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SIMULATION BASED ANALYSIS OF OLSR AND GRP PERFORMANCE IN MOBILE AD HOC NETWORKS

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Abstract: In this paper, simulation is used to analyse the performance of OLSR and GRP routing protocols for mobile ad hoc networks. Network load, Media access delay, Retransmission attempts and Throughput are used to analyse the performance of these routing protocols. OPNET modeller is used for simulation purposes. Three scenarios are used, in first scenario network size and number of nodes are kept small, in second scenario network size is increased and number of nodes are increased, and in third scenario network size is again increased but number of nodes are kept same.

Keywords- OLSR, GRP, MANET, OPNET

INTRODUCTION

A MANET (mobile ad hoc network) is self configuring infrastructure less network and its nodes are connected using wireless links. As more and more mobiles devices are coming into use, so selection of better routing protocol has always been a issue in mobile ad hoc networks. In this paper performance of OLSR and GRP is compared using various parameters under different conditions. Most of the previous researchers have used Ns-2 simulator for analyzing the performance of routing protocols. It is very crucial to analyze the routing protocols used in mobile ad hoc networks because use of correct protocols determines the overall performance of the mobile ad hoc network.

Many researchers who have used OPNET for simulation purposes have compared the performance of various routing protocols using various parameters like delay, load throughput [1]. Mainly researchers have compared the AODV with other routing protocols used for mobile ad hoc networks [2-8].

Most of the researchers have used throughput, delay for determining the performance of routing protocols. In this paper network load, media access delay, retransmission attempts and throughput are used to determine the performance of routing protocols under three different scenarios. In first scenario size in kept small and number of nodes taken are also small. In second scenario size in increased and nodes are also increased. In third scenario size in increased but number of nodes are kept same as that in second scenario. Based on these parameters performance and reliability of OLSR and GRP is analyzed.

OLSR

OLSR is a proactive routing protocol for mobile ad hoc networks. It is a link state routing algorithm optimized for the use in mobile ad hoc networks, which can also be used for wireless ad hoc networks. Message flooding is optimized to preserve to preserve bandwidth. Optimization is based on the technique called multipoint relaying. All the nodes contain the pre computed information about routing under this protocol. OLSR performs hop by hop routing. Each node selects the particular set of nodes for forwarding the control traffic, these are called multi point relays (MPRs). Function of the MPR is to form a route between source and destination. All this information is given to the neighboring MPRs through control messages. Size of control traffic is also reduced due to the use multipoint relays. Selection of MPRs reduce the flooding overhead and provide the optimal flooding distance.

GRP:

Geographical routing has become one of the most important routing strategies in wireless mobile ad hoc networks mainly due to scalability. GRP is also known as position based-routing. Geographic or position based routing is introduced to overcome the limitation of the topology based routing protocols in mobile ad hoc networks. GRP relies on the piece of information that is the physical location of the node. Thus it is necessary for the nodes to obtain their coordinates by using services like GPS or other type of positioning systems. GRP is based on two assumptions: first one is that nodes are aware of their own geographic locations and also of its immediate neighbor locations and second one is that source node is aware of position of destination. Node updates its immediate neighbor locations periodically. Routing to particular destination from source depends on the information that source have about its neighbors. Greedy routing and face routing are the most commonly used geographic routing algorithms [9].

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PERFORMANCE METERICES

Various metrics used for analyzing the performance of OLSR and GRP are as follows:

- ***a.*** ***Network load:*** it determines the total traffic received in bits/sec for upper layers of MACs and that is accepted and queued for transmission.
- ***b.*** ***Media Access Delay:*** it is calculated for each frame. It includes queuing and contention delays. It is measured in seconds.
- ***c.*** ***Retransmission Attempts:*** it measures the total number of retransmission attempts in the network until packet is successfully sent or limit is reached.
- ***d.*** ***Throughput:*** it measures the total number of bits forward. It is measured in bit/sec.

