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PERFORMANCE OF MANET ROUTING PROTOCOL IN AD-HOC NETWORK

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Abstract: A Mobile Ad-hoc Network (MANET) is a collection of wireless mobile nodes that capable of communicating with each other without the use of fixed network infrastructure or centralized administration.Due to the unavailability of controlling entity, routing and netw management are done cooperatively by respective nodes. In MANET intermediate nodes are u to route the packets from the source node to the destination node. In MANET, various kin routing protocols are taken into consideration, i.e. AODV, OLSR, GRP etc. In this paper, diffe network scenarios with increasing density of nodes in ad-hoc network have been. In propc work, new node model is designed by adapting standard node model to enhance the ov performance of network and also able to overcome the interaction of fundamental difficu such as contention, node connectivity and congestion to meet the defined Quality of Serv standards. The performance of three MANET routing protocols AODV, OLSR, GRP have b calculated by using new node model and standard node model. Network through retransmission attempts and network load metrics are considered as the performance evalua parameters.

Keywords: MANET, AODV, OLSR, GRP

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INTRODUCTION

MANET (Mobile Ad-hoc Network) is an autonomous system, where nodes are connected with each other through wireless links. There is no restriction on the nodes therefore the nodes join or leave the network freely. Mobile Ad-hoc Network topology is dynamic that can change rapidly because the nodes can organize themselves randomly and can move freely. This property of the nodes makes the Mobile Ad-hoc Network unpredictable from the point of view of scalability and topology. Mobile Ad-hoc Network is a collection of wireless mobile nodes that are capable of communicating with each other without the use of centralized administration or fixed network infrastructure. Mobile Ad-hoc Networks are self-configuring and self-organizing multi-hop wireless networks where the structure of the network changes dynamically. This is due to the mobility of the nodes because the nodes in these networks utilize the same random access wireless channel which is cooperating in a friendly manner to engage them in multi-hop forwarding. The node in the network acts as hosts but also act as routers that route data to/from other nodes in network. Each device in a Mobile Ad-hoc Network is free to move in any direction independently and will therefore change its links to other devices frequently. Each node in network must forward traffic unrelated to its own use. Routing in ad-hoc networks has been a challenging task ever since the wireless networks came into existence. The major reason is the constant change in network topology because of high degree of node mobility. There are number of protocols that have been developed for accomplish this task. Routing is the process of selecting paths in a network along which to send network traffic. The nodes in a MANET can be of varying capabilities. Mobile phones, laptop computers and Personal Digital Assistants (PDAs) are some examples of nodes in ad-hoc networks. In MANETs nodes are often mobile but it can consist of stationary nodes as well, such as access points to Internet. Mobile nodes are connected by wireless links.

