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Micro-Mobile MPLS : Performance Analysis and Improvement with RSSI

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Abstract: In this paper we propose the method to decrease the numbers of losing packet while moving across the network by Received Signal Strength Indicator (RSSI) Technique using define appropriately signal strength between MN (Mobile Node) and FA (Foreign Agent). We use this technique to serve in Micro-Mobility MPLS for improvement sending packet. The simulation has improved the performance of Mobile MPLS by reducing losing packet.

Keywords: Mobile IP, MPLS, Micro-Mobility, NS-2, RSSI, Sensor Network.

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1. Introduction

With a fast growing in assumption of mobile wireless network in Thailand within the last decade, the need for stability and quality are required in Quality of Service (QoS). The greater size of Bandwidth is required for the transmission services of data, voice and multimedia in real time. However, we found that there is a lost packet during data transmission while it is moving across the network. [1,8] Thus, this study will find out the methodology to solve this problem based on improving Protocol MPLS transmission technique. There is evidence that Multi Protocol Label Switching (MPLS) transmission technique is used to served the service of Traffic Engineering (TE) and IP as well as differentiated services by using protocol Mobile Internet Protocol (MIP) and MPLS. [9] Nowadays, the telecom businesses have been broadly using this technique for Mobile wireless network service and the research is also continually developing to improve its efficiency. [4]

MPLS is a protocol for data-carrying mechanism, it consists of two network architectures that are

(1) Micro Mobility is a architecture that any mobility is within a network where the routable address of the user does not change.

(2) Macro Mobility is a architecture that any mobility is within Mesh network.[5, 11]

Langer et al. [3],[4] proposed many researches about the Micro Mobile MPLS. They described the Micro Mobile MPLS operation into 3 Mechanisms as following;

(1) Fast Handoff (FH) Micro Mobile MPLS; this technique is principally operate the transmission mobility by anticipating the moving packet across Layer 3 in advance with considering the LSP (Label Switched Path) from Layer 2 and then creating new LSP before a MN is likely to visit into new network

According to LSP, it consists of 2 types; Active LSP and Passive LSP. Active LSP is sending keep alive-messages from Label Edge Router Gateway (LERG) to Label Edge Router/Foreign Agent (LER/FA) whilst Passive LSP is sending keep alive messages from LERG to the next subnet that a MN is likely to visit into.

Whist, Passive LSP is forwarding created when a MN is likely to move across between two cells that means Passive LSP is advanced been created but it is still now used in transmission until a MN is visiting into new sub network and registering with LERG. Then, it will be activated afterward.

(2) Forwarding Chain (FC) Micro Mobile MPLS is a technique that principally operated using Forwarding Chain methodology. According to this method, when a MN is moving into new sub network and registering with Master LER/FA instead of registering with LERG. Master LER/FA is LER/FA that a MN is firstly communicating when it is moving into MPLS Domain. When a MN is moving to the new sub network, it will register with Mater LER/FA every times. From this technique, it will enlarge the length of LSP between LERG and LER/FA continuously until Forwarding Chain's length is nearly allowed Threshold. Then a MN will start registering with LERG again and new LER/FA will transform into new Master LER/FA ,and creating new Forwarding Chain.

(3) Master Forwarding chain (MFC) Micro Mobile MPLS is a similar way of technique that is working quite closely to FC-Micro Mobile MPLS. However, there is a difference that MFC-Micro Mobile MPLS will specify Residing Area around Master LER/FA and new created Chain

will be calculated again and again for shorten the length of transmission between existing LER/FA and new LER/FA.

F.M. Chiussi, et al [10] studied the on how to adjust a packet of information (LSP) from network router by identifying the characteristics of several methods in determining the names of and the cost or distance to any neighboring routers of its. He proposed the appropriated the amount of LSP for QoS. By the way, there is very complicated for an algorithm of choosing a MN and result in the stability of transmission.

