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Performance Analysis of OLSR & GRP Protocol Under Quality of Services in MANET

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Abstract - Routing is a critical matter in MANET and hence the focus of this paper along with the performance analysis of routing protocols. A mobile ad hoc network (MANET) is generally explained as a network that has many free or autonomous nodes, often collected of mobile devices or other mobile pieces that can arrange themselves in various ways and operate without network administration. In this paper, a simulation based comparative analysis is performed on two types of routing protocols over MANET. To access and validate the feasibility of the study, simulation experiments were carried out. The simulation experiments have taken under remote login application with two scenarios (10 and 15 mobile nodes).Optimized Link State Routing (OLSR) and Geographic Routing Protocol (GRP) has been considered for investigation in this paper based on throughput, delay, and load and media access delay performance metrics using OPNET Modeler 14.5.

Keywords: OLSR, GRP, QOS, MANET Routing Protocols

1. INTRODUCTION

In the recent decade there has been a step development in the market of laptops, hand held devices. These devices are battery used with limited capacity but have the challenge of high processing capability. These mobile devices enable people to access internet or communicate with other devices by using wireless network. Wireless networks are inexpensive and needs less effort as compared to wired networks and there is no requirement of any additional devices. The constant advancement in the field of wireless network has led to growth of Ad-hoc Networks which allow the devices to communicate with each other directly without depending upon any administration. Routing plays a major role as the communication productivity depends on the select route and the productivity of the route [2]. Mobile Ad-hoc network (MANET) is additionally advancement in the field of Ad-hoc networks. In MANET the devices are called nodes which act as host and router whenever required.

MANETs use a multi-hop model for the communication. MANET provide the temporary networks in which we can easily added and deleted the nodes. In MANET all the nodes are movable and range of each host is also limited so routing in such conditions is a larger challenge. There are many types of routing protocols in MANET. The Table-driven (Proactive) and On-demand (Reactive) routing protocols are two major categories of routing protocol [10].The combinations of proactive and reactive routing protocols are called the hybrid routing protocol. In this paper, we have evaluated performance of OLSR and GRP routing protocols based on remote login applications with varying number of nodes and analyzed by means of throughput, delay, load and media access delay metrics by using OPNET Modeler 14.5.

The rest of paper is organized as follows: Section 2 presents overview of MANET routing protocols. Section 3 defines simulation environment. Section 4 shows simulation results and the discussion related to the results. Section 5 shows analysis of results. Finally, conclusion is drawn in section 6 and references shows in section 7.

2. MANET ROUTING PROTOCOLS

The first protocol is selected from proactive category namely OLSR whereas the second protocol is selected from Geographic Position Information based routing namely GRP.

Optimized Link State Routing

OLSR is a point to point routing protocol for MANETs which is based on the concept of traditional link state algorithm [4]. The nodes support topology information about the network by exchanging link state messages periodically. To reduce the overhead in the network, OLSR uses the concept of Multipoint Relays (MPR).Two control messages used in OLSR.First is Hello message and second is Topology Control. Hello message are used to observe the link state and neighboring nodes. In this protocol, nodes send HELLO messages to their neighbors at a predecided interval. These messages are periodically sent to dictate the level of the links. Topology control (TC) message is used for broadcasting information for neighbors which involves at least the MPR selector list. The selection of MPR is concluded according to the algorithm. MPRs define to selected routers that can forward broadcast messages throughout the flooding process.

Geographic Routing Protocol

GRP is a position based proactive routing protocol in which all the routing path is designed by source node in MANET. GRP protocol uses the concept of Global Positioning System (GPS) to track the location of node. To optimize way of flooding the whole network is divided into quadrants. The position of flooding is updated on gap when a node moves

and crosses the neighborhood. "Hello" messages are defined the locations of the neighbors [4]. When a node is cannot send packet to the next node then it returns its packet to final node by using route locking mechanism. GRP follows second approach separately from the concept of real l geographic coordinates received by the GPS. This approach is located on the purpose of reference points in the fixed coordinate system. The major advantage of geographic routing protocol is that it stops long network-broad searches for the destinations. The major drawback of GRP is that all the nodes should have access to their geographic coordinates at each moment.

