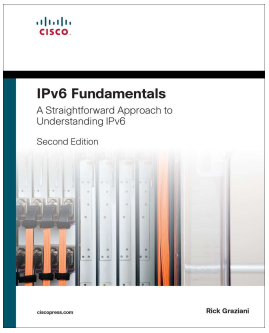

IPv6 Fundamentals, by Rick Graziani

Global Unicast Address

Selected by **Alvaro Barradas** for Redes II

<abarra@ualg.pt>

Chapter 5

Global Unicast Address

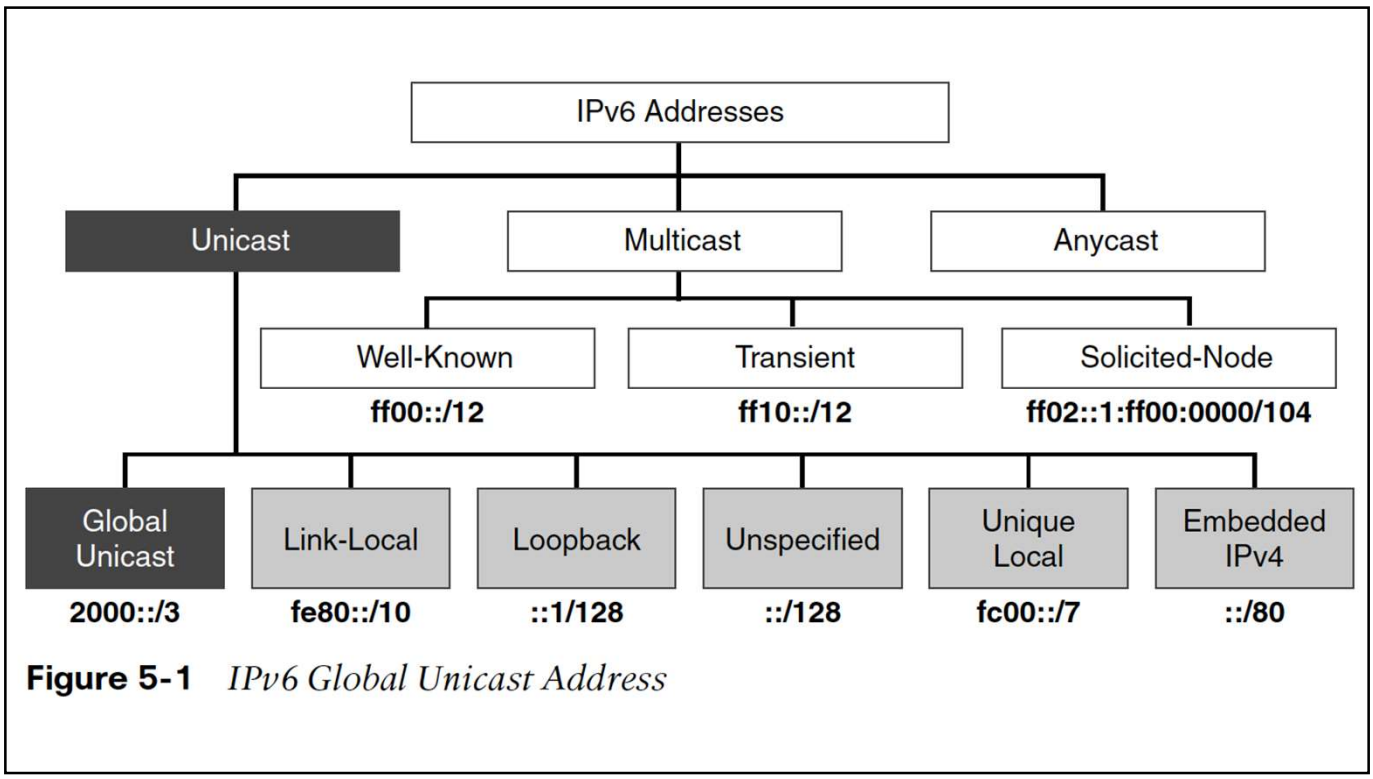

Figure 5-1 *IPv6 Global Unicast Address*

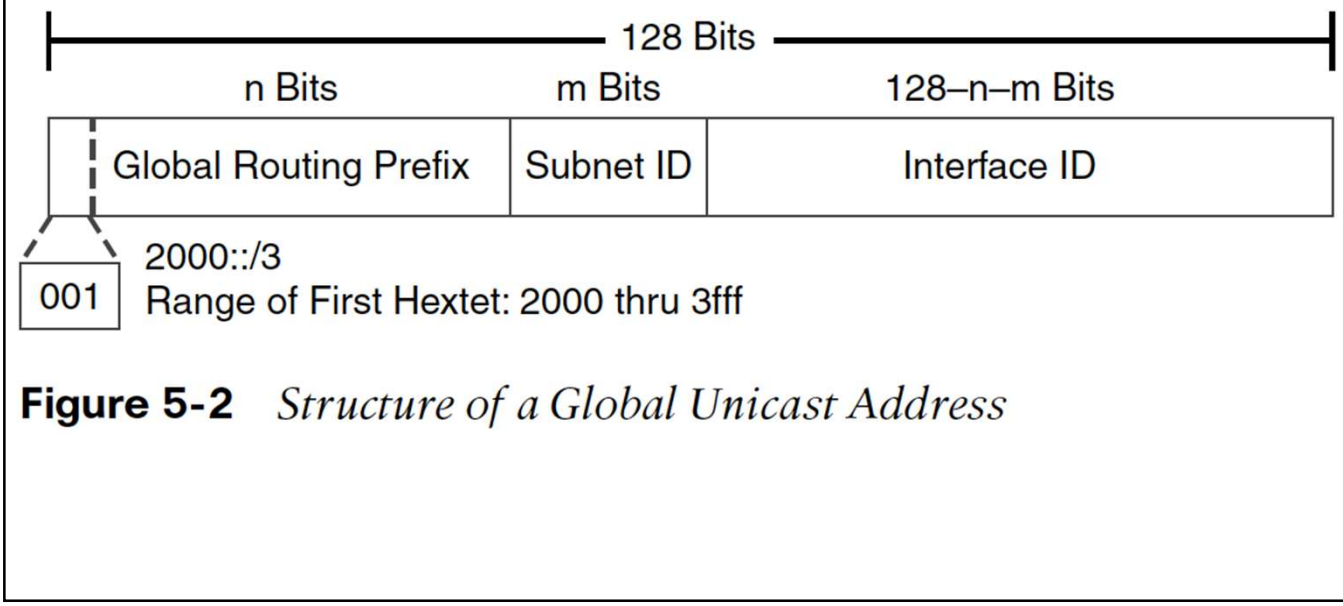

