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Performance Evaluation of MANET with Various Routing Protocols for different Applications

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Abstract:- A mobile ad hoc network (MANET) is a collection of mobile nodes, that forms on the fly a temporary wireless network in a self organizing way, without established infrastructure .In MANET, the messages are exchanged over a direct wireless link or including one or over a sequence of wireless links through intermediate nodes. For this purpose, routing protocols are required. In this paper we have evaluated the performance of MANET with various routing protocols such as AODV, DSR, OLSR, TORA and GRP. The simulation is done for various applications and the performance of all the protocols is compared in the terms of load, throughput, delay, traffic sent, traffic received etc. The number of mobile nodes is also varied to analyze the performance of these routing protocols.

Keywords: *MANET, AODV, DSR, OLSR, GRP, TORA, OPNET.*

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I. INTRODUCTION

The ad-hoc network is a collection of wireless mobile nodes forming a temporary network without centralized administration.

Mobile Ad-hoc networks [15] are self-organizing and self-configuring multihop wireless networks where, the structure of the network changes dynamically, due to the mobility of the nodes. Nodes in these networks utilize the same random access wireless channel and multihop forwarding. The nodes in the network not only act as hosts but also as routers that transfers data to or from other nodes in networks.

A.NEED OF ROUTING PROTOCOLS

Routing is a process of finding paths between nodes. The new routes are generated based on the factors like traffic, link utilization etc which is aimed at having maximum performance. Routing protocol is a protocol that specifies how routers communicate with each other, distribute information that enables them to select routes between any two nodes on a computer network, the purposes of routing protocols development are to reduce the time delay, improve the bandwidth usage, reducing power consumption, reduced the packet loss rate, reducing the routing overload, reduce the number of messages exchange and improves throughput [16]

In MANET, routing protocols are three types i.e. (1) Proactive protocols provide fast response to topology changes by continuously monitoring topology changes and disseminating the related information as needed over the network, like Optimized Link State Routing (OLSR) and Geographic Routing Protocol (GRP) is as type of proactive routing protocol. In GRP the Global Positioning System is used to locate the location of node to collects network information at a source node with a small amount of control overheads. (2) Reactive routing protocols such as Ad hoc in demand distance vector (AODV), find the route only when there is data to be transmitted hence, generate low control traffic and routing overhead. Dynamic Source routing protocol (DSR), each data packet contains complete routing information to reach its dissemination and each node uses caching technology to maintain route information. (3) Hybrid protocol could be derived from the two previous ones, containing the advantages of both the protocols [17]. Often reactive or proactive feature of a particular routing protocol might not be enough; instead a mixture might yield better solution [3]

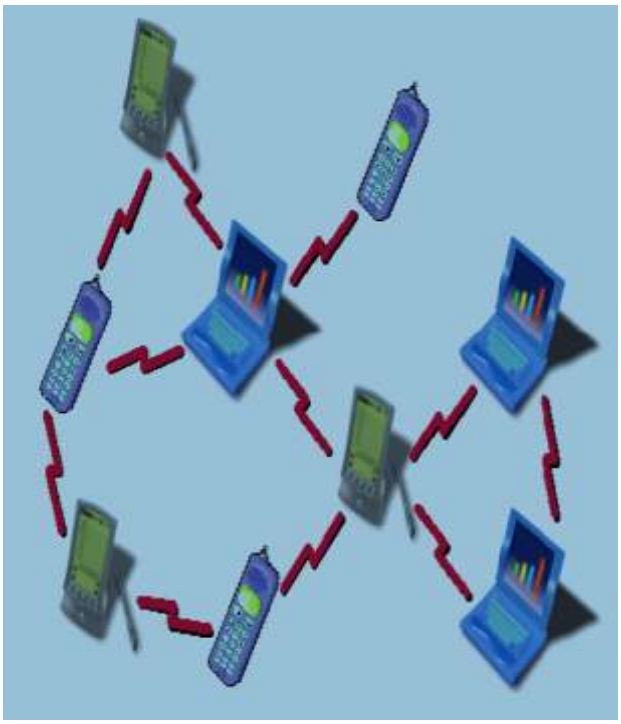

FIG.1 Mobile Ad-Hoc Network [7]

II. RELATED WORK

Work on performance evaluation of routing protocols has been carried out by many researchers using various protocols with various traffic.

