I've copied the current IPv6 policy, compared it to the Cosmetic Surgery Project run by Emilio (PDO) and edited the final text to match the policy proposal (elvis)

the added text is in font Times New Roman and the removed text is ~~striked out~~

Number:	(assigned by the RIPE NCC)	
Policy Proposal Name:	PA/PI unification IPv6 Address Space	
Authors:	Daniel Stolpe stolpe@resilans.se Elvis Daniel Velea - elvis@velea.eu Olaf Sonderegger Olaf.Sonderegger@abraxas.ch	
Proposal Version:	(assigned by the RIPE NCC)	
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Suggested RIPE WG for discussion and publication:	AP-WG, IPv6-WG (?)	
Proposal Type:	modification, unification	
Policy Term:	Indefinite	
Summary of proposal:	This policy proposal aims to unify the three RIPE documents ripe-589, ripe-451 and ripe-233 and to provide one document for all the IPv6 space. It also removes the difference between PI and PA.	
Policy text:	see below	
Rationale:	a. Arguments supporting the proposal b. Arguments opposing the proposal	

Abstract

This document defines registry policies for the ~~assignment and~~ allocation and sub-allocation of globally unique IPv6 addresses to ~~Internet Service Providers (ISPs) and other organisations~~ RIPE NCC members and their customers. It was initially developed in 1999 through joint discussions among the APNIC, ARIN and RIPE communities. It has been updated over time by the RIPE community following the PDP process.

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1. Introduction

~~1.1. Overview~~

This document describes policies for the allocation and sub-allocation ~~assignment~~ of globally unique Internet Protocol version 6 (IPv6) address space.

It also describes the policies for address space allocated for special purposes, such as Internet Exchange Points and Internet Root Servers.

[RFC 4291] designates 2000::/3 to be global unicast address space that the Internet Assigned Numbers Authority (IANA) may allocate to the RIRs. In accordance with [RFC 4291], IANA allocated initial ranges of global unicast IPv6 address space from the 2000::/3 address block to the RIRs. This document ~~concerns~~ describes the policies concerning the IPv6 ~~initial and subsequent~~ allocations and sub-allocations~~of the 2000::/3 unicast address space~~ as developed by the RIPE community.

, for which RIRs formulate allocation and assignment policies. All bits to the left of /64 are in scope.

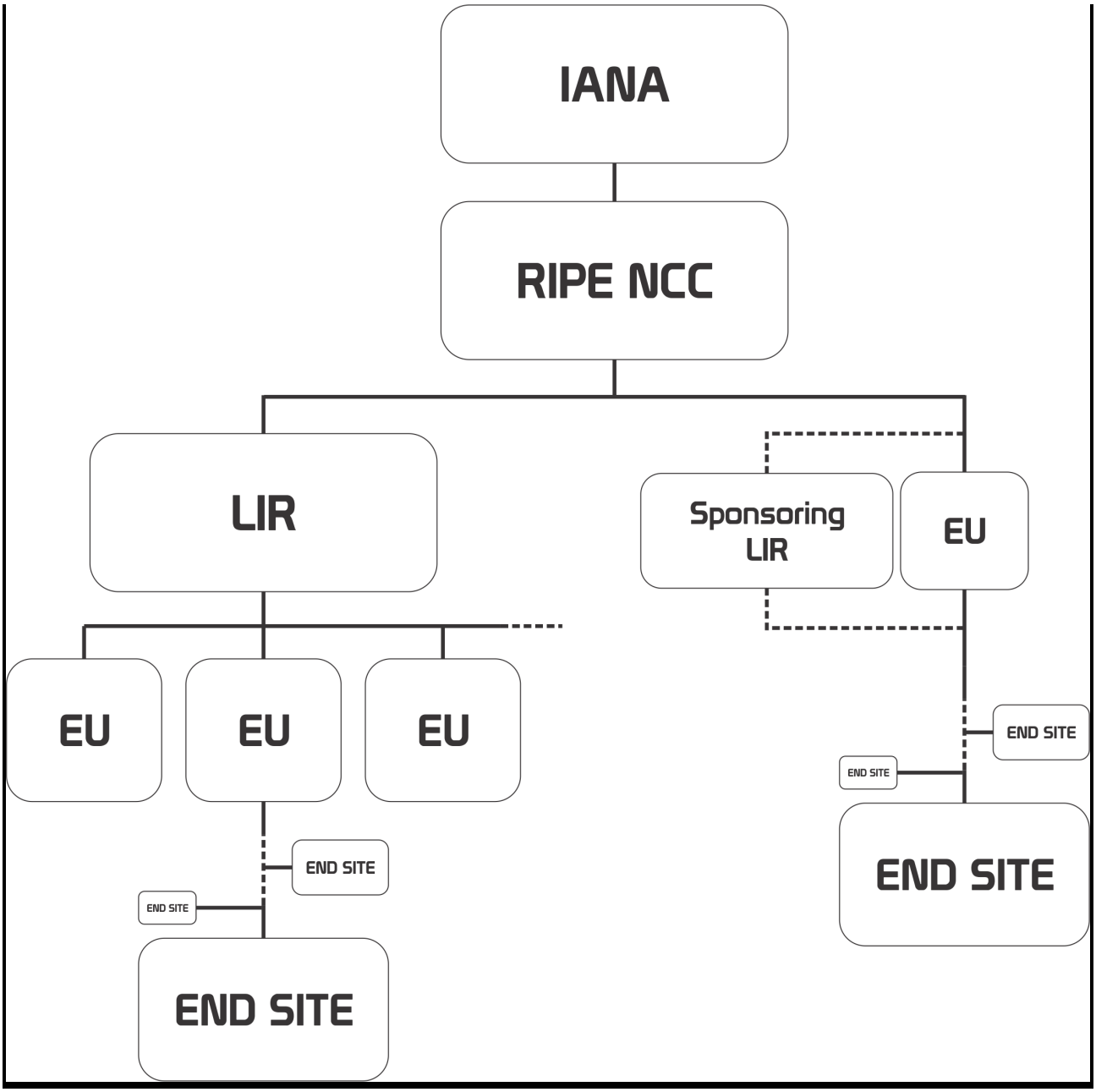
This policy is subject to future review and potential revision, subject to continuing experience in the administration of IPv6.

