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RESEARCH ARTICLE

A Comparison of Performance Metrics for Various Routing Protocols in MANET

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Abstract – MANET (Mobile Ad Hoc Network) is an independent set of mobile users that communicate through wireless connections. The network topology of MANET changes rapidly over time. Since the nodes are mobile therefore Packet delivery ratio, energy consumption, Delay is an important constraint of Mobile Ad-Hoc Network (MANET). Routing for MANET is the keys where we can save some energy and decrease delays. This paper however presents a comparison of performance metrics for DSDV, AODV, ZRP routing protocol for MANET.

Keywords – MANET, Routing Protocols, AODV, DSDV, ZRP

I. INTRODUCTION

Wireless technology has been one of the vibrant areas these days. It is technique to transmit or exchange the information over the two or more devices in the network. With the wireless network users can communicate with the current network and are then made free to move into the coverage area of the network. There are two kinds of wireless network first is infrastructure and the other one is an Ad-hoc network. In the infrastructure network all nodes communicate to the base station that provides internodes routing and connectivity with fixed network. So far all nodes in the network, there should be minimum one base station in the range of transmission. The

responsibility of base station for coordinating access to one or more than one channel for mobiles located within their transmission range.

For ad-hoc network, all nodes communicate with other nodes directly or via intermediate nodes that circulate its packets because of the transmission power limit. Each node is participating as a router in computing and maintaining the routes. The explicit advantages of ad-hoc network are cheaper and convenience because there is no base station or fixed infrastructure of network is needed. At the places where pre-deployment of infrastructure is difficult to set or even unacceptable, an ad-hoc network is very useful.

To communicate over fairly slow wireless networks, a MANET is created. Moreover it is used in the communication of unbounded (mobile) users. Mobile Nodes may vary rapidly and unpredictably overtime on a topographic network. The network lacks a specific central node that could execute the functions like topology discovery and message delivery, and hence these acts along with the routing functionalities are carried out by the nodes themselves.

It is a collection of moving nodes that are independent can communicate to each other through waves. The moving nodes communicate to each node that is in the range of the network, now those nodes want to help of intermediate nodes to transmit their information. These type of networks are infrastructure less and they can work at any place because of these networks are totally distributed.

II. CLASSIFICATION OF ROUTING PROTOL

Routing Protocols can be further classified into three sub-categories:

1. **Proactive Routing Protocol**
2. **Reactive Routing Protocol**
3. **Hybrid Routing Protocol**

1. Proactive routing protocol:

These routing protocol also known as Table-Driven Routing protocol. In proactive routing protocol, each node maintains routing tables that contains the latest information of the routes to its neighbor node in the network. Each node has the next hop for reaching to a node and the cost of this route. The Two types of table update in proactive protocols are the periodic update and triggered update. In periodic updates, nodes periodically broadcast its tables in network. Each node just arriving in the network receives that table. Whenever a node finds a change in its neighbors, a table is broadcasted, which forms the basis of triggered updates. Proactive Routing Protocols can be further classified into a

lot of sub-categories of which Destination-Sequenced Distance-Vector (DSDV) and Wireless Routing Protocol (WRP) are the major ones.

Destination-Sequenced Distance-Vector Routing (DSDV):

Destination-Sequenced Distance-Vector Routing (DSDV) is a table-driven routing protocol based on the Bellman-Ford algorithm in ad hoc networks. In DSDV, Every mobile node maintains a routing table that stores for all reachable destinations the next-hop and number of hops to reach that destination, and the sequence number assigned by the destination. There are two types of next-hop table exchanges: full dump or incremental update.

Full dump carries the entire table with all available routing information and this is suitable for fast changing networks. Incremental dump carries only the updated first appearances since last dump, which must fit in a packet and is suitable when the network is stable.

DSDV possesses routes available to all destinations at all times, which implies a much less delay time in the route setup process. The use of sequence number distinguishes stale routes from new ones, where routes with higher sequence numbers are favorable. Some of the key advantages of DSDV protocol are that it leads to complete elimination of route looping, it also brings about an increase in the convergence speed. It also makes sure that there is a reduction in the control message overhead.

2. **Reactive routing protocols**:

On-demand protocol is another name for reactive protocols. As per the latest route topology, route tables are not maintained or updated in a constant manner. A route discovery process is initiated only in the case of requirement of a path to the final node. The route maintenance procedure keeps a track of the established route, till no further routes are possible. Ad hoc on-demand Distance Vector (AODV) and Dynamic Source Routing (DSR) are some examples of on demand routing protocols.

Ad-hoc on demand Distance Vector (AODV):

AODV is ad hoc on demand distance vector routing. It is reactive routing protocol. It is extended version of DSDV. The AODV routing protocol is developed for Mobile ad hoc network. It is capable to handle unicast and multicast routing. It is working only on demand. AODV Routing works by using Route Request Message (RREQ) and Route Reply Message (RREP). Routing in AODV is carried out by the process of Route Discovery and Route Maintenance.