1. Routing protocols of MANET

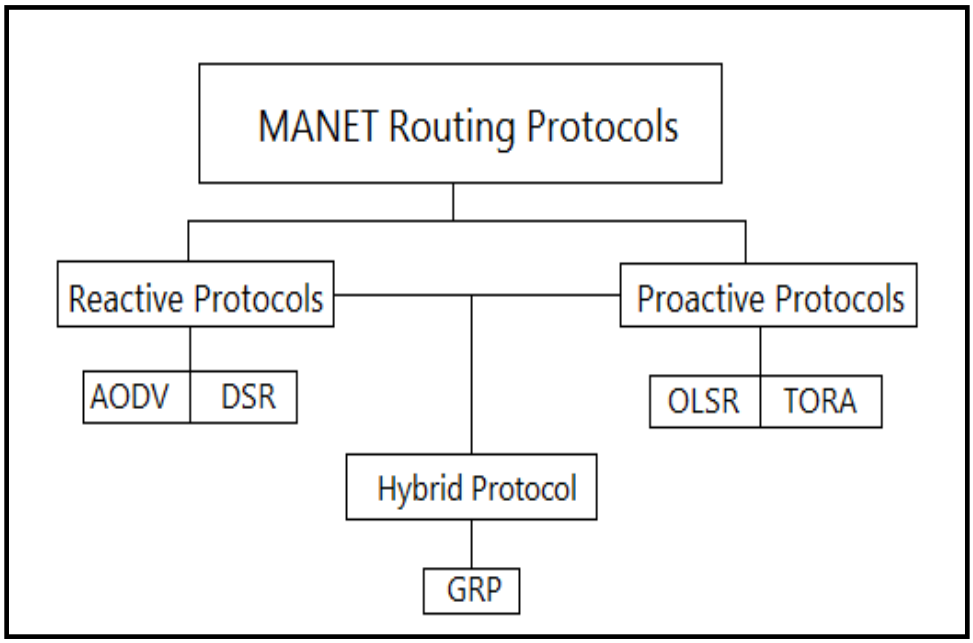

Figure 1: Hierarchy of MANET Routing Protocols

A) Reactive Protocols

Reactive protocols do not initiate route discovery by themselves until they are requested, by a source node to find a route. These protocols setup routes when demanded i.e. when a node wants to communicate with another node in the network, and the source node do not have a route to the node and source node wants to communicate with reactive routing protocols will establish a route from the source to destination node.

B) Proactive Protocols

Proactive Protocols maintain constantly updated topology of the network. All the nodes in the network know about the every other node of that network in advance. All the routing information is usually kept in number of different tables. Whenever, there is a change in the network topology the routing tables are updated according to the changes.

C) Hybrid Protocols

These protocols exploit the strengths of both reactive and proactive protocols and combine them together to get better results.

3. Performance Evaluation and Design

Performance metrics are used in the evaluation of routing protocols. These metrices represent different characteristics of the overall network performance.

- **Throughput**

It represents the total number of bits (in bits/sec) forwarded from wireless LAN layers to higher layers in all WLAN nodes of the network. Throughput can be defined as the ratio of the total amount of data that reaches a receiver from the sender. Throughput can be defined as the time it takes for the receiver to get the last packet. It is expressed in bits per second.

- **Network Load (bits/sec)**

Network load represents the total load in bit/sec submitted to wireless LAN layers by all higher layers in all WLAN nodes of the network. When there is more traffic on the network, and it become difficult for the network to handle all this traffic so it is called the network load.

- **Media Access Delay (sec)**

It represents the statistic for the total of queuing and contention delays of the data, management, delayed Block-ACK and Block-ACK Request frames transmitted by all WLAN MACs in the network.

RESULTS AND DISCUSSIONS

To design new node model the performance of three MANET routing protocols AODV, OLSR, GRP have been calculated by using new node model and standard node model. Network throughput and network load metrics are considered as the performance evaluation parameters.

Throughput for AODV: Throughput measures the overall performance of the network. The graph depicts that the throughput for the network of 20 and 40 nodes designed by modified node model using high traffic load applications to generate data in the network has increased by 13.15% and 15.83% respectively.

