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**RESEARCH ARTICLE**

# OPNET based Investigation and Simulation Evaluation of WLAN Standard with Protocols using Different QoS

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***Abstract— Mobile ad-hoc network is a network (MANET) of wireless mobile nodes (MNs) that communicate with each other without centralized control or established infrastructure. Routing protocols are divided into Proactive and Reactive. Proactive is a table–driven protocols. The proactive routing protocols use link- state routing algorithm which frequently flood the link information about its neighbors. Reactive or on-demand routing protocols create routes when they are needed by the source host and these routes are maintained while they are needed. This paper proposes a solution for performance enhancement of VoIP and HTTP in Ad-hoc WLANs. This paper compares the performance of OLSR and GRP over different IEEE standards on the basis of delay, load, media access delay and throughput, GRP total traffic sent and received OLSR neighborhood change and draws a conclusion based on performance of the network over different QoS parameters.***

***KEYWORDS— WLAN, GRP, OLSR, OPNET, IEEE802.11a, , IEEE802.11a, IEEE802.11g***

 

## WLAN INTRODUCTION

In 1997, the Institute of Electrical and Electronics Engineers (IEEE) created the first WLAN standard. They called it 802.11 after the name of the group formed to oversee its development. 802.11 is a set of IEEE standards that govern wireless networking transmission methods. They are commonly used today in their 802.11a, 802.11b, 802.11g, and 802.11n versions to provide wireless connectivity in the home, office and some commercial establishments [1]. Unfortunately, 802.11 only supported a maximum network bandwidth of 2 Mbps - too slow for most applications. For this reason, ordinary 802.11 wireless products are no longer manufactured .In our research 802.11a and 802.11b operational modes are used to assign the parametric value in network model. Table show the IEEE 802.11a/b/g standard with release year, bandwidth, frequency, data rate, modulation technique is used to simulate our networks.

Table 1: IEEE802.11 Standard

| Standard | 802.11a | 802.11b | 802.11g |
|---|---|---|---|
| Release | Sep 1999 | Sep 1999 | Jun 2003 |
| Bandwidth(MHz) | 20 | 20 | 20 |
| Frequency(GHz) | 5 | 2.4 | 2.4 |
| Data Rate(Mbit/s) | 6,9,12,18,24 ,36, 48,54 | 5.5,11 | 6,9,12,18,24,36, 48,54 |
| Modulation | OFDM | DSSS | OFDM, DSSS |

The **802.11a/g** task group created a standard for WLAN operation in the 5/2.4 GHz band, with data rates up to 54 Mbps. The **802.11b** task group produced a standard for WLAN operations in 2.4 GHz band, with data rates up to 11 Mbps and backward compatibility[2][3].

## ROUTING PROTOCOLS IN WLAN (AD HOC)

These are classified into three different categories:

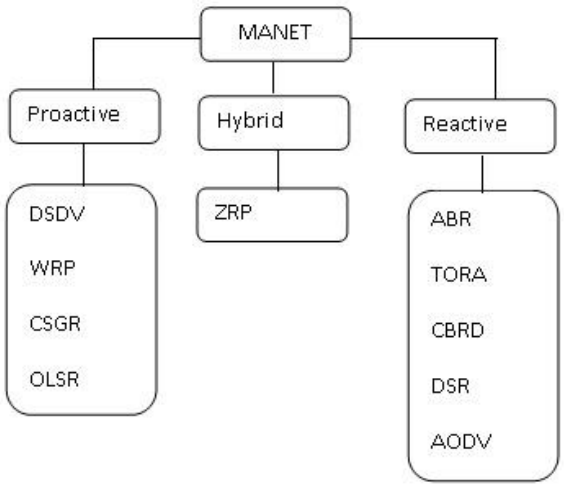


Fig. 1 Classification of MANETs Routing Protocols

 

*A. Proactive Protocols*

Proactive methods maintain routes to all nodes, including nodes to which no packets are sent. Such methods react to topology changes, even if no traffic is affected by the changes. They are also called table-driven methods. Thus using a proactive protocol, a node is immediately able to route (or drop) a packet. Optimized Link State Routing Protocol (OLSR) is an example of Proactive Protocol.

