6lo Working Group   L. Iannone
Internet-Draft   D. Lou
Intended status: Standards Track   Huawei
Expires: 17 August 2026   A. Rashid
                                                     Politecnico di Bari
                                                        13 February 2026

Generic Address Assignment Option for 6LoWPAN Neighbor Discovery
draft-ietf-6lo-nd-gaao-09

Abstract

This document specifies a new extension to the IPv6 Neighbor Discovery in Low Power and Lossy Networks (LLNs), enabling a node to request to be assigned an address or a prefix from neighbor routers. Such mechanism allows to algorithmically assign addresses and prefixes to nodes in a 6LoWPAN deployment.

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 https://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 17 August 2026.

Copyright Notice

Copyright (c) 2026 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to BCP 78 and the IETF Trust's Legal Provisions Relating to IETF Documents (https://trustee.ietf.org/license-info) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Revised BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Revised BSD License.

Table of Contents

1. Introduction

Low Power and Lossy Networks (LLNs) require adaptations of Internet protocols to operate efficiently under constraints such as limited energy, low data rates, constrained memory, and duty-cycled radio operation. In many LLN deployments, the wireless interface is the dominant source of energy consumption. As a result, protocol design must minimize transmissions, idle listening, and the number of nodes involved in control-plane operations.

IPv6 Neighbor Discovery (ND) was optimized for LLNs in [RFC6775] and later extended by [RFC8505], [RFC8929], [RFC9010], and [RFC9685]. These specifications reduce multicast usage, limit control-plane participation, and introduce explicit address registration mechanisms to better support energy-constrained and duty-cycled devices.

In general IPv6 networks, address and prefix assignment are well supported by Stateless Address Auto-Configuration (SLAAC) [RFC4862] and DHCPv6 [RFC9915]. However, these mechanisms do not fully align with the architectural and operational goals of RFC8505-based 6LoWPAN deployments, particularly in scenarios requiring:

* Strict minimization of multicast traffic,

* Avoidance of centralized infrastructure,

* Localized control-plane interactions,

* Algorithmically structured address assignment to support routing optimizations.

This document does not attempt to replace SLAAC or DHCPv6 in general IPv6 networks. Instead, it addresses a specific gap in 6LoWPAN LLNs operating under RFC8505-based Neighbor Discovery optimizations, where nodes may need to request addresses or prefixes directly from neighboring routers without introducing DHCPv6 infrastructure.

1.1. Limitations of DHCPv6 in Constrained LLNs

DHCPv6 relies on a client-server model and typically uses multicast (e.g., Solicit messages sent to FF02::1:2). In IEEE 802.15.4 [IEEE802154] and similar LLNs, IPv6 multicast is commonly mapped to link-layer broadcast. Such broadcasts cause all nodes on the channel to wake up and process the frame. In duty-cycled networks, this increases:

* Radio wake-ups,

* Idle listening time,

* Channel contention,

* Overall energy consumption.

Furthermore, DHCPv6 requires a reachable server, often via relay agents, which may introduce multi-hop control paths and centralized state management. In lossy multi-hop LLNs, longer control paths increase failure probability and recovery cost.

While DHCPv6 can be efficient in traditional IPv6 networks, including support for long lifetimes and reduced renewal frequency, its architectural model does not align with the distributed, strictly localized control-plane design promoted by RFC8505-based 6LoWPAN Neighbor Discovery.

1.2. Algorithmic and Distributed Address Assignment

Recent work has demonstrated the benefits of algorithmically structured addressing in constrained networks (e.g., [RFC9453], [I-D.ietf-6lo-path-aware-semantic-addressing], [SHENOY21], [BLESS22], [RIDOUX05]). Such approaches can simplify routing, reduce forwarding state, and improve scalability. These schemes often require routers to assign addresses or prefixes according to a distributed Address Assignment Function (AAF).

