Evaluation of Routing Protocols on the Basis of Diverse Network Simulation Area

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ABSTRACT
In present scenario, MANETs has gained very much importance and popularity in the research field. The method by which the performance of MANETs can be evaluated is the use of different simulation environments. A MANET is basically collection of distributed mobile nodes where each node whether it is transmitting or receiving data, acts as host as well as router. It is a dynamic wireless network that can be formed without any pre-existing infrastructure. This paper presents the simulation results which describe about the routing protocols on the basis of different performance metrics. AODV performs better than DSDV and ZRP on the basis of parameters like routing overhead, average end to end delay, network overload and packet delivery ratio.

General Terms
Routing, Average End To End Delay, Network Overload, Routing Overhead, Packet Delivery Ratio et. al.

Keywords
AODV, DSDV, MANET, NS-2, PDR, RREQ, ZRP.

1. INTRODUCTION
Mobile Adhoc Networks(MANETs) are the networks in which network topology changes very rapidly and unpredictably. Due to this dynamic topology, the mobile nodes in the network move to and from a wireless network without any fixed infrastructure[2]. Because of limited transmission area of these nodes, the effective throughput may be less than that of maximum transmission capacity of a node. So, it is required for one mobile node to take assistance of other nodes in forwarding its packets to the desired destination[3]. The major challenges in MANETs are routing of packets with frequent movement of mobile nodes. Also, there are resource issues like power and storage[2]. The vision of adhoc networks is wireless internet, where users can move anywhere, anytime and still remaining connected with rest of the world[4].

2. ROUTING IN MANETS
In MANETs, communication between mobile nodes always requires routing over multi-hop paths. Since, no infrastructure exists and node mobility may cause frequent link failure, it is a great challenge to design an effective and adaptive routing protocols. Some restrictions are also considered such as bandwidth and limited power[5]. MANETs are capable of handling topology changes and malfunctions in nodes through network configurations[6]. MANETs use different routing protocols according to the requirement which are classified according to several criteria, reflecting fundamental design and implementation choices[7].

MANETs routing protocols can be categorized as:

- Table driven
- Demand driven(Source initiated)

2.1 Table driven protocols
These are the protocols which maintain consistent and up to date routing information about each node in the network. These type of protocols require each node to store their routing information and when there is change in network topology, updating the information throughout the network .e.g. DSDV(Destination Sequence Distance vector), WRP(Wireless Routing Protocol ), OLSR(Optimized link State Routing) etc[7].

2.2 Demand Driven Protocols
In these type of protocols, the routes are created when required. When source wants to send to destination, it appeals to the route discovery mechanisms to find the path to the destinations. The route remains valid till the destination is reachable or until the route is no longer needed. e.g. AODV(Adhoc on-demand distance vector), DSR(Dynamic source Routing), TORA(Temporally ordered routing algorithm) etc[7].

To increase the scalability and efficiency of routing protocols third type of routing protocols are introduced which are basically the combination of characteristics of both reactive and proactive routing protocols and are called Hybrid Routing Protocols. These type of protocols are generally based on the concept of zones i.e. the whole network is divided into different number of zones. e.g. ZRP, ZHLS,SLURP[8]..

3. BRIEF DESCRIPTION OF AODV, DSDV AND ZRP
In this paper, the comparison of above three types of protocols is done by taking one from each type i.e. AODV as reactive routing protocol, DSDV as proactive routing protocol and ZRP as hybrid routing protocol.

3.1 Adhoc On-demand Distance Vector
With AODV, a source node that wants to send message to a destination for which it doesn't have a route, broadcasts an RREQ packet across the network. All the nodes receiving this packet update their information for the source node. In AODV, each node maintains only the next hop's address in a routing table and these routing tables are updated all the way along the RREQ propagation path. The RREQ contains the source node's address, broadcast ID and current sequence number as well as the destination node's most recent sequence number [9].
3.2 Destination Sequenced Distance Vector
DSDV is basically an expansion of traditional distance vector routing protocols. In this routing protocol, routing messages are exchanged among mobile nodes that are within the range of one another. A packet for which the route to its destination is not known is cached while the routing queries are sent out. The packets are cached until route replies are received from the destination[10].

3.3 Zone Routing Protocol
ZRP is a hybrid of proactive and reactive routing protocols. Since the advantage of either of the approaches depends on the characteristics of the network like degree of mobility, it could be beneficial to combine them. This protocol broadcasts a RREQ to all border nodes within the routing zone, which forwards the request if the destination node is not found within their routing zone[10].

4. SIMULATION SETUP
The simulation is performed using NS-2 simulator. NS-2 is chosen because it supports large number of routing protocols and offers easy graphical interface. The whole simulation is performed using constant number of nodes and by having different scenarios of 5000m*5000m, 6000m*6000m, 7000m*7000m and 8000m*8000m[11].

Table 1. Simulation set up used

<table>
<thead>
<tr>
<th>Protocols</th>
<th>AODV, DSDV and ZRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simulator</td>
<td>NS-2.34</td>
</tr>
<tr>
<td>Nodes</td>
<td>150</td>
</tr>
<tr>
<td>Simulation Area</td>
<td>5000m<em>5000m, 6000m</em>6000m, 7000m<em>7000m and 8000m</em>8000m</td>
</tr>
<tr>
<td>Packet Size</td>
<td>1kbps</td>
</tr>
<tr>
<td>Simulation Time</td>
<td>1000sec.</td>
</tr>
<tr>
<td>Traffic Type</td>
<td>High quality GSM voice</td>
</tr>
</tbody>
</table>

5. PERFORMANCE METRICS

5.1 Routing Overhead
Routing Overhead is the total number of control or routing (RTR) packets generated by routing protocols during the simulation. All the packets sent or forwarded at network layer is considered routing overhead[13]. On the whole, they are number of extra packets transmitted per data packet delivered at the destination[12]. Lesser value of routing overhead provides better results.

5.2 Average End to End Delay
This includes all possible delays caused by buffering during route discovery latency, queuing at the interface queue, retransmission delays at the MAC, and propagation and transfer times[1].

5.3 Network Overload
In wireless mobile adhoc networks, where there is congestion in the network due to outsized number of nodes which are sending and receiving data beyond the limit of its communication area, this is known as network overload.

5.4 Packet Delivery Ratio
It is ratio of number of packets received at the destination nodes to the number of packets sent from the source node. Higher value of PDR provides better results[13].

6. RESULTS AND OBSERVATIONS
This section provides the simulation results in order to choose the best routing protocol among AODV, DSDV and ZRP by varying the simulation area from 5000m*5000m to 8000m*8000m and denoting these simulation areas by different scenarios viz. S1 for 5000m*5000m, S2 for 6000m*6000m, S3 for 7000m*7000m and S4 for 8000m*8000m[14].


