

IPv6 Address Allocation and Assignment Policy

How to read this draft document:

This document relates to a project to improve the readability of RIPE policy documents. If approved, it will replace [ripe-512](#), [ripe-451](#) and [ripe-233](#). To show you how the new document will differ from the current one, we've both provided a summary of the changes made and listed both the current and the proposed text in this document.

We indicate changes to existing text in the document like this:

CURRENT TEXT	PROPOSED TEXT
The text from the current policy document that will be replaced is displayed here.	The proposed text will be displayed here.

If you want to print out the document, we recommend [downloading this PDF](#).

Another version of this draft document is available that contains only the proposed text. Another version of this draft document containing only the proposed text [is available](#).

Summary of changes/comments

- Merger of three documents on IPv6 into one (ripe-512, ripe-451, ripe-233)
- Wording throughout the document has been improved
- Definition of End Site has moved higher up in the document; End Site is mentioned in the definition of “utilisation”, so it has to appear before that
- Definition and all references of NIR and IR removed
- Removed 5.7. Existing IPv6 address space holders: no longer relevant, no more /35

- Notes have been remove

Added in new draft document:

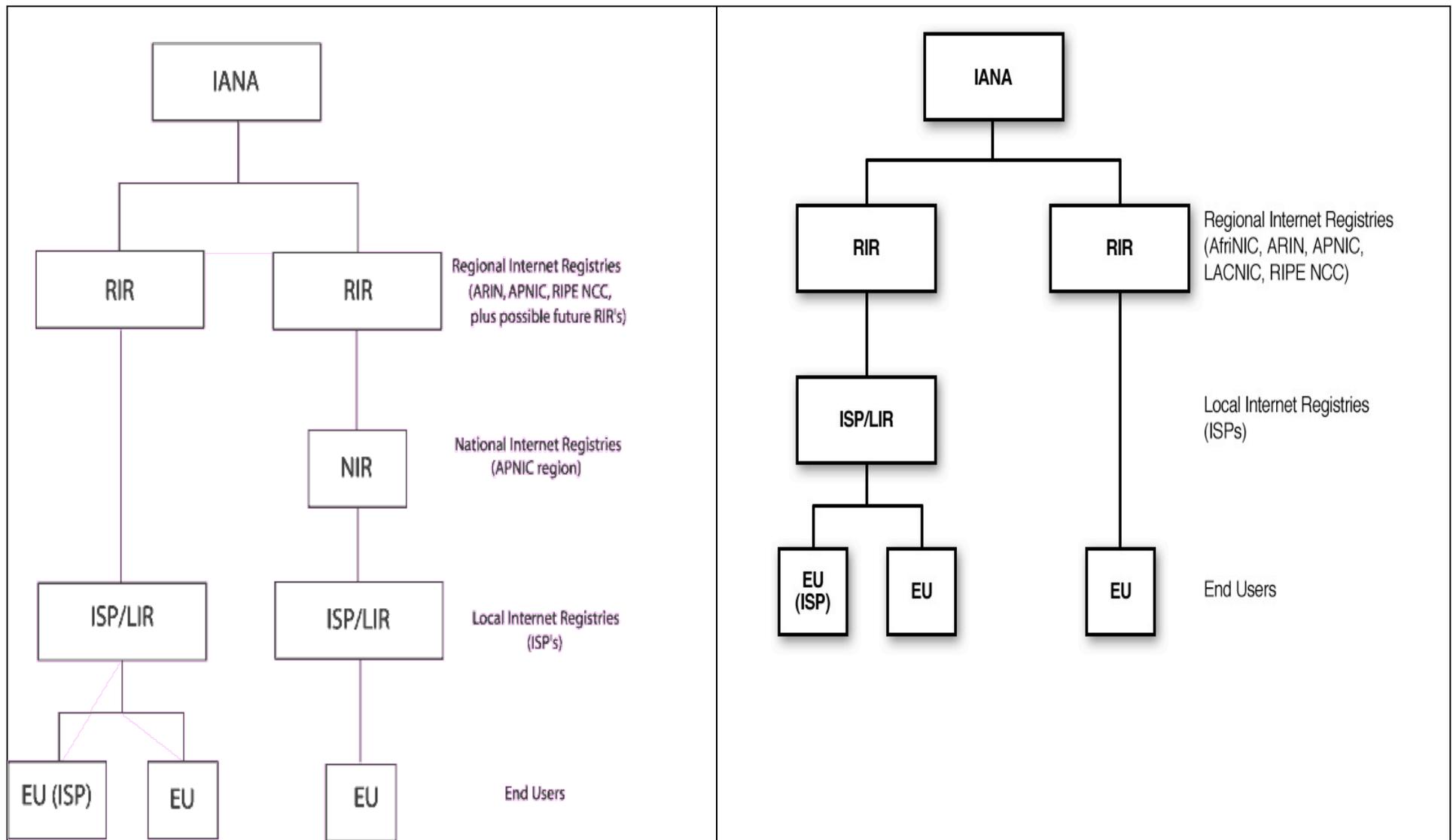
- Section 14.0 - Attribution

CURRENT TEXT	PROPOSED TEXT
<p>Abstract</p> <p>This document defines registry policies for the assignment and allocation of globally unique IPv6 addresses to Internet Service Providers (ISPs) and other organisations. It was developed through joint discussions among the APNIC, ARIN and RIPE communities.</p>	<p>Abstract</p> <p>This document defines the policies for the assignment and allocation of globally unique IPv6 addresses to Internet Service Providers (ISPs) and other organisations. It also describes the policies for IPv6 address space for special purposes, such as Internet Exchange Points and Internet Root Servers.</p>
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<ul style="list-style-type: none"> 6.1. Defining the experiment 6.2. Publication 6.3. Non-commercial basis 6.4. Period of the temporary resource registration 6.5. Registration 6.6. Making the request 7. Anycasting TLD and Tier 0/1 ENUM Nameservers 8. IPv6 Provider Independent (PI) Assignments 8.1 IPv6 Provider Independent (PI) Assignments for LIRs 9 References 10. Appendix A: HD-Ratio 11. Appendix B: Background information 11.1 Background 11.2. Why a joint policy? 11.3. The size of IPv6's address space 11.4. Acknowledgment 	<ul style="list-style-type: none"> 6.5 Registration 6.6 Making the Request 7.0 IPv6 Provider Independent (PI) Assignments 7.1 IPv6 Provider Independent (PI) Assignments for LIRs 8.0 Anycasting TLD and Tier 0/1 ENUM Nameservers 9.0 Internet Exchange Points (IXP) 10.0 Internet DNS Root Servers 11.0 References 12.0 Appendix A: HD-Ratio 13.0 Appendix B: Background Information 13.1 Background 13.2 Acknowledgment 14.0 Attribution
