6lo
Internet-Draft
Intended status: Standards Track
Expires: September 17, 2016

AR. Sangi
M. Chen
Huawei Technologies
C. Perkins
Futurewei

March 16, 2016

Designating 6LBR for IID Assignment
draft-rashid-6lo-iid-assignment-00

Abstract

In IPv6 Stateless Address Autoconfiguration (SLAAC), use of a random interface identifier (IID) is a common practice to promote privacy. If there are a very large number of nodes, as has been discussed in several use cases, the effect will to proportionately increase the number of IIDs. A duplicate address detection (DAD cycle) is needed for each configured IID, introducing more and more overhead into the network. Each failed DAD requires the initiating node to regenerate a new IID and undergo the DAD cycle again. This document proposes an optimized approach that requires 6LBR (6LoWPAN Border Router) to provide a unique IID, avoiding the potential duplication.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at http://datatracker.ietf.org/drafts/current/.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on September 17, 2016.

Copyright Notice

Table of Contents

1. Introduction

IPv6 addresses in SLAAC are formed by concatenating a network prefix, acquired from Router Advertisement (RA) messages, with a locally generated IID [RFC4862], [RFC2464]. Since the best method for generating IIDs depends on the nature of networks, none of the proposed mechanisms is considered a default mechanism [RFC4941], [RFC7217]. Using neighbour discovery (ND), the uniqueness of newly generated IID is verified [RFC6775]. 6LBR ensures the duplication detection, and replies with a status. A failed DAD would require the initiating 6LN (6LoWPAN Node) to regenerate an IID and undergo another DAD cycle, until either 6LN succeeds or reaches its maximum number of retries[RFC6775].

A locally generated IID can be derived from embedded IEEE identifier [RFC4941] or randomly (based on a few variables) [RFC7217]. MAC reuse is far common than assumed [RFC7217], and IIDs derived from MAC address are likely to cause more than the expected number of DAD failures. As soon as the 6LN generates an IID, it sends the NS (Neighbor Solicitation) message to 6LR (LLN Router) and 6LR proceeds with the address duplication request routine with 6LBR by sending an ICMPv6 based DAR (Duplicate Address Request) message. An LN sends out a NS after checking its local cache for duplication; before proceeding with DAR, the 6LR also protects against address

duplication within a locally maintained Neighbor Cache Entry (NCE) [RFC7217].

[RFC5548], [RFC5827] discuss use cases including huge numbers of nodes and vast scale networks. The arbitrary use of IIDs resolves the privacy concerns of participating node. A simple NS supposedly targeted to a very small group of nodes MAY ends-up polluting whole wireless bandwidth [I-D.vyncke-6man-mcast-not-efficient]. Multicast NS and NA are much more frequent in large scale radio environment with mobile devices [I-D.thubert-6lo-backbone-router]. Additionally, as the IIDs are periodically changed for privacy, the probability becomes high for a duplicate IIDs that would results in DAD failure and repeated cycles.

This document describes optimization to 6LoWPAN ND by enabling 6LBR to grant a unique IID for failed DAD.

2. Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119]. Additionally, this document uses terminology from [RFC6775], [RFC2464], [I-D.ietf-6man-default-iids], and [I-D.ietf-6man-ipv6-address-generation-privacy]. This document also uses the following terms:

RID: Random identifier.

PRF: Pseudo random function.

LSB: Least significant bit.

EDAC: Extended duplicate address confirmation.

EARO: Extended address registration option.

3. IID Assignment by 6LBR

MAC driven IIDs [RFC2464] reduce or eliminate the the need for DAD, but in practice such IID generation is discouraged ([I-D.ietf-6man-default-iids], [I-D.ietf-6man-ipv6-address-generation-privacy]), as common privacy concerns still persist, for instance:

o Network activity correlation,

o Location tracking,

o Address scanning, and

o Device-specific vulnerability exploitation.

Moreover, multiple approaches are proposed to suit different network constraints. Considering the scalability of a network and enabling 6LBR to suggest an IID, this draft proposes another IID generating [RFC7217] approach to support periodically changing IIDs.

