NRO

Managing Internet Number Resources

The Regional Internet Registries

APNIC
www.apnic.net

AfriNIC
The Internet Numbers Registry for Africa
www.afrinic.net

ARIN
American Registry for Internet Numbers
www.arin.net

LACNIC
www.lacnic.net

RIPE
NCC
www.ripe.net

www.nro.net

Global Coordination

A Fair and Stable Platform

The fundamental operation of the Internet and the services that it provides rely on the combined efforts of several key organizations. These organizations – including the world's five Regional Internet Registries (RIRs) - work collaboratively with the countless stakeholders who rely on the Internet's secure, robust and scalable infrastructure.

The Regional Internet Registries (RIRs)

The Internet uses a system of numbers called IP addresses (IPv4 and IPv6 – see page 5) to work.

Internet number resources (IPv4, IPv6 and Autonomous System (AS) Numbers) are assigned, allocated and managed by five RIRs, not-for-profit, membership-based organizations charged with managing the distribution of these resources in their respective regions. Each RIR community develops its own policies to manage Internet number resources, and works with the other RIR communities on policies that require global coordination.

- **AfriNIC**, serving Africa
- **APNIC**, serving the Asia Pacific region
- **ARIN**, serving Canada, many Caribbean and North Atlantic islands, and the United States
- **LACNIC**, serving Latin America and the Caribbean
- **RIPE NCC**, serving Europe, the Middle East and parts of Central Asia

Policy Development

Open and Transparent

Ensuring that Internet number resources are managed responsibly and are available to those who can demonstrate a need for them is critical to the philosophy of the Internet community. To achieve this, each of the RIR communities uses a bottom-up, open and transparent policy development process that gives all stakeholders a voice in deciding how Internet number resources are distributed.

This model of self-regulation has proven to be highly successful in ensuring the stable and reliable operation of the Internet and is crucial to its growth and development.

The current RIR system was developed to manage and conserve IP addresses by allocating and assigning Internet number resources using community driven policies.

The Number Resource Organization (NRO)

The five RIRs work together as the Number Resource Organization (NRO), a coordinating mechanism for the five RIRs to act collectively on global matters relating to the interests of the RIRs. The NRO exists to protect the unallocated Internet number resource pool, to promote and protect the bottom-up policy development process, and to act as a coordinating body so that global industry partners have a single point of contact with the RIRs.

Internet Number Resources

IPv4 and IPv6 Addresses

There are two types of IP addresses in use: IPv4 and IPv6

The pool of IPv4 address space contains around four billion IPv4 addresses. When the Internet was in its infancy, this seemed like a huge amount. But as the Internet expanded, demand for IPv4 addresses increased at an unprecedented level. On 1 February 2011, the Internet Assigned Numbers Authority's (IANA) - the organization responsible for allocating blocks of IP addresses to the RIRs - pool of available IPv4 addresses was exhausted.

Internet Protocol version 6 (IPv6) was designed by the Internet Engineering Task Force (the IETF) to greatly expand the amount of IP addresses available. There are 2^{128} IPv6 addresses, or roughly 340 trillion, trillion, trillion. This vast number of addresses is expected to accommodate the anticipated expansion of the Internet and Internet-related services over the coming years.

	Internet Protocol version 4 (IPv4)	Internet Protocol version 6 (IPv6)
Deployed	1981	1999
Address Size	32-bit number	128-bit number
Address Format	Dotted Decimal Notation: 192.168.0.1	Hexadecimal Notation: 2001:dc0:a000:4:225:4bff:fea9:d558
Prefix Notation	192.0.2.0/24	2001:DB8::/32
Number of Addresses	2^{32} = ~4,294,967,296	2^{128} = ~340,282,366,920,938,463,463,374,607,431,768,211,456

IPv4 Exhaustion

Facing a Crucial Challenge

The exhaustion of the pool of IPv4 triggered the implementation of the "Global Policy for the Allocation of the Remaining IPv4 Address Space". This global policy was proposed, developed and accepted by all five of the RIR communities and can be found online at:

http://www.icann.org/en/general/allocation-remaining-ipv4-space.htm

According to this global policy, each of the five RIRs received one of the IANA's five reserved /8 blocks. One /8 is equal to 16.8 million IPv4 addresses. Each RIR has community specific policies dealing with how this /8 is distributed within their respective communities. These policies can be found on each RIR's website (see page 8).

IPv6 Deployment

The Only Way Forward

The Internet as we know it will continue to work once the RIRs have no more IPv4 addresses in their respective pools to allocate. But because IPv4 and IPv6 are not compatible with each other, a device connected to the Internet via an IPv4-only network cannot communicate directly with a device connected using an IPv6-only network.

Without timely investment in and training on IPv6-enabled networks, products and services, there is a real risk that, in the future, parts of the Internet may be inaccessible for some users.

The NRO cannot predict how long the remaining IPv4 addresses will last. It is therefore imperative that all stakeholders invest in IPv6 now to ensure that the

Internet remains reachable for everyone:

- Network operators and Internet Service Providers (ISPs) need to invest in IPv6-enabled networks and to ensure that their customers can access other IPv6 networks
- Hardware vendors must ensure that their products are IPv6 compatible
- Software producers must ensure that that their software is IPv6 compliant
- Content providers need to make their websites available over IPv6
- Governments and regulators must insist that all Internet-related services and products they purchase are IPv6 enabled

Next Steps

Find Out More

The RIRs and the NRO have been working for several years to promote the urgent need for IPv6 deployment and to ensure smooth transition to an IPv6-enabled Internet. There has been a special emphasis on supporting capacity-building in developing economies and regions.

Each RIR conducts outreach programs, trainings and government consultations in their respective regions and operates their own dedicated IPv6 information websites. You can find information about IPv6 deployment and IPv4 exhaustion in your region on the following websites:

> AfriNIC's IPv6 Virtual Lab:
> www.afrinic.net/projects/cvl.htm
>
> APNIC's IPv6 Program:
> www.apnic.net/ipv6
>
> ARIN's IPv6 Wiki:
> www.getipv6.info
>
> LACNIC's IPv6 Information Center:
> portalipv6.lacnic.net/en
>
> RIPE NCC's IPv6 Act Now:
> www.ipv6actnow.org

More Information

Your RIR:

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the United States: www.arin.net

LACNIC – for Latin America and the Caribbean: www.lacnic.net

RIPE NCC – for Europe, the Middle East, and parts of Central Asia: www.ripe.net

The Number Resource Organization:
www.nro.net

Statistics on global Internet number resource distribution:
www.nro.net/statistics

Information on global policy development:
www.nro.net/policies