Sheau-Ru Tong [11] researched the methodology to control buffer for reducing the controlled packet that used to assign to FA with the pushed buffer control scheme in each a MN to examine the appropriated value of RSSI for the ratio of every sending of a MN packet. He found that Mobile Host (MH) continuously monitors the perceived RSSI value and issues various rate control messages if the corresponding RSSI threshold crossing events occur.

Poornachandra Bharat U [12] studied the relationship between RSSI and   the estimated amount of packaging's error; he explained that it is no any effect in sending if the amount of RSSI's indicator in the channel is below a certain threshold.

In this research, we simulated the operating of Micro-Mobile MPLS by running on Network Simulator 2 (NS-2). [14] The simulation was being the moving of cell between network by applying of RSSI methodology to reduce the loss of packet and monitor the efficiency of the amount of packet transmission. Additionally, multi channel support was used in this testing by using IEEE 802.11, directional antennas, multiple interfaces, L2-hand over, L2-trigger, Pre-established LSP, and Buffering.

After our previous literature reviewed, we will propose more result of studies as following;

Firstly, we explain the principle of micro-mobile MPLS and RSSI. Then, secondly, we propose the design method and testing of them. Thirdly, we describe the result of program testing and in the final; we give the summary and discussion.

2. Research proposal and methodology

The architecture of Mobile MPLS is the combination of using Mobile IP and MPLS. By this method, we confirm that Mobile MPLS stimulate the transmission of packet and improve efficiency in service.

This schema is presented as Hierarchical Architecture below; it consists of Label Edge Router Gateway (LG), Label Edge Router/Foreign Agent (LFA). Label Edge Router/ Home Agent (LHA), and Access Point (AP).

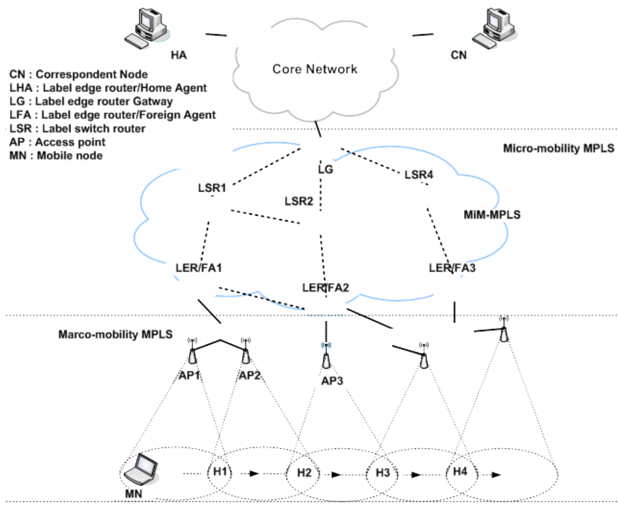

Figure 1. Hierarchical architecture of a micro-mobile MPLS.

From figure 1, the Micro-Mobility MPLS assign FA and HA to be Label Switching Router (LSR) in MPLS network and when a MN found that it is in Foreign Network, it will register with FA at Located FA. Then, FA will send this registering to Home Agent (HA) by allocating IP Routing as ordinary and wait Label Distribution Protocol (LDP) Request from HA. After that HA will adjust information of a MN-Binding and deliver the LDP Request to FA. As the result, the routing of LSP will be built up between HA and FA. Then, the needed information for sending to a MN by Co-response Node (CN) will be stored and sent to FA by rerouting with Label Switching along the route assigned by LSP. When FA receives this information, it will send to a MN by using IP Routing. A MN that moves within intra domain register will register with each FA while moving between cells at the connection. The route between LSP, LFA and Label Gateway (LG) will be pre-established when a CN send information to an MN. This information will send to established LSP.

