

LACNIC POLICY MANUAL (v1.4 - 16/12/2010)

ABSTRACT

IP address allocation follows the hierarchical scheme described in **RFC 2050**. For the region of Latin America and the Caribbean, IP address space is allocated by IANA to LACNIC for its subsequent allocation and assignment to National Internet Registries (NIRs), Internet Service Providers (ISPs), and end users. In addition, administration of Autonomous System Numbers and reverse resolution space are critical components for the efficient operation of the Internet on a global level. This document describes the policies and procedures relating to the allocation, assignment and administration of IPv4 and IPv6 address space, ASN, and the delegation of the reverse resolution space assigned to Latin America and the Caribbean. These policies must be followed by NIRs, ISPs, and end users.

Change Log:

Version 1.0 - Original Version.

Version 1.1 - Global ASNs Policy added (LAC-2007-08).

Version 1.2 - Global Policy for the Allocation of the Remaining IPv4 Address Space Added (LAC-2008-01).

Version 1.3 - IPv6 Allocations to ISPs or LIRs with previous IPv4 allocations (LAC-2009-02)

ASPLAIN notation for 32-bit ASNs (LAC-2009-03)

Allocation of 16-bit only ASNs (LAC-2009-05)

Modification of the minimum initial IPv4 allocation size for ISPs to a /22 (LAC-2009-07)

Version 1.4 - Transfers of IPv4 Blocks within the LACNIC Region (LAC-2009-04)

Resource recovery (LAC-2009-06)

Modifications to the IPv6 Prefix Initial Allocation Policy (LAC-2007-01)

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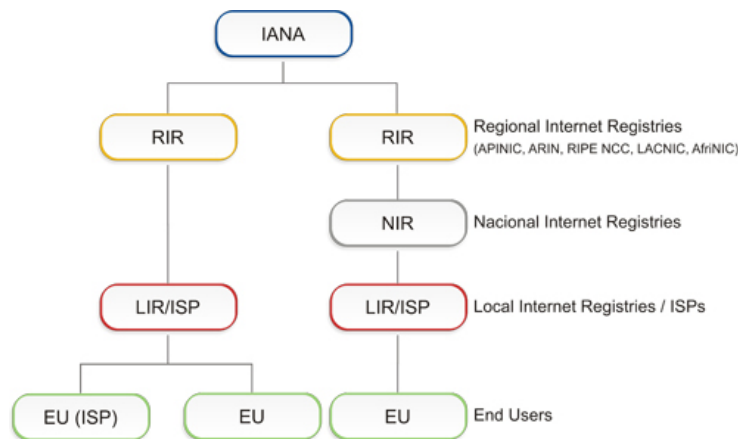
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1 - DEFINITIONS

The following terms and their definitions are of great importance for the correct comprehension of the objectives, context and policies described herein.

IP address allocation follows the hierarchical scheme described in **RFC 2050**. Responsibility for the administration of IP address space is distributed globally in accordance with the hierarchical structure shown below.



1.1. IANA (Internet Assigned Number Authority)

IANA is responsible for allocating part of the global IP address space and autonomous system numbers to Regional Registries according to established needs.

1.2. Internet Registry (IR)

An Internet Registry (IR) is an organization responsible for allocating IP address space to its members or customers and for registering those allocations. IRs are classified according to their main function and geographic area of coverage as indicated in the hierarchical structure defined in the figure above.

1.3. Regional Internet Registry (RIR)

Regional Internet Registries (RIRs) are established and authorized by their respective regional communities, and recognized by the IANA to serve and represent large geographical regions. The primary role of RIRs is to manage and allocate Internet resources within their own respective regions.

1.4. National Internet Registry (NIR)

A National Internet Registry (NIR) primarily allocates Internet resources to its members or constituents, which are generally LIRs.

1.5. Local Internet Registry (LIR)

A Local Internet Registry (LIR) is an IR that primarily assigns Internet resources to the users of the network services it provides. LIRs are generally ISPs, whose customers are primarily end users and possibly other ISPs.

1.6. Internet Service Provider (ISP)

Internet Service Providers mainly assign IP address space to end users of the network

services they provide. Their clients may be other ISPs. ISPs do not have geographical restrictions as do NIRs.

1.7. End Site or End User (EU)

An end site is defined as an end user (subscriber) that has a legal or commercial relationship (the same or associated entities) with an Internet service provider which involves:

- the service provider assigning address space to the end user
- the service provider offering transit services for the end user towards other sites
- the service provider transporting the end user's traffic
- the service provider announcing an aggregated route prefix which contains the address space assigned by LACNIC to the end user

1.8. Allocate

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

1.9. Assign

To assign means to delegate address space to an end user, for specific use within the Internet infrastructure they operate. Assignments must only be made for specific purposes documented by specific organizations and are not to be sub-assigned to other parties.

1.10. Multihomed

A site is considered to be multihomed if it receives full-time connectivity from more than one Internet service provider and has one or more routing prefixes announced by at least two of its upstream providers. Independent providers refers to the fact that one does not reach the Internet through the other.

2 - IPv4 ADDRESSES

2.1. SCOPE

This chapter describes the Internet resource management system in the region of Latin America and the Caribbean. In particular, it describes the rules and guidelines that govern the allocation of the IPv4 address blocks assigned to Latin America and the Caribbean. In the case of IP addresses, the rules established in this chapter apply to all IPv4 address blocks allocated or assigned through LACNIC as well as to those previously allocated and assigned by ARIN.

This chapter does not describe private Internet address space or multicast address space. Neither does this chapter describe IPv6 address space management, a topic that is dealt with in the chapter titled "IPv6 Address Allocation and Assignment Policies." A distinction is made in this document between IP address **allocation** and **assignment**. IP addresses are **allocated** to NIRs and ISPs so that they may in turn **assign** them to their end users.

2.2. IPv4 ADDRESS SPACE AND THE INTERNET REGISTRY SYSTEM

2.2.1- Types of IPv4 Addresses

For the purpose of this chapter, IPv4 addresses are 32-bit binary numbers that are used as addresses in IPv4 protocols used in the Internet. There are three types of IPv4 addresses.

2.2.1.1- Public IPv4 Addresses

Public IPv4 addresses constitute the Internet address space. These addresses are globally unique and allocated in accordance with the objectives that will later be described herein. The main objective of this address space is to allow communication using IPv4 on the Internet.

A secondary objective is to allow communication between interconnected private networks.

2.2.1.2- Private IPv4 Addresses

Certain IPv4 address ranges have been reserved for the operation of private networks. Any organization may use these IPv4 addresses in their private networks without the need of requesting them from an Internet Registry. The main requirement established for the use of private IPv4 addresses is that the hosts that use these IPv4 addresses do not need to be reached through the Internet.

For a more detailed description of the private IPv4 address space, see **RFC 1918**.

2.2.1.3- Special and Reserved IPv4 Addresses

These are IPv4 address ranges reserved for applications such as multicasting. These IPv4 addresses are described in **RFC 1112** and are beyond the scope of this chapter.

2.2.2- Objectives of Public IPv4 Address Space Allocation and Assignment

According to the provisions of **RFC 2050**, each allocation and assignment of public IP addresses shall guarantee that the following four conditions are met.

2.2.2.1- Exclusivity

Each public IPv4 address must be unique worldwide. This is an absolute requirement that guarantees that each Internet host can be uniquely identified.

2.2.2.2- Preservation

Fair allocation of IPv4 address space according to the operational needs of the end users that are operating networks and using this IPv4 address space. In order to maximize the lifespan of public IPv4 address space resources, IPv4 addresses must be allocated according to end users' current needs, thus avoiding the stockpiling of unused IP addresses.

2.2.2.3- Routability

Global allocation of IPv4 addresses in a hierarchical manner, which allows scaling IPv4 address routing. This scaling is necessary to ensure proper operation of Internet routing .

2.2.2.4- Registration

Submission of documentation on IPv4 address space allocations and assignments. This documentation is necessary to ensure exclusivity and to provide information for locating errors on all Internet levels.

Accomplishing the above mentioned objectives is in the best interest of the Internet community in general. However, it must be noted that preservation and routability are frequently conflictive objectives. These objectives may, at times, be in conflict with the interests of ISPs, NIRs or end users. In these cases, a careful analysis of each particular situation must be performed in order to reach an adequate compromise between the parties involved in the conflict.

2.2.3- The Internet Registry System

The Internet registry system has been established with the aim of enforcing the objectives of exclusivity, preservation, routability and information. This system consists of hierarchically organized Internet registries (IRs). Typically, IPv4 address space is assigned to end users by ISPs or NIRs. This IPv4 address space is previously assigned to NIRs and ISPs by Regional Internet Registries. Under this system, end users are organizations that operate networks that use IPv4 address space. Just as LACNIC, NIRs maintain IPv4 address space for making assignments to end users or allocations to Internet Service Providers. Assigned IPv4 address space is used to operate networks, whereas allocated IPv4 address space is kept by Internet Registries for future assignment to end users.

2.3. IPv4 ADDRESS ALLOCATION AND ASSIGNMENT POLICIES

2.3.1- Introduction

This chapter describes how an Internet Registry (for future reference, this concept encompasses Internet Service Providers and National Internet Registries) may obtain an IPv4 address allocation and how that allocated space must be administered.

IPv4 address space is allocated to Internet Registries (IR) using a slow-start model. Allocations are based on justifiable need, not only on the grounds of client prediction. Due to the fact that the number of IPv4 addresses is limited, many factors must be considered for the delegation of IPv4 address space. As previously mentioned, LACNIC's allocations to IRs are based on the slow-start procedure described in **RFC 2050**. The idea is to allocate IPv4 address space to Internet Registries in the same proportion as they will assign the IPv4 addresses to their users.