Existing mechanisms do not provide a standardized way for a 6LoWPAN Node (6LN) to explicitly request an address or prefix from a neighboring 6LoWPAN Router (6LR) within the optimized ND framework defined by [RFC8505].

This document specifies a new Neighbor Discovery option, the Generic Address Assignment Option (GAAO), that enables a node to request an address or prefix directly from a neighboring router using ND messages. The mechanism:

* Operates strictly at 1-hop,

* Avoids introducing DHCPv6 infrastructure,

* Aligns with RFC8505 registration procedures,

* Supports distributed algorithmic address assignment.

GAAO complements the Extended Address Registration Option (EARO) defined in [RFC8505] and its extensions, integrating address/prefix assignment into the existing optimized ND framework for 6LoWPAN.

2. Terminology

2.1. Requirements Notation

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 BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

2.2. Acronyms

This document assumes familiarity with the terminology defined in [RFC6775] and [RFC8505]. In particular for the following acronyms:

6CIO: Capability Indication Option

6LBR: 6LoWPAN Border Router

6LN: 6LoWPAN Node

6LoWPAN: IPv6 over Low-Power Wireless Personal Area Network

6LR: 6LoWPAN Router

AAF: Address Assignment Function

ARO: Address Registration Option

EARO: Extended Address Registration Option

GAAO: Generic Address Assignment Option

IID: Interface IDentifier

LLN: Low-Power and Lossy Network

NA: Neighbor Advertisement

ND: Neighbor Discovery

NS: Neighbor Solicitation

PfxLen: Prefix Length

RA: Router Advertisement

RS: Router Solicitation

SLAAC: Stateless Address Auto-Configuration

SLLAO: Source Link-Layer Address Option

TLLAO: Target Link-Layer Address Option

2.3. Definition of Terms

Address Assignment Function (AAF): The Address Assignment Function (AAF) is an implementation of the algorithm used by 6LRs/6LBR to assign an address/prefix to requesting nodes. In order to avoid addressing issues, only one AAF is used in a deployment. An AAF assigns either addresses or prefixes but not both. This allows in certain cases to indicate whether a node is requesting an address or a prefix.

GAAO: Generic Address Assignment Option defined in this specification (Section 4).

3. Algorithmically Assigned Addresses and Prefixes

The IPv6 address assignment model within a local domain relies on randomly generated Interface Identifiers (IIDs). These can be assigned in two ways: a centralized approach using DHCPv6 ([RFC9915]), which guarantees collision-free addresses, or a decentralized approach using SLAAC ([RFC4862]). In the latter case, additional mechanisms are required to ensure address uniqueness and security, including Duplicate Address Detection (DAD) [RFC4862], Cryptographically Generated Addresses (CGA) [RFC3972], and Secure Neighbor Discovery (SEND) [RFC3971]. However, there is a third approach for address assignment, which is distributed and collision-free: algorithmically generated addresses (e.g., [SHENOY21], [BLESS22], [RIDOUX05], [ERIKSSON04]).

The Address Assignment Function (AAF) will work as a decentralized and distributed fashion. The AAF is used to assign addresses and prefixes to nodes as they join a network. To ensure consistency, all 6LoWPAN Nodes (6LNs), 6LoWPAN Routers (6LRs), and 6LoWPAN Border Routers (6LBRs) MUST use the same AAF within a given network instance. When a node needs an address/prefix, it first selects a neighboring 6LR/6LBR from those that responded to its initial Router Solicitation (RS) with a Router Advertisement (RA), as specified in [RFC6775]. The node then sends an explicit request for an address/prefix to the chosen 6LR/6LBR (see Section 5 for details about messages sequence and processing). The 6LR/6LBR assigns the address/prefix based on the AAF. Depending on the specific technology and algorithm in use, the 6LR/6LBR will either implicitly register this assignment to the requesting 6LN, or will indicate to the 6LN that an explicit registration of the assigned address/prefix is necessary to confirm its use. The overall process is illustrated in Figure 1.

```
   STEP
        6LN                        6LR/6LBR
         |                             |
      1. | Address/Prefix Request      | \
         | --------------------------> |  \
         |                             |   + Request Phase
      2. | Address/Prefix Offer        |  /
         | <-------------------------- | /
         |                             |
      3. | Address/Prefix Acceptance   | \
         | --------------------------> |  \
         |                             |   + Optional Explicit
      4. | Address/Prefix Confirmation |  /  Registration Phase
         | <-------------------------- | /
         |                             |
```

Figure 1: Address/Prefix assignment sequence.

