International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2015): 78.96 | Impact Factor (2015): 6.391

An Implementation of MOLSR Routing Protocol in MANET

Dipali Patel[1], Amiteshwar Bhalavi[2]

[1, 2]Department of ECE, IES, IPS Academy, Indore, India

Abstract: ***Nowadays multicasting is very popular in military battlefield communication, rescue operations, conferencing, and multi-user games etc. To ensure broad popularization of these applications, they should be available irrespective of time and place. Because wireless mobile ad hoc network is automatically able to create a wide wireless network, which can expand an existing wired network, they are an ideal solution to support this concept of multicast at anytime and anywhere. Many protocols are proposed for mobile ad hoc network which provide multicast services. The internal mechanisms may differ but all protocols achieve the same goal i.e. reliable and efficient multicast packet delivery. Multicast packet delivery paths tend to become sensitive with respect to mobility. When they are optimized for bandwidth and become unsuitable with respect to bandwidth, when designed to be elastic to the dynamic nature of network. To improve the efficiency and reliability the MPRs (multi point relays) selection mechanism of OLSR is used. Our main approach is to build multicast delivery routes using multi point relays to transmit multicast packets from multicast source to group members. Simulation result shows that the proposed algorithm improves the reliability of network.***

Keywords: OLSR; MANET; Quality of Service; Routing Protocol

1. Introduction

The mobile ad-hoc network is an autonomous collection of two or more wireless nodes. These nodes might be dynamic in nature and they can communicate with each other either directly within communication range or by the multi hop data forwarding operation if they are not directly within same communication range. The wireless ad-hoc network works without any support of central administration and infrastructure and consists of wireless devices which have capability of networking. In this way, ad-hoc network has been created, administered organized and by the wireless mobile nodes. The wireless nodes don not have any right of control and administration to support the network. Only the interaction between the nodes is used to provide functions in a network.

A MANET is an autonomous collection of mobile users that communicate over relatively bandwidth constrained wireless links. Since the nodes are mobile, the network topology may change continuously over time which makes unicast routing protocols unsuitable if number of receivers are more. So, multicast routing protocols are preferred in that case. In an ad hoc environment, network hosts works in groups to carry out a given task this is called as multicasting in a network. Multicasting plays an important role in mobile ad hoc networks. Multicasting is used in various applications such as military operations, audio and video conferencing, disaster situations, sport events and integration with cellular systems.

These days demand for use of above multicast applications increased. Wireless ad hoc networks are a solution for which reduces time as well as complexity of network. Multicasting in mobile ad hoc networks is challenging because of frequent network topology changes, varying channel capacity, limited wireless bandwidth, and centralized control absence. To execute multicasting in this demanding environment, different multicast protocols have been proposed [1][2]. These protocols can be further classified in three categories like tree based protocols, mesh-based protocols, and stateless protocols. Although they are constructing multicast delivery paths in different way, all protocols aim at a same goal which is efficient and reliable multicasting.

In this work, we are going to focus on OLSR (optimized link state routing) and Multicast OLSR protocol for mobile ad hoc network. This work contains the analysis of parameters like Packet Delivery Ratio, Throughput, Energy and Normalized Routing Load for various node densities of 5, 10, 15, 20, 50 and 100.

2. Optimnized Link State Routing

Optimized Link State Routing (OLSR) is a proactive routing protocol for mobile ad hoc networks. The protocol has the benefit of having routes instantly available when needed due to its proactive nature. OLSR reduces the routing overhead which is caused due to flooding of control traffic by using the method of only selected nodes, called as Multi-Point Relays (MPR), to retransmit control messages in the network. This technique efficiently decreases the number of retransmissions which is required to flood messages to all nodes in the network. When a node receives an update message it determines the routes (sequence of hops) toward its known nodes. Each node selects its MPRs from the set of its neighbors saved in the Neighbor's table. This neighbors set covers nodes within a distance of only two hops. The technique is that whenever the node broadcasts the message, only the nodes selected as its MPR set are responsible for the further broadcasting of the message [3] [1]. OLSR uses HELLO and TC messages for the diffusion of these control messages. The Topology Control (TC) messages provides for continuous information of the routes to destinations in the network. OLSR protocol is very significant for traffic patterns where a large number of nodes are communicating with another large number of nodes, and where the [source, destination] changes frequently over time. The HELLO messages are sent periodically among the neighbor node