The size of an allocation to a particular IR is based on the rate with which it has previously assigned IPv4 address space to its clients. The aim is to avoid the existence of large blocks that are not assigned to end users. Due to technical restrictions and the possibility of overloading routing tables, certain policies must be implemented in order to ensure that the preservation and routability objectives are fulfilled.

This chapter mentions prefix sizes and block sizes. Standard notation implies that longer prefixes reference blocks of smaller size. For example, when it is said that a certain policy applies to a prefix longer than a /20, this means that a block smaller than 16 /24s is being discussed.

2.3.2- Aspects to Consider in Relation to IPv4 Address Administration

This section describes a number of aspects on which the relationships both between

Internet Registries and their clients as well as between Internet Registries and LACNIC must be based.

2.3.2.1- IPv4 Addresses are Delegated

LACNIC shall allocate Internet resources according to a delegation plan. This resource allocation plan shall be valid for one year. This allocation is renewable, and shall be subject to the conditions established at the time of renewal.

2.3.2.2- Slow-Start Policy

IPv4 address blocks are allocated to IRs using a slow-start procedure based on **RFC 2050**. Internet Service Providers applying for portable (provider-independent) IPv4 address blocks for the first time shall receive a minimal amount based on immediate requirement, with the exceptions established in Section 2.3.3.3 ("Direct Allocations to Internet Service Providers".)

After this initial allocation, allocated blocks may be increased based on the verification of block utilization according to information provided to LACNIC. Thus, LACNIC shall be responsible for determining initial and subsequent allocations. Initial IPv4 address allocations shall enable IRs to operate for at least twelve months without requiring further allocations.

Initial allocations shall not be based on any current or future routing restrictions, but on actual and demonstrated use of IPv4 addresses.

Likewise, the number of IPv4 addresses projected by the applicant is useful for planning future requirements.

2.3.2.3- Allocated Blocks

In order to ensure an efficient implementation and use of classless technologies (CIDR), LACNIC shall allocate IPv4 address blocks based on the limits supported by this technology. In order to facilitate the efficient deployment of CIDR, Internet Service Providers (ISPs) and End Users are encouraged to initially request IP address space from their upstream providers. Upstream providers shall maintain control of the assigned blocks upon termination of their clients' contracts.

2.3.2.4- Avoid Block Fragmentation

Under the CIDR scheme, IP addresses are allocated to IRs in blocks. It is recommended that the publication of these blocks on the routing tables remain intact. More specifically, ISPs shall treat IP address assignments to their clients as a loan for the duration of the connectivity. Upon termination of the Internet connectivity contract, e.g., if a customer moves to another ISP, the client shall return the IPv4 addresses currently in use and renumber its systems using the new IPv4 addresses of the new provider. New requests for IP addresses shall be conditioned to the completion of this task. The IR shall allow sufficient time for the renumbering process to be completed before these IP addresses can be used again by another client.

2.3.2.5- Documentation

Internet Registries shall use the IPv4 addresses they have been allocated in an efficient manner. To this end, IRs shall document the justification for each IPv4 address assignment. At the request of LACNIC, the corresponding IR shall make this information available. LACNIC shall not make complementary allocations to those Internet Registries that have not properly documented the use of the blocks already allocated. In these cases,

existing allocations may also be reviewed.

According to the provisions of **RFC 2050**, the documentation LACNIC may require includes:

- Engineering plans.
- Subnetting and aggregation plan.
- Description of network topology.
- Description of network routing plans.
- Receipts documenting investments (equipment).
- Other relevant documents.

2.3.2.6- Use of Classless Technology (CIDR)

Due to the requirement to increase the efficiency in the use of IPv4 address space, all allocations and/or assignments are made under the assumption that organizations use variable-length subnet masks (VLSMs) and classless technology (CIDR) within their networks.

The use of classful technologies is generally unacceptable due to the limited availability of free IPv4 address space.

2.3.2.7- Static Addressing

Due to restrictions on the availability of IPv4 addresses, LACNIC shall in no way endorse the use of static IPv4 address assignments for dial-up users (e.g., one address per customer). It is understood that the use of static addressing may simplify certain administrative aspects. However, the current rate of consumption of IPv4 addresses does not allow the assignment of static addresses for administrative reasons. Because of this, organizations that are considering the use of static IPv4 address assignment are encouraged to investigate and implement dynamic assignment technologies.

2.3.2.8- Web Hosting

The development of the HTTP 1.1 protocol has eliminated the need of reserving an IP address for each web domain in case of multiple websites on the same server. LACNIC promotes the development of webpage hosting based on name usage, as opposed to IPv4 addresses.

Therefore, this latter case shall not be accepted as justification for IPv4 address utilization. LACNIC shall consider exceptions where applications require the use of web hosting based on IPv4 addresses, which must be duly described and justified.

2.3.2.9- Non-Guaranteed Routability

Portable (provider-independent) IPv4 addresses allocated by LACNIC or NIRs are not guaranteed to be globally routable.

These problems shall be solved between the holders of the IPv4 addresses involved and their connectivity provider or providers. In those cases deemed necessary, LACNIC shall provide the necessary guidance.

2.3.2.10- Validity of IPv4 Address Allocations

IPv4 address allocations are valid as long as the objectives of exclusivity, preservation, routability and information continue to be met. LACNIC may invalidate any IPv4 address allocation if it is determined that the requirements for IPv4 address space no longer exist or that any of the objectives stated in this document have ceased to be satisfied.

There are a number of practices that might be considered grounds for losing the allocations that have been received. These are:

- Failure to use the allocated IPv4 address space during a period of one month following registration.
- Failure to update the reverse resolution registry of the IPv4 address space.
- Failure to update the allocation and assignment information on LACNIC's Whois database.
- Failure to comply with contractual obligations towards LACNIC.
- Failure to correctly apply LACNIC's policies in relation to allocations and assignments and the administration of the resources received from LACNIC.

In the event of IPv4 address space invalidation, reasonable effort shall be made by LACNIC to inform the community that the IPv4 addresses have been returned and are once again available IPv4 address blocks.

2.3.2.11- Submission of Application Templates

IRs shall request IPv4 address space from LACNIC through address application templates for IRs or End Users. Any application deemed as lacking information or insufficiently detailed shall be returned to the applicant for its completion.

2.3.2.12- Supervision of Assignments

2.3.2.12.1- Assignment Window

ISPs may assign to their clients blocks smaller than 16 /24s, i.e. prefixes longer than /20, in accordance with the policy defined by LACNIC in the present document. In some cases, the assignment shall be consulted with LACNIC or with the corresponding NIR in order to ensure optimization of the use of IP address space and the correct application of LACNIC policies.

LACNIC defines an allocation window as the assignment of blocks larger than or equal to 2 /24s, i.e. prefixes shorter than or equal to /23. These assignments shall be consulted with LACNIC or the corresponding NIR. Communication between the ISPs and LACNIC or the corresponding NIR shall include the same information and justifications required in this document for end users.

2.3.2.12.2- Allocations to NIRs

NIRs are exempt from complying with Section 3.2.12.1. Instead, they shall be subject to more severe audit programs in accordance with the provisions of the contracts between LACNIC and the NIRs.

These audits shall be carried out at least once a year and, if necessary, with greater frequency.

2.3.2.13- Submission of Assignment Information

Allocations are based on Internet Registries' requirements for twelve months, in addition to other information considered relevant by LACNIC such as that described in Section 2.3.2.5 - "Documentation." Thus, initial allocations may be relatively small. The justification for requesting new allocations must be based on the information transmitted by the corresponding IR to LACNIC's WHOIS database. Assignment information shall be sent to LACNIC within a period of seven days following the assignment, so that the WHOIS database may be updated in due time.

Submission of assignment information is also necessary for the following reasons:

- To ensure that the IR has exhausted, or is about to exhaust, the allocated IPv4 address space, thereby justifying the allocation of additional space.
- To provide the Internet community with information as to which organization is using the IPv4 address space and to provide a point of contact in case of operational, security, or other problems.
- To assist in the study of IPv4 address allocation within the region.

2.3.2.14- Security and Confidentiality

LACNIC shall maintain systems and practices that oversee and protect the confidentiality of all information entrusted to LACNIC in the documentation submitted to justify the allocation or assignment of IPv4 addresses.

2.3.2.15- Equal Processing of All Applications

LACNIC shall process every application strictly in the order in which they are received, regardless of geographical factors, demographic factors, language, etc. Under no circumstance shall LACNIC grant special treatment or make exceptions to the norm established for application processing. For this purpose, LACNIC shall use an application numbering system that will allow their proper administration.

2.3.2.16- Micro-Assignments

LACNIC shall make micro-assignments of prefixes longer than the standard (smaller blocks) in the special cases listed in Section 2.3.3 - "Initial IPv4 Address Space Allocation Policies."

2.3.2.17- Mergers, Acquisitions or Sales of ISPs or End Users

LACNIC's policies do not recognize the non-authorized sale or transfer of IPv4 address space and therefore such transfers shall be considered invalid, with the exception of those subject to the provisions of section 2.3.2.18, such transfers shall be considered invalid.

Should an ISP or end user change ownership due to a merger, sale, or acquisition, the new entity shall register these changes with LACNIC. If the name of the company is modified, legal documentation validating this change of name shall be submitted.