*1). OLSR Protocol*

OLSR is a proactive or table driven, link-state routing protocol. Link-state routing algorithms choose best route by determining various characteristics like link load, delay, bandwidth etc. Link-state routes are more reliable, stable and accurate in calculating best route and more complicated than hop count. To update topological information in each node, periodic message is broadcast over the network. Multipoint relays are used to facilitate efficient flooding of control message in the network. Route calculations are done by multipoint relays to form the rout from a given node to any destination in the network. The OLSR protocol is developed to work independently from other protocols. Conceptually, OLSR contain three generic elements: a mechanism for neighbor sensing, a mechanism for efficient flooding of control traffic, and a specification of how to select and diffuse sufficient topological information in the network in order to prove optimal routes [3], [4].

In OLSR, neighbor nodes related information are gathered with ―HELLO‖ messages which are send over network periodically [5]. These ―HELLO‖ message detect changes in neighbor nodes and related information such as interface address, type of link symmetric, asymmetric or lost and list of neighbors known to the node. Each node update and maintain an information set, describing the neighbor and two-hop neighbor periodically after some time.

The idea of multipoint relays is to minimize the overhead of flooding message in the network by reducing redundant retransmission in the same region. In MPR (Multi Point Relay) a node which is selected by its one hop neighbor to ―re-transmit‖ all the broadcast messages that it receive from other node, provided that the message is not a duplicate, and that the time to live field of the message is greater than one [5]. In OLSR protocol, Multi Point Relays use of ―HELLO‖ message to find its one hop neighbor and its two hop neighbors through their response. Each node has a Multi Point Relay selection set, which indicates, which node acts as a MPR. Message is forward after the node gets new broadcast message and message sender's interface address in the MPR Selector Set. MPR Selector Set is update continuously using ―HELLO‖ message which are periodic because neighbor nodes is called of dynamic nature of MANET.

Topology Control messages are diffused with the purpose of providing each node in the network with sufficient link-state information to allow route calculation [5]. TC messages are broadcast periodically by a node. Like ―HELLO‖ messages with these TC messages the topological information are diffused over the entire network. A minimum criteria for the node is to send at least the link of its MPR Selector Set [3], [6].

*B. Hybrid Protocols*

Hybrid routing protocol combines the advantages of both proactive and reactive routing protocols, the routing is initially established with some proactively prospected routes and then serves the demand from additionally activated nodes through reactive flooding. Gathering Based Routing Protocol (GRP) is an example of Hybrid Protocol.

*1). GRP Protocol*

GRP (Gathering based routing protocol) protocol is source initialized protocol in MANET routing protocol in which all the routing path is created by source node in Mobile Ad-hoc network. In this protocol, source node collects all the information about the route to the designation. In this procedure, source node sends a destination Query toward the destination through network. It works like AODV and DSR using RREQS (Reverse Request Query by Source). In it, when destination Query reached to the destination, destinations send a packet called Network Information Gathering (NIG) which approach through network. When NIG packet reached at a router, router gives it all the information about the network and its resources. There are many nodes called Effective Outgoing Links (EIL) where NIG packet does not riches, routers send this information to these EILs. At last NIG reaches at source node and source node get all the information [7], [8].

## OPNET MODELER

OPNET Modeler is a commercial research oriented network simulation environment tool for network modeling and simulation. It allows the users to design and study communication networks with proper flexibility and scalability. It

 

simulates the network graphically and gives the graphical structure of actual networks and network components. The users can design the network model visually [8].
In this paper, the network simulations are implemented using OPNET modeler (version 14.5).

## MODEL DESCRIPTION

In this paper we have evaluated performance of WLAN using OLSR and GRP routing protocol by considering FTP application type and IEEE 802.11a, 802.11b and 802.11g WLAN Standards in single scenarios. In scenario we have taken 50 mobile nodes and in both scenarios IEEE 802.11a, IEEE 802.11b and IEEE 802.11g standards are considered to simulate the environment and evaluate the performance of Different Protocols. Thus, in total we ran six scenarios. Two scenarios ran for IEEE 802.11a WLAN Standard for 50 nodes , two scenarios for IEEE 802.11g WLAN Standard, two scenarios for IEEE 802.11b WLAN Standard. Each scenario was simulated for 1000 seconds. After successful completion of the simulations, results are selected according to the problem solution. Results are collected in the form of graphs, with overlaid data displaying.

Fig. 2 shows the simulation environment of one scenario containing 50 WLAN mobile nodes.

