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Compare the Performance of the Two Prominent Routing Protocols for Mobile Ad-hoc Networks

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***Abstract*—An ad hoc network is a collection of wireless mobile nodes, frequently forming a network topology without the use of any existing network infrastructure or centralized administration. compare the performance of the two prominent routing protocols for mobile ad hoc networks Dynamic Source Routing – DSR, Destination Sequenced Distance Vector(DSDV) and Temporally Ordered Routing Protocols (TORA). We have chosen four performance metrics, such as Average Delay, Packet Delivery Fraction, Routing Load and Varying MANET Size, simulation for the popular routing protocols DSR, DSDV and TORA. The simulations are carried out on NS-2. The performance differentials are analyzed using varying network size and simulation times. The simulation results confirm that DSR performs well in terms of Average Delay, Packet Delivery Fraction. As far as Routing Load concerns TORA performs well.**

***Index Terms*—Ad hoc Networks, Average Delay, Performance Analysis, Routing Protocols, Simulation.**

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I. INTRODUCTION

Wireless network is the network of mobile computer nodes or stations that are not physically wired. The main advantage of this is communicating with rest of the world while being mobile. The disadvantage of this is their limited bandwidth, memory, processing capabilities, open medium and less secure compared to wired devices[2]. Two basic system models are Fixed backbone wireless system and Wireless Mobile Ad hoc Network (MANET).An ad hoc network is a collection of nodes that do not need rely on a predefined infrastructure to keep the network connected. So the functioning of Ad-hoc networks is dependent on the trust and co-operation between nodes. Nodes help each other in conveying information about the topology of the network and share the responsibility of managing the network. Hence in addition to acting as hosts, each mobile node does the function of routing and relaying messages for other mobile nodes [2]. Routing protocols can be divided into proactive, reactive and hybrid protocols, depending on the routing topology [3]. Proactive routing protocols: In proactive protocols, the routes are discovered before usage avoiding the latency incurred in finding the route. These protocols require the nodes to maintain routing and network topology information through one or more tables. Any change in the network needs to be reflected in these tables by propagating the changes throughout the network. Examples of this class include DSDV, WRP. Reactive routing protocols: Reactive protocols try to conserve the precious battery power of the nodes by discovering routes only when it is required.

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Only when there is a packet to be transferred, the route discovery protocol is initiated by the source and the route is found. Because of this nature, this class of routing protocols is also called as "Dynamic routing protocols". Examples of this class include DSR, AODV and ABR.

Ad-hoc On Demand Distance Vector –AODV:

AODV is a reactive routing protocol. That is, AODV requests a route only when needed and does not require nodes to maintain routes to destinations that are not communicating. The process of finding routes is referred to as the route acquisition. AODV uses sequence numbers in a way similar to DSDV to avoid routing loops and to indicate the freshness of a route. Whenever a node needs to find a route to another node it broadcasts a Route Request (RREQ) message to all its neighbours. The RREQ message is flooded through the network until it reaches the destination or a node with a fresh route to the destination. On its way through the network, the RREQ message initiates creation of temporary route table entries for the reverse route in the nodes it passes. If the destination, or a route to it, is found, the route is made available by unicasting a Route Reply (RREP) message back to the source along the temporary reverse path of the received RREQ message. On its way back to the source, the RREP message initiates creation of routing table entries for the destination in intermediate nodes. Routing table entries expire after a certain time-out period.

