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Simulation and Performance Analysis of OLSR Routing Protocol Using OPNET

Kuldeep Vats, Monika Sachdeva, Dr. Krishan Saluja, Amit Rathee
CSE Department, SBSCET
Ferozepur, Punjab (INDIA)

***Abstract*— In this paper discusses and evaluates "Optimized Link State Routing Protocol" OLSR routing protocol to better performance. Using OPNET simulator tools for the performance of OLSR routing protocol simulation, create in small network (30 nodes), medium size network (40 nodes) and large network (50 nodes) the complexity of the mobile ad-hoc network. The MPR count,"HELLO"message sent ,routing traffic sent and received, total TC message sent and forward, total hello message and TC traffic sent are analysis.**

***Keywords*— MANET, OLSR, OPNET, MPR, HELLO Message, Packet format**

I. INTRODUCTION

A Mobile Ad-Hoc Network (MANET) [1] is a collection of mobile nodes which communicate with each other via wireless link either directly or relying on other nodes as routers. The operators of MANETs don't depend on pre-existing infrastructure or base station. Network nodes in MANETs are free to move randomly. Due to mobility of nodes, network topology of MANET may change dynamically without turning to any existing centralized administration [2]. All network activities such as discovering the topology and delivering data packets have to be executed by the nodes themselves, either individually or collectively.In MANETs every node is a potential router for other nodes. The task of specifying a routing protocol for a mobile wireless network is not a trivial one. The main problem in mobile networking is the limited bandwidth and the high rate of topological changes and link failure caused by node movement [3]. Therefore routing in Ad-Hoc wireless network play an important role for data forwarding where each mobile node can act as a relay in addition to being a source or destination node [4], [5], [6], [7]. Because of this reason, a great number of routing protocols has been developed to provide services with Ad-Hoc Network. Mobile Ad-Hoc Routing protocols are traditionally divided into two classes (Reactive and Proactive) depending on when nodes acquire a route to a destination. Reactive protocols are characterized by node acquire and maintain routes on demand. i.e., a route to a destination is not acquire by anode until packet is not received by a destination node.Examples of reactive protocols are "Ad-Hoc on Demand Distance Vector Routing Protocol" (AODV) [9]. Proactive protocols are characterized by all nodes maintain routes to all destination in the network at all times. Thus using a proactive protocol, a node is immediately able to route (or drop) a packet. Examples of proactive protocols include the "Optimized Link State Routing Protocol" OLSR [10].

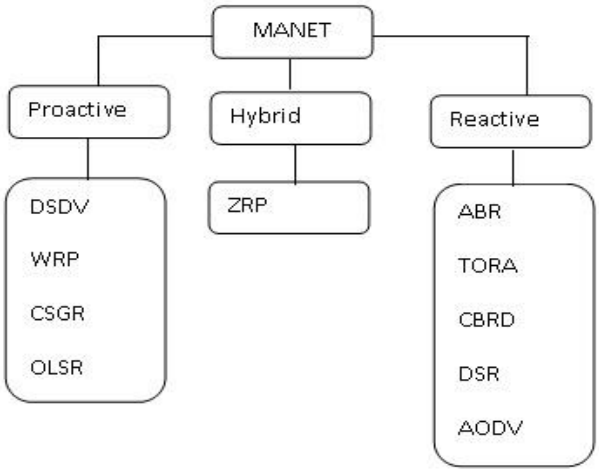

Fig.1 MANET protocol structure

II. THE OLSR PROTOCOL

An 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 neighbour 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 [11].

A. Neighbour Sensing

In OLSR, neighbour nodes related information are gathered with "HELLO" messages which are send over network periodically [12]. These "HELLO" message detect changes in neighbour nodes and related information such as interface address, type of link symmetric, asymmetric or lost and list of neighbours known to the node. Each node update and maintain an information set, describing the neighbour and two-hop neighbour periodically after some time.

B. Multi Point Relay (MPR)

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 [12]. 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.

C. Topology Control Information

Topology Control messages are diffused with the purpose of providing each node in the network with sufficient link-state information to allow route calculation [12]. 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 [10], [11].

