

IPv4 vs. IPv6

“How large is IPv6 compared to IPv4?”

by Jim Johnston

IPv6 was designed to solve one of the main issues with IPv4, a lack of address space. To handle the lack of address space in IPv4, engineers created VLSM, private addresses, and NAT to solve the obvious need for public access to the Internet.

IPv4 is a 32 bit number with a maximum amount of $2^{32} = 4,294,967,296$ roughly 4.2 billion addresses. Obviously there are unusable addresses for public use defined by RFC 1918 and other IPv4 special classes but we can mathematically state that there are no more than 2^{32} addresses available.

IPv6 is a 128 bit number with a maximum amount of 2^{128} spaces available. Again as with IPv4 there are special address spaces set aside for specific situations but these numbers do not greatly deteriorate the amount available. Using basic algebra below you will have an opportunity to mathematically realize the magnitude of the IPv6 address space in relationship to IPv4.

We will start with the size of the IPv4 space and double it through multiplication,

$$2 \cdot 2^{32}$$

This can also be written as,

$$2^1 \cdot 2^{32} = 2^{33}$$

Therefore 2^{33} is twice the size of the IPv4 space. If we quadruple the amount of IPv4 space we have,

$$4 \cdot 2^{32} = 2^2 \cdot 2^{32}$$

$$2^2 \cdot 2^{32} = 2^{34}$$

Therefore 2^{34} is four times the size of IPv4 space.

How large then is IPv6 compared to IPv4? This question can be represented algebraically as,

$$x \cdot 2^{32} = 2^{128}$$

Divide both sides by 2^{32} ,

$$x = \frac{2^{128}}{2^{32}}$$

$$x = 2^{128-32}$$

$$x = 2^{96}$$

Therefore the IPv6 address space is 2^{96} times larger than the IPv4 address space or 79,228,162,514,264,337,593,543,950,336 times larger!