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RESEARCH ARTICLE

RELATIVE INVESTIGATION OF OLSR, TORA AND GRP ROUTING PROTOCOL USING OPNET

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Abstract— A MANET network is a group of sensor nodes with wireless communication competency. Each node acts as router in the network. There are a number of issues which affect the reliability of Ad-hoc networks and limit their viability for different scenarios; lack of centralized structure within MANET requires that each individual node must act as a router and is responsible for performing packet routing tasks; this is done using one or more common routing protocols across the MANET therefore the routing in MANETs is a key issue. The node mobility is the major reason behind changing topology. In this paper routing protocols TORA, OLSR and GRP for mobile ad hoc network are compared on the basis of delay, network load and throughput. This comparative study shows that OLSR outperforms the rest of three protocols in terms of delay, network load and throughput.

Key Terms: - MANET; OPNET; TORA; GRP; OSLR; LOAD; THROUGHPUT; DELAY

I. INTRODUCTION

Mobile Ad-hoc Network (MANET) is a collection of independent mobile nodes that can communicate to each other via radio waves. The mobile nodes that are in radio range of each other can directly communicate, whereas others need the aid of intermediate nodes to route their packets [1].There are three categories of routing protocols. Reactive routing protocols are acquiring routing information only when it is needed they are on-demand protocol. In reactive routing, a route determination process is invoked on demand when a source node request for a route to destination node [2]. Proactive protocols are table driven protocols and find routes before they need it. Hybrid routing protocol, simultaneously use the strengths of reactive routing and proactive routing protocols.

In this paper, three MANET routing protocols TORA, OLSR and GRP are evaluated on the basis of three parameters: delay, network load, and throughput. The organization of the paper is as follows. We explain routing protocols in section II, related works are discussed in section III, section IV explains the simulation and performance metrics, section V explains the results of simulations and finally section VI concludes the paper.

II. ROUTING PROTOCOLS IN MANETS

In this paper we considered three type of routing protocols, one from each category:

A. Optimized Link State Routing (OLSR):

It is table driven protocol. OLSR is a table driven protocol. It usually stores and updates its routes so when a route is needed, it present the route immediately without any initial delay. In OLSR, some candidate nodes called multipoint relays (MPRs) are selected and responsible to forward broadcast packets during the flooding process. This technique reduces the overhead of packet transmission compared to flooding mechanism. OLSR performs hop-by-hop routing, where each node uses its most recent routing information to route packets. MPR‟s is made in a way that it covers all nodes that are two hops away (i.e. neighbours of the neighbours). A node senses and selects its MPR's with control messages called HELLO messages. Hello messages are used to ensure a bidirectional link with the neighbour. HELLO messages are sent at a certain interval. Nodes broadcast “TC” or Topology control messages to determine its MPR’s [4].

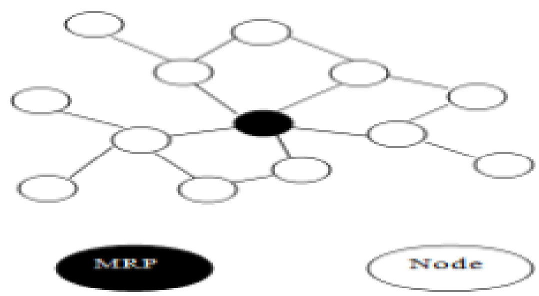

Fig 1: Flooding packets using MRP

B. Geographic Routing Protocol (GRP)

Geographic routing has become one of the most suitable routing strategies in wireless mobile ad hoc network mainly due to its scalability. That is because there is no need to maintain explicit routes. The principle approach in geographic routing is greedy forwarding, which fails if the packet encounters a void node (i.e., a node with no neighbour closer to the destination than itself).Geographic routing protocols scale better for ad hoc networks mainly for two reasons one is that there is no necessity to keep routing tables up-to-date and second is that there is no need to have a global view of the network topology and its changes. Therefore, geographic routing protocols have attracted a lot of attention in the field of routing protocols for MANETs. These geographic approaches allow routers to be nearly stateless because forwarding decisions are based on location information of the destination and the location information of all one-hop neighbours [5].