Licensed Under Creative Commons Attribution CC BY

which detects the identity of neighbors and helps in MPR selection. The protocol is particularly suited for large and dense networks, as the optimization is done by using MPRs which work well in this environment. The large and dense network achieves more optimization as compared to classic link state algorithm. OLSR uses hop-by-hop routing, i.e., each node uses its local information to route packets from source to destination [4].

Neighbor sensing: Every node must be aware of the link between the neighbor node and itself. These links can be either symmetric or asymmetric in nature. For this purpose hello message is sent to every other node in the network periodically. These hello messages contain the information about its neighbors and link status. These hello messages are broadcast to all one hop neighbors. With the help of hello message each node learns the knowledge about its neighbors up to two-hops. This information is important to select the MPR node and on reception of hello message each node is able to construct its MPR selector table. To disperse the information of topology throughout the network topology control message is used.

The nodes which are selected as MPR node will transmit topology control message. Each node declares its MPR selector set by forwarding a TC message periodically. This TC message contains list of neighbors who have selected the sender node as a multipoint relay. In OLSR, all nodes which are chosen as MPR will transmit TC messages. The TC messages contain the address of the node generating the message, as well as the list of nodes that has chosen the given node as MPR selectors. TC messages are further flooded using the MPRs, disseminating network topology information to all the nodes in the OLSR network.

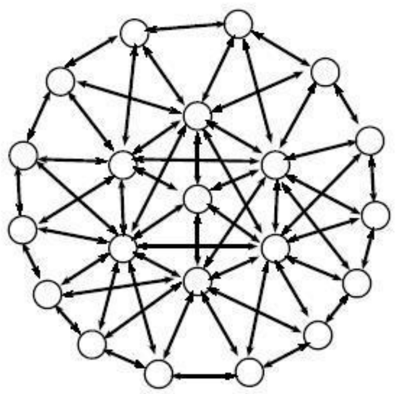

Figure 1: Flooding a Packet in a Wireless Multi-hop Network

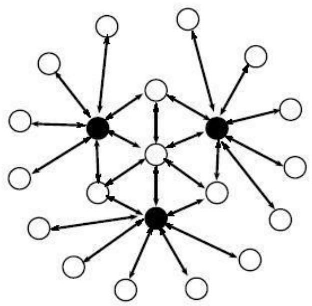

Figure 2: Flooding a Packet in Wireless Multi-hop Network from the Centre Node Using MPR

Multi Point Relay Node Selection: Multipoint relays plays an important role in minimizing the overhead which is created by redundant retransmissions in the same region by flooding messages in the network. every node selects a set of nodes in its 1 hop neighborhood that are known as multipoint relays (MPR) and they are responsible for retransmission of message in the network. MPR set is selected in such a way that it may coverall the 2-hop nodes i.e. in terms of radio range.

The nodes which are not selected as MPR node, receives the messages but do not retransmit the message. Each node in the network keeps information about the set of neighbors that have selected it as MPR and this set is said to be the "Multipoint Relay Selector set" (MPR selector set) of a node. This information is obtained by forwarding the periodic HELLO messages to the neighbors in the network. Figure 2 shows the nodes which are selected as MPR.

3. Multi Cast Optimized Link State Routing

Multi Cast Optimized Link State Routing (MOLSR) is the multicast expansion of existing OLSR protocol, where OLSR provides the unicast traffic for the network. The most recent sequence numbers are used to reach the multicast group. MOLSR includes unicast, multicast and broadcast features. In MOLSR each node in a group sends multicast data packets in order to avoid waste of bandwidth which is caused by unicast data packets for group of receivers.

