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Simple Source Address Selection for IPv6

Status of this Memo

1. Abstract

This document describes a simple algorithm by which IPv6 implementations can choose an appropriate source address to use for communication with a specified destination address.

2. Conventions used in this document

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 [2].

3. Introduction

The IPv6 addressing architecture [3] allows multiple unicast addresses to be assigned to interfaces. These addresses may have different reachability scopes (link-local, site-local, or global). Furthermore, these addresses may be "preferred" or "deprecated" [4.

On occasion, an IPv6 implementation must choose from a set of available addresses an appropriate source address to use for a given destination address. This document specifies a simple set of rules for choosing a source address of appropriate scope and configuration status (preferred or deprecated). Furthermore, this document suggests a preferred method, longest matching prefix, for choosing among otherwise equivalent source addresses in the absence of better information.

This document does not address the more general problem of choosing the "best" destination address / source address pair for communication with another node, given a set of possible destination addresses and a set of possible source addresses.

The rules specified in this document MUST NOT be construed to override an application or upper-layer's explicit choice of source address.

4. Source Address Selection

This document specifies source address selection in two steps. First, it specifies a set of candidate source addresses for a given destination address. Second, it specifies a pair-wise source address selection algorithm. Given a destination address and a pair of possible source addresses SA and SB (SA not equal to SB), it chooses a source address. Obviously, the pair-wise algorithm may be extended to select an address from the set of candidate source addresses.

4.1 Multicast Scopes

Multicast destination addresses have a 4-bit scope field that controls the propagation of the multicast packet. The IPv6 addressing architecture defines scope field values for node-local (0x1), link-local (0x2), site-local (0x5), organization-local (0x8), and global (0xE) scopes.

Application of the source address selection algorithm to a multicast destination address requires the comparison of a unicast source address scope with a multicast destination address scope. We map unicast link-local to multicast link-local, unicast site-local to multicast site-local, and unicast global scope to multicast global scope. For example, unicast site-local is equal to multicast site-local, which is smaller than multicast organization-local, which is smaller than unicast global, which is equal to multicast global.

This mapping implicitly conflates unicast site boundaries and multicast site boundaries.

4.2 Candidate Source Addresses

It is RECOMMENDED that the candidate source addresses be the set of unicast addresses assigned to the interface that will be used to send to the destination. (The "outgoing" interface.)

For multicast and link-local destination addresses, the set of candidate source addresses MUST only include addresses assigned to the outgoing interface.

For site-local destination addresses, the set of candidate source addresses MUST only include addresses assigned to interfaces belonging to the same site as the outgoing interface.

In any case, anycast and multicast addresses MUST NOT be included in the candidate set.

4.3 Pair-Wise Source Address Selection

The algorithm consists of four rules, which MUST be applied in order. If a rule chooses a source address, then the remaining rules are not relevant and MUST be ignored. Subsequent rules act as tie-breakers for earlier rules. If the four rules fail to choose a source address, some unspecified tie-breaker MUST be used.

Rule 1: If one of the source addresses is equal to the destination address, an implementation MUST choose that source address.

Rule 2: If the source addresses SA and SB have different scope, then an implementation MUST choose the source address as follows. Without loss of generality, assume that SA has smaller scope than SB. If SA's scope is smaller than the destination address scope, then choose SB. Otherwise, if one of the source addresses is "preferred" and one of them is "deprecated", then choose the "preferred" address. Otherwise, choose SA.

Rule 3: The two source addresses have the same scope. If one of the source addresses is "preferred" and one of them is "deprecated", an implementation MUST choose the one that is preferred.

Rule 4: The two source addresses have the same scope and the same configuration status (both preferred or both deprecated). If one of the source addresses has a longer prefix matching the destination address, an implementation SHOULD choose the source address with the longer matching prefix.

The fourth rule MAY be superceded if the implementation has other means of choosing among source addresses. For example, if the implementation somehow knows which source address will result in the

"best" communications performance.

5. IPv4-Compatible Addresses and Other Format Prefixes

For the purposes of this document, IPv4-compatible addresses have global scope and "preferred" configuration status.

Similarly, NSAP addresses, IPX addresses, or addresses with as-yet-undefined format prefixes should be treated as having global scope and "preferred" configuration status. Later standards may supercede this treatment.

The loopback address should be treated as having node-local scope and "preferred" configuration status.

6. Security Considerations

This document has no direct impact on Internet infrastructure security.

7. References

1 S. Bradner, "The Internet Standards Process -- Revision 3", BCP 9, RFC 2026, October 1996.

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

3 R. Hinden, S. Deering, "IP Version 6 Addressing Architecture", RFC 2373, July 1998.

4 S. Thompson, T. Narten, "IPv6 Stateless Address Autoconfiguration", RFC 2462 , December 1998.

8. Acknowledgments

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10. Changes from 00 to 01

Minor wording changes because DHCPv6 also supports "preferred" and "deprecated" addresses.

Specified treatment of other format prefixes; now they are considered global scope, "preferred" addresses.

Reiterated that anycast and multicast addresses are not allowed as source addresses.

Recommended that source addresses be taken from the outgoing interface. Required this for multicast destinations. Added analogous requirements for link-local and site-local destinations.

Specified treatment of the loopback address.

Changed the second selection rule so that if both candidate source addresses have scope greater or equal than the destination address and only of them is preferred, the preferred address is chosen.

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