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Stateless Source Address Mapping for ICMPv6 Packets
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Abstract

A stateless IPv4/IPv6 translator may receive ICMPv6 packets containing non IPv4-translatable addresses as the source that should be passed across the translator as an ICMP packet directed to the the IPv4-translatable destination. This document discusses the considerations and the stateless address mapping algorithms for source address translation in ICMPv6 headers for such cases.

Status of this Memo

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

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This Internet-Draft will expire on May 17, 2012.

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1. Introduction

The IP/ICMP translation document of IPv4/IPv6 translation [RFC6145] states that "the IPv6 addresses in the ICMPv6 header may not be IPv4-translatable addresses and there will be no corresponding IPv4 addresses represented of this IPv6 address. In this case, the translator can do stateful translation. A mechanism by which the translator can instead do stateless translation is left for future work." This document defines such a stateless translation mechanism.

2. Notational Conventions

The key words MUST, MUST NOT, REQUIRED, SHALL, SHALL NOT, SHOULD, SHOULD NOT, RECOMMENDED, MAY, and OPTIONAL, when they appear in this document, are to be interpreted as described in [RFC2119].

3. Problem Statement and Considerations

When a stateless IPv4/IPv6 translator receives an ICMPv6 message (for example "Packet Too Big") sourced from an non-IPv4-translatable IPv6 address, directed to an IPv4-translatable IPv6 address, it needs to generate an ICMP message. For the reasons discussed below, choosing the source IPv4 address of this ICMP message is problematic.

The address used should not cause the ICMP packet to be a candidate for discarding, particularly in the contest of uRPF filters [RFC3704]. This consideration precludes the use of private IPv4 address space [RFC1918] in this context.

It is also a consideration that the IPv4/IPv6 translation is intended for use in contexts where IPv4 addresses may not be readily available, so it is not considered to be appropriate to use IPv4-translatable IPv6 addresses for all internal points in the IPv6 network that may originate ICMPv6 messages.

It is also an objective that it is possible for the IPv4 recipient of the ICMP message be able to distinguish between different IPv6 ICMPv6 originations (for example, to support a traceroute diagnostic utility that provides some limited network level visibility across the IPv4/IPv6 translator). This implies that a IPv4/IPv6 translator needs to have a pool of IPv4 addresses to be used for mapping the source address of ICMPv6 packets generated from different originations.

These addresses are for use in the source address of ICMP packets, and therefore are not intended to be used as a destination address for any packet. It is therefore possible to use a common address

pool for the IPv4/IPv6 translation protocol, and, considering an objective of constraining the use of these IPv4 addresses in this application, it is feasible to use a common address pool for mapping the source addresses of non-translatable ICMPv6 packets as a part of the protocol specification.

These considerations leads to the recommendation of drawing an IPv4 /24 prefix from the IANA Special Purpose Address Registry as a "Well-Known Prefix" for use by IPv4/IPv6 translators for the purpose of mapping otherwise untranslatable IPv6 source addresses of ICMPv6 messages to IPv4 ICMP messages.

4. Routing Considerations

Addresses from the assigned address prefix are intended to be used as source addresses and not as destination addresses in the context of the public network. As packets passing through the public network need to pass through conventional packet filters, including uRPF filters [RFC3704], this implies that the assigned address may be used in routing advertisements. Such routing advertisements are non-exclusive and should be accepted from any originating AS in an anycast fashion.

5. Possible Stateless Address Mapping Algorithms

When an IPv4 /24 prefix is allocated to represent the source address of ICMP, the Last Octet can be generated using one of the following algorithms.

- The translator can randomly generates the Last Octet of the /24 prefix for different non IPv4-translatable addresses. However, in this case the translator may need to maintain states to ensure same non IPv4-translatable IPv6 address maps to same IPv4 address.

- The translator can copy the "Hop Count" in the IPv6 header of the ICMPv6 to the Last Octet. Routers typically emit ICMPv6 packets with the same hop count, thus as the ICMPv6 packet is routed through the network its hop count is decreased. However, if the routers emit ICMPv6 packets with different hop counts, it may give the appearance of a routing loop to tools such as traceroute. That minor side-effect in that particular case cannot be avoided while still being stateless.

- Hashing of the IPv6 address to generate a 8 bit value which will be used to generate the last octet. In this case, there is no need to maintain expensive states, except hashing table which

should be simple with minimal memory usage and consume minimal CPU cycles. If the hashing function is good and there are limited number of IPv6 routers (< 256) on the IPv6 side of the network, we will get unique IPv4 addresses to map the addresses of the IPv6 routers with O(1) lookup.

The selection of the algorithm SHOULD be a configuration function in the IPv4/IPv6 translator.

6. Security Considerations

The use of an address for source addresses in ICMP packets is considered "safe" in so far as ICMP packets are not intended to generate responses directed to the source address.

However it is possible to use this address as a means of gaining anonymity when launching a denial of service attacks by using this address as the source address for other forms of malicious traffic. Packet firewall filters should be configured to treat addresses in the IANA-assigned /24 network as martian addresses by discarding all non-ICMP packets that use the IANA-assigned /24 network as a source address, and all packets that use the IANA-assigned /24 network as a destination address.

7. IANA Considerations

IANA is requested to make a permanent assignment of a /24 from the IPv4 Special Purpose Address Registry [RFC5736]. The assigned address is to be used in the context of generating an IPv4 source address for mapped ICMPv6 packets being passed through a stateless IPv4/IPv6 translator. The assignment is under the category of a specialized use of a designated address block in an anycast context associated with an Internet Standards Track protocol.

The IANA IPv4 Special Purpose Address Registry records are:

- Prefix 192.70.192.0/24
- Description: To be used in the context of generating an IPv4 source address for mapped ICMPv6 packets being passed through a stateless IPv4/IPv6 translator.
- Begin: 2011-06-01
- End: Never

- Purpose: Stateless ICMPv6/ICMP translation
- Contact: See RFC
- Scope: Addresses from the assigned address prefix are intended to be used as source addresses and not as destination addresses in the context of the public network.
- RFC: This draft.

8. Acknowledgments

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9. References

9.1. Normative References

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[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

[RFC3704] Baker, F. and P. Savola, "Ingress Filtering for Multihomed Networks", BCP 84, RFC 3704, March 2004.

[RFC6145] Li, X., Bao, C., and F. Baker, "IP/ICMP Translation Algorithm", RFC 6145, April 2011.

9.2. Informative References

[RFC5736] Huston, G., Cotton, M., and L. Vegoda, "IANA IPv4 Special Purpose Address Registry", RFC 5736, January 2010.

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