4.5 IPV6 ADDRESSING

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IPv6 Header Format

From <https://datatracker.ietf.org/doc/html/rfc8200>

https://www.google.com/intl/en/ipv6/statistics.html

3.4×10^{38}

2^{128}

hex format

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Representation in Hexadecimal Format

An IPv6 address consists of 128 bits, divided into eight groups of 16 bits each. Each group is represented by four hexadecimal digits (since each hex digit represents 4 bits, and 4 bits * 4 = 16 bits). Hexadecimal numbers use the digits 0-9 to represent values zero to nine, and the letters A-F (or a-f) to represent values ten to fifteen. Therefore, an IPv6 address looks something like this:

2001:0db8:85a3:0000:0000:8a2e:0370:7334

How to Shorten an IPv6 Address

1. ~~Omit Leading Zeros~~: Within any 16-bit block of an IPv6 address, leading zeros can be omitted. For example, 0db8 can be shortened to db8, and 0000 can be simply written as 0.
2. Use Double Colon for Consecutive Zeros: A double colon :: can replace consecutive sections of zeros only once in an IPv6 address to shorten it. This is because the double colon tells the system that groups of zeros have been omitted to shorten the address. For example, the IPv6 address 2001:0db8:0000:0000:0000:8a2e:0370:7334 can be shortened to 2001:db8::8a2e:0370:7334.
   It's important to note that the double colon :: can only be used once in an address because using it more than once would create ambiguity regarding the number of zeros omitted in each instance.

An example of a fully abbreviated IPv6 address might look like this:
Original: 2001:0db8:0000:0000:0000:0000:0340:7800
Shortened: 2001:db8::340:7800
This shortening technique makes IPv6 addresses easier to read and write, but it's crucial to understand the full representation to appreciate the structure and the vast address space that IPv6 provides.