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A Method for Generating Link-Scoped IPv6 Multicast Addresses

Status of This Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

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Abstract

This document specifies an extension to the multicast addressing architecture of the IPv6 protocol. The extension allows the use of Interface Identifiers (IIDs) to allocate multicast addresses. When a link-local unicast address is configured at each interface of a node, an IID is uniquely determined. After that, each node can generate its unique multicast addresses automatically without conflicts. The alternative method for creating link-local multicast addresses proposed in this document is better than known methods like unicast-prefix-based IPv6 multicast addresses. This memo updates RFC 3306.

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1. Introduction

This document defines an extension to the multicast portion of the IPv6 addressing architecture [RFC4291]. The current architecture does not contain any built-in support for dynamic address allocation. The extension allows for use of IIDs to allocate multicast addresses. When a link-local unicast address is configured at each interface of a node, an IID is uniquely determined. After that, each node can generate its unique multicast addresses automatically without conflicts. That is, these addresses could safely be configured at any time after Duplicate Address Detection (DAD) has completed.

This method for the link-local scope is preferred over unicast-prefix-based IPv6 multicast addresses [RFC3306], since by delegating multicast addresses using the IID, each node can generate its multicast addresses automatically without allocation servers. This method works better than the unicast-prefix-based method with applications in serverless environments such as ad-hoc and network mobility. This document restricts the usage of defined fields such as the scop, plen, and network prefix fields of [RFC3306]. Therefore, this document specifies encoded information for link-local scope in multicast addresses.

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].

2. Applicability

The allocation technique in this document is designed to be used in any environment in which link-local scope IPv6 multicast addresses are assigned or selected. This method goes especially well with nodes supplying multicast services in a zeroconf/serverless environment. For example, multicast addresses less than or equal to link-local scope are themselves generated by nodes supplying multicast services without conflicts. Also, hosts that are supplied multicast services from multicast servers then make multicast addresses of multicast servers using ND (address resolution) and well-known group IDs [RFC2461].

Consequently, this technique MUST only be used for link scoped multicast addresses. If you want to use multicast addresses greater than link-local scope, you need to use other methods as described in [RFC3306].

3. Link-Scoped Multicast Address Format

This document specifies a new format that incorporates IID in the link-local scope multicast addresses.

Figure 1 illustrates the new format for link-scoped multicast addresses.

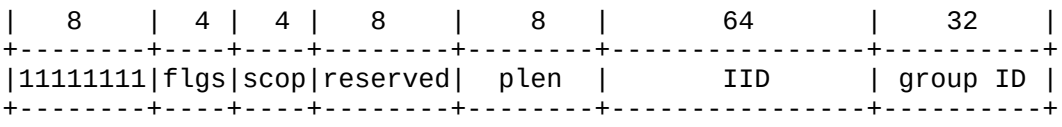

Figure 1. Link-Scoped Multicast IPv6 Address Format

The flgs, scop, and plen fields are used to identify whether an address is a multicast address, as follows:

1. flgs MUST be "0011".

2. scop MUST be <= 2.

3. The reserved field MUST be zero.

4. The "plen" field is a special value, "1111 1111" (decimal 255).

The IID field (replacing the 64-bit prefix field from [RFC3306]) is used to distinguish each node from others. Given the use of this method for link-local scope, the IID embedded in the multicast address MUST only come from the IID of the link-local unicast address on the interface after DAD has completed. That is, the creation of the multicast address MUST only occur after DAD has completed as part of the auto-configuration process.

Group ID is generated to indicate a multicast application and is used to guarantee its uniqueness only in the host. It may also be set on the basis of the guidelines outlined in [RFC3307].

4. Example

In an Ethernet environment, if the link-local unicast address is FE80::A12:34FF:FE56:7890, the link-scoped multicast prefix of the node is FF32:00FF:A12:34FF:FE56:7890::/96.

5. Consideration of Lifetime

Generally, link-scoped multicast addresses have no lifetime, because link-local unicast addresses also have no lifetime. However, this is not true in the mobile environment. Even though multicast addresses are created from the unique IIDs of unicast addresses, their useful lifetime is linked to the period during which the IID is known to be unique. Thus, conflict is possible between IIDs, due to a new node in merged network that uses the same IID as a powered node.

In this scenario, DAD also fails to guarantee uniqueness of the unicast address, but this document does not try to address this issue.

6. Security Considerations

The uniqueness of multicast addresses using this method is guaranteed by the DAD process. So, a secure DAD process is needed for stability of this method. This document proposes the mechanism in [RFC3041] for this purpose.

[RFC3041] describes the privacy extension to IPv6 stateless address autoconfiguration to configure the IID of non-link-local scope unicast addresses. [RFC3041] cannot be used for making a link-local unicast address, and hence it cannot be used to create an IID for link-scoped multicast address. However, as [RFC3041] does not protect the privacy of link-local unicast addresses, it does not seem to be required to protect the privacy of IID-based link-local multicast addresses.

7. Acknowledgements

We would like to thank Dave Thaler and Brian Haberman for their comments related to the consistency between the unicast prefix-based multicast document and this one. Special thanks are due to Erik Nordmark and Pekka Savola for valuable comments.

8. References

8.1. Normative References

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

[RFC2461] Narten, T., Nordmark, E., and W. Simpson, "Neighbor Discovery for IP Version 6 (IPv6)", RFC 2461, December 1998..ti 3

[RFC3041] Narten, T. and R. Draves, "Privacy Extensions for Stateless Address Autoconfiguration in IPv6", RFC 3041, January 2001.

[RFC3306] Haberman, B. and D. Thaler, "Unicast-Prefix-based IPv6 Multicast Addresses", RFC 3306, August 2002.

[RFC3307] Haberman, B., "Allocation Guidelines for IPv6 Multicast Addresses", RFC 3307, August 2002.

[RFC4291] Hinden, R. and S. Deering, "IP Version 6 Addressing Architecture", RFC 4291, February 2006.

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