Advanced Macro Mobility Handover Supporting Fast Handover in HMIPv6

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Abstract. In proportion to the increase of a number of various wireless devices and development of wireless access technologies, mobile users desire to access the Internet regardless of their location at anytime. In Hierarchical Mobile IPv6 (HMIPv6) when a mobile node (MN) moves from a MAP domain to another, it can experience disruption of connection as well as packet loss due to a long handover latency. To cope with these problems, we propose an advanced macro mobility scheme to reduce handover latency and packet loss. We adopt the fast handover scheme from FMIPv6 to optimize the performance of the proposed scheme. In this paper, we analyze the handover latency for various protocols and compare to our scheme with analytical model. The results show that the proposed scheme is better approach to handle the mobile node’s movement than the other protocols.

Keywords: Mobile IPv6, FMIPv6, fast handover, HMIPv6, Handover latency.

1 Introduction

With the increase of a number of various wireless devices and development of wireless access technologies, more and more people request to access the Internet regardless of their location at anytime. For this aim, the Internet Engineering Task Force (IETF) has proposed Mobile IPv6 (MIPv6) [1] protocol that supports the network mobility to the MNs on IPv6 network. In MIPv6, the MNs can experience not only interruption of connection but also packet loss due to a long handover latency. To overcome these problems, IETF has proposed various extensions of MIPv6. Two prominent extensions are fast MIPv6 (FMIPv6) [2] and hierarchical MIPv6 (HMIPv6) [3].

FMIPv6 supports fast handovers for the MN changing its point of attachment from one access router (AR) to another in IPv6 network. In order to reduce the handover latency in FMIPv6, a MN generates a new address for its new AR link prior to perform the layer 2 handover. Moreover, FMIPv6 establishes a tunnel between the MN’s current AR and new AR so as to deliver packets to the MN

* This work was supported by grant No. (R01-2004-000-10618-0) from the Basic Research Program of the Korea Science & Engineering Foundation.
without any loss. HMIPv6 is a location management protocol that can reduce registration overhead and handover latency by using a local agent (i.e., mobility anchor point (MAP)). In HMIPv6, the mobile node has two addresses; one is generated based on the prefix of MAP domain (i.e., regional care-of address (RCoA)) and another is created with the prefix of AR (i.e., on-link care-of address (LCoA)). The mobile node registers the RCoA and LCoA to the MAP. After registration of the RCoA to its Home Agent (HA), the MN can move between ARs without any address registration to the HA until it moves out of the MAP domain.

In [3] and [4], the authors have proposed fast handover methods using FMIPv6 to perform handover between the MN’s previous AR and a new AR in the same MAP domain. These methods are helpful for the MN moving within the same MAP domain. However, when the MN moves from one AR within MAP domain A to another AR belonging to MAP domain B, the handover using the schemes presented in [3] and [4] causes a long handover latency, because the movement needs to change the RCoA as well as the LCoA. Furthermore, there is no way to establish a tunnel between previous AR and a new AR to minimize the packet loss in [3], [4]. This kind of movement, which is called by macro mobility handover, also needs to support fast handover in order to perform the handover efficiently and reduce the packet loss. Therefore, we propose an advanced macro mobility handover scheme supporting fast handover so as to reduce the handover latency and packet loss during the macro mobility handover.

The rest of the paper is organized as follows: In section 2, HMIPv6 protocol is described briefly. The proposed scheme is described in section 3. The performance evaluation of the original scheme and proposed scheme in terms of handover latency and the results are given in section 4. Finally, the concluding remarks are given in the last section.

2 Related Works

2.1 Micro Mobility Handover of HMIPv6

In HMIPv6, the movement of a MN is classified into two types. One of them is micro mobility handover which is incurred when a MN changes its point of attachment from one AR to another within the same MAP domain. The MN can recognize its movement by router solicitation (RS) messages or router advertisement (RA) messages defined in [5]. Then, the MN generates a new LCoA based on the prefix of new AR. In order to inform the MAP of its new LCoA, the MN sends a local binding update (LBU) message. The MAP binds the MN’s new LCoA with the MN’s existing RCoA and sends a local binding acknowledgement (LBA) message in response to the LBU message. After that, the MAP intercepts the packets addressed to the RCoA and forwards them to the new LCoA.

After the new LCoA registration to the MAP, the MN recovers the Internet connectivity. Therefore, the total handover latency is made up of the time for performing the layer 2 handover, the time for exchanging RS/RA messages and