Tree Initialization Phase

The node which first joins the multicast group becomes the group leader and responsible for the update of group sequence number as well as broadcasts it using group hello message periodically. When the members in group remain connected within a multicast tree MOLSR don't play any role. It plays important role when a node either wants to join or leave a multicast group. If a node wants to join a multicast group and have the address of group leader it unicast a route request (RREQ) message to the group leader. The node which do not have address of group leader they broadcast the group hello message in the network. Route reply (RREP) message is sent by the member of group. Route to multicast tree is now made available by unicasting a RREP message back to the RREQ message. This RREP contains the actual distance of replying node from the group leader and recent sequence number of the multicast group. The nodes which have greater sequence number than that in the RREQ can only reply to the message. The receiver node receives several RREPs and from these it selects the most recent and shortest path and sends multicast activation (MACT) message. MACT message activates the routes [5].

Licensed Under Creative Commons Attribution CC BY

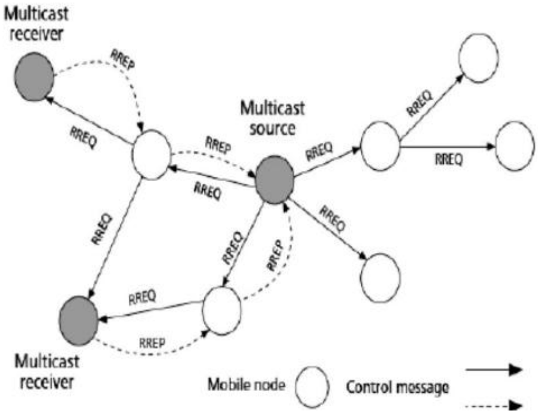

Figure 3: Discovery of Path in the MOLSR Protocol

Tree Maintenance Phase

The nodes in the multicast group are highly dynamic in nature. Each node in the multicast group is free to join or leave the group at any time. A node can leave the tree in only two cases i.e. either it is a leaf node or it is an intermediate tree node and the last downstream node of it leaves the tree. If a leaf node wants to leave the group, it sends prune message to the upstream nodes which is send further up the tree. The nodes continuously monitor the status of link of the next hops on the multicast tree. Whenever there is a link break, it is detected and repaired through the RREQ, RREP, MACT messages.

4. Simulation and Results

We have implemented our work i.e. Creation of MANET Scenario for NS-2 and so toform totally different routing protocols with the use of various performance matrices like Packet Delivery Ratio, Overall Throughput, Normalized Routing Load and Energy.

Table 1: Network Scenario

Simulation Tools	NS-2.35
IEEE Scenario	802.11
Propagation	Two Ray Ground
No. of Nodes	5, 10, 15, 20, 50, 100 nodes
Traffic Type	TCP
Antenna	Omni Directional Antenna
MAC Type	IEEE 802.11
Routing Protocol	OLSR, MOLSR
Queue Limit	50 Packets
Simulation Area (in metre)	2000 M
Simulation Time	100 seconds

In our case firstly we created scenario file for IEEE 802.11 standard which is used along with our TCL Script then we create a TCL script which contain various routing protocols in our case these are OLSR and MOLSR then a particular MANET scenario or topology in our case it consist of 5 nodes, 10 nodes, 15 nodes and 20 nodes, 50 nodes and 100 nodes with 100 sec simulation time.

Packet Delivery Ratio

Packet delivery ratio/fraction is the fraction between packets successfully delivered to destinations over total number of packets sent. The better performance of the routing protocol depends on the higher delivery ratio.

$$\text{Packet Delivery Fraction} = \frac{\text{Total number of packets Received}}{\text{Total number of packets sent}}$$

