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LISP EID Block
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Abstract

This is a direction to IANA to allocate a /16 IPv6 prefix for use with the Locator/ID Separation Protocol (LISP). The prefix will be used for local intra-domain routing and global endpoint identification, by sites deploying LISP as EID (Endpoint Identifier) addressing space.

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Table of Contents

1.	Introduction	3
2.	Definition of Terms	3
3.	Rationale and Intent	3
4.	Expected use	5
5.	Block Dimension	5
6.	3+3 Allocation Plan	6
7.	Routing Considerations	7
8.	Security Considerations	8
9.	IANA Considerations	8
10.	Acknowledgments	10
11.	References	10
11.1.	Normative References	10
11.2.	Informative References	11
Appendix A.	LISP Terminology	11
Appendix B.	Document Change Log	14
	Authors' Addresses	16

1. Introduction

This document directs the IANA to allocate a /16 IPv6 prefix for use with the Locator/ID Separation Protocol (LISP - [\[RFC6830\]](#)), LISP Map Server ([\[RFC6833\]](#)), LISP Alternative Topology (LISP+ALT - [\[RFC6836\]](#)) (or other) mapping system, and LISP Interworking ([\[RFC6832\]](#)).

This block will be used as global Endpoint IDentifier (EID) space ([Section 2](#)).

2. Definition of Terms

The present document does not introduce any new term with respect to the set of LISP Specifications ([\[RFC6830\]](#), [\[RFC6831\]](#), [\[RFC6832\]](#), [\[RFC6833\]](#), [\[RFC6834\]](#), [\[RFC6835\]](#), [\[RFC6836\]](#), [\[RFC6837\]](#)). To help the reading of the present document the terminology introduced by LISP is summarized in [Appendix A](#).

3. Rationale and Intent

Discussion within the LISP Working Group led to identify several scenarios in which the existence of a LISP specific address block brings technical benefits. Hereafter the most relevant scenarios are described:

Early LISP destination detection: With the current specifications, there is no direct way to detect whether or not a certain destination is in a LISP domain or not without performing a LISP mapping lookup. For instance, if an ITR is sending to all types of destinations (i.e., non-LISP destinations, LISP destinations not in the IPv6 EID Block, and LISP destinations in the IPv6 EID Block) the only way to understand whether or not to encapsulate the traffic is to perform a cache lookup and, in case of a LISP Cache miss, send a Map-Request to the mapping system. In the meanwhile, packets may be dropped.

Avoid penalize non-LISP traffic: In certain circumstances it might be desirable to configure a router using LISP features to natively forward all packets that have not a destination address in the block, hence, no lookup whatsoever is performed and packets destined to non-LISP sites are not penalized in any manner.

Avoid excessive stretch: In some deployment scenarios and in order to avoid packet drops, in case of LISP Cache miss packets are forwarded toward a PETR while a mapping lookup is performed over the LISP mapping system. Once a mapping is obtained packets are not forwarded anymore toward the PETR, they are LISP encapsulated and forwarded according to the LISP specifications. The existence of a LISP specific EID block would allow to avoid scenarios with excessive overhead, where the destination is a LISP EID and where (while the mapping is looked up) packets are forwarded over paths like Source->ITR->PETR->PITR->ETR->Destination, which may show an excessive stretch factor and degraded performance.

Traffic Engineering: In some deployment scenarios it might be desirable to apply different traffic engineering policies for LISP and non-LISP traffic. A LISP specific EID block would allow improved traffic engineering capabilities with respect to LISP vs. non-LISP traffic. In particular, LISP traffic might be identified without having to use DPI techniques in order to parse the encapsulated packet, performing instead a simple inspection of the outer header is sufficient.

Transition Mechanism: The existence of an LISP specific EID Block may prove useful in transition scenarios. A non-LISP domain would ask an allocation in the LISP EID Block and use it to deploy LISP in its network. Such allocation will not be announced in the BGP routing infrastructure (cf., [Section 4](#)). This approach will avoid non-LISP domains to fragment their already allocated non-LISP addressing space, which may lead to BGP routing table inflation since it may (rightfully) be announced in the BGP routing infrastructure.

