Private IP addresses in Mobile IP

draft-petri-mobileip-pipe-00.txt

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1. Background:
Private addresses in Mobile IP WG

- **1. Mobile IP charter:**

  -> "Develop solutions for IPv4 private address spaces for the scenarios needed for deployment"

- **2. History:**

  o Solutions for handling of IPv4 private addresses solicited already for several meetings

  o Some initial activities around June 99, but currently no WG draft available on this issue

  o Initial reviews showed some complexity of the problem, therefore:
    --> decision not to include handling of priv. addresses into the RFC2002-update (11/99)
    --> but to take this to the establishment a separate draft

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1. Background:
Mailing list discussions on private addressing in Mobile IP

- Discussions around Appendix of draft-ietf-mobileip-**rfc2344-bis**-01.txt:
  on: "Disparate Address Space Support"
  --> excellent outline of issues / problem space related to private addresses
  --> shows that problem applies more general to "overlapping address realms"

- Some mails on the need for "giving additional domain information" [Pete] for
  a private address, and on the need for an address **"realm ID"** [Gabriel] etc.

- Discussions on the cooperation with legacy RFC 2002 agents / nodes:
  --> re-use of an existing bit (T-bit), or definition of a new bit **("P-bit")** within the
       Mobility Agent Advertisement Extension to indicate capability to support
       private addresses

- Discussions on whether solutions based on **NAIs** (RFC 2486) might be suitable

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2. Problem statement - Handling of private addresses / disparate address realms)

General:

- if private addresses according to RFC 1918 are used, a receiveing agent or mobile node will only detect that it is a private address, but will not know, to which address realm it belongs (unless a particular realm is preconfigured)

- similar problems for overlapping / non-routable corporate address ranges, even if not private

More specific:

- Corresponding node and mobile node are in disparate address spaces

- FA offers support of address realms different from the one it uses to communicate with HA e.g. since it advertise private COAs (Ma) or offers a VPN service (Mc)

```
   Mc (or Ma)                Fa  Fb                     Hb  Hc                    Yc
 [MN]------------------[FA]------------------[HA]----------------[Y]
      Addr space A              Addr space B              Addr space C                    ------>
```
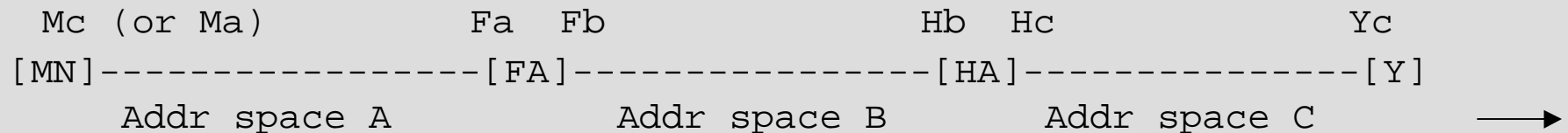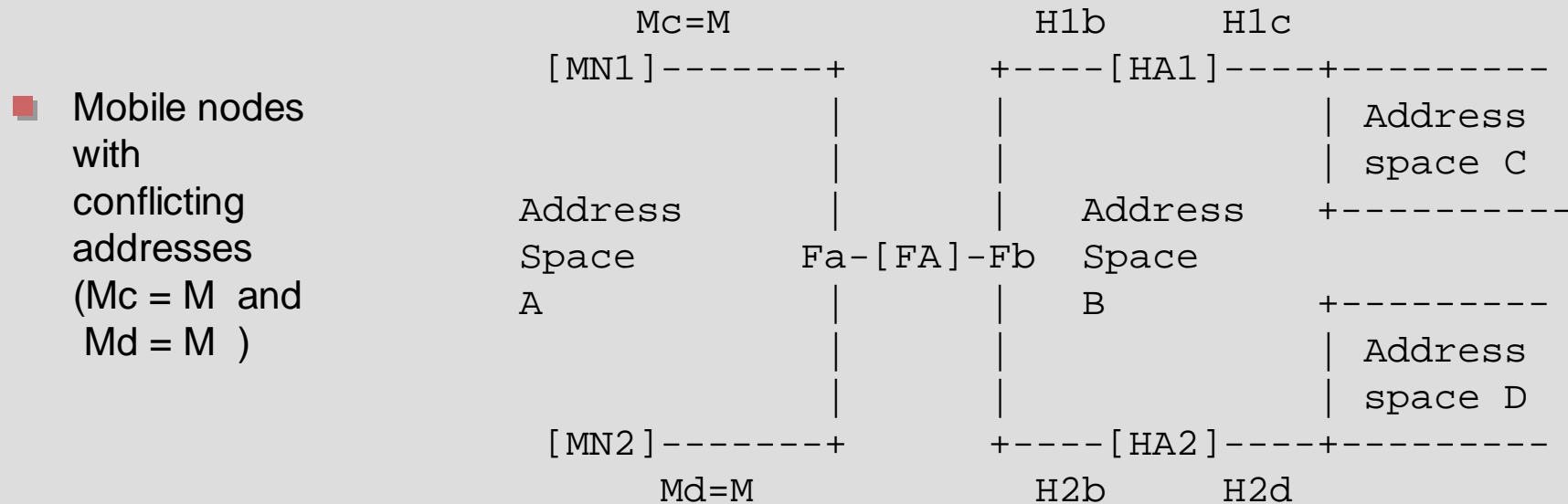
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2. Problem statement *(continued)* :
Handling of private addresses / disparate address realms)

