Performance Analysis Of AODV, DSR And DSDV Routing Protocols For Ad-Hoc Network

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Abstract

Ad-Hoc Network routing protocols assist 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 Ad-Hoc Network have been taken under consideration such as no. of Node Vs Packet Drop, no. of Node Vs end-to-end delay and no. of Node Vs packet delivery ratio and it also investigates the best routing protocol with simulation environment.

Keywords*: Ad-hoc network, NS2, DSDV, DSR, AODV*

1. Introduction

Ad-hoc network 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 (Mobile Ad-hoc network) is also characterized by a dynamic, random and rapidly changing topology [1]. 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.

The other factors which need to be considered while choosing a protocol for MANETs are as follows:

A) Multicasting: This is similar to broadcasting except the fact that the broadcasting is done to all the nodes in the network. The ability to send packet to every node is known as Multicasting.

B) Loop Free: A path taken by a packet never transits the same intermediate node twice before it arrives at the destination. To improve the overall performance in the routing protocol to guarantee that the routes supplied are loop-free. This avoids any loss of bandwidth or CPU consumption.

C) Distributed: The protocol should be distributed. It should not be dependent on a centralized node.

D) Reactive: It means that the routes are discovered between a source and destination only when the need arises to send data. Some protocols are reactive while others are proactive which means that the route is discovered to various nodes without waiting for the need.

1.1 Classification of Ad-hoc Routing Protocol

Ad-hoc On Demand Distance vector (AODV) Routing protocol

The Ad hoc On-Demand Distance Vector (AODV) algorithm enables dynamic, self-starting, multihop routing [2] between participating Mobile nodes wishing to establish and maintain an ad hoc network. AODV allows mobile nodes to obtain routes quickly for new destinations, and does not require nodes to maintain routes to destinations that are not in active communication. AODV allows mobile nodes to

respond to link breakages and changes in network topology in a timely manner. The operation of AODV is loop-free, and by avoiding the Bellman-Ford "counting to infinity" problem offers quick convergence when the Ad-hoc network topology changes (typically, when a node moves in the Network). When links break, AODV causes the affected set of nodes to be notified so that they are able to invalidate the routes using the lost link. Route Requests (RREQs), Route Replies (RREPs) and Route Errors (RERRs) are message types defined by AODV.

Destination-Sequenced Distance-Vector Routing (DSDV)

In DSDV, each node maintains a next-hop table, which it exchanges with its neighbours. There are two types of next-hop table exchanges: periodic full-table broadcast and event-driven incremental updating. The relative frequency of the full-table broadcast and the incremental

Updating is determined by the node mobility. In each data packet sent during a next-hop table broadcast or incremental updating, the source node appends a sequence number. This sequence number is propagated by all nodes receiving the corresponding distance-vector updates, and is stored in the next-hop table entry of these nodes. A node, after receiving a new next-hop table from its neighbour, updates its route to a destination only if the new sequence number is larger than the recorded one, or if the new sequence number is the same as the recorded one, but the new route is shorter. In order to further reduce the control message overhead, a settling time is estimated for each route. A node updates to its neighbours with a new route only if the settling time of the route has expired and the route remains optimal [3].

Dynamic Source Routing (DSR)

The Dynamic Source Routing protocol is an on demand protocol. DSR is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad-hoc network of mobile nodes. The DSR protocol is composed of two main mechanisms that work together to allow the discovery and maintenance of source routes in the ad-hoc network [5].

- Route Discovery
- Route Maintenance

In DSR Route Discovery and Route Maintenance each operates on demand.

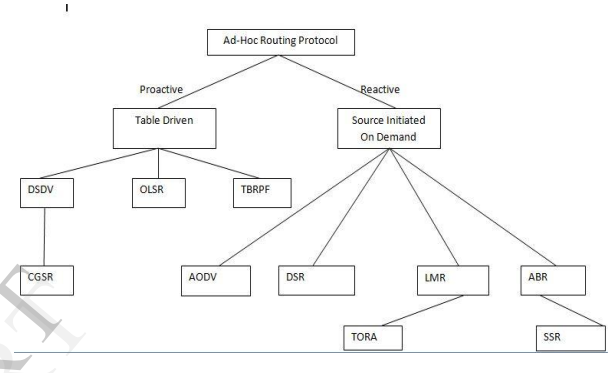

Figure 1: Classification of Ad-hoc Routing Protocol

2. Performance Evolution

2.1 Number of Nodes Vs Packet drop

A packet is dropped in two cases:

- Buffer is full when the packet needs to be buffered
- 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.

