International Journal of Computer Science and Business Informatics

IJCSBI.ORG

CBR Based Performance Analysis of OLSR Routing Protocol in MANETs

Jogendra Kumar
Department of Computer Science & Engineering
G. B. Pant engineering College Pauri Garhwal Uttarakhand, India

ABSTRACT

Mobile ad-hoc network is an autonomous system which has its own rules and regulations. MANETs control themselves by configuration the system. In this paper, we analysed and implemented TC HELLO messages by using multipoint relay (MPR) of OLSR. The routing performance is then checked using the Qualnet 5.0.2 simulator. To simulate the performance of the OLSR (Optimised Link State Routing) routing protocol, we took different performance metrics like hello messages sent, hello messages received, TC messages generated, TC messages replied and TC messages received on Constant Bit Rate (CBR) using the random waypoint model.

Keywords

Ad-hoc Network, MANETs, OLSR, Routing Protocol, Qualnet 5.0.2, Simulator.

1. INTRODUCTION

A MANET consists of mobile nodes, a router with multiple hosts and wireless communication devices. The wireless communication devices are transmitters, receivers and smart antennas. These antennas can be of any kind and nodes can be fixed or mobile. The term node referred to as which are free to move arbitrarily in every direction means it is a asymmetric that provide communicate between two or more from one direction is good communication but reverse not be good. These nodes can be a mobile phone, laptop, personal digital assistance and personal computer. It is greatly desired to have a quick communication infrastructure.

MANET is the quick remedy for any disaster situation [1][3][7][17]. The mobile nodes in wireless network communicate with each other within range because it is a self organized network means configure automatically. The mobile nodes form a network automatically without a fixed infrastructure and central management. The topology of the network changes every time by getting in and out of the mobile nodes in the network because mobile ad-hoc network has dynamic nature. MANET [1][2][5][7][9][11][17][18][22] stands for Mobile Ad hoc Network. It is not centralized autonomous wireless system because it has not central network which consists of free nodes [2].

Figure 1 shows the mobility change due to dynamic nature of the MANET routing protocol.

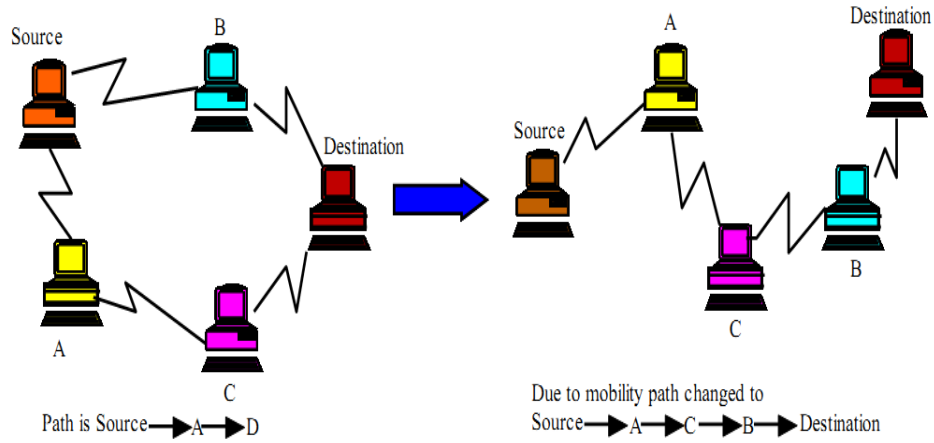

Figure 1. The dynamic scenario of network topology with mobility

2. OLSR (OPTIMIZATION LINK STATE ROUTING) IN MANETs

OLSR [8][17][19][23] is a proactive routing protocol stores and updates its routing table information permanently. OLSR keeps track of routing table in order to provide a route if needed or route all time available for communication. OLSR can be implemented in all ad hoc networks due to its nature OLSR is called as proactive routing protocol. OLSR protocols all the nodes in the network do not broadcast the route packets only Multipoint Relay (MPR) [14] [16] [18] nodes can broadcast route packets.

These MPR nodes can be selected in the neighbours of source node in a network. Each node in the network keeps a list of MPR nodes information and stores that information in routing table. This MPR selector is obtained from HELLO packets sending between in neighbours nodes within range of that node only neighbours. These routes are established before any source node intends to send a message to a particular destination. Each and every node in the network keeps a routing table and update information periodically. This is the reason the routing overhead for OLSR is minimum than other reactive routing protocols and it provide a shortest route to the destination in the network. There is no need to build the new routes, as the existing in use route does not increase enough routing overhead because every node already builds. OLSR reduces the route discovery delay.

