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                        Multihoming in Homenet
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Abstract

   Multihoming becomes popular in residential and SOHO networks
   indicating the absolute necessity of fully supporting multihoming in
   Homenet. While the approach followed in Homenet is to delegate
   multihoming management to hosts, we propose to enable multihoming in
   Homenet by the mean of the infrastructure instead of the hosts.

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1. Introduction

So far, multihoming in Homenet must be supported by the hosts with
solutions like Shim6 [RFC5533] or MPTCP [RFC6182] as there is no mean
to use simultaneously the different ISPs of the Homenet without
risking flow disruption. In this memo, we propose the creation of a
new multihoming service for Homenets. The concept relies on a
middlebox added between the home network and its gateways with the
ISPs. On the one hand, this middlebox is in charge to redirect the
home network traffic to a multihoming service provider (MSP) by
selecting the most appropriate Homenet's ISPs. On the other hand,
the MSP is in charge of attracting traffic normally destined to the
home network and then, the MSP can eventually redirect the traffic to
its final destination, the Homenet itself, such that it enters the
Homenet via the most appropriate ISP.

Section 2 describes the multihoming problem in Homenet when hosts
cannot support it directly. Section 3 gives the necessary
requirements. Section 4 sketches a possible solution to that
problem.

2. Homenet multihoming without host involvement

It is known that multihoming reduces costs for ISPs by allowing higher aggregated bandwidth, better quality of service, and higher robustness.

Alternatively, the access to multiple ISPs at the same time for residential and SOHO users is now a reality, e.g., ADSL + Cable + 4G, but there is currently no simple solution for home networks to exploit it. For now, the only solution is to modify end-hosts with protocols such as Shim6 or MPTCP in order for hosts to change IP addresses on elapsing communications.

We claim that multihoming for Homenets will become a reality and will provide the same benefits as those observed for the ISPs. Also, requiring every single device in the Homenet to be modified to support multihoming is not acceptable as some devices have limited resources and cannot achieve it correctly and also because it would dramatically slow down the adoption of multihoming in the Homenet. Finally, letting every device deciding of the routing strategy (e.g., shall I route my traffic via left or right ISP?) might cause management issues.

At the light of this, the question can be: How can we achieve multihoming in Homenets, without changing neither the devices connected to the Homenet, nor the protocols and operations of the Homenet's ISPs?

3. Requirements

In order to fix the solutions space of our problem, we have isolated fours requirements.

As we are in the context of Homenet, requirement (1) is to have zero configuration need at the Homenet user level. Multihoming must be transparent for users and devices.

Also, residential and SOHO network operators (i.e., John/Jane Does) seldom have enough power to make specific settlements or negotiations with their ISP, the solution thus have to be completely independent of the network's ISPs and the ISPs cannot have any mean to forbid the solution. Requirement (2) is thus ISP independence.

Multihoming offers the possibility to implement policies, and to some extend even capabilities, at any arbitrary level. For example, the home network can determine the number of ISPs it is using simultaneously or limit flows for example to only go via one

particular ISP at a given speed. Requirement (3) is thus policies/
capabilities.

Finally, and this is related to policies and capabilities, the system
must be able to provide quality of service (to some extend)to ensure
Quality of Experience. We call the requirement (4) Quality of
Service.

4. Homenet multihoming with MSP

To offer fast and efficient deployment of multihoming in residential
and SOHO networks, a dedicated middlebox is added to be in charge of
dealing with multihoming, on behalf of the devices. This middlebox
is logically linked with a Multihoming Service Provider (MSP). The
role of the MSP is to achieve the multihoming for the Homenet by
using offloading: the Homenets, by the mean of the middlebox,
offloads all its Internet traffic to the MSP, and the offloading is
such that the traffic leverages the Homenet's multihoming capability.

The MSP can be seen as a service in the cloud (in a remote network or
in devices widely deployed by the MSP in the ISPs). The service is
two-fold. On the one hand, the MSP must attract the traffic sent by
the Homenet to the Internet, this part is ensured by the middle-box
deployed at the Homenet. On the other hand, the MSP must attract
traffic sent by the Internet to the Homenet, before this last can
receive it. Then, the MSP can send this traffic to the Homenet via
the most relevant ISP.

The figure below gives a reference network for the multihoming
service for Homenet.

