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Performance Analysis of Routing Protocol in Mobile Ad-hoc Network

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Abstract: *Mobile Ad-hoc Networks (MANETs) are a form of a network where the mobility of nodes is relatively high, making them ideal for mobile applications. Every node in MANET can join, quit, and move all through the organization freely. This versatility brings about a profoundly powerful climate, which affects packet routing. Subsequently, quite possibly the most troublesome issues in MANET is proficient packet routing. Routing's goal is to get packets to their final destinations by guiding them through the communication network. Various protocols are designed to determine the most effectual route from source to destination, with a definitive objective of establishing an systematized route and communication exchange within MANET. In this paper, enhanced the DSR routing protocol to improve the network packet performance. For the evaluation of performance our modified protocol tested in different network scenario tested through simulations for different distributions of nodes. Our proposed modified scheme "EAM-DSR" simulate in NS-2 simulator. In simulation process we used 20, 40, 60, 80 and 100 nodes. The evaluation of performance is measured by packet delivery ratio, end to end delay and packet throughputs.*

Keywords: *Mobile ad-hoc network, Wireless network, Quality of services, Network simulator, Routing protocol, Wireless sensor networks, Wireless mesh networks.*

1. INTRODUCTION

Mobile ad-hoc Network (MANET)- The MANET is the one of the type of ad hoc network, is a infrastructure less wireless device that's why it move to anywhere in any direction. A mobile ad hoc network (MANET) consists of mobile hosts equipped with wireless communication devices. The transmission of a mobile host is received by all hosts within its transmission range due to the broadcast nature of wireless communication and Omni-directional antennae. Mobile ad hoc network is a kind of wireless network, is self-configuring infrastructures less network devices are connected by wireless. The devices of MANET network is free to move independently in any direction that's why linking with any other devices is easily done. Each must forward traffic unrelated to its own use, and therefore be a router. The primary goal of Mobile ad hoc network is each device to continuously maintain the information required to properly route traffic. Such networks may operate by themselves or may be connected to the larger Internet. The achievement of MANET is hug growth of laptops and wireless or Wi/Fi networking [14].

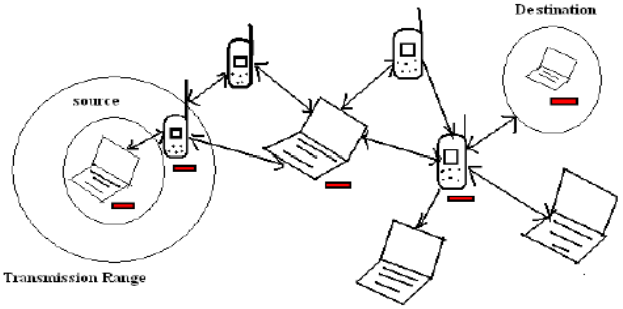

Figure 1: Mobile ad hoc network.

2. MANET ROUTING PROTOCOLS

The routing process in MANET is responsible for discovering, establishing, and maintaining a route between two mobile nodes. Routing of packets can be performed using either a single-hop or a multi-hop paradigm [1]. In the single-hop paradigm, the destination node is assumed to be inside the communication range of the source node. Thus, the source node can connect with its destination directly. Within the multi-hop model, the source node can interact with its destination via intermediate nodes while the destination is outside the source node's communication range. MANET is regarded as a multi-hop network where mobile nodes in the network collaboratively help in forwarding the data or control packets between the source node and its destination. The mobile nodes are involved in the discovery of routes, and once found, the intermediate mobile nodes on the routes would have key roles in maintaining the routes. There are some difficulties in establishing a route between source and destination nodes through intermediate nodes including low bandwidth, limited coverage and connectivity due to limited transmission range, higher error rate, high possibility of interference, power consumption, no centralized mechanism for routing, and frequent network topology changes due to mobility. Mobility makes routing a more complex task in MANET. Routing protocols should be capable of managing routing in MANET efficiently; therefore, it is important to investigate the advantages and disadvantages of the different protocols for MANET to identify the performance evaluation of each routing protocol as the applications of MANET are strongly dependent upon the underlying routing protocol which must be reliable and robust to accommodate frequent disruptions in the communication between mobile node pairs due to node mobility, interference, and lack of infrastructure. These routing protocols can be categorized functionally and structurally based on their routing processes and structures; therefore, the main goal of this work is to perform a comparison between the routing protocol categories with respect to the common parametric evaluation metrics.

