          A Method for Generating Link-Scoped IPv6 Multicast Addresses

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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].

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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.

```
    |   8    | 4 | 4 |   8    |   8    |      64        |   32     |
    +--------+----+----+--------+--------+---------------+----------+
    |11111111|flgs|scop|reserved|  plen  |      IID      | group ID |
    +--------+----+----+--------+--------+---------------+----------+
```
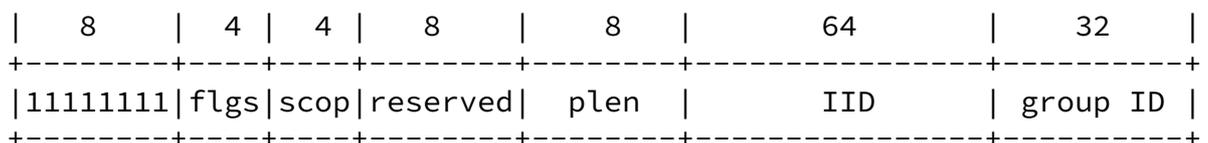
           Figure 1. Link-Scoped Multicast IPv6 Address Format

   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.

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
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              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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