FREQUENTLY ASKED QUESTIONS ABOUT IPv6

What is an IP?

The letters IP stand for ***Internet Protocol***. This protocol comprises a series of rules used by devices (computers, servers, routers and other equipment: mobile phones, etc.) to communicate in a network. In order for this to work properly, the rule states that equipment must be identified by a unique number, in other words, no two computers can have the same IP on the Internet as the recipient to which information is sent could not be identified.

What is IPv6?

IPv6 is the Internet Protocol version 6 and the successor of IPv4. It is a significantly improved version with substantial advantages over IPv4. It also serves to resolve the problem of the shortage of IPv4 addresses given the high level of demand on the market as a result of growth and the type of connectivity that is required in devices (mobile telephones, laptops, servers, etc.). It is expected that IPv4 and IPv6 will operate simultaneously for a few years although IPv6 will replace IPv4 in the long term.

Why IPv6?

One of the most important features of IP is that every device connected to the internet must have a unique identifier which is known as an IP address or IP number.

IPv6 is needed because the free addresses in IPv4 are coming to an end. According to recent news reports, IPv4 addresses assigned by IANA were all used up in mid-February 3rd 2011.

How are IPs distributed on the Internet?

The body responsible for assigning IPs is the **IANA** (Internet Assigned Numbers Authority).

IP distribution of addresses is done in second instance by regional (RIRs), which then assign them to the ISP (Internet Service Provider) for each region and even in some cases, end users. There are five of these registries or RIRs (Regional Internet Registry), and they represent the regions of Africa (AFRINIC), Asia-Pacific (APNIC), Europe-Middle East (RIPE), Latin America and the Caribbean (LACNIC), and North America (ARIN).

For example, the IANA marks a block of numbers (IP addresses) for RIPE, which is the body in charge of distribution in the Europe-Middle East region. RIPE NCC assigns a series in this block for distribution to an ISP in Spain, which then distributes it to end users.

In this context, explains that while you run out of IP addresses at the central register, each entity responsible for them (RIRs) dispose IP address, which gives them some survival for a period of several additional months depending on the demand.

Why are IPv4 addresses being exhausted?

When Internet was born it wasn't thought that its use would achieve such success and, even less, that would give way to a multitude of services that exist nowadays , it was design an experiment to connect some universities and military networks but not for mass deployment.

The IPv4 protocol was designed for a small address space. Every IPv4 address is a 32-bit number, which means there are 4,294,967,296 addresses available. A series of policies were defined for better distribution, in such a way that they were divided into addressing classes:

- **Class A:** 128 address blocks, each with around 16 million addresses.
- **Class B:** 16,000 blocks, each with 64,000 addresses.
- **Class C:** 2 million blocks, each with 256 addresses.

Given the initial abundance, the distribution of addresses by class was not properly managed and this turned out to be a great waste as only half of the available resources were used. The recipients of Class A IP addresses were major IT companies and prestigious institutions. This inefficient management was one of the reasons why IPv4 addresses were used up more quickly.

CIDR (Classless Inter-Domain Routing) was adopted in an attempt to adjust management, in such a way that the size of the CIDR blocks assigned to each network had to match its real needs. Although this measure was positive, the demand for IPs has been almost unstoppable in recent years, giving rise to a shortage of IP addresses in the medium term.

In IPv6, addresses are represented in 128-bit numbers. This means that it has around 79 billion billion times the space available in IPv4.

However, half of the 128 bits are reserved for local addresses on the same network, which means that only 18,446,744,073,709,551,616 different networks are possible. A considerable number, which would appear to be unattainable for now.

IPv6 deployment

IPv4 and IPv6 addresses must coexist for an extended period of time. The following types of mechanisms have been established for this purpose (used on their own or in combination with others):

- Dual stack, to enable IPv4 and IpV6 to coexist in the same device and networks.

- Tunnelling, to avoid dependencies when hosts, routers or regions are updated.
- Translation techniques, to enable communication between devices that operate with only one of the protocols: IPv4 or IPv6. Above all, this is the case with communication with mobile devices, cars, home automation, etc.

Over the course of the coming years, the aim is to get the entire Internet operating with IPv6 only.

What does the end user need to bear in mind?

The end user of services has no cause for concern. Current operating systems and computer network cards already accept IPv6 and the Internet connection router will continue to work.

The major work in this transition phase must be undertaken by access providers, as they need to be prepared to operate with what is known as the “dual stack”, in other words, the coexistence of IPv4 and IPv6 addresses.

OF INTEREST FOR COMPANIES

Is IPv6 important for my business?

If your business is Internet-oriented then IPv6 is very important for you. The deployment of IPv6 is essential in order for the Internet to continue to exist, grow and develop free of obstacles.

