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Comparison of Zone Routing Protocol Based on the Size of the Network

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Abstract **Review Article**

MANET is combination of wireless mobile nodes that communicate with each other without any kind of centralized control or any device or established infrastructure. Therefore, MANET routing is a critical task to perform in dynamic network. Without any fixed infrastructure, wireless mobile nodes dynamically establish the network. A mobile ad hoc network (MANET) is characterized by multihop wireless connectivity consisting of independent nodes which move dynamically by changing its network connectivity without the uses of any pre-existent infrastructure. MANET offers such flexibility which helps the network to form anywhere, at any time, as long as two or more nodes are connected and communicate with each other either directly when they are in radio range or via intermediate mobile nodes. Routing is a significant issue and challenge in ad hoc networks and many routing protocols have been proposed like OLSR, AODV, DSDV, DSR, ZRP, and TORA, LAR so far to improve the routing performance and reliability [9] This research paper provides the overview of ZRP by presenting its functionality. The performance of ZRP (Zone Routing Protocol) is analyzed on the basis of various parameters using simulator OPNET 14.0.

Keywords: MANET, Routing Protocols, ZRP.

1. INTRODUCTION

Ad-hoc networks are self-organizing wireless networks composed of mobile nodes and requiring no fixed infrastructure. The limitations on power consumption imposed by portable wireless radios result in a node transmission range that is typically small, relative to the span of the network.

To provide communication throughout the entire network, each node is also designed to serve as a relay. The result is a distributed multi -hop network with a time-varying topology. Because ad-hoc networks do not rely on existing infrastructure and are self-organizing, they can be rapidly deployed to provide robust communication in a variety of hostile environments. This makes ad-hoc networks very appropriate for providing tactical communication for military, law enforcement and emergency response efforts.

Ad-hoc networks can also play a role in civilian forums such as electronic classrooms, convention centers and construction sites. With such a broad scope of applications, it is not difficult to envision ad-hoc networks operating over a wide range of coverage areas, node densities and node velocities. A mobile ad hoc network may consist of only two nodes or hundred nodes or thousand nodes as well. The entire collection of nodes is interconnected in many different ways. As shown in Fig-1 there is more than one path from one node to another node. To forward a data packet from source to destination, every node in the hope must be willing to participate in the process of delivering the data packet. A single file is split it into a number of data packets and then these data packets are transmitted through the different paths. At the destination node, all these packets are combined in sequence to generate the original file.

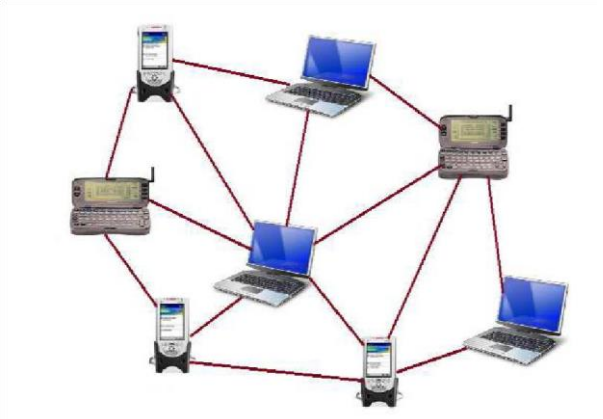
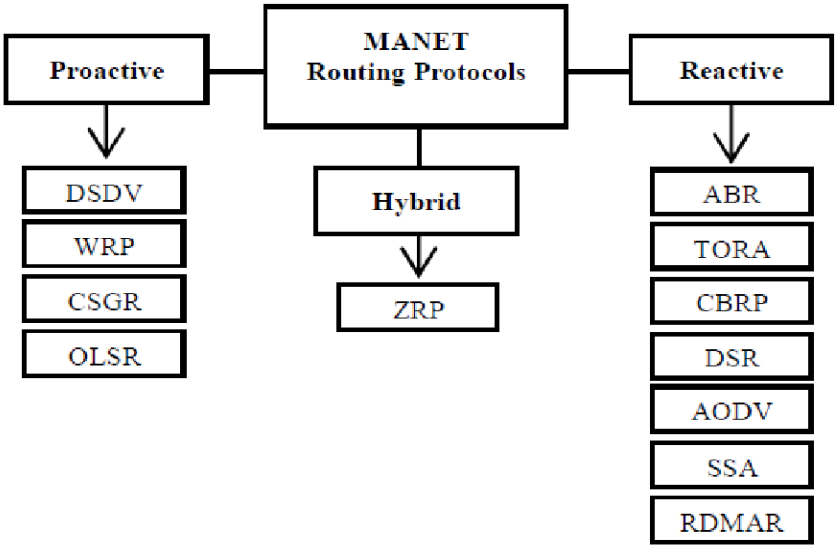


Fig. 1: Mobile Ad hoc Network

2. ROUTING IN MANET

Routing [3] is the process of transferring a packet from source to its destination. In the routing process, a mobile node will search for a path or route to communicate with the other node in the network. Protocols are the set of rules through which two or more devices communicate with each other. In MANET, routing tables are used for routing purpose. Routing tables contain the information of routes to all the mobile nodes .The routing protocols in MANET are broadly classified into three categories:

- Proactive or Table-Driven Routing Protocols.
- Reactive or On-Demand Routing Protocols.
- Hybrid Routing Protocols.