➤ More specific examples:

Source: draft-ietf-mobileip-rfc2344-bis-01.txt; Appendix

■ Mobile nodes
with
conflicting
addresses
(Mc = M and
 Md = M)

```
                   Mc=M              H1b      H1c
                   [MN1]-------+      +----[HA1]----+---------
                       |       |      |             | Address
                       |       |      |             | space C
                       |       |      |             |
        Address        |       |    Address         +----------
        Space       Fa-[FA]-Fb  Space
        A              |       |    B               +---------
                       |       |      |             | Address
                       |       |      |             | space D
                   [MN2]-------+      +----[HA2]----+---------
                   Md=M              H2b      H2d
```

■ FA/HA in disparate address realms --> compound (IP-IP/GRE/...) tunnel with addr. transl /NAT
- particularly: HAs with private-only addresses
- particularly: FAs with private-only addresses

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3. PIPE Solution Overview - What it does and what it doesn't provide ...

What PIPE provides for:

- An extension of IP-IP(RFC 2003) tunnels, allowing to handle private addresses by adding a kind of "address realm ID" for the inner IP addresses

- = the basis for a possible Mobile IP solution to handle private addresses, but not all detailed Mobile-IP extensions needed are outlined in the draft
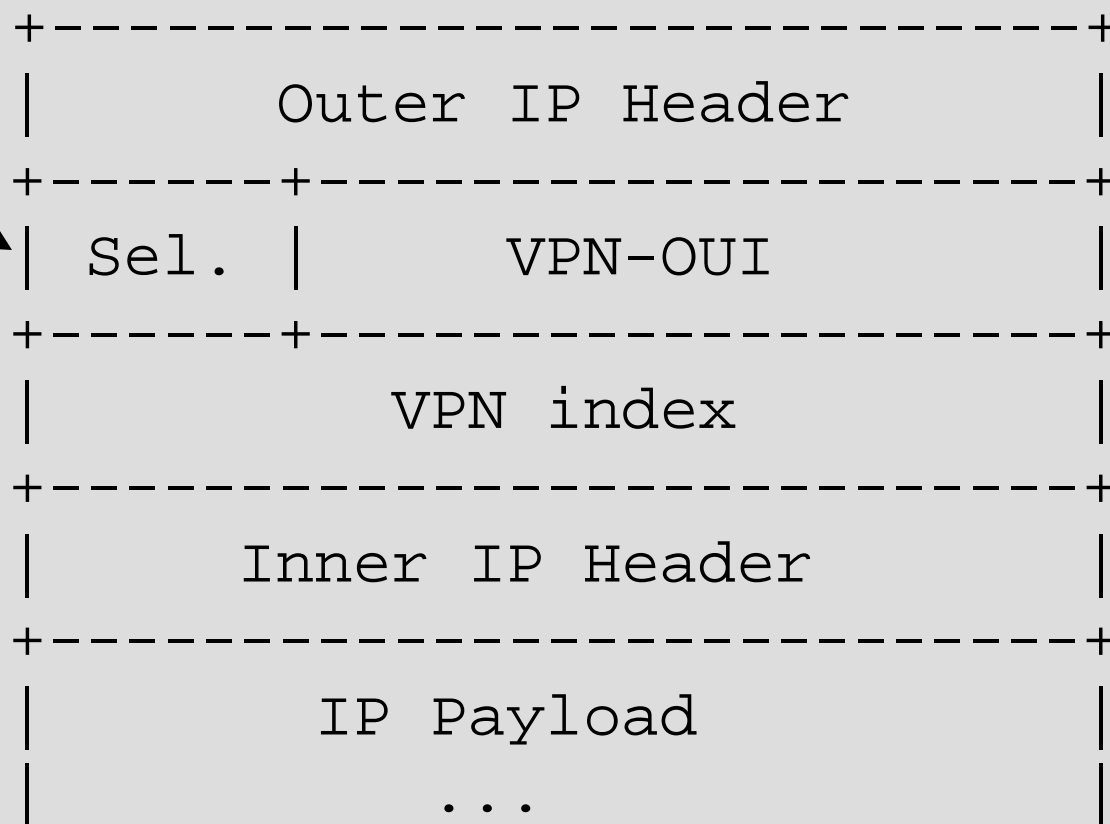
What PIPE does **not** provide for:

- How to cooperate with existing RFC 2002 MIP agents/nodes (-> "P" bit discussion)

- Solution for other types of tunnels (GRE, L2TP, MPLS, ...) [expectation: easily extensible for other tunnel types; but not checked yet]

- Address translation / NAT functions for private addresses

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3. PIPE Solution Overview -
Tunnel Format for Private IP Encapsulation within IP

.. add (sel.+) realm-ID/VPN-ID to RFC 2003 format:

```
               +----------------------------------+
               |                                  |
               |         Outer IP Header          |
               |                                  |
Selector:      +------+---------------------------+
indicates whether     |                           |
realm-ID / VPN-ID     | Sel. |      VPN-OUI        |      VPN-ID /
applies to source,    +------+---------------------------+      realm-ID:
dest. or both addr.   |                           |
of inner IP header    |         VPN index         |
                      |                           |        ———>
               +----------------------------------+          more
               |                                  |
               |         Inner IP Header          |
               |                                  |
               +----------------------------------+
               |                                  |
               |         IP Payload               |
               |                                  |
               |            ...                   |
               |                                  |
```

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3. PIPE Solution Overview -
Use of the VPN-ID (RFC 2685) as an address realm-ID

- 7-byte world-wide unique identification of networks (3-byte OUI + 4 byte index)

- specified for various VPN purposes, particularly use of private addressing

```
+---------------------------------+  ⎫
|          VPN-OUI                |  ⎪ VPN-
+------+--------------------------+  ⎬ ID /
|          VPN index             |  ⎪ realm
+---------------------------------+  ⎭ ID
```

- derived from the structure of MAC addresses (3-byte OUI + 3-byte index), but extended index field to 4-bytes to allow for a possible 2+2 AS-number +index

- "OUI" (IEEE organizationally unique identifier) = world-wide unique company-ID
  [more --> http://standards.ieee.org/regauth/oui/index.html]
  e.g. of a network operator, company, service provider, IANA (0x00-00-5E), ...

- VPN index : index value for network or address realm, allocated by owner of VPN-OUI

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3. PIPE Solution Overview - Example: packet travels from MN to HA (1)

```
   priv. realm PR2        public IP (or PR4)        private realm PR3
         |                        |                          |
   MN   --->   border gateway A ------> border gateway B --->   HA
                      (BG A)                     (BG B)
```

