RESEARCH ARTICLE OPEN ACCESS

Investigating the Impact of Maintenance Hold off Time on the performance of DSR in MANETs

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ABSTRACT
Mobile nodes in ad hoc networks move arbitrarily changing their network location and thus establish dynamic topology. Its standards are defined by IETF. Most of the previous research on MANET routing protocols have focused on simulation study by varying network conditions, such as network size (node density), pause time, or node mobility independently. The choice of the static values in protocol configuration will affect the correctness of protocol. In MANETs, DSR Routing protocol suggests that Maintenance Hold off Time (MHT),which is a configuration parameter of Route maintenance, should be a fixed value, but does not refer to how this value to be adjusted with network size. In this paper, we investigate the impact of MHT value on the performance of DSR routing protocol. Experimental results suggest that impact of MHT shows significant progress on the performance of DSR. This paper shows that in a dynamic environment, we are not supposed to use constant values like MHT in protocol configuration and proposes that the Maintenance Hold off Time (MHT) should be a suitable value with the network size.
Keywords:- MANET, DSR, IETF, MHT,OPNET

I. INTRODUCTION

Ad hoc network is a wireless network, which do not have a centralized and fixed infrastructure.[1] MANET came to know as a wireless ad hoc network or infrastructure less network in which nodes are free to move arbitrarily and mobile nodes can transmit and receive the traffic. The leading authority on Mobile ad-hoc networks or MANETs [2][3][10][11], is the Internet Engineering Task Force (IETF)[17] working group whose goal is to standardize IP-level routing protocol functionality for wireless applications within both static and dynamic topologies. The mobile nodes have transmitters and receivers with smart antennas, which enable the mobile nodes to communicate with each other. The MANETs change their topology every time by getting in and out of the mobile nodes in the network. By growing the network, combined with the node mobility the challenges of self- configuration of the network become more evident.

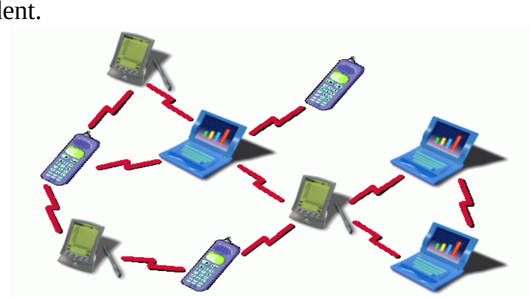

Figure 1: MANET

Effective routing is one of the challenging tasks in MANET. This is because mobile networks need to be handled by ordinary nodes that have neither specialized equipment nor a fixed position in the network. Therefore any effective and efficient routing for MANETs must tackle the challenges posed by the mobility of the nodes, their limited energy resources and heterogeneity, and lots more. So many routing protocols have been designed for MANET that have one or the other way solved the above said challenges to some extent. Of all the protocols overviewed, we discovered that the Dynamic Source Routing protocol has got some special characteristics geared at improving the efficiency of routing in MANET.

Routing Protocols plays an essential role in MANETs. Routing protocol for the ad-hoc network can be categorized into 3 categories. The classification of routing algorithms is Reactive, Proactive and Hybrid routing protocols. Pro-active routing is also called Table-driven routing where as reactive routing is called On-demand & dynamic routing. On-demand routing protocols are popular in MANET because they are more scalable and less overhead on the network. AODV, DSR and DYMO are popular reactive routing protocols