2.1. Proactive or Table Driven Routing Protocols

In proactive protocols, each node maintains individual routing table containing routing information for every node in the network. Each node maintains consistent and current up-to-date routing information by sending control messages periodically between the nodes which update their routing tables. The proactive routing protocols use link-state routing algorithms which frequently flood the link information about its neighbors. The drawback of proactive routing protocol is that all the nodes in the network always maintain an updated table. Some of the existing proactive routing protocols are DSDV and OLSR.

2.2. Reactive or On-demand Routing Protocols

In Reactive or On-Demand [1] Routing Protocols, routes are not predefined. For packet transmission, a source node calls for route discovery phase to determine the route. The route discovery mechanism is based on flooding algorithm which employs on technique that a node just broadcasts the packet to all its neighbours and intermediate nodes forwards the packets to their neighbours. Reactive protocols are Dynamic Source Routing (DSR), Ad hoc On Demand Distance Vector (AODV) and Temporally Ordered Routing Algorithm (TORA).

2.3. Hybrid Routing Protocols

Hybrid Protocols [4] are the combination of both i.e. Table-Driven and On-Demand protocols. These protocols take the advantage of best features of both the above-mentioned protocols. These protocols exploit the hierarchical network architecture and allow the nodes to work together to form some sort of backbone, thus increasing scalability and reducing route discovery. Nodes within a particular geographical area are said to be within the routing zone of the given node. For routing within this zone, Proactive i.e. table-driven approach is used. For nodes that are located outside this zone, Reactive i.e. an on demand approach is used. So in Hybrid Routing Protocols, the route is established with proactive routes and uses reactive flooding for new mobile nodes [2]. In Hybrid Routing protocols, some of the characteristics of proactive and some of the characteristics of reactive protocols are combined, by maintaining intra-zone information proactively and inter-zone information reactively, into one to get better solution for mobile ad hoc.

3. ZONE ROUTING PROTOCOL

Zone Routing Protocol or ZRP was the first hybrid routing protocol with both a proactive and a reactive routing component. ZRP was first introduced by Haas in 1997. ZRP is proposed to reduce the control overhead of proactive routing protocols and decrease the latency caused by routing discover in reactive routing protocols. ZRP defines a zone around each node consisting of its kneighborhood (e. g. k=3). In ZRP, the distance and a node, all nodes within hop distance from node belong to the routing zone of node. ZRP is formed by two sub-protocols, a proactive routing protocol: Intra-zone Routing Protocol (IARP), is used inside routing zones and a reactive routing protocol: Inter-zone Routing Protocol (IERP), is used between routing zones, respectively.

A route to a destination within the local zone can be established from the proactively cached routing table of the source by IARP; therefore, if the source and destination is in the same zone, the packet can be delivered immediately. For each node a routing zone is defined separately. Within the routing zone, routes are available immediately but for outside the zone, ZRP employs route discovery procedure. For each node, a separate routing zone is defined.

The routing zones of neighboring nodes overlap with each other's zone. Each routing zone has a radius ρ expressed in hops. The zone includes the nodes whose distance from the source node is at most ρ hops. In Fig-2, routing zone of radius 2 hops for node A is shown. Routing zone includes nodes all the nodes except node L, because it lies outside the routing zone node A. The routing zone is not defined as physical distance, it is defined in hops. There are two types of nodes for a routing zone in ZRP:

- Peripheral Nodes.
- Interior Nodes.

The nodes whose minimum distance to central node is exactly equal to the zone radius ρ are Peripheral Nodes while the nodes whose minimum distance is less than the zone radius ρ are Interior Nodes. In Fig. 2, Peripheral nodes are E, F, G, K, M and Interior Nodes are B, C, D, H, I, J.

The node L is outside the routing zone of node A.