SIMULATION SETUP AND RESULTS

Scenario1:

In the first scenario we have 20 mobile nodes, 11 Mbps is the data rate, node transmission power (W) is 0.005 and operational mode is 802.11b. Network area overlay for the first scenario is 5000 square meters. Nodes are placed in random fashion. Random way point model is used for the defining the mobility of nodes. MANET traffic generation parameter is set to one. The simulation is set to run for 400 seconds and simulation kernel is set to optimized.

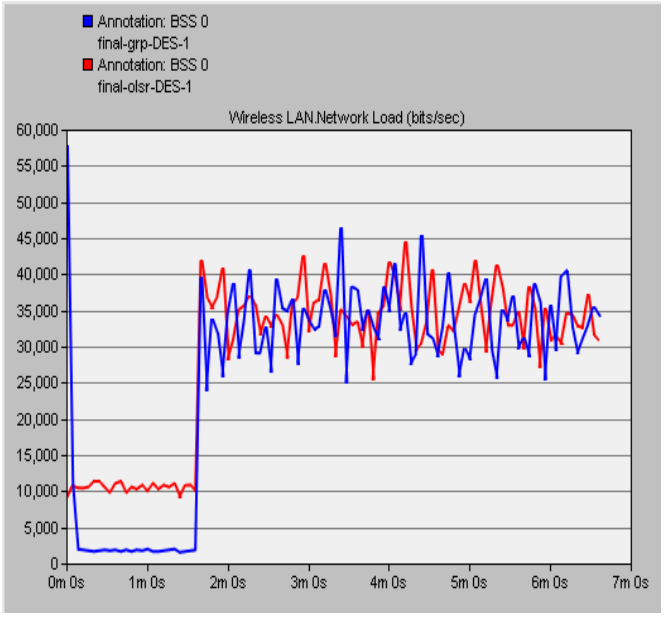

Figure 1: NETWORK LOAD for OLSR and GRP

Fig. 1 shows the two protocols OLSR and GRP for the NETWORK LOAD. Here we can see that the maximum value of network load that is handled is greater for the GRP as compared to the maximum value of network load handled by the OLSR protocol. Maximum value of NETWORK LOAD for OLSR is 44632 bits/sec and maximum value of NETWORK LOAD for GRP is 57800 bits/sec. But time average value of NETWORK LOAD is more for the OLSR as compared to the time average value for the GRP. Time average value for OLSR is 28584.4 bits/sec and for GRP is 26190.9 bits/sec.

Fig. 2 shows the MEDIA ACCESS DELAY for the OLSR and GRP protocols. Here we can see that the maximum value for the MEDIA ACCESS DELAY for OLSR is 4.16373e-005 seconds and for GRP it is 0.00265712 seconds. But the time average value for MEDIA ACCESS DELAY for OLSR is 8.91703e-006 seconds and for GRP it is 5.83154e-005 seconds.

Fig. 3 shows the graphs for the RETRANSMISSION ATTEMPTS for OLSR and GRP. The maximum value for the RETRANSMISSION ATTEMPTS for GRP protocol is 0.226804 packets and the maximum value for the RETRANSMISSION ATTEMPTS for the OLSR protocol is 0.255319 packets. The time average value for the RETRANSMISSION ATTEMPTS for the GRP protocol is 0.00302405 packets and the time average value for the RETRANSMISSION ATTEMPTS for the OLSR protocol is 0.0035752 packets.