The information that may be requested includes, but is not limited to, the following:

1. A copy of the legal document validating the transfer of assets.
2. A detailed inventory of all assets used by the applicant for maintaining the IPv4 address space in use.
3. A list of the applicant's clients that use portions of the allocated space.

2.3.2.18- Transfer of IPv4 Blocks within the LACNIC Region

NOTE: This section will come into force when LACNIC or any of its NIRs becomes unable, for the first time, to cover an IPv4 block allocation or assignment because of lack of resources.

IPv4 block transfers shall be allowed between LIRs and/or End Users within the LACNIC region (hereinafter organizations) in accordance with the conditions set forth in this section.

2.3.2.18.1.- The minimum block size that may be transferred is a /24.

2.3.2.18.2.- In order for an organization to qualify for receiving a transfer, it must first go through the process of justifying its IPv4 resource needs before LACNIC. That is to say, the organization must justify before LACNIC the initial/additional allocation/assignment, as applicable, according to the policies in force.

2.3.2.18.3.- Upon receiving an IPv4 address block transfer request, LACNIC shall verify that the organization transferring the block is in fact the holder of said block according to LACNIC's records. The approved applicant and the organization transferring the resources must present before LACNIC a copy of the legal document supporting the transfer.

2.3.2.18.4.- LACNIC shall maintain a publicly accessible transfer log of all IPv4 address block transfers registered before LACNIC. Said log shall specify the date on which each transaction took place, the organization from which the transfer originated, the receiving organization, and the block that was transferred.

2.3.2.18.5.- The organization in which the transfer originated shall automatically be ineligible to receive IPv4 resource allocations and/or assignments from LACNIC for a period of one year as of the transaction date registered in the transfer log.

2.3.2.18.6.- A block that has previously been transferred may not subsequently be transferred again for a period of one year as of the transaction date registered in the transfer log. The same applies to its sub-blocks, which are blocks that group a subset of the IPv4 addresses contained in the block.

2.3.2.18.7.- Once the transfer is complete, LACNIC shall modify the information on the transferred resource in order to reflect the change of holder.

2.3.2.18.8.- The receiving organization must comply with all LACNIC policies in force.

2.3.2.18.9.- Blocks and their sub-blocks from allocations or assignments from LACNIC, being initial or additional, can not be transferred for a period of one year as of the allocation or assignment date.

2.3.2.18.10.- Transferred legacy resources will no longer be considered as such.

2.3.3- Initial IPv4 Address Allocation and Assignment

LACNIC shall allocate IPv4 addresses to organizations covered by the following cases:

- Allocations to Internet Service Providers.
- Micro-assignments to Critical Infrastructure.
- Direct allocations to Internet Service Providers.
- End user Assignments.

This section contains a detailed description of the policies LACNIC shall apply for the initial allocation of portable (provider-independent) IPv4 addresses in each of the cases listed above.

Due to the fact that the number of IPv4 addresses available on the Internet is limited, many factors must be considered for determining IPv4 address space allocation. Therefore, IPv4 address space is allocated to ISPs based on a slow-start model. Allocations are based on current justifiable need, not on prediction of number of clients,

market research, etc.

2.3.3.1- Initial Allocations to ISPs

The minimum initial allocation size applicable to Internet Service Providers established within LACNIC's service region is a /22.

2.3.3.1.1- Requirements for a /22 prefix (block of 4 /24s)

In order to qualify for the allocation of a /22 prefix, the requesting ISP must satisfy the following requirements:

1. Prove utilization or immediate necessity of a /24.
2. Submit a detailed one-year utilization plan for a /23.
3. Agree to renumber out of the previously assigned block and return those IPv4 addresses to their ISPs no later than 12 months after the allocation of the /22.

2.3.3.1.2- Requirements for a /21 or shorter prefix (block of 8 /24s or more)

Should the requesting ISP require an initial IPv4 address allocation of a /21 prefix or larger space, the following requirements must be satisfied:

- Provide information on assignments with prefixes equal to or shorter than /29 (more than 8 IPv4 addresses) on LACNIC's WHOIS database.
- Provide documentation that justifies the initial address space allocation (Completion of the IPv4 address application template for ISPs). This must include detailed information showing how this resource will be used within a period of three, six and twelve months.
- Agree to renumber out of the blocks obtained from their providers within a period no longer than 12 months and return the space to its original provider.

In addition, depending of the multihomed or non-multihomed status of the applying ISP, the following requirements shall be considered:

If the applicant is a multihomed ISP:

Efficient utilization of at least 25% of the requested address space (contiguous or not).

An ISP is considered to be multihomed if it receives full-time connectivity from more than one Internet Service Provider and has one or more routing prefixes published by at least two of its connectivity providers. Those ISPs that will acquire this status within a period no longer than one month also qualify as multihomed ISPs. In this case, copies of the contracts or documents that validate this status shall be required.

If the applicant is a non-multihomed ISP:

Efficient utilization of at least 50% of the requested address space (contiguous or not).

2.3.3.2- Micro-Assignments to Critical Infrastructure

Micro-assignment is the name given to those assignments that involve prefixes longer than /20 but shorter than or equal to /24.

LACNIC may grant this type of assignment in case of projects and network infrastructure that are key or critical for the region, such as IXPs (Internet Exchange Points), NAPs (Network Access Points), RIRs, ccTLDs, among others.

In the case of IXPs or NAPs, in order to be eligible for this type of assignment, the organization must meet the following requirements:

1. Duly document the following aspects:
 - 1.1. Prove by means of their bylaws their IXP or NAP capacity. The organization shall have at least three members and an open policy for the association of new members.
 - 1.2. Submit a diagram of the organization's network structure.
 - 1.3. Document the numbering plan to be implemented.
2. Provide a utilization plan for the following three and six months.

The rest of the applications shall be studied based on the analysis of the documentation justifying the critical and/or key aspects of the project.

Organizations receiving micro-assignments shall not sub-assign these IPv4 addresses.

2.3.3.3- *Direct Allocations to Internet Service Providers*

LACNIC acknowledges that there may exist circumstances under which there is justifiable need for an initial allocation such that infrastructure and service investment levels warrant the allocation of a /20 or longer prefix (smaller block).

LACNIC may grant this type of allocation to those organizations that meet the following requirements:

1. The organization is currently multi-homed or will be multi-homed in the near future (have subscribed contracts or letters of intent with their access providers).
2. Submit a detailed description of their network topology.
3. Submit a portfolio with a detailed description of the services the organization will offer.
4. Submit a detailed plan of the deployment of address space utilization for three, six, and twelve months.
5. Submit a copy of receipts or purchase orders for the equipment that will support the services described above.

It should be noted that this type of allocations shall be handled as exceptions and are not covered by the response times guaranteed for processing normal IPv4 address applications. For these allocations LACNIC may, at any time, request additional information to help justify a minimal allocation.

2.3.3.4- *Assignments to End Users*

LACNIC shall assign IPv4 address blocks to end users requiring IPv4 address space for internal use, for the operation of their networks, but not for sub-delegation outside their organization.

Typically, end users receive IPv4 address space from their upstream providers, not directly from LACNIC. Portable (provider-independent) IPv4 addresses obtained directly from LACNIC or other Regional Registries are not guaranteed to be globally routable.

For this reason, end users should contact their Internet Service Providers to ensure their connectivity within the network.

End users not connected to an ISP and/or not planning to be connected to the Internet are advised to use private IPv4 addresses. The description of these IP addresses may be found in **RFC 1918**.

When assigning IPv4 addresses to end users, LACNIC follows the guidelines of the assignment policies and procedures established in **RFC 2050**. These guidelines and policies were developed to satisfy the needs of the growing Internet community in relation to preserving the limited IPv4 address space and allowing the continuity and existence of Internet routing technologies.

2.3.3.4.1- Required Information

LACNIC shall request the following information from all end users requesting IPv4 address blocks:

1. Provide detailed information showing how the requested block will be used within the following three, six and twelve months.
2. Submit subnetting plans for a period not shorter than one year, including subnet masks and host numbers on each subnet. Use of VLSM is required.
3. Submit a detailed description of the network topology.
4. Prepare a detailed description of the network routing plans, including the routing protocols to be used as well as any existing limitations

2.3.3.4.2- Utilization Rate

Utilization rate is a key factor that must be justified in order to dimension the size of the assignment. Utilization rate is the percentage of IPv4 addresses that the organization will use within a specified period of time. The rate established according to **RFC 2050** and adopted by LACNIC is:

25% immediate utilization rate of the requested block.

50% utilization rate of the requested block within one year.

A higher utilization rate may be required based on individual requirements. Should the organization presenting the application fail to comply with these parameters, addresses may be withdrawn and a reasonable period negotiated for their renumbering.

2.3.3.4.3- Applicant Status

In addition, the applicant's multihomed or non-multihomed status also affects the evaluation of the application.

2.3.3.4.3.1-If the applicant is a multihomed end user:

The size of the minimum IPv4 address allocation to a multihomed end user is a /24. In order to qualify for a block the applicant must also satisfy the following requirements:

1. Have received an assignment equivalent to a /25 from its Internet Service Providers.
2. Agree to renumber out of all the blocks allocated by providers within a period of 3 months and return the space to its original provider.

The maximum prefix size that may be assigned shall be a /24 and the minimum a /21. Initial assignments of a block larger than a /21 must follow the additional requirements established for non-multihomed end users described below.

Those users that are planning to become a multihomed user within a period of one month may also apply. In this case, copies of the contracts or documents that validate this status will be required.