2. Definitions

[Note: some of these definitions will be replaced by definitions from other RIR documents in order to be more consistent.]

The following terms and their definitions are of particular importance to the understanding of the goals, environment and policies described in this document.

Responsibility for management of IPv6 address spaces is distributed globally in accordance with the hierarchical structure shown below.



2.1. Internet Registry (IR)

An Internet Registry is an organisation that is responsible for distributing IP address space to its members or customers and for registering those distributions. IRs are classified according to their primary function and territorial scope within the hierarchical structure depicted in the figure above.

2.2. Regional Internet Registry (RIR)

Regional Internet Registries are established and authorised by respective regional communities and recognised by the IANA to serve and represent large geographical regions. The primary role of RIRs is to manage and distribute public Internet address space within their respective regions.

~~**2.3. National Internet Registry (NIR)**~~

~~A National Internet Registry primarily allocates address space to its members or constituents, which are generally LIRs organised at a national level. NIRs exist mostly in the Asia Pacific region.~~

2.3 Sponsoring LIR

Members of the RIPE NCC (LIRs) can request portable allocations on behalf of third parties. The RIPE NCC allocates resources directly to the third party. The role of the LIR is to facilitate the administrative processes and to maintain a link between the RIPE NCC and the third party that holds the resources. An LIR fulfilling this role is called the Sponsoring LIR for the third party. Third parties can choose another LIR to be their sponsoring LIR at any time.

2.4. Local Internet Registry (LIR)

A Local Internet Registry (LIR) is an IR that primarily ~~assigns~~ sub-allocates address space to the users of the network services that it provides. ~~LIRs are generally ISPs whose customers are primarily End Users and possibly other ISPs.~~

2.~~5.~~ ~~9~~ End Site

An End Site is defined as an End User (subscriber) who has a business or legal relationship (same or associated entities) with a service provider that involves:

• that service provider ~~assigning~~ sub-allocating address space to the End User

• that service provider providing transit service for the End User to other sites

• that service provider carrying the End User's traffic

• that service provider advertising an aggregate prefix route that contains the End User's ~~assignment~~ sub-allocation

2.~~6.~~ ~~5.~~ Allocate

To “allocate” means to distribute address space to LIRs for the purpose of subsequent distribution by them.

~~**2.7. 6. Assign**~~

~~To “assign” means to delegate address space to an ISP or End User End Site for specific use within the~~

~~Internet infrastructure they operate of the End Site. Assignments must only be made for specific purposes documented and are not to be sub-assigned to other parties.~~

2.7. Sub-allocate

To sub-allocate means to distribute address space to customers or members for the purpose of subsequent distribution(sub-allocation) or usage by them.

2.8. Aggregate

To aggregate means to register multiple sub-allocations that are of the same size and are used for the same purpose in one RIPE Database object.

