An Extensive Comparison among DSDV, DSR and AODV Protocols in MANET

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ABSTRACT

Mobile Ad-Hoc Network (MANET) routing protocols facilitate the creation of such networks without centralized infrastructure. Comprehensive analysis among Destination Sequence Distance Vector (DSDV), Dynamic Source Routing (DSR) and Ad-hoc on Demand Distance Vector (AODV) routing protocols of ad-hoc networks has been carried out using Network Simulator (NS-2). Some important performance metrics of MANET have been taken under consideration such as no. of Node Vs Throughput, no. of Node Vs Packet Drop, Packet Vs Propagation Delay and Throughput vs Time and it also investigates the best routing protocol with simulation environment.

Keywords

MANET, Packet, NS-2, Routing protocol.

1. INTRODUCTION

MANET is a network composed of mobile nodes mainly characterized by the absence of any centralized coordination or fixed infrastructure, which makes any node in the network act as a potential router. MANET are also characterized by a dynamic, random and rapidly changing topology. This makes the classical routing algorithms fail to perform correctly, since they are not robust enough to accommodate such a changing environment. Consequently, more and more research is being conducted to find optimal routing algorithms that would be able to accommodate for such networks. In MANET, communication between mobile nodes always requires routing over multi-hop paths [7].

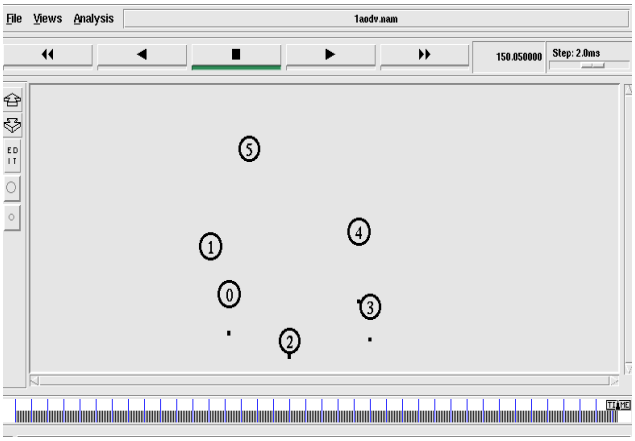

Figure 1. Sample MANET used

Since no infrastructure exists and node mobility may cause frequent link failure, it is a great performance comparison of AODV, DSDV and DSDV Routing Protocols in MANET challenge to design an effective and adaptive routing protocol. Many restrictions should be well considered, such as limited power and bandwidth

2. PERFORMANCE EVALUATION

2.1 No of nodes Vs Throughput

The number of nodes was varied each time in fig. 1 and the throughput was calculated at destination node during entire simulation period whose amount was as in fig. 2.

Table 1. No of nodes Vs Throughput

MANET Protocol	Throughput for no. of nodes			
	5	10	15	20
DSDV	10.8	90.8	241.8	509.68
DSR	10.72	72.37	206.99	368.44
AODV	40.91	431.39	1639.73	3759.79

AODV shows higher throughput than the DSR and DSDV. The AODV has much more routing packets than DSR because the AODV avoids loop and freshness of routes while DSR uses stale routes. Its throughput is higher than other two routing protocols at high mobility.

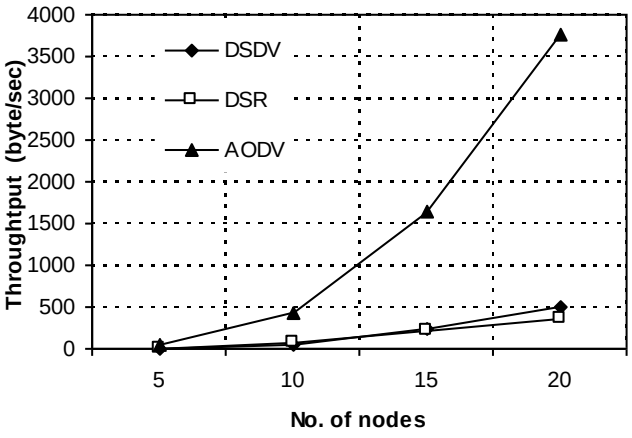

Figure 2. Throughput over no. of node

2.2 No. of nodes Vs Packet Drop

A packet is dropped in two cases: the buffer is full when the packet needs to be buffered and the time that the packet has been buffered exceeds the limit. Packet dropping was observed for several nodes and varied the nodes each time and the dropped was counted at destination node during entire simulation period whose amount was as in Table 2.

Table 2. Packet dropped at different nodes

MANET Protocol	Packet drop for no. of nodes			
	5	10	15	20
AODV	13	12	12	11
DSR	10	8	9	10
DSDV	11	17	6	12

Efficient protocols can wisely find out routing direction thus packets dropping rate reduces for them. The packet dropped for DSR is less than that of DSDV and AODV as it outperforms with fewer nodes and no periodic update is maintained in DSR.

