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IMPLEMENTATION OF OLSR IN MANET USING OMNETPP

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Abstract—
An ad hoc network is a collection of wireless mobile nodes dynamically forming a temporary network without the use of any pre-existing network infrastructure. A number of ad hoc routing protocols have been developed during the time. Scalability is an open issue in all routing protocols. In this paper, we get our observations regarding the scalability comparison of the Optimized Link State Routing (OLSR) by varying the number of nodes. The simulation is done by using OMNET++ simulator by taking end to end delay, throughput and jitter as performance metrics.
Index terms– MANET, OLSR, Scalability

I. INTRODUCTION

Ad hoc network is a multi-hop wireless network, which consists of number of mobile nodes. These nodes generate traffic to be forwarded to some other nodes or a group of nodes. Due to a dynamic nature of ad hoc networks, traditional fixed network routing protocols are not viable. Based on that reason several proposals for routing protocols has been presented. Ad hoc radio networks have various implementation areas. Some areas to be mentioned are military, emergency, conferencing and sensor applications. Each of these application areas has their specific requirements for routing protocols. For example in military applications low probability of detection and interception is a key factor such is routing efficiency during fading and disturbed radio channel conditions. At sensor applications low or minimum energy consumption is a precondition for an autonomous operation. All application areas have some features and requirements for protocols in common. The routing protocol overhead traffic is not allowed to drive the network to congestion nor is a local change in link not allowed to cause a massive control traffic storm throughout the network.

II. MOBILE AD-HOC NETWORK (MANET)

Mobile Ad-hoc NET work (MANET) [1] is a collection of wireless mobile nodes forming a temporary/short-lived network without any fixed infrastructure where all nodes are free to move arbitrarily and where all the nodes configure themselves. The entire collection of nodes is interconnected in many different ways. There is more than one path from one node to another. The nodes in a MANET can be of varying capabilities. Mobile phones, laptop computers and Personal Digital Assistants (PDAs) are some examples of nodes in ad-hoc networks.

2.1 Routing In MANETs

To facilitate communication within the network a routing protocol is used to discover routes between nodes. The goal of the routing protocol is to have an efficient route establishment between a pair of nodes, so that messages can be delivered in a timely manner.

2.2 Classification of Routing Protocols

Many protocols have been proposed for MANETs. These protocols can be mainly divided into two categories.

- Reactive/On-demand Routing Protocols
- Proactive/Table-driven Routing Protocols

A. Reactive/On-demand Routing Protocols

In reactive or On-demand protocols, the routing information is maintained only for active routes. That is, the routes are determined and maintained by a node only when it wants to send data to a particular destination. A route search is needed for every unknown destination. Therefore, the communication overhead is reduced at expense of delay due to route research. Some reactive protocols are Ad hoc On-Demand Distance Vector (AODV), Temporally Ordered Routing Algorithm (TORA) and Dynamic Source Routing (DSR). But here we'll discuss only AODV and TORA as we have simulated these two protocols from reactive category.

B. Proactive/Table-driven Routing Protocols

In proactive or table-driven routing protocols, the routing tables are used. Each node maintains up-to-date routing information to every other node in the network in the routing tables. Routing information is periodically transmitted throughout the network in order to maintain routing table consistency. However, for highly dynamic network topology, the proactive schemes require a significant amount of resources to keep routing information up-to-date and reliable. Some highly used proactive routing protocols are Optimized Link State Routing (OLSR), Destination Sequenced Distance Vector (DSDV) and Wireless Routing Protocol (WRP).

III. DESCRIPTION OF OLSR

The Optimized Link State Routing protocol (OLSR) is an optimization of a pure link state protocol (complete link information is flooded though network) as it compacts the size of information sent in each message, and reduces the number of retransmissions to flood these messages in the entire network. The protocol uses a multipoint relaying technique to flood its control messages in an efficient and economic way.

The idea of multipoint relays is to minimize the flooding of broadcast packets in the network by reducing retransmissions in the same region. Each node selects a set of 1-hop neighbors, which retransmits its packets. These neighbors are called the multipoint relays (MPRs) of that node. For the retransmission, each of the nodes maintains a set of neighbors called MPR Selectors. The node is assumed to retransmit every broadcast message coming from one of these MPR Selectors.

The multipoint relay set is chosen among a node's one-hop neighbors in such a manner that it is the minimum set that covers (radio range) all the nodes that are two hops away. The multipoint relay set of N, MPR(N), satisfies the following condition: every node in the two hop neighborhood of N must have a bi-directional link towards other nodes in MPR(N). These bi-directional links are determined by periodically broadcasting HELLO.

OLSR is designed to support large and dense wireless networks. The levels of optimization discussed above, make it better suited for such networks. OLSR is tailored for networks where the traffic is random and sporadic between large numbers of nodes. It is also suitable for scenarios, where the communicating pairs change over time. Once the communicating pair changes, a route to new pair is readily available, and no control traffic or route discovery process is needed as in the case of reactive protocols. This can be beneficial for situations where time critical or safety related data needs to be delivered with minimum possible delay.

IV. SIMULATION SETUP

4.1 Simulator

The simulation is performed using the OMNET++. OMNET is a discrete event network simulator that provides virtual network communication environment. OMNET++ is chosen because it is one of the leading environments for network modeling and simulation. It offers easy graphical interface. This tool is highly reliable, robust and efficient.

