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A mechanism for analyzing performance of Mobile Ad-hoc Network

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Abstract: The increase in accessibility and status of mobile wireless devices has lead researchers to develop a wide variety of Mobile Ad-hoc Network (MANETs) protocols. These devices are able to communicate directly using the wireless medium in a node-to-node fashion, and route messages through intermediary nodes. Because of wireless and multi hop network security and routing protocol have become main area of MANET. Nodes in MANETs act as sink and source and can also acts as Router which takes the packets and forward them to next node on the basis of some calculation. MANET also known as Need Based Network e.g .of MANETs is Bluetooth which doesn't require any central infrastructure. Here in this paper we are analyzing the performance of Reactive routing protocol with the matrices Throughput and Average End-to-End delay. The performance analyzing has been carried out in QualNet 7.1 simulator.

Keywords: MANET, AODV, QualNet 7.1.

I. INTRODUCTION (*MANETs*)

Mobile Ad-hoc network [1] consists of mobile nodes and wireless link. MANET is a network, which consists of a number of mobile wireless nodes, among which communication is carried out and there is no requirement of any centralized authority. MANET is a self-configurable network having no infrastructure and nodes may move in the network illogically, so it is very easy to install. MANET [1] is a need based network. There are a number of issues which affect the reliability of Ad-hoc networks and limit their feasibility for different scenarios, lack of centralised structure within MANET requires that each individual node must act as a router and is responsible for performing packet routing tasks; this is done using one or more common routing protocols across the MANET. Performing [2][3]routing tasks requires memory and calculation power on the other hand mobile devices feature physical size and weight limitations essential for their mobility. In this thesis, we analyze the black hole attack in network on the basis of AODV routing protocol in MANET. This protocol is a reactive protocol which is capable of both uni-casting and multicasting.. AODV [4] is on demand routing protocol which is used when network mobility is high and all the nodes are trusty. This provides reliable route between the nodes in ad-hoc network we also discussed some of the available routing protocols [10] and most common attack patterns against mobile Ad-hoc networks.

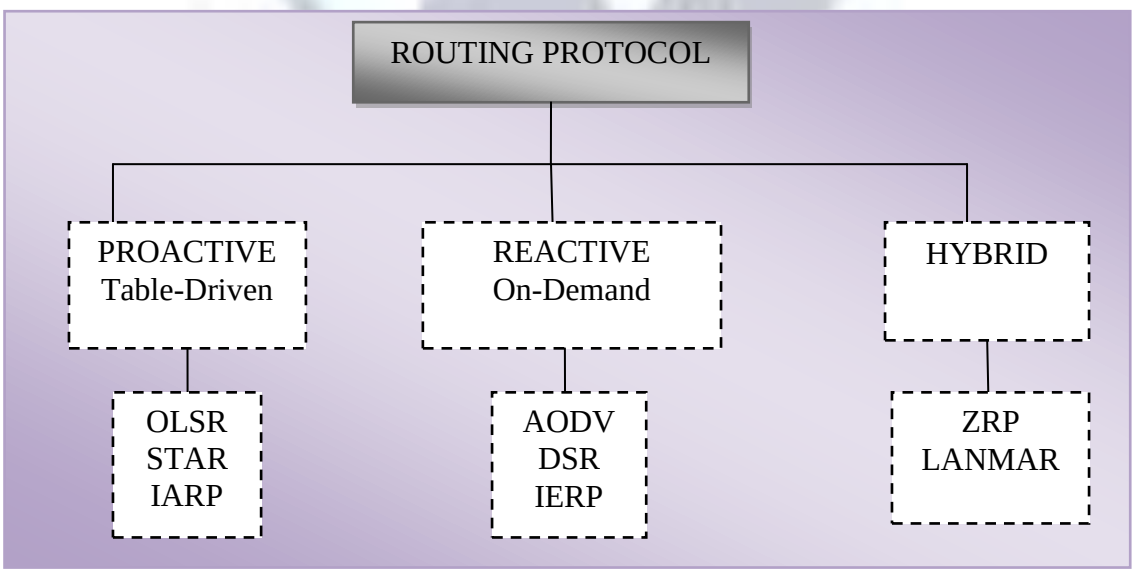

Figure: 1 MANET Routing Protocols

Proactive Routing protocol

In proactive routing[7], Protocols rely upon maintaining routing tables of known destination, this reduce the quantity of control traffic overhead that proactive routing generates because packets are forwarded immediately using known routes,each node has one or more tables that contain the latest information of the route to any other node in the network. Various table-driven protocol differ in the way how the information propagates through all nodes in the network when topology changes. The proactive routing protocol is not suitable for larger network because they need to maintain each and every node entries in the routing table. This cause more overhead in the routing table leading to consumption of more bandwidth.eg STAR, OLSR, IARP.