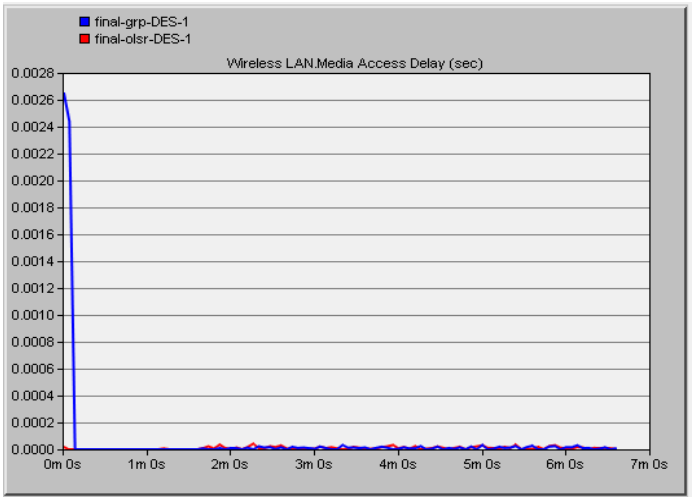

Figure 2: MEDIA ACCESS DELAY for OLSR and GRP

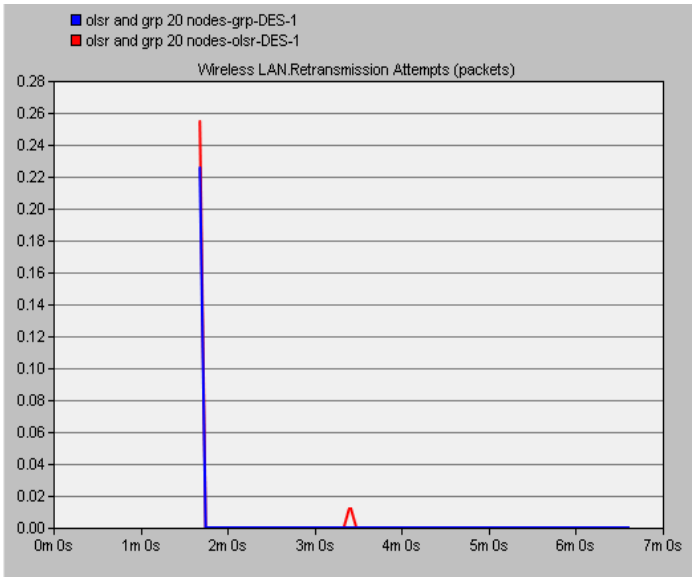

Figure 3: RETRANSMISSION ATTEMPTS for OLSR and GRP

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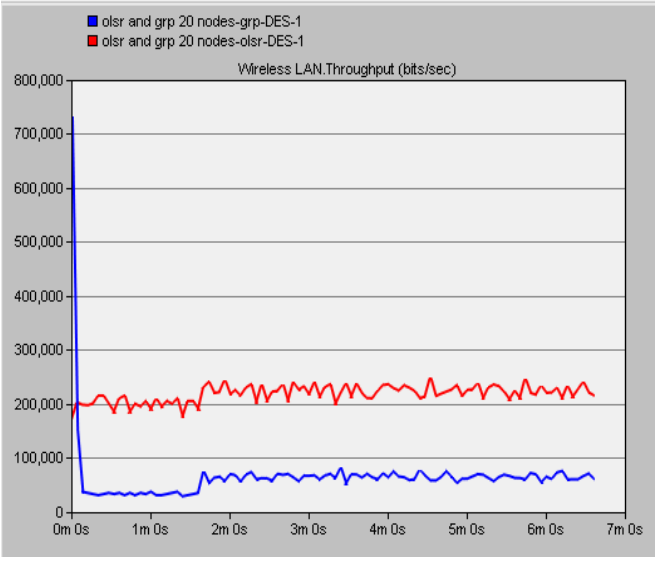

Figure 4: THROUGHPUT for OLSR and GRP

Based on the results obtained from the figure 4 THROUGHPUT for OLSR and GRP the maximum value of THROUGHPUT for OLSR is 249704 bits/sec and the maximum value of THROUGHPUT for GRP is 731170 bits/sec. Based on these graphs for THROUGHPUT the time average value for the OLSR is 218857 bits/sec and the time average value for the GRP is 65726.8 bits/sec. So we can see the maximum value of throughput is greater for the GRP.

Scenario2:

In the second scenario we have 100 mobile nodes, 11 Mbps is the data rate, node transmission power (W) is 0.005 and operational mode is 802.11b. Network area overlay for the second scenario is 8000 square meters. Nodes are placed in random fashion. Random way point model is used for the defining the mobility of nodes. MANET traffic generation parameter is set to one. The simulation is set to run for 500 seconds and simulation kernel is set to optimized.

