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**Motivation for developing Stateless Automatic IPv4 over IPv6
Encapsulation / Decapsulation Technology (SA46T)
draft-matsuhira-sa46t-motivation-03**

Abstract

This document describe a motivation for developing IPv4 over IPv6 encapsulation / decapsulation solution from standing position of Stateless Automatic IPv4 over IPv6 Encapsulation / Decapsulation Technology (SA46T) and SA46T with address sharing (SA46T-AS).

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 describe a motivation for developing IPv4 over IPv6 encapsulation / decapsulation solution from standing position of Stateless Automatic IPv4 over IPv6 Encapsulation / Decapsulation Technology (SA46T)[I-D.[draft-matsuhira-sa46t-spec](#)] and SA46T with address sharing (SA46T-AS)[I-D.[draft-matsuhira-sa46t-as](#)].

2. Recongition of IPv6 Transtion stage

2.1. Stages of IPv6 Transition

There is an idea that divited the transiton from IPv4 to IPv6 into three stages, early stage, middle stage and end stage. In early stage, majority of the Internet are based on IPv4, so IPv6 over IPv4 tunneling technologies are considered to be useful. In middle stage, majority of the Internet are based on Dual Stack (Both IPv4 and IPv6), so both IPv4 and IPv6 will treat as is, and no major tunneling technologies are considered to be use. In end stage, majority of the Internet are based on IPv6, so IPv4 over IPv6 tunneling technologies are considered to may be useful as option, because dual stack based operation still effective in end stage.

It seems that a lot of people should have thought that the majority of transiton to IPv6 are completed before the IPv4 address exhaustion. In this recognition, IPv4 over IPv6 tunneling solution is not indispensable, but is some operational option, exclude artifical made IPv6 only network.

2.2. IPv4 address exhaustion

The IPv4 address exhaustion already became the real.

In 03-Feb-2011, IANA Unallocated Address Pool was exhausted. And in 19-Apr-2011, APNIC unallocated address pool was exhausted. Other RIRs, unallocated address pool does not exhausted now, however, it should be a matter of time. For more details, please refer to IPv4 address report , <http://www.potaroo.net/tools/ipv4/>.

The IPv4 address exhaustion has already become the reality. That mean that the environment of IPv6 only also becomes the reality, too.

2.3. Current stage of IPv6 Transition

When paying attention to IPv6 traffic, current stage of IPv6 transiton should be very very early stage, however IPv4 address exhaustion is the reality.

It should be recognized that a big gap is caused between the situation of IPv6 deployment and the situation of IPv4 address supply.

IPv4 is still majority now, and there are few IPv6 environment except research networks. It is not easy to change from IPv4 to IPv6 suddenly especially servers or services. That mean, IPv4 address still required for continuance of current IPv4 service with necessary minimum enhancing.

3. Motivation of developing SA46T and SA46T-AS

The IPv4 traffic is generated by the IPv4 host. On the other hand, in general, to carry the IPv4 traffic, the IPv4 routing function is necessary. However, if the IPv4 over IPv6 tunneling technology is used, it is enough by the IPv6 routing function.

Following are the motivation of developing SA46T.

- o Develop simple and scalable IPv4 over IPv6 encapsulation / decapsulation technology.
- o Enable single stack operation by IPv6 in the backbone network.
- o Can collect the IPv4 global address from where it is not indispensable, and reallocate the IPv4 global address to where it is indispensable.
- o Can still use IPv4 address (both global and private) with access environments is IPv6 only.
- o Support IPv4 address reuse and IPv4 address sharing if necessary.
- o Can deploy to IPv6 in stub network with their own peace

4. Design goal

4.1. Can install into existing network

The IPv4 address can be collected only from an existing network where the IPv4 address is used. Therefore, it is necessary to be able to install it into an existing network.

Of course, It is possible to use it even on a new network.

4.2. Less tunnel configuration

In a existing tunnel technique, the configuration of N^2 piece is needed for number N of tunnels end points connecting for full mesh topology. When N is small, it is not a problem, however when N is large, many many configuration required, then reality disappear. It cannot be considered the technology with the scalability.

The achievement of the scalability is require for really use from small network to large network. This mean technolohy require less configuration.

4.3. Simple install strategy

In general, the tunnel technique is a technology that makes a virtual link between two arbitrary interfaces. Flexibility is very high. However, such flexibility may causes the recursive tunnelung (tunnel in tunnel), and cause the difficulties for management and the trouble shooting.

It is thought that this flexiblity make difficultly for large-scale development. That mean simple install strategy is required for avoiding such problems.

4.4. Can treat both IPv4 Global and IPv4 Privates

For applying backbone networks, it should treat stub network which used not only IPv4 global address but also IPv4 private address. Moreover, it should treat many networks which use IPv4 private address. It means it is unaffected in the reused address, or non gloablly unique address.

Moreover, it should not depend with the range of IP address. That mean it should be no dependence with the addresses used in stub networks.

4.5. Can install into varius networks

It is preferable to be able to apply widely.

For example, it should apply access network, backbone network, data-center network, enterprise network, etc. Moreover, It has no dependency with Layer two technology, such as wire and wireless.

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 consideration does not discussed in this memo.

7. Acknowledgements

SA46T implementation was tested in Fujitsu, WIDE camp network in September 2010, and NICT JGN2Plus testbed in February 2011. And SA46T was demonstrated at Interop 2011 Tokyo in June 2011.

The author would like to thank all the people who assist, support and help above tests and demonstration, especially WIDE camp network team, NICT JGN2Plus / JGN-X team, Interop Shownet NOC team and in Fujitsu.

Originally, SA46T is an abbreviation for "Stateless Automatic IPv4 over IPv6 Tunneling". Now, SA46T is an abbreviation for "Stateless Automatic IPv4 over IPv6 Encapsulation / Decapsulation Technology". This change was made in response to the indication from the software WG chair at 4th software interim meeting in September 2011.

8. References

8.1. Normative References

- [I-D.[draft-matsuhira-sa46t-as](#)]
Matsuhira, N., "Stateless Automatic IPv4 over IPv6 Tunneling with IPv4 Address Sharing", January 2013.
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