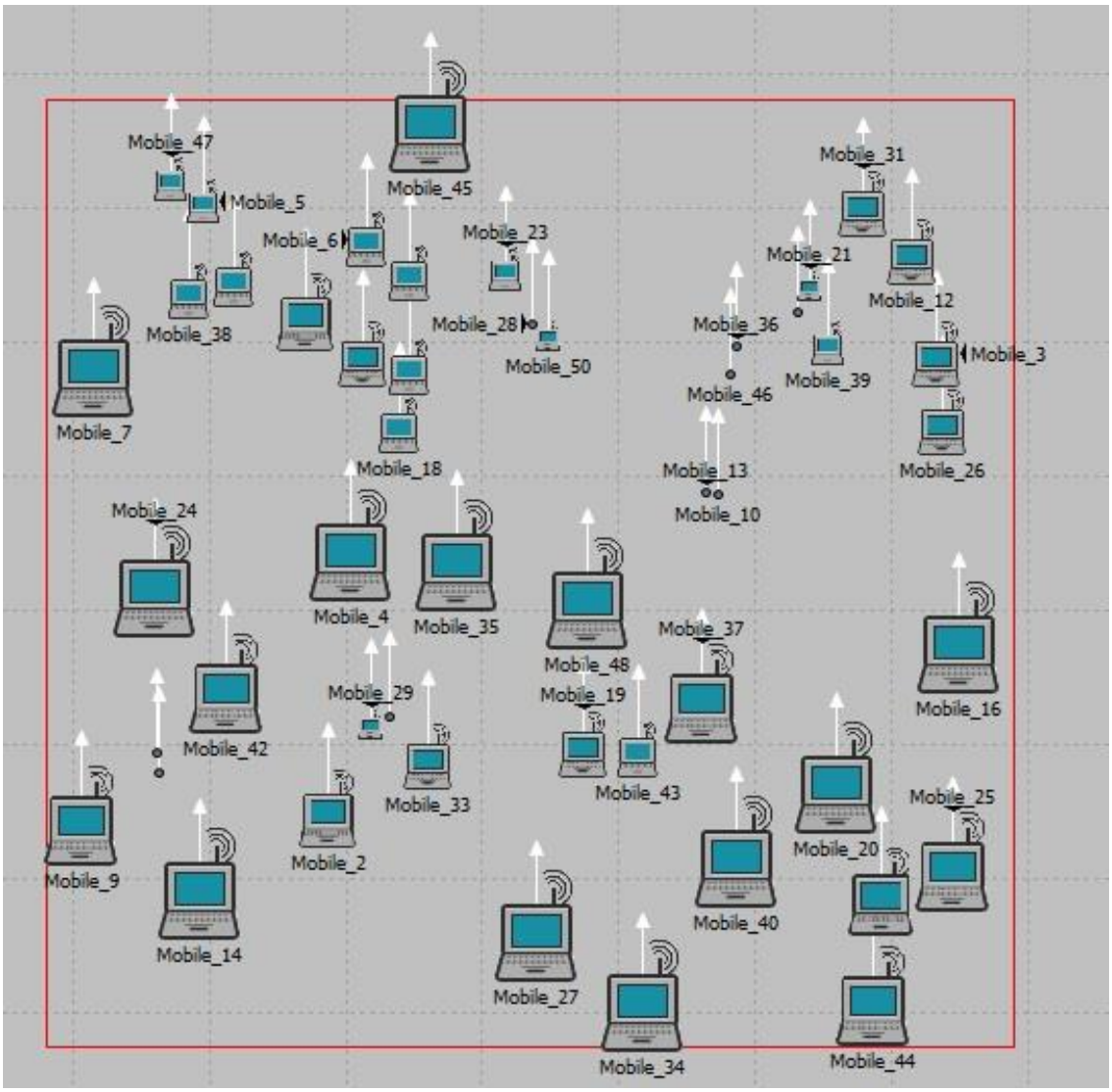


Fig 2 Network model.

 

## PARAMETER SETUP

The network designed consists of basic network entities with the simulation parameters summarized in table 1, 2 and 3.