C. Temporally Ordered Routing Algorithm (TORA)

The TORA use a "flat", non-hierarchical routing algorithm which enable it to achieve a high degree of scalability. TORA builds and maintains a Directed Acyclic Graph (DAG).It is a source-initiated on-demand routing protocol. It finds multiple routes from a source node to a destination node. The main feature of TORA is that the control messages are localized to a very small set of nodes near the occurrence of a topological change. To achieve this, the nodes maintain routing information about adjacent nodes. The protocol has three basic functions: Route creation, Route maintenance and Route erasure [7].

III. RELATED WORKS

The Performance comparison of OLSR, GRP and TORA using OPNET is done by Harmanpreet Kaur and Er. Jaswinder Singh [4]. They have concluded that with regards to overall performance of OLSR is better in term of throughput from all. However, TORA showed better efficiency to deal with high congestion and it scaled better by successfully delivering packets over heavily trafficked network compared to OLSR and GRP. Comparative Analysis of AODV, OLSR, TORA, DSR and DSDV Routing Protocols in Mobile Ad-Hoc Networks is done by Dilpreet Kaur and Naresh Kumar[8].AODV has maximum throughput under low traffic and DSDV has maximum throughput under high traffic. As network becomes dense OLSR, DSR and DSDV perform well in terms of Throughput than AODV and TORA. TORA performs well in dense networks in terms of packet delivery fraction but at the same time Normalized Routing load of TORA is maximum among all the protocols in both the networks. DSDV has least Normalized Routing load in both low and high traffic. OLSR and DSDV give the least Jitter and Average Delay. A Quantitative Study and Comparison of AODV, OLSR and TORA Routing Protocols in MANET done by Tamilarasan-Santhamurthy[7]. His research results had shown that 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 quantitative study of these routing protocols shows that OLSR is more competent in high density networks with highly sporadic traffic. It has been concluded that performance of TORA is better for dense networks. The AODV is better for moderately dense networks whereas the OLSR performs well in sparse networks.

IV. SIMULATION PARAMETERS AND PERFORMANCE METRICS

MAXIMUM SIMULATION TIME	600 SEC
ENVIRONMENT SIZE	100 * 100
NO. OF NODES	20 , 70 , 150
ROUTING PROTOCOL	TORA , OLSR , GRP
DATA RATE	1024
SPEED	10m/s
TRAFFIC TYPE	FTP
SIMULATOR	OPNET 14.5

The performance of the simulated results is analysed according to different performance metrics. The following performance metrics are employed in this study:

- 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.

V. RESULTS

A. DELAY

Fig. 2, 3 and 4 shows the delay for all three protocols with nodes 20, 70, 140 respectively. The OLSR and GRP have almost trifling time delay. The time delay increase very immaterially for OLSR and GRP when we increase the number of nodes in network. TORA has the worst time delay, it increase notably with increase in nodes.