III. PACKET FORMAT OF OLSR

OLSR uses unified packet format to carry information related to the protocol. This particular packet can be embedded in UDP datagrams for transmission over the network. It Contains Packet Length (0-15 bytes) and next 16-31 bytes in packet format Reserved for future use, Message Type, Message Size and Information[13].

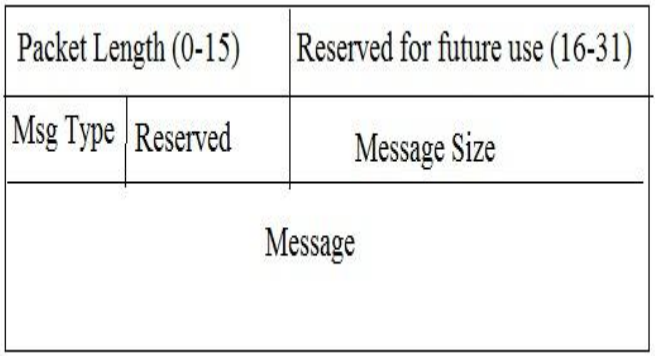

Fig 2. Packet format in OLSR

IV. SIMULATION PARAMETER & MODEL

We use the OPNET modular 14.5 [14-18] to evaluate our experimental network shows the figure 3,4,and 5 are network model, node model and process model of Mobile Ad-hoc network consist on Number of mobile nodes distributed in Circular area through wireless communication link.

