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PMIPv6 Multicasting Support using Native Infrastructure
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Abstract

To support IP multicasting in PMIPv6 domain, [I-D.ietf-multimob-pmipv6-base-solution] has been determined as a base solution. This solution requires all the LMA to forward multicast packets to MAG via PMIPv6 tunnel. This approach creates a tunnel convergence problem. To resolve the issue, the current MULTIMOB WG charter is trying to draw a solution about how to separate multicasting routing from a mobility anchor. As an effective solution, we propose the direct routing approach that makes the direct connection between MAG and multicast router. The advantages of the proposed direct routing solution are compared with the base solution and dedicated LMA approach. This draft is derived and revised from [I-D.sijeon-multimob-mms-pmipv6] as re-chartered MULTIMOB WG description.

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1. Introduction

PMIPv6 is a network-based IP mobility protocol that requires no host stack involvements; it provides enhanced mobility performance compared to host-based approaches like MIPv6, FMIPv6. However, current PMIPv6 specification does not explicitly address the method of multicasting communications [RFC5213].

To support multicasting in PMIPv6 domain, the base solution proposes deployment option [I-D.ietf-multimob-pmipv6-base-solution], which places multicast routing on LMA. MAG receives a multicast stream from LMA by using PMIPv6 tunnel. It is simply derived from PMIPv6 specification and requires no modification to PMIPv6 components and MNs. However, the base solution introduces a tunnel convergence issue in case a MAG receives the same multicast packets from more than one LMA. This causes severe network bandwidth. To avoid a tunnel convergence problem, the current MULTIMOB WG charter is trying to find a solution on how to separate multicasting routing from the mobility anchor. As potential techniques, two kinds of approaches have been presented: a dedicated mobility anchor and direct routing.

The concept of dedicated LMA is to assign dedicated multicasting LMA to each MAG. This approach resolves tunnel convergence issues; however, PMIPv6 tunnel is also used. It imposes a heavy burden on a multicasting LMA to process and forward tunnel packets to several MAGs. Additionally, it incurs severe packet tunneling overhead.

In this draft, we propose a direct routing solution that a MAG receives multicast packets directly from MR with no tunnel. This solution can completely solve tunnel-related performance issues introduced from the base solution and dedicated LMA solution.

2. Terminology and Functional Components

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 [RFC2119]

- o Mobile Node (MN)
- o Previous Mobile Access Gateway (P-MAG) - The MAG that manages mobility related signaling for a MN before handover.
- o New Mobile Access Gateway (N-MAG) - The MAG that manages mobility related signaling for the MN after handover
- o Multicast Router (MR)
- o MLD Proxy (M-Proxy)