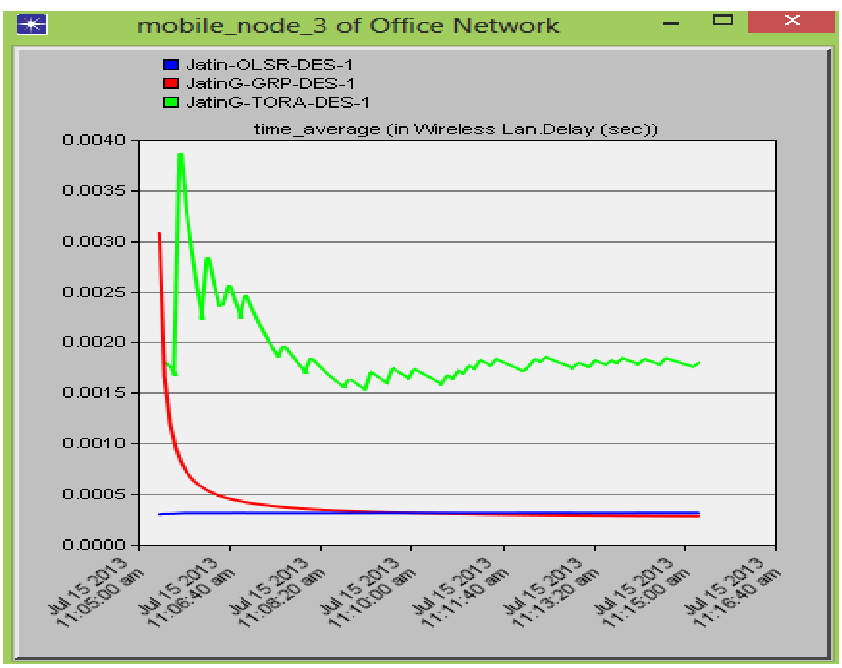

Fig 2: Delay (20 nodes)

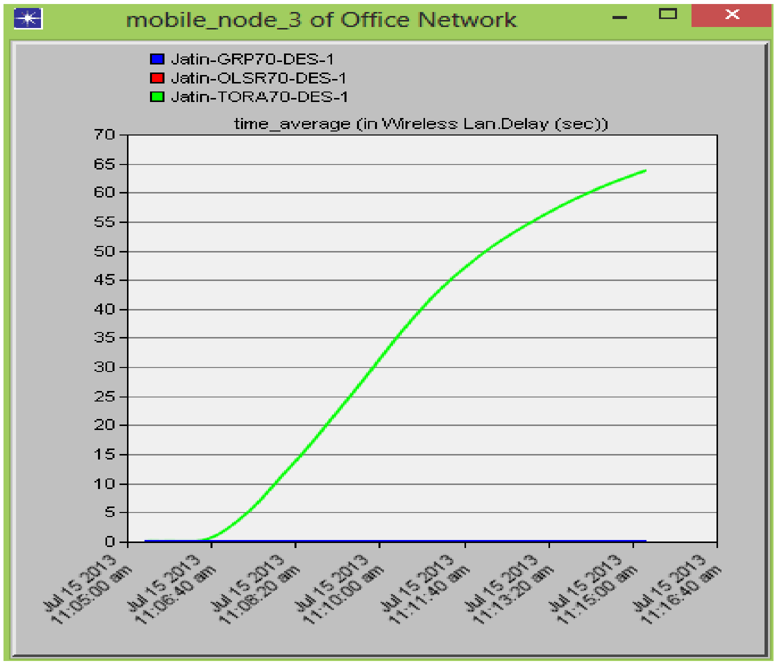

Fig 3: Delay (70 nodes)