3. SIMULATION ENVIRONMENT

The simulations are implemented using OPNET Modeler 14.5 with the nodes spread randomly over a square area of 1200 m x 1200 m. The mobility model used is "Random Waypoint Model" in which a node randomly chooses a objective, called waypoint and progress towards it in a straight line with a constant velocity [2]. The simulations are divided into scenarios with initially 10 nodes and then increasing the number to 15 nodes. The simulation was run for 5 simulation minute with seed value of 128 using application remote login. The pause time for the simulation is considered to be constant. The kernel mode is put to be optimized. The details are record in Table 1. Here in first scenario, used 10 mobile nodes and one fixed WLAN server. The application configuration and profile configuration was drag to workspace. The second scenario used 15 mobile nodes. All the attributes remain the same except the number of nodes were increased. In this sec scenario the same protocols are tested against the similar parameters.

Table 1. Simulation Parameters

Parameters	Values
Operation mode	802.11g
No. of nodes	10,15
Simulation time	5 minute
Simulation kernel	Based on kernel type preference
Data rate(bps)	11 mpbs
Routing protocol	OLSR,GRP
Transmit power	0.005
Parameters of quality of services	Delay,Throughput,Media access delay&Load
Application traffic	Remote login

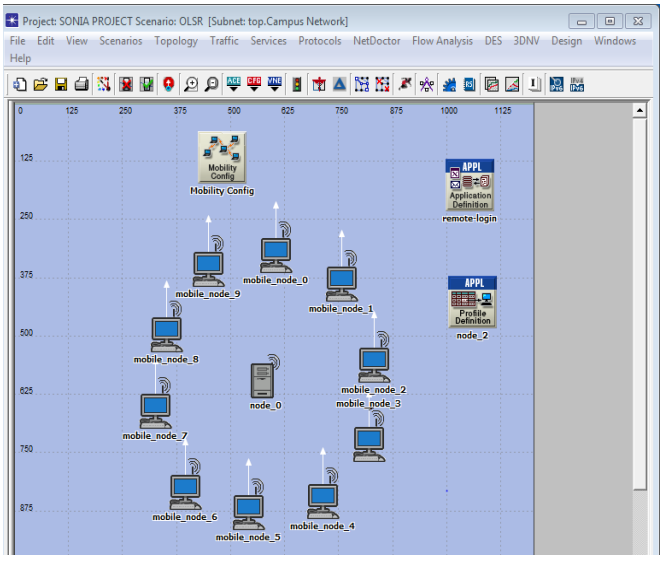

Figure 1: Environment Scenario of 10 Nodes

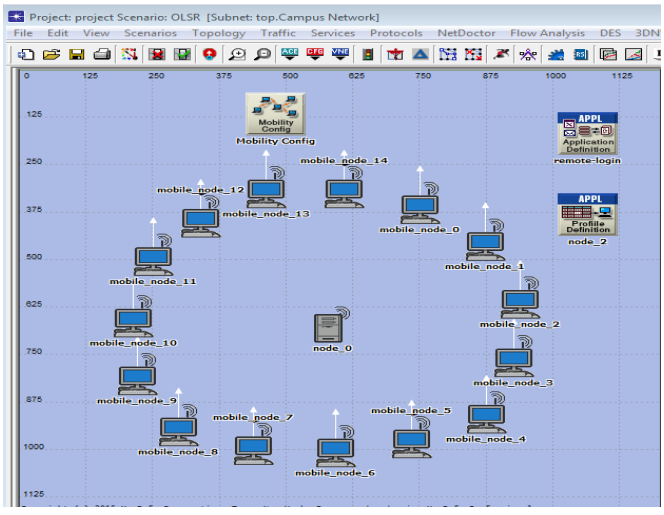

Figure 2: Environment Scenario of 15 Nodes

The performance of the simulation is examined according to different performance metrics [7]. This quantative measurement is useful for obtaining the performance of network using different routing protocols. The following performance metrics are involved in this study:

(i) Throughput: Throughput is described as the ratio of the total data that reaches a receiver from the sender.

(ii) Delay: Delay is the time of generation of a packet by the source up to the end reception. So this is the time that packets capture to go across the network.

(iii) Load: Load is defined in bit/sec and it is the total load submitted to WLAN layers by all top layers in all WLAN nodes of the network.

