AN EMPIRICAL STUDY OF THE OPTIMIZED LINK STATE ROUTING (OLSR) PROTOCOL FOR WIRELESS NETWORKS USING JIST/SWANS SIMULATOR

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ABSTRACT

The performance of a Mobile Ad hoc Network (MANET) is closely related to the capability of the implemented routing protocol to adapt itself to unpredictable changes of network topology and link status. The Optimized Link State Routing (OLSR) protocol is a one of the proactive routing protocols for MANETs. It is based on the Multi-Point Relays (MPRs) technique to reach all nodes in the network with a limited number of broadcasts. In this work we implement the OLSR protocol, and measure its performance under different nodes population and mobility scenarios. We share our experience in carrying out this work and hopeful that our implementation will be beneficial to other researchers.

***Key words*:** Ad hoc networks, OLSR protocol, Multi-Point Relays, Mobility scenarios.

1. INTRODUCTION

A Mobile Ad hoc Network (MANET) is a network consisting of a set of wireless mobile nodes that communicate with each other without centralized control or established infrastructure. Packet routing is a critical task in MANET as the nodes are moving. The purpose of present study is to implement and evaluate the performance of routing protocol in MANET [2]: Optimized Link State Routing (OLSR) protocol [1, 4].

The OLSR protocol has been developed for Mobile Ad hoc Networks. It operates as a table driven, proactive protocol, i.e., exchanges topological information with other nodes of the network regularly. Each node selects a set of its neighbour nodes as Multi-Point-Relays (MPR) [1]. In OLSR, only nodes, selected as such MPRs are responsible for forwarding control traffic, intended for diffusion into the entire network. MPRs provide an efficient mechanism for flooding control traffic by reducing the number of transmissions required.

The performance of the implemented routing protocol is analyzed using various metrics like packet Delivery ratio, Delay for varying number of node population using Jist/SWANS simulator [5,7]. Details of simulation parameters are set to evaluate the performance of the implemented protocol.

2. METHODOLOGY

The function of OLSR specifies the behaviour of a node, equipped with OLSR interface participating in the MANET and running OLSR as routing protocol. The protocol is an optimization of the classical link state algorithm tailored to the requirements of a mobile wireless LAN [2, 6]. The key concept used in the protocol is that of multipoint relays (MPRs). MPRs are

selected nodes which forward broadcast messages during the flooding process. This technique substantially reduces the message overhead as compared to a classical flooding mechanism, where every node retransmits each message when it receives the first copy of the messages. In OLSR, link state information is generated only by nodes elected as MPRs. Thus, a second optimization is achieved by minimizing the number of control messages flooded in the network. As a third optimization, an MPR node may choose to report only links between itself and its MPR selectors. Hence, as contrary to the classic link state algorithm, partial link state information is distributed in the network. This information is then used for route calculation. OLSR provides optimal routes (in terms of number of hops).

OLSR uses two kinds of the control messages: Hello and Topology Control (TC). Hello messages are used for finding the information about the link status and the host's neighbors. With the Hello message the Multipoint Relay (MPR) selector set is constructed which describes which neighborus has chosen this host to act as MPR and from this information the host can calculate its own set of the MPRs. The Hello messages are sent only one hop away but the TC messages are broadcasted throughout the entire network. TC messages are used for broadcasting information about their own advertised neighbors which includes at least the MPR Selector list. The TC messages are broadcasted periodically and only the MPR hosts can forward the TC messages.

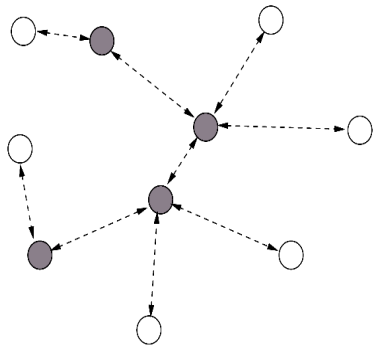

Figure 1: An OLSR routed network. The gray nodes are chosen as MPRs by one or more neighbor

3. RESULTS

The performance of Optimized Link State Routing (OLSR) protocol was evaluated by using experimental and simulation results. The experiments are carried out in Jist/SWANS simulator using selected simulation time. When there was comparison between experimental and simulation results for the same set of parameters, no packet loss was observed. But packet loss was observed when the simulation time or number of nodes is increased.

When the simulation ran, we count the number of packets, which are gone through and received by each node. We also assessed its delay and delivery of the received packets. This information is included in the data files.

Parameter	Value
Area Dimension	1000*1000 meters
Number Of Nodes	12,50
Simulation Time	3 , 6 & 9 hours
Mobility model	Random Way Point, Static
Minimum Speed	1 meter/second
Maximum Speed	10 meter/second
Network Simulator	Jist/ SWANS

Table 1: Simulation parameters used for the experimental studies in the Jist/SWANs simulator.

