                      MANET Local IPv6 Addresses
                    draft-jelger-autoconf-mla-01.txt

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Abstract

   This document defines how Unique Local IPv6 Unicast Addresses (RFC-
   4193) can be used in wireless mobile ad hoc networks (MANETs) as
   MANET Local IPv6 Addresses (MLAs). MLAs are intended to be used
   inside a MANET and are not expected to be routable on the global
   Internet. Each MANET router is expected to generate its MLA locally
   without any coordination with other MANET routers.

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1. Introduction

   This document defines a possible use of Unique Local IPv6 Unicast
   Addresses (ULAs)[1] as MANET Local IPv6 Addresses (MLAs) in wireless
   mobile ad hoc networks (MANETs). MLAs are intended to be used inside
   a MANET and are not expected to be routable on the global Internet.
   Each MANET router is expected to generate its MLA locally, i.e.
   without any coordination with other MANET routers.

   This extends the usage of ULAs to an extreme case where each MANET
   router is considered as being a site and subnet [1] by itself. In
   this particular case, routing is flat and MANET routers do not share
   a network prefix. This loose addressing model allows to use a large
   fraction of the upper 64-bit part of IPv6 addresses in order to
   create addresses that are sufficiently random to avoid the use of
   duplicate address detection schemes for intra-MANET communications.

2. Terminology

   This document employs the following terms (partly borrowed from [2]):

   Node
      Any device (router or host) which implements IP.

   MANET Router (MR)
      A router that engages in a MANET routing protocol. In certain
      scenarios, a MR may forward packets for hosts attached to it.

   Host
      Any node that is not a router, i.e. it does not forward
      packets addressed to others.

3. MANET Local IPv6 Addresses (MLAs)

3.1. Format

   Strictly speaking, MLAs have the same format as ULAs. The only
   difference with ULAs is that both the Global ID and Subnet ID fields
   are randomly generated: this results in a merged 56-bit field called
   the Random ID. To indicate this difference with ULAs, the L bit is
   set to 0. Hence in practise ULAs use FD00::/8 and MLAs use FC00::/8.

```
    | 8 bits  |         56 bits         |          64 bits          |
    +----------+-------------------------+---------------------------+
    | Prefix  |        Random ID        |        Interface ID       |
    +----------+-------------------------+---------------------------+
```
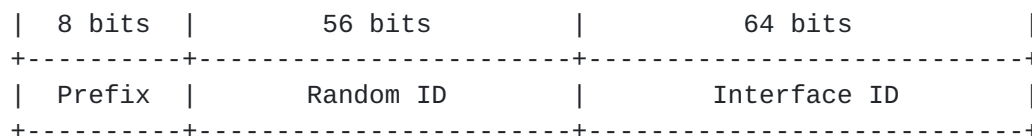
Where:

   Prefix   FC00::/8 prefix to identify MANET Local
                       addresses. (L bit of ULAs is set to 0).

   Random ID   56-bit random identifier used to create a
                       globally unique address.

   Interface ID   64-bit Interface ID as defined in [3].

3.2. Address generation

   To create an MLA for a given physical interface, a MANET router
   locally generates its Random ID in a random manner. The Random ID is
   used in addition to the Interface ID in order to create an address
   with a very high probability of uniqueness. Using 56 bits gives
   around 7.2e+16 possible values for the Random ID, hence drastically
   reducing the probability of an address collision if two routers
   having the same Interface ID generate the same Random ID.

   The probability of an address collision is further reduced by the use
   of EUI-64 identifiers as Interface IDs. EUI-64 that derive from
   EUI-48 (e.g. IEEE 802 48-bit MAC addresses) are indeed expected to
   be globally unique, while randomly generated identifiers [4] have an
   extremely low collision probability (around 1.8e+19 possible values).

   Given the network size currently being considered within the MANET
   community (a few hundred nodes), and given the extremely large
   randomness of MLAs, a node must not necessarily check whether a
   generated MLA is unique. The overhead of performing duplicate
   address detection (DAD) greatly superseeds its gain since the
   probability of address collisions is extremely low.

   Nevertheless, a passive DAD technique could be used in order to
   detect address collisions, eventhough such events are very unlikely
   to occur. This extra mechanism is however out of the scope of this
   document.

3.3. Address scope

   As Unique Local IPv6 Unicast Addresses, MANET Local Addresses have a
   global scope. However MLAs are not globally routeable, and their use
   is restricted inside a MANET. Since there does not exist any
   standardized definition of the boundaries of a MANET, we assume that
   the use of MLAs is restricted to the set of MANET nodes willing to
   route, send, and receive packets using MLAs. This assumes that a
   MANET routing protocol should always be willing to route packets
   whose source and/or destination addresses are MLAs.

4. Host configuration

If non-router hosts are attached to a MANET router, the MANET router
may advertise the upper 64 bits of its MLA (i.e. a /64 prefix) to its
attached hosts. This can be done via router advertisement messages
as in IPv6 stateless address autoconfiguration [5]. Each host
generates its MLA by appending an interface ID to the MLA prefix
advertised by the MANET router it is attached to. To allow
communications between hosts attached to different MANET routers,
MANET routers MUST exchange and use /64 routes.

Since the hosts attached to a given MANET router may not always be
able to directly communicate one with another (e.g. if they are out
of radio transmision range), the L bit of the Prefix Information
Option of the router advertisement message must be set to 0 to
indicate that the prefix is off-link (see page 30 of [6]). As a
result, hosts receiving the router advertisement message do not
create a subnet route (i.e. a /64 route) for the advertised prefix.
Hence two hosts attached to a given MANET router communicate by
default via the MANET router (as in 802.11 infrastructure mode).

5. Acknowledgements

The idea of using Unique Local IPv6 Addresses as MANET Local
Addresses has been originally discussed with a number of people
including Ryuji Wakikawa, Francisco Ros, Robert Hinden, Brian
Haberman and Guillaume Chelius. Therefore the author of this
document does not claim exclusive credit. Also note that the
formatting of this document is mostly inspired by [1].

Useful comments for version 00 of this draft have been given by Fred
Templin and Joe Macker. When possible, their suggestions have been
included in this new version. In particular, Fred Templin suggested
first that the L bit is set to 0.

6. References

[1]   Hinden, R. and B. Haberman, "Unique Local IPv6 Unicast
      Addresses", RFC 4193, October 2005.

[2]   Chakeres, I., Macker, J., and T. Clausen, "Mobile Ad Hoc Network
      Architecture", I-D draft-chakeres-manet-arch-00, July 2006.

[3]   Hinden, R. and S. Deering, "Internet Protocol Version 6 (IPv6)
      Addressing Architecture", RFC 3513, April 2003.

[4]   Narten, T. and R. Draves, "Privacy Extensions for Stateless

          Address Autoconfiguration in IPv6", RFC 3041, January 2001.

   [5]   Thomson, S. and T. Narten, "IPv6 Stateless Address
          Autoconfiguration", RFC 2462, December 1998.

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

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