comparison graphs showing results of our work. In all simulation the pause time is in seconds.

4.1 Packet Delivery Ratio

It is the ratio of data packets received by the destination to the packets send by the source. Figure 1 shows the Packet Delivery Ratio with respect to pause time for 20, 30 and 40 number of sources. Graphs depict both protocols performed well for different pause time and is nearly equal to 100% but DSR slightly beaten AODV due to fact that its route cache stores multiple path to a destination thus if one route fails packet is immediately forwarded through other routes available in the cache.





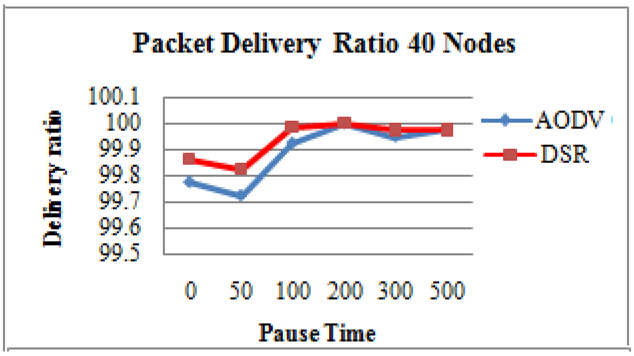


Figure 1: Packet Delivery ratio vs. Pause time for 20, 30 and 40 number of nodes

4.2 Average End To End Delay

It is the difference between the sending time and receiving time of a packet which includes all possible delays like queuing at the interface, retransmission delay at MAC level, buffering during route discovering process, propagation and transfer delay.

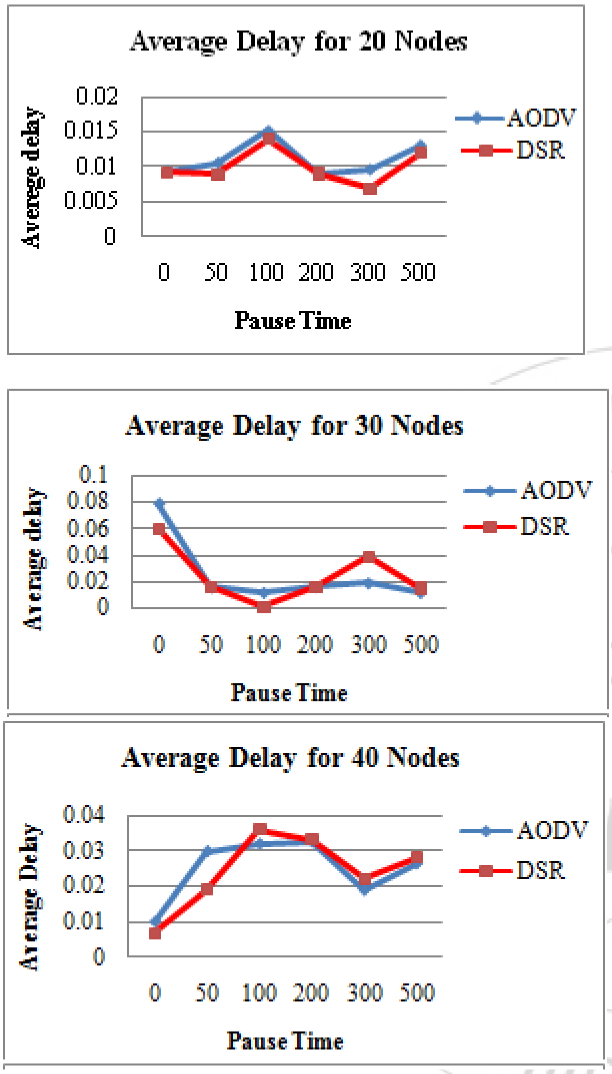


Figure 2: Average end to end delay vs. Pause time for 20, 30 and 40 number of sources

Figure 2 shows the Average Delay with respect to Pause time for 20, 30 and 40 number of sources. Here both protocols performed almost same but AODV was slightly better as it always uses best path available while in DSR cache may contain stale information.

