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IPv4 vs IPv6

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Imagine a world where your computer couldn't communicate with another device.

There'd almost be no point; certainly no online collaboration or networking of any kind.

What links all our devices together are IP addresses, identities which facilitate communication over the Internet.

IP addresses come in two forms – IPv4 and IPv6.

So, what does an IP address do and what's the difference between the two versions?

The evolution of IP addresses

In the early days of the Internet, the very first stable version of the Internet Protocol (IP) was version 4, or IPv4.

This allowed connected devices across the globe to communicate with each other through the use of a standardised protocol.

IPv4 is a 32-bit address which is a total number of 2^32 possible IP addresses; approximately 4.3 billion (4,294,967,296 to be exact).

IPv4 was designed at a time when the total number of devices on the Internet was far fewer than we have today.

As such, we've had to develop solutions such as NAT (Network address translation) to avoid circumstances where online devices are unable to communicate due to being unable to be allocated an IP address.

Have you ever noticed that devices in your home are on an IP address such as 192.168.0.x?

If so, there's a good chance this solution was implemented by your ISP to reduce the number of IP addresses you use, so that all your devices are able to properly browse the Internet.

Over the years, as more and more devices have come online, we're now at the point where there's no longer any IPv4 address space available.

Ultimately, IPv4 was never designed to accommodate the number of devices which we have today. As such, a newer version, IPv6, was drafted to combat this problem of dwindling IP address space, with added features such as improved security and more efficient routing of packets.

IPv6 is a 128-bit IP address, 4 times longer than a 32-bit IPv4 address. This is a total number of 2^128 possible IP addresses; 340,282,366 ,920,938,463,463,374,607,431,768 ,211,456 exactly.

As you can see, there are quite a few more available IP addresses than you get with IPv4 addresses!

This was by-design; when we're seeing an "Internet of Things" boom across the globe – with everything from fridges and TVs through to doorbells and even shoes having some form of connectivity to the Internet – we need to make sure we have enough address space available so that all these devices can communicate with each other.

What does an IPv6 address look like?

IPv4 addresses you may've seen before; they comprise four number sequences from 0 through to 255, with each sequence separated by a dot.

For example: 192.168.0.1.

IPv6 addresses, due to being a 128-bit, look a bit different. They're eight 16-bit hexadecimal blocks, with each block separated by colons.

For example:
2a05:2a00:0100:0000:0000:
0220:0000:0001

Due to some IPv6 addresses being quite long, there are a few rules written into the IPv6 standard which allows you to shorten the address using the following:

1. Any leading zeros from a block can be stripped out from that block.

   Taking our previous example of 2a05:2a00:0100:0000:0000:0220:0000:0001, we can shorten this to 2a05:2a00:100:0:0:220:0:1.

2. If there are continuous groups of zeros from successive blocks, they can be replaced with a double colon notation (::). However, this can only be done for one group of successive zeros.

   Taking our previous example of 2a05:2a00:100:0:0:220:0:1, we can shorten this down to 2a05:2a00:100::220:0:1 or 2a05:2a00:100:0:0:220::1, but we couldn't shorten it down to 2a05:2a00:100::220::1.

   This is because the IPv6 address has no indication of how many zero blocks are part of each double colon notation.

   This is why you can only use one double colon notation per IPv6 address.

Are there any benefits of IPv4 over IPv6?

- As IPv4 is an older version, it's more compatible, especially with legacy hardware and software.
- IPv4 is generally "simpler", so hardware which supports only IPv4 can be generally cheaper.

And what about the benefits of IPv6 over IPv4?

- IPv6 can be quicker. Despite a large number of ISPs supporting IPv6, uptake is slow. This means the network isn't as congested as IPv4, making it a potentially more performant option in certain circumstances.
- IPsec is a network protocol which encrypts packet data, thus allowing for encrypted and secure communication of data. In IPv6, this is natively built-in.
- Due to IPv4 being exhausted, they can generally be billed per IP address. Due to a large number of IPv6 addresses being readily available, these are normally provided free of charge.

Sounds great, so how can I use IPv6?

As IPv6 is a newer technology, you'll first need to make sure that the devices you're using fully support it.

If you're using new hardware or software, it's almost certain that IPv6 is supported.

If your hardware doesn't support IPv6 natively, there are solutions available which can provide IPv6 to IPv4 translation to get your equipment available on an IPv6 Internet.

Secondly, your ISP needs to support IPv6 connectivity for you.

Safe Hosts and IPv6

At Safe Hosts, our customers benefit from our in-house network with both IPv4 and IPv6 connectivity.

If you're interested in knowing more about how we can get your equipment connected using IPv6, please get in touch with our knowledgeable and friendly team today.

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