3. Direct Routing Solution

3.1. Architecture

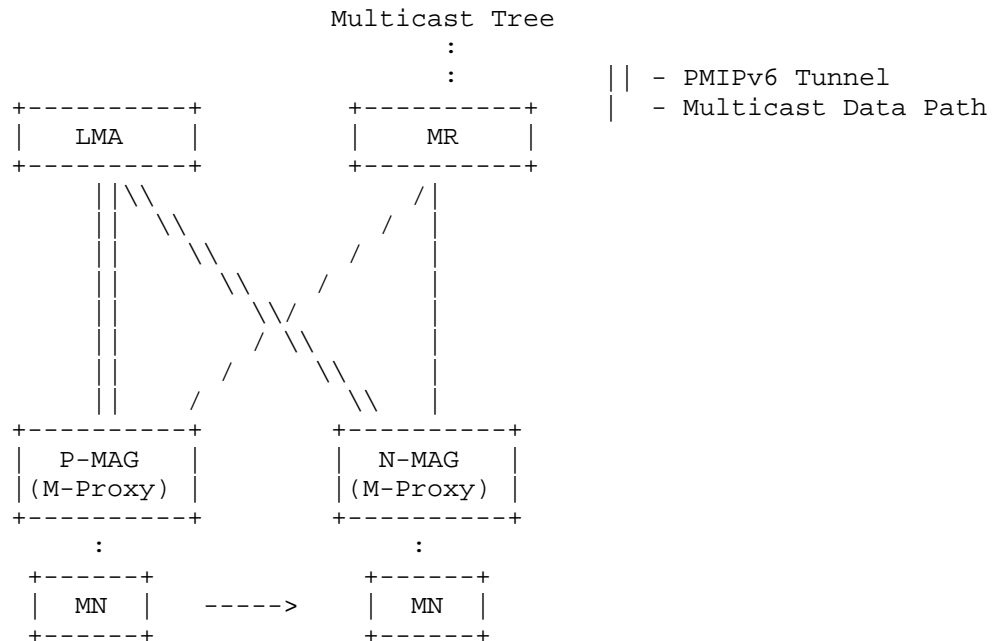


Figure 1. Direct routing solution for PMIPv6 Multicasting

Figure 1 shows the proposed direct routing architecture using native multicasting infrastructure [I-D.deng-multimob-pmip6-requirement]. To forward IGMP/MLD signaling and multicast packets, a MLD proxy function defined in [RFC4605], SHOULD be placed on a MAG. This solution is much simpler than the base solution and easy to deploy because multicasting functions are totally separated from mobility anchor by using a native multicasting infrastructure.