Table1: WLAN Simulation Parameters

| **Parameters** | **Value** |
|---|---|
| Number of nodes | 50 |
| Simulation speed(m/sec) | 10 |
| Simulation area(sq. meter) | 5000 |
| Altitude(m) | 0.10 |
| Transmit Power(W) | 0.015 |
| Simulation time(sec) | 1000 |
| Memory used(Mbps) | 52 |
| Physical characteristics | OFDMA(802.11a) |
| Data rate(Mbps) | 54 |
| Short retry limit | 9 |
| Long retry limit | 7 |
| Buffer size(bits) | 1024000 |
| Maximum receive lifetime(sec) | 1.0 |

Table 2: GRP AND OLSR attributes

| **Attribute** | **Value** |
|---|---|
| Hello interval(sec) | Uniform(4.9,5.0) |
| Number of initial flood | 3 |
| Neighbor expiry time(sec) | Constant(10) |
| Backtrack option | Enabled |
| Position Request Timer(Sec) | 10.0 |
| Distance moved(m) | 2000 |
| Routes Export | Enabled |
| Hello interval(sec.) | 3 |
| TC interval | 7 |
| Neighbor hold time | 8 |
| Topology hold time | 20 |
| Duplicate message hold time | 40 |

## SIMULATION RESULTS

While comparing the performance of GRP and OLSR in six scenarios, we focus on four performance measures Load, Delay, Media Access Delay, Throughput, Total traffic sent and received, Neighborhood change.

 

