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# Route Optimization for Mobile Nodes in Mobile Network based on Prefix Delegation

## Status of this Memo



## Abstract

This document describes how to support Route Optimization for the Mobile Nodes in IPv6 Mobile Network. The support is provided by Prefix Delegation. Mobile Router gets a prefix from an access router using Prefix Delegation protocol and advertises the delegated prefix to its subnet. Each Mobile Nodes makes its care-of address from the prefix and performs binding update. It allows the Mobile Nodes to communicate with correspondent nodes directly, avoiding ingress filtering.

Conventions used in this document

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 [2].

Table of Contents



## 1. Terminology and Abbreviation

This document uses the terminology and abbreviation conformed to [1] [2] and [3] on the assumption that the reader is familiar with Mobile IPv6 and NEMO terminology. In addition, following terms are used:

Delegated Prefix (DP)
A prefix assigned to a site by a provider, from which the site may derive link prefixes [3]

## 2. Introduction

NEMO Basic Support is to preserve session continuity using bidirectional tunnel between Mobile Router (MR) and the MRÆs HA. The support is reasonable for small-scale mobile network because MR MUST encapsulate and decapsulate all packets for Mobile Network Nodes. Specially, outbound packets MUST be tunneled in order to pass ingress filtering.

The purpose of this document is to enable MNs behind the MR to perform Mobile IPv6 Route Optimization. This can reduce the overhead on MR because MR considers the packets of Local Fixed Nodes in the bidirectional tunnel between MR and HA.

When MR detects its movement, it runs Prefix Delegation (PD) protocol such as APD, RA-PD and DHCPv6 described in [5]-[7] respectively. If MRs become placed in multiple levels, the mobile network has hierarchical architecture. Most of the current PD protocols are designed for leaf network. How to extend PD protocol for hierarchical IPv6 network is outside the scope of this specification. For example, HPD (Hierarchical APD) protocol described in [10] is an extension of the APD protocol.

Even when every AR on visited network does not support PD, there SHOULD be no problem in the communication between MN and CN. If this mechanism is disabled, all the Mobile Network Nodes (MNNs) communicate with CN by NEMO Basic Support. Therefore, it can provide Route Optimization for mobile nodes within mobile network according as the access network allows PD.

This specification defines a new Neighbor Discovery Protocol option and modifies the operation of MR and MN to support route optimization. Fixed router in mobile network is not considered in this specification.

## 3. Protocol Overview

This document assumes that all AR and MR support PD. Otherwise, only NEMO Basic Support [8] is provided to preserve session continuity and Route Optimization is disabled.

Figure 1 shows a topology before two MRs move from home link to foreign link. When the MR1 and MR2 are at home link, each MR uses 1:1:: and 2:1:: respectively as its own mobile network prefix.

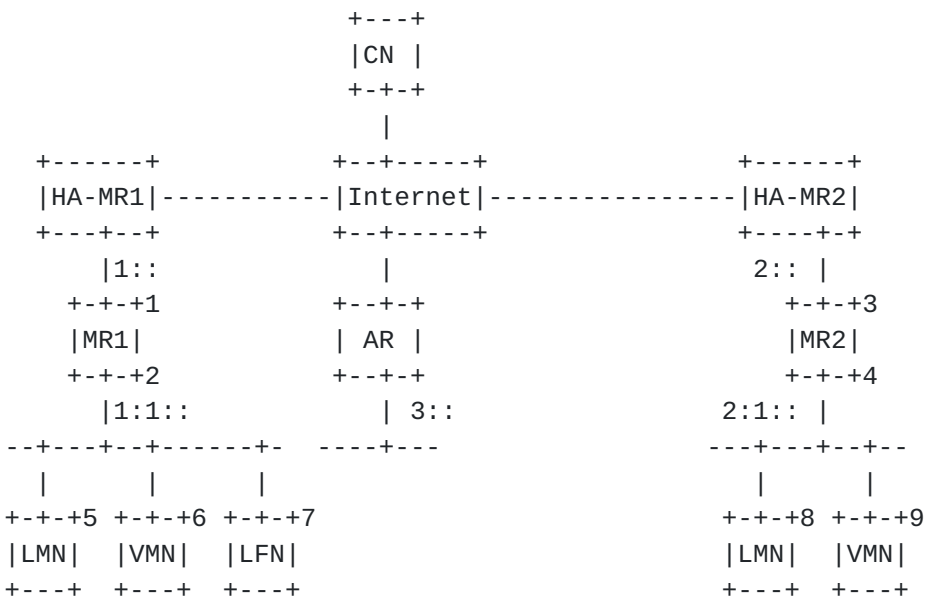


Figure 1. Mobile router at home link

Figure 2 shows a topology after two MRs move from home link to foreign link and each MR performs PD. First, MR1 detects movement and gets a prefix (3:1::) from AR. MR1 advertises the DP to its subnet by sending RA message with Delegated Prefix option. And then, MR2 moves to MR1's network. MR2 gets prefix (3:1:1::) from MR1 and advertises the prefix to its subnet.

