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Allocation Guidelines for IPv6 Multicast Addresses

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Abstract

This document specifies guidelines that must be implemented by any entity responsible for allocating IPv6 multicast addresses. This includes, but is not limited to, any documents or entities wishing to assign permanent IPv6 multicast addresses, allocate dynamic IPv6 multicast addresses, and define permanent IPv6 multicast group identifiers. The purpose of these guidelines is to reduce the probability of IPv6 multicast address collision, not only at the IPv6 layer, but also at the link-layer of media that encode portions of the IP layer address into the MAC layer address.

Table of Contents

1. Terminology

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].

The term "group ID", throughout this document, conforms to the definition contained in [UNIMCAST], that is, the low-order 32 bits of the IPv6 multicast address.

2. Introduction

This document specifies guidelines that MUST be implemented by any entity responsible for allocating IPv6 multicast addresses. This includes, but is not limited to, any documents or entities wishing to assign permanent IPv6 multicast addresses, allocate dynamic IPv6 multicast addresses, and define permanent IPv6 multicast group identifiers. The purpose of these guidelines is to reduce the probability of IPv6 multicast address collision, not only at the IPv6 layer, but also at the link-layer of media that encode portions of the IP layer address into the link-layer address.

With the current IPv6 address architecture [ADDRARCH] and the extension to the multicast address architecture specified in [UNIMCAST], a set of guidelines is needed for entities assigning any flavor of IPv6 multicast addresses.

The current approach of several physical media [RFC 2464][RFC 2467] is to map a portion of the IPv6 multicast address into a link-layer destination address. This is accomplished by taking the low order 32

bits (henceforth called the group ID) of the IPv6 multicast address and including them in the link-layer destination address. Group IDs, less than or equal to, 32 bits long will generate unique link-layer addresses within a given multicast scope.

These guidelines specify how the group ID of the IPv6 multicast address are chosen and assigned. The guidelines specify several mechanisms that can be used to determine the group ID of the multicast address, based on the type of allocation being done.

3. Applicability

These guidelines are designed to be used in any environment in which IPv6 multicast addresses are delegated, assigned, or selected. These guidelines are not limited to use by MADCAP [RFC 2730] servers. The following is a non-exhaustive list of applications of these guidelines:

- Source-specific multicast application servers can generate an SSM group address by generating a 96-bit multicast prefix, as defined in [UNIMCAST] (i.e. FF3x::/96) and concatenating that with a group ID, as defined in this document.

- A MADCAP server allocates IPv6 multicast addresses conforming to section 2.7 of [ADDRARCH], creating the group ID using the rules defined in this document.

- Nodes supplying multicast services in a zeroconf environment generate multicast addresses without the need of centralized control.

- IANA can assign permanent multicast addresses to fulfill requests via the protocol standardization process.

4. Group ID Selection Guidelines

The Group ID selection process allows for three types of multicast address assignments. These are permanent IPv6 multicast addresses, dynamic IPv6 multicast addresses, and permanent IPv6 multicast group IDs. The following guidelines assume that the prefix of the multicast address has been initialized according to [ADDRARCH] or [UNIMCAST].

4.1 Permanent IPv6 Multicast Addresses

Permanent multicast addresses, like those defined in [RFC 2375], are allocated by IANA. These addresses will be assigned with group ID's, in the range of 0x00000001 to 0x3FFFFFFF, on an Expert Review basis.

Multicast addresses assigned by IANA MUST have the T bit set to 0 and the P bit set to 0.

4.2 Permanent IPv6 Multicast Group Identifiers

Permanent group IDs allow for a global identifier of a particular service (e.g. Network Time Protocol (NTP) being assigned the group ID 0x40404040). The use of permanent group IDs differs from permanent multicast addresses in that a permanent group ID offers a global identifier for a service being offered by numerous servers.