The optional registration phase (steps 3 and 4) is implemented using the address/prefix registration procedures defined in [RFC8505], [RFC9685], or [I-D.ietf-6lo-prefix-registration]. In this phase, an Extended Address Registration Option (EARO) and SLLAO are used to register an address/prefix, which, in this context, is not self-generated. However, to initiate the process--specifically steps 1 and 2, a new Generic Address Assignment Option is required and proposed in this document. Because no existing mechanism can be readily used for this purpose. The remainder of this document first defines the format of this option (see Section 4), followed by a revised sequence and processing of Address/Prefix assignment messages (see Section 5).

4. Generic Address Assignment Option

In order for a 6LN to request the assignment of an address or prefix, GAAO message is used. The format of the GAAO message is shown in Figure 2.

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     Type      |     Length    |     Status    |    Opaque     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|R|C|Rsvd |   PfxLen    |  AAF  |     Assignment   Lifetime     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                               |
~            Registration Ownership Verifier (ROVR)             ~
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                               |
|                        Address/Prefix                         |
|                          (128 bits)                           |
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 2: Generic Address Assignment Option (GAAO) format.

Generic Address Assignment Option Fields:

Type: TBD

Length: 8-bit unsigned integer. The length of the option in units of 8 bytes. This field is set to 1 plus the size of the ROVR field when there is no address/prefix appended to the option. Its value is augmented by 2 (16 bytes) when an address/prefix is appended to the option.

Status: As defined in [RFC8505].

Opaque: As defined in [RFC8505].

R: 1-bit flag for explicit Registration being requested. It MUST be initialized to 0 in Neighbor Solicitation (NS) messages by the requester and MUST be ignored by the receiver. The 6LR/6LBR replying to the request with an Neighbor Advertisement (NA) message MAY set this bit to indicate that it requests a confirmation that the address/prefix is accepted and will be used. When the 6LR/6LBR sets the R-flag in a NA(GAAO) message, it indicates that no registration state has been created and that the requester MUST explicitly register the received address/prefix to the same 6LR/6LBR using the procedures defined in [RFC8505], [I-D.ietf-6lo-prefix-registration], and [RFC9685], according to the type of the assigned address/prefix. When the 6LR/6LBR does not set this R-flag, it implicitly indicates that the assigned address/prefix has been also registered and state created as specified in [RFC8505], [I-D.ietf-6lo-prefix-registration], and

[RFC9685], according to the type of the assigned address/prefix. In the event that the 6LN does not want to use the allocated address/prefix, it can de-register the allocation by sending an NS(EARO) setting registration lifetime to zero, as defined in [RFC8505].

C: 1-bit flag for Crypto-ID used for ROVR as defined in [RFC8928] and [I-D.ietf-6lo-updating-rfc-8928]. This flag MUST be set when the ROVR field contains a Crypto-ID.

Reserved: 3-bit reserved field for future use. It MUST be initialized to 0 by the sender and MUST be ignored by the receiver.

PfxLen: 7-bit unsigned integer. It indicates the length in bits of the address/prefix carried in the option.

AAF: 4-bit unsigned integer. Describes the Address Assignment Function (AAF), i.e. the algorithm, used to assign the address/prefix. 0 is a special value indicating that the field is not used. In an NS(GAAO) message, it is RECOMMENDED to set this field to 0 to indicate there is no preference on how the address/prefix is assigned. However, a 6LN MAY use a value different from 0, meaning that it is requested to use a specific known AAF to assign the address/prefix (see also Section 5.4). Section 7.4 describes possible values of this field.