<p>1. Introduction</p> <p>1.1. Overview</p> <p>This document describes policies for the allocation and assignment of globally unique Internet Protocol version 6 (IPv6) address space.</p> <p>[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 the initial and subsequent allocations of the 2000::/3 unicast address space, for which RIRs formulate allocation and assignment policies. All bits to the left of /64</p>	<p>1.0 Introduction</p> <p>1.1. Overview</p> <p>This document describes the policies for the allocation and assignment of globally unique IPv6 address space. It also describes the policies for address space for special purposes, such as Internet Exchange Points and Internet Root Servers.</p> <p>RFC4291 designates 2000::/3 to be global unicast address space that the Internet Assigned Numbers Authority (IANA) may allocate to the RIRs. In accordance with RFC4291, IANA allocated initial ranges of global unicast IPv6 address space from the 2000::/3 address block to the RIRs. This document describes the policies concerning the IPv6 allocations and</p>

<p>are in scope. This policy is subject to future review and potential revision, subject to continuing experience in the administration of IPv6.</p>	<p>assignments as developed by the RIPE community.</p>
<p>2. Definitions <i>[Note: some of these definitions will be replaced by definitions from other RIR documents in order to be more consistent.]</i> 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.</p>	<p>2.0 Definitions The following terms and definitions are of particular importance to the understanding of the goals, environment and policies described in this document. Responsibility for management of IPv6 address space is distributed globally in accordance with the hierarchical structure shown below.</p>



<p>2.1. Internet Registry (IR)</p> <p>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.</p>	
<p>2.2. Regional Internet Registry (RIR)</p> <p>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.</p>	<p>2.1. Regional Internet Registry (RIR)</p> <p>Regional Internet Registries are established and authorised by respective regional communities and recognised by the ICANN 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.</p>
<p>2.3. National Internet Registry (NIR)</p> <p>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.</p>	
<p>2.4. Local Internet Registry (LIR)</p> <p>A Local Internet Registry is an IR that primarily assigns 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.</p>	<p>2.2. Local Internet Registry (LIR)</p> <p>A Local Internet Registry is an organisation that assigns 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.</p>
<p>2.5. Allocate</p>	<p>2.3. Allocate</p> <p>To “allocate” means to distribute address space to IRs for the purpose of</p>