Dynamic Source Routing – DSR:

Dynamic Source Routing [6,10] is a reactive routing protocol which uses source routing to deliver data packets. Headers of data packets carry the sequence of nodes through which the packet must pass. This means that intermediate nodes only need to keep track of their immediate neighbours in order to forward data packets. The source, on the other hand, needs to know the complete hop sequence to the destination. As in AODV, the route acquisition procedure in DSR requests a route by flooding a Route Request packet. A node receiving a Route Request packet searches its route cache, where all its known routes are stored, for a route to the requested destination. If no route is found, it forwards the Route Request packet further on after having added its own address to the hop sequence stored in the Route Request packet. The Route Request packet propagates through the network until it reaches either the destination or a node with a route to the destination. If a route is found, a Route Reply packet containing the proper hop sequence for reaching the destination is unicasted back to the source node. DSR does not rely on bi-directional links since the Route Reply packet is sent to the source node either according to a route already stored in the route cache of the replying node, or by being piggybacked on a Route Request packet for the source node. However, bi-directional links are assumed throughout this study. Then the reverse path in the Route Request packet can be used by the Route Reply message. The DSR protocol has the advantage of being able to learn routes from the source routes in received packets. To avoid unnecessarily flooding the network with Route Request messages, the route acquisition procedure first queries the neighbouring nodes to see if a route is available in the immediate neighbourhood. This is done by sending a first Route Request message with the hop limit set to zero, thus it will not be forwarded by the neighbours. If no response is obtained by this initial request, a new Route Request message is flooded over the entire network.

DSDV (Distance sequenced distance vector):
Distance sequence distance vector is proactive routing protocol, which is conventional modification of Bellmen-Ford routing algorithm. This protocol adds sequence number, attribute for each route table in each node. Routing table is maintained in each node and this table transmits data packets to other nodes in the network. This protocol was motivated for the use of data exchange along with changing and arbitrary paths of interconnection which may not be close to any base station. All stations list available in the destinations and number of nodes required to transmit data to destination in the routing table. The routing entry is tagged with the sequence number which is originated by the destination station. To consistency this, each station transmits and updates routing table periodically. The packets being broadcasted between stations indicate which station are sending and number of hopes required to reach the particular station [7]. The data broadcast by each node will contains new sequence number and destination address, the number of hops required to reach destination and new sequence number, originally stamped by the destination in each new route table. The Broadcasting of data in DSDV protocol mainly two types 1) full dump and 2) Incremental dumps. Full dump will carry all routing information while incremental dump is only the last change of full dump. These two types of broadcasting done in the network protocol data unit. For full dumps required network protocol data unit but incremental dumps required one network protocol data unit. Proactive routing protocol is based on periodic exchange of control message and maintaining routing table. Each node maintains complete information about the network. This information is collected from each node from routing table. And each node knows complete topology and it can find best node to route the information. Proactive protocols generates large volume of control message, it uses large amount of bandwidth. The control messages may consume almost the entire bandwidth with the large amount of nodes.

Temporally Ordered Routing Algorithm (TORA):
TORA is most well know LRR (Link Reversal Routing) algorithm. The Temporally Ordered Routing Algorithm (TORA) is a highly adaptive loop-free distributed routing algorithm based on the concept of link reversal. TORA is supposed to be operative in a highly dynamic mobile networking environment. TORA is efficient to use where the topology is not changes fast as to make flooding the only from transmitting the messages and it is not so slow to make the use of algorithms supporting shortest path calculation applicable. So algorithm is applicable where network size, rate of topology changes and bandwidth size. TORA minimizes the network messages in reaction to changes in topology, which are caused by link activation and failure. The algorithm localizes the reaction to these topological changes. TORA does not maintains information sufficient to support shortest path calculation, and it maintains only the state information which is sufficient for a DAG (directed acyclic graph)routed at destination. So the destination node with no outing links. The maintenance of Dag provides a loop free commutation to the destination, and also it allows multi path extensions to destinations. TORA is source initiated and demand driven. Therefore, due to its nature, it forgoes optimal routing. It does not make sure to select the shortest possible path, even though it can be shown that due to the nature of RPY message propagation, shorter paths are more likely to form. TORA's key feature is its reaction to link failures. This reaction is structured as a temporally ordered sequence of diffusing computations with each computation consisting of a sequence of directed link reversals. Each link reversal sequence effectively conducts a search for alternative routes to the destination. The search mechanism in TORA often involves only a single pass of the distributed algorithm because it simultaneously modifies the routing tables during the outward phase of the search procedure itself. This is not the case in other approaches such as DSR and AODV which take three-pass procedures (i.e. route-error/route-request/route-reply) to discover new routes when a node loses its last route. The algorithm uses a "physical or logical clock" to provide a temporal order of topological change events, which is used to structure the protocol's reaction to changes.