When a MN moves to the area of existing AP, it will receive the signal of Beacon from a new AP that is closing to with the mechanism of link layer that is able to find the moving and new position of a MN. After that a MN will start pre-registering with new and current LFA. Then it will buffer the sent information when a MN moved to the area which old cells and new cells are overlapped. This mechanism triggers the transmission at the Layer 2 and sends a moving Message to an existing LFA that send a moving Reply Message back to a MN. After that it will move across cells in Link Layer 2. Then, a MN will send a registration message to new LFA as well as LG. At the same period, current LFA stop buffering sent information and send stored information that buffered to a MN at the new sub network via LSP that is pre-established. In this case a MN will receive information from existing LFA via new LFA before it moves across cells in Layer 3 completely that is before a MN get a registration reply from LG.

2.1 Handoff mechanism and Buffer Management

While a MN moves across from AP1 to AP2 or other AP, there may be loss of signal because of following causes;

1. MN is in area H1; the loss of connection may be in this period however a MN will try to reconnect to the nearest AP.

2. MN is in area H1; in this case, a MN will reconnect with old AP or new AP.

For avoiding this kind of situation that it is always in real time tasks such as transmission of photos and sound. We will apply the methodology that when a MN moves to new FA, it will let old FA to stop buffering and pre-information that previously buffered. By this method, it will allow FA to choose whether it should re-buffer or not. Additionally, FA will use parameter for example the Received Signal Strength Indicator (RSSI) of MN, the size of buffering or MN’s prioritization etc. for simulation of the strength of signal from a MN. It will use in case of buffering FA when it reaches the assigned value, a MN will send the Received Signal Strength Indicator(RSSI)’s values as presented in figure 1. This value will be used in FA’s decision to start buffering when a MN gets the clear signal from sent channel. It will require FA1 to increase the ratio of sending to sending a packet from FA1 that previously buffered.

2.2 Received Signal Strength Indicator (RSSI)

Received Signal Strength Indicator (RSSI) is used in measuring the quality of signal of mobile equipments according to Srinivasan et al. [6] They also proposed that the pattern of RSSI is an estimation of quality of signal indicator by giving a reason that if the average value of RSSI is good, it will indicate that the transmission is likely good. Additionally, from this study of RSSI, if RSSI’s value is lower than threshold, it will be likely in low ratio of packet transmission and not certain. Bhaskaran et al [7] analyzed the relationship between RSSI at different value and error of packet transmission. The study found that the rate of packet’s transmission error could not be predicted in case that the high uncertain of RSSI value is greater than pre-assigned value. However, if RSSI is lower than threshold, it will be more stability and low error in transmission.

2.3 The handoff mechanism

In this section, we will study the handoff mechanism of MN's register while moving from old to new AP. When a MN is searching a new AP, it will search for several APs that hold the high Received Signal Strength Indicator (RSSI)'s signal. However, those APs may not be good routes for a moving MN, a MN may not connect for registering. As the result, the handoff may be mistaken. Thus, we may not only use the high Received Signal Strength Indicator (RSSI)'s signal for single choosing in connection to new AP. We need to indentify the appropriated of signal for a MN connection. It means that we have to define a threshold that the packet transmission is likely to be in good status and in low error.

3. Experimental design

The simulation of mobile network is presented in figure 2; there will be 3 agents' bases;

(1) Home Agent, HA; the previous base that the transmission is begins or firstly connected.

(2) Foreign Agent, FA1; the current base that the transmission is in service.

(3) Foreign Agent, FA2; new base that is the transmission is visiting into.

The explanations of transmission, the route will start moving from exiting FA1 to FA2 while HA is responsible for transmit information to a MN and a MN will be responsible for transmit information from HA and carrying transmission from FA1 to FA2.[2] The link connection will be a Full-Duplex queuing format that is a drop Tail and define the size of queue as 2,000 packets.