Assignment Lifetime: 16-bit unsigned integer, expressed in minutes. In an NS(GAAO) message, the field expresses a desired lifetime. It MAY be set to zero, indicating no particular desired lifetime. In NA(GAAO) message it expresses the granted lifetime. A node MUST NOT use the address/prefix after expiration of the lifetime. Address/prefix lifetime SHOULD be configurable according to the AAF in use and as mitigation of certain attacks (see Section 8).

ROVR: As defined in [RFC8505] and extended in [RFC8928] and [I-D.ietf-6lo-updating-rfc-8928].

Address/Prefix: 128-bit IPv6 address/prefix. This field MAY be present in NS(GAAO) request messages to indicate the prefix from which the address or sub-prefix has to be derived. If not present in an NS(GAAO) message, it means that the address returned in an NA(GAAO) message is implicitly used on the interface used to send the request. This field MUST be present in NA(GAAO) messages that return a successful address/prefix allocation, but MUST NOT be present in case of error. When the field is used return a prefix, the leftmost bits are used for its encoding according to the length field, the remaining bits are set to zero.

5. Messages Sequence and Processing

When a node bootstraps, it typically does multicast a RS message and receives one or more unicast RA messages from neighbor 6LRs. The node MAY choose one or more 6LRs from which to request address(es) or prefix(es). A node MAY perform a request at any time, not necessarily at boot time, using NS and NA messages.

5.1. Request Phase

When the node requests an address/prefix, the node will go through the following steps:

1. The node will issue an NS(GAAO) message to obtain the address/prefix. In this initial address request, GAAO Status field MUST be set to 0. Opaque, ROVR, and C-flag are set according to the local configuration. R-Flag MUST be set to 0. The AAF field SHOULD be set to zero unless by configuration there is a preference for the assignment algorithm. The Assignment Lifetime field MAY be set to the desired lifetime, or zero otherwise. The Address/Prefix field MAY be present to indicate the prefix from which the address or sub-prefix has to be derived. In this case the PfxLen field MUST be set accordingly. If the Address/Prefix field is not present, the PfxLen field MUST be set to 0.

2. Assuming no errors occur, the node will receive an NA(GAAO) message where all fields have been copied back except for:

   * *Pfxlen:* Now indicating the actual length of the prefix. For address assignments this field MUST be set to 64.

   * *R:* The R-bit is set if the 6LR requests an explicit registration.

   * *AAF:* It is the algorithm, used to assign the address/prefix. If the node is a 6LR it MUST use the same AAF to generate addresses/prefixes to requesting neighbor nodes.

* *Assignment Lifetime:* The maximum lifetime of the assigned address/prefix.

The message sequence is depicted in Figure 3.

```
STEP
     6LN                                        6LR/6LBR
      |                                           |
      | ===== RS-RA Transaction Completed ====== |
      |                                           |
      |                                           |
      |         Address/Prefix Request            |
   1. | --------------------------------------> |
      |               NS (GAAO)                   |
      |                                           |
      |           Address/Prefix Offer            |
   2. | <-------------------------------------- |
      |               NA (GAAO)                   |
      |                                           |
```

Figure 3: Address/Prefix assignment message sequence.

5.2. Explicit Registration Phase (Optional)

Depending on the algorithm in use and the underlying technology, the address/prefix assignment procedure terminates after these two messages. This may be sufficient for instance in deployments where the link-layer offers reliable packet delivery. The use of this option is done by configuration. Documents defining AAFs MUST explicitly state whether this phase remains optional or is mandatory due to factors specific to the proposed algorithm.

If the R-flag is set in the received NA(GAAO) message, the 6LN MUST register with the obtained address/prefix by following the procedures in [RFC8505], [RFC9685], or [I-D.ietf-6lo-prefix-registration] depending on the type of address/prefix. When setting the R-flag, and as for [RFC4861], the 6LR is expect to receive a registration within RETRANS_TIMER multiplied by MAX_UNICAST_SOLICIT. If no registration is received within this amount of time the 6LR will consider that address/prefix is not in use by the requesting 6LN.