Step 1 of 3: From MN to BG A:

```
    Outer Header:   Source Address:        MN(PR2)
                    Destination Address:   BG A(PR2)
    Selector:       0xE1 (explicitly indicated destination)
    VPN-ID:         VPN-ID = PR 3
    Inner Header:   Source Address:        MN(PR2) = default
                    Destination Address:   HA(PR3)
```
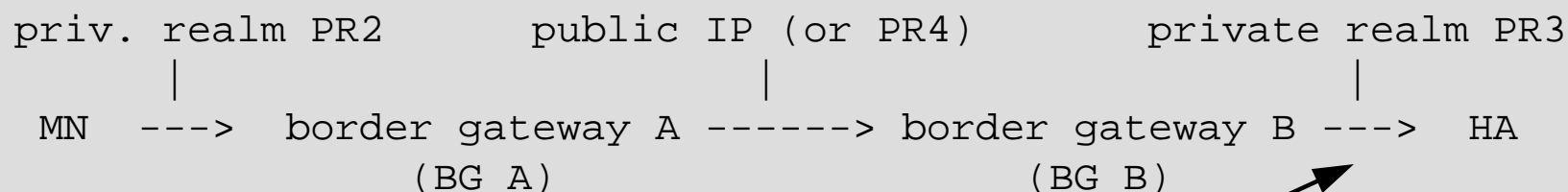
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3. PIPE Solution Overview - Example: packet travels from MN to HA (2)

```
   priv. realm PR2          public IP (or PR4)         private realm PR3
         |                           |                          |
    MN   --->  border gateway A ------> border gateway B --->   HA
                  (BG A)                      (BG B)
```
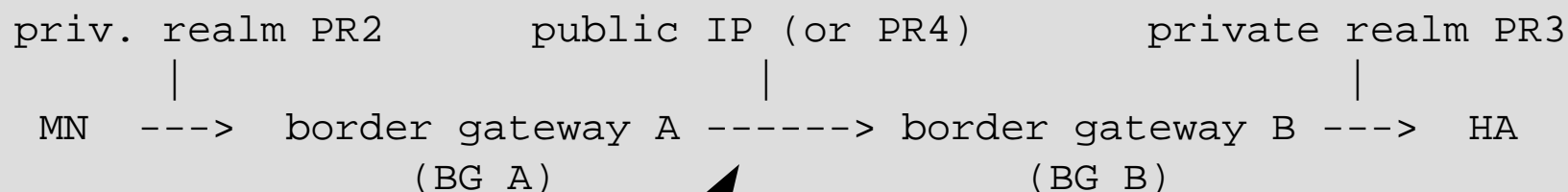
Step 2 of 3: From BG A to BG B:

```
    Outer Header:  Source Address:        BG A (public IP or PR4)
                   Destination Address:   BG B (public IP or PR4)
    Selector:      0xE3 (explicit source/dest realm, different)
    VPN-ID:        VPN-ID1 = PR 2
    VPN-ID:        VPN-ID2 = PR 3
    Inner Header:  Source Address:        MN(PR2)
                   Destination Address:   HA(PR3)
```

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3. PIPE Solution Overview -
Example: packet travels from MN to HA (3)

```
 priv. realm PR2         public IP (or PR4)        private realm PR3
        |                        |                         |
  MN  --->  border gateway A ------> border gateway B --->  HA
                  (BG A)                     (BG B)
```

Step 3 of 3: From BG B to HA::

```
    Outer Header:   Source Address:       BG B (PR3)
                    Destination Address:  HA (PR3)
    Selector:       0xE2 (explicitly indicated source)
    VPN-ID:         VPN-ID = PR 2
    Inner Header:   Source Address:       MN(PR2)
                    Destination Address:  HA(PR3) = default
```

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4. PIPE - Private IP Encapsulation within IP : Benefits

- outlines solution for the use of private addresses / disparate address realms for Mobile IP

- does not only care for simple cases (privately addressed MN), but for any type of combination of address realms (as illustrated in the example above) used for nodes and agents

- low administrative overhead involved to derive a realm-ID / VPN-ID, using either OUIs of operators or companies, or allocating realm-IDs from IANA's OUI (0x00-00-5E)

- low additional overhead for packets in the IP-IP tunnels

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5. How to proceed -
Private Addresses in Mobile IP

■ received messages to cooperate and work on a MIP WG framework / architecture
document
-> sounds good
-> Appendix to draft-2344-bis looks like a good starting point

■ additional work needed to specify how MIP nodes / agents supporting handling
of private addreses communicate with existing RFC 2002 nodes / agents
-> advertisements, "P"-bit discussion
-> what else .. ?

■ discussion to move PIPE towards an Experimental RFC for the time being, and
possibly reconsider status later pending results of the 2 activities above

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