ABSTRACT

Wireless Mesh Network consist of two types of node which are mesh router and mesh client. Mesh clients can be either stationary or mobile and only have one interface to form client mesh network. The integration of WMN with other networks such as the internet, cellular, IEEE 802.11, IEEE 802.15, IEEE 802.16, etc can be accomplished through the gateway and bridging function in the mesh routers. Deploying a WMN is not too difficult because all the required components are already available in the form of ad hoc network routing protocol, IEEE 802.11 MAC protocol, wired equivalent privacy (WEP) security, etc. Several kinds of ad hoc routing protocol have been considered for using in WMN and Optimized Link State Routing (OLSR) protocol is one of them. This paper shows the detail simulation to evaluate the performance of OLSR protocol in WMN. It is done by tuning the timing interval of control packet of OLSR protocol.

Key words: OLSR tuning, WMN, Performance.

I. INTRODUCTION

Wireless Mesh Networks (WMNs) is the new technology in wireless network. This is a promising technology for numerous applications so that become new field research recently. In WMN, nodes operate not only as a host but also as a router. Researchers have started to revisit the protocol design of existing wireless networks such as IEEE 802.11, IEEE 802.15 and IEEE 802 [5]. There are two types of nodes in WMN: mesh routers and mesh clients. Mesh router are used to form the backbone of WMN where mesh clients are connected to. A mesh client views the network as an infrastructure while all mesh routers are connected in ad hoc fashion [8].

Deploying a WMN is not too difficult because all the required components are already available in the form of ad hoc network routing protocols, IEEE 802.11 MAC protocol, wired equivalent privacy (WEP) security, etc [5]. Hence ad hoc routing protocol can be used in WMN.

OLSR is one of many proactive link state routing protocol uses two types of control in order to update routing information. Link sensing is done through hello messages while the control of the topology changes by using the topology control (TC) messages. Both messages are broadcasting with fixed time interval [12]. These time intervals determine the performance of OLSR. Some choices enabled for both types of the message. Does small message interval or big message interval yielding good performance.

If small interval is used, the connectivity of network is good but it produces large routing overhead. On the contrary, packets control become small but the adaptation to the network change is bad.

In past years, tuning of OLSR time interval have done in several researches [4][8][10][11][16]. Tuning of both hello interval and TC interval in MANET can be found in [4][6]. In [10][11], they introducing new phase called fast OLSR. This phase only works when mobility of nodes is high. In [8], OLSR with fisheye technique[2] to form OFLSR is compared to AODV routing protocol in WMN[14].

II. Optimized Link State Routing (OLSR)

OLSR is a proactive link state routing protocol that uses two types of control messages: Hello messages and Topology Control (TC) messages. Hello messages are used to link sensing, neighbor detection and compute the multipoint relay (MPR) of a node at the same time. The MPR technique is the key of OLSR to reduce overhead routing. Hello messages sent by a node contain the status of its link with the other nodes in its neighborhood. This status can be: symmetric, asymmetric, or multipoint relay.

During the initialization phase, when a node A receives a hello message from a neighbor, say node B, this station sets in its neighbor table station A with a status asymmetric. At the reception of the hello message from B, A will put in its neighbor table B with the status symmetric. A will then sent a
hello message in which B will appear with the status symmetric and B will update the status of A in its neighbor table and will register it as symmetric.

Hello messages are sent in broadcast at one hop only while TC messages are broadcasted in the whole network. It broadcasted by a not contain the list of it neighbors. Actually this list does not contain all its neighbors but a subset of nodes which make it possible to cover all its two hop nodes. The TC messages are sent in broadcast with the multipoint relay rule which mean only the multipoint relay nodes will retransmit the messages. This technique can reduce retransmit of the overhead significantly as shown in Fig. 4. Through the hello messages, a node will select its MPR node independently. MPR nodes have responsibility to retransmit the TC messages that it received to its MPR selectors. The information from both messages: Hello messages and TC messages are used to compute the shortest path of a node to the other. The information from a hello message is stored in “local link information base” with holding time: “Neigh_Hold_Time”. Its value is three times of refresh interval. The information from TC messages are stored in “topology information base” with validity time: ”Top_Hold_Time” which is three times of TC interval [12]. By default, hello interval is set to be 2 second, TC interval is 5 second and refresh interval is 2 second.