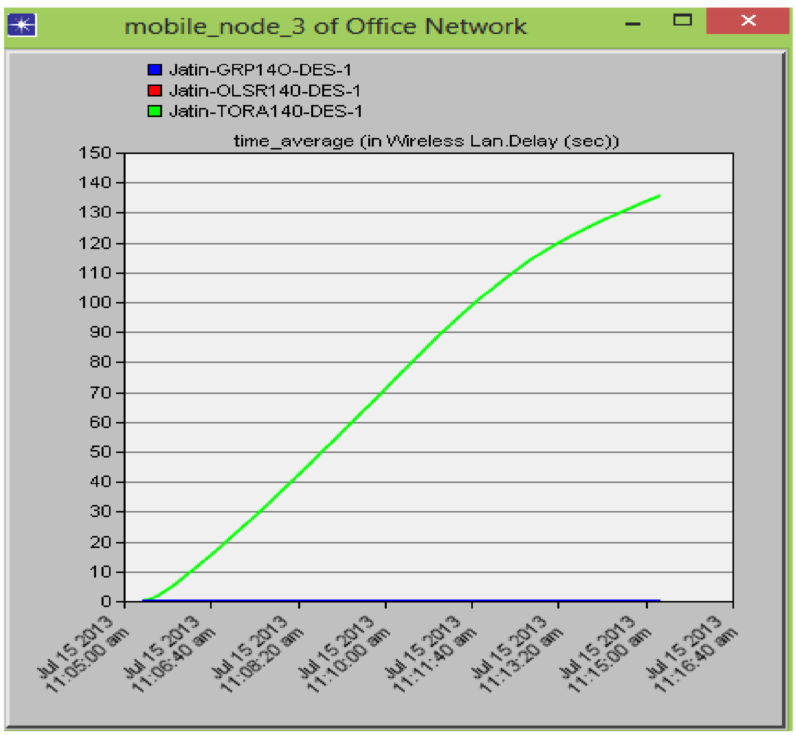

Fig 4: Delay (150 nodes)

B. NETWORK LOAD

As depicted in the fig. 5 ,6 and 7 , there is brusquely increase in load for single moment then sharply decrease in load value in GRP routing protocol. The performance of GRP in term of network load in best and OLSR shows worst for less number of nodes. As shown in Fig. 5, the OLSR has the maximum network load , but as the number of nodes in the network increase, the performance of TORA is poorest in term of network load. The performance of GRP is far better than TORA and OLSR in term of network load.

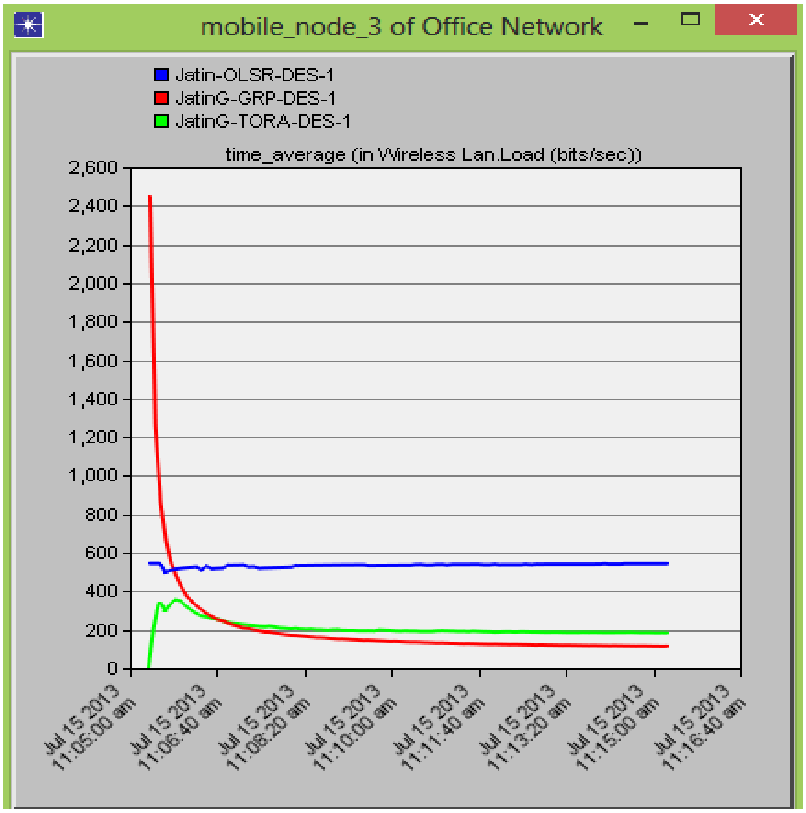

Fig 5: Load (20 nodes)

