Performance Evaluation of Routing Protocols in MANET

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Abstract-This paper describes the performance evaluation of different routing protocols of MANET that includes DSDV (Destination Sequenced Distance Vector Routing), DSR (Dynamic Source Routing) and ZRP (Zone Routing Protocol) with different metrics. Mobile Ad-hoc Network (MANET) has opened a new dimension in wireless networks by facilitating wireless nodes to communicate in absence of centralized support.

The simulation results using network simulator NS-2 shows the better performance of Hybrid protocol among all using different simulation time and the results presented in this work illustrate the importance in carefully evaluating and implementing routing protocols in an ad hoc environment.

Keywords*:* MANET, Routing protocols, Performance, DSDV, DSR, ZRP, NS-2(Network Simulator-2).

I. INTRODUCTION

A wireless network communication has made a revolution by allowing users to access services and different information anywhere and at anytime, irrespective of their geographical position. In fact, Wireless technology is a growing technology that has removed the over burden of the cables and allows us to create networks on demand .Wireless networks uses radio frequencies to transmit and receive data. Now, we are using wireless networks for different perspectives like in military applications, industrial applications and even in personal area networks. Mobile Ad-hoc networking is becoming popular since the apparition of powerful radio devices allowing the connection of mobile nodes. Mobile Ad-hoc Network (MANET) has opened a new dimension in wireless networks by facilitating wireless nodes to communicate in absence of centralized support. MANET is a temporary network that frequently changes and consists of mobile nodes without any infrastructure. Mobile nodes communicating directly to each other when they resides in each other's radio waves otherwise we need to use the intermediate nodes to forward the information from the source mobile node to destination mobile node in which each mobile node acts the router in order to forward information to next mobile node in route. The routing protocols in the MANET deals with different challenges which become possible only because of the nodes mobility. These networks are fully distributed, and can work at any place without the aid of any infrastructure. This property makes these networks highly robust.

II. RELATED WORK

Many routing protocols has been proposed, but with few comparisons between different protocols have been made. Different researchers have done the qualitative and quantitative analysis of Ad Hoc Routing Protocols by means of different performance metrics by using different simulators for this purpose. Their research proposed the performance comparison of DSDV, DSR, AODV protocol with IEEE 802.11 MAC for Mobile Ad-hoc Network using NS-2[1] that involves generated packets Vs. number of nodes, total dropped packets Vs. number of nodes and average end to end delay Vs. number of nodes and concluded that the competitive reactive routing protocols AODV and DSR shows better performance than other.

On the same basis one more research did previously, they proposed the performance analysis of AODV and DSR routing protocol in Mobile Ad hoc networks [2] and done the analysis of route discovery and packet transmission in AODV and DSR and concluded that for a small amount of time its good to prefer AODV instead of DSR due to low initial packet loss and good packet delivery ratio in AODV.

One researcher has done the comparative analysis of AODV and OLSR routing protocols in MANET at different traffic load[3] that presents simulation based comparisons and performance analysis on different parameters like

Packet delivery fraction ,Average end-to-end delay, Throughput and Normalized routing overhead only for AODV and OLSR. But at the end of this research, they were not able to do the comparisons among all the three types of routing protocols.

III. PROPOSED APPROACH

This research work is considering three routing protocols from three broad categories such as proactive, reactive and hybrid routing protocols. The routing protocols such as DSDV, DSR and ZRP are investigated and evaluated in order to check their performance by considering the matrices such as Send and Received packets, Routing packets, Packet delivery friction, Normalized routing load, Route discovery delay, Dropped packets, Dropped bytes and Packet delivery ratio for the various numbers of nodes.

3.1. Classification of Routing Protocols

There are mainly three categories of the mobile routing protocols such as proactive, reactive and hybrid routing protocols as shown following figure 1. There are many protocols but we are going to consider DSDV, DSR and ZRP for the investigation and evaluation in the mobile ad hoc networks.