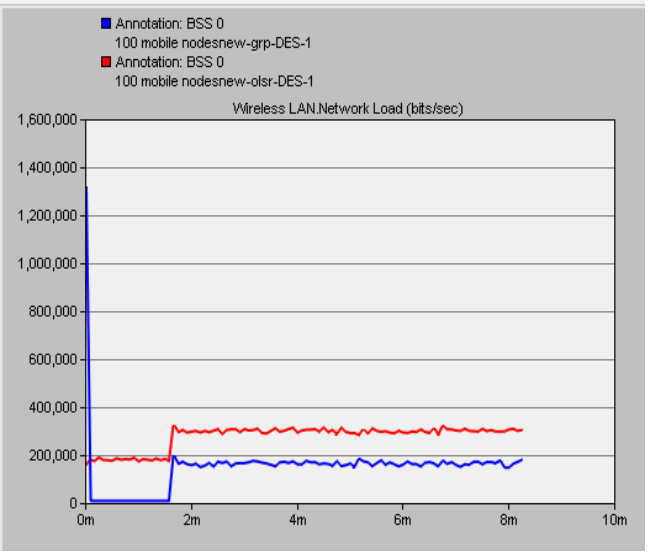

Figure 5: NETWORK LOAD for OLSR and GRP

Based on the results obtained from figure 5 for NETWORK LOAD for OLSR the maximum value of NETWORK LOAD that can be handled by network is 326722 bits/sec and for GRP it is 1.31961e+006 bits/sec. The time average value of NETWORK LOAD for GRP protocol is 147002 bits/sec and for OLSR it is 276870 bits/sec.

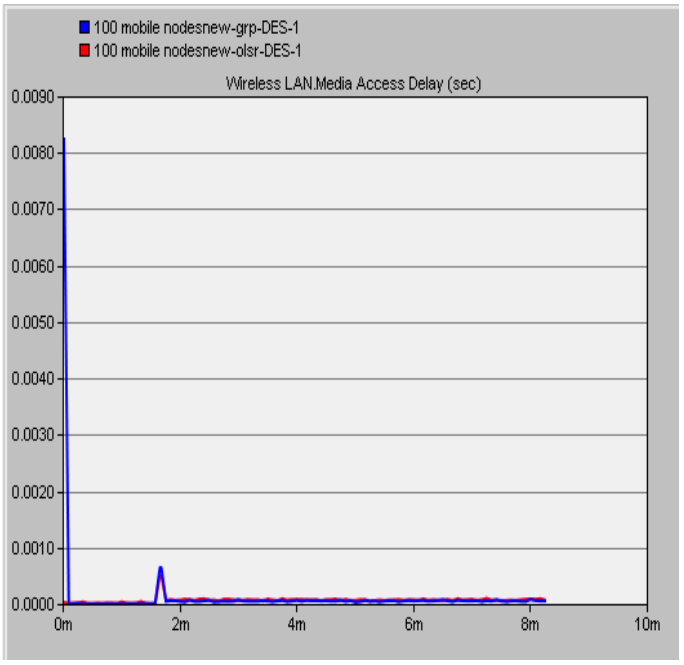

Figure 6: MEDIA ACCESS DELAY for OLSR and GRP

Figure 6 shows the MEDIA ACCESS DELAY for the OLSR and GRP protocols. Here we can see that the maximum value for the MEDIA ACCESS DELAY for OLSR is 0.000536926 seconds and for GRP it is 0.00827591 seconds. But the time average value for MEDIA ACCESS DELAY for OLSR is 6.54872e-005 seconds and for GRP it is 0.000132871 seconds.