Reactive Routing Protocol

These protocols[5][6] are designed to overcome the wasted effort in maintaining unused routesReactive Protocols use a route discovery process to flood the network with route query requests when a packet needs to be routed using source routing or distance vector routing.The needed routes are made on demand. This calculation saves the overhead of maintaining unneeded routes at every node, but on the other side the time for sending packets will increase highly. It is true that a long delay can produce before data transmit; it has to wait until a route to destination is acquired. As reactive routing protocol floods the network to discover the route, they are not optimal in terms of bandwidth utilization, but they are scale well in topology change. Thus this strategy is highly suitable in high mobility network. Reactive protocol can be classified into two categories, Source routing and hop-by-hop routing. In source routing on demand protocol, each data packet carries a complete source to target address. That's why each intermediate node transmits these packets according to the information kept in the header of each packet. This means that the intermediate nodes don't need to maintain up to date routing information for each active route in order to forward the packet toward the destination. Furthermore nodes don't need to maintain neighbor connectivity through periodic beaconing messages .In hop by hop routing each data occur by coding route request packets through packets only carries the destination address and the next target address. Therefore each intermediate node in the path to the destination uses its routing table to forward each data packets toward the destination. e.g. AODV, IERP,DSR[8].

Hybrid Routing Protocol

Hybrid routing protocol uses the properties of both the routing protocol i.e. proactive and reactive, means between the networks it use reactive routing protocol and inside the network it uses proactive routing protocol.eg are LANMAR and ZRP(Zone Routing Protocol). It reduces the latency in route discovery and reduces the overhead of control message.

II. Brief Description of Routing Protocol in MANET(AODV)

Ad-hoc On-demand Distance Vector Routing protocol (AODV)

It is a protocol [9] which is capable of both uni-casting and multicasting. It is designed for Ad-hoc mobile network. It is an on demand algorithm meaning that it builds routes between nodes only as desired by source node .It maintains these routes as long as they are needed by sources. Ad-hoc on demand uses sequence number to ensure that of freshness of routes in ***network.*** It is does not contain loop, self starting and scales to large no of mobile nodes or for large networks. It is a reactive protocol. AODV is on demand routing protocol which is used when network mobility is high and all the nodes are trusty. This provide reliable route between the nodes in ad-hoc network . The network remains silent until there is request of transmission from a node. As a node broadcast request for connection to some specific node, which called as destination node, all intermediate nodes recode the route and forward the message. As if the message is received by the destination node, it selects the route with minimal hop count and sends back the route information to the source node and route information in being stored by intermediate nodes. In order to decrease routing search message overhead, node uses sequence no. to identify the recent route. Only least sequence no. request is forwarded. Moreover if route failed, total route will not be repaired only the breaking point will be repaired. In case link is broken or transmission failure the process of route creation will be repeated again. Entries will be refreshed after transmission over.

AODV contains three types of control messages for any type of route maintenance:

RREQ

A route request message is transmitted by a node requiring transmitting the data packets as an optimized AODV uses an expanding technique when flooding / broadcasting these messages. Every RREQ carries a time to live value that states for how many hops this packets should be forwarded. This value is set to a default value at the first transmission and

increased at every retransmission. Retransmissions occur if no replies are received from any node. Data packets waiting to be transmitted should be buffered locally and transmitted by a First In First Out principle when a route is already set.

RREP

A route reply message is unicast back to the originator node of a RREQ (Route Request) if the receiver node is either the node using the requested address, or it has a valid route to the requested address. The reason may be that one cans unicast the message back, is that every route forwarding a RREQ (Route Request) caches a route back to the originator.

RERR

Whenever there is a breakage in any active route then the nodes which are monitoring the status of the link that will notify the other node by using RERR message that the link has an error. In order to enable this reporting mechanism, each node keeps a list, containing the Internet Protocol address for each its neighbours node that are likely to use it as a next hop towards each destination nodes.

III. Issue to affect the performance of routing protocols

Throughput (bits/sec)

It is rate of successful message delivery over a communication channel. This data may be delivered over a physical or logical link, or pass through a certain network node. The throughput is usually measured in bits per second (bit/s or bps), and sometimes in data packets per second or data packets per slot. Higher the value of throughput better is the performance of protocol.