2.3.3.4.3.2-If the applicant is a non-multihomed end user:

The size of the minimum IPv4 address assignment to a non-multihomed end user is a /20 block. Should the need for IPv4 address space be smaller than a /20, in order to obtain the required addresses end users should contact their corresponding Internet Service Providers.

In order to assign a /20 to an end user, in addition to the previous requirements, the following shall be satisfied:

1. Have received a minimum assignment of 8 /24 prefixes from its Internet Service Provider.
2. Agree to renumber out of the previously assigned space within a period of 12 months and return it to its original provider. This requirement is essential for obtaining the requested /20 prefix. The assigned /20 prefix must be used to renumber out of the addressing previously assigned by its provider.

Additional assignments shall follow the policies included in Section 2.3.4 applicable to end users.

2.3.4- Policies for the Distribution of Additional IPv4 Address Space

This policy is presented with the aim of assisting Internet Registries in the process of applying for additional IPv4 address space. The most important factor in the evaluation of additional IPv4 address space applications is the revision of the current IPv4 address space of the organization presenting an application.

In order to receive additional space, the organization presenting an application must have used at least 80% of the IPv4 address space previously assigned by the corresponding RIR or NIR. This includes the space assigned to its clients. Therefore, it is important that IRs demand that their clients follow the efficient utilization practices described in these policies.

The steps that must be completed for the allocation of new IPv4 address blocks are the following:

1. The first step of the process is to verify the utilization of at least 80% of previous allocations. This utilization percentage shall be based solely on announced networks with IPv4 addresses connected to the Internet. For IRs that have assigned IPv4 addresses to their clients, the method available to prove this utilization is through the records kept in LACNIC's WHOIS database. Consideration of the application shall not continue until utilization of at least 80% of the previously allocated block is verified. Use of 80% of previously allocated IP addresses also covers those addresses dedicated to internal use and dial-up clients of the company. In this latter case, utilization may be justified through the report included in Annex 3 [Additional Report for IPv4 Address Space Allocation].

The application process for additional space shall continue once the utilization of at least 80% of the previously assigned space has been verified.

2. Organizations shall prove they are using LACNIC policies in assigning space to their clients, particularly in relation to:
 - Issuing prefixes longer than /24, wherever possible.
 - Verifying that the assignment of blocks within the allocation window were previously submitted to LACNIC for approval.
3. Organizations shall demand that their clients adhere to the following criteria:

- The information on assignments smaller than a /29 must be available through WHOIS and they must comply with the 80% space utilization requirement before assigning additional space to their clients.
 - LACNIC policies for the Internet community in general are communicated to and followed by their clients.
4. When reviewing applications for additional IPv4 addresses, LACNIC shall also review whether the space designated for its return was actually returned in due time as described in this document.
 5. Maintain the reverse resolution registry of the administered IPv4 address space up-to-date. The reverse resolution registry shall also comply with 80% utilization.
 6. For the allocation of additional blocks, LACNIC shall verify that the organization presenting the application is in compliance with its contractual obligations.
 7. The final step is to determine the appropriate allocation. In order to determine the size of the allocation, detailed information must be provided showing how the IPv4 address space will be used within the following three, six and twelve-month periods. The policy for determining the size of additional allocations is based on the efficient utilization of space within a time frame of 12 months.

3 - ALLOCATION OF AUTONOMOUS SYSTEM NUMBERS (ASN)

An Autonomous System (AS) is a group of IP address networks managed by one or more network operators having a clear and unique routing policy. Each Autonomous System (AS) has an associated number that is used as the Autonomous System's identifier when exchanging external routing information. Exterior routing protocols, such as BGP, are used for exchanging routing information among Autonomous Systems.

The term "Autonomous System" is frequently misinterpreted as merely a convenient way to refer to a group networks that are under the same management. However, if there is more than one routing policy in the group, then more than one AS is necessary. On the other hand, if the group of networks has the same policy as the other groups, they fall within the same AS regardless of their management structure. Thus, by definition, all networks that make up an Autonomous System share the same routing policy.

In order to simplify global routing tables, a new Autonomous System Number (ASN) should only be assigned when a new routing policy is necessary.

Sharing the same ASN among a group of networks that are not under the same management will require additional coordination among network administrators and, in some cases, will require redesigning the network to a certain degree. However, this is probably the only way to implement the desired routing policy

LACNIC shall allocate Autonomous System Numbers to those organizations that meet the following requirements:

1. The organization must be multi-homed and each provider must have two or more independent Autonomous Systems at the time of the application, or planning to become multi-homed within a period of no more than two weeks as of the moment of the application.
2. The organization must submit detailed documentation describing the applicant's routing policy, which must be unique and different to that applied by the ASN to which it is connected. This documentation must include the exterior routing protocol to be used,

IP addresses that will conform the AS, and a detailed explanation of the reasons why its routing policy differs from that of its providers.

It is the obligation of the organization receiving an Autonomous System Number from LACNIC to maintain updated records of postal addresses and points of contact.

LACNIC's WHOIS system allows representing up to three different points of contact, namely:

owner-c, which represents the administrative contact of the organization to which the ASN was assigned;

routing-c, contact who, by means of the IP and ASN administration system, may register the routing policies adopted by the Autonomous System;

abuse-c, security contact (Abuse Contact).

3.1. Terminology

16-bit AS numbers were defined in RFC 1930 and integers ranging from 0 to 65535 will be used for their identification. Likewise, 32-bit AS numbers were defined by RFC 4893 and , integers ranging from 0 to 4294967295 will be used for their identification. In both cases the "asplain" decimal value representation defined in RFC 5396 will be used..

Consequently, the following terminology will be adopted to refer to 16-bit and 32-bit ASNs:

- "16-bit only AS Numbers" refers to AS numbers in the range 0 – 65535
- "32-bit only AS Numbers" refers to AS Numbers in the range 65536 – 4294967295
- "32-bit AS Numbers" refers to AS Numbers in the range 0 – 4294967295

3.2. AS Allocation Phases

There shall be three phases for ASN allocation on the part of LACNIC:

1. On 1 January, 2007, the registry will process applications that specifically request 32-bit only AS Numbers and allocate such AS Numbers as requested by the applicant. In the absence of any specific request for a 32-bit only AS Number, a 16-bit only AS Number will be allocated by the registry.
2. On 1 January, 2009, the registry will process applications that specifically request 16-bit only AS Numbers and allocate such AS Numbers as requested by the applicant. In the absence of any specific request for a 16-bit only AS Number, a 32-bit only AS Number will be allocated by the registry
3. As of January 1st, 2010, LACNIC shall allocate 32-bit AS numbers by default. 16-bit AS numbers shall be allocated, if available, in response to applications specifically requesting said resource and that duly justify the technical reasons why a 32-bit AS number would not be appropriate for its needs.

4 - IPv6 ADDRESS ALLOCATION AND ASSIGNMENT POLICIES

4.1. Scope

This chapter describes policies for the allocation and assignment of the globally-unique IPv6 address space.

[RFC2373, RFC2373bis] designate 2000::/3 to be the global unicast address space that IANA may allocate to RIRs. This chapter concerns initial and subsequent allocations of the 2000::/3 unicast address space, for which RIRs formulate allocation and assignment policies. Because end sites will generally be given /48 assignments [RFC 3177, RIRs-on-48s], the particular emphasis of this document is on policies relating to the bits within 2000::/3 to the left of the /48 boundary.

4.2. Definitions

The following terms are specific to IPv6 allocation policies.

4.2.1- Utilization

Unlike IPv4, IPv6 is generally assigned to end sites in fixed amounts (/48). The actual utilization of addresses within each assignment will be quite low when compared to IPv4 assignments. In IPv6, "utilization" is only measured in terms of the bits to the left of the /48 boundary. In other words, utilization refers to the assignment of /48s to end sites, and not to the number of addresses assigned within individual /48s at those end sites.

Throughout this chapter, the term utilization refers to the assignment of /48s to end sites, and not to the number of addresses assigned within individual /48s at those end sites.

4.2.2- HD-Ratio

HD-Ratio is a way of measuring the efficiency of address assignment [RFC 3194]. It is an adaptation of the HD-Ratio originally defined in [RFC1715] and is expressed as follows:

$$\text{HD} = \frac{\text{Log (number of assigned objects)}}{\text{Log (maximum number of assignable objects)}}$$

where, in the case of this document, the objects are IPv6 site addresses (/48s) assigned from an IPv6 prefix of a given size (see Appendix 10.2).

4.3. IPv6 Address Space Management

4.3.1- 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.

4.3.2- 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.

4.3.3- 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.

4.3.4- 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, RIRs should apply practices that maximize the potential for subsequent allocations to be made contiguous with past allocations currently held. However, there can be no guarantee of contiguous allocation.

4.3.5- 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.

4.3.6- 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.

4.3.7- Minimized Overhead

It is desirable to minimize 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.

4.3.8- Conflict of Goals

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.

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

4.4. IPv6 Policy Principles

To address the goals described in the previous section, the policies in this chapter discuss and follow the basic principles described below.

4.4.1- 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 chapter 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.

RIRs will generally renew licenses automatically, provided requesting organizations 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 organization 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.

4.4.2- 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.

4.4.3- Minimum allocation

RIRs will apply a minimum size for IPv6 allocations, to facilitate prefix-based filtering.

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

4.4.4- 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.