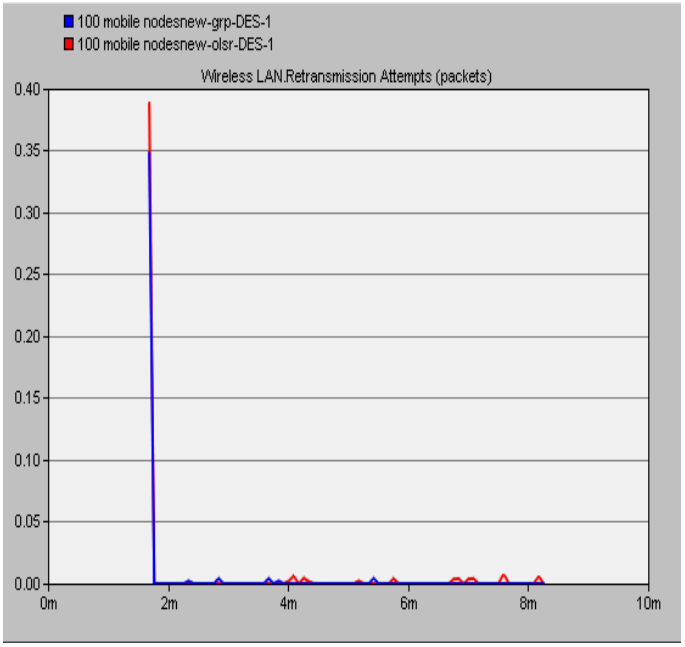

Figure 7: RETRANSMISSION ATTEMPTS for OLSR and GRP

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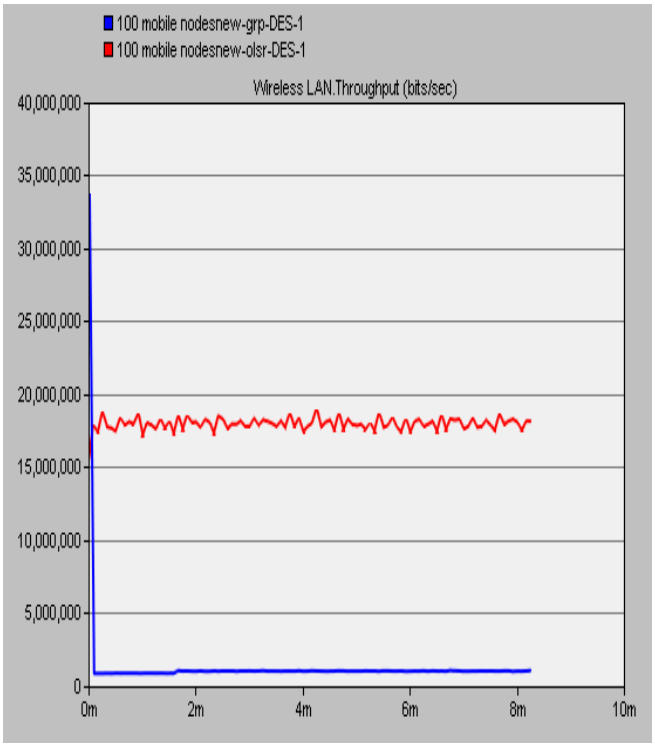

Figure 8: THROUGHPUT for OLSR and GRP

Figure 7 shows the graphs for the RETRANSMISSION ATTEMPTS for OLSR and GRP. The maximum value for the RETRANSMISSION ATTEMPTS for GRP protocol is 0.349153 packets and the maximum value for the RETRANSMISSION ATTEMPTS for the OLSR protocol is 0.388982 packets. The time average value for the RETRANSMISSION ATTEMPTS for the GRP protocol is 0.00457042 packets and the time average value for the RETRANSMISSION ATTEMPTS for the OLSR protocol is 0.00547779 packets.

Based on the results obtained from the figure 8 THROUGHPUT for OLSR and GRP the maximum value of THROUGHPUT for OLSR is 1.90167e+007 bits/sec and the maximum value of THROUGHPUT for GRP is 3.37242e+007 bits/sec. Based on these graphs for THROUGHPUT the time average value for the OLSR is 1.79734e+007 bits/sec and the time average value for the GRP is 1.33326e+006 bits/sec.

Scenario3:

In the third scenario we have 100 mobile nodes, 11 Mbps is the data rate, node transmission power (W) is 0.005 and operational mode is 802.11b. Network area overlay for the third scenario is 9000 square meters. Nodes are placed in random fashion. Random way point model is used for the defining the mobility of nodes. MANET traffic generation parameter is set to one. The simulation is set to run for 500 seconds and simulation kernel is set to optimized.