In [4] authors presented an overview of routing protocols by presenting their characteristics, functionality, benefits and limitations and then made their comparative analysis so to analyze their performance and observations about how the performance of these protocols can be improved. The result showed that the performance of all protocols studied was almost stable in sparse medium with low traffic. TORA performs much better in packet delivery owing to selection of better routes using acyclic graph. The results also indicated that AODV keeps on improving with denser mediums and at faster speeds. In [8] authors presented a logical survey on performance analysis of three mobile ad hoc routing protocols (OLSR, AODV and TORA) on the basis of end to- end delay, packet delivery ratio, media access delay, path optimality, routing overhead performance metrics. The results showed that OLSR is more competent in high density networks with highly sporadic traffic. OLSR requires that it continuously have some bandwidth in order to receive the topology updates messages. AODV keeps on improving in packet delivery ratio with dense networks. The performance of all protocols was almost stable in sparse medium with low traffic. TORA performs much better in packet delivery owing to selection of better routes using acyclic graph. It has been concluded that performance of TORA is better for dense networks. The AODV is better for moderately dense networks where as the OLSR performs well in sparse networks. In case of HTTP traffic the delay and throughput both are less as compared with FTP traffic. In [12] authors presented the issues and protocols (OSPF, DSR, AODV, TORA, OLSR and DSDV) of MANET and investigated behavior of DSR, AODV,TORA protocol using metrics throughput and Network Load. The results showed that for 150 nodes TORA create less network load and throughput is high for AODV. In [15] authors compared the performance of routing protocols OLSR, GRP and TORA for mobile ad hoc network on the basis of delay, load, media access delay and throughput. The result showed OLSR performs best in terms of load and throughput.GRP performs best in terms of delay and routing overhead. TORA is the worst choice when we consider any of the four performance parameters. In summary, we could say that OLSR is best as compared to GRP and TORA in all traffic volumes since it has maximum throughput. In [18] authors presented the reactive and proactive routing protocols by focusing on DSR, AODV, TORA and OLSR routing protocol in MANET While comparing four routing protocol load, delay is low in OLSR when the number of nodes is less, so OLSR can be used in small network size. Performance is enhanced when the number of nodes is less. Throughput is high in DSR when the number of nodes increases and hence it can be used in large network size but it is not suitable for wireless transmission. TORA and AODV perform better than DSR and it is suitable in larger network size. In [21] authors compared the routing protocols AODV and OLSR for mobile ad hoc network on the basis of delay, network load and throughput. The OLSR outperforms the rest of three protocols in terms of network load and throughput. Two MANET routing protocols was analyzed. OLSR performs best in terms of network load and throughput. AODV performs worst in terms of load and throughput. AODV's performance was better for delay out of three parameters.

III. PERFORMANCE EVALUATION

A. *Simulation set up*

In this paper we have evaluated and compared the performance of MANET with five Routing Protocols namely AODV, DSR, GRP, OLSR and TORA. The performance of the network was analyzed with 25 and 50 mobile nodes. The traffic used in this work is as FTP, Video Conferencing and Voice. The comparison was done on the basis of Delay, Load and Throughput. Mobility configuration is used in this work is Random way point. Fig.2 shows the scenario of 25 mobile nodes with FTP as traffic.

B. *Performance Metrics*

The various performance metrics used for performance evaluation are as follows:

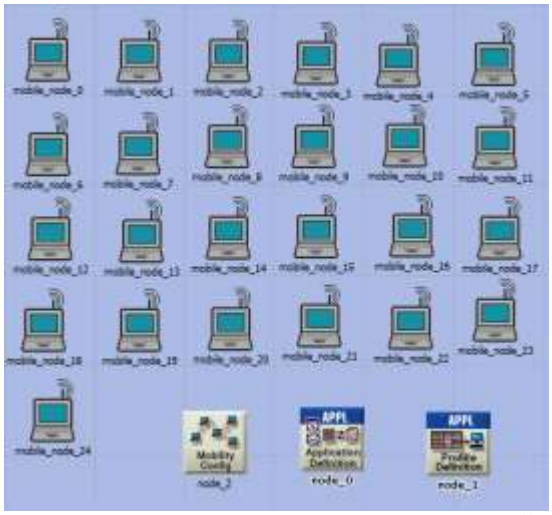

Fig.2: MANET with 25 Mobile nodes and FTP traffic

- *Throughput*-Throughput is total packets successfully delivered to individual destination over total time divided by total time.
- *Delay*- It is the ratio of time difference between every packet sent and received to the total time difference over the total number of packets received.
- *Load*- Load represents the total load in bit/sec that all higher layers submit to wireless LAN layers in all WLAN nodes of the network.