Limit the impact on BGP routing infrastructure: As described in the previous scenario, LISP adopters will avoid fragmenting their addressing space, which would negatively impact the BGP routing infrastructure. Adopters will use addressing space from the EID block which might be announced in large aggregates and in a tightly controlled manner only by proxy xTRs.

Is worth to mention that new use cases can arise in the future, due to new and unforeseen scenarios.

Furthermore, this will give a tighter control, especially filtering, over the traffic in the initial experimental phase, while facilitating its large-scale deployment.

[RFC3692] considers assigning experimental and testing numbers useful, and the request of a reserved IPv6 EID prefix is a perfect

match of such practice. The present document follows the guidelines provided in [[RFC3692](#)], with one exception. [[RFC3692](#)] suggests the use of values similar to those called "Private Use" in [[RFC2434](#)], which by definition are not unique. One of the purposes of the present request to IANA is to guarantee uniqueness to the EID block. The lack thereof would result in a lack of real utility of a reserved IPv6 EID prefix.

4. Expected use

Sites planning to deploy LISP may request a prefix in the IPv6 EID Block. Such prefix will be used for routing and endpoint identification inside the site requesting it. Mappings related to such prefix, or part of it, will be made available through the mapping system in use and registered to one or more Map Server(s).

To guarantee reachability from the Legacy Internet the prefix may be announced in the BGP routing infrastructure by one or more P1TR(s) as part of larger aggregates (ideally just the entire LISP EID block). Indeed, the use of PxTRs allow EID prefix aggregation; the deployment model for this element is described in [[RFC6832](#)] and [[I-D.ietf-lisp-deployment](#)].

As the LISP adoption progress, the EID prefix space will potentially help in reducing the impact on the BGP routing infrastructure with respect to the case of the same number of adopters using global unicast space allocated by RIRs ([[MobiArch2007](#)]). From a short-term perspective, the EID space offers potentially large aggregation capabilities since it is announced by PxTRs possibly concentrating several contiguous prefixes. Such trend should continue with even lower impact from a long-term perspective, since more aggressive aggregation can be used, potentially leading at using few PxTRs announcing the whole EID space ([[FIABook2010](#)]).

The EID Block will be used only at configuration level, it is recommended not to hard-code in any way the IPv6 EID Block in the router hardware. This allows avoiding locking out sites that may want to switch to LISP while keeping their own IPv6 prefix, which is not in the IPv6 EID Block.

The prefix must not be used as normal prefix and announced in the BGP routing infrastructure.

5. Block Dimension

The working group reached consensus on an initial allocation of a /16

prefix out of a /12 block which is asked to remain reserved for future use as EID space. The reason of such consensus is manifold:

- o The working group agreed that /16 prefix is sufficiently large to cover initial allocation and requests for prefixes in the EID space in the next few years for very large-scale experimentation and deployment.
- o As a comparison, it is worth mentioning that the current LISP Beta Network ([\[BETA\]](#)) is using a /32 prefix, with more than 250 sites using a /48 sub prefix. Hence, a /16 prefix looks as sufficiently large to allow the current deployment to scale up and be open for interoperation with independent deployments using EIDs space in the new /16 prefix.
- o A /16 prefix is sufficiently large to only allow deployment of independent (commercial) LISP enabled networks by third parties, but may as well boost LISP experimentation and deployment.
- o The /16 size and alignment allows the use to current policies to allocate and distribute prefixes out of this space, without the need to introduce any new specific address management policy.
- o The proposed alignment provides as well a natural support for DNS. In particular, reverse DNS for IPv6 in the special ip6.arpa domain is represented as sequence of nibbles. A different alignment would force to a binary representation.
- o The use of a /16 prefix is in line with previous similar prefix allocation for tunnelling protocols ([\[RFC3056\]](#)).

6. 3+3 Allocation Plan

This document requests IANA to initially assign a /16 prefix out of the IPv6 addressing space for use as EID in LISP (Locator/ID Separation Protocol).

It is suggested to IANA to temporarily avoid allocating any other address block the same /12 prefix the EID /16 prefix belongs to. This is to accommodate future requests of EID space without fragmenting the EID addressing space. This will also help from an operational point of view, since it will be sufficient to change the subnet mask length in existing deployments. If in the future there will be need for a larger EID Block the address space adjacent the EID Block could be allocate by IANA according to the current policies.