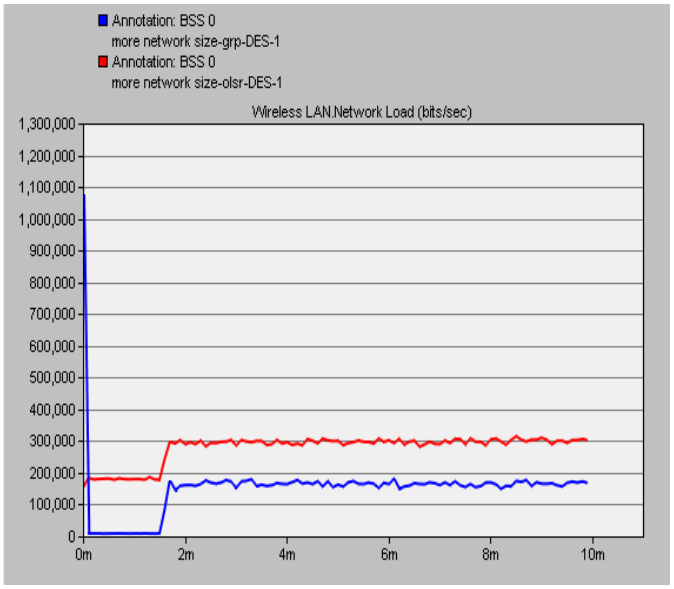

Figure 9: NETWORK LOAD for OLSR and GRP

Based on the results obtained from figure 9 for NETWORK LOAD for OLSR the maximum value of NETWORK LOAD that can be handled by network is 314965 bits/sec and for GRP it is 1.07841e+006 bits/sec. The time average value of NETWORK LOAD for OLSR protocol is 278282 bits/sec and for GRP it is 150112 bits/sec.

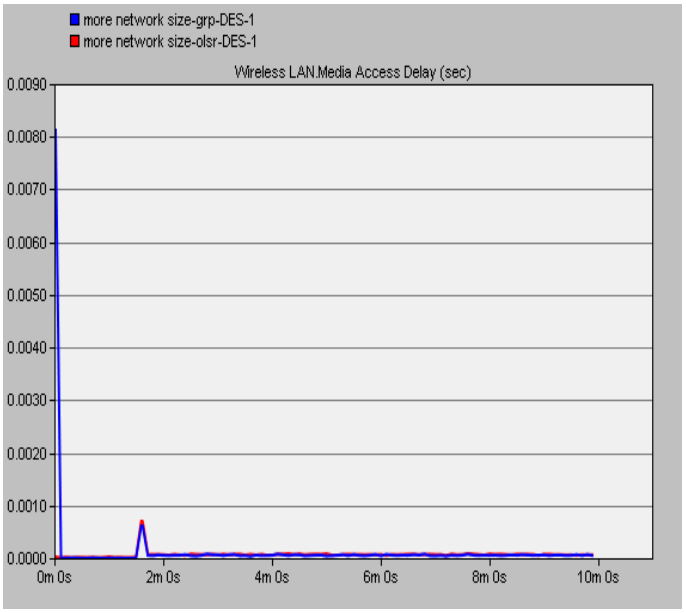

Figure 10: MEDIA ACCESS DELAY for OLSR and GRP

Figure 10 shows the MEDIA ACCESS DELAY for the OLSR and GRP protocols. Here we can see that the maximum value for the MEDIA ACCESS DELAY for OLSR is 0.000731991 seconds and for GRP it is 0.00814474 seconds. But the time average value for MEDIA ACCESS DELAY for OLSR is 6.74127e-005 seconds and for GRP it is 0.000134545 seconds.

Figure 11 shows the graphs for the RETRANSMISSION ATTEMPTS for OLSR and GRP. The maximum value for the RETRANSMISSION ATTEMPTS for GRP protocol is

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0.742958 packets and the maximum value for the RETRANSMISSION ATTEMPTS for the OLSR protocol is 0.772109 packets. The time average value for the RETRANSMISSION ATTEMPTS for the GRP protocol is 0.00904215 packets and the time average value for the RETRANSMISSION ATTEMPTS for the OLSR protocol is 0.00944313 packets.

