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Centrally Assigned Unique Local IPv6 Unicast Addresses

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Status of this Memo

Abstract

This document defines Centrally allocated IPv6 Unique Local addresses. These addresses are globally unique and are intended for local communications, usually inside of a site. They are not expected to be routable on the global Internet.

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1.0 Introduction

This document defines the characteristics and technical allocation requirements for centrally assigned Local IPv6 addresses in the framework defined in [ULA]. They are not expected to be routable on the global Internet. They are routable inside of a more limited area such as a site. They may also be routed between a limited set of sites.

Local IPv6 unicast addresses, as defined in [ULA], have the following characteristics:

- Globally unique prefix.
- Well known prefix to allow for easy filtering at site boundaries.
- Internet Service Provider independent and can be used for communications inside of a site without having any permanent or intermittent Internet connectivity.
- In practice, applications may treat these addresses like global scoped addresses.

It is a highly desirable property of ULAs that they are unique, as ULA uniqueness would allow sites to be combined or privately interconnected without creating any address conflicts.

Topics that are general to all Local IPv6 address can be found in the following sections of [ULA]:

3.3 Scope Definition
4.0 Operational Guidelines **
4.1 Routing
4.2 Renumbering and Site Merging
4.3 Site Border Router and Firewall Packet Filtering
4.5 Application and Higher Level Protocol Issues
4.6 Use of Local IPv6 Addresses for Local Communications
4.7 Use of Local IPv6 Addresses with VPNs
5.0 Global Routing Concerns
6.0 Advantages and Disadvantages

** Note: Operational guidelines specific to centrally assigned Local IPv6 addresses are in Section 4.0 of this document.

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].

2.0 Acknowledgments

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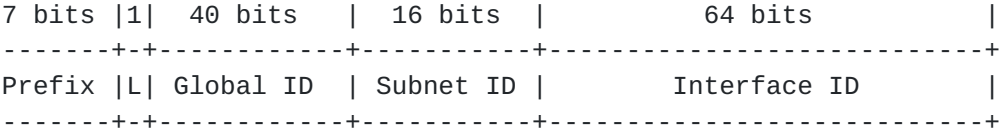
3.0 Centrally Assigned Local IPv6 Unicast Addresses

3.1 Format

The Centrally assigned Local IPv6 addresses, based on Unique Local Addresses [ULA], have the following format:



Where:

Prefix FC00::/7 prefix to identify Local IPv6 unicast addresses.

L	Set to 0 if the prefix is centrally assigned, Note: [ULA] defined L=1 for locally assigned ULAs. This document defines L=0 for centrally assigned ULA addresses. See Section 3.2 for additional information.
Global ID	40-bit global identifier used to create a globally unique prefix. See Section 3.2 for additional information.
Subnet ID	16-bit Subnet ID is an identifier of a subnet within the site.
Interface ID	64-bit Interface ID as defined in [ADDARCH].

3.2 Global ID

The allocation of Global IDs should be pseudo-random [RANDOM]. They MUST not be assigned sequentially. They MUST not be allocated in a manner where there is a relationship between allocations that would make it easy to aggregate the resulting prefixes. This is done to make clear that these prefixes are not intended to be routed globally.

The major difference between the locally assigned Unique Local Addresses defined in [ULA] and the centrally assigned Unique Local Addresses, as defined in this document, is that they are uniquely assigned and the assignments are registered in a public database.

It is expected that large managed sites will prefer central assignments and small or disconnected sites will prefer local assignments. It is recommended that sites planning to use Local IPv6 addresses for extensive inter-site communication, initially or as a future possibility, use a centrally assigned prefix as there is no possibility of assignment conflicts. Sites are free to choose either approach.

This document defines the allocation procedure for creating global-IDs for centrally assigned local IPv6 addresses (i.e., L=0). The allocation procedure for locally assigned local IPv6 addresses (i.e., L=1) is defined in [ULA].

3.2.1 Allocation of Centrally Assigned Global IDs

Global IDs should be allocated by a new registry function such that each allocation is unique and that the assignment is recorded and

published in a public database to verify that that allocation was unique.

Global IDs may be assigned under the authority of a single allocation organization or by multiple organizations. If there are multiple organizations, there MUST be an operating procedure that ensures that the entire allocation space maintains it property of uniqueness and that the allocations are recorded in a single public database.

The requirements for centrally assigned Global ID allocations are:

- Globally unique.
- Available to anyone in an unbiased manner.

The allocation function must include the ability to make an allocation on a permanent basis, without any need for renewal and without any procedure for de-allocation. Other forms of allocation, including periodic renewable allocations and explicit provision for de-allocation may also be provided.

The allocation service should include sufficient provisions to mitigate attempts to artificially reduce the number pool through hoarding of numbers. The mechanism used by the registration authority should not include onerous provisions that reduce the intent that these allocations should be available to anyone in an unbiased manner, and should not attempt to perform rationing or impose quotas upon allocations.

The registration authority may covers its costs through registration fees and may also use registration agreements to clearly set forth the terms conditions and liabilities associated with registration of such allocations. The payments and conditions associated with this function should not be unreasonably onerous to the extent that the availability of allocations is impaired.