Figure 2 shows the broadcast packet from center node A to all the other neighbours' nodes that nodes attached to A. Distance counting is based on the hop count.

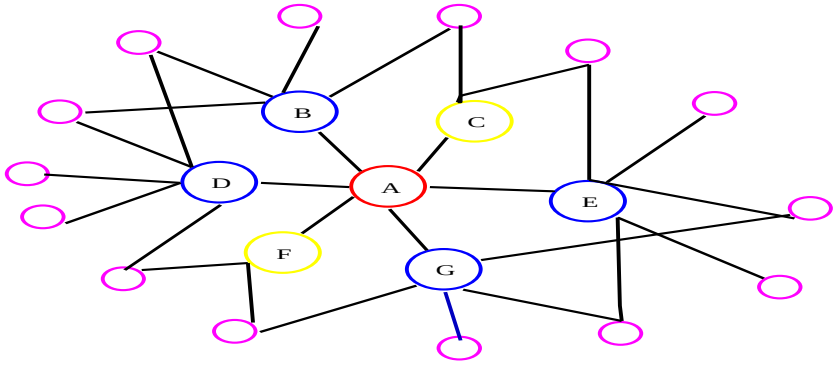

Figure 2. Showing the Multipoint relays (hop count = 2)

Figure 3 shows the nodes in the network sending HELLO messages to their neighbours. These messages are sent at a predetermined interval in OLSR to determine the link status [1][2][16].

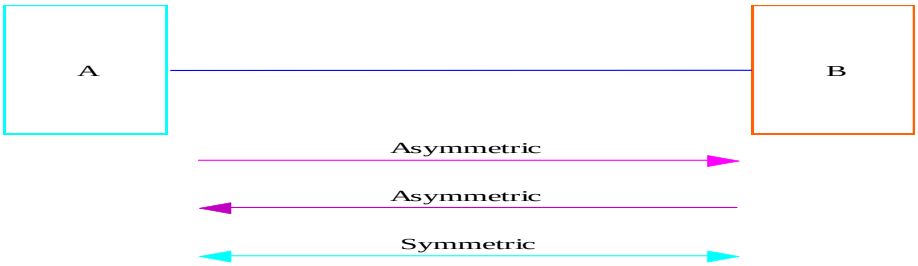

Figure 3. HELLO Messages in MANET Using OLSR

The HELLO messages contain the entire neighbor information store in routing table. This enables the mobile node to have a table in which it has information about its entire multiple hop neighbors. A node chooses minimal number of MPR nodes, when symmetric connections are made. It broadcast topology control (TC)[16][18][22] messages with information about link status at predetermined TC interval. TC messages also calculate the routing table's information and update periodically.

3. RELATED WORKS

Vats et al. [13] proposed a MANET routing protocol in the OLSR were performance analyzed. The performance of OLSR protocol through a network of different size showed that it had better performance in all aspects. The performance of OLSR which can be achieved by Hello Traffic Sent (bit/sec), Total TC Message Sent (TTMS) and Total TC Message Forward (TTMF), Total hello message and TC traffic sent (bit/sec), Routing traffic received (pkt/s), Routing traffic sent (pkt/s), MPR count using the OPNET Modular simulation tool.

Kaur et al. [9] proposed a MANET routing protocol. OLSR performs best in terms of load and throughput. GRP performs best in terms of delay and routing overhead. TORA is the worst choice when we consider any of the four performance parameters. We can say that OLSR is best as compared to GRP and TORA in all traffic volumes since it has maximum throughput using OPNET modeler simulation tools. All the above works proposed several routing protocols to construct a route performance on TC hello message. This paper checks the performance of the OLSR routing protocol using CBR in Qualnet which gives faster performance and takes minimum time for executing the scenarios as compared to OPNET.

4. SIMULATION PARAMETERS AND PERFORMANCE METRIC

4.1 SIMULATION PARAMETERS

Table 1. Simulation Parameters

Parameter Name	Parameter Values
Area	700m*700m
Simulation Time	260sec
Channel-Frequency	2.4 GHz
Path loss-Model	Two Ray Model
Shadowing-Model	Constant
Number of Nodes	50 nodes
Routing Protocols	OLSR
PHY-Model	PHY802.11b
Antenna-Model	Omni directional
Mobility Model	Random-Waypoint Model
Traffic Source	CBR
Data Rate	2 Mbps

4.2 PERFORMANCE METRIC

Hello Messages Received: Total number of Hello Messages Received by the node.