4.5. Policies for Allocations and Assignments

4.5.1- Initial Allocation

4.5.1.1- IPv6 allocation to a LIR or ISP with a previous IPv4 allocation from LACNIC

LACNIC will allocate IPv6 address blocks to a LIR or ISP that has already received an IPv4 allocation from LACNIC. If the allocation would be announced in the Internet inter-domain routing system, the organization must announce the allocated block with the minimum possible level of disaggregation to the one that is publishing the IP blocks. LACNIC will allocate a single /32 when received a request from a LIR or ISP with a previous IPv4 allocation. In case that the organization request the allocation of an address block larger than a /32, the LIR or ISP must present the documentation required in section 4.5.1.3.

4.5.1.2- IPv6 allocation to a LIR or ISP without a previous IPv4 allocation from LACNIC.

To qualify for an initial allocation of IPv6 address space, an organization must:

- Be an LIR or ISP.
- Document a detailed plan for the services and IPv6 connectivity to be offered to other organizations (clients) or self-owned/related departments/entities/sites to which it will assign /48s.
- Announce the allocated block in the Internet inter-domain routing system, with the minimum possible level of disaggregation to the one that is publishing the IP blocks, within a period no longer than 12 months.
- Offer IPv6 services to clients or self-owned/related entities (including departments and/or sites) physically located in the region covered by LACNIC within a period not longer than 24 months.

4.5.1.3- Initial Allocation Size

Organizations that meet the initial allocation criteria are eligible to receive a minimum allocation of /32.

Organizations 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 organization's infrastructure.

4.5.2- Subsequent Allocation

Organizations that hold an existing IPv6 allocation may receive a subsequent allocation in accordance with the following policies.

4.5.2.1- Subsequent Allocation Criteria

Subsequent allocation will be provided when an organization (ISP/LIR) satisfies the evaluation threshold of past address utilization in terms of the number of sites in units of /48 assignments. The HD-Ratio [RFC 3194] is used to determine the utilization thresholds that justify the allocation of additional address as described below.

4.5.2.2- Applied HD-Ratio

The HD-Ratio value of 0.94 is adopted as indicating an acceptable address utilization for justifying the allocation of additional address space. Appendix 10.2 provides a table showing the number of assignments that are necessary to achieve an acceptable utilization value for a given address block size.

4.5.2.3- Subsequent Allocation Size

When an organization has achieved an acceptable utilization 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 organization 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.

4.5.2.4- *Returning the First Allocation for the Second Allocation*

If an organization holds only one IPv6 allocation, a differentiated analysis shall be performed on a one-time-only basis.

If an organization that satisfies these conditions is willing to return to LACNIC, within a period of 6 months, the block it was initially allocated, the new allocation shall be studied as if it were an initial allocation, applying the criteria described in Section 4.5.1. Thus, in this case only, the criteria described in Sections 4.5.2.1 (criteria), 4.5.2.2 (HD-ratio), and 4.5.2.3 (size) shall not be applicable.

4.5.2.5- *LIR-to-ISP Allocation*

There is no specific policy for an organization (LIR) to allocate address space to subordinate ISPs. Each LIR organization may develop its own policy for subordinate ISPs to encourage optimum utilization 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.

4.5.3- *Assignments by ISPs*

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

4.5.3.1- *Assignment address space size*

Assignments are to be made in accordance with the existing guidelines [RFC3177,RIRs-on-48], which are summarized here as:

- /48 in the general case, except for very large subscribers.
- /64 when it is known that one and only one subnet is needed by design.
- /128 when it is absolutely known that one and only one device is connecting.

RIRs/NIRs are not concerned about which address size an LIR/ISP actually assigns. Accordingly, RIRs/NIRs will not request the detailed information on IPv6 user networks as they did in IPv4, except for the cases described in Section 4.5.2 and for the purposes of measuring utilization as defined in this chapter.

4.5.3.2- *Assignment to Operator's Infrastructure*

An organization (ISP/LIR) may assign a /48 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.

4.5.4- *Direct Assignments to End Sites*

LACNIC will assign portable (provider-independent) IPv6 addresses directly to end sites in

accordance with the two policies detailed in Sections 4.5.4.1 and 4.5.4.2, depending on whether or not the organization holds portable IPv4 addresses previously assigned by LACNIC.

4.5.4.1- *Direct assignment of portable IPv6 addresses to End Sites having portable IPv4 addresses previously assigned by LACNIC*

LACNIC will assign portable IPv6 address blocks directly to end sites if they hold portable IPv4 addresses previously assigned by LACNIC.

In case of announcing the assignment on the Internet inter-domain routing system, the receiving organization shall announce a single block, aggregating the total IPv6 address assignment received.

Assignments will be made in blocks smaller than or equal to a /32 but always greater than or equal to a /48.

Where possible, subsequent allocations will be made from an adjacent address block, but only if duly documented and justified.

4.5.4.2- *Direct assignment of portable IPv6 addresses to End sites not having portable IPv4 addresses previously assigned by LACNIC*

LACNIC will assign portable IPv6 address blocks directly to end sites that satisfy the following requirements:

- a. Not be an LIR or ISP.
- b. In case of announcing the assignment on the Internet inter-domain routing system, the receiving organization shall announce a single block aggregating the total IPv6 address assignment received.
- c. Provide detailed information showing how the requested block will be used within the following three, six and twelve months.
- d. Submit addressing plans for at least a year, and host numbers on each subnet.
- e. Submit a detailed description of the network topology.
- f. Prepare a detailed description of the network routing plans, including the routing protocols to be used as well as any existing limitations.

Assignments will be made in blocks smaller than or equal to a /32 but always greater than or equal to a /48.

Where possible, subsequent allocations will be made from an adjacent address block, but only if duly documented and justified.

4.5.5- IPv6 Micro-Assignments

LACNIC shall make micro-assignments in case of projects and network infrastructure that are key or critical for the operation and development of IPv6 within the region, such as, among others, IXPs (Internet Exchange Points), NAPs (Network Access Points), RIRs, DNS ccTLD providers. These assignments shall be made in prefixes longer than or equal to /32 but always shorter than or equal to /48.

In the case of IXPs or NAPs, in order to be eligible for this type of assignment, the organization must meet the following requirements

1. Duly document the following aspects:

- 1.1. Prove by means of their bylaws their IXP or NAP capacity. The organization shall

have at least three members and an open policy for the association of new members

1.2. Submit a diagram of the organization's network structure.

1.3. Document the numbering plan to be implemented.

2. Provide a utilization plan for the following three and six months.

The rest of the applications shall be studied based on the analysis of the documentation justifying the critical and/or key aspects of the project.

All micro-assignments shall be made from address blocks specifically reserved for this type of assignments. LACNIC shall publish the list of these blocks and those micro-assignments already awarded.

Organizations receiving micro-assignments shall not sub-assign these IP addresses.

4.5.6- Registration

When an organization holding an IPv6 address allocation makes IPv6 address assignments, it must register assignment information in a database, accessible by RIRs as appropriate (information registered by an RIR/NIR may be replaced by a distributed database for registering address management information in future). Information is registered in units of assigned /48 networks. When more than a /48 is assigned to an organization, the assigning organization is responsible for ensuring that the address space is registered in an RIR/NIR database.

RIR/NIRs will use registered data to calculate the HD-Ratio at the time of application for subsequent allocation and to check for changes in assignments over time.

IRs shall maintain systems and practices that protect the security of personal and commercial information that is used in request evaluation, but which is not required for public registration.

4.5.7- Reverse Lookup

When an RIR/NIR delegates IPv6 address space to an organization, it also delegates the responsibility to manage the reverse lookup zone that corresponds to the allocated IPv6 address space. Each organization should properly manage its reverse lookup zone. When making an address assignment, the organization must delegate to an assignee organization, upon request, the responsibility to manage the reverse lookup zone that corresponds to the assigned address.

4.5.8- Existing IPv6 Address Space Holders

Organizations that received /35 IPv6 allocations under the previous IPv6 address policy [RIRv6-Policies] 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 4.5.1.1. 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 organization. Requests for additional space beyond the minimum /32 size will be evaluated as discussed elsewhere in the document.

5 - DELEGATION OF REVERSE RESOLUTION

5.1. *Introduction*

Most connections through the Internet use machine names instead of IP addresses. Names are obviously easier to remember than numbers. However, Internet connections between computers connected to this network are made using IP addresses. Therefore, before a connection can be made, the computer's name must be translated into its IP address. This process is known as direct DNS Resolution, i.e., converting names into IP addresses.

it is frequently also necessary to perform the reverse operation, known as Reverse Resolution.

This conversion attempts to find the name associated to an IP address.

Reverse resolution is only possible with the use of a pseudo-domain, "in.addr-arpa", an acronym for "Address and Routing Parameter Area."

DNS delegation of this pseudo-domain is responsibility of Internet Registries, as they are responsible for allocating IP addresses.

5.2. *DNS Server Registration*

All allocated IP address space must have an associated DNS server, which shall be responsible for reverse resolution. In the case of LACNIC's area of coverage [Annex 1], these servers must be registered at LACNIC, which in turn is responsible for the reverse resolution of blocks administered by this organization.

LACNIC may use information obtained through reverse resolution as an indicator of the utilization of allocated IP address blocks.

DNS server registration of the IP address space administered by LACNIC shall vary according to the size of the allocated space.

Blocks allocated by LACNIC with prefixes shorter than or equal to /16 shall have their DNS servers responsible for reverse resolution registered at LACNIC. Information shall be entered in relation to /16 blocks. Suballocations of segments with longer prefixes within these blocks shall have their DNS servers registered at the organizations that received the blocks with prefixes shorter than or equal to /16 directly from LACNIC.