IANA should assign the requested address space by beginning 2014 for a duration of 3 (three) initial years (through December 2017), with an option to extend this period by 3 (three) more years (until December 2020). By the end of the first period, the IETF will provide a decision on whether to transform the prefix in a permanent assignment or to put it back in the free pool.

In the first case, i.e., if the IETF decides to transform the block in a permanent allocation, the EID block allocation period will be extended for three years (until December 2020) so to give time to the IETF to define the final size of the EID block, the transition phase, and the allocation and management policies.

In the latter case, i.e., if the IETF decides to stop the EID block experimental use, by December 2017 all temporary prefix allocations in such address range must expire and be released, so that by January 2018 the entire /12 is returned to the free pool.

The allocation and management of the Global EID Space for the initial 3 years period (and the optional 3 more years) is detailed in [\[I-D.iannone-lisp-eid-block-mgmt\]](#).

7. Routing Considerations

In order to provide connectivity between the Legacy Internet and LISP sites, PITRs announcing large aggregates (ideally one single large aggregate) of the IPv6 EID Block could be deployed. By doing so, PITRs will attract traffic destined to LISP sites in order to encapsulate and forward it toward the specific destination LISP site. Routers in the Legacy Internet must treat announcements of prefixes from the IPv6 EID Block as normal announcements, applying best current practice for traffic engineering and security.

Even in a LISP site, not all routers need to run LISP elements. In particular, routers that are not at the border of the local domain, used only for intra-domain routing, do not need to provide any specific LISP functionality but must be able to route traffic using addresses in the IPv6 EID Block.

For the above-mentioned reasons, routers that do not run any LISP element, must not include any special handling code or hardware for addresses in the IPv6 EID Block. In particular, it is recommended that the default router configuration does not handle such addresses in any special way. Doing differently could prevent communication between the Legacy Internet and LISP sites or even break local intra-domain connectivity.

8. Security Considerations

This document does not introduce new security threats in the LISP architecture nor in the Legacy Internet architecture.

9. IANA Considerations

This document instructs the IANA to assign a /16 IPv6 prefix for use as the global LISP EID space using a hierarchical allocation as outlined in [[RFC5226](#)] and summarized in Table 1.

Attribute	Value
Address Block	XXX0::/16 [1]
Name	EID Space for LISP
RFC	[This Document]
Allocation Date	September 2013
Termination Date	September 2023
Source	True [2]
Destination	True
Forwardable	True
Global	True
Reserved-by-protocol	True [3]

[1] XXX value to be provided by IANA before published as RFC. [2] Can be used as a multicast source as well. [3] To be used as EID space by LISP [[RFC6830](#)] enabled routers.

Table 1: Global EID Space

During the discussion related to this document, the LISP Working Group agreed in suggesting to IANA to reserve adjacent addressing space, more specifically the /12 covering the assigned /16 prefix, for future use as EID space if needs come. Table 2 summarizes the request. Following the policies outlined in [[RFC5226](#)], such space will be assigned only upon IETF Review.

Attribute	Value
Address Block	XXX0::/12 [1]
Name) EID Space for LISP
RFC	[This Document]
Allocation Date	September 2013
Termination Date	September 2023
Source	False
Destination	False
Forwardable	False
Global	False
Reserved-by-protocol	True [2]

[1] XXX value to be provided by IANA before published as RFC. [2] To be used as EID space by LISP [[RFC6830](#)] enabled routers.

Table 2: Reserved for Future Use as Global EID Space

This document does not specify any specific value for the requested address block but suggests that should come from the 2000::/3 Global Unicast Space. Furthermore, it is suggested to assign the /16 prefix from the first /16 block out of the reserved /12 prefix. IANA is not requested to issue a AS0 ROA, since the Global EID Space will be used for routing purposes.

The reserved address space is requested for a period of time of three initial years starting in beginning 2014 (until December 2017), with an option to extend it by three years (until December 2020) up on decision of the IETF. Following the policies outlined in [[RFC5226](#)], upon IETF Review, by December 2017 decision should be made on whether to keep the assignment making the reserved prefix assignment permanent (this includes final decision on the size of the prefix). If the IETF review outcome will be that is not worth to have a reserved prefix as global EID space, the whole /12 (and all sub-block assigned out of it) will be taken out from the IPv6 Special Purpose Address Registry and put back in the free pool managed by IANA by end of January 2018.