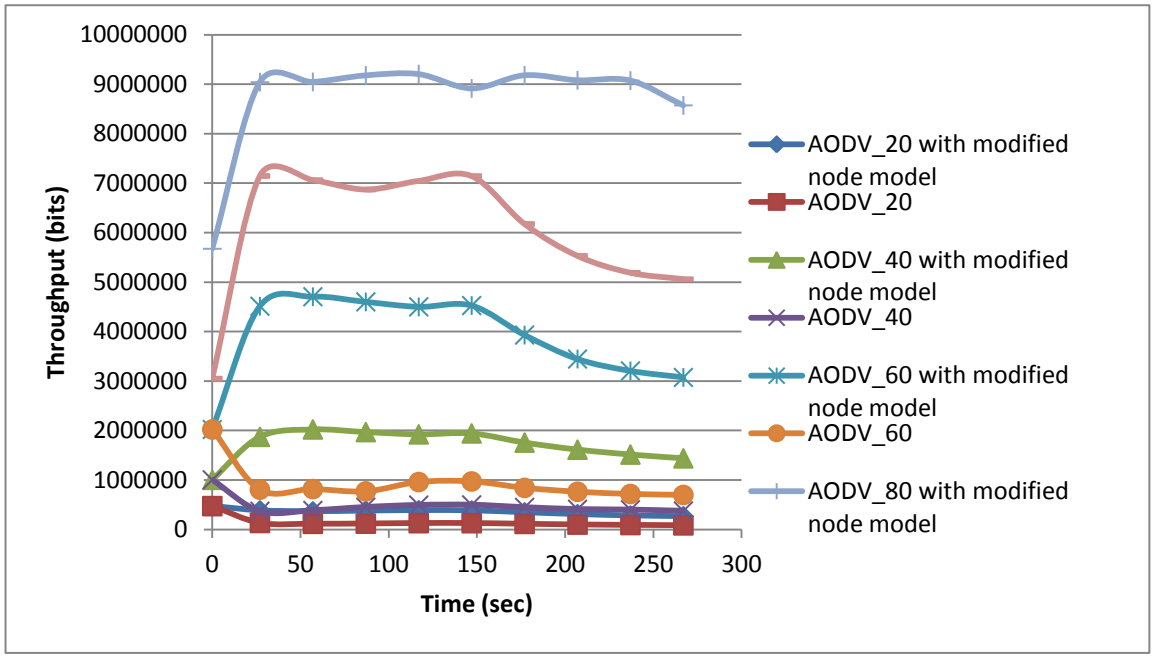

Figure 2: Throughput of AODV

In modified node model, the re-routing of the data packets from the overflowed server to the under flowed server makes the data packets not be dropped and make their delivery more reliable. The AODV protocol throughput begins with the small value, after that it keeps on increasing and decreasing within some specific range. At the same time, the throughput of AODV protocol with large network size begins with greater value. The network that is designed by 60 and 80 nodes, throughput has increased by 17.16% and 18.67%.

Throughput for OLSR: Figure 3 shows throughput of OLSR protocol with varying node densities from 20 to 80 nodes under network scenarios using with modified node model and standard node model. The throughput of network of 20 and 40 nodes has been increased by 10.40% and 13.56% respectively.

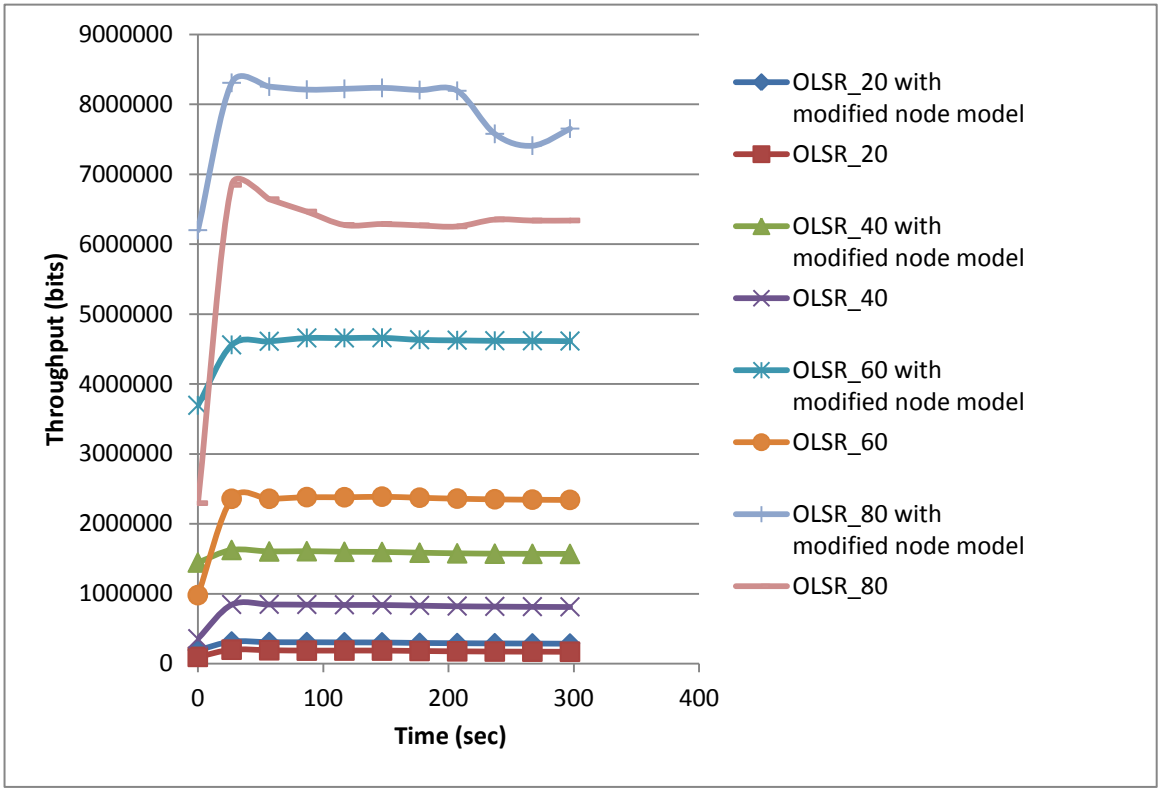

Figure 3: Throughput of OLSR

By analyzing the graph, it is observed that throughput of OLSR protocol with modified node model is increased, when the number of nodes is increased at transmission speed of 10 Mbps than standard node model. OLSR protocol is independent of the traffic and network density. OLSR reduce the control overhead forcing the MPR to propagate the updates of the link state and it is suitable for dense networks. The increment is 15.72% and 17.42% in network of 60 and 80 nodes.