Hello Messages Sent: Total number of Hello Messages Sent by the node.

TC Messages Received: Total number of TC Messages Received by the node.

TC Messages Generated: Total number of TC Messages Generated by the node.

TC Messages Relayed: Total number of TC Messages Relayed by the node

4.3 SIMULATION TOOLS

Qualnet 5.0.2 [24] is an extended version of Glomosim. Glomosim simulator tools for wireless network. Design scenarios and routing protocol in mobile ad-hoc network (MANET) [1] [4] [5] [16] but Qualnet use for both wireless and wired network. Qualnet is more 10 times powerful as compared to the Glomosim because it takes less time for the execution of the scenarios, establish more nodes at the same time and taken the performance easily as compared to Glomosim and NS2, OPNET, etc.

4.4 NODES PLACEMENT AND ANIMATION VIEW OF OLSR ROUTING PROTOCOLS

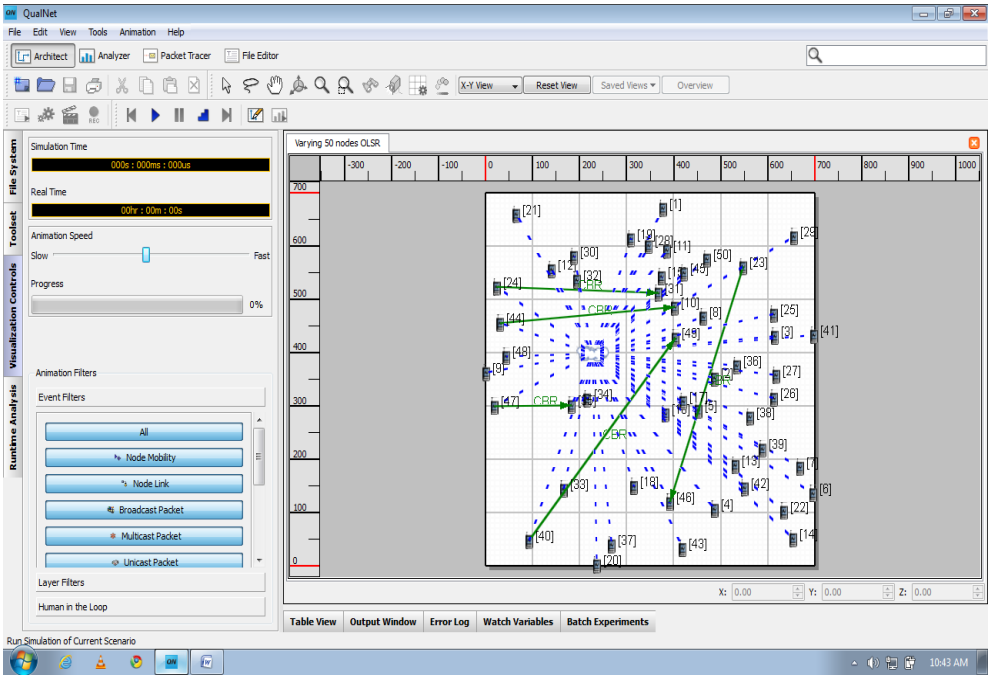

Figure 4. Showing Nodes Placement Scenarios of OLSR routing protocol for 50 nodes

In Figure 4, we described the nodes placement strategies of the random waypoint model. We have taken an area of 700*700 m wireless network which attached with all nodes randomly. OLSR routing protocol use CBR apply for source node to destination node with constant speed. In this model, all 50 nodes have constant speed. Overall execution time of this scenario is 260 sec and data rate flow is 2 Mbps with a channel frequency of 2.4 Ghz. We have taken omni-directional model for controlling both direction signals.