Blocks allocated by LACNIC with prefixes longer than /16 shall register at LACNIC the DNS servers responsible for the reverse resolution of all blocks with the prefix /24 that account for the total IP address space allocated by LACNIC. Thus, suballocations with prefixes of up to /24 made within these blocks must have their DNS servers registered at LACNIC.

For example:

1. ISP-A receives from LACNIC a /15 prefix (200.0.0.0/15). It must report to LACNIC which DNS servers will be responsible for the reverse resolution of each one of the /16 prefixes that make up the allocated block, i.e., blocks 200.0.0.0/16 and 200.1.0.0/16. The DNS servers of suballocations of longer prefixes made within this block must be registered at the DNS servers of ISP-A, which in turn are registered at LACNIC's DNS servers as responsible for the reverse resolution of blocks 200.0.0.0/16 and 200.1.0.0/16.
2. ISP-B receives from LACNIC a /20 prefix (200.2.0.0/20). It must report to LACNIC which DNS servers will be responsible for the reverse resolution of blocks 200.2.0.0 to

200.2.15.0.

If ISP-B suballocates a block with a prefix longer than /21 and shorter than or equal to /24, it must register at LACNIC's servers the new DNS servers responsible for the reverse resolution of the suballocated block.

Thus, within LACNIC's IP address administration system, it shall not be possible to register DNS servers for suballocations made in blocks with prefixes shorter than or equal to /16 that have been directly allocated by LACNIC. The organization receiving the allocation shall maintain the registry of the DNS servers responsible for the reverse resolution of suballocations made within that block.

This shall also be reflected on the WHOIS server database. In other words, in the case of suballocations within blocks with prefixes shorter than or equal to /16 directly allocated by LACNIC, the DNS servers responsible for the reverse resolution of those suballocations shall not be visible through WHOIS. This is because these servers are not registered at LACNIC.

Should it be necessary to identify the DNS servers of suballocations made within these blocks, the use of DNS query tools is recommended.

This condition does not exist for allocations with prefixes longer than /16 made by LACNIC. In this case, suballocations of prefixes of up to /24 made within blocks allocated by LACNIC and having prefixes longer than /16 may have a DNS server delegated through LACNIC's IP address administration system.

LACNIC's IP address administration system does not accept the delegation of DNS servers for blocks with prefixes longer than /24. For these cases the adoption of BCP 20 is recommended.

To summarize:

Prefix of the block allocated by LACNIC - DNS server for suballocations made by LACNIC must be registered at:

- /16 or shorter: ISP that received the block
- /17 or longer: LACNIC.

6 - LAME DELEGATION POLICY

A DNS server is considered to have a lame delegation problem when this server appears registered in the zones for reverse resolution of IP address blocks but when the server is queried it does not respond authoritatively.

The DNS server's non-authoritative response is interpreted as a server configuration error and, in accordance with LACNIC's standards, this DNS server shall be considered as having lame delegation problems.

The process for correcting lame delegations within the IP address space administered by LACNIC follows the following phases:

1. Detecting lame delegations.
2. Monitoring DNS servers with lame delegation problems.
3. Notifying the responsible parties.
4. Deactivating DNS servers.
5. Activating new DNS servers.

6.1. *Detecting Lame Delegations*

LACNIC shall periodically revise in-addr.arpa and ip6.arpa zones where there are DNS servers registered for reverse resolution within the region covered by LACNIC. Only those segments delegated directly by LACNIC shall be considered in DNS server monitoring and deactivation processes.

A DNS server registered in LACNIC's system shall be considered to have lame delegation problems if a query of the SOA record of the DNS server does not provide an authoritative answer for said record.

The verification will be performed for each in-addr.arpa and ip6.arpa zone delegated to each DNS server.

If there is no authoritative answer, the DNS server shall be catalogued as having lame delegation problems for the in-addr.arpa and ip6.arpa zone reviewed and therefore it will enter a monitoring process.

6.2. *Monitoring DNS Servers with Lame Delegation Problems*

Prior to establishing that a DNS server has permanent lame delegation problems for an in-addr.arpa or ip6.arpa zone, LACNIC shall monitor the DNS server for a period of seven days. If after this period the problems still persist, LACNIC shall notify those responsible for the IP address block.

If a DNS server that was originally detected as having lame delegation problems responds correctly for the in-addr.arpa or ip6.arpa zone before the DNS server deactivation phase, the server shall be removed from the monitoring list corresponding to these zones.

6.3. *Notifying the Responsible Parties*

Firstly, the administrative contact of the affected block shall be notified, together with the technical contact if this information is available. Notifications shall be sent out every fifteen days over a period of sixty days. LACNIC reserves the right to investigate other types of contacts if during the first thirty days no answer is received from the administrative and/or technical contacts.

6.4. *Deactivating DNS Servers*

Once the notification period defined above has ended, these servers shall be eliminated from LACNIC zones.

The DNS server will only be deactivated in those in-addr.arpa or ip6.arpa zones where it exhibited lame delegation problems. Other DNS servers providing services for those zones will not be affected.

A comment shall be added to the block's record in the WHOIS database specifying that the DNS server registered for reverse resolution of the in-addr.arpa or ip6.arpa zones corresponding to the segment was deactivated due to lame delegation problems.

Only those segments delegated directly by LACNIC shall be considered in DNS server monitoring and deactivation processes.

6.5. *Activating New DNS Servers*

DNS server activation shall follow the usual procedures already set forth in LACNIC's policy. Only the block's administrative or technical contact shall be able to activate new

DNS servers through LACNIC's registration system. Any new DNS server registered at LACNIC must respond authoritatively to the block at the moment it is activated, otherwise server registration shall be rejected.

7 - RESOURCE RECOVERY

Seeking to achieve an efficient utilization of the resources assigned/allocated to the LAC region, LACNIC shall attempt to recover resources in order to re-assign/re-allocate them to organizations.

If there is evidence to suggest that the assigned/allocated resources are possibly not being utilized or are being incorrectly utilized, LACNIC shall verify with the organization that received the assignment/allocation whether the resource is being properly utilized.

The following are some of the evidences that LACNIC may use to initiate the resource recovery process:

- Lack of visibility of the resource on the global routing table.
- Breach of LACNIC policies.
- Breach of the provisions of the registration service agreement or other legal agreements between the organization holding the resource and LACNIC or one of its NIRs.
- Evidence that an organization has disappeared and its blocks have not been transferred.
- Unauthorized transfers under the provisions of the policies.

The resource recovery process begins once LACNIC is in possession of the evidence mentioned above.

LACNIC shall attempt to contact the organization and rectify the situation. Certain organizations exist that may have assignments/allocations that are being used but are not visible on the global routing table. If the organization can justify that this is the case, LACNIC shall consider this sufficient and the resource recovery process shall end.

If the situation cannot be rectified, LACNIC shall publish the resource that is to be recovered for a period of six months. During this period the organization may rectify the situation with LACNIC. After this period, the resource shall be recovered and therefore the records of the previous holder of the recovered resource shall be removed from LACNIC's database.

LACNIC shall publish the resources that have been recovered so that the routing filters may be modified.

LACNIC shall frequently attempt to identify resources that are capable of being recovered.

Any IPv4 resources recovered under this policy may only be assigned/allocated under the

guidelines set forth in item 10.1 of the policy manual.

Assignment/allocation of recovered IPv4 resources will begin when, for the first time, it is not possible to perform an assignment/allocation from the IPv4 special reserve pool. Resources having an earlier recovery date shall be assigned/allocated first. Recovered IPv6 and ASN resources shall not be assigned/allocated until a new policy defines the appropriate time.

8 - REQUEST FOR BULK WHOIS FROM THE LATIN AMERICAN AND CARIBBEAN INTERNET ADDRESS REGISTRY

LACNIC shall provide a bulk copy of the WHOIS information only to those organizations that will use the information for technical research and/or Internet operation purposes. The request for information and LACNIC's resolution either denying or authorizing the request may be published.

In order to request this information, you must complete the following [form](#) and send the original copy, by post, to the following address:

LACNIC Subject: Bulk WHOIS Request

Rambla República de México 6125,

Montevideo Uruguay, CP 11400

Application forms sent by fax shall not be accepted. In order to be accepted, the application form must contain the following information:

Applying Organization:

Address of the Organization:

Point of Contact:

Name: _____

Telephone: _____

Fax: _____

E-mail: _____

Reason for the application and intended use of the information:

8.1. Acceptable Use of LACNIC's Bulk Whois

LACNIC's bulk WHOIS shall only be used for technical research and/or Internet operation purposes, such as designing and developing security software, projects for improving Internet performance, and web traffic optimization. It may not be used for publicity, direct marketing, market research, or other similar purposes. The use of information contained in LACNIC's WHOIS for these purposes is expressly prohibited, and shall entitle LACNIC to

discontinue the applicant's access to information and initiate the corresponding legal actions. LACNIC requests that it be notified in case of proven or suspected misuse of this information.

Redistribution or retransmission of the information by any means is expressly prohibited. Should an Applicant intend to publish all or part of the supplied information, said Applicant must request LACNIC's prior written consent.

This application form shall be governed by and interpreted in accordance with the laws of the Republic of Uruguay. In case of differences, disagreements or controversies between parties arising from this contract, said parties shall attempt to solve them by conciliation through the Center for Conciliation and Arbitrage of the Uruguayan Stock Exchange (Centro de Conciliación y Arbitraje de la Bolsa de Comercio del Uruguay), according to the regulations contained in the Conciliation Code of said Center. Should this conciliation fail, these differences, disagreements or controversies shall be definitely solved through arbitration. The arbitrators shall be three in number and for their designation, as well as for the arbitration procedure, the regulations contained in the Arbitration Code of the Center shall be observed.