2.9. ~~7.~~ Utilisation

The actual usage of addresses within each assignment may be low when compared to IPv4 assignments. In IPv6, "utilisation" is only measured in terms of the bits to the left of the efficiency measurement unit (/56). In other words, "utilisation" effectively refers to the (sub-)allocation ~~assignment~~ of network prefixes to End Sites and not the number of addresses (sub-)allocated ~~assigned~~ within individual End Site (sub-)allocations ~~assignments~~.

Throughout this document, the term "utilisation" refers to the sub-allocation ~~assignment~~ of network prefixes to End Sites and not the number of addresses ~~assigned within individual subnets within those End Sites~~ used with the /56.

2.10. ~~8.~~ HD-Ratio

The HD-Ratio is a way of measuring the efficiency of address sub-allocation ~~assignment~~ ~~[~~RFC3194~~]~~. It is an adaptation of the H-Ratio originally defined in ~~[~~RFC1715~~]~~ and is expressed as follows:

$$HD = \frac{\text{Log (number of allocated objects)}}{\text{Log (maximum number of allocatable objects)}}$$

where (in the case of this document) the objects are IPv6 networks sub-allocated ~~assigned~~ from an IPv6 prefix of a given size.

More details are found in appendix A.

3. Goals of IPv6 address space management

~~3.1. Goals~~

IPv6 address space is a public resource that must be managed in a prudent manner with regards to the long-term interests of the Internet. Responsible address space management involves balancing a set of sometimes competing goals. The following are the goals relevant to IPv6 address policy.

3.1. ~~2.~~ Uniqueness

Every ~~assignment and/or~~ allocation or sub-allocation of address space must guarantee uniqueness worldwide. This is an absolute requirement for ensuring that every public host on the Internet can be uniquely identified.

3.2. ~~3.~~ Registration

~~Internet address space must be registered in a registry database accessible to appropriate members of the Internet community. This is necessary to ensure the uniqueness of each Internet address and to provide reference information for Internet troubleshooting at all levels, ranging from all RIRs and IRs to End Users.~~

~~The goal of registration should be applied within the context of reasonable privacy considerations and applicable laws.~~

All allocations, sub-allocations or aggregations must be registered in the RIPE Database. This is necessary to ensure uniqueness and to support network operations.

Only allocations, sub-allocations or aggregations registered in the RIPE Database are considered valid. Registration of objects in the database is the final step in making an allocation. sub-allocation or aggregation. Registration data (range, contact information, status etc.) must be correct at all times (i.e. it has to be maintained).

3.3. ~~4.~~ Aggregation

Wherever possible, address space should be distributed in a hierarchical manner, according to the topology of network infrastructure. This is necessary to permit the aggregation of routing information by ISPs and to limit the expansion of Internet routing tables.

This goal is particularly important in IPv6 addressing, where the size of the total address pool creates significant implications for both internal and external routing.

IPv6 address policies should seek to avoid fragmentation of address ranges.

Further, ~~R~~IRs should apply practices that maximise the potential for subsequent allocations to be made contiguous with past allocations currently held. However, there can be no guarantee of contiguous allocation.

3.4. ~~5.~~ Conservation

Although IPv6 provides an extremely large pool of address space, address policies should avoid unnecessarily wasteful practices. Requests for address space should be supported by appropriate documentation and stockpiling of unused addresses should be avoided.

3.5. ~~6.~~ Fairness

All policies and practices relating to the use of public address space should apply fairly and equitably to all existing and potential members of the Internet community, regardless of their location, nationality, size, or any other factor.

3.6. ~~7.~~ Minimised overhead

It is desirable to minimise the overhead associated with obtaining address space. Overhead includes the need to go back to ~~R~~IRs for additional space too frequently~~,~~ and the administrative work ~~the overhead~~ associated with managing address space that grows through a number of small successive incremental expansions rather than through fewer, but larger, expansions.

3.7. ~~8.~~ Conflict of goals

The goals described above will often conflict with each other, or with the needs of ~~individual~~ IRs or ~~End Users~~ their customers. All IRs evaluating requests for (sub-)allocations ~~and assignments~~ must make judgments, seeking to balance the needs of the applicant with the needs of the Internet community as a whole.

In IPv6 address policy, the goal of aggregation is considered to be the most important.

4. IPv6 Policy Principles

To address the goals described in the previous section, the policies in this document discuss and follow

the basic principles described below.

4.1. Address space not to be considered property

It is contrary to the goals of this document and is not in the interests of the Internet community as a whole for address space to be considered freehold property.