Throughput for GRP: It shows throughput of GRP protocol with varying node densities from 20 to 80 nodes. Throughput of the networks based on new node model and standard node model with different network sizes configured by using a hybrid protocol.

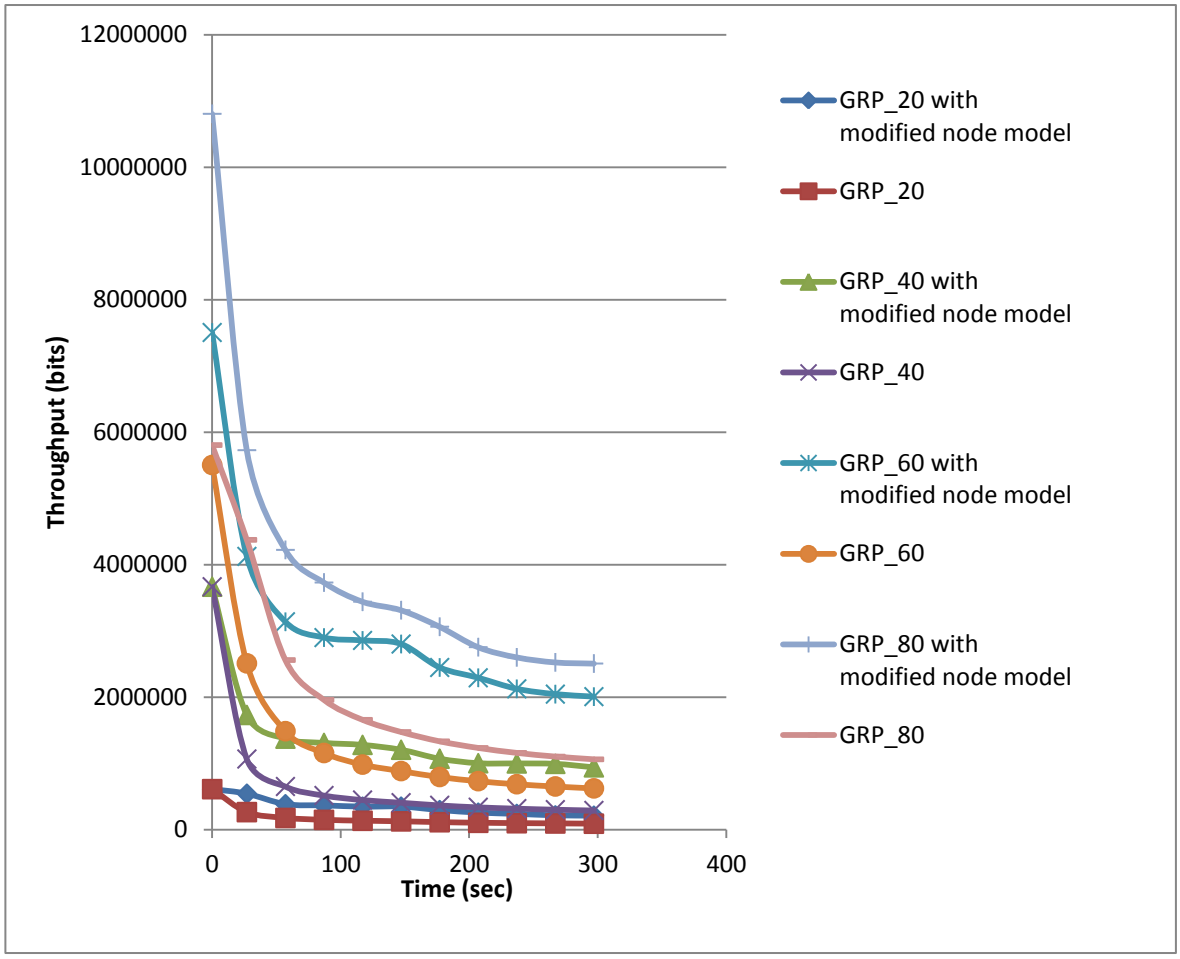

Figure 4: Throughput of GRP

The rendered graph depicts that the throughput for the network designed by using new node model using high traffic load applications to generate data in the network has increased by 13.20% and 15.63% for network of 20 and 40 nodes. The throughput of network that is designed by 60 and 80 nodes has been increased by 18.44% and 20.64% respectively.