In witness whereof, I have signed my name on the date set forth below:

Organization:

Signature:

Full Name:

Position within the Organization:

Date: ___ | ___ | ____ (dd | mm | yyyy)

9 - GLOBAL POLICIES

9.1. POLICY FOR THE ALLOCATION OF IPv4 ADDRESS SPACE FROM IANA TO RIRs

This chapter describes the policies governing the allocation of IPv4 address space from the IANA to the Regional Internet Registries (RIRs). This chapter does not stipulate performance requirements in the provision of services by IANA to an RIR in accordance with these policies. Such requirements should be specified by appropriate agreements among the RIRs and ICANN.

9.1.1- Allocation Principles

- The IANA will allocate IPv4 address space to the RIRs in /8 units.
- The IANA will allocate sufficient IPv4 address space to the RIRs to support their

- registration needs for at least an 18-month period.
- The IANA will allow for the RIRs to apply their own respective chosen allocation and reservation strategies in order to ensure the efficiency and efficacy of their work.

9.1.2- Initial Allocations

Each new RIR shall, at the moment of recognition, be allocated a new /8 block by the IANA. This allocation will be made regardless of the newly formed RIR's projected utilization figures and shall be independent of the IPv4 address space that may have been transferred to the new RIR by the already existing RIRs as part of the formal transition process.

9.1.3- Additional Allocations

An RIR is eligible to receive additional IPv4 address space from the IANA when either of the following conditions are met:

- The RIR's AVAILABLE SPACE of IPv4 addresses is less than 50% of a /8 block.
- The RIR's AVAILABLE SPACE of IPv4 addresses is less than its established NECESSARY SPACE for the following 9 months.

In either case, IANA shall make a single allocation of a whole number of /8 blocks, sufficient to satisfy the established NECESSARY SPACE of the RIR for an 18-month period.

9.1.3.1- Calculation of AVAILABLE SPACE

The AVAILABLE SPACE of IPv4 addresses of an RIR shall be determined as follows:

- $AVAILABLE\ SPACE = CURRENTLY\ FREE\ ADDRESSES + RESERVATIONS\ EXPIRING\ DURING\ THE\ FOLLOWING\ 3\ MONTHS - FRAGMENTED\ SPACE$
- FRAGMENTED SPACE is determined as the total amount of available blocks smaller than the RIR's minimum allocation size within the RIR's currently available stock.

9.1.3.2- Calculation of NECESSARY SPACE

If the applying Regional Internet Registry does not establish any special needs for the period concerned, NECESSARY SPACE shall be determined as follows:

- **NECESSARY SPACE = AVERAGE NUMBER OF ADDRESSES ALLOCATED MONTHLY DURING THE PAST 6 MONTHS * LENGTH OF PERIOD IN MONTHS**

If the applying RIR anticipates that due to certain special needs the rate of allocation for the period concerned will be different from the previous 6 months, it may determine its NECESSARY SPACE as follows:

- Calculate NECESSARY SPACE as its total needs for that period according to its projection and based on the special facts that justify these

- needs.
- Submit a clear and detailed justification of the above mentioned projection (Item A).

If the justification is based on the allocation tendency prepared by the Regional Internet Registry, data explaining said tendency must be enclosed.

If the justification is based on the application of one or more of the Regional Internet Registry's new allocation policies, an impact analysis of the new policy/policies must be enclosed.

If the justification is based on external factors such as new infrastructure, new services within the region, technological advances or legal issues, the corresponding analysis must be enclosed together with references to information sources that will allow verification of the data.

If IANA does not have elements that clearly question the Regional Internet Registry's projection, the special needs projected for the following 18 months, indicated in Item A above, shall be considered valid.

9.1.4- Announcement of IANA Allocations

When address space is allocated to an RIR, the IANA will send a detailed announcement to the receiving RIR. The IANA will also make announcements to all other RIRs, informing them of the recent allocation. The RIRs will coordinate announcements to their respective membership lists and any other lists they deem necessary.

The IANA will make appropriate modifications to the "IPv4 Address Space" page of the IANA website and may make announcements to its own appropriate announcement lists. The IANA announcements will be limited to informing which address ranges, the time of allocation and to which Registry they have been allocated.

9.2. GLOBAL POLICY FOR THE ALLOCATION OF THE REMAINING IPV4 ADDRESS SPACE

This policy describes the process for the allocation of the remaining IPv4 space from IANA to the RIRs. When a minimum amount of available space is reached, one /8 will be allocated from IANA to each RIR, replacing the current IPv4 allocation policy.

In order to fulfill the requirements of this policy, at the time it is adopted, one /8 will be reserved by IANA for each RIR. The reserved allocation units will no longer be part of the available space at the IANA pool. IANA will also reserve one /8 to any new RIR at the time it is recognized.

The process for the allocation of the remaining IPv4 space is divided in two consecutive phases:

9.2.1- Existing Policy Phase

During this phase IANA will continue allocating IPv4 addresses to the RIRs using the existing allocation policy. This phase will continue until a request for IPv4 address space from any RIR to IANA either cannot be fulfilled with the remaining IPv4 space available at the IANA pool or can be fulfilled but leaving the IANA remaining IPv4 pool empty.

This will be the last IPv4 address space request that IANA will accept from any RIR. At this point the next phase of the process will be initiated.

9.2.2- Exhaustion Phase

IANA will automatically allocate the reserved IPv4 allocation units to each RIR (one /8 to each one) and respond to the last request with the remaining available allocation units at the IANA pool (M units).

9.2.3- Size of the final IPv4 allocations

During this phase IANA will automatically allocate one /8 to each RIR from the reserved space defined in this policy. IANA will also allocate M allocation units to the RIR that submitted the last request for IPv4 addresses.

9.2.4- Allocation of the remaining IPv4 Address space

After the completion of the evaluation of the final request for IPv4 addresses, IANA MUST:

- A. Immediately notify the NRO about the activation of the second phase of this policy.
- B. Proceed to allocate M allocation units to the RIR that submitted the last request for IPv4 address space.
- C. Proceed to allocate one /8 to each RIR from the reserved space.

9.3. POLICY FOR THE ALLOCATION OF IPv6 ADDRESS SPACE FROM IANA TO REGIONAL INTERNET REGISTRIES(RIRs)

This chapter describes the policy governing the allocation of IPv6 address space from the IANA to the Regional Internet Registries (RIRs). This document does not stipulate performance requirements in the provision of services by IANA to an RIR in accordance with this policy. Such requirements will be specified by appropriate agreements between ICANN and the NRO.

9.3.1- Allocation Principles

- The unit of IPv6 allocation (and therefore the minimum IPv6 allocation) from IANA to an RIR is a /12.
- The IANA will allocate sufficient IPv6 address space to the RIRs to support their registration needs for at least an 18-month period.
- The IANA will allow for the RIRs to apply their own respective chosen allocation and reservation strategies in order to ensure the efficiency and efficacy of their work.

9.3.2- Initial Allocations

On inception of this policy, each current RIR with less than a /12 unallocated address space shall receive an IPv6 allocation from IANA.

Any new RIR shall, on recognition by ICANN, receive an IPv6 allocation from the IANA.

9.3.3- Additional Allocations

An RIR is eligible to receive additional IPv6 address space from the IANA when either of the following conditions are met.

- The RIR's AVAILABLE SPACE of IPv6 addresses is less than 50% of a /12.
- The RIR's AVAILABLE SPACE of IPv6 addresses is less than its established NECESSARY SPACE for the following 9 months.

In either case, IANA shall make a single IPv6 allocation, sufficient to satisfy the established NECESSARY SPACE of the RIR for an 18-month period.

9.3.3.1- Calculation of AVAILABLE SPACE

The AVAILABLE SPACE of IPv6 addresses of an RIR shall be determined as follows:

AVAILABLE SPACE = CURRENTLY FREE ADDRESSES + RESERVATIONS EXPIRING DURING THE FOLLOWING 3 MONTHS – FRAGMENTED SPACE

FRAGMENTED SPACE is determined as the total amount of available blocks smaller than the RIR's minimum allocation size within the RIR's currently available stock.

9.3.3.2- Calculation of NECESSARY SPACE

If the applying Regional Internet Registry does not establish any special needs for the period concerned, NECESSARY SPACE shall be determined as follows:

NECESSARY SPACE = AVERAGE NUMBER OF ADDRESSES ALLOCATED MONTHLY DURING THE PAST 6 MONTHS * LENGTH OF PERIOD IN MONTHS

If the applying RIR anticipates that due to certain special needs the rate of allocation for the period concerned will be different from the previous 6 months, it may determine its NECESSARY SPACE as follows:

Calculate NECESSARY SPACE as its total needs for that period according to its projection and based on the special facts that justify these needs.

Submit a clear and detailed justification of the above mentioned projection.

If the justification is based on the allocation tendency prepared by the RIR, data explaining said tendency must be enclosed.

If the justification is based on the application of one or more of the RIR's new allocation policies, an impact analysis of the new policy/policies must be enclosed.

If the justification is based on external factors such as new infrastructure, new services within the region, technological advances or legal issues, the corresponding analysis must be enclosed together with references to information sources that will allow verification of the data.

9.3.4- Announcement of IANA Allocations

The IANA, the NRO, and the RIRs will make announcements and update their respective websites regarding an allocation made by the IANA to an RIR. ICANN and the NRO will

establish administrative procedures to manage this process.