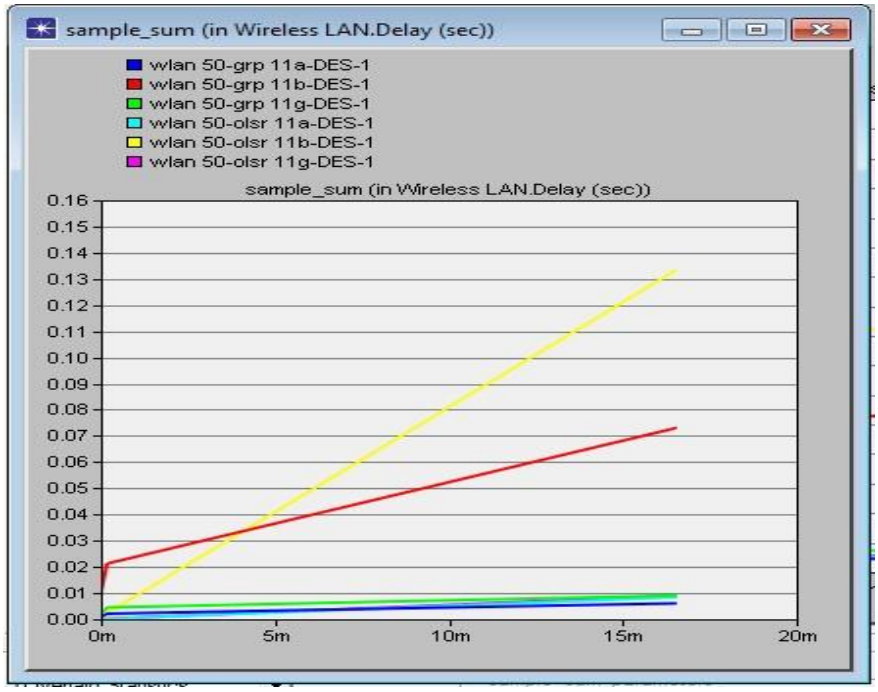


Fig 2 WLAN delay

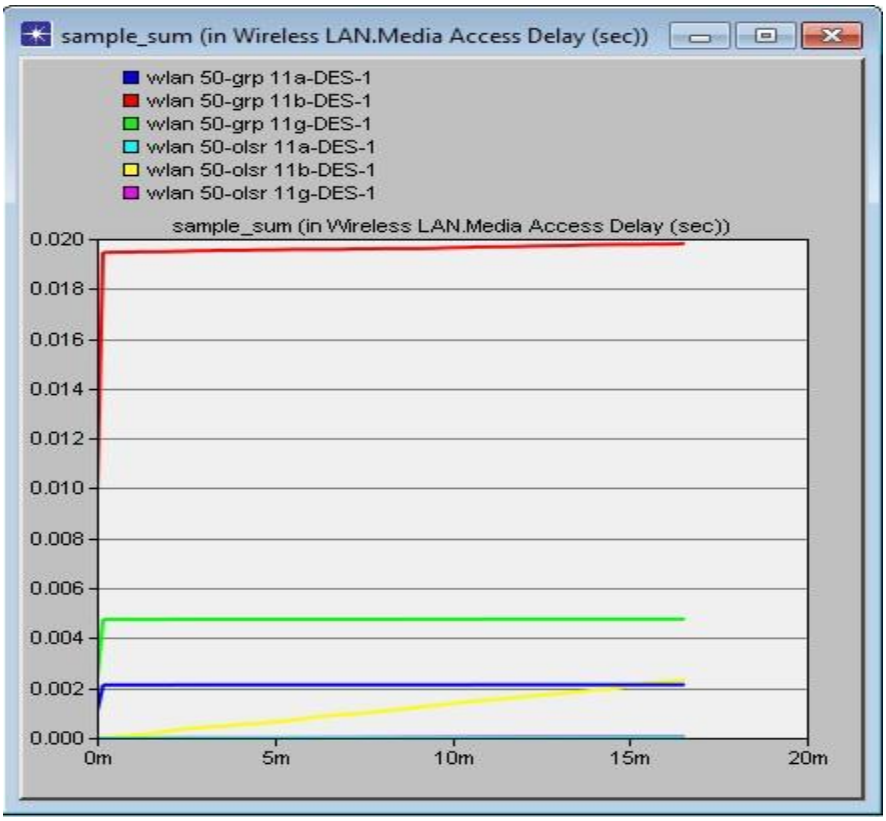


Fig 3 WLAN media access delay

From figures 2 and 3, we can see that WLAN end to end delay in olsr and MAC delay are higher in grp for IEEE standard 802.11b and small in IEEE standard 802.11a and IEEE standard 802.1g in GRP and OLSR protocols.

 