(iv) Media Access Delay: For every frame, this delay is calculated as the period from the time when it is entered into the transmission queue, which is arrival time for higher layer data packets and creation time for all other frames types, until the time when the frame is sent to the physical layer for the first time.

4. SIMULATION RESULTS

The main target of this paper is to evaluate the performance and behavior of each routing protocol with respect to the effect of varying the number of nodes for remote login application. The results are based on evaluation metrics of delay, load, throughput and media access delay. We have divided our study into two sets of experiments: the first set studies the performance of two protocols over a small number of nodes (10 nodes) followed by increase in number of nodes to 15 in second set.

4.1 Media access Delay

The Fig.3(a) & Fig.3(b), x-axis shows the time (minute/second) and y-axis shows the media access delay (sec).The value for OLSR & GRP is 0.00014 &0.000306 using 10 nodes and value for OLSR & GRP is 0.000251 &0.000311 using 15 nodes. In both cases OLSR perform better than GRP protocol.

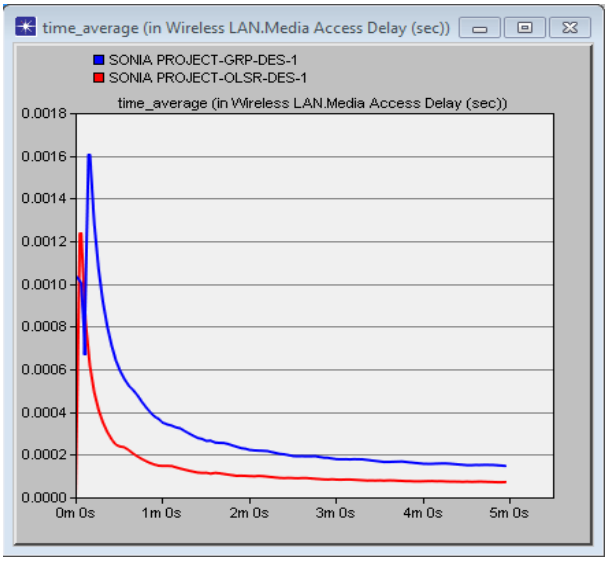

Fig 3(a): Comparison of OLSR and GRP protocol for media access delay using 10 nodes

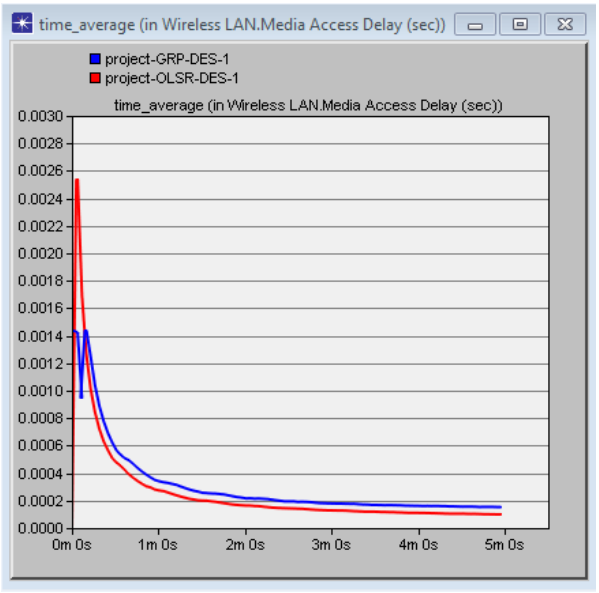

Fig 3(b): Comparison of OLSR and GRP protocol for media access delay using 15 nodes

4.2 Throughput

The Fig.4(a) & Fig.4(b), x-axis shows the time (minute/second) and y-axis shows the throughput (bits/second).The value for OLSR & GRP is 43301.14 & 19222.01using 10 nodes and value for OLSR & GRP is 112382.6 & 45726.5 using 15 nodes. In both cases OLSR perform better than GRP protocol.

