29. IPv6 Addressing & Subnetting

IPV6 ADDRESS TYPES

Prefix	Address Type	Description
FD00::/8 Subset of FC00::/7	Unique Local	Not registered, therefore unroutable (unfindable) on the internet. Add 40 random bits to yield a /48 network that is almost certainly unique, yet unroutable due to its non-hierarchical nature—the world's routers wouldn't know where it is. Note: the first half of FC00::/7 is undefined.
FE80::/64 (/10 + 54 zeroes)	Link Local	Used for overhead, like routing protocols. Routers do not forward. When pinging, must tell ping which interface to exit.
FF00::/8	Multicast	
Anything Else	Global Unicast	Public addresses, just like IPv4 before everyone started hiding behind NAT. Originally, this was just addresses beginning with 2 or 3 (2000::/3)
:: (all zeroes)	unknown / unspecified	Source (self) IP during early stages of dynamic address discovery
::1	loopback	

GLOBAL UNICAST

Global Routing Prefix—A company is given a block, which it subnets at will and assigns to hosts, resulting in a hierarchically addressed internet—address matches become more specific the further you go toward the destination.

IANA (Internet Assigned Numbers Authority)—Oversees IP addressing for the world.

ARIN (American Registry for Internet Numbers)—Receives and manages a block of addresses from IANA for north America, assigning sub-blocks to ISPs and large corporations.

Prefix ID—The network portion of an address. Just like IPv4, this can't be assigned to a host.

Subnetting—Everyone just uses /64 for the final subnet with hosts. Anything between the prefix length of the global routing prefix and /64 is subnet bits. So, if your ISP gave you a /48, you have 16 subnet bits, enough for 65,536 subnets. This isn't really wasteful, since /48 allows 65,000 more global routing prefixes (companies) than IPv4 has addresses.

SLAAC (Stateless Address Autoconfiguration)—Inbuilt IPv6 mechanisms for hosts to automatically give themselves an address.

UNIQUE LOCAL UNICAST

Address Format— "FD" + 40 chosen bits (10 hex digits) + 16 subnet bits + 64 host bits.

RFC 4193 lists the logic to create a prefix that's highly likely to be unique. This avoids the problem of a merger where both companies are using, e.g. 10.0.0.0 /8 (IPv4 example).

! You may actually see FC00::/7 discussed. All of that is reserved, but only the second half has a defined format (2 paragraphs up). If you see FEC0::/10 mentioned, get a newer book.