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Multiple IPv4 - IPv6 address mapping encapsulation - prefix translator (M46E-PT)
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Abstract

This document specifies Multiple IPv4 - IPv6 mapping encapsulation - Prefix Translator (M46E-PT) specification. M46E-PT expand IPv4 network plane by connecting M46E-FP domain and M46E-PR domain. M46E-PT translate prefix part of M46E-FP address and M46E-PR address both are IPv6 address. M46E-PT does not translate IPv4 packet which is encapsulated, so transparency of IPv4 packet is not broken.

Requirements Language

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 [RFC2119].

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1. Introduction

This document provide M46E Prefix Translator (M46E-PT) specification.

The basic strategy for IPv6 deployment is dual stack. However, because of exhaustion of IPv4 address, there will be no IPv4 addresses for configuring dual stack in near future. That means there will be IPv6 only networks automatically.

However, there are many IPv4 only networks still exist and those seems continuous use in near future. That means methods continuous use of IPv4 network over IPv6 only network will be required.

M46E-FP [I-D.draft-matsuhira-m46e-fp] provide such methods. In addition, M46E-PR [I-D.draft-matsuhira-m46e-pr] also provide such methots. M46E-FP is backbone network based approach, on the other hand, M46E-PR is stub network based approach.

M46E-PT expand IPv4 network plane by connecting M46E-FP domain and M46E-PR domain. M46E-PT translate prefix part of M46E-FP address and M46E-PR address both are IPv6 address. M46E-PT does not translate IPv4 packet which is encapsulated, so transparency of IPv4 packet is not broken.

2. Basic Network Configuration

Figure 1 shows network configuration with M46E-PT. At large view, the network consists three parts, M46E-FP domain, M46E-PR domain, and M46E-PT. M46E-PT connect M46E-FP domain and M46E-PR domain.

```
    <------ M46E-FP Domain ------------> <--------- M46E-PR Domain ---->

    /--------------------------------/   /-----------------------------\
    |                                |   |                             |
    |    Backbone Network         +----------+   Backbone Network     |
    |                             | M46E-PT  |                         |
    |                             +----------+                         |
    |   +----------+  +----------+  |   |                             |
    \---| M46E-FP  |--| M46E-FP  |--/   /-----------------------------/
        +----------+  +----------+           |                |
              |           |                  |                |
              |           |                  |                |
              |           |              +----------+    +----------+
    /--------------\/--------------/   /-| M46E-PR  |-\/-| M46E-PR  |-\
    |              ||              |   | +----------+ || +----------+ |
    |              ||              |   |              ||              |
    | Stub Network || Stub Network |   | Stub Network || Stub Network |
    |              ||              |   | (IPv4 only)  || (Dual Stack) |
    |              ||              |   |              ||              |
    \--------------//--------------/   \--------------/\--------------/
```

Figure 1

M46E-FP domain consists three parts, backbone network, stub network and M46E-FP. Backbone network can be operated with IPv6 only. Stub network has three cases, IPv4 only, Dual Stack (both IPv4 and IPv6), and IPv6 only.M46E-FP connects backbone network and stub network in case IPv4 still works in that stub network. If stub network is IPv6 only, M46E-FP is not needed. M46E-FP is a backbone network based approach, that mean M46E-FP advertise special route for M46E-FP.

And also, M46E-PR domain consists three parts, backbone network, stub network and M46E-FP. Backbone network can be operated with IPv6 only. Stub network has three cases, IPv4 only, Dual Stack (both IPv4 and IPv6), and IPv6 only.M46E-FP connects backbone network and stub network in case IPv4 still works in that stub network. If stub network is IPv6 only, M46E-PR is not needed. M46E-PR is a stub network based approach.

3. Basic function of M46E-PT

This section describe basic function of M46E-PT.

3.1. Translation processing

M46E-PT translate between M46E-FP packet and M46E-PT packet. M46E-FP packet and M46E-PT packet are almost the same, however IPv6 address are different.

Fig shows packet format of M46E-FP domain and M46E-PT domain.

```
+--------+--------+------------+       +--------+--------+------------+
|IPv6 Hdr|IPv4 Hdr|    Data    |  -->  |IPv6 Hdr|IPv4 Hdr|    Data    |
+--------+--------+------------+       +--------+--------+------------+

+--------+--------+------------+       +--------+--------+------------+
|IPv6 Hdr|IPv4 Hdr|    Data    |  <--  |IPv6 Hdr|IPv4 Hdr|    Data    |
+--------+--------+------------+       +--------+--------+------------+


    /-------------------\  +----------+  /---------------------------\
    |   M46E-FP Domain  |--| M46E-PT  |--|      M46E-PR Domain       |
    |                   |  +----------+  |                           |
    \-------------------/                \---------------------------/
```

Figure 2

3.2. M46A architecture

M46E-FP and M46E-PR use M46A [I-D.draft-matsuhira-m46a].

figure Figure 3 shows M46A architecture.

```
   |    96 - m bits           |          m bits        |     32 bits  |
   +--------------------------+------------------------+--------------+
   |        M46A prefix       | IPv4 network plane ID  | IPv4 address |
   +--------------------------+------------------------+--------------+
```