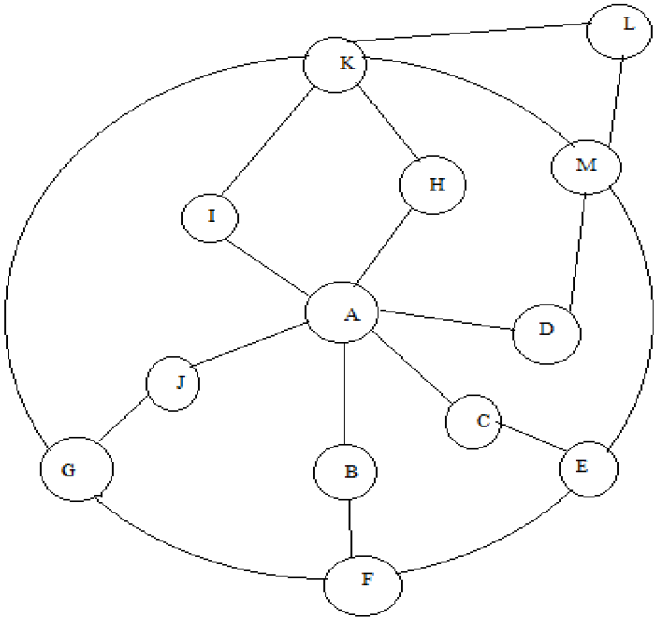


Fig. 2: Routing Zone of Node A with Radius ρ=2 hop

4. SIMULATION PARAMETERS

To analyse the performance of ZRP OPNET 14.0 simulator is used. Scenario is created with 40 numbers of mobile nodes. The pause time and traffic load are kept constant under all the scenarios. Simulation parameters used for the implementation of ZRP are listed in the Table 1.

Table 1: Simulation Parameters

Parameters	Values
Simulator	OPNET 14.0
Protocol	ZRP
Simulation Time	600 sec
Simulation Area	800m *800 m
Data Rate	11 Mbps
Number of Nodes	40
Buffer Size	1024000

4.1 Performance Metrics

The following performance metrics are used to analyze the simulated result:-

(a) Throughput [2]: Throughput is the average rate of successful data packets received at the destination .It is the measure of how fast we can actually send the packets through the network. It is measured in bits per second (bits/sec or bps) or data packets per second.

(b) Load [4]: Load in the wireless LAN is the number of packets sent to the network greater than the capacity of the network. When the load is less than the capacity of the network, the delay in packets is minimum. The delay increases when the load reaches the network capacity.

(c) Delay [7]: The packet end-to-end delay refers to the time taken for a packet to be transmitted across

the network from source to destination. In other words, it is the time a data packet is received by the destination minus the time a data packet is generated by the source. It is measured in seconds. End. Lost packets due to delay have a negative effect on received quality.

5. RESULTS AND ANALYSIS

1. **Load:** From Fig-4 it is observed that load of ZRP is 50,000 bits per second with 20 nodes. Maximum load of 182,000 bits per second is observed with 40 nodes.

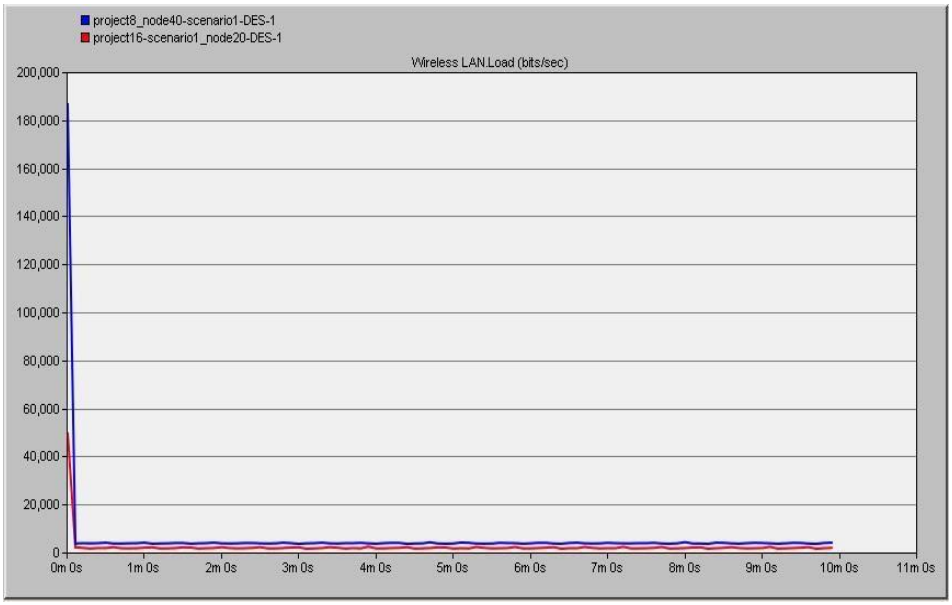


Fig. 3: Load over 20 and 40 nodes in ZRP

2. **Throughput**: It is observed from the Fig-4 that with 40 nodes the throughput of ZRP is about 3,550,000 bits per second in starting and 580,000 bits per second with 20 nodes.