When each MN receives RA message with Delegated Prefix option, it processes the DP option preferentially: make CoA from the prefix and performs binding updates to HA and CN. In figure 2, CoA1 is used as a primary CoA, which is made from DP. This process is transparent to LFNs.

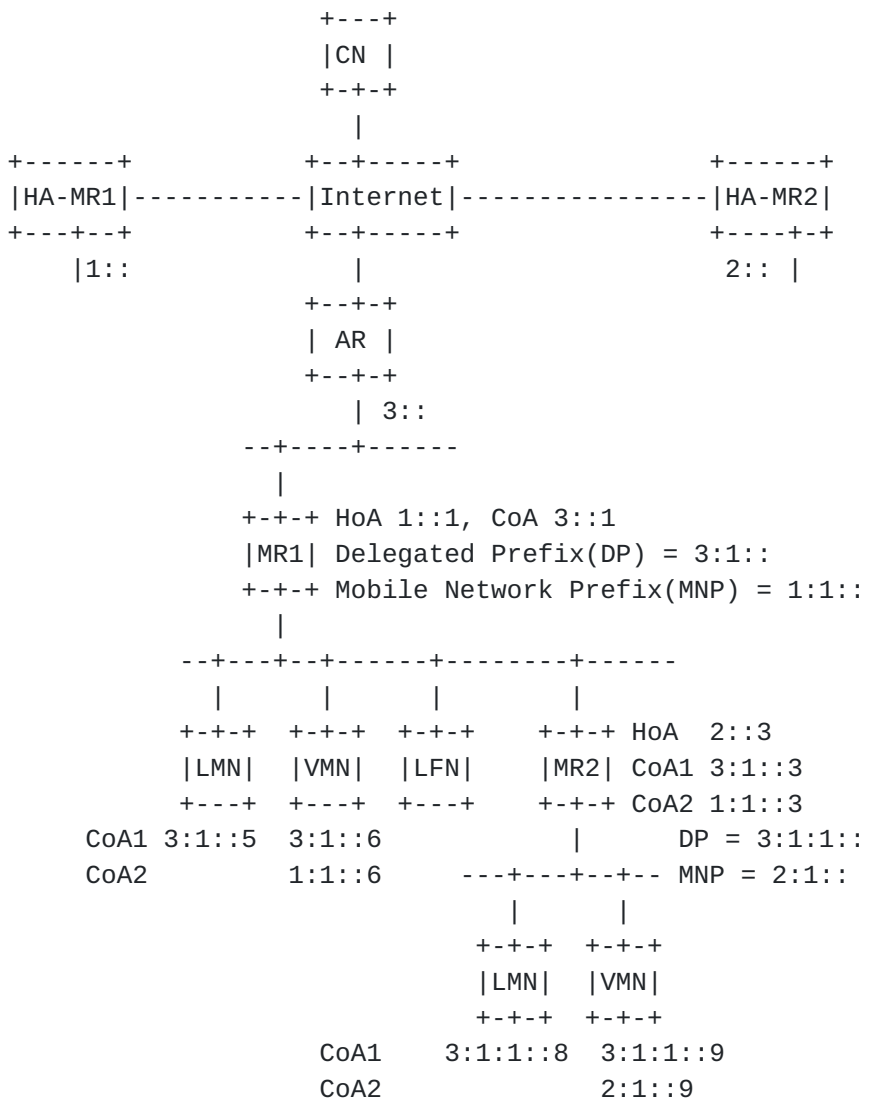


Figure 2. Prefix Delegation for Route Optimization

After the PD, the routing table of routers is updated. It is possible because each router has information about delegated prefix.

## 4. Neighbor Discovery extension : Delegated Prefix option format

This specification defines a new option, the Delegated Prefix option, for the Neighbor Discovery protocol of IPv6. The option format is shown in Figure 2.

