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Estimation of Assorted Traffic Loads in MANET with DSR Routing Protocol using OPNET 14.5 Modeler

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Abstract- As per the fast technology advancement, there is a wide scope of research in wireless mobile Ad-hoc Network (MANET). Security services and routing services are the core application areas of the wireless communication network. MANET is a collection of wireless mobile nodes dynamically forming a transitory network without the help of any centralized administration. There is a need of dynamic routing network topology in MANETs as far as the mobility of nodes is concerned. Routing protocols in MANET directs node to send and receive packets. In this paper, the performance of DSR routing protocol was evaluated with respect to throughput and end to end delay under various traffic loads using OPNET 14.5 modeler. Simulation was carried out for 35 nodes with traffic types FTP, HTTP, video conferencing and E-mail. Simulation results showed that throughput is highest in Video Conferencing and lowest in HTTP. End to end delay is highest for Video Conferencing and lowest for HTTP.

Keywords- Wireless mobile Ad-hoc Network, DSR, HTTP, FTP, throughput and end to end delay.

I. INTRODUCTION

A mobile Ad-hoc Network (MANET) is composed of a collection of independent mobile hosts connected by wireless links without any centralised or fixed government. MANET is characterized by its dynamic topology, network scalability, multihop routing and energy limited operation. The operation of mobile Ad-hoc Network depend on the trust and cooperation between the nodes. Nodes communicate with each other without the intercession of centralized access points or base stations. In such a network, each node acts both as a router and as a host. As node transmission range is limited, data transmission between the two nodes in MANET needs multiple hops. The mobility of different nodes makes the condition more complicated results in frequent changes of network topology makes routing in MANET an exigent task.

Mobile Ad-hoc Network is the rapid growing technology from the past two decades. The increase in their reputation is because of the ease of deployment, infrastructure-less and their dynamic behaviour. MANETs created a new set of demands to be implemented and to provide efficient better end to end communication. The Dynamic Source Routing (DSR) Protocol is a source routed on-demand routing protocol. A node maintains route caches containing the source routes that it is aware of. The node updates entries in the route cache when it learns about new routes. In its packet head, each given routing packet has a complete and ordered node list which the packet will pass inevitably.

II. DSR ROUTING PROTOCOL

DSR- Dynamic source routing protocol comes under the category of reactive protocol. The Dynamic Source Routing [1], [2] is one of the purest examples of an on-demand routing protocol that is based on the concept of source routing. DSR used to modifies its route caches while discovering new routes. It updates its caches with new route discovered or when there exist a direct route between source and destination node. When a node wants to transmit data, it defines a route for the transmission and then starts transmitting data through the defined route. In the DSR protocol, source node sends the routing request (RREQ) packets by means of flooding technology. Each RREQ packet includes source node address (S-id), destination node address (D-id) and the unique request sequence-number (R-id). An advantage of DSR is that nodes can store multiple routes in their route cache, which means that the source node can check its route cache for a valid route before starting route discovery, and if a valid route is found there is no need for route discovery. This is very beneficial in network with low mobility. Since the routes stored in the route cache will be valid longer. Another advantage of DSR is that it does not require any exchange of hello messages, therefore nodes can enter sleep node to conserve their power. This also saves a significant amount of bandwidth in the network and thus reduces cost.

DSR uses source routing and protocol composed of two main mechanisms Route Discovery and Route Maintenance which works together completely on demand [3].These mechanisms are as follows:

1. Route discovery process- When a source node wants to start data transmission with a node in the network, it checks its routing cache. When there is no route available to the destination in its cache or route is expired, it broad cast RREQ. When destination is located or any intermediate node that has fresh route to the destination node, RREP is generated [4]. When the source node receives the RREP it modifies its caches and the traffic is routed through the route.

2. Route maintenance process- When the transmission of data started, it is the accountability of the node that is transmitting data to confirm the next hop received the data along with source route. The node generates a route error

message, if it does not receive any confirmation to the originator node. The originator node again performs new route discovery process.

