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A Survey and Comparative Study Of Ad-hoc Routing Protocols in Mobile Ad-hoc Network

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ABSTRACT-**A Mobile Ad hoc Network is a wireless ad-hoc network, and is a self-configuring network of mobile routers connected by wireless links. Mobile Ad-Hoc Network (MANET) is infrastructure less, Self-configurable andeasy deployment feature of the MANET resulted in numerous applications in this modern era. Efficient routing protocols will make MANETs reliable. [4] Mobile ad hoc network topology is dynamic that can change rapidly because the nodes move freely and can organize themselves randomly. This property of the nodes makes the mobile ad hoc networks unpredictable from the point of view of scalability and topology. In this paper, an attempt has been made to compare three well know protocols DSR, AODV & DSDV by using three performance metrics packet delivery ratio, average end to end delay and routing overhead.[1]It also discusses the routing protocols in detail and implementation or the above work is done in Network Simulator(NS2)**

Keywords: MANET, DSR, AODV, Routing Misbehavior, DSDV.

I. INTRODUCTION:

An ad-hoc network is a collection of wireless mobile hosts forming a temporary network which is infrastructure less and does not have any centralized administration [1]. Mobile Ad-hoc networks are self-organizing and self-configuring multihop wireless networks where, The Structure of the network changes dynamically. This is mainly due to the mobility of the nodes [6]. Nodes in these networks utilize the same random access wireless channel, cooperating in a friendly manner to engaging themselves in multihop forwarding. The node in the network not only acts as hosts but also as routers that route data to/from other nodes in network [2]. Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Each must forward traffic unrelated to its own use, and therefore be a router. Routing in ad-networks has been a challenging task ever since the wireless networks came into existence. The major reason for this is the constant change in network topology because of high degree of node mobility. A number of protocols have been developed for accomplish this task. Routing is the process of selecting paths in a network along which to send network traffic.

In packet switching networks, routing directs packet forwarding, the transit of logically addressed packets from their source toward their ultimate destination through intermediate nodes. An adhoc routing protocol is a convention, or standard, that controls how nodes decide which way to route packets between computing devices in a mobile ad-hoc network. The basic idea is that a new node may announce its presence and should listen

For broadcast by its neighbors. Each node learns about nodes nearby and how to reach them, and may confirm that it, too, can reach them. Wireless ad-hoc networks have gained a lot of importance in communications. Wirelesscommunication is established by nodes acting as routers and transferring packets from one to another in ad-hoc networks. Routing in these networks is highly complex due to moving nodes and hence many protocols have been developed. In this paper we have selected three main routing protocols for analysis of their performance. The detailed discussion of the Routing Protocols and the performance comparison between them will be discussed further.

II. AD-HOC ROUTING PROTOCOLS:

Routing protocols for MANETs can be categorized in proactive, reactive and hybrid types.[4]

i) Proactive protocols are also calledtable driven protocols. These protocols manage and find all the routes to destinations in advance and nodes broadcast their tables to allneighbors periodically whether topology changes or not. This consumes more bandwidth incurs overhead to system and reducesthroughput. Updates can be "Time Driven" or "Event Driven". In time driven whenever update time expires, tables are forwardedand in event driven when topology changes occur tables are sent to neighbors. Tables can be sent via "full dump" or through"incremental updates". Whole table is sent in full dump and only topological changes are sent in incremental updates.

ii) Reactive protocols do not manage the routes in advance and request the route whenever a device wants to send the data packets.All the nodes in network that are not participating in this communication do not need to manage the route.

iii) Hybrid routing protocolsuse the best features of reactive and proactive protocols.

Figure1: Depicts Broad classification of different routing protocols and the characteristics are explained in the subsections

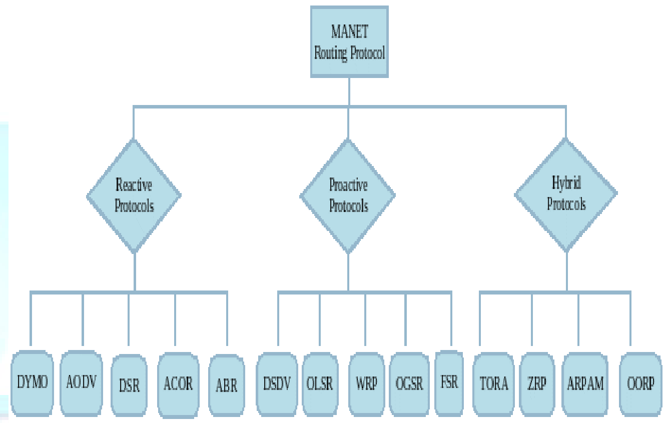

Figure1[5]: Routing Protocols

AODV and DSR are Reactive routingprotocol Whereas DSDV is proactive protocol and are explained in detail in this paper

1.DSR (DYNAMIC SOURCE ROUTING):

Dynamic source routing protocol (DSR) is an on-demand protocol designed to restrict the bandwidth consumed by control packets in ad hoc wireless networks by eliminating the periodic table-update messages required in the table-driven approach.[1] This protocol is truly based on source routing whereby all the routing information is maintained (continually updated) at mobile nodes. It has only two major phases, which are Route Discovery and Route Maintenance. Route Reply would only be generated if the message has reached the intended destination node (route record which is initially contained in Route Request would be inserted into the Route Reply).To return the Route Reply, the destination node must have a route to the source node. If the route is in the Destination Node's route cache, the route would be used. Otherwise, the node will reverse the route based on the route record in the Route Request message header (this Requires that all links are symmetric). In the event of fatal transmission, the Route Maintenance Phase is initiated whereby the Route Error packets are generated at a node. The erroneous hop will be removed from the node's route cache; all routes containing the hop are truncated at that point. Again, the Route Discovery Phase is initiated to determine the most viable route.