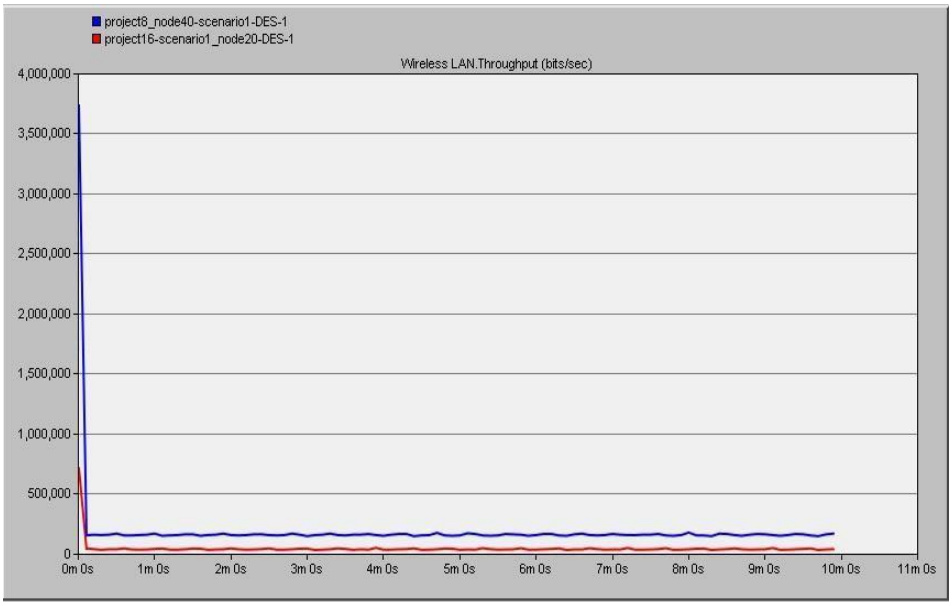


Fig. 4: Throughput over 20 and 40 nodes in ZRP

3. **Delay**: From Fig-5, it is observed that delay of ZRP is high at .0057 sec is observed with 40 nodes and .0033 second with 20 nodes.

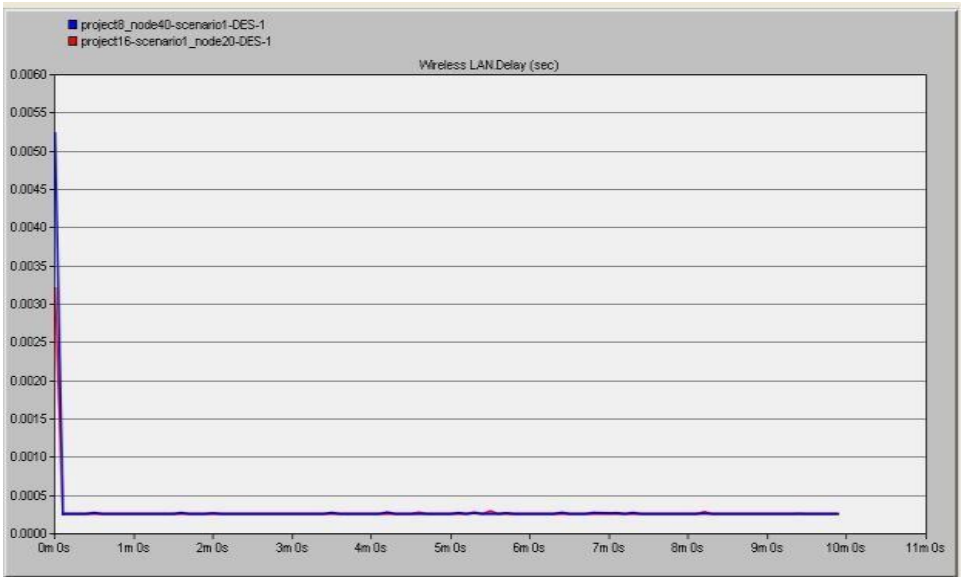


Fig. 5: Delay over 20 and 40 nodes in ZRP

6. CONCLUSION

The Zone Routing Protocol (ZRP) provides a flexible solution to the challenge of discovering and maintaining routes. The ZRP combines two radically different methods of routing into one protocol. Route discovery is based on a reactive route request / route reply scheme. This querying can be performed efficiently through the proactive maintenance of a local *routing zone* topology. In this paper, a performance analysis of ZRP routing protocols for mobile Ad-hoc networks is presented with 20 and 40 nodes. Performance of these routing protocols is evaluated with respect to four performance metrics such as delay, load and throughput. As observed from the results that when the simulation starts no data is dropped till one minute also the throughput is also less and throughput also increases till the end of the simulation. The simulation study of this report consisted of routing protocol ZRP deployed over MANET using Voice Conferencing Application analysing their behavior. So the results of zrp are pretty good.

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