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464XLAT: Combination of Stateful and Stateless Translation
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Abstract

This document describes a method (464XLAT) for IPv4 connectivity across IPv6 network by combination of stateful translation and stateless translation. This 464XLAT method is applicable to the access network.

Status of this Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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This Internet-Draft will expire on April 18, 2012.

Table of Contents

1. Introduction

On the 3rd of Feb 2011, IANA unallocated IPv4 address pool was exhausted. And each RIR unallocated IPv4 address pool will be exhausted in the near future. In this situation, it will be difficult for most ISPs to assign IPv4 global address to end users. This means the IPv4 Internet can not be scaling up in a conventional way.

This document describes an IPv4 over IPv6 Translating solution as one of the measures of IPv4 address exhaustion and encouragement of IPv6 deployment.

This method (464XLAT) in this document is using twice IPv4/IPv6 translation standardized in [RFC6145] and [RFC6146]. It does not need DNS64 [RFC6147] technology for the purpose of providing IPv4 over IPv6 service by this method. Therefore, we can reach IPv4 single stack hosts that can not be resolved in DNS, for example, the IPv4 hosts without A Resource Record. And, it is capable in providing IPv4/IPv6 translation service once, which will be needed in the future. This feature is one of the advantages, because this can be an encouragement to gradually transition to IPv6.

In conclusion, this method is a combination of existing technologies and a use case of service provided for Internet access service providers.

2. 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 [RFC2119].

3. Terminology

PLAT: PLAT is Provider side translator(XLAT). A stateful translator complies with [RFC6146] that performs 1:N translation. It translates global IPv6 address to global IPv4 address, and vice versa.

CLAT: CLAT is Customer side translator(XLAT). A stateless translator complies with [RFC6145] that performs 1:1 translation. It algorithmically translates private IPv4 address to global IPv6 address, and vice versa. It has also IPv6 router function that can forward IPv6 packet for IPv6 hosts in end-user network. And furthermore, it has DNS Proxy

function with IPv6 transport that provides name resolution for IPv4 hosts and IPv6 hosts in end-user network. It does not need DNS64 [RFC6147] and ALG. It is a simple and reasonable implementation.

4. Network Architecture

464XLAT method is shown in the following figure.