The complete sequence of actions is depicted in Figure 4.

```
   STEP

        6LN                                          6LR/6LBR
         |                                              |
         |   ====== RS-RA Transaction Completed ======  |
         |                                              |
         |           Address/Prefix Request             |
      1. | -------------------------------------------> |
         |                 NS(GAAO)                     |
         |                                              |
         |           Address/Prefix Offer               |
      2. | <------------------------------------------- |
         |                 NA(GAAO)                     |
         |                                              |
         |      Address/Prefix Registration Request     |
      3. | -------------------------------------------> |
         |            NS(EARO + SLLAO)                  |
         |                                              |
                             ...
            Procedure According to [RFC8505], [RFC9685],
             or [I-D.ietf-6lo-prefix-registration]
             depending on the type of address.
                             ...
         |                                              |
         |      Address/Prefix Registration Response    |
      4. | <------------------------------------------- |
         |        NA(EARO with Status + SLLAO)          |
         |                                              |
```

Figure 4: Address/Prefix assignment message sequence with explicit registration.

[RFC8505], [RFC9685], and [I-D.ietf-6lo-prefix-registration], define how nodes keep address/prefix registering state so to maintain addressing in case of reboot. When needed, in order to use this feature with GAAO, after reboot the registration phase MUST be used to perform an explicit registration and continue using the address/prefix. However, when using GAAO, and when preforming the re-registering, if a "Registration Refresh Request" or "Invalid Registration" Status value is returned, the node MUST restart from the top with the initial Request Phase.

5.3. Message Exchange Optimization

There are two ways to optimize the prefix/address Request Phase: GAAO with Address Registration and GAAO with Router Discovery.

5.3.1. GAAO with Address Registration

Prefix/address Registration utilize NS/NA transactions for the link-local address registration [RFC8505]. In this specification, for prefix/address Request procedure utilizes an additional NS/NA transaction. To minimize the number of transactions, GAAO MAY be used together with the EARO option during address registration phase. This piggybacking approach provides flexibility and maintains compatibility with existing specifications [RFC8505]. In response the NA message will contain GAAO. Figure 5 illustrates the GAAO piggybacked within a link-layer address registration request and response.

```
STEP

     6LN                                       6LR/6LBR
      |                                           |
      |       Address Registration Request        |
   1. | ---------------------------------------> |
      |         NS(EARO + SLLAO + GAAO)           |
      |                                           |
      |       Address Registration Response       |
   2. | <--------------------------------------- |
      |    NA(EARO with Status + SLLAO + GAAO)    |
      |                                           |
```

Figure 5: GAAO piggybacking with link-layer Address Registration.

5.3.2. GAAO with Router Discovery

Another optimization for prefix/address requests can be performed during the bootstrapping phase of a 6LN. The GAAO MAY be included in the initial RS message, thereby implicitly indicating that the node supports this specification. Similarly, 6LR/6LBR that support this specification MUST include a prefix/address offer in a GAAO appended to the corresponding RA message, as depicted in Figure 6.

```
   STEP

        6LN                                       6LR/6LBR
         |                                           |
         |               RS message                  |
      1. | ---------------------------------------> |
         |         (6CIO + SLLAO + GAAO)             |
         |                                           |
         |               RA message                  |
      2. | <--------------------------------------- |
         |    (PIO + 6CIO + ABRO + SLLAO + GAAO)     |
         |                                           |
```

Figure 6: GAAO piggybacking with Router Discovery.

A 6LR/6LBR that does not support GAAO will simply ignore this option, and the corresponding RA message will not include a GAAO. This behavior implicitly signals that the feature is not supported.