~~The policies in this document are based upon the understanding that globally unique IPv6 unicast address space is licensed distributed for use rather than owned. Specifically, IP addresses will be allocated and assigned on a license basis, with licenses subject to renewal on a periodic basis to organsations based on the policies in place at that time. The granting of a license is subject to specific conditions applied at the start or renewal of the license.~~

~~RIRs will generally renew licenses automatically, Address space is allocated or assigned for an indefinite period of time provided requesting organisations are making a "good faith" effort at meeting the criteria under which they qualified for or were granted an allocation or assignment. However, in those cases where a requesting organisation is not using the address space as intended, or is showing bad faith in following through on the associated obligation, RIRs reserve the right to not renew the license reclaim these addresses. Note that when a license is renewed, the new license will be evaluated under and governed by the applicable IPv6 address policies in place at the time of renewal, which may differ from the policy in place at the time of the original allocation or assignment.~~

The policies in this document are based upon the understanding that globally unique IPv6 unicast address space is registered for use rather than owned as an asset.

Specifically, IP addresses are (sub-)allocated based on demonstrated and justified need. The (sub-)allocations are registered in the RIPE Database. The (sub-)allocation is only valid for as long as the original criteria under which the organisation qualified for an allocation or a sub-allocation are still valid.

In those cases where the organisation is not using the address space as intended, or is not complying with the policies and/or the responsibilities associated with it, the RIPE NCC reserves the right to deregister the address space.

When requesting additional address space or changes to existing address space, these requests will be evaluated according to the IPv6 policies that are current at that time.

4.2. Routability not guaranteed

There is no guarantee that any address allocation or ~~assignment~~ sub-allocation will be globally routable.

However, ~~R~~IRs must apply procedures that reduce the possibility of fragmented address space which may lead to a loss of routability.

~~**4.3. Minimum allocation**~~

~~The minimum allocation size for IPv6 address space is /32.~~

4.~~3.~~ ~~4.~~ Consideration of IPv4 infrastructure

Where an existing IPv4 service provider requests IPv6 space for eventual transition of existing services to IPv6, the number of present IPv4 customers may be used to justify a larger request than would be justified if based solely on the IPv6 infrastructure.

5. Policies for Allocations ~~and Assignments~~ and Sub-allocations

5.1. Initial allocation

5.1.1. Initial allocation criteria

To qualify for an initial allocation of IPv6 address space, an ~~organisation~~ IR must:

~~a) be an LIR;~~

~~b)~~ have a plan for making sub-allocations to other ~~organisations~~ customers and/or End Sites ~~and/or End Site assignments~~ within two years.

5.1.2. Initial allocation size

~~Organisations that meet the initial allocation criteria are eligible to receive an initial allocation of /32.~~

The minimum size of the allocation is a /32.For allocations made by the RIPE NCC to the LIR which are up to a /29 no additional documentation is necessary.

~~Organisations~~ IRs may qualify for an initial allocation greater than ~~/29~~ the initial allocation size by submitting documentation that reasonably justifies the request. If so, the allocation size will be based on the number of existing users ~~and~~, the extent of the organisation's infrastructure and by taking into account future growth plans for up to two years in the future.

/48 allocations can be made by the RIPE NCC to the customers of the LIR which do not expect to ever need more **or** for the special purposes. The special purposes are covered in Chapter 6 of this policy.When an organisation requests a /48 allocation it must specifically mention in their request that they do not plan to use anything larger in the foreseen future.

5.1.3 Initial non-portable allocations

An LIR can only receive non-portable allocations.

5.1.4 Initial portable allocations

To qualify for portable address space, a LIR's customer must meet the requirements of the policies described in the RIPE NCC document ripe-452 or it's updates.

The RIPE NCC will allocate the prefix directly to the customer of the Sponsoring LIR upon a request properly submitted to the RIPE NCC by the Sponsoring LIR.

5.2. ~~Subsequent~~ Additional allocation

Organisations that hold an existing IPv6 allocation may receive an ~~subsequent~~ additional allocation in accordance with the following policies.

5.2.1. Additional ~~Subsequent~~ allocation criteria

A /32 (or larger when documented) additional allocation may be made when different routing requirements are demonstrated.

Also, an additional ~~Subsequent~~ allocation will be provided when an ~~organisation (i.e. ISP/LIR)~~ IR satisfies the evaluation threshold of past address utilisation in terms of the number of sites in units of /56s ~~assignments~~. The HD-Ratio (RFC3194) is used to determine the utilisation thresholds that justify the allocation of additional address as described below.

5.2.2. Applied HD-Ratio

The HD-Ratio value of 0.94 is adopted as indicating an acceptable address utilisation for justifying the

allocation of additional address space. Appendix A provides a table showing the number of sub-allocations ~~assignments~~ that are necessary to achieve an acceptable utilisation value for a given address block size.

