CHAPTER VI

CONCLUSION AND RECOMMENDATION

6.1 Conclusion

This research aims to improve the performance of Paging Mobile IP. Paging Mobile IP reduces the signaling cost and power consumption in Mobile IP significantly by utilizing the idle state of the MN. However, Paging Mobile IP still uses the same handoff and registration method as Mobile IP. The handoff latency and number of lost packets are still high because of slow movement detection using Agent Advertisement message and long registration signaling delay to far away HA. In this research, we propose to combine Paging Mobile IP with regional registration and multicasting to solve the problems that occur in Paging Mobile IP.

There are two proposed methods in this research. The first proposed method still uses Agent Advertisement message for movement detection while second proposed method utilizes Link Layer beacon for the same purpose. Both proposed methods use the hierarchical topology of Mobile IP Regional Registration. Proposed methods use multicasting to send packets to MN within the GFA domain. In Proposed Method 1, the multicast group is constructed every time the MN conducts Network Layer registration. The GFA will send packets to MN's multicast group during active time. These multicast packets are forwarded at the present FA and buffered at neighbor FAs. Once the MN moves to new FA and registers to it, that new FA forwards recent buffered packets to MN after that FA receives Regional Registration Request from the MN. Proposed Method 2 is further proposed to improve the performance of Proposed Method 1 in IEEE 802.11 system. Link Layer information is used for movement detection and as the trigger for multicast group construction during active time. The GFA sends multicast packets to the old FA and new FA after the new FA join the multicast group. The packets are only multicast to the previous and present FA until the MN conducts Network Layer registration to GFA via the new FA.

We then simulate our proposed methods by using Borland Delphi 7 programming language and compare the simulation results with that of Mobile IP, Paging Mobile IP, Paging Mobile IP Post Registration, and Paging Mobile IP Regional Registration in terms of handoff latency, number of lost packets, signaling

cost, and data hop. Firstly, we discuss the simulation results for each protocol. Here, we find that the first packet in the proposed methods arrives faster than that of original Paging Mobile IP. Paging process in proposed methods can reduce the time that happen for paging process in Paging Mobile IP by the way that the MN only conducts regional registration to GFA and not to far away HA. In this section, we also show the handoff process and its analysis for each protocol.

We then compare the performance of all protocols as the function of various parameters. We find that our proposed methods perform much better than original Paging Mobile IP in all scenarios. Proposed method 1 can reduce the handoff latency, number of lost packets, and signaling cost significantly by using regional registration and multicasting. Proposed Method 2, furthermore, improves the performance of Paging Mobile IP by using multicasting and Link Layer beacon sent every 100 ms by each FA for movement detection. We also observe that the handoff latency and lost packets depend on the movement detection used in each method. When we increase the number of cells in a paging area, the effect of the growth is significant to signaling cost. The more the number of cell in a paging area, the higher the signaling cost in every method. Proposed methods, however, are better than Mobile IP, Paging Mobile IP, and Paging Mobile IP Post Registration in terms of signaling cost since the MN in the proposed methods only registers to GFA and not to far away HA. Proposed Method 1 is the best in terms of handoff latency and lost packets among all protocols that use Agent Advertisement for movement detection. In addition, Proposed Method 2 has better overall performance than Paging Mobile IP Post Registration because Proposed Method 2 can construct multicast group faster than BET in Paging Mobile IP Post Registration. In this scenario, we also observe that Proposed Method 1 has the largest data hop among all protocols and Proposed Method 2 is better than Paging Mobile IP Post Registration since the packets in Proposed Method 2 use shorter route.

Signaling cost and number of lost packets tend to be higher as the MN's speed increases. It is because the MN crosses more cell boundaries when it moves at high speed. The handoff latency and lost packets of all protocols that use Network Layer movement detection follow the same trend as in the previous scenario. The handoff latency and lost packets of Paging Mobile IP Post Registration are better than that of Proposed Method 2 when the MN moves with low speed. On the other hand, Proposed Method 2 performs better when the MN moves with medium and high speed. It may happen because the MN with medium and high speed is likely to have leaved the overlapping area before the BET is constructed in Paging Mobile IP Post Registration.

When we vary the distance between GFA/router and HA, we can use the same explanations in the previous paragraphs for the handoff latency and lost packets in Paging Mobile IP Regional Registration, Proposed Method 1, Paging Mobile IP Post

Registration, and Proposed Method 2. Handoff latency and lost packets in Paging Mobile IP Regional Registration and Proposed Method 1 are stable because the MN only registers to GFA while the handoff latency and lost packets in Paging Mobile IP Post Registration and Proposed Method 2 are fluctuated since they depend on Link Layer beacon. The handoff latency, lost packets, and signaling cost in Mobile IP and Paging Mobile IP are influenced by the distance between router and HA since the MN has to registers to far away HA. The signaling cost of Paging Mobile IP Post Registration is also influenced since the MN still registers to the HA after the MN receives Agent Advertisement from new FA. Signaling cost in Proposed Method 1, Proposed Method 2, and Paging Mobile Regional Registration is constant since the MN only registers to GFA. In this scenario, we further show that the data hops of each protocol increases significantly as the distance between GFA/router and HA rises.

We finally compare the handoff latency and number of lost packets for Paging Mobile IP Post Registration and Proposed Method 2 in non-overlapping cell scenario. We discover that Proposed Method 2 is better than Paging Mobile IP Post Registration when we vary the speed of the MN in this scenario. It is because the MN in Proposed Method 2 can receive Link Layer beacon to construct the multicast group faster than that of in Paging Mobile IP Post Registration to build the BET between previous and present FA. The construction of multicast group in Proposed Method 2 is also faster than that of BET in Paging Mobile IP Post Registration.

6.2 Recommendation for Future Work

In this research, we concentrate to reduce the handoff latency and number of lost packets when a moving MN is receiving packets from HA. In the future, it is interesting to investigate the handoff performance when the MN sends data packets to another node in the internet. We also only consider one MN to check the performance of all methods. Therefore, we recommend future research to develop a program that can support until hundreds of MN so that the performance evaluation that closes to real system can be investigated. Furthermore, we assume that the MN moves in straight direction with constant speed in our research. It is not suitable with the real system where the MN moves in random direction and does not moves all the time. Future research should consider about random movement model to investigate the performance of the proposed methods. Finally, the duplication of multicast packets received at MN in Proposed Method 2 in overlapping cell scenario is also an interesting topic for future work. It is because the overlapping cell scenario is used almost in all real wireless networks topology. The addition of packet's ID within Association Request message seems can handle this problem. However, this idea needs further study and investigation.