Allocation and management of the Global EID Space is detailed in a different document. Nevertheless, all prefix allocations out of this space must be temporary and no allocation must go beyond December 2017 unless the IETF Review decides that the Global EID Space is permanently assigned.

10. Acknowledgments

Special thanks to Roque Gagliano for his suggestions and pointers. Thanks to David Conrad, Scott Bradner, John Curran, Paul Wilson, Geoff Huston, Wes George, Arturo Servin, Sander Steffann, Brian Carpenter, Roger Jorgensen, Terry Manderson, Brian Haberman, Adrian Farrel, Job Snijders, Marla Azinger, Chris Morrow, and Peter Schoenmaker, for their insightful comments. Thanks as well to all participants to the fruitful discussions on the IETF mailing list.

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Appendix A. LISP Terminology

LISP operates on two name spaces and introduces several new network

elements. To facilitate the reading, this section provides high-level definitions of the LISP name spaces and network elements and, as such, it must not be considered as an authoritative source. The reference to the authoritative document for each term is included in every term description.

Legacy Internet: The portion of the Internet that does not run LISP and does not participate in LISP+ALT or any other mapping system.

LISP site: A LISP site is a set of routers in an edge network that are under a single technical administration. LISP routers that reside in the edge network are the demarcation points to separate the edge network from the core network. See [[RFC6830](#)] for more details.

Endpoint ID (EID): An EID is a 32-bit (for IPv4) or 128-bit (for IPv6) value used in the source and destination address fields of the first (most inner) LISP header of a packet. A packet that is emitted by a system contains EIDs in its headers and LISP headers are prepended only when the packet reaches an Ingress Tunnel Router (ITR) on the data path to the destination EID. The source EID is obtained via existing mechanisms used to set a host's "local" IP address. An EID is allocated to a host from an EID-prefix block associated with the site where the host is located. See [[RFC6830](#)] for more details.

EID-prefix: A power-of-two block of EIDs that are allocated to a site by an address allocation authority. See [[RFC6830](#)] for more details.

EID-Prefix Aggregate: A set of EID-prefixes said to be aggregatable in the [[RFC4632](#)] sense. That is, an EID-Prefix aggregate is defined to be a single contiguous power-of-two EID-prefix block. A prefix and a length characterize such a block. See [[RFC6830](#)] for more details.

Routing LOCator (RLOC): A RLOC is an IPv4 or IPv6 address of an egress tunnel router (ETR). A RLOC is the output of an EID-to-RLOC mapping lookup. An EID maps to one or more RLOCs. Typically, RLOCs are numbered from topologically aggregatable blocks that are assigned to a site at each point to which it attaches to the global Internet; where the topology is defined by the connectivity of provider networks, RLOCs can be thought of as Provider Aggregatable (PA) addresses. See [[RFC6830](#)] for more details.

EID-to-RLOC Mapping: A binding between an EID-Prefix and the RLOC-set that can be used to reach the EID-Prefix. The general term "mapping" always refers to an EID-to-RLOC mapping. See [[RFC6830](#)] for more details.

Ingress Tunnel Router (ITR): An Ingress Tunnel Router (ITR) is a router that accepts receives IP packets from site end-systems on one side and sends LISP-encapsulated IP packets toward the Internet on the other side. The router treats the "inner" IP destination address as an EID and performs an EID-to-RLOC mapping lookup. The router then prepends an "outer" IP header with one of its globally routable RLOCs in the source address field and the result of the mapping lookup in the destination address field. See [[RFC6830](#)] for more details.

Egress Tunnel Router (ETR): An Egress Tunnel Router (ETR) receives LISP-encapsulated IP packets from the Internet on one side and sends decapsulated IP packets to site end-systems on the other side. An ETR router accepts an IP packet where the destination address in the "outer" IP header is one of its own RLOCs. The router strips the "outer" header and forwards the packet based on the next IP header found. See [[RFC6830](#)] for more details.

Proxy ITR (PITR): A Proxy-ITR (PITR) acts like an ITR but does so on behalf of non-LISP sites which send packets to destinations at LISP sites. See [[RFC6832](#)] for more details.