When a node wants to transmit a packet to some destination node, it looks into its route table to see whether it delivers a path to the destination node. If it behaves, it forwards the packet to the next hop towards the destination. All the same, if the node does not receive any valid route to the destination, it

must initiate a path discovery process. The source node creates a route request (RREQ) packet that holds the source node's IP address, current sequence number, destination's IP address and last known sequence number. The RREQ also holds a broadcast ID and this is increased every time the source node initiates a RREQ. Therefore, the broadcast ID and the source IP address uniquely identify a route request. Once The RREQ is created, the node sends this packet and puts a timer to wait for a response.

When a node receives a RREQ, it first checks whether it has identified it before observing the source IP address and broadcast ID pair. If it has already identified a RREQ with the same source IP address and broadcast ID, it removes the packet. Otherwise, it records this information and processes the packet. A reverse route entry is set up for the source node in the route table by the current node. Using this Reverse Route Entry, the IP address for the source node and IP address for the neighbor (from which the RREQ was received) could be obtained. Also for a particular timeout period, the route entry is not taken into consideration.

The receiver node acknowledges the Respond Route Reply packet, back to the source. If the receiver node is not the destination node, it increments the RREQ's hop counter by one and re-sends it to all of its neighbors. If at any stage the RREQ is misplaced, a re-initiation of the route discovery is done by the initial/source node. And once the route is discovered between the source and the destination, a track of it is maintained till the time it is required by the source node.

3. Hybrid Routing Protocols:

Hybrid routing protocols combine both the proactive and reactive routing protocols. As the number of nodes increases, hybrid reactive/proactive protocols are applied to attain higher performance.

The core concept behind the Hybrid Protocols is that it aims at combining the benefits of purely proactive and reactive protocols.

It is used for the large number of nodes. Examples of hybrid routing protocols is Zone Routing Protocol (ZRP).

Zone Routing Protocol (ZRP):

ZRP exploits the characteristics of both proactive and reactive protocol. For routing across the network, the reactive part of the protocol is used. This is where it is different from the proactive part, which has its existence limited to a relatively smaller area of the node. So this implementation is advantageous because it results in latency reduction. It also brings about depreciation in the number of control messages as well.

We use two procedures in ZRP routing protocol. These are Intra-zone routing protocol (IARP) and Inter-zone routing protocol (IERP). An IARP is a proactive approach and it is used within routing

zones and IERP is a reactive approach and it is used between routing zones. The zone routing protocol (ZRP) provides a framework for additional process. The size of the zone is Depending on the strength of the signal and power which is accessible node consistency etc.

III. SIMULATION ENVIRONMENT

Simulation Parameter:

Scenario Setup	Value
Routing Protocol	DSDV, AODV, ZRP
Channel	Wireless Channel
Propagation model	Two ray ground
Network area	1000X1000
No. of nodes	50
Simulation time	200 sec
Packet size	512 bytes
Zone radius	1

IV. PERFORMANCE METRIC

1. Packet delivery ratio.
2. Energy consumption.
3. End to end delay.

Packet Delivery Ratio:

This is ratio of total number of packets successfully received by destination node to the number of packets sent the source node.

$$PDR = \frac{\text{Number of packets received by destination}}{\text{Number of packet sent by source}}$$

Energy Consumption:

It is the ration of total network energy consumption to the number of data packet successfully delivered to destination.

End To End Delay:

The average time taken by a data packet to reach the destination. End to end delay can also be defined mathematically as the ratio of the time lapse/interval between the initial/starting and the following packet to the overall packet delivery.

V. SIMULATION RESULT

We assume the scenario for MANET to implementation on NS-2.35. Performance metrics used in this paper are Packet delivery ratio, energy consumption and average delay for different routing protocols. At last we compare the results of routing protocol.