4.5 SIMULATION VIEW OF OLSR ROUTING PROTOCOL

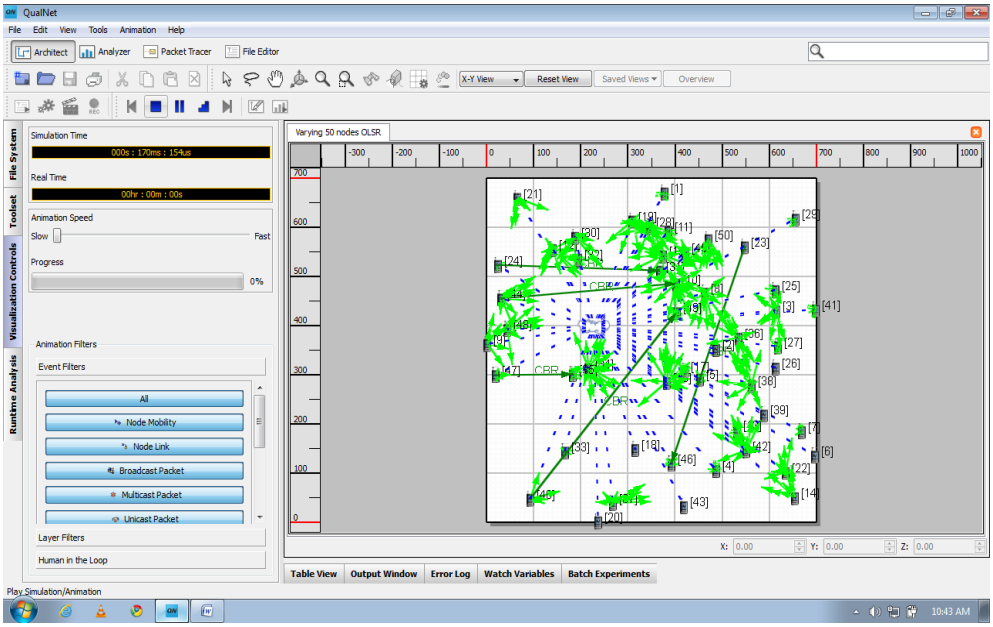

Figure 5. Showing the simulation view of OLSR routing protocol for 50 nodes

Figure 5 shows the animation view of OLSR routing protocols' scenarios using the Qualnet simulation tool and takes the performance on the basis of metrics like Hello Messages Received, Hello Messages Sent, TC Messages Received, TC Messages Generated and TC Messages Relayed.

5. SIMULATION RESULTS AND DISCUSSION OF OLSR ROUTING PROTOCOLS

OLSR: Hello Messages Sent

Figure 6 shows the Hello Messages Sent by root sending a hello message broadcast to all neighbors to attach nodes using the OLSR routing protocols. Only 15 packets were sent in this scenario. The rate was 4 packets/s.

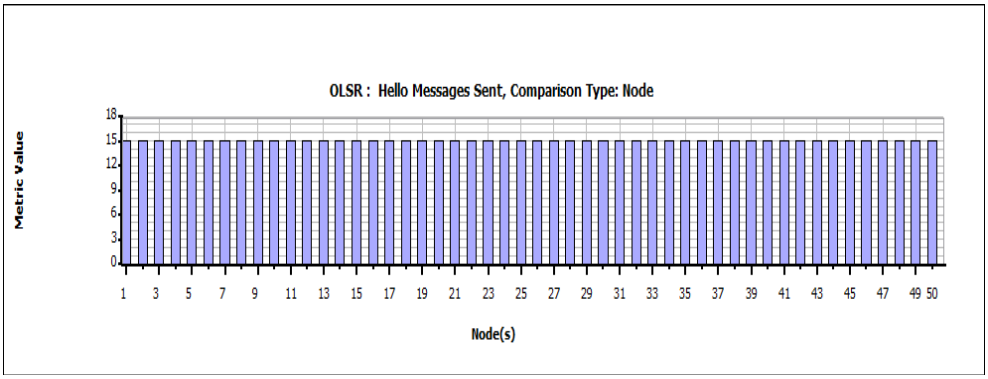

Figure 6. Showing the performance result of OLSR: Hello Messages sent from the Nodes

OLSR: Hello Messages Received:

Figure 7 shows hello messages received from the nodes. In case of OLSR routing, packet are sent at a constant rate but are received at a different rate due to some interference. We have seen nodes 21, 29 receiving 100% packets but at nodes 8, 49 receiving minimum 40% packet received and all other nodes receiving packet approximately 50%. In overall scenarios all packet received not 100%.

