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Performance Evaluation of DSDV, DSR AND ZRP Protocol in MANET

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Abstract: Mobile Ad-Hoc Networks are rapidly deployable and self-configuring networks. In MANET all the network node work as a router and must be capable to relay traffic from one to another since communicating nodes might be out of range. MANET is characterized by dynamic topology, possibly unidirectional links, constrained resources and network partitions. The main two attributes are mobility and multi-hop.[1][3] The size of MANET can be varied from small static network to highly large dynamic network. MANET use dynamic changing network topologies that are proactive, reactive and hybrid protocol.[1][2] In this paper, an attempt has been made to compare performance of Proactive, reactive and hybrid protocol for the MANET. A comparative study of DSDV (proactive) DSR (reactive) and ZRP (hybrid) has been done on the basis of their performance in MANETs using NS2 simulator. Packet delivery fraction ratio and throughput are considered as a performance parameter for evaluating the performance of DSDV,DSR and ZRP protocol.

Keywords: MANET, DSDV, DSR, ZRP, NS2

1. INTRODUCTION

A mobile ad-hoc network is a group of wireless nodes that have the capability to communicate with each other without any dependency on a fixed supportive infrastructure or a centralized administration. Therefore MANET is a "spontaneous network "that automatically "emerges" when nodes gather together [1]. Each node of a MANET can perform as a router and a host. Nodes in the MANET can communicate with other all nodes within their radio range or can use intermediates nodes to communicate with the nodes that are not present in their radio range. MANET is characterized by dynamic topology, use unidirectional links, constrained resources and network partitions. The main two attributes are mobility and multi-hop communication between the nodes. One tries to find the optimum route for the destination. The word optimum means here the route which has lower cost in comparison to other routes in the network [1] [2]. Nodes have tendency to freely move in any direction, at any time, thus frequently make or break the links with other nodes. Fig [1]

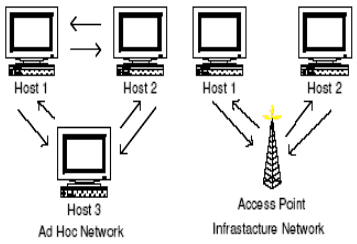

Fig 1. Ad Hoc Networks vs. Infrastructure Networks [1]

Many routing protocols have already been proposed and well-accepted in the research community and also the performance of these protocols is analyzed by different simulator tool. Many simulators can successfully simulate various routing protocols of MANET but there are only a few tools to handle the simulations with a graphical interface. In this paper NS-2 use to analyze the performance of MANET's routing protocols.

The paper is organized as follows: Section 2 gives a brief description of three major MANET routing protocols – DSDV, DSR and ZRP that have been used for performance analysis of proactive, reactive and hybrid protocol of MANET. Section 3 describes NS-2 simulator and the performance evaluations parameter to analyze the performance of routing protocol. Section 4 talks about some result and analysis and finally Section 5 discuss the conclusion of this paper.

2. MANET ROUTING PROTOCOL

2.1 DSDV (Destination Sequence Distance Vector routing)

DSDV is proactive protocol. Proactive protocol always keeps the routing Information independently of need for communication. All nodes sends update messages throughout the network periodically or whenever network topology changes , any other nodes add in the network, node move away from the network.[4] It provides low latency and suitable for real-time traffic but bandwidth might get wasted due to periodic updates of routing table.

In DSDV each node maintains a routing table which stores next hop towards each destination, cost metric for the path to each destination, destination sequence number that is created by the destination itself and sequence numbers used to avoid formation of loops. Each node periodically forwards this routing table to all its neighbors. Each node increments and appends its sequence number when sending its local routing table. This sequence number will be attached to route entries created for this node.[10][4] The sequence numbers assigned by the destination are generally even. If the broken link is detected, then the metric is assigned as infinity and the sequence number is assigned to odd. In order to maintain uniformity, each node periodically broadcasts its route and updates its routing table on the basis of received information from the neighbor routing table.[4][5]

