28. IPv6 Basics

BACKGROUND

Purpose—Cisco limits discussion to IPv4 running out of public addresses.

IPv6 Header—At 40 bytes, the required part is simpler than IPv4. In fact, 32 of the 40 are source (16) & destination (16) addresses.

Ethernet Encapsulation—just like v4, the protocol field of the Ethernet header tells that the contents are and IPv6 packet.

Dual Stacking—running both IPv4 and 6 on an interface (one address of each, same interface).

Protocols—defined by RFCs, except for EIGRP, which is a Ciscoism.

- NDP (Neighbor Discovery Protocol)—more generalized superset replacement for ARP
- ICMP version 6
- OSPFv3—First accommodated IPv6, now both 4 and 6 (the old IPv4 version was 2)
- RIPng (next generation)
- EIGRPv6
- MP BGP-4 (Multi-Protocol Border Gateway Protocol version 4)—Made highly extendable "while we're at it" to support more than just IPv6)

ADDRESSES

Addresses—128 bits (16 bytes) expresses in 8 groups of 4 hex digits, separated by colons (:)

Hexadecimal—each digit, 0-F, expresses 4 bits and the values 0-15

Abbreviating IPv6 Addresses

- Within each colon-delimited grouping of 4 hex digits ("quartet"), you can drop leading 0s, *not the trailing ones*
- When you have one or more sequences of all-0 quartets, you can drop that sequence and replace it with "::" ONCE. If you do it twice, you won't know how many zeroes are in each

```
FE00:0000:0000:0001:0000:0000:0000:0056
 = FE00:0:0:1::56
```

Not FE:0:0:1::56 (dropping trailing zeroes instead of leading zeroes on the FE00)
Not FE00::1::56 (two double-colons)

Prefix Length—just like CIDR in IPv4, usually /64. To get the prefix (network address), set the following bits to zero and rewrite that address. With luck, the prefix length is a multiple of 4, meaning you just change some hex digits to 0 without having to recalculate one that straddles the border.