Proxy ETR (PETR): A Proxy-ETR (PETR) acts like an ETR but does so on behalf of LISP sites which send packets to destinations at non-LISP sites. See [[RFC6832](#)] for more details.

Map Server (MS): A network infrastructure component that learns EID-to-RLOC mapping entries from an authoritative source (typically an ETR). A Map Server publishes these mappings in the distributed mapping system. See [[RFC6833](#)] for more details.

Map Resolver (MR): A network infrastructure component that accepts LISP Encapsulated Map-Requests, typically from an ITR, quickly determines whether or not the destination IP address is part of the EID namespace; if it is not, a Negative Map-Reply is immediately returned. Otherwise, the Map Resolver finds the appropriate EID-to-RLOC mapping by consulting the distributed mapping database system. See [[RFC6833](#)] for more details.

The LISP Alternative Logical Topology (ALT): The virtual overlay network made up of tunnels between LISP+ALT Routers. The Border Gateway Protocol (BGP) runs between ALT Routers and is used to carry reachability information for EID-prefixes. The ALT provides

a way to forward Map-Requests toward the ETR that "owns" an EID-prefix. See [[RFC6836](#)] for more details.

ALT Router: The device on which runs the ALT. The ALT is a static network built using tunnels between ALT Routers. These routers are deployed in a roughly-hierarchical mesh in which routers at each level in the topology are responsible for aggregating EID-Prefixes learned from those logically "below" them and advertising summary prefixes to those logically "above" them. Prefix learning and propagation between ALT Routers is done using BGP. When an ALT Router receives an ALT Datagram, it looks up the destination EID in its forwarding table (composed of EID-Prefix routes it learned from neighboring ALT Routers) and forwards it to the logical next-hop on the overlay network. The primary function of LISP+ALT routers is to provide a lightweight forwarding infrastructure for LISP control-plane messages (Map-Request and Map-Reply), and to transport data packets when the packet has the same destination address in both the inner (encapsulating) destination and outer destination addresses ((i.e., a Data Probe packet). See [[RFC6836](#)] for more details.

[Appendix B](#). Document Change Log

Version 06 Posted October 2013.

- o Clarified the rationale and intent of the EID block request with respect to [[RFC3692](#)], as suggested by S. Bradner and J. Curran.
- o Extended [Section 3](#) by adding the transition scenario (as suggested by J. Curran) and the TE scenario. The other scenarios have been also edited.
- o [Section 6](#) has been re-written to introduce the 3+3 allocation plan as suggested by B. Haberman and discussed during 86th IETF.
- o [Section 9](#) has also been updated to the 3+3 years allocation plan.
- o Moved [Section 10](#) at the end of the document.
- o Changed the original Definition of terms to an appendix.

Version 05 Posted September 2013.

- o No changes.

Version 04 Posted February 2013.

- o Added Table 1 and Table 2 as requested by IANA.
- o Transformed the prefix request in a temporary request as suggested by various comments during IETF Last Call.
- o Added discussion about short/long term impact on BGP in [Section 4](#) as requested by B. Carpenter.

Version 03 Posted November 2012.

- o General review of [Section 5](#) as requested by T. Manderson and B. Haberman.
- o Dropped [RFC 2119](#) Notation, as requested by A. Farrel and B. Haberman.
- o Changed "IETF Consensus" to "IETF Review" as pointed out by Roque Gagliano.
- o Changed every occurrence of "Map-Server" and "Map-Resolver" with "Map Server" and "Map Resolver" to make the document consistent with [[RFC6833](#)]. Thanks to Job Snijders for pointing out the issue.

Version 02 Posted April 2012.

- o Fixed typos, nits, references.
- o Deleted reference to IANA allocation policies.

Version 01 Posted October 2011.

- o Added [Section 5](#).

Version 00 Posted July 2011.

- o Updated section "IANA Considerations"
- o Added section "Rationale and Intent" explaining why the EID block allocation is useful.
- o Added section "Expected Use" explaining how sites can request and use a prefix in the IPv6 EID Block.
- o Added section "Action Plan" suggesting IANA to avoid allocating address space adjacent the allocated EID block in order to accommodate future EID space requests.

- o Added section "Routing Consideration" describing how routers not running LISP deal with the requested address block.
- o Added the present section to keep track of changes.
- o Rename of [draft-meyer-lisp-eid-block-02.txt](#).

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