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                           |
      .------.        .+------+--------+.
    .'        '.    .'                   `-.
    | REMOTE   |.-'                         `\
    .          .                             `.
     '.------.'           Internet             \
         |                                       +
         :      .-----.              .------.     ;
          `. .  '     '.           .'       '. .'
           '.|  ISP1   |           |  ISP2   |-'
             .        .`------'.              .
              '.--+--.'         '.--+--.'
                  |                 |
            .-----|------------------|------.
          .'     +--+--+           +--+--+    '.
         /       | Gw1 |   HOMENET  | Gw2 |      \
        .'       +--+--+           +--+--+        '.
                    '.                 .'
                      \   +-------+   ./
                       '.| MSPMB |.'
                         +---+---+
                             |
                         ____+____  LAN
```
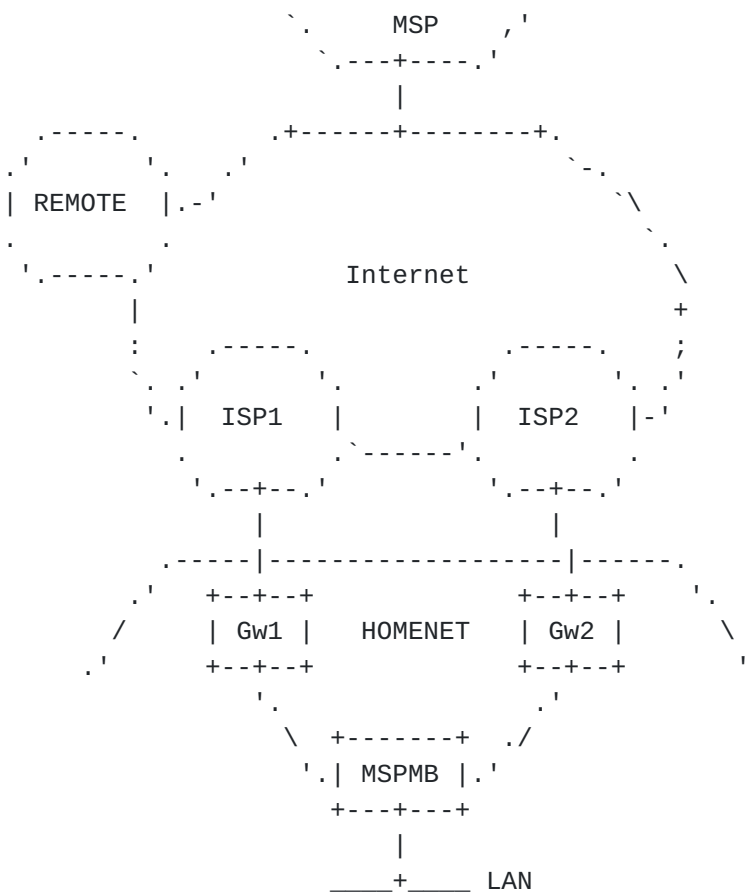
                    Figure 1: Reference Network

   In this figure, HOMENET is the multihomed Homenet, connected to ISP1
   via gateway Gw1 and to ISP2 via gateway Gw2. The remote end of
   communications with the Homenet is designated by REMOTE. MSPMB
   designates the MSP middlebox in the home network and is logically
   linked to the MSP multihoming service provider.

   Let's imagine that the best to send traffic from the Homenet to the
   remote end is to go via ISP2 while for the traffic from the remote
   end to the Homenet it is better to go via ISP1. In this case, the
   traffic generated from Homenet's LAN is caught by MSPMB that divert
   traffic to Gw2, then crosses ISP2 and the Internet to reach MSP, then
   REMOTE. On the other direction, traffic sent by REMOTE goes to MSP
   that sends the traffic on the Internet to ISP1, then it goes to Gw1,
   MSPMB, and finally the LAN.

   The Multihoming Service Provider (MSP) would typically be operated on
   an AS well connected to Homenet's ISPs. Or alternatively, a Service
   provider that has its own devices deployed at the Homenet's ISPs.

As Homenet is targeting IPv6 networks, communications between the
Homenet and the MSP cannot rely on NAT but instead they might use
encapsulation. For that purpose, LISP [RFC6830] is a perfect
candidate. In this case, the MSPMB is an xTR. To ensure zero
configuration at the Homenet level, the EID-to-RLOC Cache can be
populated on the fly by a mapping system hosted and managed by the
MSP. A major advantage of using LISP for communications between the
MSP and the Homenet is that residential and SOHO networks would then
have access the IPv6 Internet without the need of subscribing to IPv6
ISPs.

The service we propose answers the problem exposed in Section 3 in an
elegant way. It also fulfills the four requirements stated above.
Requirement (1) (zeroconf) is respected if MSPMB is given directly by
the MSP, which can thus be pre-configured to access the MSP service
provider. If it is not the case, the process can be simplified if a
generalized name and protocol is used to configure the middlebox
(e.g., msp.example.org). In addition, if Gw1 and Gw2 provide
addresses by the mean of DHCPv6 or RA, addresses at the MSPMB will be
configured automatically as well. Obviously, policies and
capabilities need configuration either from the home network operator
or the MSP directly (which is straightforward with LISP). Finally,
UPnP can be used for special services provided to the Homenet by its
ISPs.

5. Security Considerations

Traffic redirection can be used for DoS or eavesdropping.

6. Conclusion

Multihoming in Homenet is considered to be solved by the hosts
directly. In this memo, we propose to not involving host in
multihoming operations and instead rely on a Multihoming Service
Provider deploying a middlebox in the Homenet network in charge of
operating multihoming services.

7. Normative References

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