<p>To “allocate” means to distribute address space to IRs for the purpose of subsequent distribution by them.</p>	<p>subsequent distribution.</p>
<p>2.6. Assign To “assign” means to delegate address space to an ISP or End User for specific use within the Internet infrastructure they operate. Assignments must only be made for specific purposes documented by specific organisations and are not to be sub-assigned to other parties.</p>	<p>2.4. Assign To “assign” means to delegate address space to an ISP or End User for specific use within the Internet infrastructure they operate. Assignments must only be made for specific purposes documented by specific organisations and are not to be sub-assigned to other parties.</p>
	<p>2.5. End Site An End Site in IPv6 policies is defined as an End User (subscriber) who has a business or legal relationship (same or associated entities) with a service provider:</p> <ul style="list-style-type: none"> • that assigns address space to the End User; • that provides transit service for the End User to other sites; • that carries the End User's traffic; • that advertises an aggregate prefix route that contains the End User's assignment.
<p>2.7. 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 assignment of network prefixes to End Sites and not the number of addresses assigned within individual End Site assignments. Throughout this document, the term "utilisation" refers to the</p>	<p>2.6. Utilisation 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 assignment of network prefixes to End Sites and not to the number of addresses assigned within individual End Site assignments. The actual usage of addresses within each assignment may be low when compared to IPv4 assignments. Throughout this document, the term "utilisation" refers to the assignment</p>

<p>assignment of network prefixes to End Sites and not the number of addresses assigned within individual subnets within those End Sites.</p>	<p>of network prefixes to End Sites and not the number of addresses assigned within individual subnets within those End Sites.</p>
<p>2.8. HD-Ratio The HD-Ratio is a way of measuring the efficiency of address assignment [RFC 3194]. 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 site addresses assigned from an IPv6 prefix of a given size.</p>	<p>2.7. HD-Ratio The HD-Ratio is a way of measuring the efficiency of address assignment within an allocation (RFC3194). It is an adaptation of the H-Ratio originally defined in RFC1715 and is expressed as follows: $HD = \frac{\text{Log (number of assigned address blocks)}}{\text{Log (maximum number of assignable address blocks)}}$ More details are found in appendix A.</p>
<p>2.9. 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:</p> <ul style="list-style-type: none"> • that service provider assigning 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 	
<p>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</p>	<p>3.0 Goals of IPv6 Address Space Management IPv6 address space is a public resource that must be managed in a prudent manner to benefit the long-term interests of the Internet. Responsible address space management involves balancing a set of</p>

<p>sometimes competing goals. The following are the goals relevant to IPv6 address policy.</p>	<p>sometimes competing goals. The following goals are relevant to IPv6 address policy.</p>
<p>3.2. Uniqueness Every assignment and/or 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.</p>	<p>3.1. Uniqueness Every assignment and/or allocation of address space must be unique. This is an absolute requirement for ensuring that every public host on the Internet can be uniquely identified.</p>
<p>3.3. 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.</p>	<p>3.2. Registration Internet address space must be registered in a 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. The goal of registration should be applied within the context of reasonable privacy considerations and applicable laws.</p>
<p>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.</p>	<p>3.3. 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 growth 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</p>

<p>Further, RIRs 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.</p>	<p>ranges.</p> <p>The RIPE NCC should apply practices that maximise the potential for additional allocations to be contiguous with previous allocations. However, the RIPE NCC cannot guarantee a contiguous allocation.</p>
<p>3.5. Conservation</p> <p>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.</p>	<p>3.4. Conservation</p> <p>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.</p>
<p>3.6. Fairness</p> <p>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.</p>	<p>3.5. Fairness</p> <p>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.</p>
<p>3.7. Minimised overhead</p> <p>It is desirable to minimise the overhead associated with obtaining address space. Overhead includes the need to go back to RIRs for additional space too frequently, the overhead associated with managing address space that grows through a number of small successive incremental expansions rather than through fewer, but larger, expansions.</p>	<p>3.6. Minimised Overhead</p> <p>It is desirable to minimise the overhead associated with obtaining address space. Overhead includes the need to go back to the RIPE NCC for additional space too frequently, and the administrative work associated with managing address space that grows through a number of small successive incremental expansions rather than through fewer, but larger, expansions.</p>