HTTP- In the simulation environment of HTTP traffic performance evaluation, scenarios have been implemented discretely on HTTP heavy traffic load. HTTP traffic has been chosen because of its importance in the Internet applications. To achieve secure communication http has been used with web. The simulation attempts to show the effect of HTTP traffic load on the routing protocols. It is understood that the network includes 35 nodes with speed of 10 m/s. For each investigated scenarios, the performance parameters throughput and end to end delay have been calculated as shown in Table-2.

E-Mail- In the simulation environment using OPNET 14.5 modeler of E-Mail traffic effect variation, scenarios have been implemented separately on E-Mail heavy traffic load. E-Mail traffic has been selected because of its significance in the Internet applications and to send messages by E-mail. The simulation attempts show the effect of E-Mail traffic load on the routing protocols. It is assumed that the network includes 35 nodes with speed of 10 m/s. For each investigated scenarios, the performance parameters throughput and end to end delay have been estimated and tabulated as shown in Table-2.

Video Conference- In the simulation environment of video conferencing traffic effect evaluation, scenarios has been implemented independently on video conferencing heavy traffic load. The performance matrices for video conferencing as load has been evaluated and shown in Table-2.

III. RELATED WORK

Several researchers have done the qualitative and quantitative analysis of Ad-hoc Routing Protocols by means of different performance metrics. They have used various simulators for their research purpose.

The results given in [5] analyze DSR and DSDV in idealized and realistic simulation environments on their performance. The paper in reference [6] gives conclusion in mobile ad hoc network that reactive protocols i.e. AODV and DSR perform well when the network load is moderate. In paper [6] the reactive protocols are saving many resources like energy and bandwidth. It has been analyzed that the proactive protocols perform well in heavy network traffic load.

In paper [7] author studied the Reactive protocols, DSR and AODV as well as a Proactive Protocol, DSDV and their characteristics with respect to diverse mobility were analyzed based on packet delivery fraction, routing load, end to end delay, number of packets dropped, throughput and jitter using Network Simulator-2.

In reference [8], author presented the performance comparison of DSDV, AODV, DSR and TORA based on simulations performed using Network Simulator-2. Three metrics: normalized routing overhead, packet delivery fraction and average end to end delay, were used to measure performance. Author concentrated on the energy consumption issues of routing protocols [9]. They presented a performance comparison of the DSR, AODV, TORA and DSDV routing protocols with respect to energy consumption.

In reference [10], the simulation was done in QUALNET simulator. The author discussed that AODV protocols gives best performance in low and medium node density but in high node density both OLSR and DSR outperforms. The DSR routing protocol is selected for file transfers where delivery and throughput are decisive factors.

R. K. Nadesh et al. [11] in their work analyzed the performance of four protocols AODV, DSR, GRP and OLSR using OPNET simulator. The results were obtained for throughput, HTTP traffic and delay for different protocols.

Parma Nand et al. [12] compared the STAR, AODV, and DSR by varying CBR data traffic load using Qualnet Network Simulator. Simulation result showed that AODV outperforms both the DSR and STAR routing protocols in terms of packet delivery ratio.

IV. SIMULATION TOOL

OPNET 14.5 Modeler, discrete event simulation software for network optimization offered by OPNET Technologies is used for conducting this research. In order to estimate the throughput and end to end delay, OPNET 14.5 Modeler has been adopted in our study. It is one of the most comprehensively used commercial simulator based on Microsoft Windows platform, which includes most of the MANET routing parameters compared to other commercial simulators available.

The network entities used during the blueprint of the network model are wireless server, application configuration and workstations. The simulation parameters that have been used in the following experiments are summarized in Table-1.

Table-1. Simulation Parameter

Simulation Parameter	**Value**
Simulator	OPNET 14.5 Modeler
Network Size	35 nodes
Area	800×800 m^2
Mobility Model	Random way point
Traffic type	Email**,** HTTP, FTP, Video Conferencing
Packet Reception Power Threshold	-95
Address mode	IPv4
Simulation Time	300 seconds

V. PERFORMANCE METRICS

Throughput – It can be defined as average rate at which the data packet is transmitted successfully from one node to another node over a communication network. It is generally measured in bits per second. For every network, higher value of the throughput is desirable to achieve higher efficiency. Mathematically, throughput can be formulated as

Throughput = (number of delivered packet*packet size)/total duration of simulation

End to End Delay - The end to end delay is the time required to traverse from the source node to the destinations node in a network. End to end delay evaluates the ability of the routing protocols in terms of use-efficiency of the network resources.