A. Table Driven Routing Protocols

Tables-driven protocols also called proactive protocols are developed depending on link state and distance vector routing techniques that are traditionally used on the Internet. The main characteristic of this type of protocol is that they are proactive in the sense that every mobile node maintains an updated routing table to any other node in the network. Therefore, each node should periodically communicate routing information with other nodes in order to maintain its routing table up-to-date on whether the routes are used or not [23], [24]. The frequency of updating the routing tables is crucial. Even though it can reflect the state of the network accurately, and the routing process would be robust to the dynamic changes in the network; however, the bandwidth usage for exchanging routing information will be high. This would leave not much bandwidth for delivering data packets, which affects throughput at the destination nodes considerably. Furthermore, it causes Broadcast Storm Problems (BSP) [4], [20], as the network will be flooded with routing information updates. Hence, the bandwidth for sending data packets will be reduced significantly; especially, in MANET with high node density. On the other hand, as table-driven protocols ensure that routes to destinations are always available, this would reduce the delay in sending data packets once required. In reaction to network topology changes, each proactive protocol reacts differently according to its routing structure, the size of the routing table, and the frequency of routing information updates.

B. On-demand Routing Protocols

On-demand routing protocols also called reactive routing protocols were developed to improve scalability and overhead problems presented by table-driven routing protocols. The aim is to save bandwidth by reducing the number of control messages sent across the network. Therefore, a route to a destination is only looked up when the higher protocol levels demand it, compared with the periodic search for routes and updating them as with proactive protocols. Subsequently, the routing overhead is decreased significantly, which makes it more suitable for mobile network environments [15]. There are two main processes in reactive routing; which are route detection and route maintenance. When a Source node (S) needs to forward data, it first searches its routing table to examine whether it has a route to the desired Destination (D). If there is no route found, a route detection procedure is generated in order to discover a route to the destination.

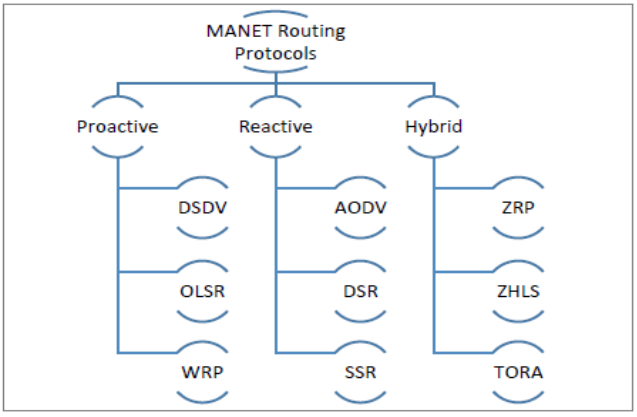

Figure 2: MANET routing protocols categories [4].

C. Proactive Routing Protocols

When it comes to routing protocols of this sort, the path that will be taken between nodes is determined in advance. The most recent route between different nodes in the network needs to be meticulously maintained at all times. On the other hand, for particularly dynamic network topologies, proactive schemes place an emphasis on the management of significant amounts of resources in order to maintain the accuracy and consistency of routing information. In such designs, the finding overheads are significant because one needs to discover all of the nodes. Therefore, there will be no delay in transmission if a route has already been obtained by a node before the traffic arrives at that node. Nodes will periodically share their information with one another in proactive routing protocols as a reaction to topological changes that have been caused. The primary benefit is that it reduces the amount of time that is wasted waiting on a needed route when there is initiating traffic to a required destination and it determines in a short amount of time whether or not a destination is attainable. It is possible that a substantial number of network resources will be used up during the procedure.

D. Reactive Routing Protocols

In this type of routing protocol, the path between the nodes is formed when a node decides it wants to exchange its packets. As it moves from the source node to the destination node, this node now starts the process of route discovery in advance. The method is considered successful when a route is recognized by both nodes in the hypothetical situation. This type of data transfer is recorded in a table along with each potential path, starting at the source and remaining there until the route is no longer required. Each intermediate node is essential for maintaining the link's records between the source and the destination. These intermediary nodes will help send the replies back to the source after a request has been issued to the destination from the source node. Data traffic will start being transmitted to the destination as soon as the source node receives the response.

E. Hybrid Protocols

The proactive and reactive routing techniques have been combined to create the hybrid routing protocol. It is believed that the protocols at issue combine elements from both of the aforementioned groups. It is envisaged that the utilization of this scenario will allow for a reduction in the overheads associated with route discovery, as well as the realization of the benefits of both proactive and reactive routing methods.