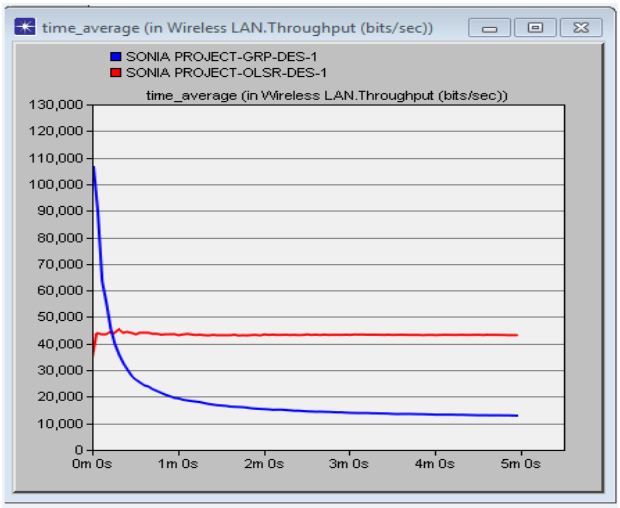

Fig 4(a): Comparison of OLSR and GRP protocol for throughput using 10 nodes

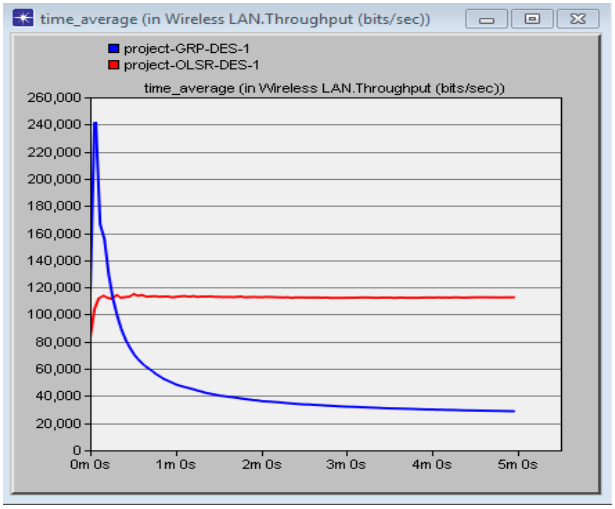

Fig 4(b): Comparison of OLSR and GRP protocol for throughput using 15nodes

4.3 Load

The Fig.5(a) & Fig.5(b), x-axis shows the time (minute/second) and y-axis shows the load (bits/sec) The value for OLSR & GRP is 5317.388 & 3978.425 using 10 nodes and value for OLSR & GRP is 9136.537 & 8964.137 using 15 nodes.

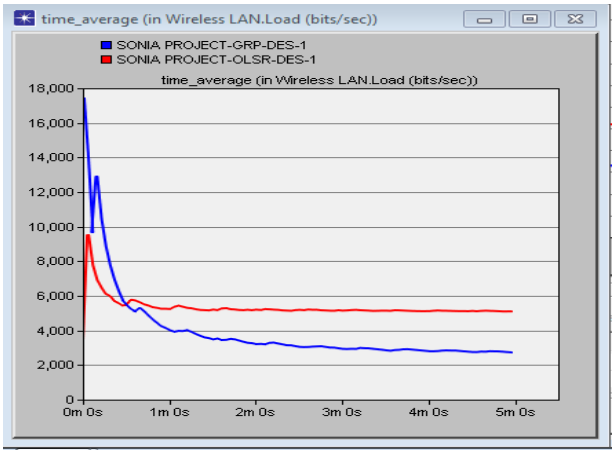

Fig 5(a): Comparison of OLSR and GRP protocol for load using 10 nodes

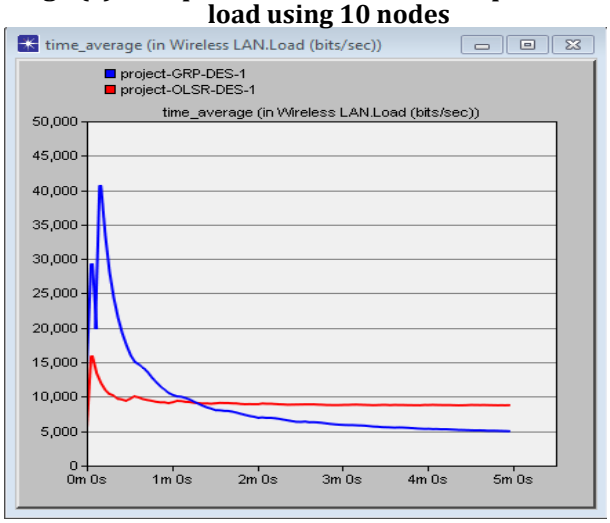

Fig 5(b): Comparison of OLSR and GRP protocol for Load using 15 nodes

4.4 Delay

The Fig.6 (a) &Fig.6 (b), x-axis shows the time (minute/second) and y-axis shows the delay (sec).The value for OLSR & GRP is 0.000257 & 0.000374using 10 nodes and value for OLSR &GRP is 0.000284 & 0.000395 using 15 nodes. In both cases OLSR perform better than GRP.