4.3 Normalized Routing Overhead

It is the number of routing packets transmitted by the source per delivery of data packet by the destination. Figure 3 shows the Normalized Routing Overhead with respect to Pause time for 20, 30 and 40 number of sources. In this DSR outperformed AODV due to fact it finds and stores all paths available to destination in a cache after route discovery unlike AODV which stores only one path. Thus DSR does not have to initiate route discovery very often every time a route breaks on other hand AODV as to initiate route discovery every time. At high mobility, routing overload for both increases due to more route breaks. Figure 8 shows the Normalized Routing Overhead with respect to Speed for 20, 30 and 40 number of sources. The results and reasons are same as above.

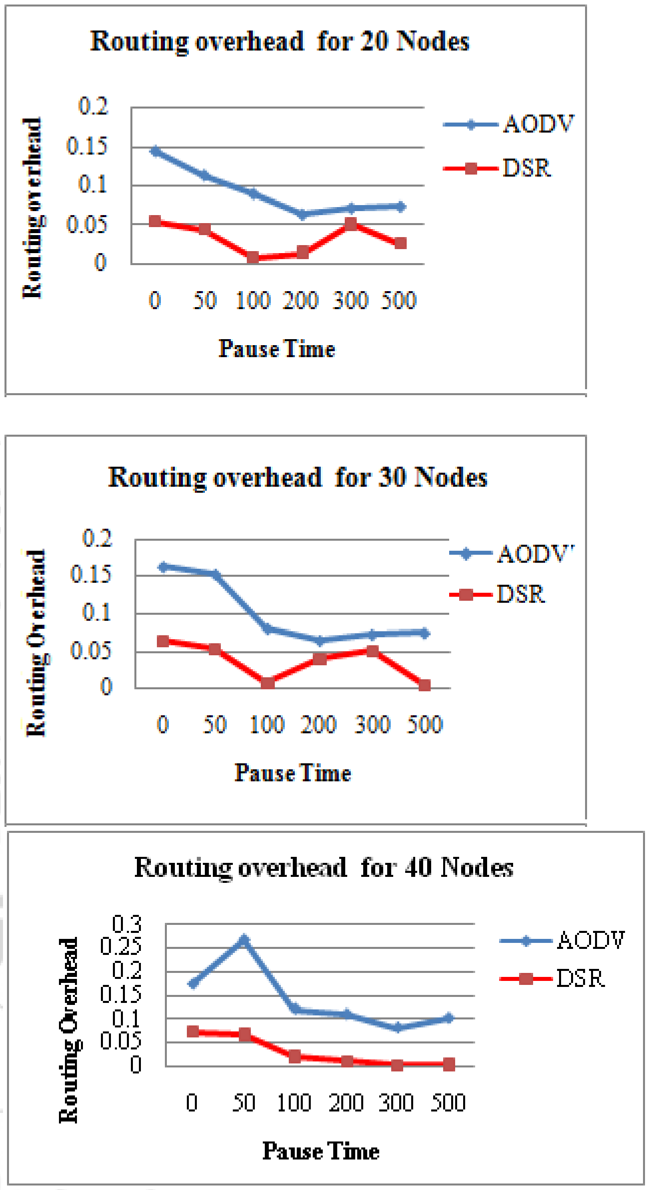


Figure 3: Normalized Routing Overhead vs. Pause time for 20, 30 and 40 number of sources

5. Conclusion

The analysis shows that routing is very important factor for evaluating the performance of the system. Traditional routing algorithms cannot satisfy the requirements of an ad hoc network, because of the dynamic topology and the limited bandwidth that characterize these networks. For this reason there is a lot of research that deal with the extension of the existing routing algorithms or with the discovery of new and more efficient routing algorithms. This paper evaluated and compared AODV and DSR routing algorithm using simulation. Results of our work shows that DSR has performed slightly better than AODV for performance parameters like Packet Delivery Ratio and Normalized Routing Overload but performed slightly poor in terms of

Average Delay. This is due to fact that DSR uses route cache very aggressively.

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