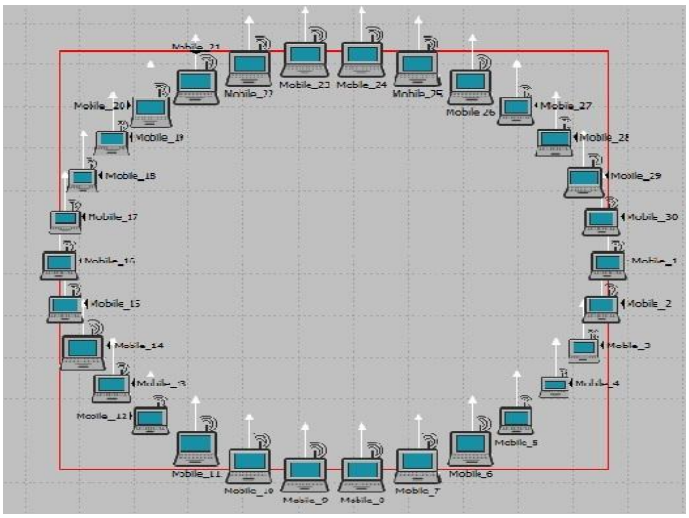

Fig.3 Network model using mobile node

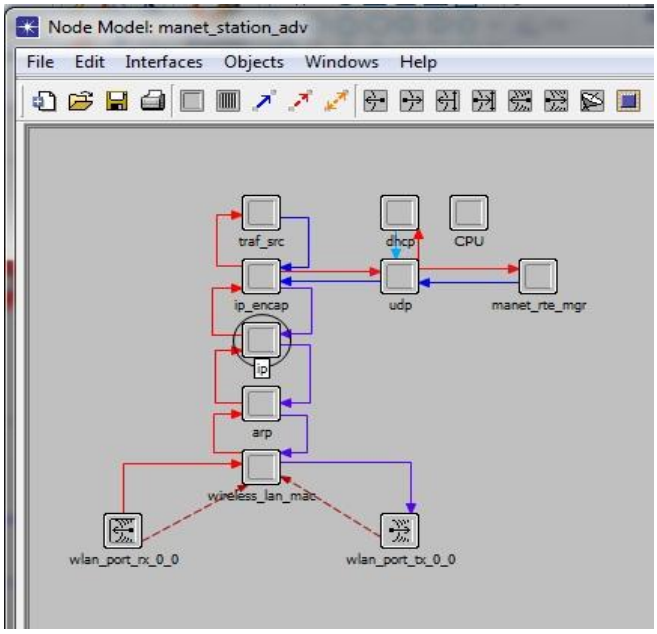

Fig.4 Node model in Mobile node

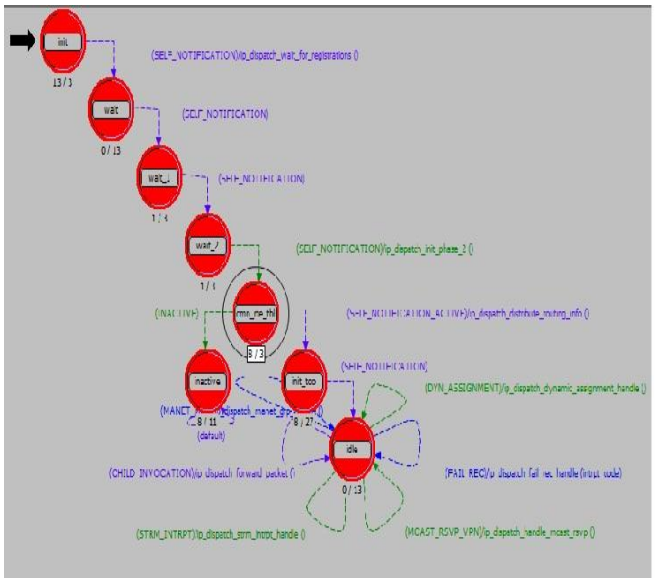

Fig.5 Process model

The Simulation analysis, we compare the no of nodes under various Optimized Link-State Protocol performances. To define a simulation parameter in 30, 40, 50 mobile nodes are created with the data rate of 18 mbps and transmit power of 0.11 watts. Each node moves randomly within the network range 10,000 sq m. And another parameters or its value define in Parameter Table (Tab.1).

Parameters	Value
Operation Mode	802.11a
Node Position	Circular
No. of Nodes	30, 40, 50
Speed	10 ms
Simulation Time	1 hr
Seed	128
Value per Statistic	100
Update Interval	50,000 event
Simulation kernel	Based on 'Kernel-Type' preference
"HELLO" interval (sec)	2.0
TC interval	5.0
Neighbor hold Time	15.0
Publicly Message hold time	30.0
Addressing Mode	IPV4

Table 1 Network parameter

V. EXPERIMENTAIL RESULT

In OLSR routing protocol simulation experiment result using different parameters of OPNET Modular with the help of DES graphs we choose the global statistics for analysis result of OLSR routing protocol. figure 6 shows "HELLO" traffic sent result with the help of overlaid statistics output are shows in average different nodes 30, 40, 50. In this, destination nodes are selected randomly and send "HELLO" message to each destination node. After one hour simulation time the value of 30 nodes is 17,000 and 40 nodes is 29,000 and 50 nodes is 45,000.

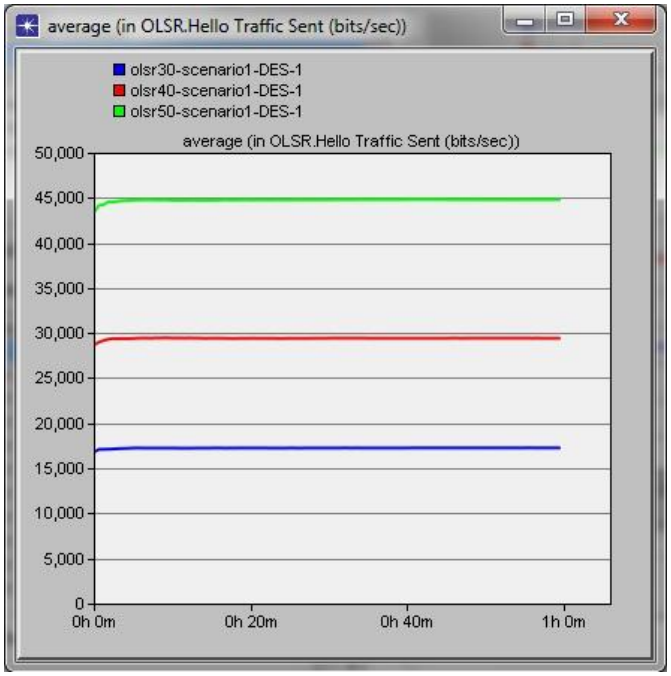

Fig.6 Hello Traffic Sent (bit/sec)

Fig.7 Shows that Simulation result are repeated for different densities of the node in network. We compute the average MPR count. MPR selection with the help of stacked statistics output are shows in frequency during 30 and 40 nodes is almost same but increase instantly after taking 50 nodes. The MPR count is 3 during 30 and 40 nodes but increase to 4 when we take total node 50.