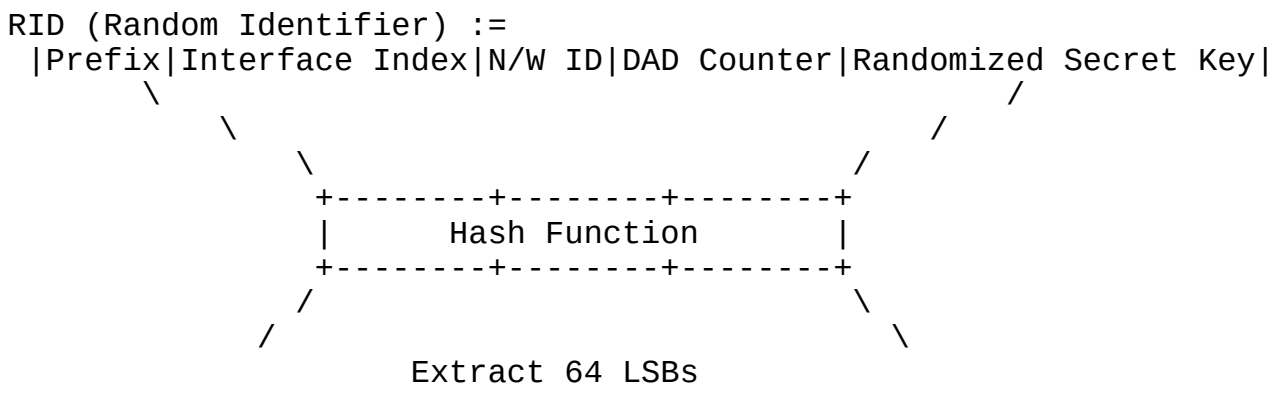

Figure 1: Using RFC7217 to generate IID

In case DAD fails, the 6LBR will use public values for Prefix, Interface Index, and Network ID; the remaining two variables (DAD Counter, Randomized Private Key) are local values. Neighbor solicitation using link-local address cannot be avoided, but only the newly generated IID needs to be passed on to LN (by way of relevant 6LR).

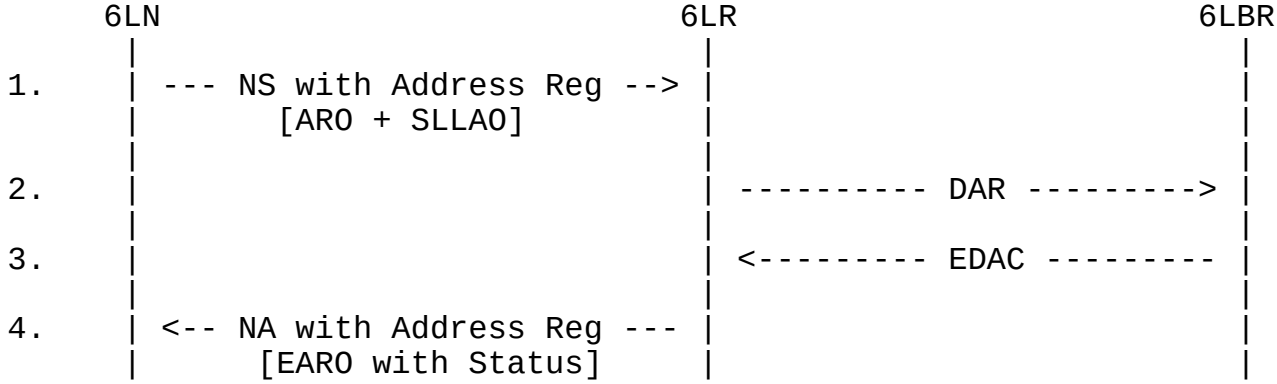

Figure 2: DAD cycle when 6LBR generates an IID

The Approach in this draft is of reactive nature rather than proactive. 6LBR only replies with locally generated IID when DAD fails.

3.1. Extended Confirmation Message

The Prefix is the same throughout each LoWPAN network. This draft extends the DAC:

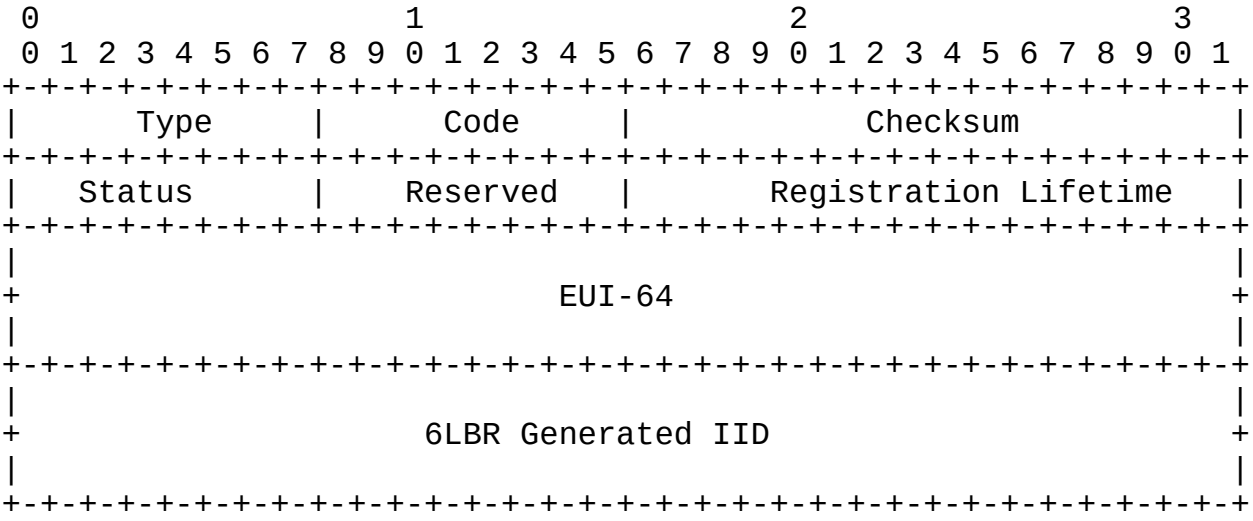

Figure 3: Extended Duplication Address Confirmation

The fields are similar to DAC in [RFC6775] except:

Type: 159

6LBR Generated IID: 64 bit IID generated by 6LBR.

3.2. Extended Address Registration Option

ARO and EARO can ONLY be initiated by host and 6LR, respectively. [RFC6775] expects the reply of a host initiated ARO from 6LR with same ARO except the changed status bit to indicate the duplication result. EARO is introduced in this document and 6LR can send out this option if it receives EDAC instead of DAC from 6LBR.

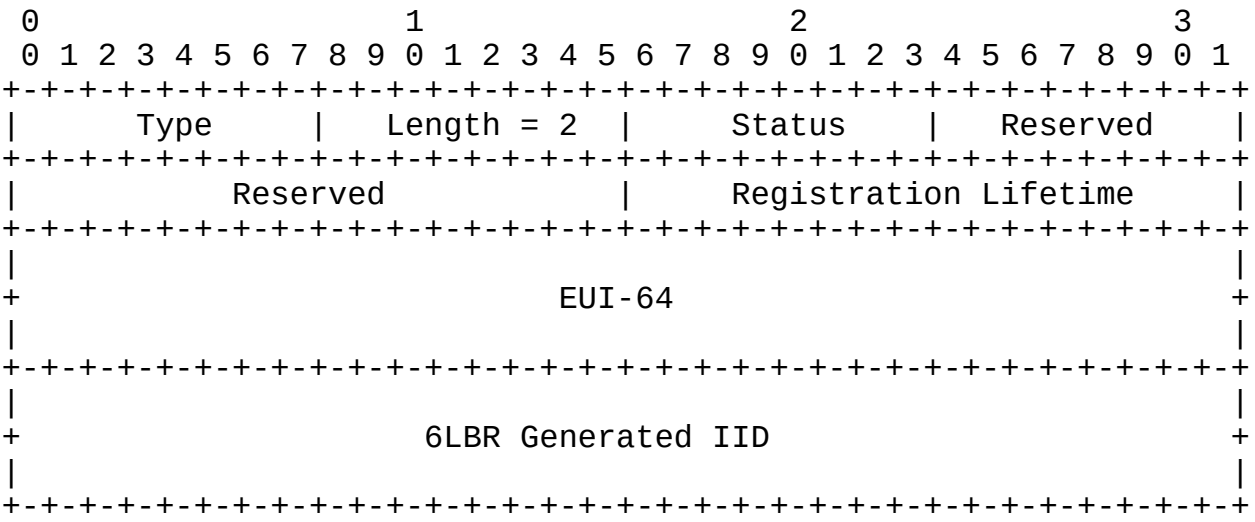

Figure 4: Extended Address Registration Option

The fields are similar to ARO in [RFC6775] except:

Type: 36

6LBR Generated IID: a 64 bit IID generated by 6LBR.