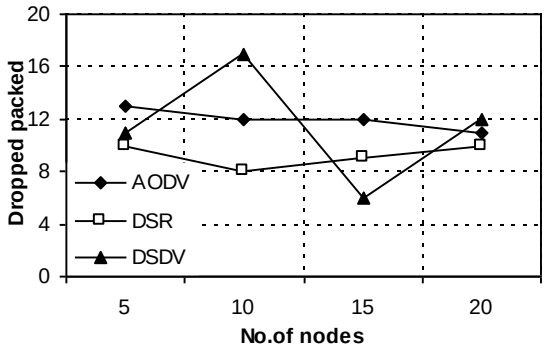

Figure 3. Packet drop over . of node

2.3 Packet Received Vs Propagation Delay

Packet receiving statistic were performed for several propagation delays incase of all MANET protocols, whose nature of packet variation becomes as in fig 4. DSR perform better when the propagation delay of nodes increases because nodes become more stationary will lead to more stable path from source to destination. DSR is superior to DSDV as well as AODV especially when the node's propagation delay begins to rise.

Table 3. Packet received at different delays

MANET Protocol	Packet received at propagation delay				
	10 (ms)	20 (ms)	30 (ms)	40 (ms)	50 (ms)
AODV	0	453	596	596	596
DSR	0	336	504	676	820
DSDV	156	600	750	740	550

For AODV, it shows significant dependence on route stability, thus its packet received rate is lower. Although, the amount of packet received is inversely proportional to propagation delay, DSR has the best performance than AODV and DSDV.

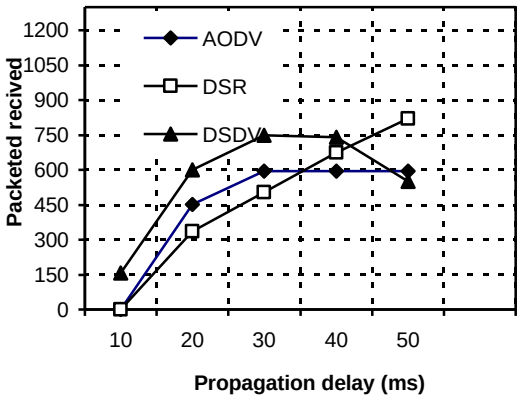

Figure 4. Packet received over propagation delay

2.4 Throughput vs Simulation Time

Throughput was gained at destination node against various dimension of networks and varied the simulation time uniformly for each protocol whose measure was as in fig 5. Throughput is 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. The throughput is usually measured in bits per second (byte/sec), and sometimes in data packets per second or data packets per time slot. This is the measure of how soon an end user is able to receive data. It is determined as the ratio of the total data received to required propagation time. A higher throughput will directly impact the user's perception of the quality of service (**QoS**).

Table 4. Throughput at different simulation delays

MANET Protocol	**Throughput at delay**						
	10 ms	20 ms	30 ms	40 ms	50 ms	60 ms	70 ms
AODV	0	53	68	68	68	84	84
DSR	0	37	56	80	80	80	80
DSDV	12	52	79	99	114	150	183

Based on the fig 5, it is shown that DSDV perform better when the time increases because nodes become more stationary will lead to more stable path from source to destination. DSDV has higher throughput than AODV and DSR because of avoiding the formation of loops and it uses stale routes in case of broken links. The rate of packet received for AODV is better than the DSDV because this periodic broadcast also add a large overhead into the network. For AODV, the routing overhead is not likely affected as generated in DSDV. For AODV, it shows significant dependence on route stability, thus its throughput is lower when the time decreased.

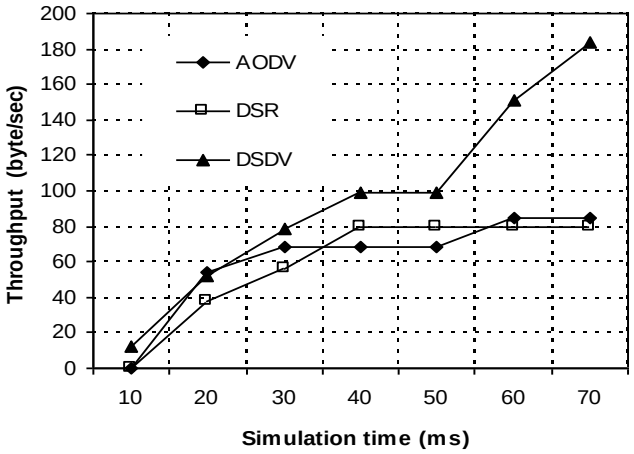

Figure 5. Throughput over time

2.5 Selecting the Best MANET Routing protocols

Statistical analysis on the experimental data shown in above mentioned tables and corresponding figures produces Table 5 wherefrom the best performing protocol with respect to a specific network parameter can be selected to optimize MANET performance.

Table 5. Throughput at different simulation delays

PARAMETERS	THE BEST PROTOCOL
No. of nodes Vs Throughput	AODV
No. of nodes Vs Packet Drop	DSR
Packet received Vs Propagation Delay	DSR
Throughput Vs Simulation Time	DSDV

3. CONCLUSION

Performance analysis has been done on three well known MANET protocols DSDV, DSR and AODV. A comprehensive simulation study has been presented to compare these routing protocol using a varying workload such as throughput, packet count, packet drop and propagation delay of ad-hoc network. It is found that for packet received DSR is superior to DSDV and AODV.

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