<p>3.8. Conflict of goals</p> <p>The goals described above will often conflict with each other, or with the needs of individual IRs or End Users. All IRs evaluating requests for allocations and assignments must make judgments, seeking to balance the needs of the applicant with the needs of the Internet community as a whole.</p> <p>In IPv6 address policy, the goal of aggregation is considered to be the most important.</p>	<p>3.7. Conflict of Goals</p> <p>The goals described above will often conflict with each other, or with the needs of individual IRs or End Users. All IRs evaluating requests for allocations and assignments must make judgments, seeking to balance the needs of the applicant with the needs of the Internet community as a whole.</p> <p>In IPv6 address policy, the goal of aggregation is considered to be the most important.</p>
<p>4. IPv6 Policy Principles</p> <p>To address the goals described in the previous section, the policies in this document discuss and follow the basic principles described below.</p>	<p>4.0 IPv6 Policy Principles</p> <p>To address the goals described in the previous section, the policies in this document follow the basic principles described below.</p>
<p>4.1. Address space not to be considered property</p> <p>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.</p> <p>The policies in this document are based upon the understanding that globally unique IPv6 unicast address space is licensed 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. The granting of a license is subject to specific conditions applied at the start or renewal of the license.</p> <p>RIRs will generally renew licenses automatically, provided requesting organisations are making a “good faith” effort at meeting the criteria under which they qualified for or were granted an allocation or</p>	<p>4.1. Address space not to be Considered Property</p> <p>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.</p> <p>Specifically, IP addresses are allocated and assigned based on demonstrated and justified need. The allocations and assignments are registered in the RIPE Database. The allocation/assignment is only valid for as long as the original criteria under which the organisation qualified for an allocation or assignment are still valid.</p> <p>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</p>

<p>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. 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.</p>	<p>address space.</p> <p>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.</p>
<p>4.2. Routability not guaranteed There is no guarantee that any address allocation or assignment will be globally routable. However, RIRs must apply procedures that reduce the possibility of fragmented address space which may lead to a loss of routability.</p>	<p>4.2. Routability not Guaranteed There is no guarantee that any address allocation or assignment will be globally routable. However, the RIPE NCC must apply procedures that reduce the possibility of fragmented address space, which may lead to a loss of routability.</p>
<p>4.3. Minimum allocation The minimum allocation size for IPv6 address space is /32.</p>	<p>4.3. Minimum Allocation The minimum allocation size for IPv6 address space is /32.</p>
<p>4.4. 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.</p>	<p>4.4. Consideration of IPv4 Infrastructure If 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.</p>

<p>5. Policies for Allocations and Assignments</p> <p>5.1. Initial allocation</p> <p>5.1.1. Initial allocation criteria</p> <p>To qualify for an initial allocation of IPv6 address space, an organisation must:</p> <ul style="list-style-type: none"> a) be an LIR; b) have a plan for making sub-allocations to other organisations and/or End Site assignments within two years. 	<p>5.0 Policies for Allocations and Assignments</p> <p>5.1. Initial Allocation</p> <p>5.1.1. Initial Allocation Criteria</p> <p>To qualify for an initial allocation of IPv6 address space, an organisation must:</p> <ul style="list-style-type: none"> a) be an LIR; b) have a plan for making sub-allocations to other organisations and/or End Site assignments within two years.
<p>5.1.2. Initial allocation size</p> <p>Organisations that meet the initial allocation criteria are eligible to receive a minimum allocation of /32.</p> <p>Organisations may qualify for an initial allocation greater than /32 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.</p>	<p>5.1.2. Initial Allocation Size</p> <p>Organisations that meet the initial allocation criteria are eligible to receive a minimum allocation of /32.</p> <p>Organisations may qualify for an initial allocation greater than /32 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.</p>
<p>5.2. Subsequent allocation</p> <p>Organisations that hold an existing IPv6 allocation may receive a subsequent allocation in accordance with the following policies.</p>	<p>5.2. Additional Allocation</p> <p>Organisations that hold an existing IPv6 allocation may receive an additional allocation in accordance with the following policies.</p>
<p>5.2.1. Subsequent allocation criteria</p> <p>Subsequent allocation will be provided when an organisation (i.e. ISP/LIR) satisfies the evaluation threshold of past address utilisation in terms of the number of sites in units of /56 assignments. The HD-Ratio [RFC 3194] is used to determine the utilisation thresholds</p>	<p>5.2.1. Additional Allocation Criteria</p> <p>An additional allocation will be provided when an organisation (i.e. an ISP/LIR) satisfies the evaluation threshold of past address utilisation in terms of the number of sites in units of /56 assignments. The HD-Ratio</p>