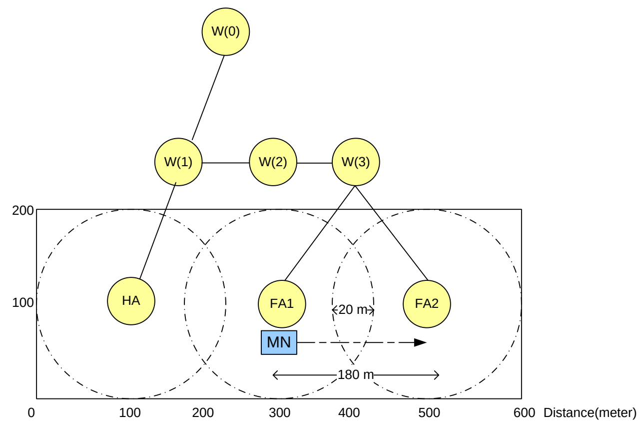

Figure 2. The simulation of mobile network**.**

The speed of link in data transmission between W(, W(and HA is approximately Mbps and relay time of link is seconds. The speed of link between W (and W (is Mbps, and relay time of link is second. The speed of link between W (and W (is Mbps, and relay time of link is second. The speed of link between W (and FA is Mbps, and relay time of link is second. The speed of link between W (and FA is Mbps, and relay time of link is second. Additionally, it starts sending transmission at time= ; stop time = with the size of packet = bytes.

A MN will move from the service area of FA to FA with the speed of transmission = mps. The overlapped area of FA will be mostly meter. Moreover, the Received Signal Strength Indicator (RSSI) will be at the different range from - to - dBm for measure of the error of transmission.

4. Result

From the simulation of data transmission, we defined the RSSI value in sending from a MN to FA for required registering by the value from -87 to -110 dBm (Figures 3-5). And then, we monitor the values of each packet transmission, use those numbers to plot graph for comparison of the loss of packet in each signal. Then, we brought the signal that got the lowest loss to calculate the throughput value by define the scanning value of the Received Signal Strength Indicator (RSSI) at -89 , -93 , -94 dBm respectively . We did this for finding out the throughput of each signal. The result of experimental shown that the appropriated of Received Signal Strength Indicator (RSSI) is at -93 dBm because at this value, it is likely to have the lowest error of packet transmission and to gain high efficiency in packet transmission (Figure 6).

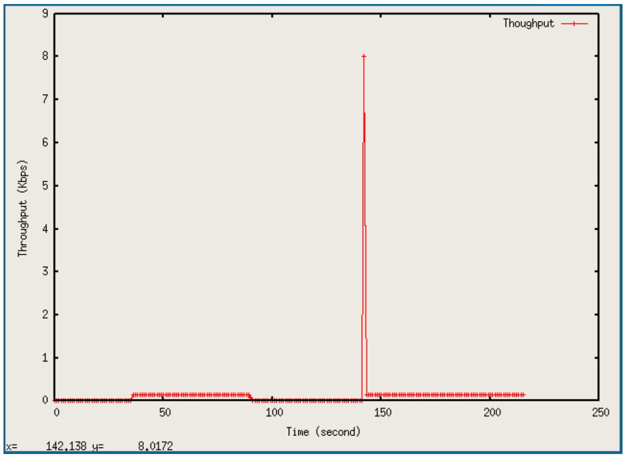

Figure 3. The efficiency of Received Signal Strength Indicator (RSSI) = -93 dBm.

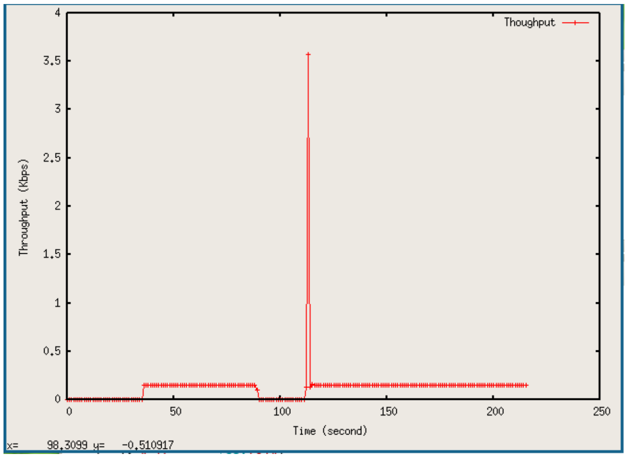

Figure 4. The efficiency of Received Signal Strength Indicator (RSSI) = -89 dBm.