Packet Delivery Ratio

It is calculated by dividing the number of packets received by the destination through the no of packet originated by the application layer of the source this illustrate the level of delivered data to the destination. The grater the value of packet delivery ratio betters the performance of protocol.

Average End to End Delay

It signifies the average time taken by the packets to reach one end to another end (source node to destination node)

Total Packet received

It signifies the total no of packets received at destination node.

Average Jitter

It signifies the packet from the source will reach the destination with different delays .A packet's delay varies with its position in the queues of the router along the path between source and destination and this position can vary unpredictably.

Energy Computation

It is the amount of energy which is consumed by nodes during the transmission of data packet .This must be decrease during the inc of time.

IV. Proposed Algorithm for analyzing the performance of MANETs

Step 1: Firstly we need to the calculate the packet delivery ratio for all the experiments.

Packet delivery ratio ← Total no of packet received / Total no of packets sent

Step 2: Now calculate the Packet drop ratio in routing protocols

Packet drop ratio ← 1.00 - Packet Delivery Ratio

Step 3: Maximum packet drop ratio value for best performance for routing protocol is choose as a Threshold value.

Threshold← value of Best performance routing protocol (Packet Drop ratio)

Threshold1←value of without flaws performance routing protocol (End to End delay)

Step 4: Check packet delivery ratio and average End-to-End delay for current simulation

If less than Threshold and Threshold1 then routing protocol working without flaws other wise there is some flaw in routing protocol.

If (Packet Drop ratio > Threshold && Var > Threshold1)

Then Message ("System is working with some flaws, kindly improve the performance");
Else
Message ("System is working without flaws");

Var = It is variable of Double type that access the current value of Routing protocol (Average end to end delay)
Threshold and Threshold1 may vary with scenarios and types of networks.

V. Simulation and Results

Simulation Environments

In this paper work all the simulation work is performed in QualNet wireless network simulator version 7.1 .The movement proceeds for a specific amount of time or distance , and the process is repeated a predetermined number of times .we choose min speed =10 m/s ,max speed =50 m/s and pause time= 10 s to 50 s.
Wireless network which we have used following values for different parameter

Table: 1

Parameters	Values
Mobility model	Random way Point
Pause time	10 sec
Maximum speed	50 mbps
Data Rate	2 Mbps
Simulation time	30 Minutes
Terrain	Coordination 1500 * 1500 m
Connection	CBR (Constant Bit Rate) 3 client to 14 server
Seed	1
Max Segments Size	512 bytes
Radio Type	802.11b Radio
Mac Protocol	802.11
Routing Protocol	AODV
Transport Protocol	UDP
Node	50
Node Placement	Random

Design View

It specifies we have setup an environment for AODV with 50 nodes and node 3 acts as client node and node 14 acts as server node. Link between nodes 3 to node 14 is CBR (Constant Bit Rate). Data will be transfer from source to destination with constant speed.

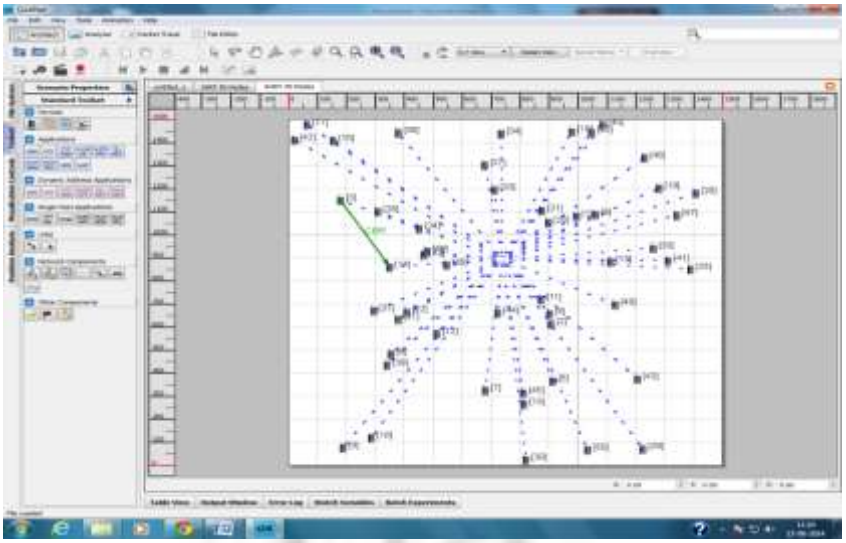

Figure: 2 AODV

Running view

This is the running scenario of our setup in design view . Here nodes will not transfer their routing table to their neighbour node , They will only send when they need to find the route between the source and destination.