Figure 5-2 *Structure of a Global Unicast Address*

Table 5-1 *Range of Global Unicast Addresses*

Global Unicast Address (Hexadecimal)	Range of First Hextet	Range of First Hextet in Binary
2000::/3	2000 to	0010 0000 0000 0000
	3fff	0011 1111 1111 1111

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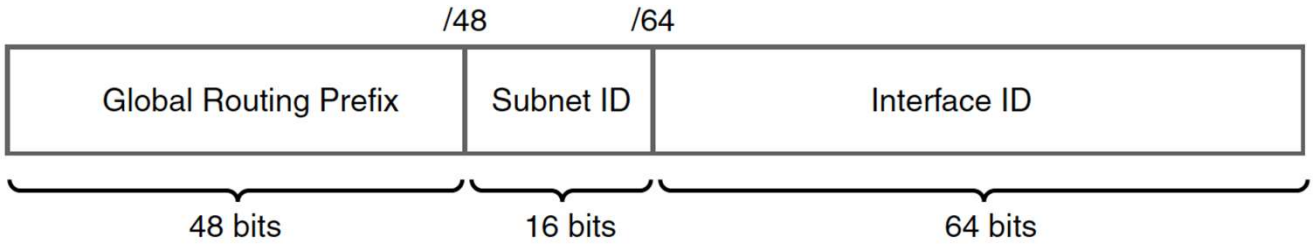