5.4. Error Conditions

GAAO Status field uses same Status values defined in [RFC6775] and [RFC8505], further revised in [RFC9010], for error reporting. This specification introduces a new Status value when the AAF in GAAO in an NS message is not in use in the 6LoWPAN network, as follows (see also Section 7):

AAF Not Used: The AAF in GAAO in the NS message is not in use in the 6LoWPAN network.

This status MUST be used when a node requesting an address/prefix did put an AAF value, in the corresponding field, which is not in use in the 6LoWPAN network. When the node receives this status back it SHOULD perform one of the following actions:

* Re-issue the same request without specifying an AAF, meaning set the AAF field to 0. The 6LR will return the AAF in use in the 6LoWPAN network and employed to generate the returned address/prefix. If the requesting node does not support the returned AAF it does not participate in the AAF-based 6LoWPAN network and does not use the proposed address/prefix.

* Re-issue the same request with a different AAF. The 6LoWPAN network is not using the requested AAF but may be using a different one. Note that such an approach may lead to repeated requests that may consume bandwidth and energy.

* Do nothing and do not participate in the AAF-based 6LoWPAN network.

The action to be used is selected by configuration. When nodes fail to participate in the AAF-based 6LoWPAN network they MAY still use a different mechanism (e.g., [RFC8505]) to configure addresses/ prefixes.

6. Signaling GAAO Support

This specification defines a new capability bit, named M-flag, for use in the 6CIO as defined by [RFC7400] ("6LoWPAN-GHC: Generic Header Compression for IPv6 over Low-Power Wireless Personal Area Networks"). A 6LN that supports this specification MUST set the M-flag in RS and RA messages.

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     Type      |   Length = 1  |   Reserved    |X|A|D|L|B|P|E|G|
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|F|M|                       Reserved                            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 7: New GAAO Capability Bit in the 6CIO.

M: 1-bit flag. The node supports managed addresses/prefixes via the Generic Address Assignment Capability.

7. IANA Considerations

This section provides guidance to the Internet Assigned Numbers Authority (IANA) regarding registration of values related to the GAAO specification, in accordance with BCP 26 [RFC8126].

7.1. IPv6 Neighbor Discovery (ND) Option Types

IANA is requested to make an addition to the "IPv6 Neighbor Discovery Option Formats" registry under the heading "Internet Control Message Protocol version 6 (ICMPv6) Parameters" as indicated in Table 1:

Type	Description	Reference
TBD	Generic Address Assignment Option	[This Document]

Table 1: New Generic Address Assignment Option.

7.2. 6LoWPAN Capability Bits

IANA is requested to make an addition to the "6LoWPAN Capability Bits" registry under the registry group "Internet Control Message Protocol version 6 (ICMPv6) Parameters" as indicated in Table 2:

Bit	Description	Reference
TBD	M-Flag for Generic Address Assignment Capability	[This Document]

Table 2: New 6LoWPAN Capability Bit.

7.3. GAAO Error code

IANA is requested to make an addition to the "Address Registration Option Status Values" registry under the registry group "Internet Control Message Protocol version 6 (ICMPv6) Parameters" as indicated in Table 3:

Value	Description	Reference
13 (Suggested)	AAF Not Used	[This Document]

Table 3: New Address Registration Option Status Field Value.

7.4. Address Assignment Function Registry

IANA is asked to create a registry group named "Generic Address Assignment Option".

Such registry group should be populated with an octet registry named "Address Assignment Function" and used to identify the used AAF. The registry is populated as shown in Table 4:

Value	AAF Name	Reference
0x0	No AAF. This can be used only in NS message to indicate that no specific AAF is demanded.	[This Document]
0x1-0xE	Un-assigned	
0xF	Experimental Use. Used for experimental purposes during implementation of new AAFs.	[This Document]

Table 4: Allocation Function Sub-registry

Values can be assigned by IANA on a "First Come, First Served" basis according to [RFC8126].