VI. SIMULATION RESULT AND ANALYSIS

A network size of 35 nodes and the file size of 50,000 bytes for HTTP in 800×800 square meter area.
This paper represent the scenarios of 35 nodes which are simulated by taking Reactive routing protocols DSR and showing graphically their end to end delay and throughput. The simulation time is 300 seconds for all cases.

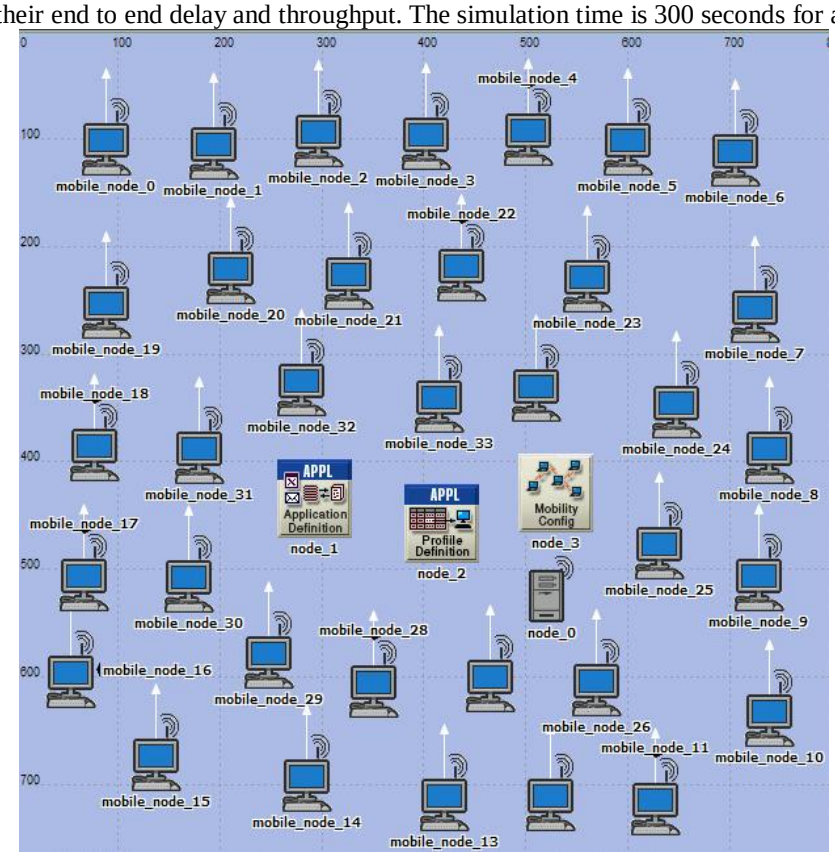

Figure-1 Simulation scenario having 35 nodes

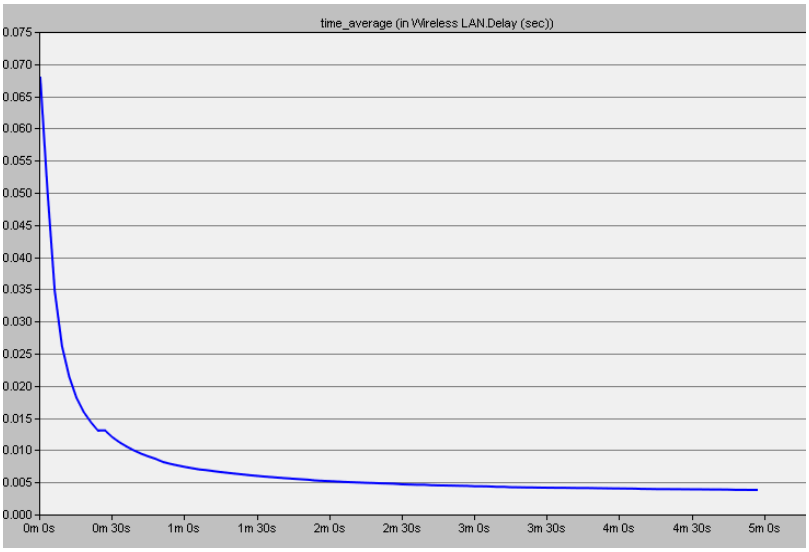

Figure-2 Average end to end delay with HTTP load

In the figure-2 shown the average end to end delays of HTTP.