Benefits of IPv6

The foremost benefit is that the Internet will not be able to grow without IPv6. In any case, on a technical level it improves network management and opens up a wide range of possibilities:

1. It will eliminate the need for NAT (Network Address Translation), as there is a large number of free addresses and the IPv6 includes autoconfiguration mechanisms. In this way, it simplifies network design and management.
2. There is the option of end-to-end connectivity, without the need to use NAT. It facilitates the creation of computer programmes that use the Internet to communicate. Applications such as videoconferencing and voice over IP, for example, will be much simpler and will enable better work practices.
3. The mobility features of IPv6 will allow portable devices to operate without problems or interruptions, even when the user is in transit and has to connect through different networks.
4. The use of VPN (Virtual Private Network) IPSec will improve secure access to certain resources, including end-to-end.
5. The protocol's new format means new networks can be built with better performance and greater control over service quality.

6. It will be easier to have more than one Internet provider.

DNS operation in IPv6

The use of DNS registries for IPv6 does not change very much compared to operation in IPv4. Registries associated with IPv4 are called A, while with IPv6 they are AAAA. Every computer name has an associated IPv6 address in the following format: [Computer name] AAAA [Address_IPv6]

The DNS server used must be adapted so that it can operate with IPv6 addresses. Current versions of Bind (versions 8.3 and 9) and the dns/djbdns port (with the relevant IPv6 patch) support AAAA registries.

What advantages will IPv6 bring to my business?

The main advantage of the new IPv6 protocol compared to IPv4 is the ability to connect a large number of devices, each with their own IP address, without the need to use mechanisms such as NAT to deal with the address limitations found in IPv4. (Considering the limited IPv4 addresses presented).

Moreover, it has been designed in "plug & play" mode with inbuilt security and features that enable mobility. In addition, the network management and configuration has been significantly simplified. Volume-based NAT management can be quite complex and in some cases the reconfiguration associated with networks with this mechanism can prove very costly.

IPv6 is a solution that allows companies to cut running costs and reduce the administrative load, in addition to the potential range of services that can be provided with this new addressing. Although the initial outlay can be higher or lower depending on the infrastructure and services your company has, this will be recouped in the medium term.

The IPv6 protocol provides mobility for next generation mobile services and their applications, as it has terminals that maintain IP connectivity as they move through networks using different access technologies.

What must I do to adapt to IPv6?

Given that transition to IPv6 cannot happen simultaneously on a worldwide scale, it was specified in the IPv6 design premises that it must coexist with IPv4. For this purpose, several transition mechanisms have been defined that will be implemented before the entire Internet operates on IPv6:

- "**Dual stack**": This consists of maintaining both the IPv4 protocol and IPv6 protocol stacks in the device simultaneously. In this way, one of the two stacks will be used depending on the stack that the node we want to communicate with has implemented.

- **Translation:** This consists of making a "translation" similar to NAT operation, where the IPv4 header is modified to an IPv6 header. Although this is among the possible options, it is not one of the most recommended and is not necessary when using the dual-stack.
- **Tunnelling:** This mechanism allows computers with IPv6 to communicate through an IPv4 network. Basically, it works by creating IPv6 packets in the usual way and then entering them in an IPv4 packet. The reverse process occurs in the recipient computer which receives an IPv6 packet.

The key to final transition to IPv6 lies in the services, and the DNS service in particular. They must all be ready to support this protocol, in addition to adapting the company's own network infrastructure. To the extent that the new services are developed in IPv6, they will slowly "parked" the IPv4, so that the transition will be gradual and without a "final" date: The traffic on the network itself will indicate when it IPv4 is no longer used.

What happens if I've adapted but my ISP hasn't?

This question is one of the issues that was raised during the design stage of IPv6, so that the transition could take place on a gradual basis.

Indeed, a situation could emerge where our company or organisation's entire network infrastructure operates with the “dual stack”, but the connection with our ISP only supports IPv4. This situation is a reality at present and the way to resolve it is by applying the tunnelling mechanism.

Glossary of terms

- **NAT (Network Address Translation):** This is a mechanism that transforms private IP addressing to public and vice-versa.
- **Router:** This is a hardware device for connecting to a computer network.
- **VPN (Virtual Private Network)**: This is a network technology that enables the local network to extend over a public network. For example, employees accessing corporate network resources from outside their offices.
- **IPSec (Internet Protocol Security)**: This is a set of protocols whose function is to secure communications over the Internet Protocol (IP) by authenticating and/or encrypting every IP packet in a data stream.
- **ISP (Internet Service Provider)**: Provider of Internet connection services to customers by means of different technologies: ADSL, GPRS, Wifi, etc. In addition, they can provide services such as: e-mail, website hosting, domain registry, news servers, etc.

References

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