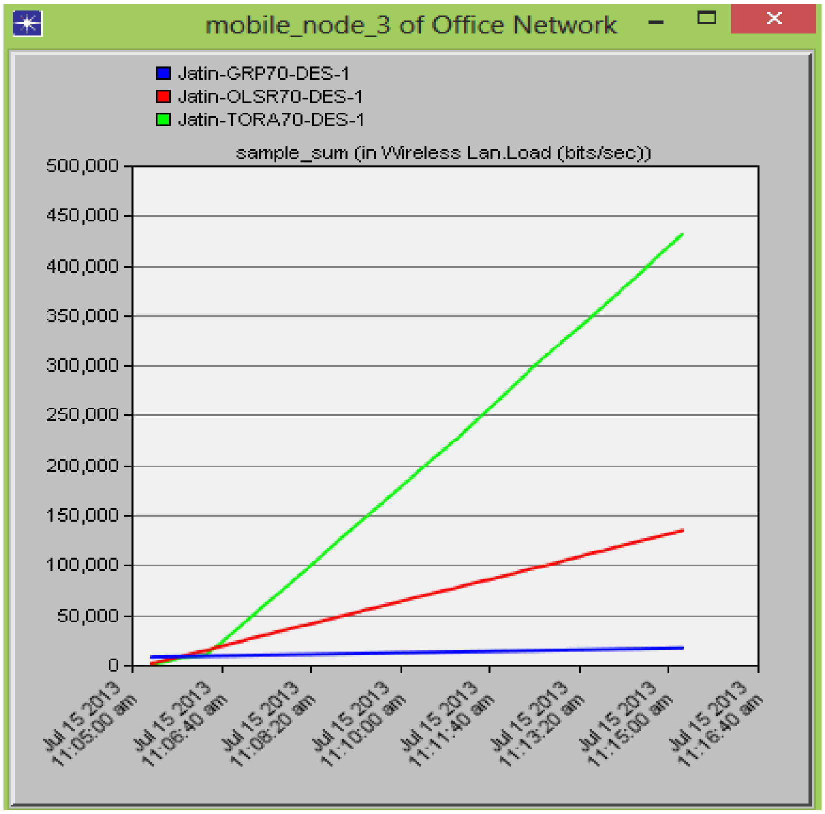

Fig 6: Load (70 nodes)

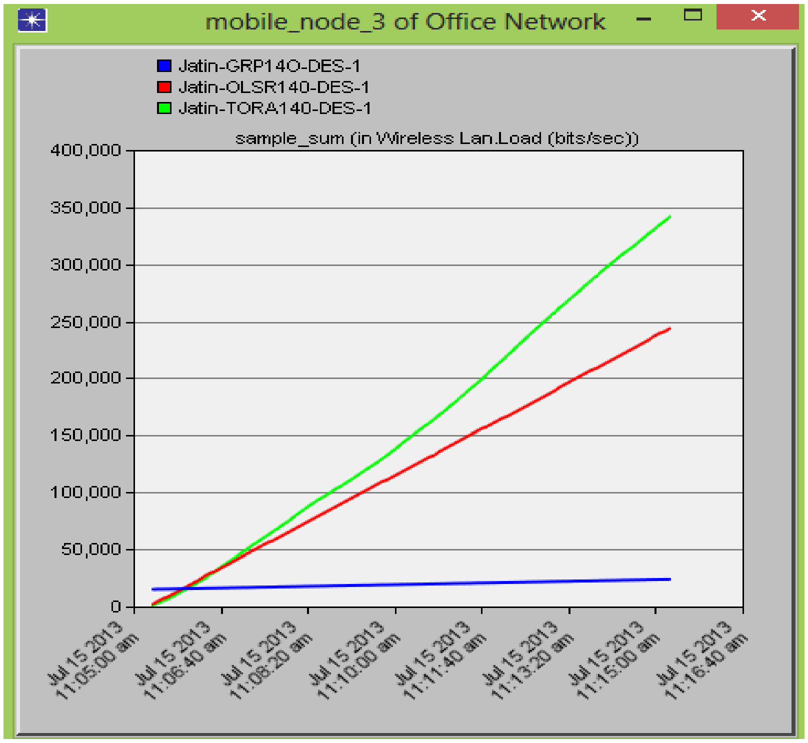

Fig 7: Load (150 nodes)

C. THROUGHPUT

As shown in Fig. 8, 9 and 10. The throughput of the OLSR routing protocol is far more enhanced than GRP and TORA. The TORA shows the vilest throughput. The throughput of the GRP routing protocol is better than TORA, but very less in contrast with OLSR. So, the OLSR show the maximum throughput.