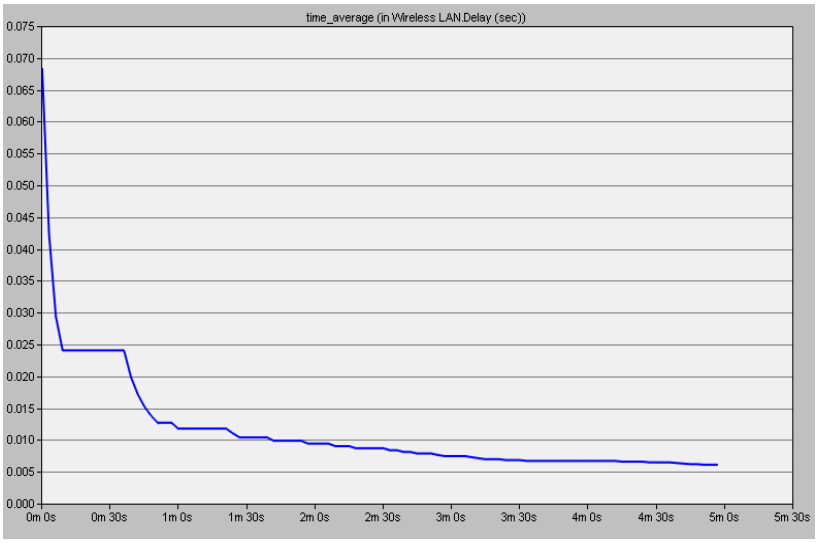

Figure-3 Average end to end delay with FTP load

As compare to FTP, HTTP has low end to end delay.

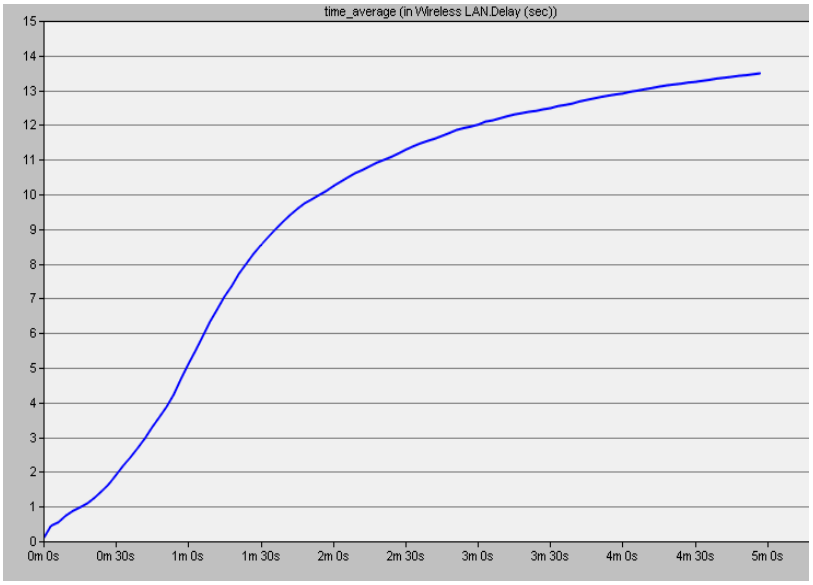

Figure-4 Average end to end with load Video Conferencing

In the figure 4 shows the highest average end to end delay while taking video conferencing as load.