The first performance metric we would like to measure is the Packet Delivery Ratio (PDR). It is calculated using the formula:

PDR= (Total Number of Received Packet / Total Number of Sent Packet) * 100

The second performance metric we would like to measure is the packet transmission Delay . It is calculated using the formula:

Delay= (Packet Received Time- Packet Sent Time)

Graphical Representation of Simulation Results

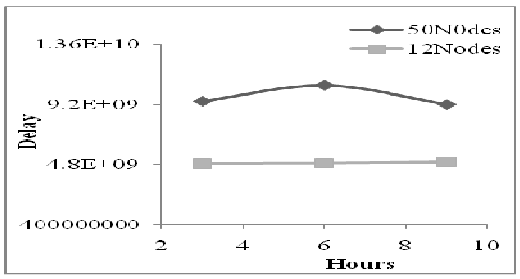

Figure 2: Delay vs. Hours in Random Way point mobility model

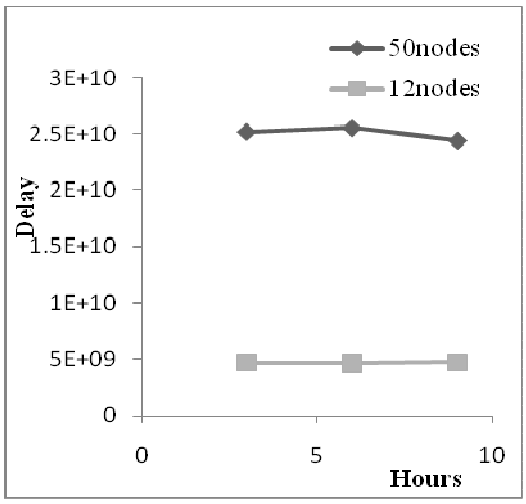

Figure 3: Delay vs. Hours when nodes were Static

Figure 2 and Figure 3 indicate the Average Delay of 12 nodes, 50 nodes at different simulation time intervals and in a 1000m x 1000m grid simulation area. Both the Figure 2 and Figure 3 were obtained using Random Way point Mobility model and Static Mobility model respectively. According to the results obtained the Random Way point Mobility model shows of low performance than the Static Mobility model in Average Delay.

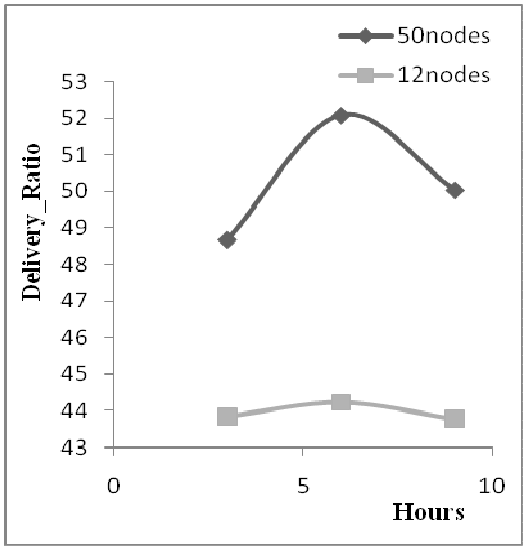

Figure 4: Average Delivery vs. Hours in Random Way point Mobility model

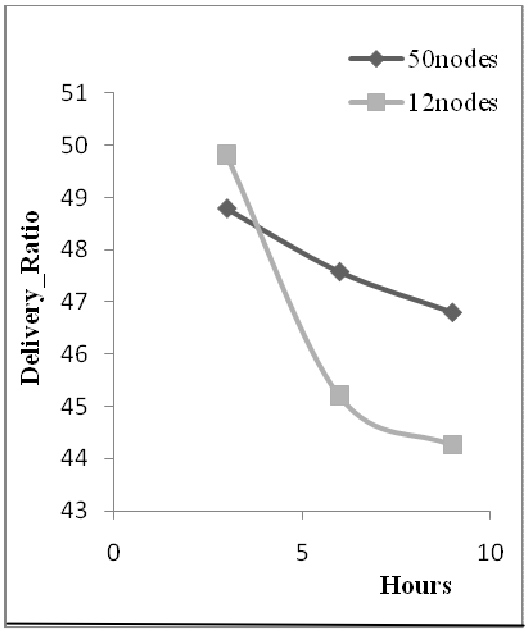

Figure 5: Average Delivery vs. Hours when nodes were Static

Considering the Packet Average Delivery Ratio (Figure 4 & 5), Performance of the Random way point mobility model is much higher than the Static mobility model. According to these four graphs finding the Random way point mobility model is the best to be chosen.

4. CONCLUSION

In this work we have implemented and evaluated the performance of OLSR protocol in Jist/SWANS simulator under different test scenarios. Unlike other protocols, the OLSR reduces the message overloading using MPR. This is more efficient than other classical link state protocols. Further, we find that our implementation of this protocol is very well scalable with varying number of nodes population. We hope our extension of the simulator by implementing this protocol would benefit the research community for their future experimental studies.

5. REFERENCES

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