Associativity-Based Routing (ABR):
Associativity Based Routing (ABR) protocol is a new approach for routing proposed by C.K. Toh at the Cambridge University in 1996. In ABR, a route is chosen based on associativity states of nodes and temporal stability of the links between the node. ABR is beacon-based, so that each node generates periodic beacons (hello messages) to indicate its existence to the neighbors. The fundamental objective of ABR is to find longer-lived routes for ad hoc mobile networks. These beacons are used to revise the associativity table of each node. With the temporal stability and the associativity table the nodes are able to classify each neighbor link as stable or unstable. The three phases of ABR are Route discovery, Route reconstruction (RRC) and Route deletion. Stable routes have a higher preference compared to shorter routes. Fewer paths will break which reduces flooding (bandwidth). In ABR a broken link is repaired locally, so the source node would not begin a new path-finding-process when a broken link appears. Stability information is only used during the route selection process. Sometimes the elected path may be longer than the shortest path, because of the preference given to stable paths, which are not necessary, this may be disadvantage. In ABR local query broadcasts may result in high delays during the route repair.

II. Simulation Model

Network Simulator (NS-2.34) accepts input as a scenario file. The proposed project runs under 2mbps bit rate. And the fixed number of packet sizes of 512 bytes with a pause time. The simulation uses 5 different nodes with one source and destination and by 2 getaways. The scenario contains exact way of each node and the exact packets source by each node, and with that exact time at which each change in motion or packet sources is to occur. The trace file created by each run, it the file stored in disk, and it is analyzed using a variety of scripts, and the file is calls trace file, with extension of (.tr). The trace tile that counts the number of packets successfully delivered and the length of the paths taken by the packets, as well as additional information about the internal functioning of each script executed. This data is further analyzed with AWK file. The bellow figure show the exact flow of data.

SIMULATION
The aim of proposed paper is implementation of DSDV and DSR routing protocols for 5 different nodes sending CRB packets with randomly. After that CRB and scenario file generated. After that DSDV simulation will be done and NAM, trace file created. And the same way another NAM and trace file will be generated.

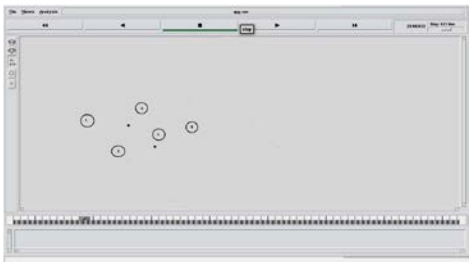

Figure 1. Packet discovery

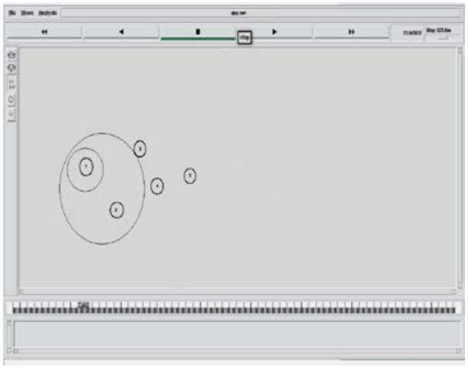

Figure 2: Packet dropping

The mobility model uses the random waypoint in a rectangular area. The area is configured with 500 X 800 m with a 5 nodes. And these five mobile nodes communicate with some fixed nodes located on the internet through a getaway. And it is then selects a random destination in defined topology area and moves to the destination with a random speed. Once the destination is reached, another random destination is target at a pause time. The pause time which effective relative time of the mobiles, is varied. And the simulation time is 100 simulated second. The simulation goal is comparing different approaches for getaway, the traffic sources chosen is to be constant bit rat (CBR). In this study we found that each node generates packets for every 0.2 seconds. Means for every one minute each source generates 5 packets. And each packet contains 512 of bytes of data. It means the total amount of data generated is 5*512*8=20 bits per second each sources. The complete traffic Patten is generated by CMU traffic generator.