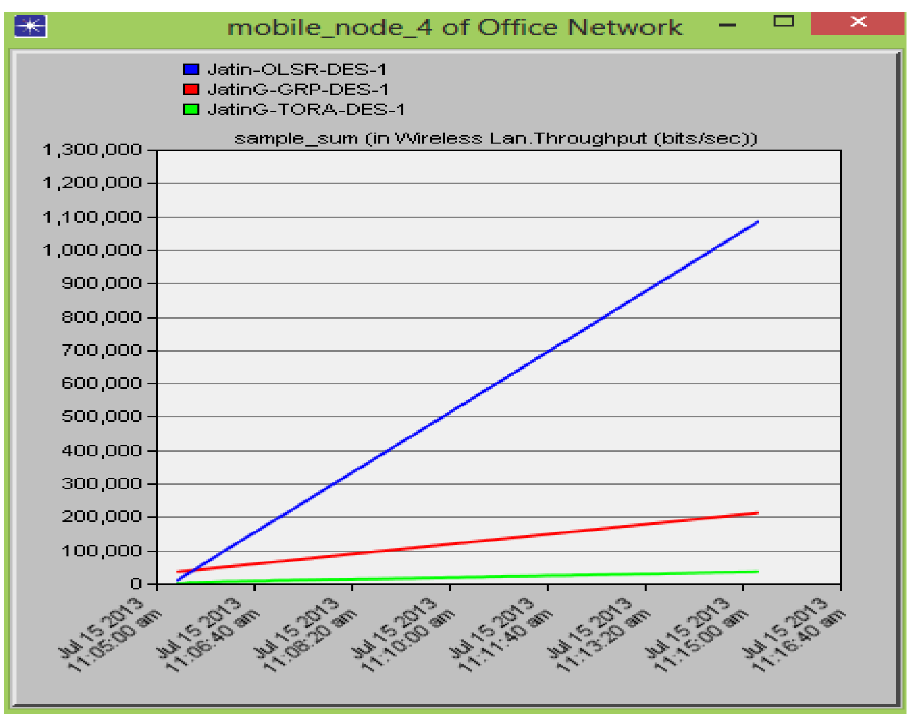

Fig 8: Throughput (20 nodes)