<p>that justify the allocation of additional address as described below.</p>	<p>(RFC3194) is used to determine the utilisation thresholds that justify the allocation of additional address space as described below.</p>
<p>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 assignments that are necessary to achieve an acceptable utilisation value for a given address block size.</p>	<p>5.2.2. Applied HD-Ratio The HD-Ratio value of 0.94 is adopted as an acceptable address utilisation to justify the allocation of additional address space. Appendix A provides a table showing the number of assignments that are necessary to reach an acceptable utilisation value for a given address block size.</p>
<p>5.2.3. Subsequent allocation size When an organisation 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. Where possible, the allocation will be made from an adjacent address block, meaning that its existing allocation is extended by one bit to the left. 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.</p>	<p>5.2.3. Additional Allocation Size When an organisation has reached 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. Where possible, the allocation will be made from an adjacent address block, meaning that its existing allocation is extended by one bit to the left. If an organisation needs more address space, it must provide documentation justifying its requirements for a two-year period. The new allocation will be based on these requirements.</p>
<p>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</p>	<p>5.3. LIR-to-ISP Allocation There is no specific policy for an organisation (LIR) to allocate address space to subordinate ISPs. Each LIR may develop its own policy for subordinate ISPs to encourage optimum utilisation of the total address block allocated to the LIR. The LIR is responsible for the registration of</p>

<p>subordinate ISPs in such a way that the RIR/NIR can properly evaluate the HD-Ratio when a subsequent allocation becomes necessary.</p>	<p>ALL assignments that are made from their allocation.</p>
<p>5.4. Assignment LIRs must make IPv6 assignments in accordance with the following provisions.</p>	<p>5.4. Assignment LIRs must make IPv6 assignments in accordance with the following provisions.</p>
<p>5.4.1. Assignment address space size End Users are assigned an End Site assignment from their LIR or ISP. The size of the assignment is a local decision for the LIR or ISP to make, anticipated for the End Site).</p>	<p>5.4.1. Assignment Address Space Size End Users are assigned an End Site assignment from their LIR or ISP. The size of the 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).</p>
<p>5.4.2. Assignment of multiple /48s to a single End Site When a single End Site requires an assignment shorter than a /48, it must request the assignment with documentation or materials that justify the request. Requests for multiple or additional prefixes exceeding a /48 assignment 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.</p>	<p>5.4.2. Assignment of Multiple /48s to a Single End Site When a single End Site requires an assignment shorter than a /48 or multiple /48, it must request the assignment providing documentation or materials that justify the request. These requests will be processed and evaluated by the RIPE NCC.</p>

<p>5.4.3. Assignment to operator's infrastructure</p> <p>An organisation (i.e. ISP/LIR) may assign a network prefix per PoP as the service infrastructure of an IPv6 service operator. Each assignment to a PoP is regarded as one assignment regardless of the number of users using the PoP. A separate assignment can be obtained for the in-house operations of the operator.</p>	<p>5.4.3. Assignment to Operator's Infrastructure</p> <p>An organisation (i.e. ISP/LIR) may assign a network prefix per Point of Presence (PoP) as the service infrastructure of an IPv6 service operator. Each assignment to a PoP is regarded as one assignment regardless of the number of users using the PoP. A separate assignment can be obtained for the in-house operations of the operator.</p>
<p>5.5. Registration</p> <p>An organisation holding an IPv6 allocation must register its IPv6 address assignments in the appropriate RIR database.</p> <p>These registrations can be made either as individual assignments or by inserting an object with a status value of "AGGREGATED-BY-LIR" where the "assignment-size:" attribute contains the individual assignment size 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'.</p> <p>The LIR must be able to provide statistics on the number of individual assignments made on all "AGGREGATED-BY-LIR" object statuses so that the RIR can calculate and verify the HD-ratio in the case of audits or subsequent allocation requests.</p>	<p>5.5. Registration</p> <p>When an organisation holding an IPv6 address allocation makes IPv6 address assignments, it must register these assignments in the appropriate RIR database.</p> <p>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'.</p> <p>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 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.</p>
<p>5.6. Reverse lookup</p> <p>When an RIR/NIR delegates IPv6 address space to an organisation, it also delegates the responsibility to manage the reverse lookup zone that corresponds to the allocated IPv6 address space. Each organisation</p>	<p>5.6. Reverse Lookup</p> <p>When the RIPE NCC delegates IPv6 address space to an organisation, it also delegates the responsibility to manage the reverse lookup zone that</p>