As an example, consider the NTP example group ID of 0x40404040. An NTP client would be able to access multiple servers and multiple scopes. That is, the NTP client will know that the group ID 0x40404040 identifies an NTP multicast stream regardless of the upper 96 bits of the multicast address.

Permanent group IDs are allocated on an Expert Review basis, in the range 0x40000000 to 0x7FFFFFFF. These permanent group IDs are meant to be used in IPv6 multicast addresses, defined in [UNIMCAST].

4.3 Dynamic IPv6 Multicast Addresses

Dynamic IPv6 multicast addresses can be allocated by an allocation server or by an end-host. Regardless of the allocation mechanism, all dynamically allocated IPv6 multicast addresses MUST have the T bit set to 1. This will distinguish the dynamically allocated addresses from the permanently assigned multicast addresses, defined in [RFC 2375], at the link-layer on any media that maps the lower portion of the IPv6 multicast address into a link-layer address. It should be noted that the high-order bit of the Group ID will be the same value as the T flag.

As an example, the permanent IPv6 multicast address FF02::9 maps to an Ethernet group address of 33-33-00-00-00-09. A dynamically allocated IPv6 multicast address of FF32::8000:9 would map to the Ethernet group address 33-33-80-00-00-09.

4.3.1 Server Allocation

The allocation of IPv6 multicast addresses, by a server, is defined in [RFC 2730]. Address management is the responsibility of the allocation protocol and outside the scope of this document. Allocation servers MUST use the group ID range 0x80000000 to 0xFFFFFFFF.

4.3.2 Host Allocation

Host-based allocation allows hosts to self-select IPv6 multicast addresses. One example of host-based allocation is the Zeroconf Multicast Address Allocation Protocol [ZMAAPDOC]. Issues with collision detection, claim notification, etc. are outside the scope of this document and the responsibility of the protocol being used, such as [ZMAAPDOC].

The group ID portion of the address is created using either a pseudo-random 32-bit number or a 32-bit number created using the guidelines in [RFC 1750]. The generated group ID MUST fall in the range 0x80000000 to 0xFFFFFFFF. This can be accomplished by setting the high-order bit of the generated number to 1.

5. IANA Considerations

This document requests the creation of a new registry maintained by IANA. This new registry will maintain permanent group ID values. The premise of this new registry is to allow for permanent group IDs to be used across multiple domains utilizing the multicast address architecture defined in [UNIMCAST]. The permanent group IDs will fall in the range 0x40000000 to 0x7FFFFFFF.

In addition, this document also defines rules for the allocation of permanent IPv6 multicast addresses by IANA. These rules specify different ranges for multicast addresses that are IPv6-only and for IPv6 multicast addresses that have corresponding IPv4 multicast addresses.

Following the policies outlined in [RFC 2434]:

- Permanent IPv6 multicast addresses with corresponding IPv4 multicast addresses, like those defined in [RFC 2375], are allocated with group ID's in the range of 1 to 0x3FFFFFFF on an Expert Review basis, see Section 4.1.

- Permanent IPv6-only multicast addresses are allocated with group ID's in the range 0x100 to 0x3FFFFFFF on an Expert Review basis.
- Permanent group ID's are allocated on an Expert Review basis in the range 0x40000000 to 0x7FFFFFFF, see Section 4.2.
- The range 0x80000000 to 0xFFFFFFFF is reserved for use by dynamic multicast address allocation mechanisms, see Section 4.3.

All approved requests for a permanent IPv6 multicast address will result in the assignment of a unique group ID which shall be reserved in all valid IPv6 multicast scopes.

6. Security Considerations

The allocation mechanisms described in this document do not alter the security properties of either the Any Source or Source Specific multicast service models of IPv4 and IPv6.

The potential to allocate large blocks of addresses can lead to Denial-of-Service attacks. A more in-depth discussion of the security issues surrounding dynamic allocation of multicast addresses can be found in [RFC 2908].

7. Acknowledgements

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