Figure 5-3 *Structure of a GUA for a Typical Site*

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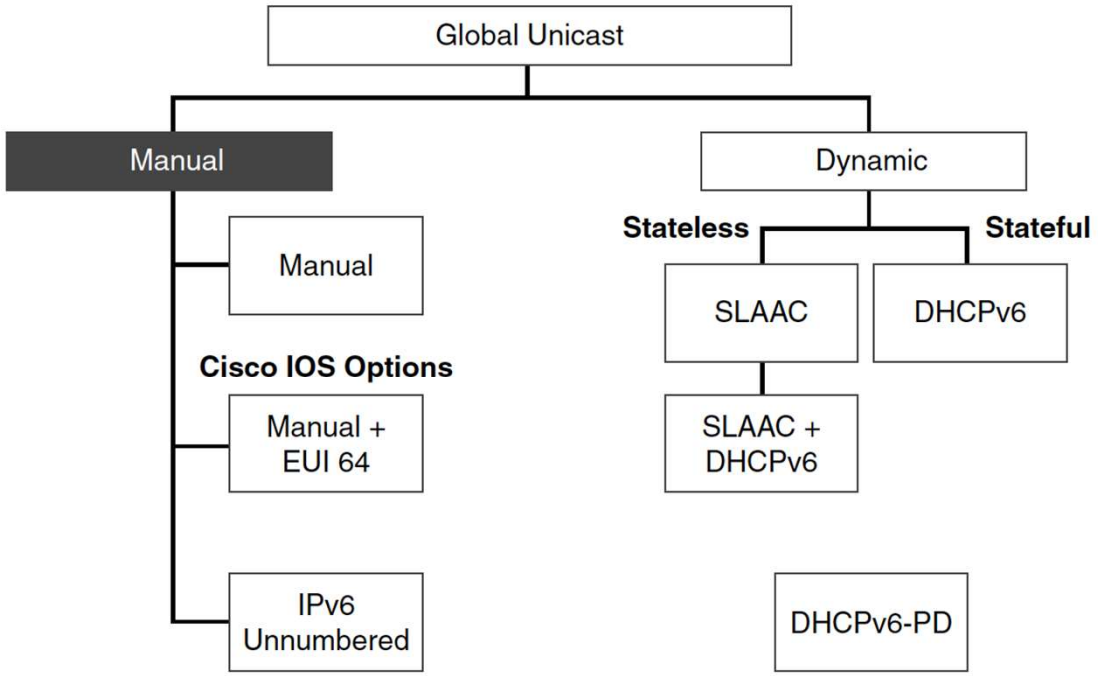

Figure 5-4 *Options for Configuring a GUA*

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Table 5-2 ipv6 address *Command*

Command	Description
Router(config)# **interface** *interface-type -interface-number*	Specifies the interface type and interface number.
Router(config-if)# **ipv6 address** *ipv6-address/prefix-length*	Specifies the IPv6 address and prefix length to be assigned to the interface. To remove the address from the interface, use the **no** form of this command.

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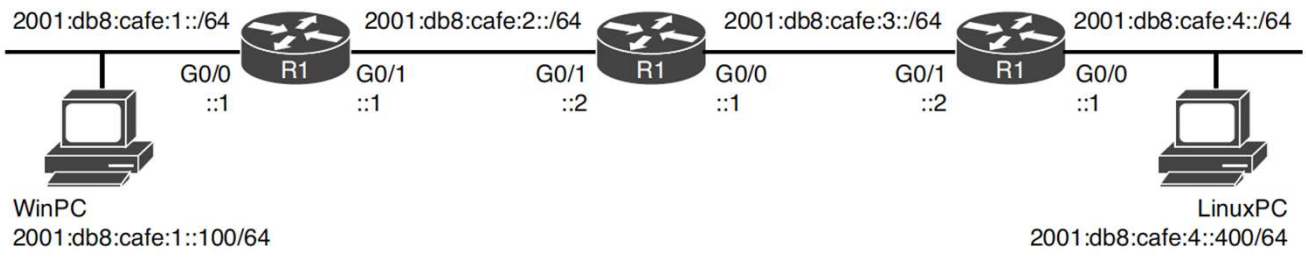

Figure 5-5 *IPv6 Topology*

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Example 5-1 *Configuring Global Unicast Addresses on Routers R1, R2, and R3*

```
R1(config)# interface gigabitethernet 0/0
R1(config-if)# ipv6 address 2001:db8:cafe:1::1/64
R1(config-if)# no shutdown
R1(config-if)# exit
R1(config)# interface gigabitethernet 0/1
R1(config-if)# ipv6 address 2001:db8:cafe:2::1/64
R1(config-if)# no shutdown
```