Network Load for AODV: The rendered graph 4.4 depicts the network load of AODV possessed by the network using standard node model and modified node model under different types of network sizes that varies from 20 to 80 nodes. In the graphs, it has shown that for AODV protocol, the network load for the network new node model has increased by 1.66% and 3.05% for node density 20 and 40. In the network load, all the successfully received data packets, control messages and dropped data packets are considered. If the network load of modified node model is increasing than standard node model that means the drop of data has decreased

and flow of control messages has also decreased due to the stability of the routes between the nodes. The increment in network load is 4.34% and 5.62% for the network of 60 and 80 nodes.

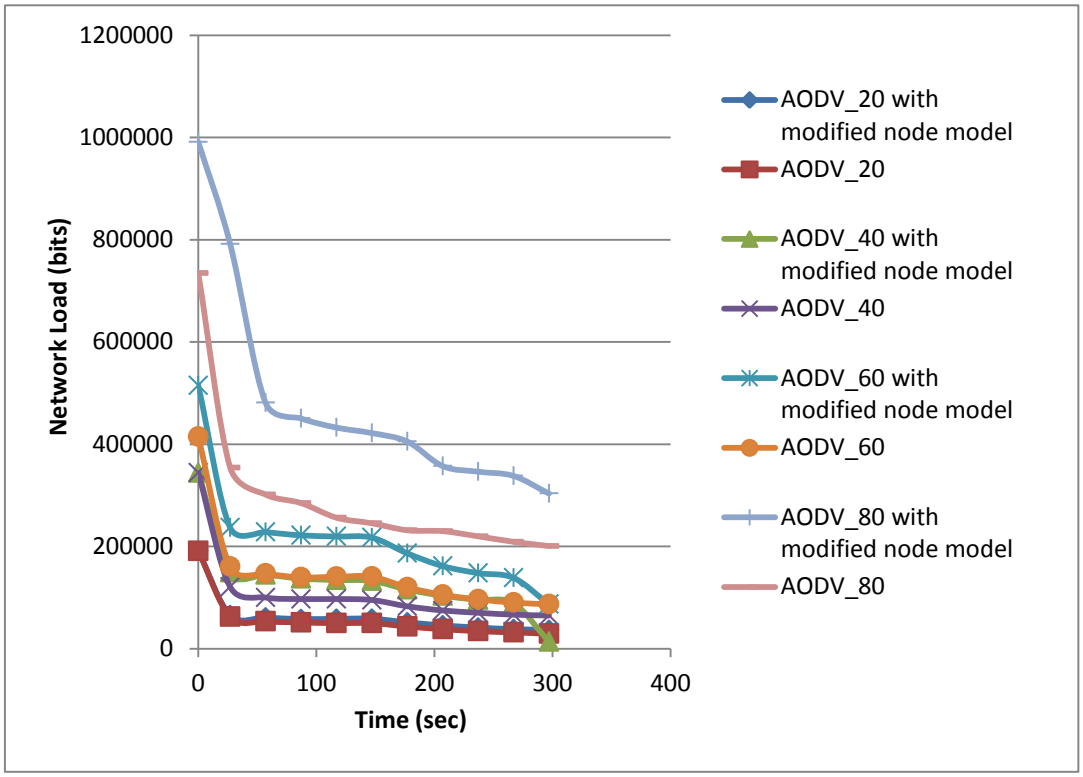

Figure 5: Network Load of AODV

Network Load for OLSR: As shown in figure 6, the network load for OLSR protocol has increased for all the networks using standard node model under different types of network sizes that varies from 20 to 80 nodes.