Advantages: This protocol uses a reactive approach which eliminates the need to periodically flood the network with table update messages which are required in a table-driven approach. In a reactive (on-demand) approach such as this, a route is established only when it is required and hence the need to find routes to all other nodes in the network as required by the table-driven approach is eliminated. The intermediate nodes also utilize the route cache information efficiently to reduce the control overhead.

2. AODV (AD HOC ON-DEMAND DISTANCE VECTOR ROUTING PROTOCOL):

AODV is a Reactive routingpure on-demand route acquisition system.The routes are created when needed, so called "on-demand"It is a reactive routing protocol which establishes a route when a node requires sending data packets .It is capable of both unicast and multicast routing. The operation of the protocol is divided in two functions: route discovery and route maintenance.

2.1 Route discovery:

Every node maintains two separate counters

i) Sequence number

ii) Broadcast-id (increments whenever the source issues a new RREQ).

The source requests using RREQ broadcasting:<source_addr, source sequence, broadcast_id, dest_addr, dest_sequence#, hop_cnt>Destination number of RREQ is the last known number to the source. [4]

The destination replies using RREP (Route Reply) unicasting<source_addr, dest_addr, dest_sequence#, hop_cnt, lifetime>.The sequence number is first incremented if it is equal to the number in the requestRREP contains the current sequence number, hop count = 0, full lifetime.

Intermediate nodes Discard duplicate requestsReplies if it has an active route with higher destination sequence numberOtherwise broadcasts the request on all interfaces .A node records the address of the neighbor who send RREQKeep track of some information Destination IP address, Source IP address, Broadcast_id, Expiration time for reverse path route entry, Source node's sequence number Setup forward path Unicast RREP (Route reply) back to the reverse path Each node along the path sets up a forward pointer to the node from which the RREP came Update its routing table entry Propagate the first RREP or the RREP if contains a greater destination sequence# or the same sequence# with a smaller hop count then contained in RREQ Nodes that are not along the path determined by the RREP will timeout and will delete the reverse pointers

2.2 Route maintenance

Neighboring nodes with active routes periodically exchange **hello** messages. If a next hop link in the routing table fails, the active neighbors are informed The RERR (unsolicited RREP) indicates the unreachable destinations<source_addr, dest_addr, current sequence# + 1, infinity, lifetime>the source

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performs a new route request when it receives a RERR

3. DSDV (DESTINATION-SEQUENCED DISTANCE-VECTOR ROUTING):

Destination-Sequenced Distance-Vector Routing (DSDV) is a table-driven routing scheme for adhoc mobile networks based on the Bellman-Ford algorithm. It was developed by C. Perkins and P.Bhagwat in 1994.[5]
It eliminates route looping, increases convergence speed, and reduces control message overhead. In DSDV, each node maintains a next-hop table, which it exchanges with its neighbors. There are two types of next-hop table exchanges: periodic full-table broadcast and event-driven incremental updating. The relative frequency of the full-table broadcast and the incremental updating is determined by the node mobility. In each data packet sent during a next-hop table broadcast or incremental updating, the source node appends a sequence number. This sequence number is propagated by all nodes receiving the corresponding distance-vector updates, and is stored in the next-hop table entry of these nodes.[1] A node, after receiving a new next-hop table from its neighbor, updates its route to a destination only if the new sequence number is larger than the recorded one, or if the new sequence number is the same as the recorded one, but the new route is shorter. In order to further reduce the control message overhead, a settling time is estimated for each route. A node updates to its neighbors with a new route only if the settling time of the route has expired and the route remains optimal.

III EXPERIMENTAL RESULTS FOR MANET PROTOCOLS

Simulation Environment: The Performance Evaluation of the following MANET Routing Protocols DSR, AODV & DSDV are based on the following Metrics.