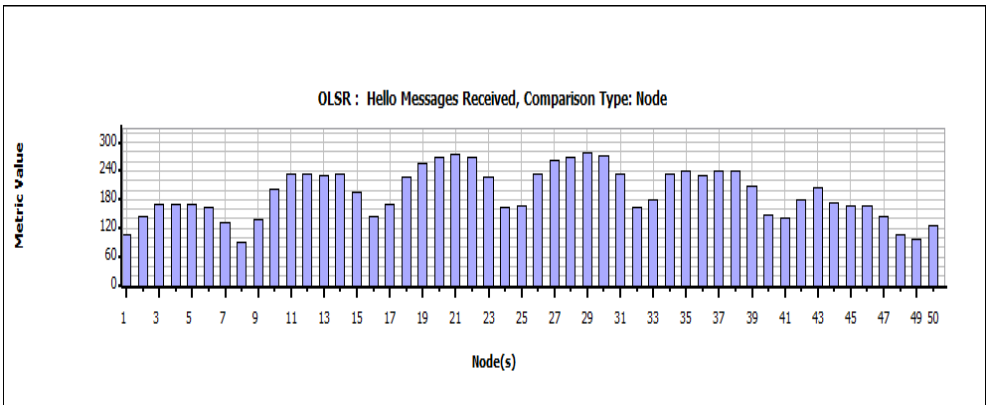

Figure 7. Showing the performance result of OLSR: Hello Messages Received at the Nodes

Combine performance result of OLSR:

Figure 8 shows the combined performance of the hello messages sent and the hello messages received at the various nodes.

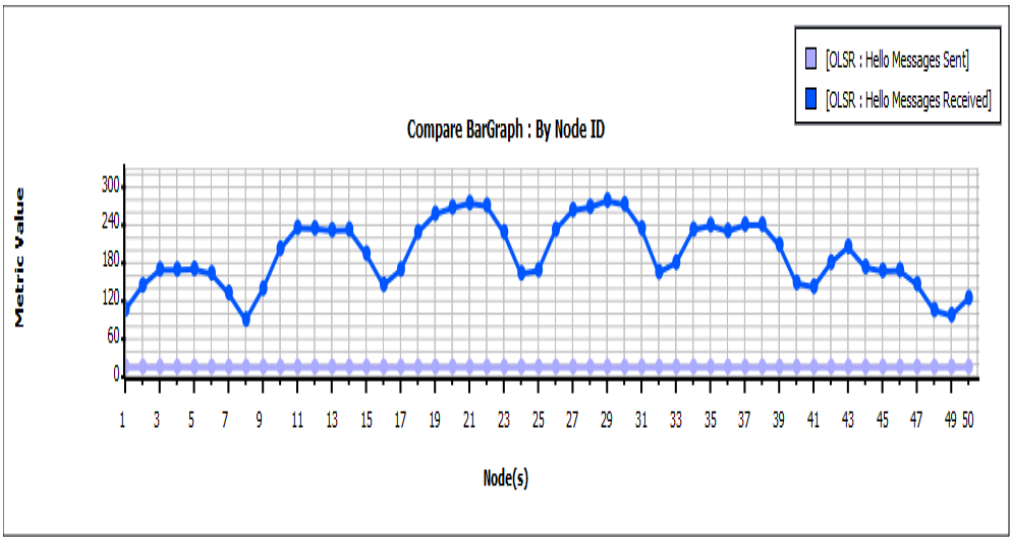

Figure 8. Showing the combined performance result of OLSR: Hello Messages Sent and Hello Messages Received at the Nodes

OLSR: TC Messages Generated: Figure 9 shows the performances of TC messages generated by MPR. In MPR have all information related to the attached list of nodes like sending address, destination address, secret code, MAC address are updated periodically. Figure 9 shows nodes 7, 41 and 49 where no TC messages were generated because these nodes were not selected by MPR. In OLSR routing protocols, TC messages generated almost 95 % and less than 5 % are not generated by MPR.

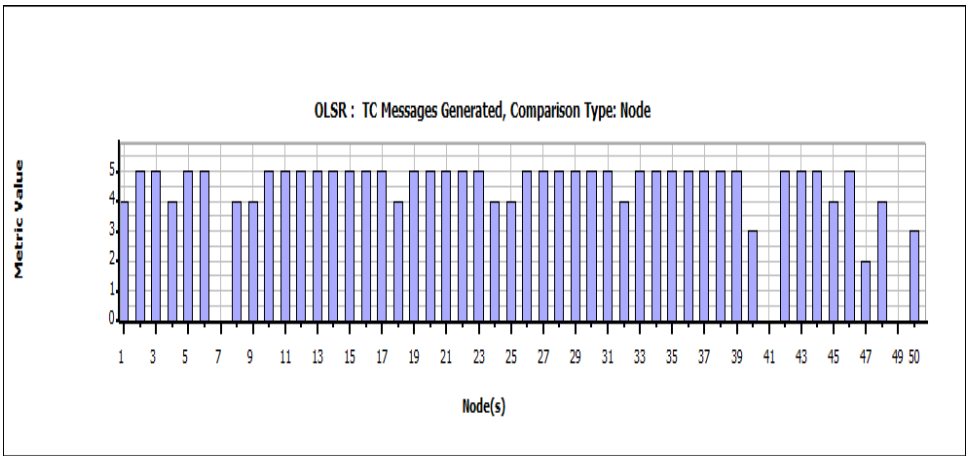

Figure 9. Showing the performance result of OLSR: TC Messages Generated at the Nodes

