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MAP-T Trail in ChinaTelecom
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Abstract

With the depletion of the IPv4 address space, large-scale SPs are now faced with the real option to deploy IPv6 in a timely manner. In order to achieve smooth transition to IPv6, migration tools should be introduced for different deployment models. Among different IPv6 transition mechanisms, MAP-T is a stateless translation method which can directly translate IPv4 packet to IPv6 packet. This document describes the challenges and requirements for large SP to deploy IPv6 in operational network, the experimental results of MAP-T in our laboratory and the field trials in large SP operational network.

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1. Introduction

The dramatic growth of the Internet is accelerating the exhaustion of available IPv4 addressing pool. It is widely accepted that IPv6 is the only real option on the table for the continued growth of the Internet. However, IPv6 deployment is a huge systematic project and a lot of challenges will arise especially in large SP operational network.

1.1. Major Motivation

In order to achieve smooth transition to IPv6, migration tools should be introduced for different deployment models, among which MAP-T [RFC7599] is a stateless translation mechanism with good scalability. This document describes the challenges and requirements for large SPs in IPv6 transition period. Then, we introduce MAP-T experimental results in our laboratory and the field trials in large SP operational network.

1.2. IPv4-as-a-Service Requirements

In order to facilitate smooth IPv6 migration, some factors need to be taken into consideration especially for large SPs. There are ten major requirements:

1. It should deploy in an incremental fashion and the overall transition process should be stable and operational.

2. It should largely reduce IPv4 public address consumption.

3. It should accelerate the deployment of IPv6, rather than just prolonging the lifecycle of IPv4 by introducing multiple layers of NAT.

4. There should be no perceived degradation of customer experience. As a result, IPv6 transition mechanisms should provide IPv4 service continuity.

5. It should achieve scalability, simplicity and high availability, especially for large-scale SPs.

6. It should have user management and network management ability.

7. It should support user authentication, authorization and accounting as an essential part of operational network.

8. Most SPs need some kind of mechanisms to trace the origin of traffic in their networks. This should also be available for

IPv6 traffic.

9. It should have good throughput performance and massive concurrent session support.

10. It should maintain the deployment concepts and business models which have been proven and used with existing revenue generating IPv4 services.

2. Architecture and Methodology

2.1. Major Design Considerations

The major objective listed in the following is to verify the functionality and performance of MAP-T:

- Verify how to deploy MAP-T in practical network.

- Verify what applications can be used in MAP-T.

- Verify what Operating Systems can be supported in MAP-T.

- Verify the effect of user experience with limited ports.

- Verify the performance of MAP-T.

2.2. Regulatory Considerations

The government requires server operators to detect the packet sender by source IP (and port) and therefore stateless address mapping technologies are preferred. This will dramatically reduce the volume of material required to be held for logging compliance.

In addition, the stateless translation technology is preferred, since IPv6 addresses in the IPv6 packets everywhere in the network contain both the IPv6 and IPv4 address information without the requirement of decapsulation.

2.3. Security Considerations

From operation point of view, single stack (IPv6-only) is easier for ensuring the security compared with the dual stack.

The stateless mechanism can help for the trace-back and identifying the source addresses (and port).

The translation mechanism can help for configuring the access list and rate-limiting control without decapsulation.

2.4. Operational Considerations

The MAP-T deployment should support the DHCPv6-PD and MAP-T parameter auto-configuration [RFC7598], the PPPoE authentication and source address tracing back.

2.5. End-User Experience Considerations

The major issues are:

o Application test: The applications we have tested include web, email, Instant Message, ftp, telnet, SSH, video, Video Camera, P2P, online game, Voip, VPN and so on.

o Operating System test: The OS we have tested includes Win7/8, OSX, windows XP, iOS, Android, and Linux.

o Performance test: We have measured the parameters of concurrent session number, throughput performance.

3. Design and Deployment

3.1. Lab Test

The lab test topology is Figure 1

```
     +-----+  +-----+
     |Host1+--+ CE1 +------+                              ------
     +-----+  +-----+      |                          ////      \\\\
                         /-+--\      +----------+   //              \\
                       //      \\    |          |  |                  |
     +-----+  +-----+ |  IPv6    |   | MAP-T BR |  |  IPv4 Internet   |
     |Host2+--+ CE2 +-+ Network  +---|          +--+                  |
     +-----+  +-----+  \\      //    |          |   \\              //
                         |---+/      +----------+     \\\\      ////
                         |   |                            ------
     +-----+  +-----+    |   |
     |Host3+--+ CE3 +----+   |
     +-----+  +-----+        |                            ------
                             |                        ////      \\\\\
                             |                      |/                |
                             +----------------------+  IPv6 Internet  |
                                                    |                 |
        CEs are connted to the                      |\               /
        IPv6 Network via BRAS                         \\\\      /////
        (PPPoE and DHCPv6)                                ------
```

Figure 1: MAP-T Lab Test

3.2. Field Trial

The deployment model of MAP-T in operational network is depicted in Figure 2

```
       ----             -----
     //    \\         //     \\         ---------              --------
    /        \       /         \      //         \\         //  CPN
   |         +-----+            +----+             \       /   --------
   |         |     |   Metro    |BRAS|              |-----|--End System
   | Backbone|Core |   Area     |/SR |   Access     |     |    --------
   | Network |Route|  Network   +----+   Network    | CPE |    --------
   |         |     |            |AAA |              |-----|--End System
   |         +-----+            +----+             /    |  \   --------
    \        /       \          /      \\         //    |   \\
     \\    //         \\      //         --------       |     ---------
       ----            ----|--                          |
                           |                            |
    -----------------|     |      |----------------|    |    |---------|
                      \    |     /                  \   |    /          |
                       \---|--- /                    \--|--/            |
        IPv6/IPv4      | MAP-T  |       IPv6-only    |MAP-T| IPv6/IPv4  |
         Internet      |   BR   |        Network     |  CE |  Network   |
                      / ------- \                   / ----- \           |
                     /           \                 /         \          |
    ----------------|             |----------------|          |--------|
```

Figure 2: MAP-T Field Trial

4. Observations and Experiences

4.1. Effects on End-User

- o MAP-T can support all IPv4 applications, sam as NAT44.

- o MAP-T can support a variety of Operating Systems.

- o With the ratio of 128 (512 maximum concurrent sessions), there is no perceived degradation of customer experience.

4.2. Effects on Internal Staff

- o MAP-T can have good scalability. MAP-T BR does not need to maintain any session state, and only limited session states have to been maintained in CE for its customer.

- o MAP-T can be deployed in an incremental way.

o MAP-T supports DHCPv6-PD and PPPoE user authentication and the function of the source address trace back.

4.3. Effects on Business

MAP-T can help to promote IPv6 business and to use public IPv4 address more effectively..

5. Summary: Post-mortem Report

MAP-T is a useful tool for IPv6 transition for large scale SPs.

5.1. Deviations from IETF Documents

The IETF RFCs for the testing and field trial are [RFC7597], [RFC7599], [RFC7598] and [I-D.ietf-softwire-map-deployment]

6. IANA Considerations

This specification does not require any IANA actions.

7. Security Considerations

There are no other special security considerations.

8. Acknowledgements

9. References

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