2.2 DSR (Dynamic Source Routing)

Dynamic Source Routing (DSR) is a reactive routing protocol used for wireless mesh networks. It is similar to AODV because it also establishes a route on-demand when a transmitting mobile node requests for transmitting the data and need a path for particular destination.. However, it rely on source routing instead of using routing table of intermediate nodes. That's why it is called dynamic source routing.DSR. This protocol used two main mechanisms "Route Discovery" and "Route Maintenance", which work together to find out and maintain the optimum route for particular destination.[3][7] In this protocol, the mobile nodes maintains route cache that have the information of known route. When a source node desired to send a packet to a destination, it first consults its route cache to find out whether this node already knows any route to the destination or not. If node already have the information about the route to the destination in its route cache there is an entry for that destination than source node use this information to send its packet. If not than route request process starts for find out the route. Route request packet includes the source and a unique identification number. Each intermediate node checks its route cache to know that intermediate node knows the route for the destination if intermediate node does not have the information than it again forwards the packet until data reaches to the destination.[4][10] A node processes the route request packet only if it has not previously processed the packet and its address is not present in the route record of the packet. A route reply is generated by the destination or by any of the intermediate nodes when it knows about how to reach the destination.[4][7][9]

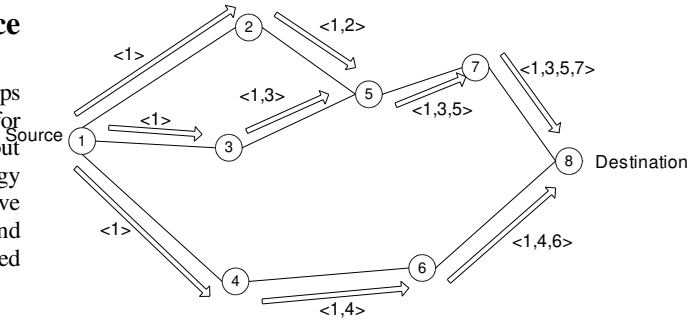

Fig 2.Building Record Route during Route Discovery [7]

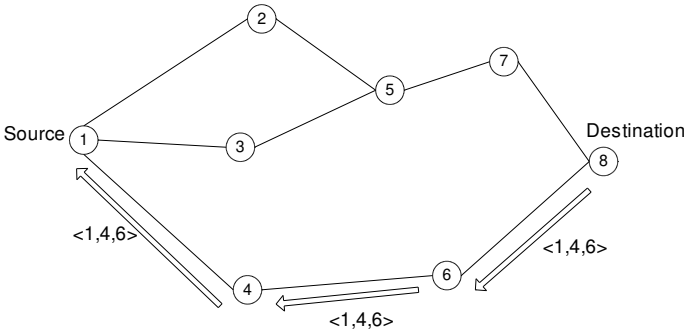

Fig 3 .Propagation of Route Reply with the Route Record [7]

2.3 ZRP (Zone Routing Protocol)

Hybrid Routing is the combination of proactive and reactive protocol. This attempts to strike balance between the two protocols. ZRP falls under the category of hybrid routing protocols with both proactive and reactive routing components. ZRP overcome the disadvantage of control overhead caused by proactive protocol and also decreases the latency in reactive protocols. It takes advantage of proactive discovery within a node close immediacy/ local neighborhood, and using a reactive approach for communication between these neighborhoods. With this ZRP reduces the proactive scope to a zone and reactive approach outside the zone. When a node has a data packet for a particular destination, a check is carried out whether a destination is within its zone or not. Packet is routed proactively if it is within the zone and if the destination is outside the zone reactive routing is used.[5][4][3]

The zone is defined as a collection of nodes whose minimum distance from the node in question is not greater than a value known as "zone radius". Each node creates its own neighborhood separately. The size of a zone is given by a radius of length r where, r is number of hops to the perimeter of the zone [5]. Each zone may have different size and each node may lie within multiple overlapping zones [6][5].

3. NS-2 NETWORK SIMULATOR

Ns-2 is a discrete event simulator using in networking research. NS-2 used for wired and wireless network to provides significant support for simulation of TCP, routing and multicast protocols. It is combination of two simulation tools. The network simulator (ns) contains all commonly used IP protocols. The network animator (nam) ,which is use to visualize the simulations. Ns-2 can fully simulates a layered network from the physical radio transmission channel to high-level applications. Ns-2 is an object-oriented simulator written in C++ and OTcl. The simulator supports a class hierarchy in C++ and a similar class hierarchy within the OTcl interpreter. There is a one-to-one correspondence between a class in the interpreted hierarchy and one in the compile hierarchy.[6][7]

Table 1 Simulation Parameters Used

Parameter	Value
Platform	Linux CentOS 5
NS Version	Ns-2.33
Mobility Model	Random Way Point
Traffic Type	CBR
Area	500 * 500 m
Experiment Duration	150 sec
Packet Size	512 bytes
Radio Propagation	TwoRayGround
Packet Interval	0.2 second
Protocols	DSDV, DSR, ZRP
Antenna Type	OmniAntenna
Packet Size	512 bytes
Pause Time	5, 10, 20, 40, 100
Number of nodes	10, 20, 30, 40, 50

3.1 Performance Evaluation Parameter

Packet Delivery Fraction: Ratio of all received packets at the destinations to all transmitted packets from CBR source.