3.2.2 Sample Code for Pseudo-Random Global ID Algorithm

The algorithm described below is intended to be used for centrally assigned Global IDs. In each case the resulting global ID will be used in the appropriate prefix as defined in Section 3.2.

1) Obtain the current time of day in 64-bit NTP format [NTP].
2) Obtain an EUI-64 identifier from the system running this algorithm. If an EUI-64 does not exist, one can be created from a 48-bit MAC address as specified in [ADDARCH]. If an EUI-64 cannot be obtained or created, a suitably unique identifier, local to the node, should be used (e.g. system serial number).

3) Concatenate the time of day with the system-specific identifier creating a key.
4) Compute an SHA-1 digest on the key as specified in [FIPS, SHA1]; the resulting value is 160 bits.
5) Use the least significant 40 bits as the Global ID.
6) Verify that the computed Global ID is not already assigned. If it is, discard the value and rerun the algorithm.
7) Concatenate FC00::/7, the L bit set to 0, and the 40 bit Global ID to create a centrally assigned Local IPv6 address prefix.

This algorithm will result in a Global ID that is unique and can be used to create a centrally assigned local IPv6 address prefix.

3.3 Public Registration Services

The registration of centrally assigned ULAs should be available in a public database. This function should support a query of a specific ULA prefix and then return the registrant's provided detail. Information should be provided in a robust fashion, consistent with the current state of similar registration services provided by address and domain name registration authorities.

4.0 Operational Guidelines

4.1 DNS Issues

AAAA and PTR records for centrally assigned local IPv6 addresses may be installed in the global DNS. This may be useful if these addresses are being used for site to site or VPN style applications, or for sites that wish to avoid separate DNS systems for inside and outside traffic.

The operational issues relating to this are beyond the scope of this document.

5.0 Global Routing Considerations

Since [ULA] was first published, the Regional Internet Address Registries (RIR) created a new policy to allocate IPv6 Provider Independent Addresses [RIR-PI]. Given the availability of RIR allocated provider-independent addresses the authors believe that there is considerably less concern that ULAs of either type will be used as IPv6 provider-independent addresses.

The operational guidelines regarding routing of centrally assigned local addresses is that such address prefixes should be readily routed within a site or comparable administrative routing domain.

By default, such prefixes should not be announced beyond such a local scope, due to the non-aggregateability of these prefixes within the routing system and the potential negative impact on the total size of the routing space in large scale internet environments.

Entities wishing to use IPv6 Provider Independent Addresses (PI Space) in such larger routing contexts should consult the Regional Internet Registries policies relating to the allocation of PI Space [RIR-PI].

6.0 Security Considerations

Local IPv6 addresses do not provide any inherent security to the nodes that use them. They may be used with filters at site boundaries to keep Local IPv6 traffic inside of the site, but this is no more or less secure than filtering any other type of global IPv6 unicast addresses.

Local IPv6 addresses do allow for address-based security mechanisms, including IPSEC, across end to end VPN connections.

7.0 IANA Considerations

The IANA is instructed to designate an allocation authority for centrally assigned Unique Local IPv6 unicast addresses. This allocation authority shall comply with the requirements described in Section 3.2 of this document, including in particular allocation on a permanent basis and with sufficient provisions to avoid hoarding of numbers. If deemed appropriate, the authority may also consist of multiple organizations performing the allocation authority duties.

The Regional Internet Address registries are expected to be the allocation authority for centrally assigned Unique Local IPv6 addresses.

The designated allocation authority is required to document how they will meet the requirements described in Section 3.2 of this document in an RFC.

8.0 References

8.1 Normative References

[ADDARCH] Hinden, R., S. Deering, S., "IP Version 6 Addressing Architecture", RFC 3515, April 2003.

[FIPS] "Federal Information Processing Standards Publication", (FIPS PUB) 180-1, Secure Hash Standard, 17 April 1995.

[NTP] Mills, David L., "Network Time Protocol (Version 3) Specification, Implementation and Analysis", RFC 1305, March 1992.

[RANDOM] Eastlake, D. 3rd, J. Schiller, S. Crocker, "Randomness Recommendations for Security", RFC 4086, June 2005.

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", RFC 2119, BCP14, March 1997.

[SHA1] D. Eastlake 3rd, P. Jones, "US Secure Hash Algorithm 1 (SHA1)", RFC 3174, September 2001.

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

8.2 Informative References

[RIR-PI] O. DeLong, K. Loch, A. Dul, "Policy Proposal 2005-1: Provider-independent IPv6 Assignments for End Sites", http://www.arin.net/policy/proposals/2005_1.html, May 2006.

9.0 Authors' Addresses

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10.0 Change Log

Draft <draft-hinden-ipv6-global-local-addr-02.txt>

- o Major revision based on experience to date with [ULA] and later input from the RIR community

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- o Revised to keep consistent with [ULA]. This includes single prefix, L bit, change to SHA-1 algorithm, and clarifications to suggested algorithm.
- o Revised IANA considerations section based on feedback from the IAB.
- o Added new DNS operational guidelines sections specific to centrally assigned local IPv6 addresses.
- o Editorial changes.

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- o Initial Draft created from [ULA]. This draft defines the centrally assigned Local IPv6 addresses.

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