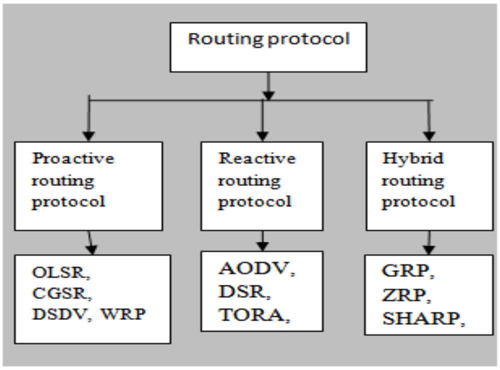

Figure 2. Categorization of Ad Hoc Routing Protocols

II. RELATED WORK

To improve the performance of a typical MANETs, various routing protocols have been proposed and analyzed by many network researchers. We summarize representative samples of the existing work. Various static parameters are used during the configuration of DSR routing protocol. One of the static parameters is Maintenance Hold off Time (MHT). This is a fixed value in DSR which is not suitable for the dynamic environment. The performance of Dynamic Source Routing (DSR) is evaluated under different Maintenance hold off time values. The main focus of these studies is to analyze the impact of Maintenance Hold off Time on the performance of DSR routing protocol. Narasimha Raju and Prof. SP Shetty analyzed the impact of NTT[7][9] on the performance of AODV and they developed new protocol called FBNTTAODV, which gives better performance than AODV [10]. Sarch edenhofer published his paper titled rigorous analysis on DYMO by comparing AODV and AODVv2 (DYMO)[15]. Isha Sharma and Rajesh Kochher analyzed the impact of MHT on the performance of DSR and they developed new protocol by optimizing the Maintenance Hold off Time which gives better performance than DSR [8]

III. DYNAMIC SOURCE ROUTING PROTOCOL (DSR)

Dynamic Source Routing [2][3][4][5][6][11] is specially designed for the networks having mobile nodes. In DSR, two mechanisms work together for the packet transmission, they are Route Discovery and Route Maintenance. Route Discovery is used when a source wants to send a packet to the destination but does not have a route, Route Discovery finds a route for the packet transmission. Due to the mobile nodes in MANET, the nodes move frequently that results in route breakage, in that case, Route Maintenance mechanism is used, it detects other routes that lead the packet to the destination [6].

As per the IETF draft, the timing parameters for DSR should be administratively configurable. Ideally, for networks with frequent topology changes the DSR parameters should be adjusted using either experimentally determined values or dynamic adaptation. As per IETF draft the default value of MHT for DSR routing protocol is 0.25 seconds. MHT value plays an active role in the performance of DSR which uses specifically, when forwarding a packet, a node must attempt to confirm the reachability of the next hop node, unless such confirmation had been received in the last Maintenance Hold off Time. The default MHT value for DSR is 0.25 seconds but it does not disclose how this value is optimal for networks with different size.

IV. METHODOLOGY

OPNET Simulator: Optimized Network Engineering Tool [5, 6] (OPNET v14.5) was used for simulation of networks which is one of the most powerful simulation tools regarding wireless communications. OPNET is a research-oriented network simulation tools which provides a development environment for modeling and simulation of deployed wired as well as wireless networks

In Opnet simulator, the MHT value is set to fixed 0.25sec. But in a dynamic topology, we are not supposed to take fixed values, because of mobility and different network sizes. This paper evaluates the performance of DSR routing protocol by varying the MHT values from 0.1 sec to 0.4sec under different network sizes. Initially the performance of DSR was tested with a default stable value i.e., MHT 0.25sec. Later we verified with different MHT values.

V. SIMULATION ENVIRONMENT

In this, we employed OPNET (Optimized Network Engineering Tool)[11][12][13] for simulation which is a network modeler through which we can design any kind of Network model and then can simulate it. OPNET [14][16] version 14.5 is a software for simulations. It provides many solutions for managing networks and applications e.g. network operation, planning, research and development, network engineering and performance management. OPNET 14.5 is designed for modeling communication devices, technologies, protocols and to simulate the performance of these technologies.

In the simulation experiment, the routing protocol used is DSR. A campus network was modeled with in an area of 1000m x 1000m.Simulation time 300 sec, traffic type is Exponential, minimum and maximum speeds are 0 and 12 m/s. Pause time is set to 0, which indicates high mobility. The

Random Waypoint mobility model was used in this simulation. Maintenance Holdoff Time is 0.1, 0.15, 0.2, 0.25, 0.3, 0.35, 0.4 sec. The MAC layer protocol used is 802.11.