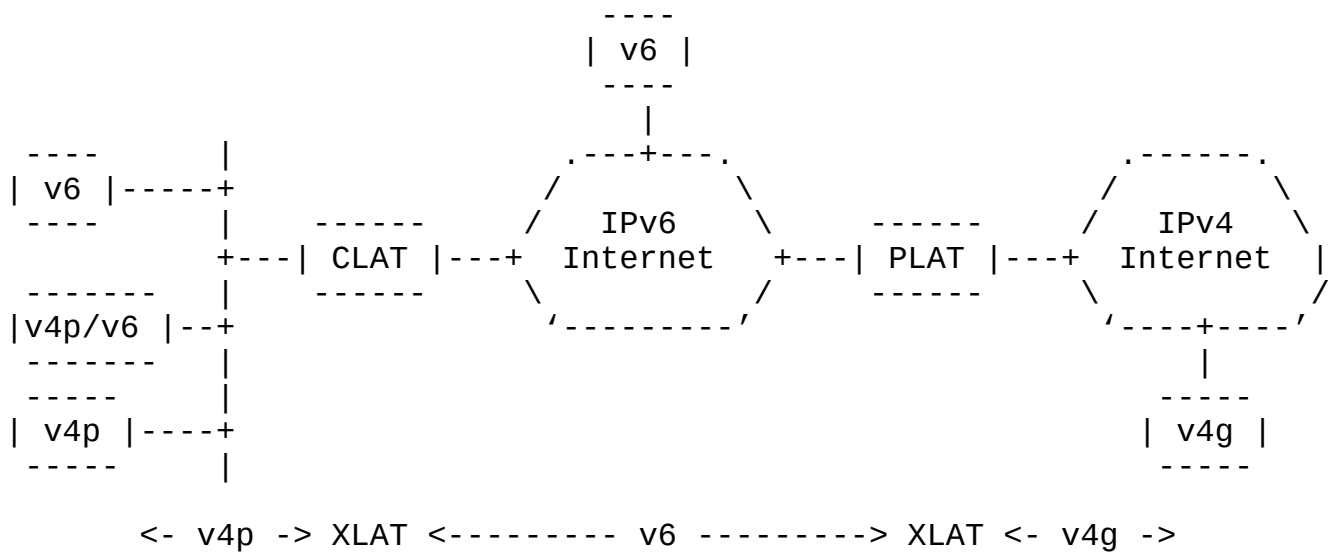


Figure 1: Network Topology

5. Applicability

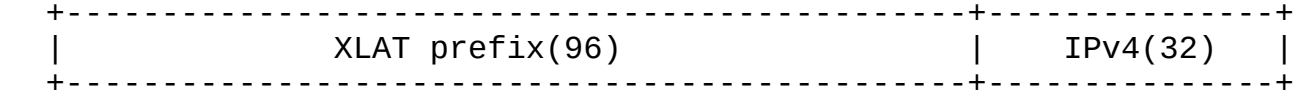
When ISP has IPv6 access network infrastructure and 464XLAT, ISP can provide IPv4 service to end users.

If the IXP or another provider operates the PLAT, all ISPs have to do is to deploy IPv6 access network. All ISPs do not need IPv4 facilities. They can migrate quickly their operation to an IPv6-only environment. Incidentally, Japan Internet Exchange(JPIX) is providing 464XLAT trial service since July 2010.

6. Implementation Considerations

6.1. IPv6 Address Format

IPv6 address format in 464XLAT is presented in the following format.



IPv6 Address Format for 464XLAT

Source address and destination address have IPv4 address embedded in the low-order 32 bits of the IPv6 address. The format is defined in Section 2 of [RFC6052]. However, 464XLAT does not use the Well-Known Prefix "64:ff9b::/96".

6.2. DNS Proxy Implementation

CLAT perform DNS Proxy for IPv4 hosts and IPv6 hosts in end-user network. It MUST provide name resolution with IPv6 transport. It does not need DNS64 [RFC6147] function.

6.3. IPv6 Fragment Header Consideration

In the 464XLAT environment, the PLAT and CLAT SHOULD include an IPv6 Fragment Header, since IPv4 host does not set the DF bit. However, the IPv6 Fragment Header has been shown to cause operational difficulties in practice due to limited firewall fragmentation support, etc. Therefore, the PLAT and CLAT may provide a configuration function that allows the PLAT and CLAT not to include the Fragment Header for the non-fragmented IPv6 packets. At any rate, both behaviors SHOULD match.

6.4. Auto Prefix Assignment

Source IPv6 prefix assignment in CLAT is via DHCPv6 prefix delegation or another method. Destination IPv6 prefix assignment in CLAT is via some method. (e.g., DHCPv6 option, TR-069, DNS, HTTP, etc.)

7. Deployment Considerations

Even if the Internet access provider for consumers is different from the PLAT provider (another Internet access provider or Internet exchange provider, etc.), it can implement traffic engineering independently from the PLAT provider. Detailed reasons are below.

1. The Internet access provider for consumers can figure out IPv4 source address and IPv4 destination address from translated IPv6 packet header, so it can implement traffic engineering based on IPv4 source address and IPv4 destination address (e.g. traffic monitoring for each IPv4 destination address, packet filtering, for each IPv4 destination address, etc.). The Tunneling method don't have such a advantage, without any deep packet inspection for decapsulating tunnel packets.

2. If the Internet access provider for consumers can assign IPv6 prefix greater than /64 for each subscriber, this 464XLAT method can separate IPv6 prefix for native IPv6 packets and XLAT prefix for IPv4/IPv6 translation packets. Accordingly, it can identify the type of packets ("native IPv6 packets" and "IPv4/IPv6 translation packets"), and implement traffic engineering based on IPv6 prefix.

And this 464XLAT method have two capabilities. One is a IPv6 -> IPv4 -> IPv6 translation for sharing IPv4 global addresses, another is a IPv4 -> IPv6 translation for reaching IPv6 only servers from IPv4 only clients that can not support IPv6. IPv4 only clients will remain for a while.

8. Security Considerations

To implement a PLAT, see security considerations presented in Section 5 of [RFC6146].

To implement a CLAT, see security considerations presented in Section 7 of [RFC6145]. And furthermore, the CLAT SHOULD perform Bogon filter, and SHOULD have IPv6 firewall function as a IPv6 router. It is useful function for native IPv6 packet and translated IPv6 packet. The CLAT SHOULD check IPv6 packet received from WAN interface. If the packet is invalid prefix (i.e., it is not XLAT prefix), then SHOULD silently drop the packet. In addition, the CLAT SHOULD check IPv4 packet after the translation. If the packet is not match private IPv4 address of LAN, then SHOULD silently drop the packet.

9. IANA Considerations

This document has no actions for IANA.

10. Acknowledgements

The authors would like to thank JPIX NOC members for their helpful

comments.

11. References

11.1. Normative References

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