8. Security Considerations

This document extends [RFC8505], which already extended [RFC6775], as such the security considerations of both documents apply to this specification. In particular, the link layer SHOULD provide sufficient protection to prevent potential attacks. Recommendations listed in Section 7 of [RFC8505] SHOULD be applied as well to this specification.

Depending on the AAF in use, the number of available addresses may encounter limitations. A rouge node may leverage on this knowledge to carry out address exhaustion attacks by impersonating different nodes and performing multiple requests. To mitigate such risks the recommendation about the lifetime and number of addresses per node described in Section 7 of [RFC8505] remains valid.

Acknowledgements

This document received many comments and help from community people. The authors would like to thank all of them. Thanks as well to Joel Halpern (GENART) and Brian Haberman (INTDIR) for their reviews that helped to spot overlooked points in the definition of the GAAO mechanism. Thanks to Pascal Thubert for his help in making this specification more integrated with existing specifications. Thanks to Carles Gomez Montenegro for his very thorough shepherd review.

References

Normative References

[I-D.ietf-6lo-prefix-registration]
Thubert, P., "IPv6 Neighbor Discovery Prefix Registration", Work in Progress, Internet-Draft, draft-ietf-6lo-prefix-registration-18, 20 August 2025, <https://datatracker.ietf.org/doc/html/draft-ietf-6lo-prefix-registration-18>.

[I-D.ietf-6lo-updating-rfc-8928]
Thubert, P. and A. Rashid, "Fixing the C-Flag in Extended Address Registration Option (EARO)", Work in Progress, Internet-Draft, draft-ietf-6lo-updating-rfc-8928-05, 26 June 2025, <https://datatracker.ietf.org/doc/html/draft-ietf-6lo-updating-rfc-8928-05>.

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

[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, <https://www.rfc-editor.org/rfc/rfc4861>.

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

[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, <https://www.rfc-editor.org/rfc/rfc6775>.

[RFC7400] Bormann, C., "6LoWPAN-GHC: Generic Header Compression for IPv6 over Low-Power Wireless Personal Area Networks (6LoWPANs)", RFC 7400, DOI 10.17487/RFC7400, November 2014, <https://www.rfc-editor.org/rfc/rfc7400>.

[RFC8126] Cotton, M., Leiba, B., and T. Narten, "Guidelines for Writing an IANA Considerations Section in RFCs", BCP 26, RFC 8126, DOI 10.17487/RFC8126, June 2017, <https://www.rfc-editor.org/rfc/rfc8126>.

[RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174, May 2017, <https://www.rfc-editor.org/rfc/rfc8174>.

[RFC8505] Thubert, P., Ed., Nordmark, E., Chakrabarti, S., and C. Perkins, "Registration Extensions for IPv6 over Low-Power Wireless Personal Area Network (6LoWPAN) Neighbor Discovery", RFC 8505, DOI 10.17487/RFC8505, November 2018, <https://www.rfc-editor.org/rfc/rfc8505>.

[RFC8928] Thubert, P., Ed., Sarikaya, B., Sethi, M., and R. Struik, "Address-Protected Neighbor Discovery for Low-Power and Lossy Networks", RFC 8928, DOI 10.17487/RFC8928, November 2020, <https://www.rfc-editor.org/rfc/rfc8928>.

[RFC9010] Thubert, P., Ed. and M. Richardson, "Routing for RPL (Routing Protocol for Low-Power and Lossy Networks) Leaves", RFC 9010, DOI 10.17487/RFC9010, April 2021, <https://www.rfc-editor.org/rfc/rfc9010>.

[RFC9685] Thubert, P., Ed., "Listener Subscription for IPv6 Neighbor Discovery Multicast and Anycast Addresses", RFC 9685, DOI 10.17487/RFC9685, November 2024, <https://www.rfc-editor.org/rfc/rfc9685>.

Informative References

[BLESS22] Bless, R., Zitterbart, M., Despotovic, Z., and A. Hecker, "KIRA: Distributed Scalable ID-based Routing with Fast Forwarding", 2022 IFIP Networking Conference (IFIP Networking) pp. 1-9, DOI 10.23919/ifipnetworking55013.2022.9829816, June 2022, <https://doi.org/10.23919/ifipnetworking55013.2022.9829816>.