5.2.3. ~~Subsequent~~ Additional allocation size

When ~~an organisation~~ LIR or it's customer has achieved an acceptable utilisation for its allocated address space, it is immediately eligible to obtain an additional allocation that results in a doubling of the address space allocated to it. If an organisation needs more address space, it must provide documentation justifying its requirements for a two-year period. The allocation made will be based on this requirement or, where possible, based on the usage of the previous two years.

Where possible, the additional allocation will be made from an adjacent address block, meaning that its existing allocation is extended by one or more bits to the left. An exception is the case when an additional allocation is needed for different routing requirements.

~~5.3. LIR-to-ISP allocation~~

~~There is no specific policy for an organisation (LIR) to allocate address space to subordinate ISPs. Each LIR organisation may develop its own policy for subordinate ISPs to encourage optimum utilisation of the total address block allocated to the LIR. However, all /48 assignments to End Sites are required to be registered either by the LIR or its subordinate ISPs in such a way that the RIR/NIR can properly evaluate the HD-Ratio when a subsequent allocation becomes necessary.~~

5.3 Allocations made by RIR

The RIPE NCC will make allocations to LIRs or their customers according to the points 5.1 and 5.2 of this policy. These allocations can be made to the LIR (not portable) or (via a Sponsoring LIR) to a customer of the LIR (portable).

5.4 Sub-allocations

5.4.1 Sub-allocations made by LIR

An LIR can make a sub-allocation to a customer encouraging optimum utilisation of the total address block allocated. When more than a /32 is to be sub-allocated to the same customer, the LIR is must request an approval from the RIPE NCC.

5.4.2 Sub-allocations made by customer of the (Sponsoring) LIR

A customer of an LIR which has received an allocation (portable or not) can further sub-allocate parts of this sub-allocation to a downstream customer.

~~**5.4. Assignment**~~

~~LIRs must make IPv6 assignments in accordance with the following provisions.~~

5.4.3. ~~1.~~ Sub-allocation ~~Assignment address space~~ size

End ~~Users~~ Sites or customers are ~~assigned~~ sub-allocated an IPv6 block ~~an End Site assignment from their LIR or ISP~~. The size of the sub-allocation ~~assignment~~ is a local decision for the ~~LIR or ISP~~ to make, using a minimum value of a /64 (only one subnet is anticipated for the End Site).

A sub-allocation of a /56 or shorter is recommended when two or more subnets are anticipated for the End Site.

5.4.4. ~~2. Assignments~~ Sub-allocations shorter than a /48 to a single End Site

When a single End Site requires a~~n assignment~~ sub-allocation shorter than a /48, it must request the ~~assignment~~ sub-allocation with documentation or materials that justify the request. Requests for multiple or additional prefixes exceeding a /48 ~~assignment~~ sub-allocation for a single End Site will be processed and reviewed (i.e., evaluation of justification) at the RIR~~/NIR~~ level.

~~Note: There is no experience at the present time with the assignment of multiple network prefixes to the same End Site. Having the RIR review all such assignments is intended to be a temporary measure until some experience has been gained and some common policies can be developed. In addition, additional work at defining policies in this space will likely be carried out in the near future.~~

5.4.5. ~~3. Assignment~~ Sub-allocation to operator's infrastructure

An ~~organisation (i.e. ISP/LIR)~~ IR may ~~assign~~ sub-allocate a network prefix per PoP as the service infrastructure of an IPv6 service operator. Each ~~assignment~~ sub-allocation to a PoP is regarded as one ~~assignment~~ regardless of the number of users using the PoP. A separate ~~assignment~~ sub-allocation can be obtained for the in-house operations of the operator.

5.5 Registration

When an ~~organisation~~ IR holding an IPv6 address allocation makes IPv6 ~~address assignments, it must register these assignments in the appropriate RIR database.~~ allocations, sub-allocations or aggregations these must be registered in the RIPE Database. Multiple sub-allocations which have the same justification can be aggregated. Status AGGREGATED can be used in the RIPE Database as long as the inet6num object includes an attribute showing the sub-allocation size within that aggregation. The

sub-allocation size can be a number between 48 and 64.Aggregations are multiple contiguous sub-allocations of the same size made to different End Sites for the same purpose. Sub-allocations larger than a /48 can not be part of an aggregation, these must be registered separately in the RIPE Database.

~~These registrations can either be made as individual assignments or by inserting a object with a status value of 'AGGREGATED-BY-LIR' where the assignment-size attribute contains the size of the individual assignments made to End Users.When more than a /48 is assigned to an organisation, it must be registered in the database as a separate object with status 'ASSIGNED'.~~

In case of an audit or when making a request for a subsequent allocation, the LIR must be able to present statistics showing the number of individual ~~assignments~~ sub-allocations made in all objects with a status of 'AGGREGATED~~-BY-LIR~~' in such a way the RIR is able to calculate and verify the actual HD-ratio.