III. Analysis And Results

There are three different approaches for performance matrices.
1) Packet delivery fraction,
2) average end to end delay of packets,
3) Average routing load.

PACKET DELIVERY RATIO

It is observed that for mobiles more link breaks due to the shorter routes getaway problem. Due to link break it is possible that lost of data packets, because source continuously sends data packets until it gets reroute reply message from any mobile node that the link has been broken. Getting route reply message from source can be delay or long time, during this time data can be lost. When a pause time interval increase mobile node receives less getaway information and it is not able to update the route getaway for short advertisement intervals. The positive effect of periodic information decreases and advertisement inter increases.

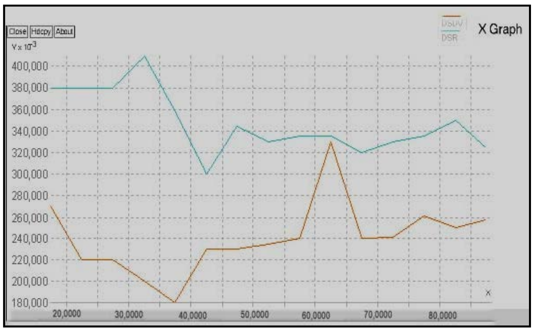

Figure 3. Packet delivery ratios

END TO END DELAY

It is observed that the average end to end delay is less for DSDV protocol comparing to DSR protocol. Because of the periodic getaway information sent by the getaways allows the all mobile nodes to update their route tale according to the getaway, for finding latest and shorter getaway. But while coming to DSR end to end delay is more because of it is reactive approach, a mobile node continuous to use a route to a getaway until the links is broken. But in some times it may be long and even if a mobile nod is near to another getaway in that even it doesn't uses this getaway. And it continuously sends data packets along the long route to getaway until the link is broken. For this the delay of data packets increase for end to end, once it is delay for all packets will be delayed. And it is also observed that end to end delay decreases for very sort time when the advertisement interval is increase.

ROUTING LOAD

It observed that lower routing load for DSR comparing to DSDV, when number of nodes are increased. In DSDV routing table maintained in each node and this table transmits data packets to other nodes in the network. The occasion routing table may be old or it may not be updated. In DSDV the routing table will be maintained in each host, due to that the average routing load on network.

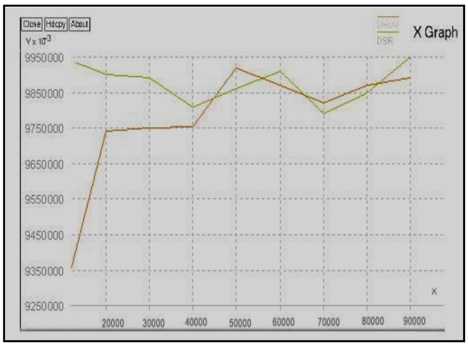

Figure 4. End to end delay.

IV. Conclusion

The proposed paper implemented two different routing protocols Destination sequenced Distance vector (DSDV) and Dynamic Source Routing (DSR) protocol. The performance of these two protocols measured with different scenario like 1) packet delivery fraction 2) packet delay at end to end point 3) routing load. The simulation results show that Dynamic Source Routing (DSR) protocol is better then DSDV. It is also observed that some time DSDV is also better then DSR. It is also observed that the speed and performance of the DSR is very good. And when number of nodes are increased the performance will goes down for DSDV. While working with DSDV, in DSDV routing each host maintains routing a table. This may cause routing load on network. And it is also observed that when the pause time low performance is better. But when the pause time is higher, it is better performance of DSR comparing to DSDV. And all these performances are depends on different seniors.

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