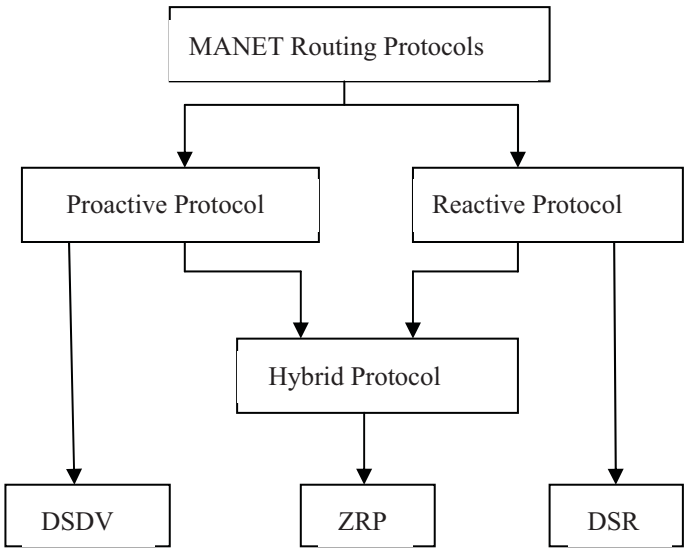

Figure 1: MANET Routing Protocol

3.1.1. Proactive (Table Driven)Protocols

Proactive routing protocols continuously try to maintain up-to-date routing information on every node in the network are also called as Table-driven protocols as they will actively determine the layout of the network. There is hence minimal delay in determining the route to be taken. This is especially important for time-critical traffic [4].This has as an advantage that connection times are fast, because routing information is already available when the first packet is sent.

Destination-Sequenced Distance-Vector Routing (DSDV) is one of the proactive routing protocols for ad hoc mobile networks based on the Bellman-Ford algorithm. In this routing, each node maintains a list of all destinations and number of hops to each destination and each entry is marked with a sequence number. This protocol requires each mobile station to advertise, to each of its current neighbors, its own routing table. DSDV requires a regular update of its routing tables and whenever the topology of the network changes, a new sequence number is necessary before the network re-converges.

3.1.2. Reactive(On Demand) Protocols

These protocols try to eliminate the conventional routing tables and consequently reduce the need for updating these tables to track changes in the network topology. Reactive protocols help to set up routes on-demand In the On-Demand approach, when a node desires a route to a new destination, it will have to wait until such a route can be discovered i.e. routes are discovered whenever a source node have packets to send [5]. The routing protocol will try

to establish a route for such a node that wants to initiate communication with another node to which it has no route. These kinds of protocols are usually based on flooding the network with Route Request (RREQ) and Route reply (RERP) messages. The protocol is composed of the two main mechanisms of "Route Discovery" and "Route Maintenance", which work together to allow nodes to discover and maintain routes to arbitrary destinations in the ad hoc network [6].

Dynamic source routing protocol (DSR) is an on-demand, source routing protocol [7], whereby all the routing information is maintained (continually updated) at mobile nodes. DSR allows the network to be completely self-organizing and self-configuring, without the need for any existing network infrastructure or administration. Dynamic Source Routing (DSR) is a routing protocol for wireless mesh networks. It is similar to AODV in that it establishes a route on-demand when a transmitting mobile node requests one. However, it uses source routing instead of relying on the routing table at each intermediate device [8].

3.1.3. Hybrid Protocols

To combine the advantages of proactive routing algorithms and reactive routing protocols, one more category came in place which is called Hybrid Unicast Routing Protocols which is combining the advantages of both. It is used to find a balance between both protocols. Proactive operations are restricted to small domain, whereas, reactive protocols are used for locating nodes outside those domains [9].

ZRP (Zone Routing Protocol) is nothing but a one kind of framework for the hybrid routing protocols and which is consists of different modules like Intrazone routing protocol, Interzone routing protocol and Bordercast resolution protocol. As mentioned earlier, the ZRP is not so much a distinct protocol as it provides a framework for other protocols. The separation of a nodes local neighborhood from the global topology of the entire network allows for applying different approaches and thus taking advantage of each technique's features for a given situation. These local neighborhoods are called zones.

IV. PERFORMANCE ANALYSIS

We have evaluated the performance of DSDV, DSR and ZRP on Network Simulator-2 and then compare and analyze their performance. In this grid, boundaries of 10 nodes are arranged in grid faction. Simulations were performed on the NS-2 simulator with wireless components. Nine important performance metrics are measured and their output graphs are shown in following Figures:

4.1. Send packets- This result shows that ZRP sends Maximum packets to route at different nodes.

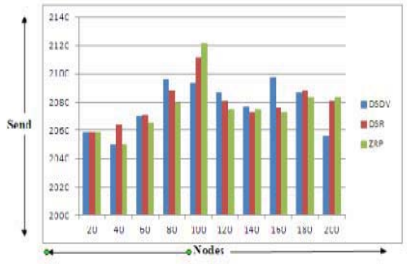

Figure 2: Send Packets graph for DSDV, DSR and ZRP Protocol

4.2. Received Packets- It signifies that DSR receives maximum packets as compare to DSDV but ZRP receives maximum packets as compare to DSR.

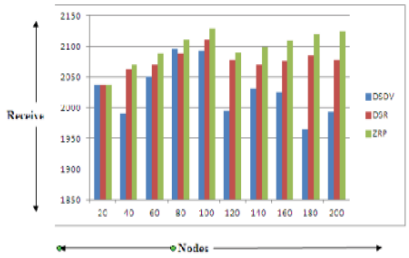

Figure 3: Received Packets graph for DSDV, DSR and ZRP Protocol

4.3. Routing Packets- A simulation result shows that ZRP have minimum routing packets among DSDV and DSR. So it is better with respect to routing packets.

