Achievable

CCNA DUMP SHEET

IPv6

Address format

- **Size:** 128 bits, 8 quartets (hextets) of 4 hex digits, 16 bits each
- **Hex digit:** 4 bits, with values 8, 4, 2, 1. A = 10 through F = 15
- **Hex to binary:** 89AB = 1000 1001 1010 1011
- **Network prefix:** the network bits, usually /64
- **Interface ID:** the host bits
- **Prefix length** does the job of the IPv4 mask

Shorten	Before	After
Leading zeroes in a quartet	0DB8	DB8
Other zeroes stay	DB80	DB80
All-zero quartet, as often as you like	0000	0
Run of all-zero quartets, **once only**	0:0:0	::

- **Full:** 2001:0DB8:0000:89AB:CDEF:0000:ABCD:FFFF
- **Short:** 2001:DB8::89AB:CDEF:0:ABCD:FFFF

Address types

Type	Prefix	What it is
Global unicast	2000::/3	Public, routed on the Internet
Unique local	FC00::/7	Private, like RFC 1918; usually FD
Link-local	FE80::/10	One link only, never routed
Multicast	FF00::/8	One to many; never a source
Anycast	No prefix	One address on many routers
Loopback	::1/128	Like 127.0.0.1
Unspecified	::/128	No address yet; never configured
Default route	::/0	Like 0.0.0.0/0

- **FF02::1:** all IPv6 nodes. **FF02::2:** all routers
- **No broadcast in IPv6:** multicast replaces it
- **Anycast:** one to nearest, or load balancing
- **Unicast types:** global, unique local, link-local
- **One interface** holds link-local, global and multicast at once

Modified EUI-64

Step	MAC 00:21:2A:B5:6E:10	MAC 52:54:00:99:69:07
Invert the 7th bit	0221:2AB5:6E10	5054:0099:6907
Split in half	0221:2A | B5:6E10	5054:00 | 99:6907
Insert FF:FE	0221:2AFF:FEB5:6E10	5054:00FF:FE99:6907
Link-local address	FE80::221:2AFF:FEB5:6E10/64	FE80::5054:FF:FE99:6907/64

- **Why:** a 48-bit MAC plus FFFE makes a 64-bit interface ID
- **7th bit** is worth 2 in the first byte: 00 → 02, 52 → 50
- **The MAC itself** does not change
- **Global address:** the same ID behind a /64 prefix

Configure and verify

```
R1(config)# ipv6 unicast-routing
R1(config)# interface g0/0
R1(config-if)# ipv6 address 2001:DB8:A:B::1/64
R1(config-if)# no shutdown
```

Command	What it does
`ipv6 address 2001:DB8:A:B::/64 eui-64`	Interface: EUI-64 ID
`show ipv6 interface brief`	Link-local, global

- **Routing:** `ipv6 unicast-routing` enables IPv6 forwarding
- **Dual stack:** IPv4 and IPv6 together on a router

Static routes

Global config command	Route
`ipv6 route 2001:DB8:2::/64 2001:DB8:1::2`	Network
`ipv6 route 2001:DB8:2::A/128 2001:DB8:1::2`	Host
`ipv6 route ::/0 2001:DB8:1::2`	Default
`ipv6 route 2001:DB8:2::/64 2001:DB8:1::2 5`	Floating
`ipv6 route 2001:DB8:2::/64 g0/0 FE80::2`	Link-local

- **Host:** always /128. **Floating:** higher distance, at the end
- **Link-local next hop:** name the exit interface first
- **Verify:** `show ipv6 route`; static routes show as S

Subnetting

- **Networks:** 2^n, n = new prefix length minus old
- **/48 into /64s:** 2^{16} = 65,536 networks
- **/56 into /64s:** 2^8 = 256 networks
- **Second /64 of 2001:DB8:ABCD::/48:** 2001:DB8:ABCD:1::/64
- **/126 link:** 2^2 = 4 addresses, 3 assignable
- **First address:** reserved, the Subnet-Router anycast address
- **Last address:** usable, because IPv6 has no broadcast
- **Address conservation:** not a concern; plan in /64s