4. IANA Considerations

4.1. Additions of EDAC Message and EARO Option

The document requires one new ICMPv6 "type" number under the subregistry "ICMPv6 "type" Numbers":

o Extended Duplicate Address Confirmation (159)

This document requires a new ND option type under the subregistry "IPv6 Neighbor Discovery Option Formats":

o Extended Address Registration Option (36)

4.2. Additions to Status Field

IANA is required to assign two new values to the Status bit in Address Registration Option under the sub registry "IPv6 Neighbor Discovery Option Formats":

Status	Description
0	Success
1	Duplicate Address
2	Neighbor Cache Full
3	6LBR generated IID
4-255	Allocated using Standards Action [RFC5226]

Addition to Status bits

5. Security Considerations

TBD

6. References

6.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <http://www.rfc-editor.org/info/rfc2119>.

[RFC2464] Crawford, M., "Transmission of IPv6 Packets over Ethernet Networks", RFC 2464, DOI 10.17487/RFC2464, December 1998, <http://www.rfc-editor.org/info/rfc2464>.

[RFC4861] Narten, T., Nordmark, E., Simpson, W., and H. Soliman, "Neighbor Discovery for IP version 6 (IPv6)", RFC 4861, DOI 10.17487/RFC4861, September 2007, <http://www.rfc-editor.org/info/rfc4861>.

[RFC4862] Thomson, S., Narten, T., and T. Jinmei, "IPv6 Stateless Address Autoconfiguration", RFC 4862, DOI 10.17487/RFC4862, September 2007, <http://www.rfc-editor.org/info/rfc4862>.

[RFC4941] Narten, T., Draves, R., and S. Krishnan, "Privacy Extensions for Stateless Address Autoconfiguration in IPv6", RFC 4941, DOI 10.17487/RFC4941, September 2007, <http://www.rfc-editor.org/info/rfc4941>.

[RFC6775] Shelby, Z., Ed., Chakrabarti, S., Nordmark, E., and C. Bormann, "Neighbor Discovery Optimization for IPv6 over Low-Power Wireless Personal Area Networks (6LoWPANs)", RFC 6775, DOI 10.17487/RFC6775, November 2012, <http://www.rfc-editor.org/info/rfc6775>.

[RFC7217] Gont, F., "A Method for Generating Semantically Opaque Interface Identifiers with IPv6 Stateless Address Autoconfiguration (SLAAC)", RFC 7217, DOI 10.17487/RFC7217, April 2014, <http://www.rfc-editor.org/info/rfc7217>.

6.2. Informative References

[I-D.ietf-6man-default-iids]
Gont, F., Cooper, A., Thaler, D., and S. LIU, "Recommendation on Stable IPv6 Interface Identifiers", draft-ietf-6man-default-iids-10 (work in progress), February 2016.

[I-D.ietf-6man-ipv6-address-generation-privacy]
Cooper, A., Gont, F., and D. Thaler, "Privacy Considerations for IPv6 Address Generation Mechanisms", draft-ietf-6man-ipv6-address-generation-privacy-08 (work in progress), September 2015.

[I-D.thubert-6lo-backbone-router]
Thubert, P., "IPv6 Backbone Router", draft-thubert-6lo-backbone-router-03 (work in progress), November 2015.

[I-D.vyncke-6man-mcast-not-efficient]
Vyncke, E., Thubert, P., Levy-Abegnoli, E., and A. Yourtchenko, "Why Network-Layer Multicast is Not Always Efficient At Datalink Layer", draft-vyncke-6man-mcast-not-efficient-01 (work in progress), February 2014.

[RFC5548] Dohler, M., Ed., Watteyne, T., Ed., Winter, T., Ed., and D. Barthel, Ed., "Routing Requirements for Urban Low-Power and Lossy Networks", RFC 5548, DOI 10.17487/RFC5548, May 2009, <http://www.rfc-editor.org/info/rfc5548>.

[RFC5827] Allman, M., Avrachenkov, K., Ayesta, U., Blanton, J., and P. Hurtig, "Early Retransmit for TCP and Stream Control Transmission Protocol (SCTP)", RFC 5827, DOI 10.17487/RFC5827, May 2010, <http://www.rfc-editor.org/info/rfc5827>.

Authors' Addresses

Abdur Rashid Sangi
Huawei Technologies
No.156 Beiqing Rd. Haidian District
Beijing 100095
P.R. China

Email: rashid.sangi@huawei.com

Mach (Guoyi)Chen
Huawei Technologies
No.156 Beiqing Rd. Haidian District
Beijing 100095
P.R. China

Email: mach.chen@huawei.com

Charles E. Perkins
Futurewei
2330 Central Expressway
Santa Clara 95050
USA

Email: charliep@computer.org