III. SIMULATIONS

A. Simulation Parametric
This simulation using two topology scenario which are 25 nodes to represent a low density network and 50 nodes to simulate a high density network. For low density network, the nodes are placed in an area of 1200m by 1000 m while for high density network the area is 1800m by 1400 m. The type of WMN is client WMN. The amount of connections is 20 sessions for low density network and 40 connections for high density network. These connections using two types of traffic which are TCP and CBR. All simulations run for 200 sec. It’s all done by NS-2.

B. Performance Metrics
In each simulation, throughput, packet drop and packet control are used to measure the performance. It used average throughput which is the amount of data transferred divided by simulated data transfer time. Packet drop is the amount of data packet that drop by the node while packet control is the amount of transferred overhead routing.
IV. PERFORMANCE EVALUATION

A. Scenario 1

CBR Traffic

Fig. 3. Shows that if the load is CBR traffic then small hello interval (1 second) yielding better average throughput than standard hello interval OLSR (2 second). The drop packet resulted is also the least (Fig 4). Thus the number of packet control resulted is big enough (Fig 5). From the result, it can be concluded that if the network is injected by CBR traffic, then the good Hello interval is the small one. It is due to transpost protocol used is UDP so that the capable routing information is highly needed.

TCP Traffic

Fig. 3. CBR Throughput

Fig. 4. Packet Drop

Fig. 5. Packet Control

Fig. 10. TCP Throughput

Fig. 11. Packet Drop
With TCP traffic, hello interval 2 sec and 3 sec tend to have better average throughput than 1 sec and 4 sec. Actually, 1 sec interval hello throughput is not really far from 2 sec and 3 sec ones but the control packet resulted is big enough so that it’s not good enough for wireless network due to bandwidth limitation.

B. Scenario 2

CBR Traffic

Throughput resulted on scenario 2 with bigger connection number shows the same tendency while 1 sec Hello interval still gives the best value. Fig 17 shows that small Hello intervals (1 sec and 2 sec) give almost flatten throughput value for all TC intervals used. The resulted packet drop is also the lowest of all the rest Hello intervals (3 sec and 4 sec).

TCP Traffic

Fig. 12. Packet Control

Fig. 13. Packet Control

Fig. 17. CBR Throughput

Fig. 20. TCP Throughput

Fig. 18. Packet Drop

Fig. 21. Packet Drop
Throughput resulted shows that 2 sec and 3 sec Hello intervals are good result (Fig 20). While for packet drop, 3 sec Hello interval is the lowest value for 5, 7, and 8 sec TC intervals (Fig 21). On 2 sec Hello interval, the 7 sec TC interval give the least packet drop number. So, this kind combination is also a good result compare to OLSR standard interval.

Considering those two kinds of traffic, 2 sec Hello interval and 7 sec TC interval are the best choice. This combination results better throughput than the OLSR interval standard although it’s not too significant. For packet drop, there is a number decrease especially for TCP traffic. The good thing is on packet control number resulted where there is a significant decrease of packet number.

V. CONCLUSIONS

The simulation results show that there is a different best time interval for different traffic. For CBR traffic, the best Hello packet interval is 1 sec, the throughput resulted reach the highest value of the rest Hello intervals. Also, the packet drop resulted is the lowest value. The results are gained on all scenario used. While for TC interval is 7 sec with consideration of the resulting packet control number.

It is different when the weight is TCP where the best Hello interval is 3 sec with the best throughput and the least packet drop number.

With this consideration, 2 sec Hello interval with 7 sec TC interval become the compensation choice for OLSR standard interval on static typical client mesh network.

REFERENCES