Throughput: It is defined as the ratio of data packets received to the destination to those generated by source means it is average rate of packets successfully transferred to their final destination per unit time.

Above two parameters are evaluated against the number of nodes and different pause time for the MANET protocols.

4. SIMULATION RESULT AND DISCUSSION

4.1 Packet Delivery Fraction

Fig shows the packet delivery fraction against the number of nodes and pause time for DSDV, DSR and ZRP protocol respectively. Fig 4.1(a),Fig 4.1(b)

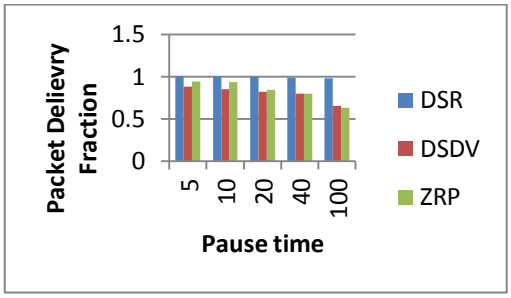

Fig 4.1(a) Packet Delivery Fraction Vs Pause Time

Fig 4.1(a) displays that number of packets received at the destination to the transmitted by the CBR source is more in DSR as compare to DSDV and DSR for different pause time and it is almost same but for DSV and ZRP when the pause time increases packet delivery fraction decreases.

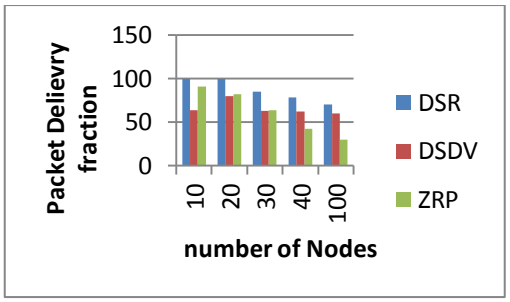

Fig 4.1(b) Packet Delivery Fraction Vs Number of Nodes

Fig 4.1(b) display as the number of nodes increases, packet delivery fraction decrease but it is still maximum in case of DSR as compare to DSDV and ZRP but ZRP have the better performance for lesser number of nodes as compare to DSDV and this performance will decrease as the number of nodes increase.

4.2 Throughput

It is shown by the graph fig 4.2(a) that throughput is increases when pause time increases for DSR,DSDV and ZRP but it is maximum for DSR. When pause time increases throughput of DSDV and ZRP is almost same.

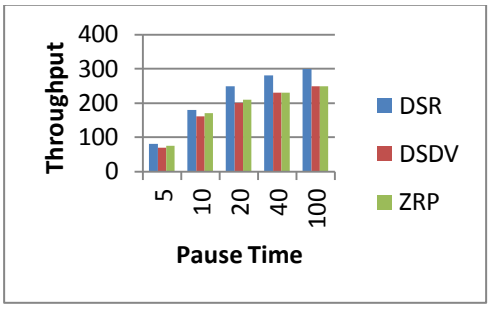

Fig 4.2(a) Throughput Vs Pause Time

Fig 4.2(b) shows that throughput of the DSR increases as the number of nodes increases but it is decreases for the ZRP when number of node increases.

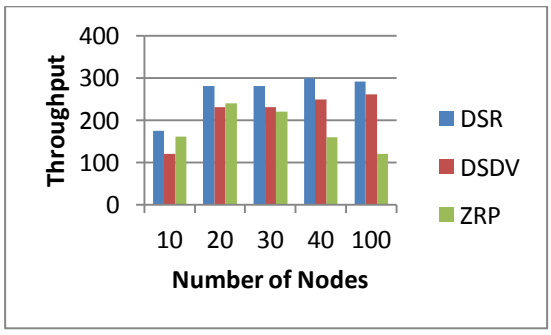

Fig 4.2(b) Throughput Vs Number of Nodes

5. CONCLUSION

In this study we have concluded that each protocol performs well in some cases while have some drawbacks in other cases. Simulation results demonstrated in terms of throughput, packet delivery fraction against number of nodes and pause time for DSR,DSDV and ZRP. This paper conclude that DSR perform better in each condition and the performance of ZRP is good for lesser number of nodes and its performance decreases when number of nodes increases. When the pause time is less throughput is low for all DSR, DSDV and ZRP protocol.Simulation results show that better performance is achieved in DSR protocol in terms of packet lost, throughput over a discontinuous network.

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