5.6. Reverse lookup

When an RIR~~/NIR delegates~~ allocates IPv6 address space to ~~an organisation~~ an IR, it also delegates the responsibility to manage the reverse lookup zone that corresponds to the allocated IPv6 address space. Each ~~organisation~~ LIR or customer should properly manage its reverse lookup zone. When making a~~n address assignment~~ sub-allocation, the ~~organisation~~ IR ~~must~~ can delegate to ~~an assignee~~ it's customer ~~organisation~~, upon request, the responsibility to manage the reverse lookup zone that corresponds to the ~~assigned address~~ sub-allocated block.

5.7. Existing IPv6 address space holders

5.7.1 LIRs holding an allocation

LIRs that hold one or more IPv6 allocations are able to request extension of each of these allocations up to a /29 without providing further documentation.

The RIPE NCC should allocate the new address space contiguously with the LIRs' existing allocations and avoid allocating non-contiguous space ~~under this policy section~~.

5.7.2 Holders of portable space

The RIPE NCC has previously made IPv6 assignments. These assignments have been transformed automatically by the RIPE NCC in IPv6 allocations with the status ALLOCATED PORTABLE.

Organisations holding an allocation lower than a /32 (except the ones made for special purposes) can request an extension of this allocation to a /32. Where this extension not possible, the organisations has the option to return the allocation and automatically receive a /32 (or larger if justified).

~~6. Anycasting TLD and Tier 0/1 ENUM Nameservers~~

6. Special purposes

Allocations made by the RIPE NCC to these special purposes are considered to be portable and are subject to the policies described in the RIPE Document ripe-452 or it's updates.

These allocations will be made from a separate 'designated block' to facilitate filtering practices and must be returned to the RIPE NCC if no longer in use for the purpose these have been allocated for.

6.1 Allocations for Anycasting TLD and Tier 0/1 ENUM Nameservers

The organisations applicable under this policy are TLD managers, as recorded in the IANA's Root Zone Database and ENUM administrators, as assigned by the ITU. The organisation may receive up to four /48 prefixes per TLD and four /48 prefixes per ENUM. These prefixes must be used for the sole purpose of anycasting authoritative DNS servers for the stated TLD/ENUM, as described in BCP126/RFC 4786.

~~Anycasting assignments are registered with a status of 'ASSIGNED ANYCAST' in the RIPE Database~~These allocations are registered with a status of "ALLOCATED-FOR-ANYCAST" or "ALLOCATED-FOR-ENUM" in the RIPE Database and must be returned to the RIPE NCC if not in use for infrastructure providing authoritative TLD or ENUM Tier 0/1 DNS lookup services any longer.

6.2 Allocations of Internet Exchange Points

The organisations applicable under this policy are Internet Exchange Points which are defined as a physical network infrastructure (layer 2) operated by a single entity whose purpose is to facilitate the exchange of Internet traffic between ISPs. These organisation must have at least three ISPs connected and there must be a clear and open policy for others to join.

The organisation may receive one /48 allocation. The prefix must be used for the sole purpose of operating the IXP.The allocation is registered with a status of "ALLOCATED-FOR-IXP" in the RIPE Database and must be returned to the RIPE NCC if not in use for IXP services any longer.

6.3 Allocations for Internet DNS Root Servers

DNS resolvers and resolving name servers need to be pre-configured with the network addresses of the root name servers. This makes these addresses special and not easy to be changed.

Each (current or future) Internet DNS root server (as listed in the DNS root-servers.net zone) in the RIPE NCC Service Region will be allocated ~~assigned~~ a block of IPv6 address space for the purpose of

root server operations. The size of the block shall be the same as the size of the minimum allocation to Local Internet Registries (LIRs) valid at the time of the root server allocation ~~assignment~~.

The allocated ~~assigned~~ prefix must be used for root server operations and support functions directly related to the operations, such as monitoring, statistics, etc. The allocated ~~assigned~~ prefix is bound to the root server service itself and is not associated with the organisation(s) that operate the root server at a particular point in time.

These organisations should not use the address space to provide any services that are not related to the root server.

If the operational responsibility for a root server moves to a new organisation, the RIPE NCC should be notified so it can make the necessary updates to reflect the changes.

If the new location of the root server is outside the RIPE NCC Service Region, the address space must be returned to the RIPE NCC and a new allocation or assignment must be requested from the appropriate Regional Internet Registry (RIR).

