PMIPv6 with Bicasting for Soft Handover
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Abstract

This document proposes an enhanced handover scheme on the Proxy Mobile IPv6 (PMIPv6) with bicasting for IP handover (B-PMIPv6). In B-PMIPv6, a mobile node (MN) performs binding update to Local Mobility Anchor (LMA) in advance, and then the LMA begins the bicasting of data packets to the new Mobile Access Gateway (N-MAG) as well as the previous MAG (P-MAG). The B-PMIPv6 minimizes the possible packet losses and handover latency during handover.

Table of Contents

1. Introduction ................................................ 3
2. Conventions used in this document .............................. 3
3. Protocol Detail ............................................. 3
4. Handover process ........................................... 7
5. Security Considerations ...................................... 7
6. IANA Considerations ........................................ 7
7. Conclusions ............................................... 7
8. References ................................................ 7
   8.1. Normative References .................................... 7
   8.2. Informative References ................................ 7
9. Acknowledgments ............................................ 8
1. Introduction

The Mobile IPv6 (MIPv6) can be used to support the IP handover in Mobile networks [1]. However, there are still a lot of challenging issues to be addressed in the MIPv6. One of them is how to reduce the modification of mobile node (MN). For example, to perform the mobility management signaling, each MN should be equipped with the MIPv6 functionality. Such a protocol is referred to 'host-based mobility management' protocol.

In the wireless network environment, however, it is not effective that each MN performs the MIPv6 because of the short of resource in wireless network such as link bandwidth or MN power. Above all, it is not easy for MN to implement any mobility software such as MIPv6.

Recently, the Proxy Mobile IPv6 (PMIPv6) protocol provides the network-based IP mobility management protocol. In PMIPv6, the mobile agent located in the network will perform the mobility signaling instead of MN and will keep track of the movement of MN.

It is noted that PMIPv6 is used mainly for binding update of the location of MNs. A recent work has been made on the PMIPv6 handover. However, there are still lots of issues that need to be solved in the perspective of seamless handover.

This document describes a new handover scheme of PMIPv6 with bicasting for seamless IP handover, in which the PMIPv6 Local Mobility Agent (LMA) will bicast the data packets to the Previous-Mobile Access Gateway (P-MAG) and New-Mobile Access Gateway (N-MAG) toward MN, when MN is in the handover region.

2. Conventions used in this document

In examples, "C:" and "S:" indicate lines sent by the client and server respectively.

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC-2119 [1].

3. Protocol Detail

This document extends the PMIPv6 handover scheme, which can be used to reduce the packet loss and handover latency during handover using bicasting in the PMIPv6 network.
The reference network configuration for B-PMIPv6 domain is shown in Figure 1. MN moves from P-MAG region to N-MAG region. This document supposes that there is overlapping region between MAGs. When MN is in the overlapping region, and then the LMA begins the bicasting of data packets to the N-MAG as well as P-MAG. This bicasting is performed to minimize the possibility of packet losses and handover latency during handover, because it is possible that the MN receives the data packet from whether P-MAG or N-MAG.
Figure 2 B-PMIPv6 handover procedure
The operation of the B-PMIPv6 is shown as figure 2. First, when MN moves to the bicasting region, it detects that a handover is imminent and reports the identifications of itself (MN-ID) and the access point (New AP ID) to which the MN is most likely to move. The MN ID could be the NAI or a Link Layer Address (LLA), or any other suitable identifier. This step is access technology specific. In some cases, the Previous-Access Network (P-AN) will determine which AP ID the MN is moving to. The P-AN, to which the MN is currently attached indicates the handover of the MN to the P-MAG. Detailed definition and specification of this message are outside the scope of this document.

After P-MAG receives an HO Initiate, the P-MAG sends Handover Initiate (HI) message to N-MAG where the HI message includes MN’s IP address that are both Proxy-CoA (P-CoA) and Home address (MN-NoA), LMA address (LMAA) and MN’s Identifier. The N-MAG receives HI message, it should examine whether a tunnel to the LMA exists or not. If the tunnel has not been established, it should establish the tunnel from LMA.

To establish the tunnel, the N-MAG sends a PBU (Bicasting Init) message to the LMA. It includes MN-Identifier and MN-NoA.

When the LMA receives the PBU (Bicasting Init) message, it creates a new binding entry. If the LMA successfully processes the PBU (Bicasting Init), it sets the tunnel with N-MAG for sending and receiving data packets. After successful establishment of the tunnel, the LMA sends a PBA (Bicasting Ack) message, it examines whether or not the PBU (Bicasting Init) message was processed successfully. If there is a failure, the PBA (Bicasting Ack) message indicates the failure. On the other hand, N-MAG creates a tunnel to the LMA and ensures that the packets with destination address as P-CoA are copied and forwarded over the tunnel. It also creates a host route for forwarding packets to the MN. The N-MAG sends a Handover Ack message back to the P-MAG to indicate whether handover procedure was successfully done or not.

When the MN connects to the new link, the MN establishes a physical link connection with the New Access Network (N-AN), for example, radio channel assignment, which is turn triggers the establishment of a link-layer connection between the N-AN and N-MAG if not yet established. An IP layer connection setup may be performed at this time (e.g., PPP IPv6CP) or at a later time (e.g., stateful or stateless auto address configuration). This step can be a substitute for the UNA in [4], but since they are all access technology specific, details are outside the scope of this document. And then the N-MAG sends a PBU (Bicasting Completion) message to the LMA. This message...
includes MN-Identifier and P-CoA of N-MAG. On reception of this BC message, the LMA deletes the binding cache entry associated with the P-MAG, and stop the bicasting (i.e., release the tunnel between LMA and P-MAG). In response to PBU (Bicasting Completion) message, the LMA sends PBA (Bicasting Completion Ack) message to the N-MAG. By thus, the bicasting operations are completed.

4. Handover process

MAG is responsible for detecting the mobile node’s movements to and from the access link and for initiating binding registrations to the mobile node’s LMA.

5. Security Considerations

TBD

6. IANA Considerations

TBD

7. Conclusions

This document described an enhanced handover scheme on the PMIPv6 with bicasting, in which binding update is performed in advance and then perform the bicasting of data packets to the N-MAG as well as P-MAG. From the performance analytical results, we can see that the proposed scheme reduces the packet losses and handover latency when it is compared with the two existing PMIPv6 handover schemes by performing bicasting data packets from LMA to MN during handover.

8. References

8.1. Normative References


9. Acknowledgments

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