4.2 Simulation Parameters

This simulation study focuses on the performance of routing protocol OLSR with increase in the number of nodes. Therefore, three simulation scenarios consisting of different number of nodes i.e. 30, 60 and 90 are considered.

4.3 Performance Metrics

The metrics have been chosen in order to evaluate the routing protocols for scalability. The metrics which capture the most basic overall performance of Routing protocols studied in the research work are as follows:

(a) Average End-to-End Delay: Average End-to-End delay (seconds) is the average time it takes a data packet to reach the destination. This includes all possible delays.
Delay= (Total Delay for all successful data packet delivery)/ Number of received data packets.

(b) Throughput (messages/second): Total number of delivered data packets per second of simulation time. We analyze the throughput of the protocol in terms of number of messages delivered per second.
Throughput= (number of delivered packets * packet size)/ total duration of simulation.

(C) Average Jitter: It Signifies the Packets from the source will reach the destination with dissimilar delays. A packet's wait varies with its location in the queues of the routers along the path between source and destination and this position can varies unpredictably

A. Average End-to-End Delay

B. The first performance metric, Average End-to-End Delay is calculated for routing protocol for 30(Blue), 60(Green) and 90 (Red) number of nodes.

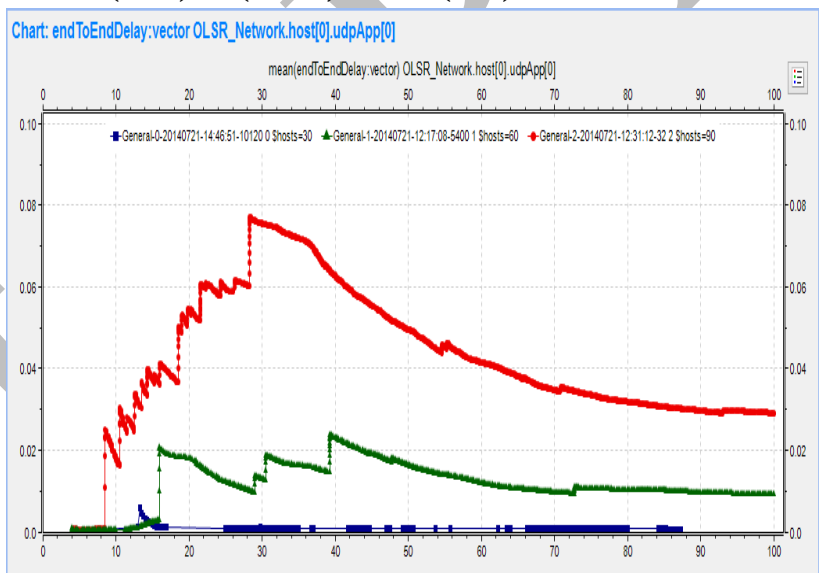

Figure 1. Network Delay for 30, 60, 90 nodes (OLSR)

C. Throughput

Network Throughput is taken as main performance metric for the comparative analysis of the protocols. It is calculated for routing protocol for 30(Blue), 60(Green) and 90 (Red) number of nodes.

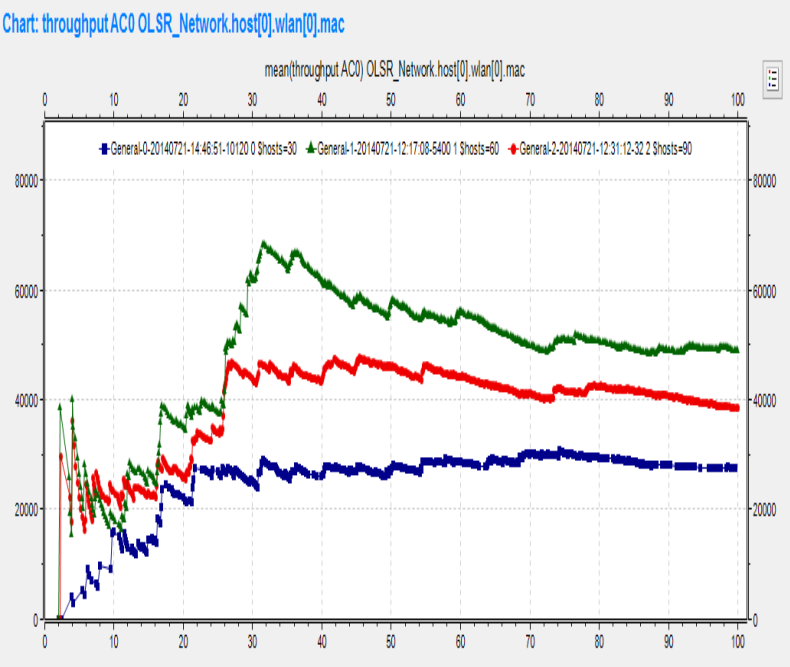

Figure 2. Throughput for 30, 60, 90 nodes (OLSR)

D. Jitter

It Signifies the Packets from the source will reach the destination with dissimilar delays. It is calculated for routing protocol for 30(Blue), 60(Green) and 90 (Red) number of nodes.

Figure 3 Jitter for 30,60,90 nodes (OLSR)

V. CONCLUSION

In this research paper, MANET routing protocol OLSR with different no nodes to evaluate their scalability and then compared them. Simulation is done using OMNET++. In the research work, Average end to end delay and throughput, Jitter is considered as the performance evaluation parameters.

The performance of OLSR was tested using parameters like jitter, end to end delay, and throughput. It is concluded that OLSR performs optimally in different network scenario consist of different no of nodes.

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