OLSR: TC Messages Received:

Figure 10 shows the performance of TC messages Received in MPR. Figure 10, shows nodes 7, 41 and 49 where no TC messages generated but received packets because these nodes were attached to the center so that these nodes have some information related to the neighbors. Nodes 21 to 29 received 100 % TC messages and nodes 12, 20, 27, 35 and 43 received 85% and the other nodes received less than 40 %.

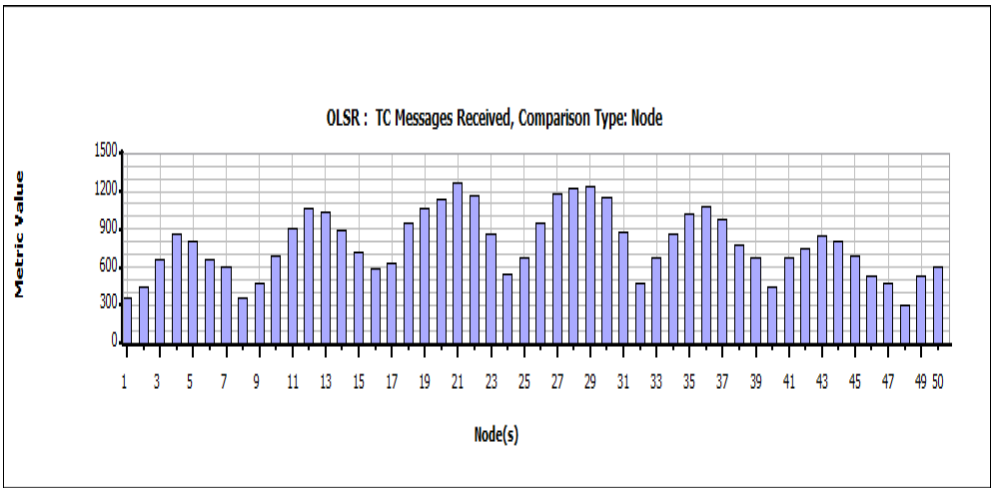

Figure 10. Showing the performance result of OLSR: TC Messages Received at the Nodes

TC Messages Relayed:

Figure 11 shows the performances of TC messages relayed by MPR. Figure 11 shows nodes 7, 41 and 49 where no TC messages were relayed. From nodes 14, 16 and 38, TC messages relayed 100 %. TC messages and nodes 6, 10, 13, 21, 22, 23, 27, 35, 43, 27, 35 and 43 TC messages relayed almost 65% and the other nodes relayed less than 20 % of TC messages.

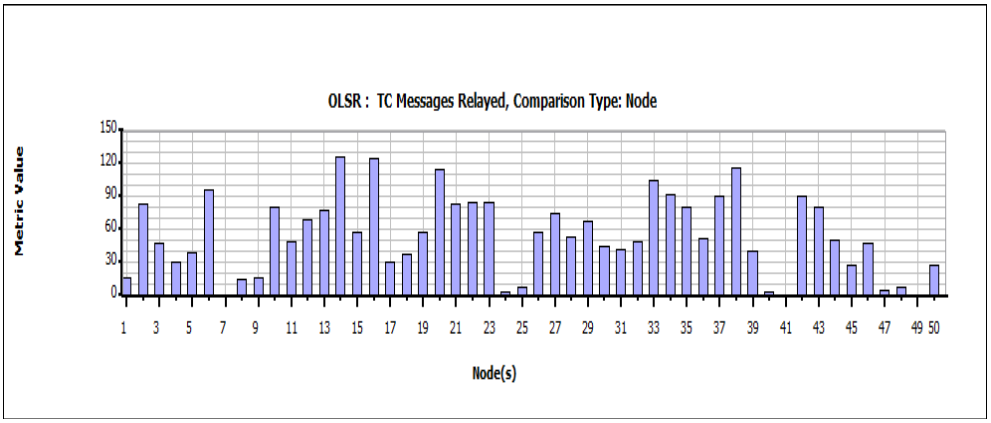

Figure 11. Showing the performance result of OLSR: TC Messages Relayed Vs Nodes

Combine performance result of OLSR: TC Messages Generated, TC Messages received and TC Messages Relayed:

Figure 12 shows the combine performance of OLSR: TC Messages Generated, TC Messages received and TC Messages Relayed and Nodes.