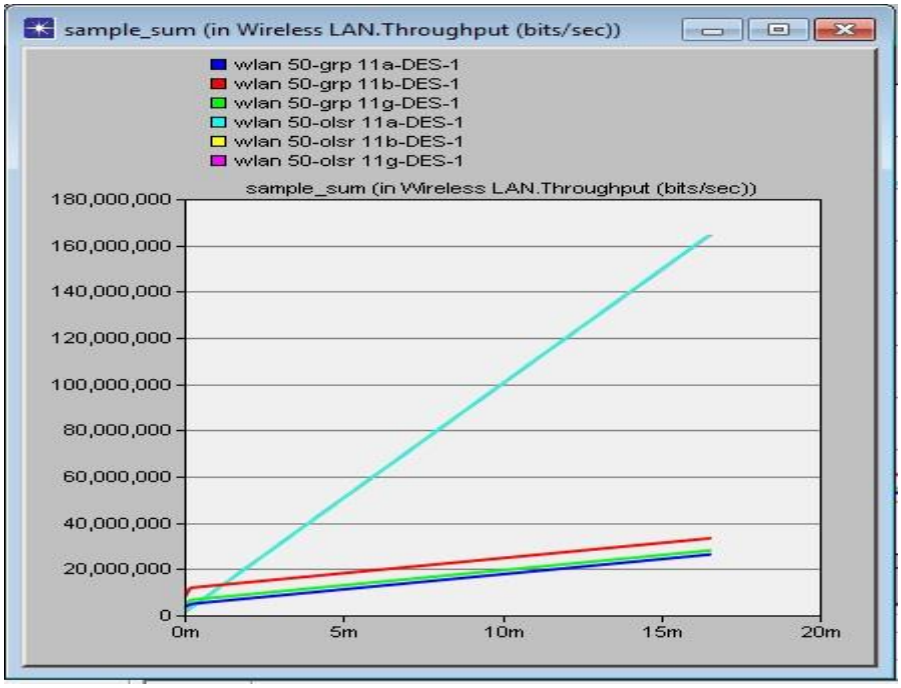


Fig 4 WLAN throughput

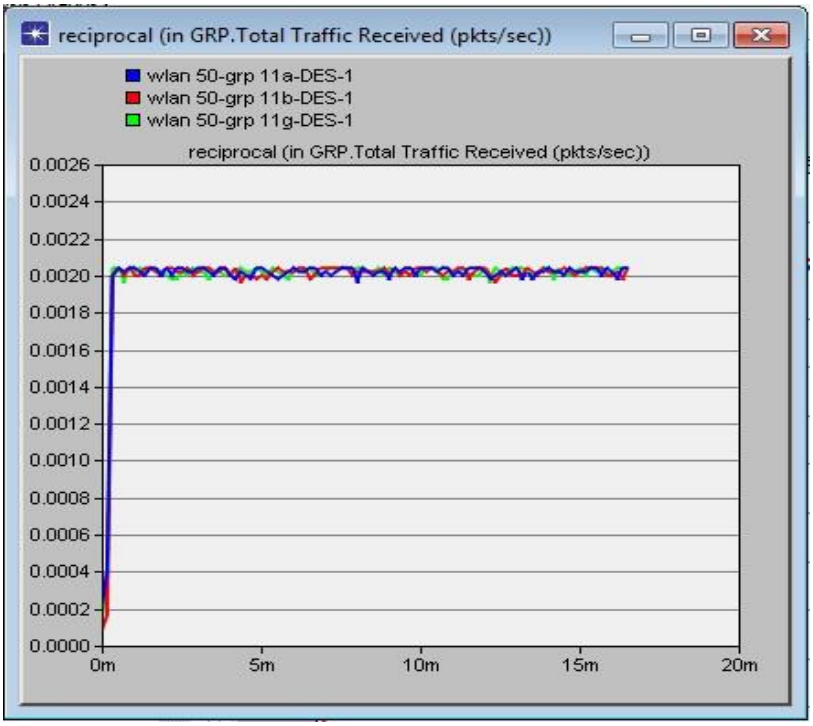


Fig 5 Total traffic received.

From figure 4 and 5, it is clear that Wireless LAN throughput in GRP, OLSR and total traffic received for IEEE standard 802.11b, IEEE standard 802.11a and IEEE standard 802.1g in GRP protocols.

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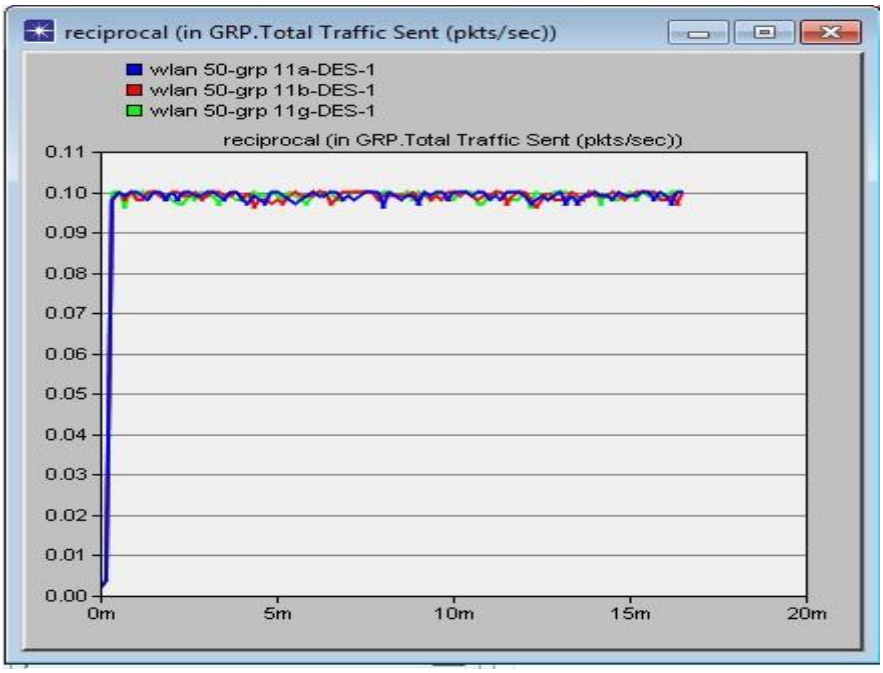


Fig 6 Total traffic sent.