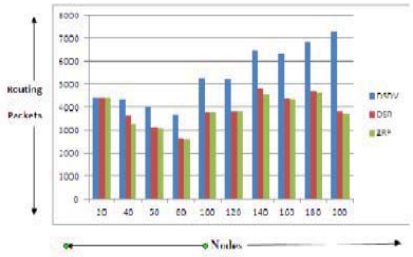

Figure4: Routing Packets graph for DSVD, DSR and ZRP protocol

4.4. Packet Delivery Friction- The packet delivery friction of ZRP is maximum as compare to others.

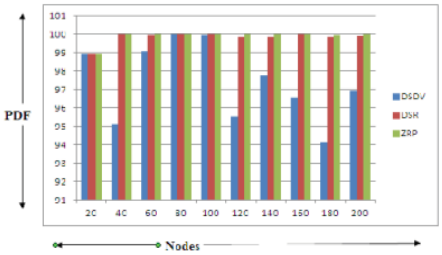

Figure 5: Packet Delivery Friction graph for DSDV, DSR and ZRP Protocol

4.5. Normalized Routing Load- We can see that the load in routing is minimum at ZRP.

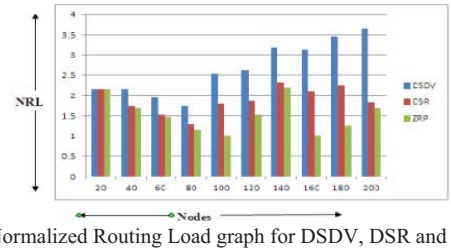

Figure 6: Normalized Routing Load graph for DSDV, DSR and ZRP protocol

4.6. Route Discovery Delay- In this graph, ZRP is giving best output as compare to DSDV and DSR but DSR is also giving good output to DSDV. In ZRP, there is no end to end delay for route discovery.

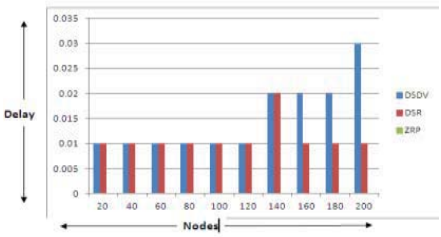

Figure 7: Route Discovery Delay graph for DSDV, DSR, and ZRP protocol

4.7. Dropped Packets- Results shows that DSDV is giving poor output and DSR is giving good result at the time of dropped packets but ZRP is giving best output at the time of dropping packets.

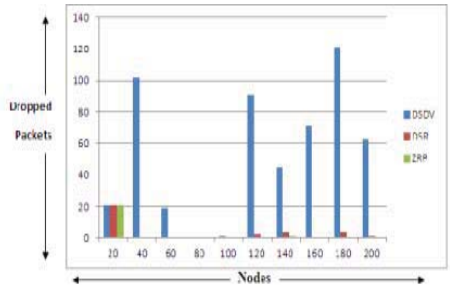

Figure 8: Dropped Packets graph for DSDV, DSR, ZRP protocol

4.8. Dropped Bytes- DSR and ZRP are giving less number of dropped bytes at the time of routing.

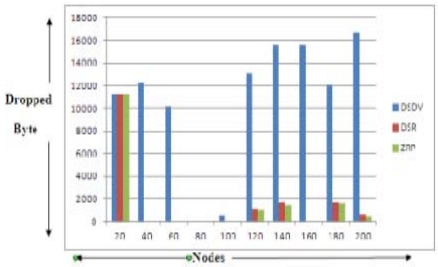

Figure 9*:* Dropped Bytes graph for DSDV, DSR and ZRP protocol

4.9. Packet Delivery Ratio- The packet delivery ratio has a downtrend with the zone radius increase in ZRP Protocol.

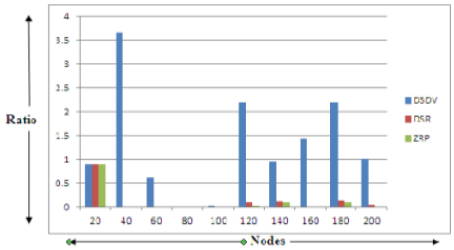

Figure 10*: Packet Delivery Ratio graph for DSDV, DSR and ZRP protocol*

V. CONCLUSION

Performance of different routing protocols like DSDV, DSR and ZRP are evaluated with different parameters. The simulation results show the better performance for ZRP with these parameters.AWK scripts is used to analyze the Trace Files, which are generated during simulations. Future prospects of these algorithms such as Proactive, Reactive, and Hybrid have some limitations. In order to remove these limitations, we need to combine the above mentioned algorithms together so as to produce a higher level algorithm and also evaluate the performance at the time of link failures of these algorithms.

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