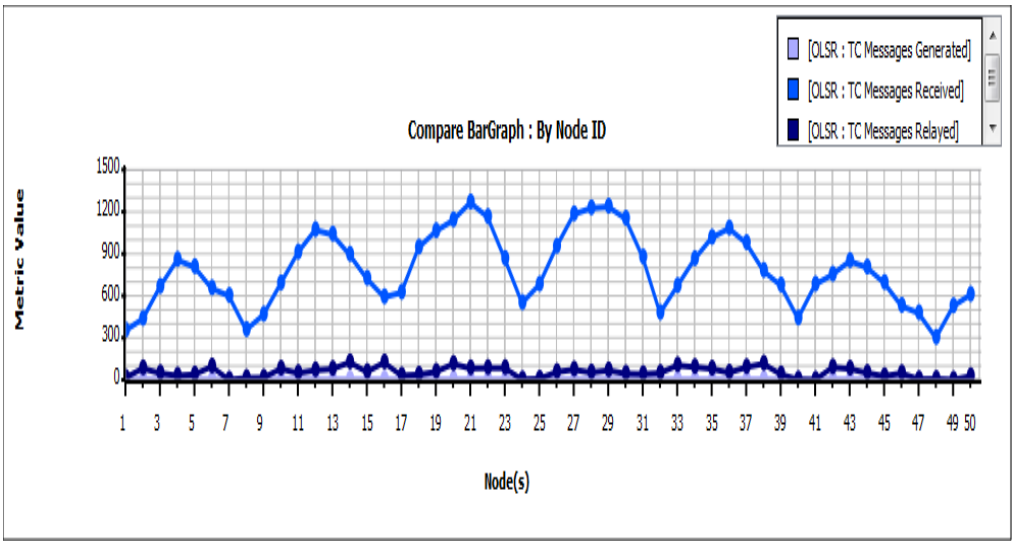

Figure 12. Showing the combine performance result of OLSR: TC Messages Generated, TC Messages Received and TC Messages Relayed at the Nodes

6. CONCLUSIONS AND FUTURE WORKS

This paper discusses Mobile ad-hoc networks (MANETs) and checks the performance of the optimization link state routing (OLSR) protocol on the basis of constant bit rate. The performance is checked using the random waypoint model in which nodes are placed randomly. In the OLSR routing protocol, hello messages are created to sense the neighboring nodes and a list of MPR selection nodes and TC hello messages controlling the route calculation and its routing information are maintained periodically, minimizing the broadcasting by MPR. In OLSR routing protocols, sending and receiving packet 95% and less than 2% packets are wasted so that this protocol is best for large networks. In case of MPR selected nodes gives TC Messages Generated at 90%, 85% TC Message Received and 80% TC Messages Relayed so that designing and controlling messages in OLSR routing protocol almost 80% so that OLSR routing protocol gives better performances in case of large networks and small networks due to proactive routing nature protocols as compared to other proactive routing protocols in MANETs. As future work, another routing protocol and different nodes placement strategies, energy consumption, fixed bit rate, and variable bit rate will be analysed on the basis on applying different loads and modification of existing routing protocols.

REFERENCES

[1] A. B. Malany, V. R. S. Dhulipala, R. M. Chandrasekaran, "Throughput and Delay Comparison of MANET Routing Protocols," Intl. Journal Open Problems Comp. Math., Vol. 2, No. 3, Sep 2009.

[2] Alexander Klein, "Performance Comparison and Evaluation of AODV, OLSR, and SBR in Mobile Ad-Hoc Networks", IEEE Personal Communications, pp. 571-575, 2008.

[3] C. Perkins, E.M. Royer, S.R. Das and M.K. Marina, "Performance Comparison of Two On-demand Routing Protocols for Ad Hoc Networks", IEEE Personal Communications, pp. 16-28, Feb. 2001.

[4] C. Siva Rammurty and B. S. Manoj, "Ad hoc wireless networks architectures and protocols," ISBN 978-81-317-0688-6, 2011.