3. PROPOSED MODEL

Simulation is a fundamental tool in the development of MANET protocols, because the difficulty to deploy and debug them in real networks. The simulation eases the analyzing and the verification of the protocols, mainly in large-scale systems. It offers flexible testing with different topologies, mobility patterns, and several physical and link-layer protocols. However, a simulation cannot provide evidence in real-world scenarios, due to assumptions and simplifications that it makes. Therefore, the results obtained from the simulations should be evaluated appropriately. The well-known simulators are used for MANET simulations: NS-2.34. In this simulation model, The NS-2 tool is used for the simulation of routing protocols. It provides complete multi-hop wireless networks with the physical, data link, and medium access control (MAC) layer.

In this work, the protocol EAM-DSR is proposed as an optimization of the currently functioning efficient DSR protocol. This adaptive protocol utilizes the battery power of the node and links signal strength as the metrics for the route selection. The signal strength of node depends upon the distance that exists between the neighboring linked nodes. The choosing of the path is done on the basis of path with maximum battery power and signal strength.

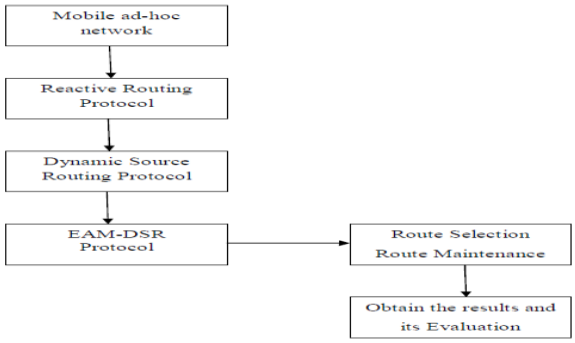

Figure 3: Proposed work block diagram

Initially, the new route finding process is initiated on requirement of data transfer from one node to another node in case of the non-availability of existing route to the receiver node. The source node starts the process of finding the new route by broadcasting the RREQ packet to all the nodes available in the neighborhood of the source node. The neighboring nodes on accepting the RREQ record the address of the source node in RREQ table and avoid receiving the RREQ once again from the same node. It searches for the availability route to destination in routing table of the nodes present currently in the neighborhood. If the neighboring node is the destination node or if the neighboring node has the exact path available to the destination node, then the route is generated and data transmission gets started. In case if the neighboring node does not have the route to the receiver node, then it rebroadcasts the RREQ packet to its neighboring nodes and increases the hop count value by 1. This process continues till receiver node is reached or it reaches an intermediate node with path to the receiver node.

There are some steps we have to follow to implement this system are following:-

Step 1- begin the process of virtualization and open the vmware machine and turn on the power of virtual machine.
Step 2- After the successful power on for machine login with the id and password to enter into machine.
Step 3- Run the tool command script file for the network simulator.
Step 4- Open the shell scripting window and run the file using shell command.
Step 5- Apply the reactive routing protocol with network simulator like DSR and EAMDSR approach.
Step 6- Find the best route according to applied techniques with network simulator and find the best route or path.
Step 7- Getting the optimal routing results.
Step 8- Stop the experimental simulation process and end the vmware machine with power off signal.

4. RESULT &DISCUSSIONS

In this section we discuss about the proposed experimental results compare with the existing techniques; also discuss about the simulation experimental environment and the snapshot for the proposed and existing methods results. The proposed work gives the better results than the existing techniques, the performance evaluation parameters are such as the delay between the packets are transmitting between source and destination, throughput for the delivered number of packets and the packet delivery ratio for a packet between source and destination. For experimental process used network simulator 2 and find some performance parameters and their comparative study between dynamic source routing protocol, and enhanced adaptive multipath dynamic source routing protocol on some parameters like packet delivery ratio, throughput, and end to end delay.