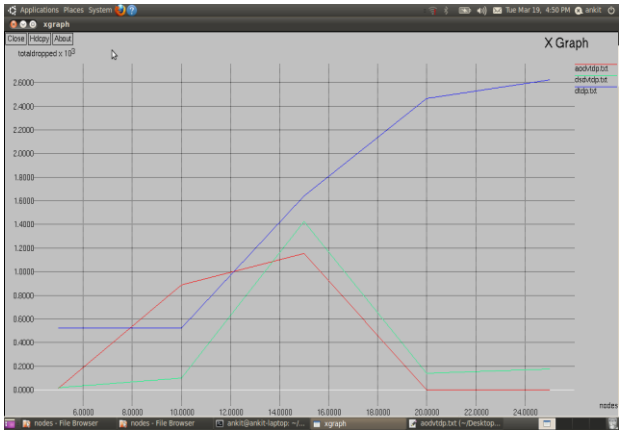

Figure 2.1: XGRAPH for Nodes Vs Packet

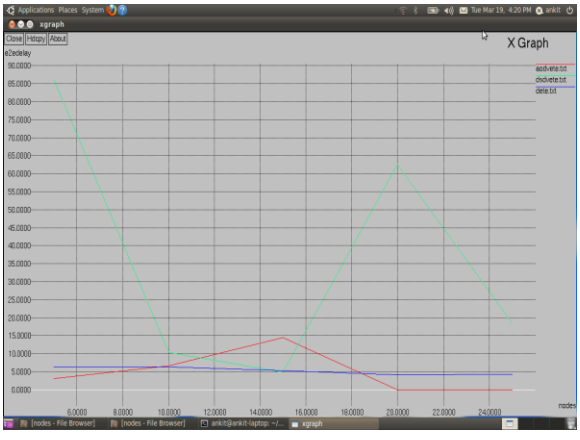

Figure 2.2: XGRAPH of Nodes Vs end to end delay

Table2.1: Packet drop at Different Node

Nodes Vs Packet drop			
Nodes	Protocol		
	AODV	DSR	DSDV
5	14	525	19
10	890	525	98
15	1156	1640	1425
20	0	2467	141
25	0	2624	177

Table2.2: Nodes Vs end to end delay

Number of Nodes Vs end to end delay			
Nodes	Protocol		
	AODV	DSR	DSDV
5	3.046	6.332	86.045
10	6.664	6.332	10.359
15	14.416	5.374	4.842
20	0	4.163	62.645
25	0	4.318	18.539

2.2. Number of Nodes Vs end to end delay

End to end delay refers to the time taken for a packet to be transmitted across a network from source to destination.

2.3. Number of Nodes Vs Packet Delivery Ratio

Packet delivery ratio is the ratio of the number of delivered data packet to the destination. The greater value of packet delivery ratio means the better performance of the protocol.

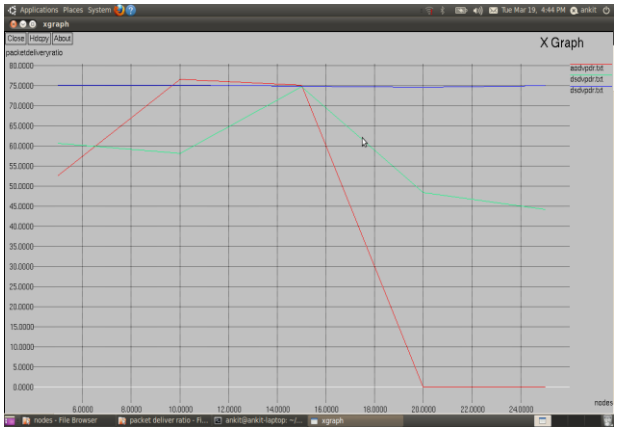

Figure 2.3: XGRAPH of Nodes Vs Packet Delivery Ratio

Table 2.3: Number of Nodes Vs Packet Delivery ratio

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3. Conclusion

Performance analysis has been done on three well known Ad-hoc networking protocols AODV, DSR and DSDV. A widespread simulation study has been presented to compare these routing protocols using a varying workload such as packet drop, end-to-end delay, and packet delivery ratio.

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