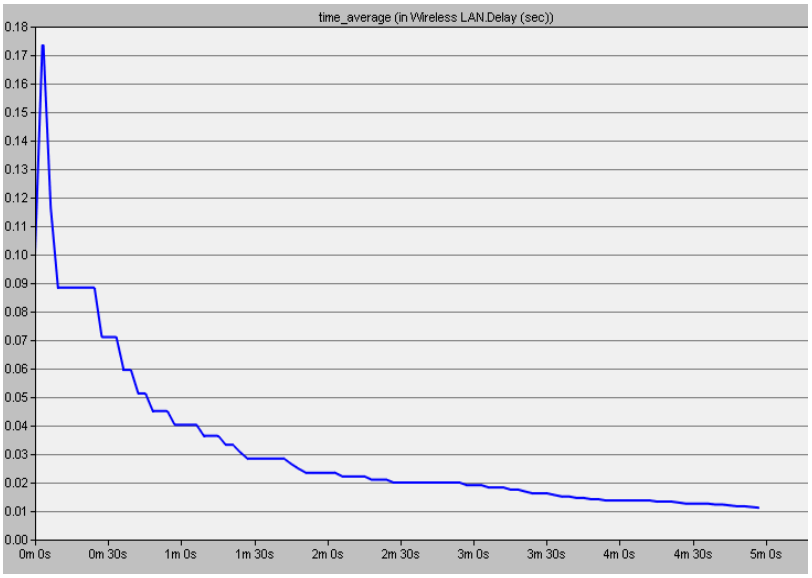

Figure-5 Average end to end delay with Email

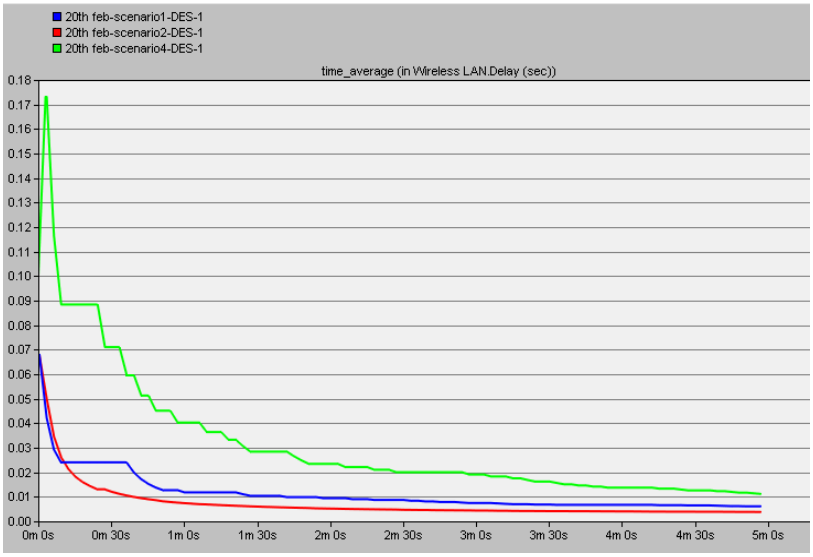

Figure-6 Average end to end delay comparison of HTTP, FTP, E-mail

As shown in figure-6 end to end delay is highest in video conferencing and lowest in HTTP and FTP case.

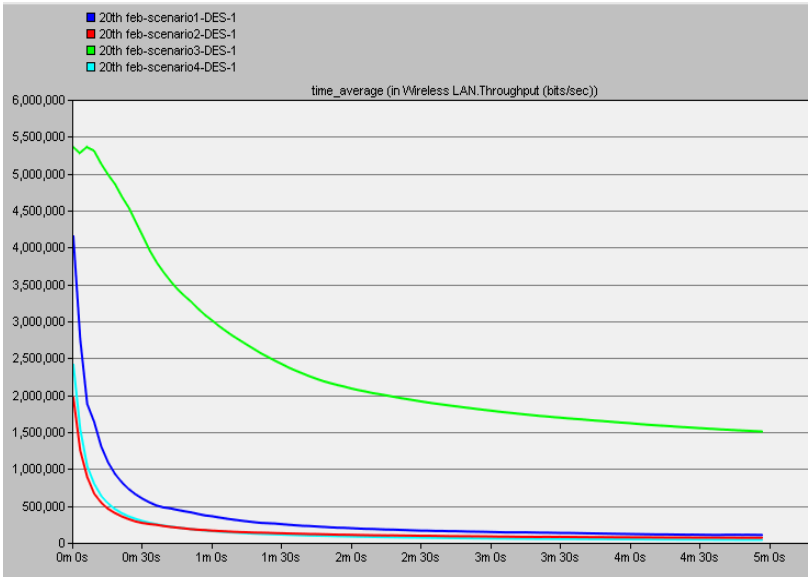

Figure-7 Throughputs of FTP, HTTP, E-mail and Video Conferencing

As shown in figure-7 Throughput is highest in case of video conferencing and lowest in case of HTTP.