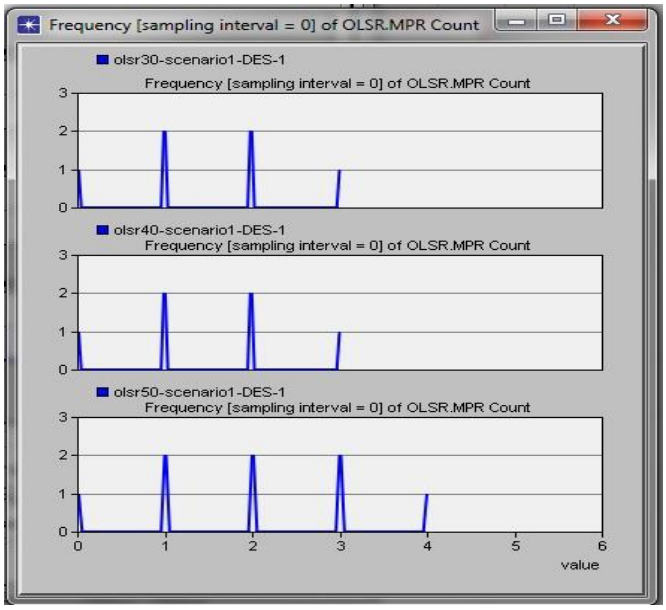

Fig.7 MPR Count

Figure 8 Show on different Routing traffic sent and received through random way point. The DES graphs shows results with help of overlaid statistics output are shows in logarithm. The value of routing traffic sent and received in OLSR routing protocol using randomly source to destination node. In our simulation OPNET modeler we use 30, 40 and 50 nodes. In 30 nodes, routing traffic sent in 15 (pkt/sec) and routing traffic received in 430 (pkt/sec) and 40 nodes routing traffic sent in 20(pkt/s) and routing traffic received in 780 (pkt/sec) or using 50 nodes routing traffic sent in 25 (pkt/sec) and routing traffic received in 1230 (pkt/sec).

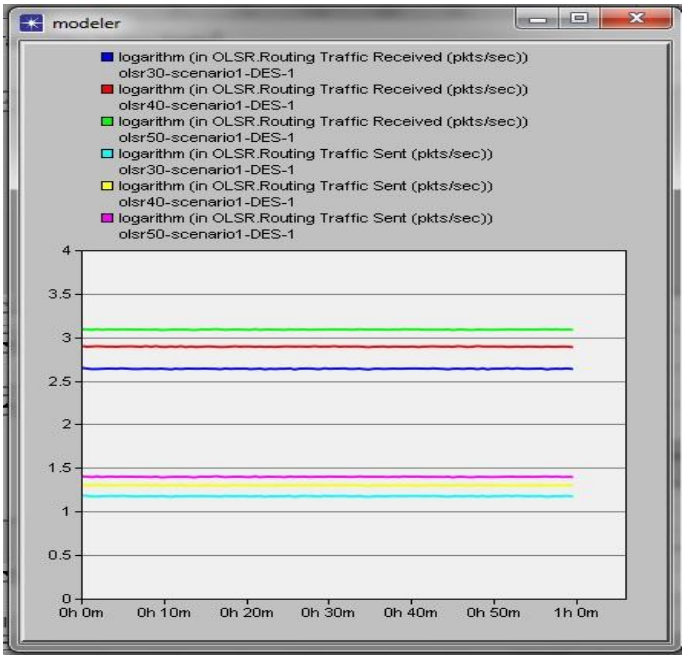

Fig.8 Routing traffic sent (pkt/s)Routing traffic received (pkt/s)

Fig.9 shows the total hello message value and Topology Control (TC) traffic sent (bit/s) with the help of stacked statistics output are shows in Sample_sum type after one hour simulation time, total "HELLO" message created in circular network in between different nodes are 30, 40, and 50 in numbers shows different result. Using 30 nodes simulation result of total "HELLO" message is 535 and using 40 nodes simulation result of total "HELLO" message are created in 725 or using 50 nodes simulation result of total "HELLO" message are created in 900 and the same 30, 40, 50 nodes. The topology control traffic sent in bit per second. In our simulation we use 30 nodes TC traffic sent value are 100, or 40 and 50 nodes TC traffic sent are 130 (bit/s).