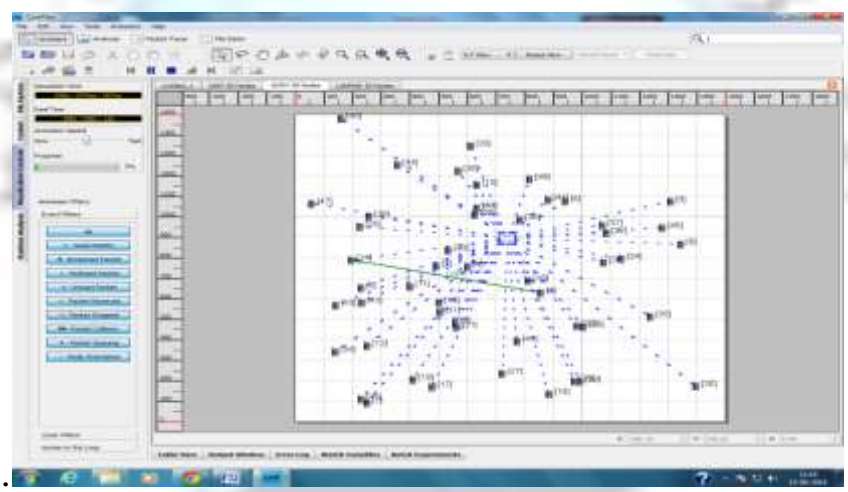

Figure: 3 AODV

AODV (Ad-hoc on Demand Routing Protocol

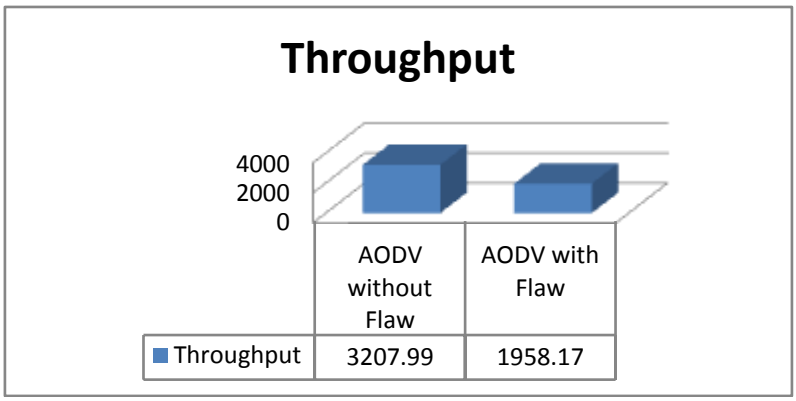

Figure: 4 AODV Throughput

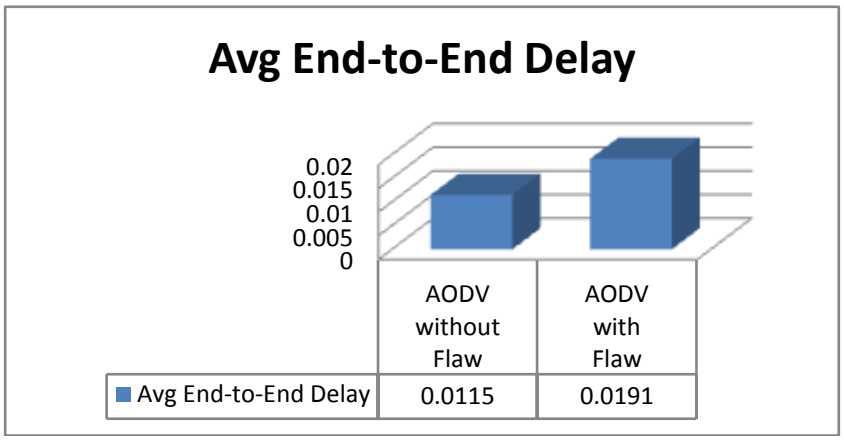

Figure: 5 AODV Average End to End Delay

VI. CONCLUSION AND FUTURE WORK

After analyzing the figure above if there is flaw in the network then Throughput will decrease and Average End-to-End delay will increase. That will be the worst scenario for the network and performance of network will automatically decrease and congestion in the network will increase automatically. MANET is very lucrative area of research, many students and researchers are doing research in the area of MANET. A lot of opportunities are there in this area for those who are doing research in this area. In the future any student or researcher can refer this thesis for the further enhancement to analyze the performance of MANET more deeply via different parameter. Like Average Jitter, and by increasing the no of nodes, and also by applying different routing protocol like DSR, IERP, ZRP routing protocol.

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