3.2. Handover Procedure

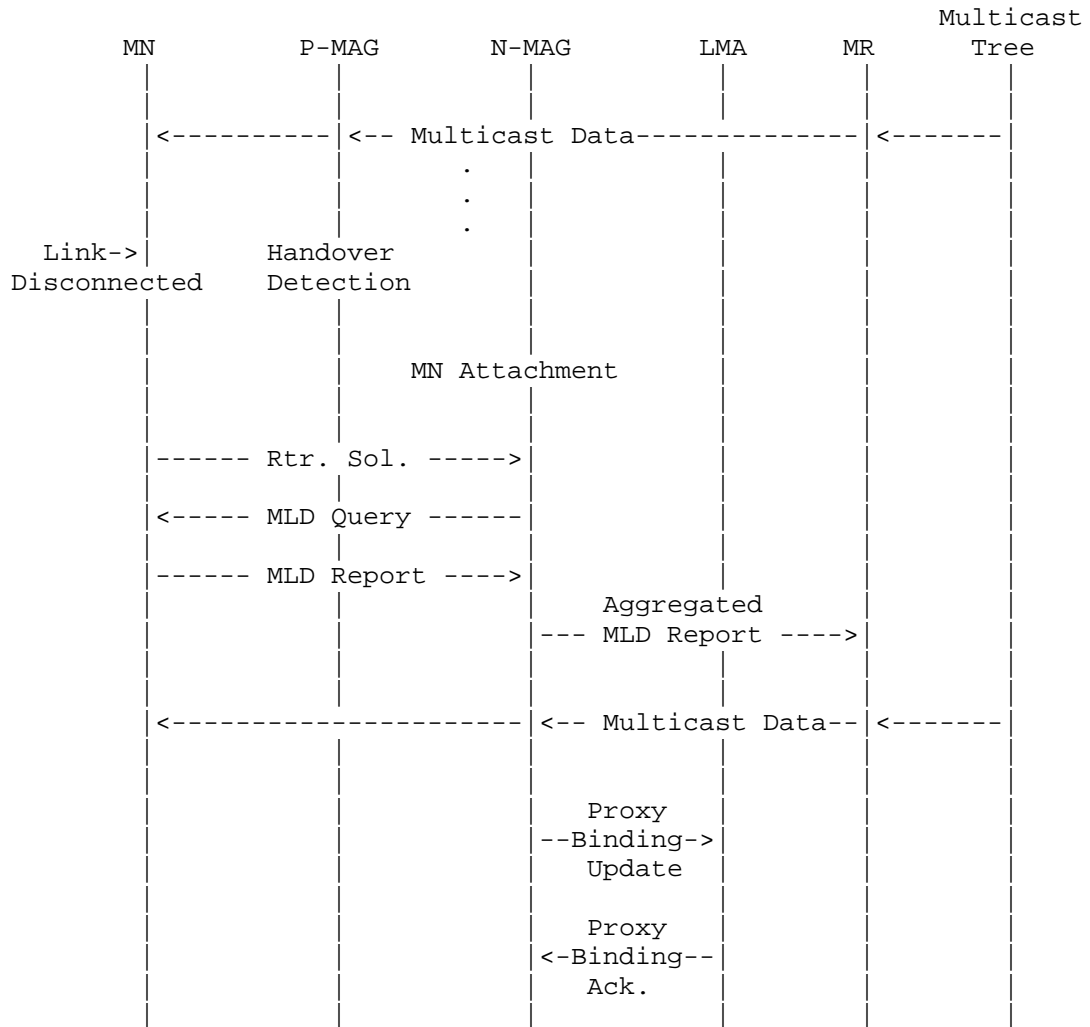


Figure 2. Handover procedure in direct routing architecture

Figure 2 shows the handover operation in direct routing architecture. When an MN hands off to the N-MAG from the P-MAG, the N-MAG detects

the newly arrived MN and transmits an MLD query message to the MN. After receiving the MLD query message, the MN sends an MLD report message that includes the multicast group information. The N-MAG then sends an aggregated MLD report message to the MR. When the N-MAG receives the multicast packets from the MR, it then simply forwards them without tunnel encapsulation. The N-MAG updates the MN's location information to the LMA by exchanging PBU/PBA signaling messages.

4. Comparison with Base Solution, Dedicated LMA, and Direct Routing

In this section, we compare the direct routing with the base solution [I-D.ietf-multimob-pmipv6-base-solution] and dedicated LMA [I-D.zuniga-multimob-smsspmpip] in terms of performance, ease of deployment, and other factors.

4.1. Tunnel Convergence

In the base solution, the MR function is combined with LMA. Thus, all the packets are delivered to MNs through PMIPv6 tunnel between MAG and LMA, which raises the tunnel convergence problem. because a MAG may receive the same multicast packets from several LMAs. Dedicated LMA and the proposed direct routing have different approaches; however, they can avoid the tunnel convergence issue.

4.2. Complexity in LMA

In the tunnel-based approaches, a LMA needs to deal with MLD signaling, join/leave procedure, and tunnel packet processing (i.e., encapsulating/decapsulating and tunnel packet lookup) as well as the role of mobility anchor. When using a dedicated entity, these complexities can be reduced but cannot be avoided completely. On the other hand, the direct routing is absolutely not affected by these complexities.

4.3. Packet Overhead

With native multicasting infrastructure, direct routing does not make any packet overhead while tunnel-based approaches bring about tunneling overhead per packet. Tunneling overhead could become severe as the packet arrival rate increases.

4.4. Another Advantage

When we consider that MNs move to non-PMIPv6 domains from PMIPv6 domains as described in [I-D.von-hugo-multimob-future-work], the direct routing approach can provide a compatible method because it does not depend on PMIPv6 tunnel for multicasting operation.

5. Message Formats

This section describes source and destination address of MLD signaling messages. The interface A-B means that an interface on node A, which is connected to node B.

5.1. MLD Query

```

+-----+-----+-----+-----+
| Interface | Source Address | Destination Address |
+-----+-----+-----+-----+
| MR-MAG    | MR link local  | [RFC2710], [RFC3810] |
+-----+-----+-----+-----+
| MAG-MN    | MAG link local  | [RFC2710], [RFC3810] |
+-----+-----+-----+-----+

```

5.2. MLD Report

```

+-----+-----+-----+-----+
| Interface | Source Address | Destination Address |
+-----+-----+-----+-----+
| MN-MAG    | MN link local  | [RFC2710], [RFC3810] |
+-----+-----+-----+-----+
| MAG-MR    | MAG link local  | [RFC2710], [RFC3810] |
+-----+-----+-----+-----+

```

5.3. Multicast Packets

```

+-----+-----+-----+-----+
| Interface | Source Address | Destination Address |
+-----+-----+-----+-----+
| MR-MAG    | Streaming Source Addr. | Multicast Group Addr. |
+-----+-----+-----+-----+
| MAG-MN    | Streaming Source Addr. | Multicast Group Addr. |
+-----+-----+-----+-----+

```

6. IANA Considerations

TBD.

7. Security Considerations

This document does not discuss any special security concerns in detail. The protocol of this document is built on the assumption that all participating nodes are trusted each other as well as there is no adversary who modifies/injects false messages to corrupt the procedures.

8. References

8.1. Normative References

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