If a root server stops operating completely, the address space must be returned to the RIPE NCC. The RIPE NCC will mark the prefix as "reserved" for a suitably long period of time.

~~7. IPv6 Provider Independent (PI) Assignments~~

~~To qualify for IPv6 PI address space, an organisation must meet the requirements of the policies described in the RIPE NCC document entitled "Contractual Requirements for Provider Independent Resources Holders in the RIPE NCC Service Region".~~

~~The RIPE NCC will assign the prefix directly to the End User organisations upon a request properly submitted to the RIPE NCC, either directly or through a sponsoring LIR.~~

~~The minimum size of the assignment is a /48. Organisations requesting a larger assignment (shorter prefix) must provide documentation justifying the need for additional subnets.~~

~~Additional assignments may also be made when the need is demonstrated and documented based on address usage, or because different routing requirements exist for additional assignments. When possible, these further assignments will be made from an adjacent address block.~~

~~Assignments will be made from a separate 'designated block' to facilitate filtering practices.~~

~~The PI assignment cannot be further assigned to other organisations.~~

~~7.1 IPv6 Provider Independent (PI) Assignments for LIRs~~

~~LIRs can qualify for an IPv6 PI assignment for parts of their own infrastructure that are not used for customer end sites. Where an LIR has an IPv6 allocation, the LIR must demonstrate the unique routing requirements for the PI assignment.~~

~~The LIR must return the IPv6 PI assignment within a period of six months if the original criteria on which the assignment was based are no longer valid.~~

~~If an organisation already received a PI assignment before becoming an LIR, the PI assignment should be returned upon receiving an IPv6 allocation if there are no specific routing requirements to justify both.~~

7. References

[RFC 1715] "The H Ratio for Address Assignment Efficiency", C. Huitema. November 1994, ftp://ftp.ripe.net/rfc/rfc1715.txt.

[RFC 2026] "The Internet Standards Process --Revision 3 IETF Experimental RFC, ftp://ftp.ripe.net/rfc/rfc2026.txt see Sec. 4.2.1

[RFC 2462] "IPv6 Stateless Address Autoconfiguration", S. Thomson, T. Narten, 1998, ftp://ftp.ripe.net/rfc/rfc2462.txt

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[RFC 2928] "Initial IPv6 Sub-TLA ID Assignments", R. Hinden, S. Deering, R. Fink, T. Hain. September 2000, ftp://ftp.ripe.net/rfc/rfc2928.txt

[RFC 3194] "The H-Density Ratio for Address Assignment Efficiency An Update on the H ratio", A. Durand, C. Huitema. November 2001, ftp://ftp.ripe.net/rfc/rfc3194.txt

[RFC 4291] "IP Version 6 Addressing Architecture", R. Hinden, S. Deering. February 2006, ftp://ftp.ripe.net/rfc/rfc4291.txt

[RFC 4786] "Operation of Anycast Services", J. Abley, K. Lindqvist. December 2006, ftp://ftp.ripe.net/rfc/rfc4786.txt

8. Appendix A: HD-Ratio

The utilisation threshold T, expressed as a number of individual /56 prefixes to be allocated from IPv6 prefix P, can be calculated as:

$$T = 2^{((56-P)*HD)}$$

Thus, the utilisation threshold for an organisation requesting subsequent allocation of IPv6 address block is specified as a function of the prefix size and target HD ratio. This utilisation refers to the use of /56s as an efficiency measurement unit, and does not refer to the utilisation of addresses within those End Sites. It is an address allocation utilisation ratio and not an address assignment utilisation ratio.

In accordance with the recommendations of [RFC 3194], this document adopts an HD-Ratio of 0.94 as the utilisation threshold for IPv6 address space allocations.

The following table provides equivalent absolute and percentage address utilisation figures for IPv6 prefixes, corresponding to an HD-Ratio of 0.94.

Prefix	**Total /56**	**/56s HD 0.94**	**Util %**
10	70368744177664	10388121308479	14.76
11	35184372088832	5414630391777	15.39
12	17592186044416	2822283395519	16.04
13	8796093022208	1471066903609	16.72
14	4398046511104	766768439460	17.43
15	2199023255552	399664922315	18.17
16	1099511627776	208318498661	18.95
17	549755813888	108582451102	19.75
18	274877906944	56596743751	20.59

19	137438953472	29500083768	21.46
20	68719476736	15376413635	22.38
21	34359738368	8014692369	23.33
22	17179869184	4177521189	24.32
23	8589934592	2177461403	25.35
24	4294967296	1134964479	26.43
25	2147483648	591580804	27.55
26	1073741824	308351367	28.72
27	536870912	160722871	29.94
28	268435456	83774045	31.21
29	134217728	43665787	32.53
30	67108864	22760044	33.92
31	33554432	11863283	35.36
32	16777216	6183533	36.86

9. ~~10.~~ Appendix B: Background information

9.1. ~~10.1.~~ Background

In 1999 the first provisional IPv6 policy was published in all regions.