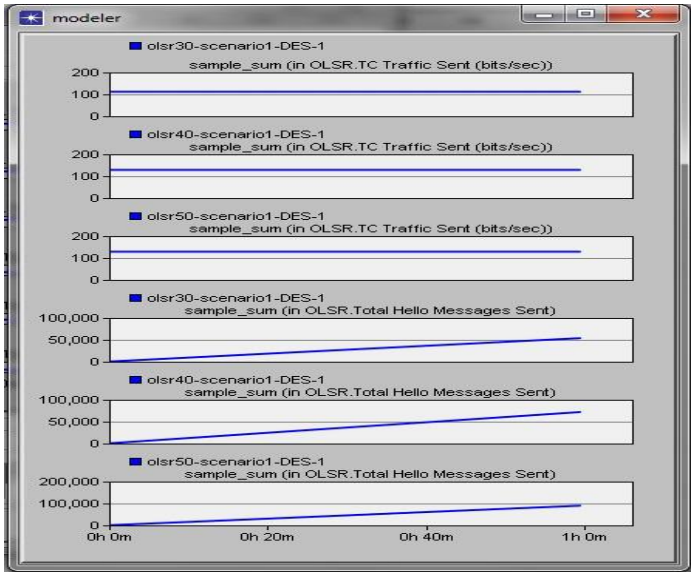

Fig.9 Total hello message and TC traffic sent (bit/sec)

In simulation result on Optimized Link State Protocol(OLSR) routing protocol in MANET using different parameter Fig. 10 shows the total TC message sent (TTMS) and total TC message forward (TTMF) with the help of stacked statistics output are shows in moving average types After simulation time simulation result scenario we use 30,40,50 nodes in analysis the performance of OLSR protocol in different method .using 30,40,50 nodes OLSR simulation result of total TC message sent is 13,11,15 and using same number of nodes total TC message forward value is 3,2,4 in MANET circular network.

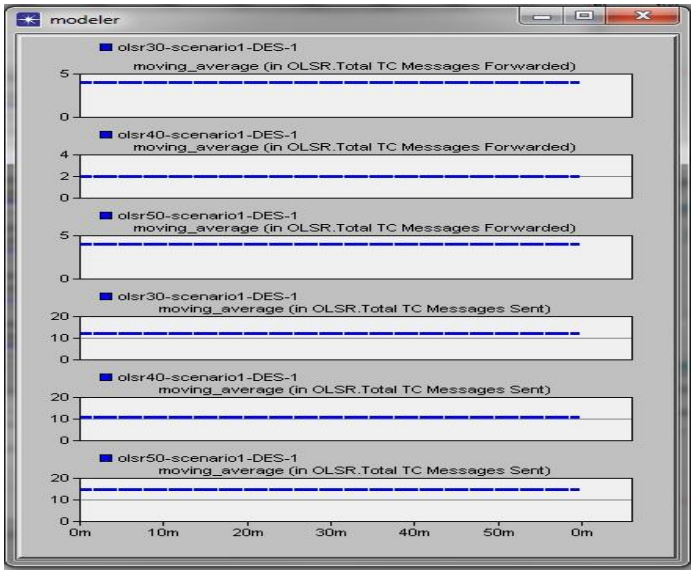

Fig.10 Total TC message sent (TTMS) and Total TC message forward (TTMF)

VI. CONCLUSIONS

An Mobile AD-hoc Network OLSR routing protocol was simulated with 30, 40, and 50 node moving randomly in an area of within the network range 10,000 sq m . In this paper, MANET routing protocol in the OLSR were performance analyzed. The performance of OLSR protocol through a network different size carried out a comparative analysis of the performance and found it had better performance in all aspects in a network. 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.

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