[5] Dilpreet Kaur and Naresh Kumar, "Comparative Analysis of AODV, OLSR, TORA, DSR and DSDV Routing Protocols in Mobile Ad-Hoc Networks", I. J. Computer of Network and Information Security, 2013, 3, 39-46.

[6] Elizabeth Royer and C. K. Toh, "A Review of Current Routing Protocols for Ad hoc mobile Wireless Networks", RFC 2409, IEEE Personal Communications 1999.

[7] G. Karthiga, J. Benitha Christinal and Jeban Chandir Moses, "Performance Analysis of Various Ad-Hoc Routing Protocols in Multicast Environment", IJCST, Vo l. 2, Issue 1, March 2011, pp. 161-165.

[8] Haas and M. Pearlman. The performance of query control scheme for the zone routing protocol. ACM/IEEE Transactions on Networking, 9(4) pages 427-438, August 2001.

[9] Harmanpreet Kaur and Jaswinder Singh," Performance comparison of OLSR, GRP and TORA using OPNET", International Journal of Advanced Research in Computer Science and Software Engineering, Vol. 2, Issue 10, October 2012.

[10] Hong Jiang, 1994. "Performance Comparison of Three Routing Protocols for Ad Hoc Networks", Communications of the ACM, Vol. 37.

[11] Hong, K. Xu, M. Gerla, "Scalable Routing Protocols for Mobile Ad-Hoc Networks" IEEE Network Magazine, Vol. 16, Issue 4, pp. 11–21.

[12] Krishna Kumar Chandel, Sanjeev Sharma and Santosh Sahu," Performance Analysis of Routing Protocols Based on IPV4 and IPV6 for MANET", International Journal of Computer Technology and Electronics Engineering (IJCTEE), Vol. 2, Issue 3, June 2012.

[13] Kuldeep Vats, Monika Sachdeva, Krishan Saluja and Amit Rathee," Simulation and Performance Analysis of OLSR Routing Protocol Using OPNET", International Journal of Advanced Research in Computer Science and Software Engineering, Vol. 2, Issue 2, February 2012.

[14] M. Joa-Ng and I. T. Lu, "A Peer-to-Peer zone based two-level link state routing for mobile Ad Hoc Networks", IEEE Journal on Selected Areas in Communications, Special Issue on Ad-Hoc Networks, August 1999, pp. 1415-1425.

[15] M.K. J. Kumar, R.S. Rajesh, "Performance Analysis of MANET Routing Protocols in different Mobility Models", IJCSNS International Journal of Computer Science and Network 22 Security, Vol. 9, No. 2, February 2009.

[16] M.L Sharma, Noor Fatima, Rizvi Nipun Sharma, Anu Malhan and Swati Sharma, "Performance Evaluation of MANET Routing Protocols under CBR and FTP traffic classes", Int. J. Comp. Tech. Appl., Vol. 2 (3), pp. 393-400.

[17] M. Sreerama Murty and M. Venkat Das," Performance Evaluation of MANET Routing protocols using Reference Point Group Mobility and Random Way Point Models", International Journal of Ad hoc, Sensor & Ubiquitous Computing (IJASUC), Vol. 2, No. 1, March 2011, pp. 33-43.

[18] Pearlman MR, Haas ZJ, "Determining the optimal configuration for the zone routing protocol", IEEE Journal on Selected Areas in Communications 1999, Vol. 17, pp. 1395–1414.

[19] QualNet documentation, "QualNet 5.0 Model Library: Advanced Wireless", http://www.scalablenetworks.com/products/Qualnet/download.php#docs.

[20] T. Clausen, P. Jacquet, "RFC 3626 Optimized Link State Routing Protocol (OLSR)" October 2003.

[21] S. A. Ade and P. A. Tijare, "Performance Comparison of AODV, DSDV, OLSR and DSR Routing Protocols in Mobile Ad Hoc Networks", International Journal of

Information Technology and Knowledge Management July-December 2010, Vol. 2, No. 2, pp. 545-548.

[22] Syed Basha Shaik and S. P. Setty, "Performance Comparison of AODV, DSR and ANODR for Grid Placement Model", International Journal of Computer Applications, Vol. 11, No. 12, 6-9, 2010.

[23] Thakore Mitesh, "Performance Analysis of AODV and OLSR Routing Protocol with Different Topologies", International Journal of Science and Research (IJSR), Vol. 2, Issue 1, January 2013.

[24] The Qualnet 5.0.2 simulator tools. [Online]. Available at www.scalable-networks.com.