This document was replaced in 2002 by a joint policy document. At the time it was considered important to have one policy for all regions to prevent RIR shopping. Over time regional policies started

diverting from each other from 2004 onwards.

9.2. Acknowledgment

The following people contributed to the initial version of this document: Akihiro Inomata, Akinori Maemura, Kosuke Ito, Kuniaki Kondo, Takashi Arano, Tomohiro Fujisaki, and Toshiyuki Yamasaki, Thomas Narten, David Kessens, John Crain, Steve Deering, Gert Doering, Richard Jimmerson, Mirjam Kuehne, Anne Lord, Jun Murai, Paul Mylotte, Ray Plzak, Dave Pratt, Stuart Prevost, Barbara Roseman, Gerard Ross, Paul Wilson, Cathy Wittbrodt and Wilfried Woeber.

10.0 Attribution

This document is compiled from policies developed by the RIPE community.

The following people actively contributed by making proposal through the RIPE Policy Development Process:

Brett Carr, Ondrej Sury, Jordi Palet Martinez, Andy Davidson, Rob Evans, Kurtis Lindqvist, Geoff Huston, Elvis Daniel Velea, Daniel Stolpe, Olaf Sonderegger.

10.1. Background

~~The impetus for revising the 1999 provisional IPv6 policy started with the APNIC meeting held in Taiwan in August 2001. Follow-on discussions were held at the October 2001 RIPE and ARIN meetings. During these meetings, the participants recognised an urgent need for more detailed, complete policies. One result of the meetings was the establishment of a single mailing list to discuss a revised policy together with a desire to develop a general policy that all RIRs could use. This document does not provide details of individual discussions that lead to policies described in this document; detailed information can be found in the individual meeting minutes at the www.apnic.net, www.arin.net, and www.ripe.net web sites.~~

~~In September 2002 at the RIPE 43 Meeting in Rhodes, Greece, the RIPE community approved the policy allowing Internet experiments to receive temporary assignments. As a result, Section 6 was added to this document in January 2003.~~

~~10.2. Why a joint policy?~~

IPv6 addresses are a public resource that must be managed with consideration to the long-term interests of the Internet community. Although regional registries adopt allocation policies according to their own internal processes, address policies should largely be uniform across registries. Having significantly varying policies in different regions is undesirable because it can lead to situations where "registry shopping" can occur as requesting organisations request addresses from the registry that has the most favorable policy for their particular desires. This can lead to the policies in one region undermining the efforts of registries in other regions with regards to prudent stewardship of the address space. In cases where regional variations from the policy are deemed necessary, the preferred approach is to raise the issue in the other regional registries in order to develop a consensus approach that all registries can support.

10.3. The size of IPv6's address space

Compared to IPv4, IPv6 has a seemingly endless amount of address space. While superficially true, short-sighted and wasteful allocation policies could also result in the adoption of practices that lead to premature exhaustion of the address space.

It should be noted that the 128-bit address space is divided into three logical parts, with the usage of each component managed differently. The rightmost 64 bits, the Interface Identifier [RFC 4291], will often be a globally unique IEEE identifier (e.g., mac address). Although an "inefficient" way to use the Interface Identifier field from the perspective of maximizing the number of addressable nodes, the numbering scheme was explicitly chosen to simplify Stateless Address Autoconfiguration [RFC 2462].

The middle bits of an address indicate the subnet ID. This field may often be inefficiently utilised, but the operational benefits of a consistent width subnet field were deemed to be outweigh the drawbacks. This is a variable length field, determined by each LIR's local assignment policy.

10.4. Acknowledgment

The initial version of this document was produced by the JPNIC IPv6 policy drafting team consisting of Akihiro Inomata, Akinori Maemura, Kosuke Ito, Kuniaki Kondo, Takashi Arano, Tomohiro Fujisaki, and Toshiyuki Yamasaki. Special thanks goes out to this team, who worked over a holiday in order to produce an initial document quickly.

An editing team was then organised by representatives from each of the three RIRs (Takashi Arano, Chair of APNIC's Policy SIG, Thomas Narten, Chair of ARIN's IPv6 WG, and David Kessens, Chair of the RIPE IPv6 Working Group).

The editing team would like to acknowledge the contributions to this document of Takashi

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The final editing of the initial version of this document was done by Thomas Narten.