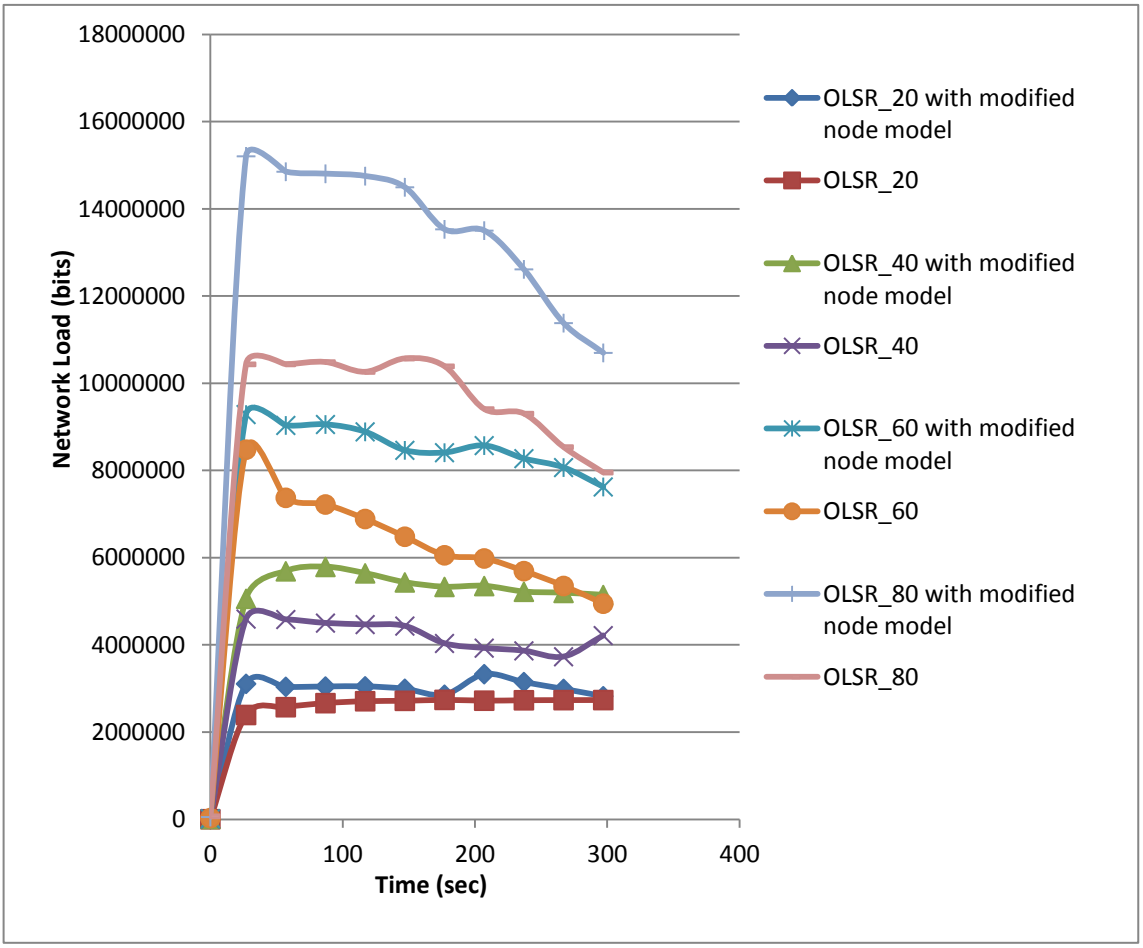

Figure 6: Network Load of OLSR

In the case of the new node model based networks, the network load has increased by 2.06% and 3.35% for 20 and 40 node networks. Due to less data drop and less network overhead, the network load has been increased for all networks. The network that is designed by 60 and 80 nodes, network load has increased by 4.72% and 6.99% respectively.

Network Load for GRP: Figure 7 shows the network load of GRP possessed by the network that varies from 20 to 80 nodes. In the graph, the network load for the network new node model has increased by 2.76% and 5.27% for 20 and 40 nodes network.