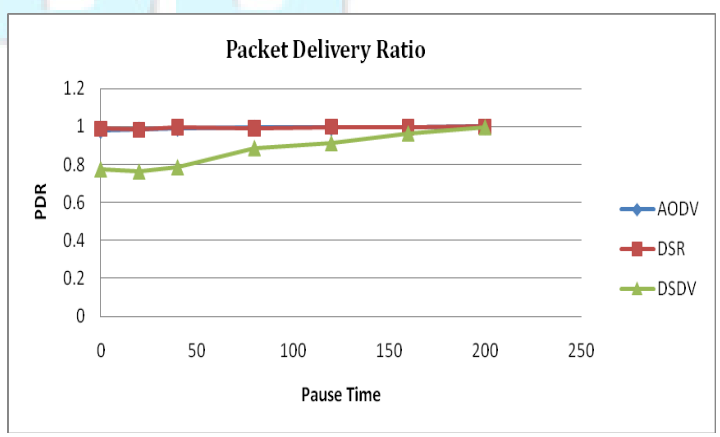
Parameter	Value
• Platform	Windows 8
• NS Version	Ns –allinone-2.34
• Simulation time	200s
• Pause Time	0, 20, 40, 80 …
• Simulation area	500×500m
• Traffic type	CBR
• No of Nodes	50
• Maximum speed	20m/s

3.1 Analysis and Results Comparison:

In this section we evaluate the performance of AODV, DSDV and DSR protocols on the following parameters:

A) Packet Delivery Ratio:
Packet delivery ratio is the ratio of number of packets received at the destination nodes to the number ofpackets sent from the source nodes. The performance is better when packet delivery ratio is high.

Figure 2[4]: Result for Packet delivery ratio versus pause time for AODV, DSDV and DSR.



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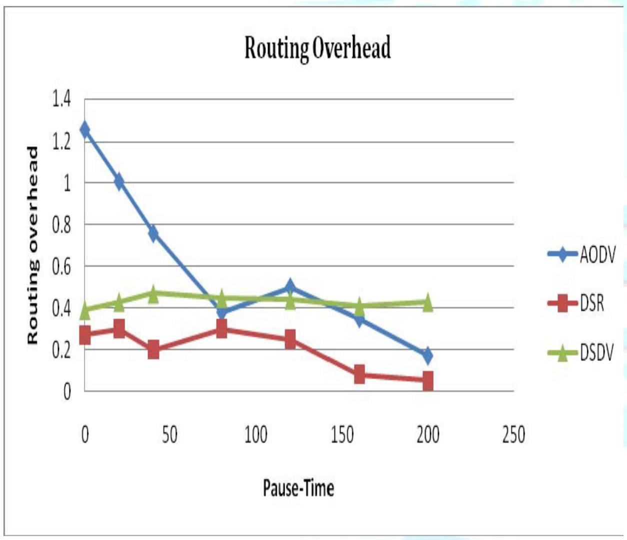
B) Routing Overhead:

Routing overhead is the total number of control or routing (RTR) packets generated by routing protocol during the simulation. All packets sent or forwarded at network layer is consider routing overhead. The performance is better when routing overhead is low.

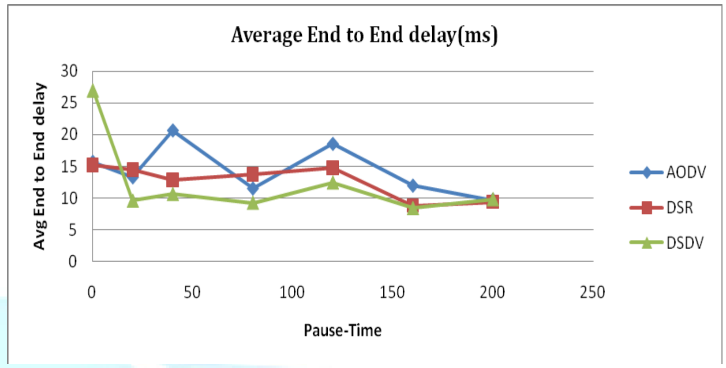
Figure 3[4]: Routing overhead versus pause time for AODV, DSDV and DSR



C) Average End-to-End Delay:

End-to-end delay is the average time delay for data packets from the source node to the destination Node. To find out the end-to-end delay the difference of packet sent and received time was stored and then dividing the total time difference over the total number of packet received gave the average end to- end delay for the received packets. The performance is better when packet end-to-end delay is low.

Figure 4[4]: Average end to end delay versus pause time for AODV, DSDV and DSR



Experimental Results: The following are the results after executing the scripts for AODV, DSDV and DSR Routing Protocols

	Nodes 50 (DSR)	Nodes 50 (AODV)	Nodes 50 (DSDV)
No of packets sent	4335	4533	4334
No of packets Received	4335	2756	656
Packet delivery ratio	100	51.7185	14.4859
Routing Overhead	0.000474953	0.0180897	1.9009
Average End to end delay	0.00315396	20.2093	11.2556
Throughput	468084	274304	622758

Figure5 [5]: Table comparing the results for AODV, DSDV & DSR routing Protocols using 50 No of Nodes.

IV CONCLUSION:

The Performance of the Routing Protocols Like AODV, DSDV & DSR have been analyzed in this paper which shows that AODV and DSR routing Protocols Performs much Better than the DSDV routing Protocol. But comparing the performance of DSR and AODV it results that the Packet Delivery Ratio, Routing Overhead & Average end to end delay of the DSR routing Protocol is much better than the AODV protocol. The Further work is to find the performance of the AODV and DSR routing protocols after malicious attacks on the Network and also finding the solution for mitigating such malicious activities by using Trust Based algorithms.

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