<p>should properly manage its reverse lookup zone. When making an address assignment, the organisation must delegate to an assignee organisation, upon request, the responsibility to manage the reverse lookup zone that corresponds to the assigned address.</p>	<p>corresponds to the allocated IPv6 address space. Each organisation should properly manage its reverse lookup zone. When making an address space assignment, the organisation must delegate, when requested, the responsibility to the End User to manage the reverse lookup zone that corresponds to the assigned address space.</p>
<p>5.7. Existing IPv6 address space holders Organisations that received /35 IPv6 allocations under the previous IPv6 address policy are immediately entitled to have their allocation expanded to a /32 address block without providing justification so long as they satisfy the criteria in Section 5.1.1. The /32 address block will contain the already allocated smaller address block (one or multiple /35 address blocks in many cases) that was already reserved by the RIR for a subsequent allocation to the organisation. Requests for additional space beyond the minimum /32 size will be evaluated as discussed elsewhere in the document.</p>	
<p>6.0 Assignments for Internet Experiments Organisations often require deployment tests for new Internet services and technologies. These require numbering resources for the duration of the test. The policy goal of resource conservation is of reduced importance when resources are issued on a temporary basis.</p>	<p>6.0 Assignments for Internet Experiments Organisations often require deployment tests for new Internet services and technologies. These require numbering resources for the duration of the test. The policy goal of resource conservation is of reduced importance when resources are issued on a temporary basis.</p>
<p>6.1 Defining the experiment An organisation receiving numbering resources must document the experiment. This may be in the form of a current IETF Experimental</p>	<p>6.1 Defining the Experiment An organisation receiving numbering resources must document the</p>

<p>RFC ([RFC 2026] see Sec. 4.2.1) or an “experiment proposal” detailing the resources required and the activities to be carried out.</p>	<p>experiment. This may be in the form of a current IETF Experimental RFC (RFC2026, see Sec. 4.2.1) or an “experiment proposal” detailing the resources required and the activities to be carried out.</p>
<p>6.2 Publication The experiment proposal must be made public (e.g. published on web site), upon registration of the resources by the RIPE NCC. Following the conclusion of the experiment the results must be published free of charge and free from disclosure constraints.</p>	<p>6.2 Publication The experiment proposal must be made public (e.g., published on a website) upon registration of the resources by the RIPE NCC. Following the conclusion of the experiment the results must be published free of charge and free from disclosure constraints.</p>
<p>6.3 Non-commercial basis Resources issued for an experiment must not be used for commercial purposes.</p>	<p>6.3 Non-commercial Basis Resources issued for an experiment must not be used for commercial purposes.</p>
<p>6.4 Period of the Temporary Resource Registration The resources will be issued on a temporary basis for a period of one year. Renewal of the resource’s registration is possible on receipt of a new request that details any continuation of the experiment during the extended period. The resources issued cannot be used for a commercial service following the conclusion of the experiment.</p>	<p>6.4 Period of the Temporary Resource Registration The resources will be issued on a temporary basis for a period of one year. Renewal of the resource’s registration is possible on receipt of a new request that details any continuation of the experiment during the extended period. The resources issued cannot be used for a commercial service following the conclusion of the experiment.</p>
<p>6.5 Registration The RIPE NCC will register the resources issued in the RIPE Whois Database.</p>	<p>6.5 Registration The RIPE NCC will register the resources issued in the RIPE Database.</p>

<p>6.6 Making the request</p> <p>The request must be made by a Local Internet Registry (LIR) using the appropriate request form for the resource found at: http://www.ripe.net/ripe/docs/internet-registries.html#request</p>	<p>6.6 Making the Request</p> <p>The request must be made by an LIR using the appropriate request form for the resource found at: https://www.ripe.net/ripe/docs/request-forms-supporting-notes</p>
<p>7. Anycasting TLD and Tier 0/1 ENUM Nameservers</p> <p>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/RFC4786.</p> <p>Assignments for authoritative TLD or ENUM Tier 0/1 DNS lookup services are subject to the policies described in the RIPE Document entitled "Contractual Requirements for Provider Independent Resource Holders in the RIPE NCC Service Region". Anycasting assignments are registered with a status of 'ASSIGNED ANYCAST' 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.</p>	
<p>8. IPv6 Provider Independent (PI) Assignments</p> <p>To qualify for IPv6 PI address space, an organisation must:</p> <p>a) demonstrate that it will be multihomed</p>	<p>7.0 IPv6 Provider Independent (PI) Assignments</p> <p>To qualify for IPv6 PI address space, an organisation must:</p>