9.4. GLOBAL POLICY FOR ALLOCATION OF ASN BLOCKS TO REGIONAL INTERNET REGISTRIES

This document describes the policy governing the allocation of Autonomous System Numbers (ASNs) from the IANA to the Regional Internet Registries (RIRs).

This policy document does not stipulate performance requirements in the provision of services by the IANA to an RIR. Such requirements will be specified by appropriate agreements between ICANN and the Number Resource Organization (NRO).

9.4.1- Allocation Principles

IANA allocates ASNs to RIRs in blocks of 1024 ASNs. In this document the term "ASN block" refers to a set of 1024 ASNs. Until 31 December 2009, allocations of 2-byte only and 4-byte only ASN blocks will be made separately and independent of each other[1]. This means until 31 December 2009, RIRs can receive two separate ASN blocks, one for 2- byte only ASNs and one for 4-byte only ASNs from the IANA under this policy. After this date, IANA and the RIRs will cease to make any distinction between 2-byte only and 4-byte only ASNs, and will operate ASN allocations from an undifferentiated 4-byte ASN allocation pool.

9.4.2- Initial Allocations

Each new RIR will be allocated a new ASN block.

9.4.3- Additional Allocations

An RIR is eligible to receive (an) additional ASN block(s) from the IANA if one of the following conditions is met:

- The RIR has assigned or allocated 80% of the previously received ASN block; or
- The number of free ASNs currently held by the RIR is less than its two month need. This projection is based on the monthly average number of ASNs assigned or allocated by the RIR over the previous six months.

An RIR will be allocated as many ASN blocks as are needed to support their registration needs for the next 12 months, based on their average rate of assignment or allocation over the previous six months, unless the RIR specifically requests fewer blocks than those for which it qualifies.

9.4.4- Announcement of IANA Allocations

The IANA, the NRO and the RIRs will make announcements and update their respective websites/databases when an allocation is made by the IANA to an RIR. ICANN and the NRO will establish administrative procedures to manage this process.

10 - POLICY FOR THE ALLOCATION OF INTERNET RESOURCES FOR RESEARCH AND EXPERIMENTAL NEEDS

LACNIC shall make experimental allocations with the aim of promoting research and

development within the region. These allocations shall cover all of LACNIC's resources (IPv4, IPv6, ASN).

LACNIC shall promote the use of private resources (whenever possible), both for IPv4 addresses (RFC 1918) as well as for ASN (64512 -65535).

In order to qualify for an initial allocation, the experiment shall meet one of the following requirements:

- Be based on an IETF RFC designated as an experimental RFC.
- Be considered by LACNIC and by external specialists on the subject as favorable for the development of the region and technology in general.

In order to obtain an experimental allocation, the applicant shall:

- Initially submit all the information relevant to the experiment that LACNIC and external specialists on the subject consider necessary to assess the application. LACNIC shall publish the information pertaining to the experiment on a public website (which shall be defined by LACNIC), and announce the existence of the application through an open-subscription mailing list (which shall be defined by LACNIC). In order to receive comments from the community, LACNIC shall wait for a period of 30 days before making the allocation.
- Use allocated resources only for the purposes detailed in the application submitted to LACNIC.
- Not use the allocation for commercial purposes.
- The results of the experiment must be published on a public website (without access control). A link to these results will be placed on LACNIC's website.
- Present before LACNIC an annual report on the progress of the experiment. LACNIC may make these reports public through its forums, mailing lists, website and through any other means it considers relevant, respecting the sources of the information.
- Enter reallocation information in LACNIC's WHOIS database.
- Maintain the reverse resolution of allocated blocks updated.

Failure to comply with these requirements may cause the corresponding allocation to be cancelled.

Minimum allocation blocks shall be restricted by micro-assignment policies (both for IPv4 as well as for IPv6).

Although there is no maximum allocation size, LACNIC shall assign resources in such a manner as to ensure its normal operation.

During the initial assessment, LACNIC's staff shall determine the resources to be allocated.

Experimental allocations shall be for a period of one year, renewable for a period of the same duration, with no specified maximum. For the renewal, the annual report submitted by the applicant shall be considered.

At the moment of renewal, the applicant shall be able to apply for additional resources. The evaluation shall be based on the fulfillment of the requirements detailed above,

together with an assessment of the additional information presented by the applicant.

LACNIC shall publish the information pertaining to the additional resource application on a public website (which shall be defined by LACNIC), and announce the existence of the application through an open-subscription mailing list (which shall be defined by LACNIC). In order to receive comments from the community, LACNIC shall wait for a period of 15 days before making the additional allocation.

11 - POLICIES RELATING TO THE EXHAUSTION OF IPV4 ADDRESS SPACE

The following policies relate to the IPv4 address space exhaustion process

11.1. Special IPv4 Allocations/Assignments Reserved for New Members

When IANA's pool of IPv4 addresses is exhausted or when the remaining available space cannot be allocated to the RIRs and LACNIC has in its custody the equivalent of a /12, LACNIC will begin to apply exclusively the following criteria for allocating and assigning IPv4 addresses:

1. Only allocations larger than or equal to a /24 and smaller than or equal to a /22 will be made.
2. No allocations will be made to organizations that already have IPv4 addresses allocated by LACNIC or by the organizations that preceded LACNIC in the region currently serviced by LACNIC.
3. /22 blocks will only be allocated to new ISPs that have not been allocated IPv4 addresses by LACNIC or by their upstream providers, and that can prove the need for at least a /24 during the following 12 months.
4. /24 blocks will be assigned to critical infrastructure with no other requirement than that of being critical infrastructure in accordance with the definitions contained in LACNIC's policies. These organizations may receive up to a /22 if they can prove their need during the following 12 months.
5. Those organizations that receive IPv4 addresses from LACNIC under the conditions established in items 3 and 4 of the present policy will not be able to receive future IPv4 allocations or assignments from LACNIC.

12 - APPENDIXES.

12.1. Appendix 1. List of countries and territories covered by LACNIC.

List of countries and territories within LACNIC's area of coverage:

Argentina
Aruba
Belize
Bolivia
Bonaire
Brazil
Chile
Colombia

Costa Rica
 Cuba
 Curaçao
 Dominican Republic
 Ecuador
 El Salvador
 Falkland Islands (Islas Malvinas)
 French Guiana
 Guatemala
 Guyana
 Haiti
 Honduras
 Mexico
 Nicaragua
 Panama
 Paraguay
 Peru
 Saba
 Saint Martin
 Saint Eustace
 South Georgia and the South Sandwich Islands
 Suriname
 Trinidad and Tobago
 Uruguay
 Venezuela

12.2. Appendix 2: HD-Ratio

The HD-Ratio is not intended to replace the traditional utilization measurement that ISPs perform with IPv4 today. Indeed, the HD-Ratio still requires counting the number of assigned objects. The primary value of the HD-Ratio is its usefulness in determining reasonable target utilization threshold values for an address space of a given size. This document uses the HD-Ratio to determine the thresholds at which a given allocation has achieved an acceptable level of utilization and the assignment of additional address space becomes justified.

The utilization threshold T , expressed as a number of individual /48 prefixes to be allocated from IPv6 prefix P , can be calculated as:

$$T = 2^{((48-P)*HD)}$$

Thus, the utilization threshold for an organization requesting subsequent allocation of IPv6 address blocks is specified as a function of the prefix size and target HD-ratio. This utilization refers to the allocation of /48s to end sites, and not the utilization of those /48s within those end sites. It is an address allocation utilization ratio and not an address assignment utilization ratio.

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

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

P	48 – P	Total /48s	Threshold	Util %
48	0	1	1	100,0%

47	1	2	2	95,9%
46	2	4	4	92,0%
45	3	8	7	88,3%
44	4	16	14	84,7%
43	5	32	26	81,2%
42	6	64	50	77,9%
41	7	128	96	74,7%
40	8	256	184	71,7%
39	9	512	352	68,8%
38	10	1024	676	66,0%
37	11	2048	1296	63,3%
36	12	4096	2487	60,7%
35	13	8192	4771	58,2%
34	14	16384	9153	55,9%
33	15	32768	17560	53,6%
32	16	65536	33689	51,4%
31	17	131072	64634	49,3%
30	18	262144	124002	47,3%
29	19	524288	237901	45,4%
28	20	1048576	456419	43,5%
27	21	2097152	875653	41,8%
26	22	4194304	1679965	40,1%
25	23	8388608	3223061	38,4%
24	24	16777216	6183533	36,9%
23	25	33554432	11863283	35,4%
22	26	67108864	22760044	33,9%
21	27	134217728	43665787	32,5%
20	28	268435456	83774045	31,2%
19	29	536870912	160722871	29,9%
18	30	1073741824	308351367	28,7%
17	31	2147483648	591580804	27,5%
16	32	4294967296	1134964479	26,4%
15	33	8589934592	2177461403	25,3%
14	34	17179869184	4177521189	24,3%
13	35	34359738368	8014692369	23,3%
12	36	68719476736	15376413635	22,4%
11	37	1,37439E+11	29500083768	21,5%
10	38	2,74878E+11	56596743751	20,6%
9	39	5,49756E+11	108582451102	19,8%
8	40	1,09951E+12	208318498661	18,9%
7	41	2,19902E+12	399664922315	18,2%
6	42	4,39805E+12	766768439460	17,4%
5	43	8,79609E+12	1471066903609	16,7%
4	44	1,75922E+13	2822283395519	16,0%

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