[ERIKSSON04] Eriksson, J., Faloutsos, M., and S. Krishnamurthy, "Scalable ad hoc routing: the case for dynamic addressing", IEEE INFOCOM 2004 vol. 2, pp. 1108-1119, DOI 10.1109/infcom.2004.1356997, February 2005, <https://doi.org/10.1109/infcom.2004.1356997>.

[I-D.ietf-6lo-path-aware-semantic-addressing] Iannone, L., Li, G., Lou, D., Liu, P., and P. Thubert, "Path-Aware Semantic Addressing (PASA) for Low power and Lossy Networks", Work in Progress, Internet-Draft, draft-ietf-6lo-path-aware-semantic-addressing-13, 16 September 2025, <https://datatracker.ietf.org/doc/html/draft-ietf-6lo-path-aware-semantic-addressing-13>.

[IEEE802154]
"IEEE Standard for Low-Rate Wireless Networks", IEEE standard, DOI 10.1109/ieeestd.2016.7460875, April 2016, <https://doi.org/10.1109/ieeestd.2016.7460875>.

[RFC3971] Arkko, J., Ed., Kempf, J., Zill, B., and P. Nikander, "SEcure Neighbor Discovery (SEND)", RFC 3971, DOI 10.17487/RFC3971, March 2005, <https://www.rfc-editor.org/rfc/rfc3971>.

[RFC3972] Aura, T., "Cryptographically Generated Addresses (CGA)", RFC 3972, DOI 10.17487/RFC3972, March 2005, <https://www.rfc-editor.org/rfc/rfc3972>.

[RFC8929] Thubert, P., Ed., Perkins, C.E., and E. Levy-Abegnoli, "IPv6 Backbone Router", RFC 8929, DOI 10.17487/RFC8929, November 2020, <https://www.rfc-editor.org/rfc/rfc8929>.

[RFC9453] Hong, Y., Gomez, C., Choi, Y., Sangi, A., and S. Chakrabarti, "Applicability and Use Cases for IPv6 over Networks of Resource-constrained Nodes (6lo)", RFC 9453, DOI 10.17487/RFC9453, September 2023, <https://www.rfc-editor.org/rfc/rfc9453>.

[RFC9915] Mrugalski, T., Volz, B., Richardson, M., Jiang, S., and T. Winters, "Dynamic Host Configuration Protocol for IPv6 (DHCPv6)", STD 102, RFC 9915, DOI 10.17487/RFC9915, January 2026, <https://www.rfc-editor.org/rfc/rfc9915>.

[RIDOUX05] Ridoux, J., Fladenmuller, A., Viniotis, Y., and K. Salamatian, "Trellis-Based Virtual Regular Addressing Structures in Self-organized Networks", Lecture Notes in Computer Science pp. 511-522, DOI 10.1007/11422778_41, 2005, <https://doi.org/10.1007/11422778_41>.

[SHENOY21] Shenoy, N., Chandraiah, S., and P. Willis, "A Structured Approach to Routing in the Internet", 2021 IEEE 22nd International Conference on High Performance Switching and Routing (HPSR) pp. 1-6, DOI 10.1109/hpsr52026.2021.9481818, June 2021, <https://doi.org/10.1109/hpsr52026.2021.9481818>.

Authors’ Addresses

Luigi Iannone
Huawei Technologies France S.A.S.U.
18, Quai du Point du Jour
92100 Boulogne-Billancourt
France
Email: luigi.iannone@huawei.com

David Lou
Huawei Technologies Duesseldorf GmbH
Riesstrasse 25
80992 Munich
Germany
Email: zhe.lou@huawei.com

Adnan Rashid
Politecnico di Bari
Via Edoardo Orabona 4
70126 Bari
Italy
Email: adnan.rashid@poliba.it