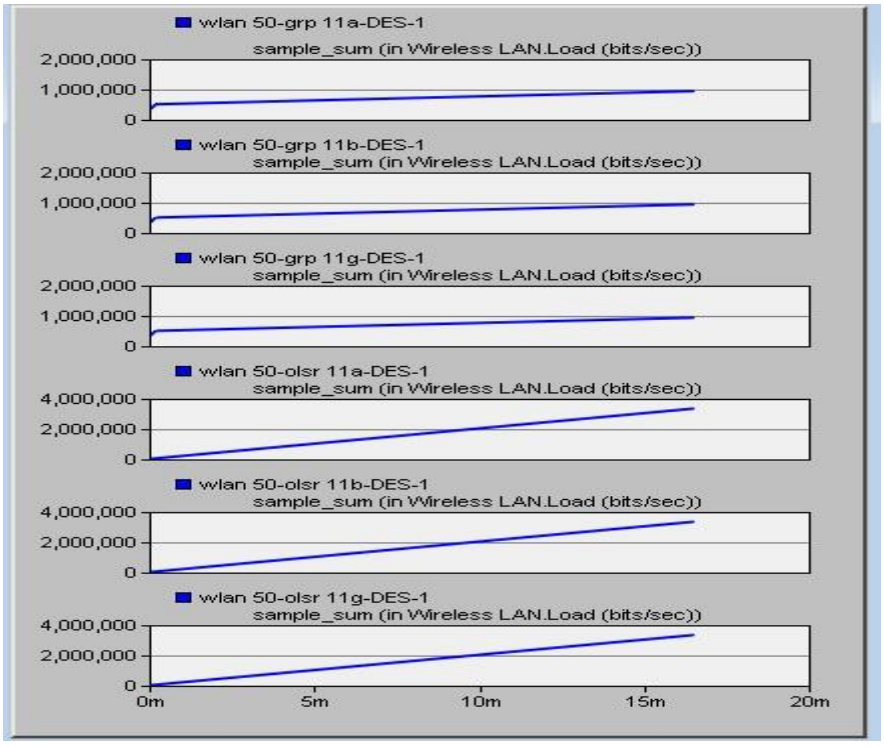


Fig 7 WLAN network load

As from figure 6 and 7, total traffic sent and network load for IEEE standard 802.11b, IEEE standard 802.11a and IEEE standard 802.1g in GRP and OLSR protocols.

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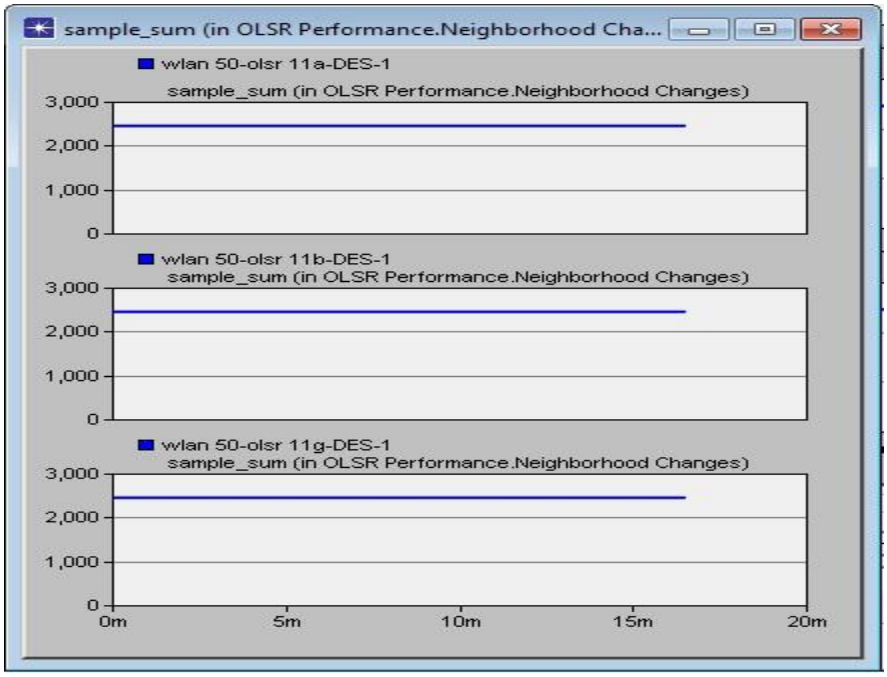


FIG 8 OLSR Neighborhood changes

As from figure 8 Neighborhood changes for IEEE standard 802.11b, IEEE standard 802.11a and IEEE standard 802.1g in OLSR protocols are equal value in all three scenario.

## CONCLUSION

In this paper, we analyze the performance of mobile Ad-hoc network in GRP and OLSR routing protocols using WLAN IEEE802.11a/b/g standard. The simulation results shows GRP and OLSR protocol in IEEE 802.11a/g has better performance in the term of delay, total traffic sent and received, routing traffic sent and received in packet and bit form, Throughput, MAC Delay, load and Poor performance in both protocols in IEEE802.11b. The same result also holds good for other networking applications. On the basis of this simulation we can deploy the network in all over the world with efficiently and provide the platform for location based security because security is the primary concern for any ad-hoc network

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