IV. SIMULATION RESULT

All the routing protocols are simulated with varying number of nodes as well as FTP, Video and Voice traffic. Results of various simulations are taken and compared on the basis of delay, load and throughput.

A. Performance of AODV Protocol:

Fig.3 shows the delay characteristics of AODV protocol for 25 and 50 mobile nodes. The traffic used in the simulation is

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FTP. As shown in Fig.2 delay increases as the number of nodes increases.

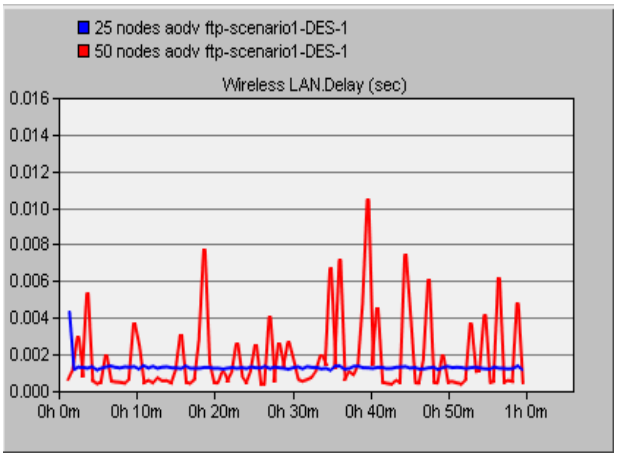

Fig. 3 Delay characteristics in AODV protocol for 25 and 50 nodes.

Table 1. Shows the combined results of all the scenarios for different traffic configurations

Table 1. Performance evaluation of AODV protocol

Nodes	FTP	VIDEO	VOICE
25	Delay=0.001298 Load=96,740.20 Throughput=1,502,812	Delay=0.001237 Load=90,880.62 Throughput=1,365,896	Delay=0.00130 Load=93,032.56 Throughput=1,434,398
50	Delay=0.001735 Load=28,994.59 Throughput=33,576.81	Delay=0.001778 Load=412,189.96 Throughput=886,102.7	Delay=0.00464 Load=237,438.49 Throughput=318,287.08
Result	25 nodes have high delay ,load and throughput.	50 nodes have high load , throughput but less delay.	50 nodes have high delay ,high load but less throughput.

B. Performance of GRP Protocol: Fig. 4 shows the delay characteristics of GRP protocol for 25 nodes and varying traffic. As shown in Fig. GRP protocol gives more delay for FTP traffic as compared with Voice and Video traffic with 25 nodes.

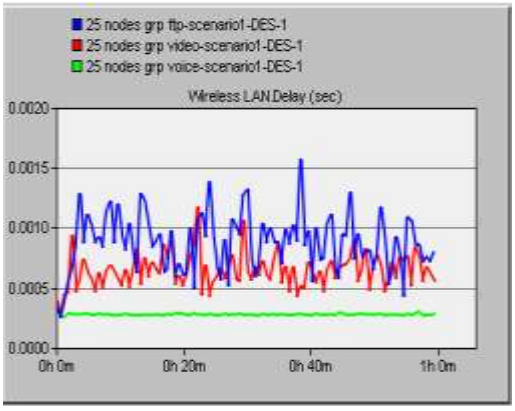

Fig. 4: Performance comparison of GRP Protocol with varying traffic

Similarly the protocol is analyzed for load characteristics and it can be shown in Fig.5 that GRP produced more load for video traffic as compared with FTP and Voice traffic with 25 nodes.

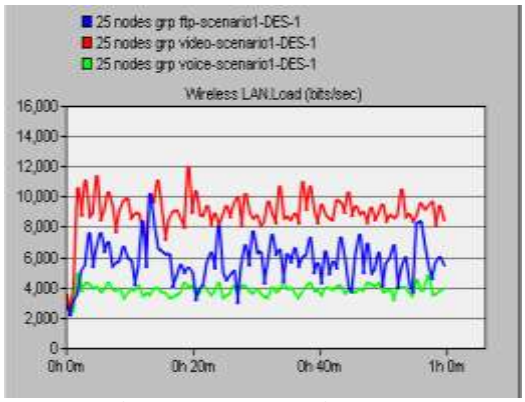

Fig. 5: Performance comparison of GRP Protocol with varying traffic

Fig.6 shows throughput characteristics of GRP protocol and it can be shown that GRP protocol gives more Throughput for video traffic as compared with Voice and ftp traffic with 25 nodes.

