IP Addresses: Intro to IPv6

Reading

20 minutes

Status | Incomplete

Introduction

IPv6 is an evolution of IPv4, with a much greater capacity. IPv4 is 32-bit, and IPv6 is 128-bit. IPv6 was created because the Internet, at first, was not programmed to reach such large proportions, and nowadays, it is inevitable to replace the system with a new protocol.

What experts call IPv4 exhaustion is proof of how the Internet has scaled in just a few decades of existence. Imagine, four billion available combinations of IP addresses are no longer enough. The transition process, of course, cannot happen overnight. It is necessary to find ways where IPv4 and IPv6 can coexist, making improvements between the two and not wholly changing the structure we know today.

Reading

The primary purpose of IPv6 is to increase the number of possible combinations for IP addresses. IPv6 provides advantages such as more efficient connection routing, better processing of Internet packets, direct data flow, simplified network configuration, prepared support for new services, and security improvement.

What does changing the protocol version bring to users?

- Safety: Regarding security, IPv6 comes out on top, as it was designed to use end-to-end encryption. So, in theory, with the increasing adoption of the new protocol version, attacks of the **man-in-the-middle (MitM)** type will be considerably more challenging to occur. harder
- MitM attack/public Wi-Fi: Another advantage regarding security is that IPv6 relies on IPSec natively and ensures that it is possible to check and validate the user connection.
- Data integrity can also be checkable, ensuring that the received content is identical to the one sent.
- Almost unlimited availability: It is possible to create approximately 340 undecillion IPv6 addresses. It is also no longer necessary to use NAT in internal networks since there is no longer the need to worry about limiting addresses.

- **IoT** connection allows all devices to have real IPs and simultaneously belong to many networks using a unique address.

It is worth mentioning that, with the updates that IPv4 received over time, it also started to rely on IPSec, but this depends on an implementation being carried out on the network by administrators. As IPv6 is already on the market, many companies end up not investing in the upgrade.

Types of IPv6

Any IPv6 adapter should always have two IP addresses if you're using it for Internet traffic: your link-local address and your global address.

Your **link-local address** is just for your **local area network (LAN)**. Consider it the equivalent of a 192.168.0.1 or 10.1.1.1 address. They are not routable and can be used for internal communications. If your world-routable prefix changes, you don't have to update all your IP references to internal IP addresses.

Your **global address** is world-routable, so anyone anywhere in the world can see that IP address (although there should be a firewall between you and them to stop them from accessing you).

The only functional difference is that your link-local address is not routable, and your global address must be routable. There are issues where non-routable global addresses have been allocated (via DHCPv6). For some reason, your computer seems to have a routable IPv6 address when it doesn't, and then all your IPv6 connectivity breaks.

IPv6 Address Structure

An IPv6 address consists of 32 hexadecimal digits in 8 sections (hextets) of 4 digits each, separated by the colon character [:]. Each 16-bit group has 4 hexadecimal symbols ranging from 0000 to FFFF.

It looks something like this:

```
1234 : 5678 : 90ab : cdef : 1234 : 5678 : 90ab : cdef
```

The writing of each IPv6 address is extended, which makes its representation difficult. With IPv6, the DNS service that provides a friendly name to a computer will be more necessary than ever because it is simply impossible to memorize the IPv6 addresses in network infrastructure, as many IT professionals today do with their IPv4 blocks.

Some naming rules have been defined to facilitate the representation, and leading zeros can be omitted, such as in the example below:

`2001:0db8:afa0:000f:1` can be represented by: `2001:db8:afa0:f:0:0:0:1`

Continuous empty blocks can be represented by the characters :: ONCE within the address, and what comes before the first colon means the first bits, and what comes after the second colon represents the last bits of the address.

`2001:0db8:afa0:000f:0000:0000:0000:0001` can be represented by: `2001:db8:afa0:f::1`

Providing a Subnet Mask

IPv6 subnetting is easier to implement than IPv4, and the conversion to binary isn't required. To determine the next available subnet, count in hexadecimal for the subnet.

For example, suppose an organization received the global routing prefix `[2001:db8:afa0::/48]` with a 16-bit subnet ID, allowing the organization to create 65,536 with 64 subnets.

The table shows that the global routing prefix is the same for all subnets.

			Subnet ID	**Prefix**
2001:	db8:	afa0:	0000::	/64
2001:	db8:	afa0:	0001::	/64
2001:	db8:	afa0:	0002::	/64
2001:	db8:	afa0:	0003::	/64
2001:	db8:	afa0:	0004::	/64
2001:	db8:	afa0:	0005::	/64
		...		
2001:	db8:	afa0:	000a::	/64
2001:	db8:	afa0:	000b::	/64
		...		
2001:	db8:	afa0:	ffff::	/64

References

[IPv6 Subnetting]

Mark Completed

Previous
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Next
The Value of Group Work!

How well did this activity help you to understand the content?

Let us know how we're doing

W01D2

Tue Jun 25

Lectures (1)

Work (15)

8 hrs *+ 1 hr stretch*

- Managing Linux Processes ✓
- *Fork vs Exec*
- *Adjusting Process Priority*
- Managing Linux Software ✓
- Linux Processes and Software ✓
- OSI layer models ✓
- The Encapsulation Process ✓
- Encapsulation Process Demonstration ✓
- Packets on the Network
- IP Addresses: Intro to IPv4
- IP Addresses: Intro to IPv6
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