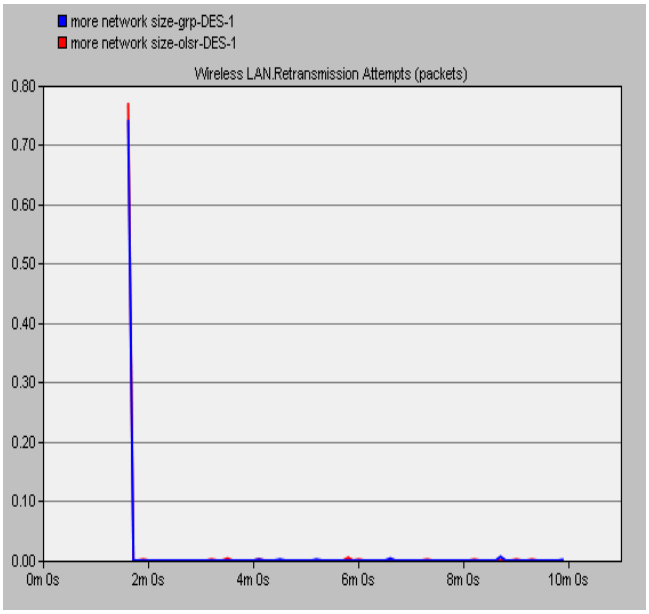

Figure 11: RETRANSMISSION ATTEMPTS for OLSR and GRP

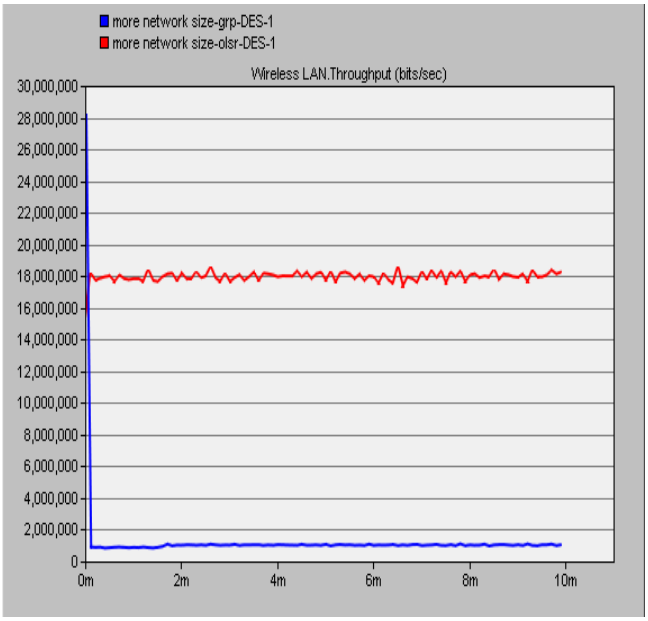

Figure 12: THROUGHPUT for OLSR and GRP

Based on the results obtained from figure 12 THROUGHPUT for OLSR and GRP the maximum value of THROUGHPUT for OLSR is 1.86092e+007 bits/sec and the maximum value of THROUGHPUT for GRP is 2.82199e+007 bits/sec. Based on these graphs for THROUGHPUT the time average value for the OLSR is 1.79655e+007 bits/sec and the time average value for the GRP is 1.28404e+006 bits/sec.

CONCLUSION

Based on the results obtained we can see that behavior of the protocols for the metrics network load, media access delay, retransmission attempts and throughput remained similar for the three different scenarios. On the average maximum network load that is accepted from upper layer's and queued for further transmission is more for OLSR as compared to GRP. Maximum and average value of media access delay value is small for OLSR as compared to GRP in all the three scenarios. Maximum and average number of retransmission attempts for OLSR are more as compared to GRP protocol in all the three scenarios. It implies OLSR is more reliable as compared to GRP. Average value of throughput is more for OLSR as compared to GRP for all the three scenarios. So in conclusion on the basis of these metrics OLSR has performed better in comparison to GRP.

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