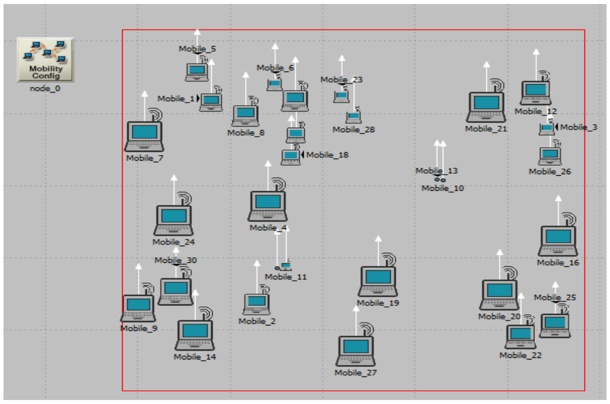

Figure 3 Simulation Scenario with Network size 30

Table 1: Simulation Parameters

Routing Protocol	DSR
Simulation Time	300 sec.
Simulation Area	1000m x 1000m
Traffic	Exponential
Node type	MANET
Packet size	1024 bytes
Nodes	30,63,95
Transmission Range	250 m
Receiver Range	250m
Min. & Max speed	0 m/s & 12 m/s
Pause time	0 m/s
Mobility model	Random way point
Maintenance Hold off Time(sec)	0.1,0.15,0.2,0.25,0.3,0.35,0.4
Node Placement Model	Random

Different performance metrics are used in the evaluation of routing protocols. They represent various characteristics of the overall network performance in terms of QoS. In this paper, we have primarily selected various performance metrics[12] for evaluation of DSR with varying MHT values are Throughput, Delay, Network load, traffic received, and Packets Salvaged

A. Throughput (bits/second): Represents the total number of bits forwarded from wireless LAN layers to higher layers in all WLAN nodes of the network.

B. Delay (sec): it indicates how long it a packet takes to travel from the source initiator to the application layer of the target destination. This includes all possible delays caused by buffering during route discovery latency, queuing at the interface queue, retransmission delays [16].

C. Network Load (bits/sec): This is dimensioned in order to measure the network load separately for each BSS. The statistic represents the total data traffic (in bits/sec) received by the entire WLAN BSS from the higher layers of the MACs that is accepted and queued for transmission.

D. Traffic Received (bits/sec): The total number of MANET traffic received in bits per second by all MANET traffic destinations in the entire network.

E. Total packets salvaged (packets): When an intermediate node receives a data packet, but however, the next hop along the path of the source route is broken (no acknowledgements received), the intermediate node salvages the packet by rerouting it along a different route to the destination if an alternate route exists in the node's route cache. It represents the total number of packets salvaged by all nodes in the network.

VI. RESULTS AND DISCUSSIONS

For better performance, the Throughput should be maximum. Throughput with different MHT values is shown in figure 4. From experimental results, we found that throughput is maximum at MHT value 0.2 i.e., 19,910.937bits/sec.

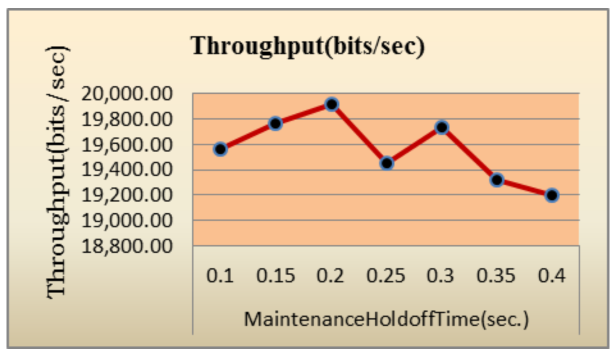

Figure 4 Variance of Throughput with MHT for 30 nodes

For better performance, the delay should be minimum. Delay with different MHT values is shown in figure 5. From experimental results we found that delay is low at MHT value 0.15 i.e., 0.008789sec.

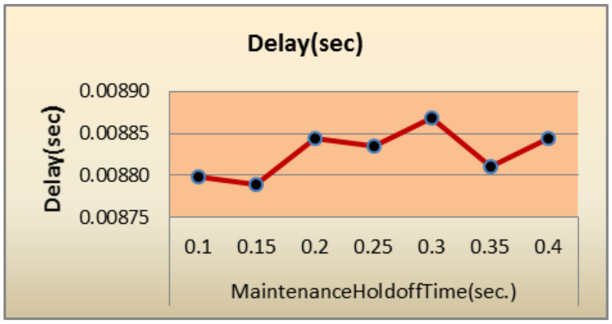

Figure 5 Variance of Delay with MHT FOR 30 nodes

For better performance, the Network load should be minimum. Network load with different MHT values is shown in figure 6. From experimental results, we found that Network load is minimum at MHT value 0.4 i.e., 15241.75 bits/sec.