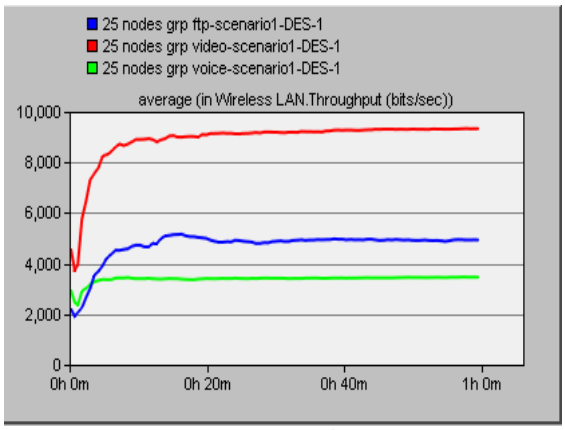

Fig. 6: Throughput characteristics of GRP Protocol with varying traffic

C. Performance of DSR Protocol: Fig. 7 shows the performance comparison of DSR protocol for 25 nodes and varying traffic. As shown in Fig. DSR protocol gives more Load for voice traffic as compared with Video and ftp traffic with 25 nodes.

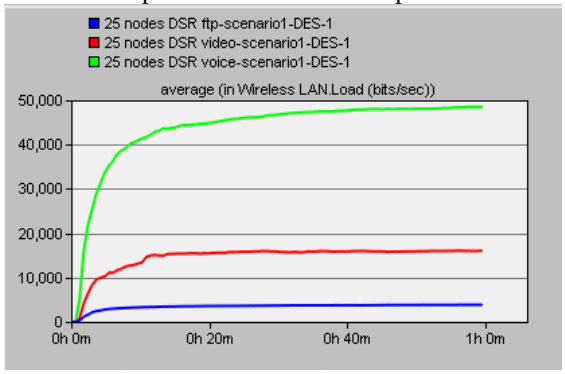

Fig. 7: Performance comparison of DSR Protocol with varying traffic

Fig. 8 shows the delay characteristics of DSR protocol for 25 nodes and varying traffic. As shown in Fig. DSR protocol gives more Delay for video traffic as compared with Voice and ftp traffic with 25 nodes.

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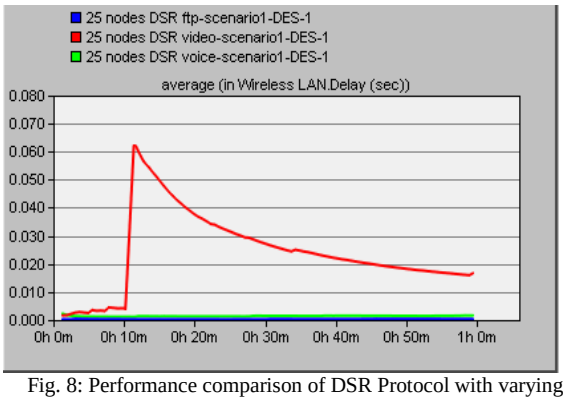

Fig. 8: Performance comparison of DSR Protocol with varying traffic

Similarly DSR protocol gives more Throughput voice traffic as compared with Video and ftp traffic with 25 nodes as shown in Fig. 9.

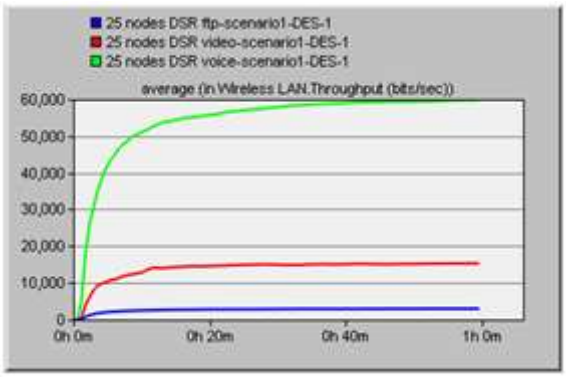

Fig. 9: Throughput Characteristics of DSR Protocol with varying traffic

D. Performance of OLSR Protocol**:** Table 2. Shows the combined results of all the scenarios for different traffic configurations for OLSR protocol

nodes	ftp	voice	video	Results
25	Delay=3.44812 Load=14,299,335.8 Throughput=14,883,814.94	Delay=6.86437 Load=17,767,694.3 Throughput=18,412,219.8	Delay=3.020285 Load=71,988,702.45 Throughput=75,405,652.1	Voice has high delay, load and throughput.
50	Delay=2.77853 Load=81,284,649.29 Throughput=96,109,146,86	Delay=6.86490 Load=1,095,936,634.9 Throughput=765,535,115.8	Delay=5.53274 Load=552,398,751.71 Throughput=553,462,710.5	Same in both traffic.

