**The Number Resource Organization (NRO)**

*Formed by the Regional Internet Registries (RIRs) to formalise their cooperative efforts, the NRO exists to protect the unallocated Number Resource pool, to promote and protect the bottom-up policy development process, and to act as a focal point for Internet community input into the RIR system.*

# Internet Number Resources

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### What is an IP address?

An Internet Protocol (IP) address is a numeric identifier that includes information about how to reach a network location via the Internet routing system. Every device directly connected to the Internet must have an IP address, whether it is a home computer, a PDA, a router, or a web server. Every IP address must be unique for these devices to connect to the Internet and to each other. The Internet infrastructure is mainly composed of information-forwarding devices called routers.

The Internet infrastructure does not need to know what or who is communicating or the content of the communications; that is left to the programs and devices themselves. The Internet infrastructure only transports IP packets between devices, as identified by the associated IP addresses. This is often referred to as the "End-to-End Principle".

A specific IP address does *not* identify:

- The geographic location of a network or device
- Who is using the IP address
- Where the user received the IP address
- Why the IP address is in use

### IPv4 and IPv6

There are two versions of Internet Protocol in use: IP version 4 (IPv4) and IP version 6 (IPv6). IPv4 was the first version to be widely used, and still accounts for most of today's Internet traffic. The total size of the IPv4 address pool is not expected to support the growing numbers of Internet devices. IPv6 provides a vastly bigger address pool. IPv6 will not replace IPv4 - both protocols are likely to be used together for the foreseeable future.

Each IPv4 address is 32 bits. Programs often format the number into a dotted decimal notation such as 192.0.2.0. Each byte is a number between 0 and 255.

An IPv6 address is 128 bits, usually written as eight groups of four hexadecimal characters, such as 2001:DB8:0000:0000:0000:0000:0000:0000/32. A double colon (::) may replace sets of consecutive zeros, i.e. 2001:DB8::/32.

### What is an Autonomous System Number?

An Autonomous System (AS) is a group of IP networks that use a single and clearly defined routing policy. Autonomous System Numbers (ASNs) are globally unique numbers used to identify these groups of networks. ASNs enable an autonomous system to exchange routing information with neighbouring autonomous systems. ASNs are currently 16-bit numbers, providing 65,535 unique ASNs. Work is underway with the IETF to redefine ASNs as 32-bit numbers to create more unique ASNs.

## Internet Number Resource Distribution

Internet number resources (IPv4/IPv6 address space, ASNs) are allocated in a delegated, hierarchical manner to avoid fragmentation. Allocation is managed on a regional basis: the Internet Assigned Numbers Authority (IANA) distributes large blocks of Internet number resources to the five Regional Internet Registries (RIRs), AfriNIC, APNIC, ARIN, LACNIC, and RIPE NCC, which in turn allocate smaller blocks to networks within their defined regions. Internet number resources are finite and the technical requirements for their use need careful management to ensure responsible consumption.

Internet number resources are managed following community-defined technical and operational policies. These policies ensure addresses are allocated to safeguard efficient use of the finite resource (conservation); to consider the impact on the routing of information (aggregation); and to ensure IP addresses remain unique (uniqueness).

AfriNIC The Internet Numbers Registry for Africa · APNIC · ARIN American Registry for Internet Numbers · LACNIC · RIPE NCC

### DNS and IP Addresses

IP addresses are not easy to remember. The Domain Name System (DNS) provides names for numbered devices on the Internet. Internet applications use the DNS to translate each name to an IP address. The IP address is how the device moves information through the Internet; DNS allows people to use names instead of remembering large numbers.

### IP Address Rights

IP addresses are not owned as property. Regional Internet Registries (RIRs) provide them to Local Internet Registries (LIRs), National Internet Registries (NIRs), and Internet Service Providers (ISPs), who in turn provide them to consumers. The Internet community develops technical and operational policies that determine how addresses are provided. When a consumer no longer requires the use of the IP address space, it is returned to the LIR or ISP.

Since IP addresses are not property, they cannot be bought, sold, traded, transferred, attached, or otherwise provided to anyone other than by methods in the community-defined policy.

### Protocols

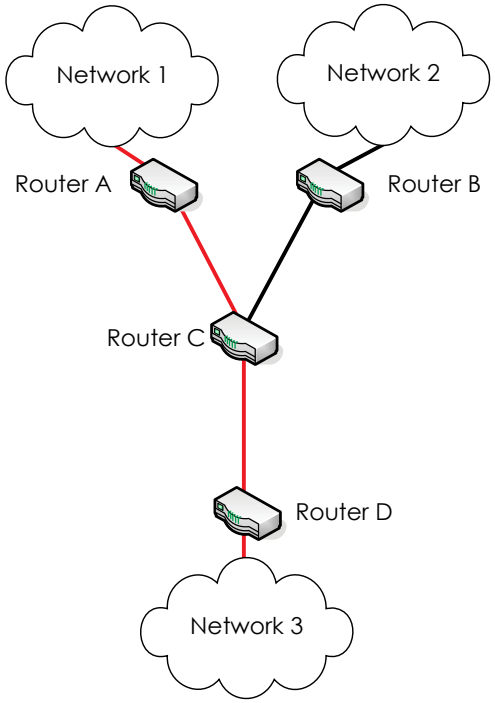
Almost all Internet standards are recorded in Requests for Comments, or RFCs. RFCs are defined by the Internet Engineering Task Force (IETF) and the Internet Engineering Steering Group (IESG). These documents and standards are widely followed by engineers in the Internet community. The RFC Editor, funded by the Internet Society, then publishes the RFCs online at **http://www.rfc-editor.org/**.

## *Internet Routing*

For any network to provide useful services, programs must communicate by sending data to a chosen destination. This connectivity applies to a global network such as the Internet. The Internet relies on specialised computers, called routers, to determine each step in the data's path toward its destination.

Each router has at least two physical interfaces and specialised databases of network information stored in the form of IP addresses. Information travels through the router by determining the next step it should take toward its destination.

An illustration of reaching an Internet destination:




Example: A device within Network 1 needs to send data to a device with IP address 193.0.0.131, located in Network 3.

Step 1:
A device within Network 1 sends information to its destination address, 193.0.0.131, using Router A.

Step 2:
Router A determines the route to send the information to its destination network. Following the best available route, it forwards the IP packet to Router C.

Step 3:
Router C determines the route to send the information to its destination network. Following the best available route, it forwards the IP packet to Router D.

Step 4:
Router D determines that the data's destination is within its network. It forwards the IP packet to the destination device, which has the IP address 193.0.0.131.

## *More Information*

For more information on Internet number resources, contact the NRO at **nro@nro.net**.