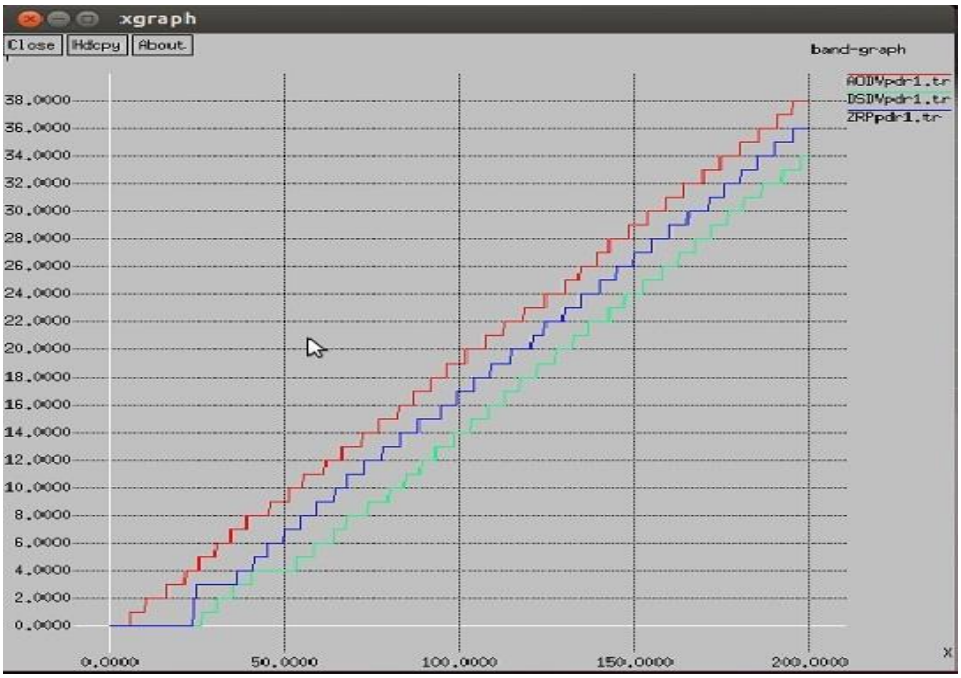

Fig 1: Packet Delivery Ratio

Fig 1 shows the result of packet delivery ratio of different routing protocol and comparison for DSDV, AODV, ZRP respectively using 50 nodes. Fig 1 shows the comparison that AODV is better than DSDV and ZRP.

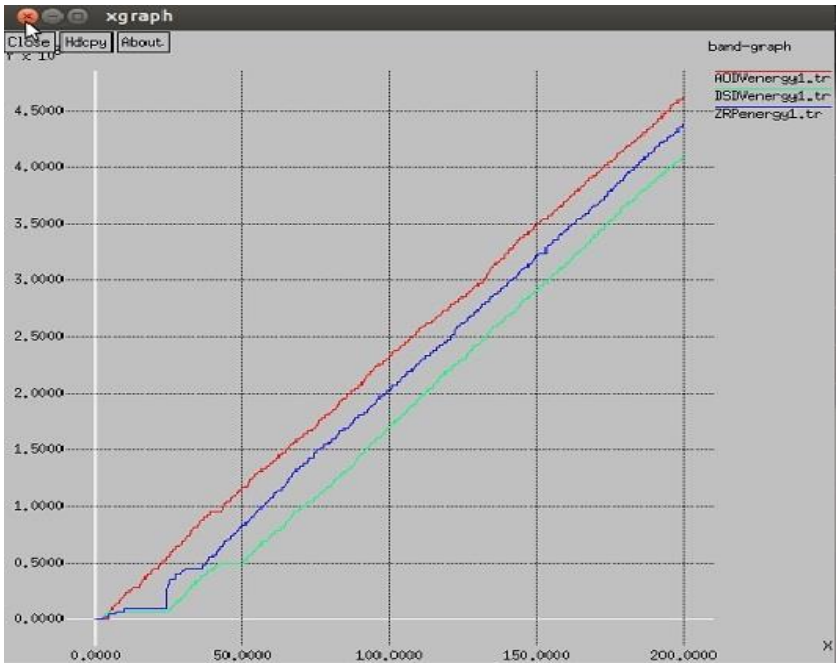

Fig 2: Energy Level of Different Routing Protocol

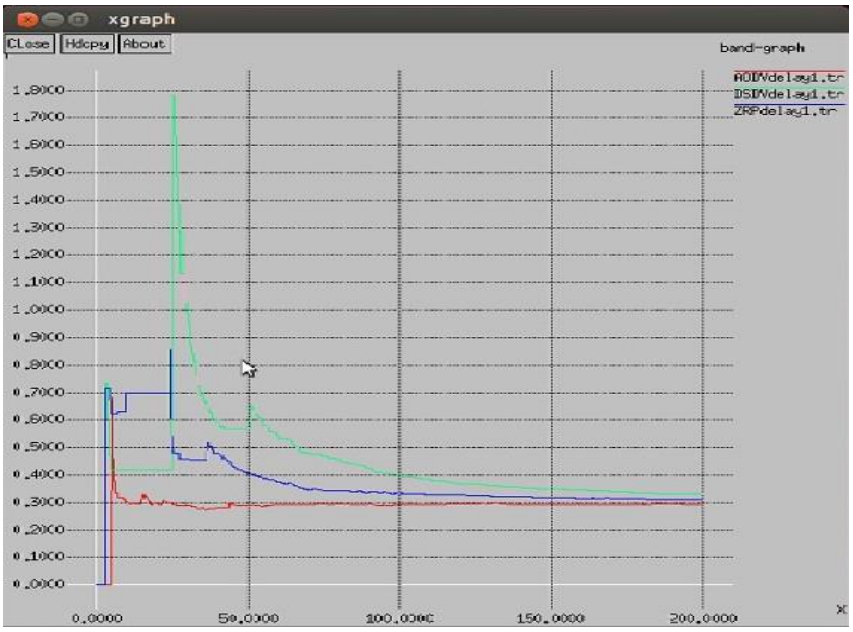

Fig 3: Average End-to-End Delay

Fig 3 shows the comparison of end to end delay for DSDV, AODV and ZRP using 50 nodes. In this figure average delay in DSDV, AODV and ZRP respectively and AODV is better than to other routing protocol.

VI. CONCLUSION

In this paper we analyzed different routing protocol for MANET in terms of energy consumption, packet delivery ratio and average delay between sources to destination using 50 nodes. Comparison shows in the above figures.

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