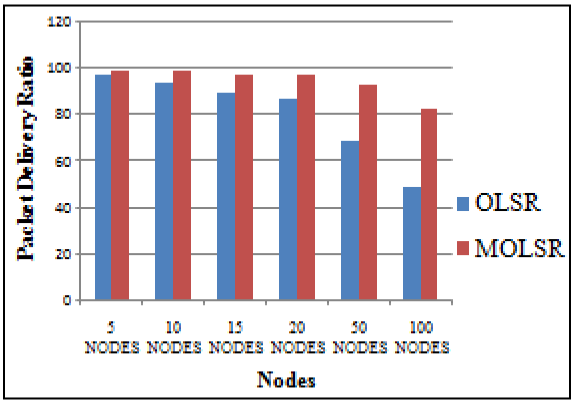

Figure 4: Packet Delivery Ratio for OLSR and MOLSR

From the figure 4 we analyzed that theMOLSR routing protocol has better Packet Delivery Ratio for different traffic scenario which are 5 nodes, 10 nodes, 15 nodes, 20 nodes, 50 nodes, 100 nodes. Figure 4 shows that the packet delivery ratio is increased for high node density. The calculation of packet delivery ratio for 100 nodes is increased by 68.43% which is better among other nodes. At 50 nodes packet delivery ratio is increased by 34.03%.

Throughput:

Ratio of the total amount of data that reaches receiver from sender in unit time this is referred as throughput. It is expressed in bits per second or packets per second.

$$\text{Throughput} = \frac{\text{Total no. of Packets Received Successfully}}{\text{Total Simulation Time}}$$

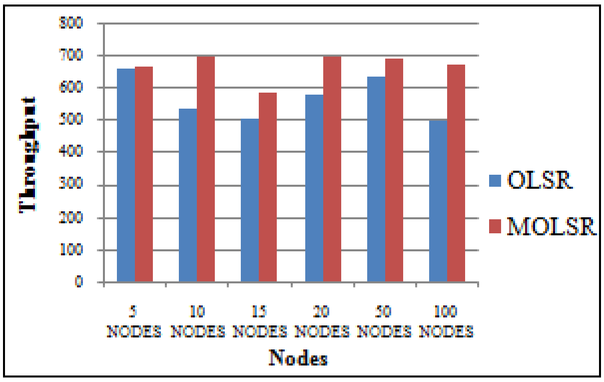

Figure 5: Throughput for OLSR and MOLSR

From the figure 5 we analyzed that the MOLSR routing protocol has better Throughput as compare to the OLSR routing protocol for different traffic scenario which are 5 nodes, 10 nodes, 15 nodes, 20 nodes, 50 nodes, 100 nodes. Figure 5 shows that there is constant increase in throughput of MOLSR as compared to OLSR. The average throughput of MOLSR is increased by 18%.

Normalized Routing Load:

This is the ratio of overhead bytes to the delivered data bytes. The transmission at each hop along the route is counted as one transmission in the calculation of this metric. The routing overhead of a simulation run is calculated as the

Licensed Under Creative Commons Attribution CC BY

number of routing bytes generated by the routing agent of all the nodes in the simulation run.

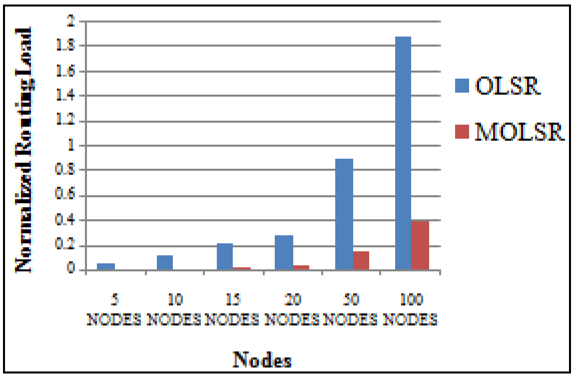

Figure 6: Throughput for OLSR and MOLSR

From the figure 6 we analyzed that the MOLSR routing protocol have less routing load as compared to the OLSR routing protocol for different traffic scenario which are 5 nodes, 10 nodes, 15 nodes, 20 nodes, 50 nodes, 100 nodes. From above figure it is concluded that Normalized Routing Load at node 100 is decreased by 78.70 % which is best as compared to other node densities.