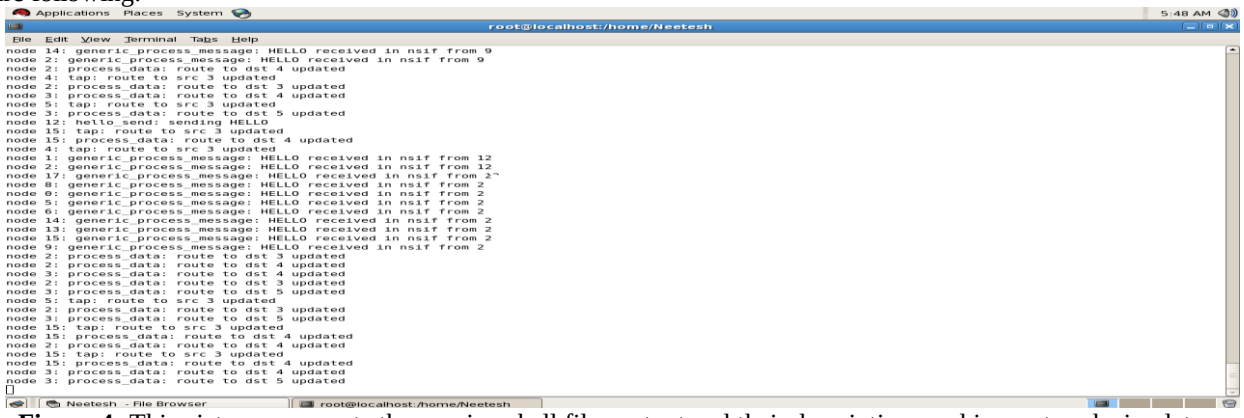

Figure 4: This picture represents the running shell files output and their description used in a network simulator.

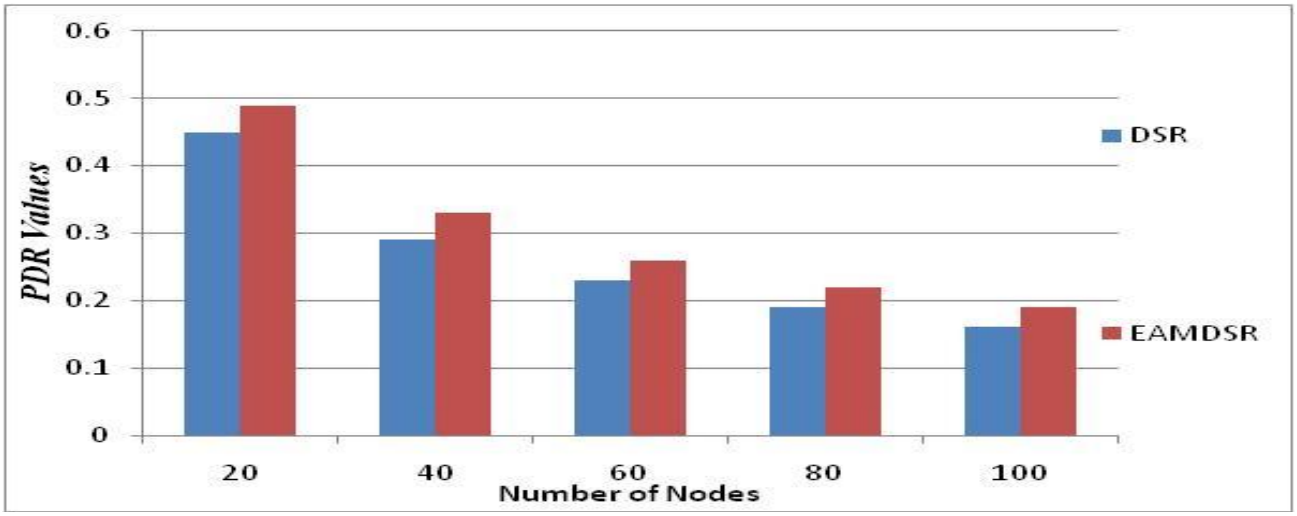

Figure 5: This picture represents the packet delivery ratio performance parameters value using the dynamic source routing protocol and enhanced adaptive multipath dynamic source routing protocol.

5. CONCLUSION

A Mobile Ad-hoc network is a combination of different nodes, created for communicating each other without any infrastructure. Transmitting of packets from source to destination is one of the greatest challenges because the packet should reach the destination without disturbances like delay, packet loss. There are various routing protocols are used to send packet data from source to destination, Dynamic source routing protocol is one of them which transfer the data in an efficient manner. In this dissertation enhanced the DSR routing protocol to improve the network packet performance. For the evaluation of performance our modified protocol tested in different network scenario tested through simulations for different distributions of nodes. Our proposed modified scheme "EAM-DSR" simulate in NS-2 simulator. In simulation process we used 20, 40, 60, 80 and 100 nodes. The evaluation of performance is measured by packet delivery ratio, end to end delay and packet throughputs.

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