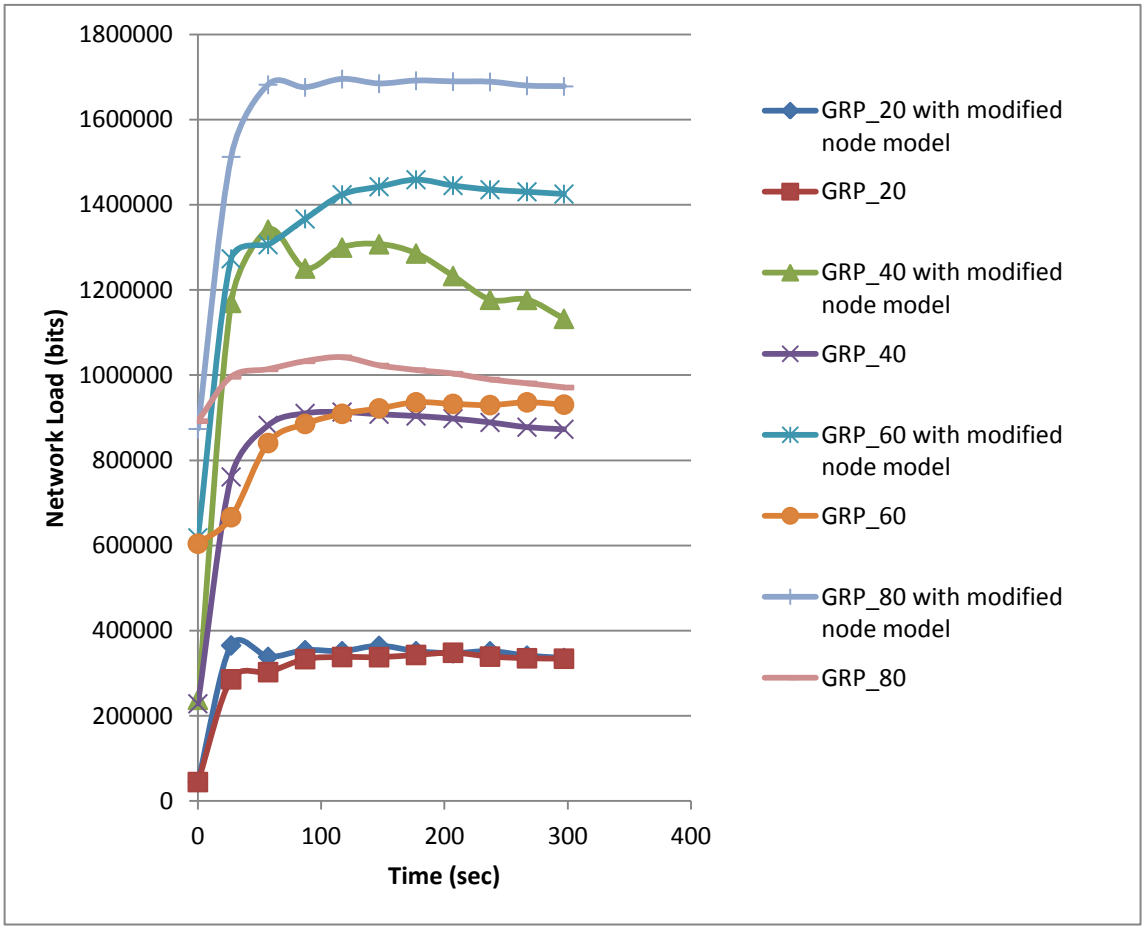

Figure 7: Network Load of GRP

In the load of a network, all the successfully received data packets, control messages and dropped data packets are considered. In this, the value of network load start with peak value and start to decrease for some duration of simulation period and after that start to increase along the simulation period. The increment in network load is 6.09% and 7.57% for 60 and 80 node density networks.

cONCLUSION

In this work, Simulation of three MANET routing protocols AODV, OLSR and GRP under different client-server architecture and peer-to-peer architecture based applications such as Heavy HTTP Browsing, High Load Remote Login, respectively using OPNET modeler are performed. The performance of three MANET Routing Protocols with increasing density of nodes in ad hoc network effects on QoS (Quality of Services) of MANET has been analyzed. From the simulation results it has been concluded that on increasing the number of nodes, the performance of all

protocols has improved by using new modified node model that causes less routing overhead and less packet dropped but it varies from protocol to protocol. As the number of nodes increased, the network load also increased for all three routing protocols. Finally, simulation results confirm that AODV protocol giving better performance under the given circumstances, providing better QoS by providing good throughput, less delay and less data dropped. In case of network load too it is observed that on varying the node density, performance of GRP protocol is very high. OLSR performance is average during the simulation. High network load affects the MANET routing packets. By comparing gathered results of AODV, OLSR and GRP routing protocols, it has seen that AODV perform well than OLSR and GRP in delay, network load and throughput and retransmission attempts.

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