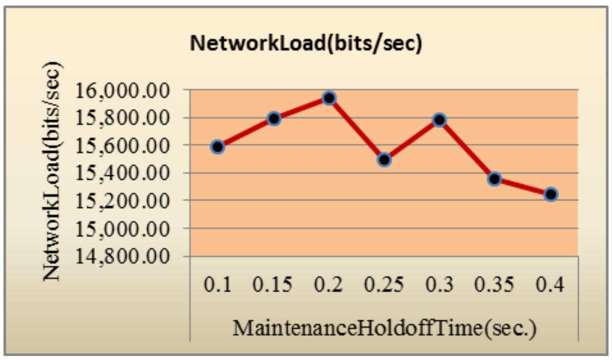

Figure 6 Variance of Network load with MHT for 30 nodes

For better performance, the Traffic received should be maximum. Traffic Received with different MHT values is shown in figure 7. From experimental results, we found that Traffic Received is maximum at MHT value 0.4 i.e. 9,601.8801 bits/sec.

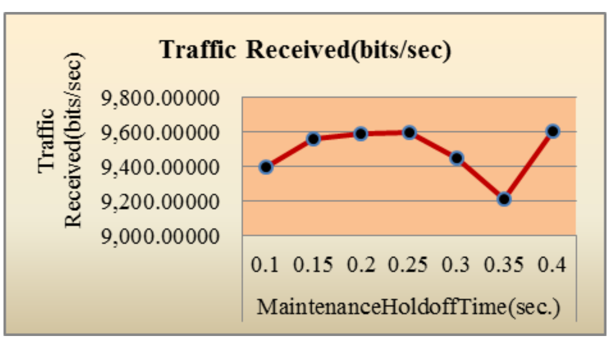

Figure 7 Variance of Traffic received with MHT for 30 nodes

For better performance, the Total packets salvaged should be maximum. Total packets salvaged with different MHT values is shown in figure 8. From experimental results, we found that Total packets salvaged is high at MHT value 0.35 i.e., 3.125

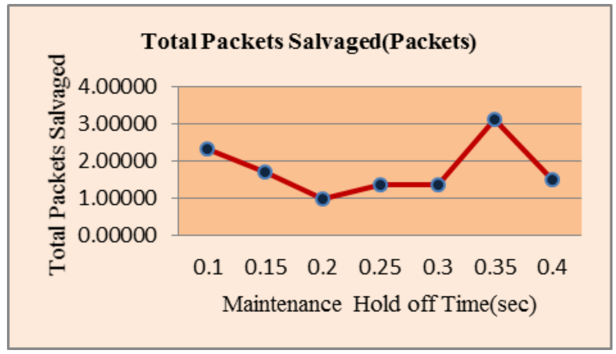

Figure 8 Variance of Total Packets Salvaged with MHT for 30 nodes

VII. CONCLUSION AND FUTURE SCOPE

In this paper, we investigated the impact of Maintenance Hold off Time on the performance of on-demand routing protocol DSR. The performance is analysed by using Opnet 14.5 Simulator. The fixed MHT parameter value for DSR is 0.25 sec. In our experimentation we modified the MHT values from 0.25 to 0.1, 0.15, 0.2, 0.3, 0.35 and 0.4. The experimental results proved that impact of Maintenance Hold off Time shows significant changes in QoS metrics of DSR protocol. The QoS metrics used in performance analysis are Throughput, Delay, Network load, Traffic received, and Packets Salvaged.

The performance of DSR is enhanced by varying the standard MHT value 0.25. For example, when the network size is 30 and MHT is 0.25s, the throughput is 19,455.00 bits/sec. whereas for the same scenario by varying MHT values from 0.25 to 0.1, 0.15, 0.2, 0.3, 0.35, and 0.4, we observed better results for throughput. The throughput for MHT 0.2 is 19,910.93 bits/sec. When we vary the MHT value from 0.25, the other important parameters end to end delay, Network load, Traffic Received, total packets salvaged shows better results. This work can be extending to other on-demand routing protocols in MANETs.

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