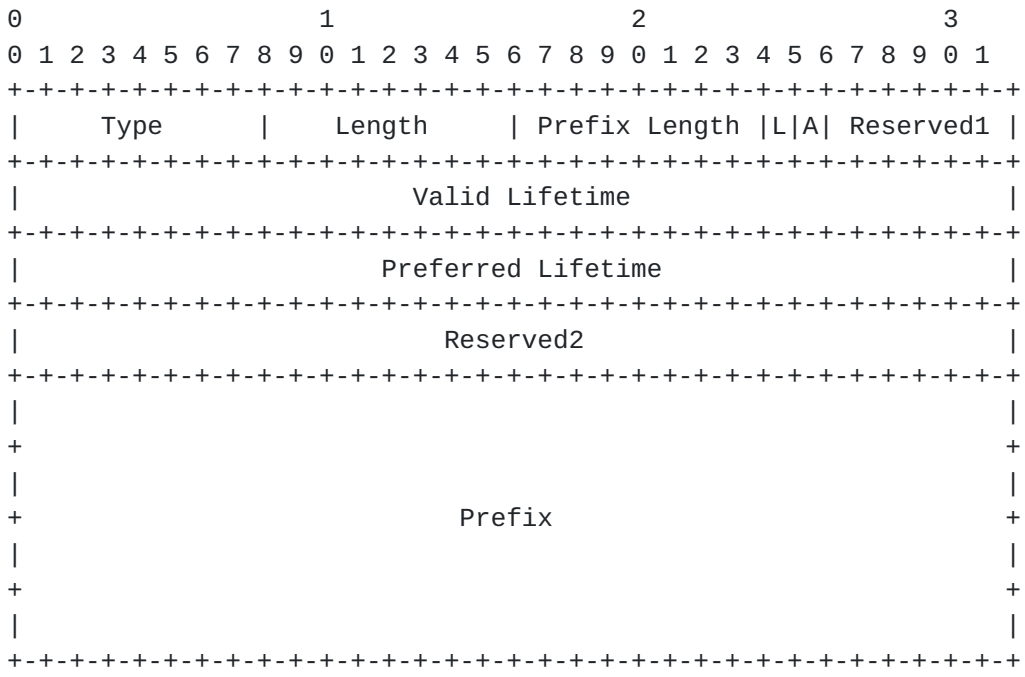


Figure 2. Delegated Prefix Option Format for Route Optimization

Fields:

Type XXX [TBD: IANA]

Prefix Delegated Prefix. The Prefix Length field contains the number of valid leading bits in the prefix. The bits in the prefix after the prefix length are reserved and MUST be initialized to zero by the sender and ignored by the receiver

The Delegated Prefix option provides mobile nodes with on-link prefix of access network and prefix for address autoconfiguration of CoA. The Delegated Prefix option appears in Router Advertisement packets and MUST be silently ignored for other messages.

## 5. Mobile IPv6 extension : Process of Delegated Prefix option

MN scans all options in received router advertisement message. To initiate Route Optimization MN operation MUST be extended as follows:

(1)Process the new RA option, Delegated Prefix option: MN forms CoA using the prefix.
(2)Use the CoA as primary CoA.

MN performs registration procedure according to the Mobile IPv6 protocol. Even if LMN is on home link, it SHOULD make new CoA using the DP and SHOULD perform binding updates to HA and CN. In this case, deregistration SHOULD NOT be performed.

There is no change of HA and CN operations.

## 6. Handover Considerations

When a MR moves into another AR and detects movement, it SHOULD NOT return prefix delegated from the old AR immediately. It takes some time to find out whether the new AR supports PD or not. Moreover, MR can fail in PD for several reasons. Therefore, some considerations are needed for smooth handover.

## 7. Security Considerations

Because the mechanism described in this document needs to exchange PD message between a MR and its AR, AAA MAY be used to authenticate MR.

## 8. Consideration for Optimization of DNS Name Resolution

The optimization of DNS name resolution is possible if mobile router announces the address of local recursive DNS server as well as prefix information through RA message. The DNS server can exist either within mobile network or within access network. The address of recursive DNS server is delivered to mobile nodes through Recursive DNS Server option, one of RA options [10].

## 9. Applicability Statements

Proposed mechanism in this draft is applicable to large, hierarchical and stable mobile network such as train or airplane because it takes some time to configure and update new CoA by prefix delegation protocol. Those mobile networks do not change its topology frequently

so it reduces time to be consumed for prefix delegation whenever the topology changes in the mobile network.

## 10. References

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