VII. CONCLUSION

DSR is based on source routing. One advantage with source routing approach is however that in its route discovery process, it learns more routes. In this paper the performance of DSR routing protocol is made under different traffic load like HTTP, FTP, E-mail and video conferencing at fix mobility 10 m/s. From the observation, average end to end delay is highest in video conferencing while lowest in HTTP. Throughput is also highest in video conferencing and lowest in HTTP. In all our simulation results, HTTP shows the best performance in terms of throughput and end to end delay.

For the future prospect we can vary the node size. The network load is selected for the smaller size like 40 nodes and larger size like 90 nodes. We can work out the results with proactive protocols like OLSR and get the simulation results.

Table-2 Resultant values of Performance metrics for different Loads

Load	Mobility (m/sec)	Type	Throughput (bits/sec)	End to end delay (sec)
FTP	10	High load	4.17×10^{6}	0.0695
HTTP	10	High browsing	1.96×10^{6}	0.068
E-mail	10	High load	2.46×10^{6}	0.174
Video Conferencing	10	High load	5.40×10^{6}	13.52

REFERENCES

[1] M. Rajput, P. Khatri, A. Shastri and K. Solanki, "Comparison of Ad-hoc Reactive Routing Protocols using OPNET Modeler," IEEE Proceedings 2010.

[2] A. K. Gupta, H. Sadawarti and A. K. Verma, "Performance Analysis of AODV, DSR & TORA Routing Protocols," IACSIT, International Journal of Engineering and Technology, Vol.2, No.2, April 2010.

[3] Salman Bhimla, Neeru Yadav, "Comparison between AODV protocol and DSR protocol in MANET". E-ISSN2249-8974, IJAERS, Vol.2, Issue-1, Oct-Dec 2012, pp 104-107.

[4] Zhu. C. Lec, M. J. Saadawi, T., "RTT- Based Optimal Waiting time for Best Route Selection in Ad hoc Routing Protocols," IEEE Militiary Communications Conference, Vol.2, Oct 2003, pp 1054-1059.

[5] Amr M. Hassain, MohamdI. Youssef, Mohamed M. Zahra, "Evaluation of Ad Hoc Routing Protocols in Real Simulation Environments", *Electronics and Electrical Communications Department, Faculty of Engineering, AL-AZHAR University Cairo, Egypt.*

[6] F. Bertocchi, P. Bergamo, G. Mazzini, M. Zorzi, "Performance Comparison of Routing Protocols for Ad Hoc Networks", *DI, University of Ferrara, Italy.*

[7] N. Karthikeyan, V. Palanisamy And K. Duraiswamy, "A Performance Evaluation of Proactive and Reactive Protocols using NS-2 Simulation", International J. of Engineering Research & Indu. Appls. (IJERIA), ISSN 0974-1518, Vol.2, No.2 (2009), pp 309-326.

[8] Humaira Ehsan and Zartash Afzal Uzmi, "Performance Comparison of Ad-hoc Wireless Network Routing Protocols", IEEE Transaction, 2004.

[9] Juan-Carlos Cano and Pietro Manzoni, "A Performance Comparison of Energy Consumption for Mobile Ad-hoc Network Routing Protocols", IEEE Transaction, 2000.

[10] Md. Anisur Rahman, Md. Shohidul Islam, Alex Talevski, "Performance Measurement of Various Routing Protocols in Ad-hoc Network".

[11] R. K. Nadesh, D. Sumanthy, M. B. Benjula Anbu Malar, "Performance Analysis of MANET using Different Routing Protocols in Multi Service Environments- An Quantitative Study", Int J. Advanced Network and Applications, Vol.3, Issue-2, 2011, pp 1076-1079.

[12] Parma Nand, S. C. Sharma, Rani Astya, "Traffic Load Based Performance Analysis of DSR, STAR and AODV Adhoc Routing Protocol", International Journal of Advanced Computer Science and Applications, Vol.1, No.4, Oct 2010, pp 58-62.

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