Residual Energy:
It is the total amount of remaining energy by the nodes after the completion of Communication or simulation. If a node is having 100% energy initially and having 70% energy after the simulation than the energy consumption by that node is 30%.The unit of it will be in Joules. Residual energy is calculated as:

$$\text{Residual Energy} = \text{Total Energy} - \text{Consumed Energy}$$

From the figure 7 we analyzed that the OLSR routing protocol has more residual energy as compared to the MOLSR routing protocol for different traffic scenario which are 5 nodes, 10 nodes, 15 nodes, 20 nodes, 50 nodes, 100 nodes.

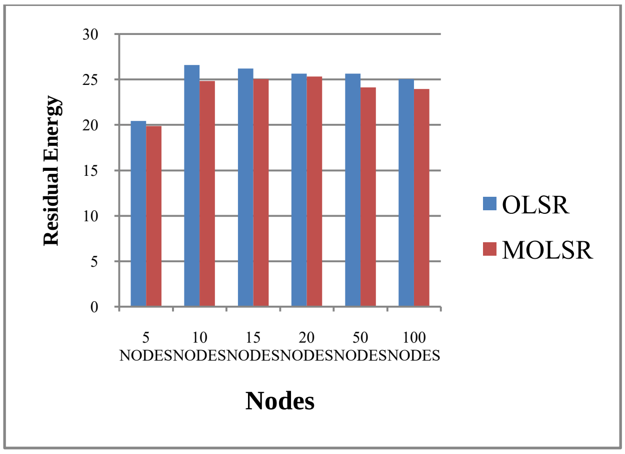

Figure 7: Packet Delivery Ratio for OLSR And MOLSR

5. Conclusion and Future Work

This thesis presents the analysis of OLSR and MOLSR protocol. The parameters like packet delivery ratio, throughput, end to end delay, normalized routing load and energy has been analyzed and concluded that performance of MOLSR gives the better results. The analysis is performed from small node density to larger i.e. for 5 nodes, 10 nodes, 15 nodes, 20 nodes, 50 nodes, 100 nodes with 100 sec simulation time with two ray ground propagation model and omni directional antenna with unity gain. We concluded that the performance of MOLSR is better for packet delivery ratio as well as throughput. We focused on the successful delivery of data packets so the energy consumption that is caused can be neglected.

Security of communication is the challenging part in Ad-hoc networks. Wireless networks are prone to the passive and active attacks like grey hole, sink hole etc. In order to provide security different attacks should be analyzed and reduced.

References

[1] SINGH, S., WOO, M., AND RAGHAVENDRA, C. S. “Power-Aware Routing in Mobile Ad Hoc Networks”. In *Proceedings of the Fifth Annual ACM/IEEE International Conference on Mobile Computing and Networking (MobiCom)* (Dallas, TX,1998), pp. 181–190.
[2] S.Ahmed, M. Bilal, U. Farooq and F. Hadi, “Performance Analysis of various routing strategies in Mobile Ad-hoc Network using QualNet simulator”, *Int. Conf. on Emerging Technologies (ICET),* Islamabad, 2007.
[3] P. Jacquet, P. Miihlethaler, T. Clausen, A. Laouiti, A. Qayyum and L. Viennot, “Optimized link state routing protocol for ad-hoc networks”, *Multi Topic Conference, Technology for the 21st Century. Proceedings IEEE International*, pp. 63-68, 2011.
[4] Florino De Rango, Marco Fotino and Salvatore Marano, “EE-OLSR: Energy Efficient OLSR routing protocol for Mobile ad-hoc Networks”, *Military Communications Conference, IEEE,* 2008.
[5] Philippe Jacquet et altres, “Multicast Optimized Link State Routing”, *draftietf- manet-olsr-molsr-01, txt,* april 2002.
[6] Teerawat Issariyakul and Ekram Hossain, “Introduction to network simulator NS2”, *Springer*, 2011.

Licensed Under Creative Commons Attribution CC BY