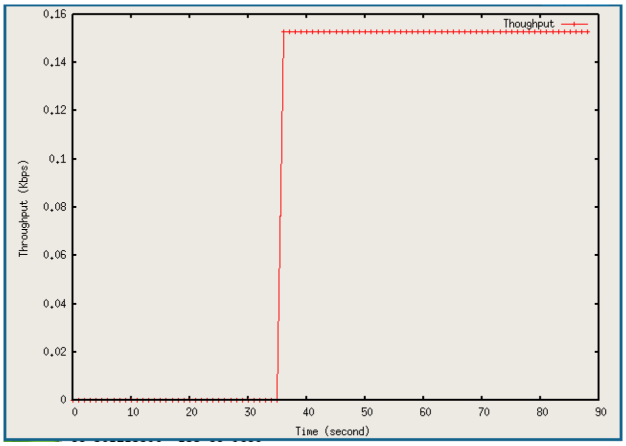

Figure 5. The efficiency of Received Signal Strength Indicator (RSSI) = -94 dBm.

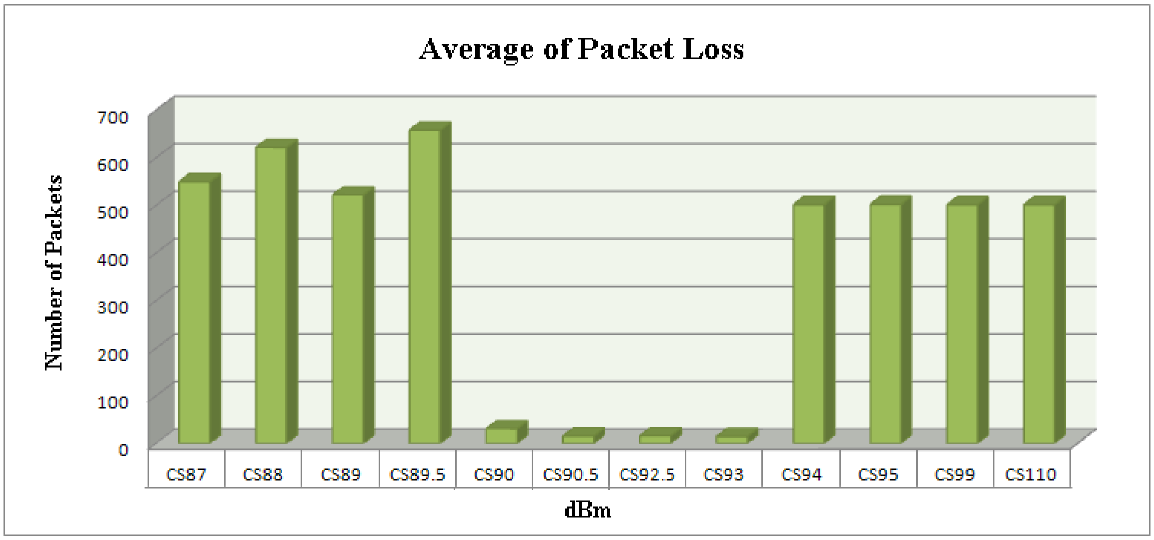

Figure 6. The loss of packet transmission at different range of the RSSI.

4. Conclusions

From our study, we propose the methodology to reduce the error in packet transmission while it handoffs between cells within a network using Micro-Mobility MPLS. The simulation's result shown that if we define the appropriated Received Signal Strength Indicator (RSSI) value, it will support a MN in choosing an appropriated AP while hand offing. Moreover, it will reduce the error of packet transmission. For the next research, we will study on the reduction of error by this technique for different network service.

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