<p>b) 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”</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>Assignments will be made from a separate 'designated block' to facilitate filtering practices.</p> <p>The PI assignment cannot be further assigned to other organisations.</p>	<p>a) demonstrate that it will be multihomed</p> <p>b) 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”</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>Assignments will be made from a separate "designated block" to facilitate filtering practices.</p> <p>The PI assignment cannot be further assigned to other organisations.</p>
<p>8.1 IPv6 Provider Independent (PI) Assignments for LIRs</p> <p>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.</p> <p>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.</p>	<p>7.1 IPv6 Provider Independent (PI) Assignments for LIRs</p> <p>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.</p> <p>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</p>

<p>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.</p>	<p>longer valid.</p> <p>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.</p>
	<p>8.0 Anycasting TLD and Tier 0/1 ENUM Nameservers</p> <p>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/RFC4786.</p> <p>Assignments for authoritative TLD or ENUM Tier 0/1 DNS lookup services are subject to the policies described in the RIPE Document entitled "Contractual Requirements for Provider Independent Resource Holders in the RIPE NCC Service Region".</p> <p>Anycasting assignments are registered with a status of "ASSIGNED ANYCAST" in the RIPE Database and must be returned to the RIPE NCC if no longer in use for infrastructure providing authoritative TLD or ENUM Tier 0/1 DNS lookup services.</p>

IPv6 Address Space Policy for Internet Exchange Points

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- 1.0 Introduction
- 2.0 Definition
- 3.0 Policy
- 4.0 Warning
- 5.0 Obtaining the Address Space

1.0 Introduction

Internet Exchange Points (IXPs) are used to exchange Internet traffic between different Internet Service Providers (ISPs). Many Exchange Point operators require address space for the peering mesh that is independent from any of the address space in use by member networks.

2.0 Definition

An Internet Exchange Point is 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.

There must be a minimum of three ISPs connected and there must be a clear and open policy for others to join. Addresses needed for other purposes (e.g. additional services provided to the members) should be acquired through the appropriate means (e.g. an upstream ISP).

3.0 Policy

Requesting organisations that meet the definition in section 2.0 may receive address space to meet their needs. If the requesting organisation is confident that it will never need more than a single network then a /64 will be assigned.

9.0 Internet Exchange Points (IXP)

An Internet Exchange Point is 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.

Exchange Point operators require address space for the peering mesh (peering LAN) that is independent from any of the address space in use by member networks or any other organisation. This specific policy applies only to this particular part of the infrastructure of the IXP. Addresses needed for any other purposes (e.g. additional services provided to the members, IXP office network etc.) should be requested separately.

To qualify for an assignment, the IXP must have a minimum of three ISPs connected. The IXP must have a transparent and published policy describing the requirements to join.

By default a /48 will be assigned. If the requesting organisation is confident that it will never need more than a single network they can request for a /64 to be assigned.

The RIPE NCC will assign the prefix directly to the IXP, upon a request properly submitted to the RIPE NCC, either directly or through a sponsoring LIR. IPv6 IXP address assignments are subject to the policies described in the RIPE NCC document entitled “Contractual Requirements for Provider Independent Resources Holders in the RIPE NCC Service Region”.

Address space assigned under this policy may not be globally routable.

<p>Otherwise, a /48 will be assigned.</p> <p>The prefix will be assigned by the RIPE NCC directly to the IXP, upon a request properly submitted to the RIPE NCC, either directly or through a sponsoring LIR. IXP IPv6 address assignments are subject to the policies described in the RIPE NCC document entitled “Contractual Requirements for Provider Independent Resources Holders in the RIPE NCC Service Region”.</p> <p>4.0 Warning</p> <p>Networks assigned under this policy may not be globally routable.</p> <p>5.0 Obtaining the Address Space</p> <p>Address space for IXPs qualifying under this policy can be requested by using the form "IPv6 Request Form for Internet Exchange Points" available from the RIPE Document Store at: http://www.ripe.net/ripe/docs/ipv6request-exchange.html</p>	
<p>IPv6 Addresses for Internet Root Servers in the RIPE Region</p> <p>Abstract</p> <p>This document describes the special case assignment policy for Internet DNS root servers in the RIPE region</p> <p>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 change.</p>	<p>10.0 Internet DNS Root Servers</p> <p>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.</p> <p>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 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</p>

Although it is undesirable to give special status to any IP (IPv4 or IPv6) address block, it was agreed by the community that the particular need defined in this document is the only justifiable exception to that general principle.

Under this policy, each (current or future) Internet DNS root server (as listed in the root-servers.net zone) in the RIPE region will be assigned a block of IPv6 address space for purposes 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 assignment.

The assigned prefix is only for root server operations and support functions related directly to the operations, such as monitoring, statistics, etc., and is bound to the root server service itself.