E: Performance of TORA Protocol: Fig. 10 shows the performance comparison of TORA protocol for 25 nodes and varying traffic. As shown in Fig. TORA protocol gives more Load variation for ftp traffic as compared with Video traffic with 25 nodes.

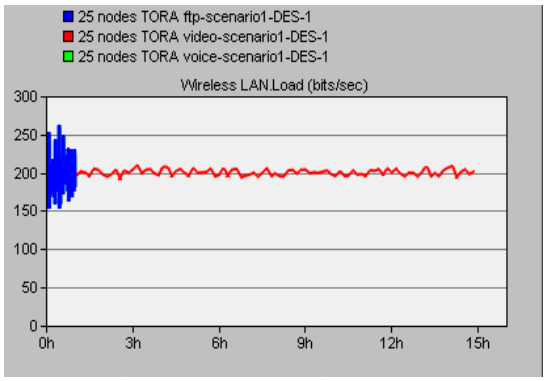

Fig. 10: Performance comparison of TORA Protocol with varying traffic

Fig. 11 shows the performance comparison of 5 routing protocols for 25 nodes with ftp traffic. As shown in Fig. AODV protocol gives more Load for ftp traffic as compared with other. Table 3 shows the compiled results of all the scenarios for various traffic configurations with all protocols.

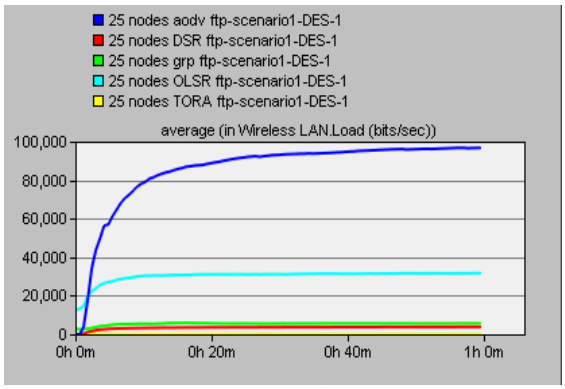

Fig. 11: Performance comparison of 5 routing Protocols with ftp traffic

Table3. Performance comparison of 5 routing protocols

Protocol→		AODV		DSR		GRP		OLSR		TORA	
Nodes→		25	50	25	50	25	50	25	50	25	50
Traffic↓											
	PARAMETER↓										
	delay(sec)	0.001298	0.0017356	0.000377	0.003281	0.00069	0.00092	0.0065	0.0004137	-	-
FTP	load(bits/sec)	96,740.20	28,994.50	3,839.38	236,241.40	5,669.58	34,118.20	31,727.52	60,095.25	199.16	398.98
	thr.(bits/sec)	1,502,812	33,576.81	2,981.12	271,743.20	4,934,917	30,501.27	44,680.39	101,979.62	-	-
	delay(sec)	0.001237	0.001778	0.016691	0.003166	0.000642	0.00062	0.000536	0.000571	-	-
VIDEO	load(bits/sec)	90,880.60	412,189.96	16,082.71	392,784.80	6,912.36	28,080.01	57,888.75	158,665.70	200.32	400,124
	thr.(bits/sec)	1,365,896	886,102.77	15,36,324	410,715.78	9,338.47	29,304.48	82,183.38	368,188.98	-	-
	delay(sec)	0.0013	0.004642	0.001613	same as	0.006279	0.00109	0.00055	0.000658	-	-
VOICE	load(bits/sec)	93,032,564	237,438.49	48,507.34	50 nodes	3,800.99	57,555.07	30,728.80	270,126.03	same as video	
	thr.(bits/sec)	1,434,398	318,287.08	59,827.05	video	3,463.52	61,316.68	48,097.91	473,818.39	-	-

V. CONCLUSION

In this paper, we have evaluated the performance of MANET with five Routing Protocols with FTP, Video and Voice traffic using OPNET simulator. The results shows that AODV protocol provides higher delay for 25 nodes as DSR provides higher load in 50 nodes and GRP provides higher throughput for 25 nodes in FTP Traffic. AODV protocol provides higher delay for 25 nodes as DSR provides higher load in 50 nodes and GRP provides higher throughput for 25 nodes in video Traffic. GRP protocol provides higher delay for 50 nodes as AODV provides

higher load in 25 nodes and AODV provides higher throughput for 25 nodes in voice Traffic. TORA have bad performance.

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