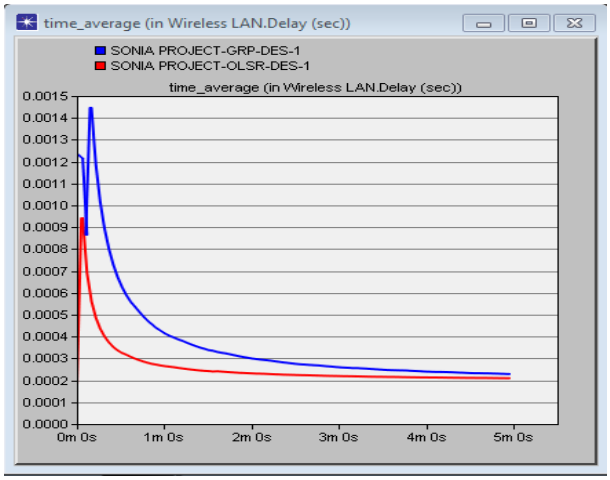

Fig 6(a): Comparison of OLSR and GRP protocol for delay using 10 nodes

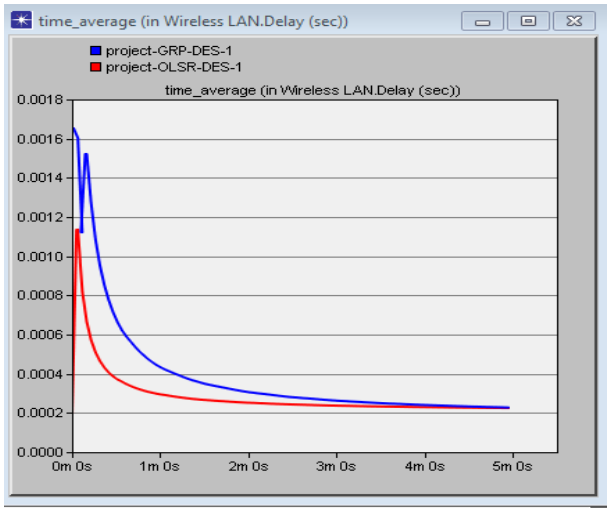

Fig 6(b): Comparison of OLSR and GRP protocol for delay using 15 nodes

5. RESULT ANALYSIS

The result analysis of OLSR and GRP protocols is shown in this section with the help of the simulation outputs with respect to the four performance metrics. The aim of this comparative study of OLSR and GRP routing protocols is to analyze the presentation of protocols. OLSR in our simulation experiments present the overall best performance. The execution of increase in the number of nodes is also clearly display in the result tables shown below.

Metrics	Delay(sec)	Load (bits/sec)	Throughput (bits/sec)	Media Access Delay(bits/sec)
OLSR	0.000257	5317.388	43301.14	0.00014
GRP	0.000374	3978.425	19222.01	0.000306

Table 2. Results for 10 nodes

Metrics	Delay(sec)	Load (bits/sec)	Throughput (bits/sec)	Media Access Delay(bits/sec)
OLSR	0.000284	9136.537	112382.6	0.000251
GRP	0.000395	8964.137	45726.5	0.000311

Table 3. Results for 15 nodes

6. CONCLUSION

The simulation study helps to understand the behavior of OLSR and GRP routing protocols setup over MANET using medium remote login analyzing their actions with respect to the parameters of quality of services. Analysis of routing protocols using OPNET modeler 14.5 shows that in 10 mobile nodes the OLSR perform well than GRP in delay, throughput and media access delay except load. In 15 mobile nodes OLSR is again showing good results in delay, throughput and media access delay except load than GRP. So the overall analysis shows OLSR best protocol in all scenarios than GRP in MANET.

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