It is not associated with the organisation(s) that operate the root server at a particular point in time and these organisations should not use the address space to provide any services not related to the root server.

Should the operational responsibility for a DNS root server move to a new organisation, the IPv6 address space associated with the server will be returned to the RIPE NCC with possible reassignment to the new organisation.

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

allocation to Local Internet Registries (LIRs) valid at the time of the root server assignment.

The assigned prefix must be used for root server operations and support functions directly related to the operations, such as monitoring, statistics, etc. The 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 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.

If a root server stops operating within the RIPE region, the address space will be returned to the RIPE NCC and marked as "reserved" for a suitably long period of time.

9. References

[RFC1715] "The H Ratio for Address Assignment Efficiency", C. Huitema. November 1994, <ftp://ftp.ripe.net/rfc/rfc1715.txt>.

[RFC2026] "The Internet Standards Process -- Revision 3 IETF Experimental RFC <ftp://ftp.ripe.net/rfc/rfc2026.txt> see Sec. 4.2.1

[RFC2462] "IPv6 Stateless Address Autoconfiguration", S. Thomson, T. Narten, 1998, <ftp://ftp.ripe.net/rfc/rfc2462.txt>

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

[RFC2928] "Initial IPv6 Sub-TLA ID Assignments", R. Hinden, S. Deering, R. Fink, T. Hain. September 2000
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[RFC4291] "IP Version 6 Addressing Architecture", R. Hinden, S. Deering. February 2006, <ftp://ftp.ripe.net/rfc/rfc4291.txt>

[RFC4786] "Operation of Anycast Services", J. Abley, K. Lindqvist.

11.0 References

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<http://www.ietf.org/rfc/rfc2928.txt>

[RFC3194] "The H-Density Ratio for Address Assignment Efficiency An Update on the H ratio", A. Durand, C. Huitema. November 2001, <http://www.ietf.org/rfc/rfc3194.txt>

[RFC4786] "Operation of Anycast Services", J. Abley, K. Lindqvist. December 2006, <http://www.ietf.org/rfc/rfc4786.txt>

10. 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:

$$T = 2 \frac{((56-P)*HD)}{1}$$

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 /56s	/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

12.0 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:

$$T = 2 \frac{((56-P)*HD)}{1}$$

Thus, the utilisation threshold for an organisation requesting subsequent allocation of an 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 [[RFC3194](#)], the HD-Ratio of 0.94 is 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.

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10	70368744177664	10388121308479	14.76
11	35184372088832	5414630391777	15.39
12	17592186044416	2822283395519	16.04

14	4398046511104	766768439460	17.43	13	8796093022208	1471066903609	16.72
15	2199023255552	399664922315	18.17	14	4398046511104	766768439460	17.43
16	1099511627776	208318498661	18.95	15	2199023255552	399664922315	18.17
17	549755813888	108582451102	19.75	16	1099511627776	208318498661	18.95
18	274877906944	56596743751	20.59	17	549755813888	108582451102	19.75
19	137438953472	29500083768	21.46	18	274877906944	56596743751	20.59
20	68719476736	15376413635	22.38	19	137438953472	29500083768	21.46
21	34359738368	8014692369	23.33	20	68719476736	15376413635	22.38
22	17179869184	4177521189	24.32	21	34359738368	8014692369	23.33
23	8589934592	2177461403	25.35	22	17179869184	4177521189	24.32
24	4294967296	1134964479	26.43	23	8589934592	2177461403	25.35
25	2147483648	591580804	27.55	24	4294967296	1134964479	26.43
26	1073741824	308351367	28.72	25	2147483648	591580804	27.55
27	536870912	160722871	29.94	26	1073741824	308351367	28.72
28	268435456	83774045	31.21	27	536870912	160722871	29.94
29	134217728	43665787	32.53	28	268435456	83774045	31.21
30	67108864	22760044	33.92	29	134217728	43665787	32.53

31	33554432	11863283	35.36	30	67108864	22760044	33.92
32	16777216	6183533	36.86	31	33554432	11863283	35.36
				32	16777216	6183533	36.86

11. Appendix B: Background information
11.1. 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.

13.0 Appendix B: Background Information
13.1. 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.

11.2. 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.

11.3. 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 [RFC4291], 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 [[RFC2462](#)].

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.

11.4. 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).

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

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14.0 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:

	<p>Brett Carr, Ondrej Sury, Jordi Palet Martinez, Andy Davidson, Rob Evans, Kurtis Lindqvist, Geoff Huston.</p>
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