Figure 3

3.3. Resolving translate prefix

M46E-PT translate from M46E-FP prefix to M46E-PR prefix, or from M46E-PR prefix to M46E-FP prefix using M46E-FP Prefix Translation (M46E-PT) table. fig Figure 4shows address resolution manner and fig Figure 5shows M46E-PT table.

```
    |        96 - m bits       |         m bits         |     32 bits  |
    +--------------------------+------------------------+--------------+
    |        M46A prefix       | IPv4 network plane ID  | IPv4 address |
    +--------------------------+------------------------+--------------+

    \--------------------------/\-------------------------------------/
               ^                                     |
               |                                     |
               |                                     v
    +-------------------------------------------------------------------+
    |                                                                   |
    |       M46E-FP Prefix Translation Table (M46E-PT Table)            |
    |                                                                   |
    +-------------------------------------------------------------------+
```

Figure 4

M46E-FP-AT table is similar with M46E-PR table, however M46E-AT table may contain M46E-FP prefix.

```
+---------------------+------------+-------++-----------------------+
|IPv4 network plane ID|IPv4 address|netmask||M46A prefix            |
+---------------------+------------+-------++-----------------------+
|IPv4 network plane ID|IPv4 address|netmask||M46A prefix            |
+---------------------+------------+-------++-----------------------+
|IPv4 network plane ID|IPv4 address|netmask||M46A prefix            |
+---------------------+------------+-------++-----------------------+
|IPv4 network plane ID|IPv4 address|netmask||M46A prefix            |
+---------------------+------------+-------++-----------------------+
              :              :               :
+---------------------+------------+-------++-----------------------+
|IPv4 network plane ID|IPv4 address|netmask||M46A prefix            |
+---------------------+------------+-------++-----------------------+
```

Figure 5

3.4. Destination address resolution

For address resolution for destination address, M46E-PT use M46E-PT table.

3.5. Source address resolution

For address resolution for source address, M46E-PT use interface information, not M46E-PT table. From M46E-FP domain to M46E-PR domain, M46E-PT use IPv6 address prefix of the interface which belong M46E-PR domain. From

4. Sample Configuration

Figure Figure 6shows sample confiuration of M46E-PT. In this example, there are four IPv4 stub network with the same IPv4 network plane, and two of four are in M46E-FP domain and other two of four are in M46E-PR domain.

In this example, M46E-FP prefix is 2001:0db8:0:46::/64.

```
    /------------\
    |           +--------+  /----------------------\
    | Backbone  |        |  |Stub Network#1        |
    | Network   |M46E-FP |--|10.1.1.0/24(plane 1)  |
    |(IPv6 only)|        |  |2001:0db8:1:1::/64    |
    |           +--------+  \----------------------/
    |       <--[2001:0db8:1:1::/64]
    |       <--[2001:0db8:0:46:0:1:10.1.1.0/120]
    |            |
    |           +--------+  /----------------------\
    |           |        |  |Stub Network#2        |
    |           |M46E-FP |--|10.1.2.0/24(plane 1)  |
    |           |        |  |2001:0db8:1:2::/64    |
    |           +--------+  \----------------------/
    |       <--[2001:0db8:1:2::/64]
    |       <--[2001:0db8:0:46:0:1:10.1.2.0/120]
    |            |
    |       <--[2001:0db8:0:46:0:1:10.1.4.0/120]
    |       <--[2001:0db8:0:46:0:1:10.1.5.0/120]
    |           +------------+
    |           | M46E-PT   |
    |           +------------+
    \------------/    |
          |           |Stub Network #0
    /------------\    | 2001:0db8:2:0::/64
    |            |----+
    |            |  /--------------------------------------/
    |            |  | Stub Network #3                      |
    |            |  |  2001:0db8:2:1::/64                  |
    |            |  | +--------+  /----------------------\ |
    |            |--| |M46E-PR |--|10.1.3.0/24(plane 1)  | |
    |            |  | +--------+  /----------------------/ |
    |           <--[2001:0db8:2:1::/64]                    |
    |            |  /--------------------------------------/
    |            |
    |            |  /--------------------------------------/
    |            |  | Stub Network #4                      |
    |            |  |  2001:0db8:2:2::/64                  |
    | Backbone   |  | +--------+  /----------------------\ |
    | Network    |--| |M46E-PR |--|10.1.4.0/24(plane 1)  | |
    |            |  | +--------+  \----------------------/ |
    |           <--[2001:0db8:2:2::/64]                    |
    |            |  /--------------------------------------/
    \------------/
```

Figure 6

Figure Figure 7 shows M46E-PT table for this example. This example is default free case.

IPv4 network plane ID	IPv4 address	netmask	M46E-PR address prefix
1	10.1.1.0	/120	2001:0db8:0:46
1	10.1.2.0	/120	2001:0db8:0:46
1	10.1.3.0	/120	2001:0db8:2:1
1	10.1.4.0	/120	2001:0db8:2:2

Figure 7

Fig Figure 8shows another M46E-PT table for this example. This example use default for M46E-FP. If there are many stub network in M46E-FP domain, by using default as M46E-FP prefix, reduction of M46E-PT table size can be possible.

IPv4 network plane ID	IPv4 address	netmask	M46E-PR address prefix
1	10.1.3.0	/120	2001:0db8:2:1
1	10.1.4.0	/120	2001:0db8:2:2
1	0.0.0.0	/0	2001:0db8:0:46

Figure 8

5. IANA Considerations

This document makes no request of IANA.

Note to RFC Editor: this section may be removed on publication as an RFC.

6. Security Considerations

Security Considerations does not discussed in this memo.

7. Acknowledgements

8. References

8.1. Normative References

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