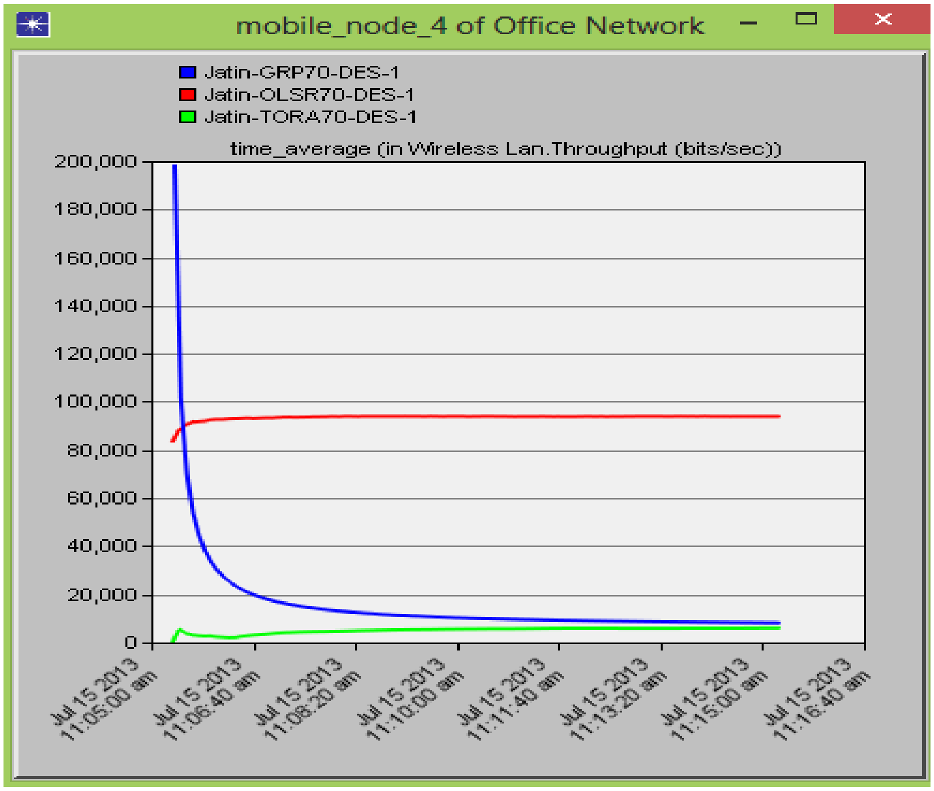

Fig 9: Throughput (70 nodes)

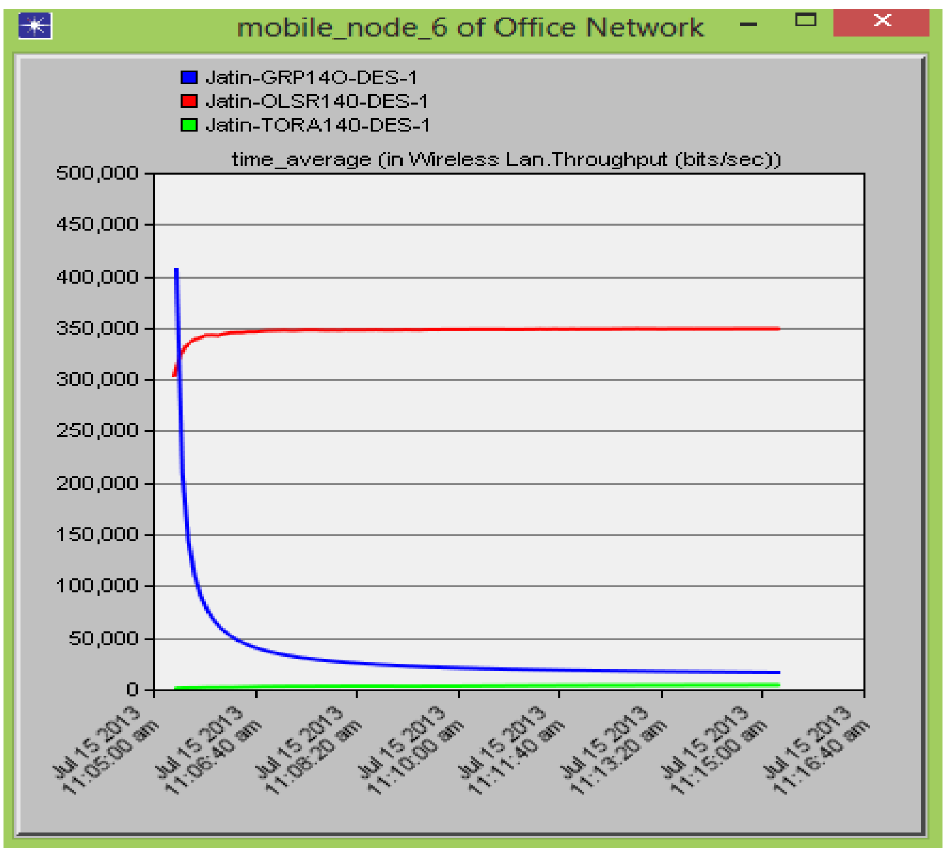

Fig 10: Throughput (150 nodes)

VI. CONCLUSION

The study of the simulation has shown that the GRP routing protocol outshines in term of delay and network load, but shows average concert in term of throughput. TORA routing protocol produces worst performance for all parameters. The OLSR routing protocol shows supreme throughput, but high network load in contrast with GRP. So, the conclusion is the GRP protocol is quite good to implement when number of nodes are less, it is hybrid type of routing protocol, and it acquires features of both reactive and proactive routing. The OLSR is picking of the bunch in term of throughput, it is well suited for all size of networks.

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