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```
R2(config)# interface gigabitethernet 0/1
R2(config-if)# ipv6 address 2001:db8:cafe:2::2/64
R2(config-if)# no shutdown
R2(config-if)# exit
R2(config)# interface gigabitethernet 0/0
R2(config-if)# ipv6 address 2001:db8:cafe:3::1/64
R1(config-if)# no shutdown
--------------------------------------------------------------------------------
R3(config)# interface gigabitethernet 0/1
R3(config-if)# ipv6 address 2001:db8:cafe:3::2/64
R3(config-if)# no shutdown
R3(config-if)# exit
R3(config)# interface gigabitethernet 0/0
R3(config-if)# ipv6 address 2001:db8:cafe:4::1/64
R1(config-if)# no shutdown
```

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Example 5-2 show running-config *Command on Router R1*

```
R1# show running-config
<output omitted for brevity>
!
interface GigabitEthernet0/0
 no ip address
 duplex auto
 speed auto
 ipv6 address 2001:DB8:CAFE:1::1/64
!
interface GigabitEthernet0/1
 no ip address
 duplex auto
 speed auto
 ipv6 address 2001:DB8:CAFE:2::1/64
!
```

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Example 5-3 show ipv6 interface brief *Command on Router R1*

```
R1# show ipv6 interface brief
GigabitEthernet0/0      [up/up]
    FE80::5AAC:78FF:FE93:DA00      ! Link-local address
    2001:DB8:CAFE:1::1             ! Global unicast address
GigabitEthernet0/1      [up/up]
    FE80::5AAC:78FF:FE93:DA01      ! Link-local address
    2001:DB8:CAFE:2::1             ! Global unicast address
R1#
```

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Example 5-4 show ipv6 interface gigabitethernet 0/0 *Command on R1*

```
R1# show ipv6 interface gigabitethernet 0/0
GigabitEthernet0/0 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::5AAC:78FF:FE93:DA00
  No Virtual link-local address(es):
  Global unicast address(es):
    2001:DB8:CAFE:1::1, subnet is 2001:DB8:CAFE:1::/64
  Joined group address(es):
    FF02::1
    FF02::FB
    FF02::1:FF00:1
    FF02::1:FF93:DA00
  MTU is 1500 bytes
  ICMP error messages limited to one every 100 milliseconds
  ICMP redirects are enabled
  ICMP unreachables are sent
  ND DAD is enabled, number of DAD attempts: 1
  ND reachable time is 30000 milliseconds (using 30000)
  ND NS retransmit interval is 1000 milliseconds
  Default router is FE80::662:73FF:FE5E:F961 on GigabitEthernet0/1
R1#
```

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Example 5-5 *Configuring a GUA Address with the EUI-64 Option*

```
R1# show interface g 0/0
GigabitEthernet0/0 is up, line protocol is up
  Hardware is CN Gigabit Ethernet, address is 58ac.7893.da00 (bia 58ac.7893.da00)
<output omitted for brevity>

R1(config)# interface g 0/0
R1(config-if)# ipv6 address 2001:db8:cafe:1::/64 ?
  anycast  Configure as an anycast
  eui-64   Use eui-64 interface identifier
  <cr>

R1(config-if)# ipv6 address 2001:db8:cafe:1::/64 eui-64
R1(config-if)# end

R1# show ipv6 interface g 0/0
GigabitEthernet0/0 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::5AAC:78FF:FE93:DA00
  No Virtual link-local address(es):
  Global unicast address(es):

    2001:DB8:CAFE:1:5AAC:78FF:FE93:DA00, subnet is 2001:DB8:CAFE:1::/64 [EUI]
<output omitted for brevity>
```


Example 5-6 *Example of Using the* **ipv6 unnumbered** *Command*

```
Router(config)# interface gigabitethernet 0/0
Router(config-if)# ipv6 address 2001:db8:abcd:1234::1/64
Router(config)# interface serial 0/0/1
Router(config-if)# ipv6 unnumbered gigabitethernet 0/0
```

Example 5-7 *Viewing the IPv6 Configuration on WinPC and LinuxPC*

```
WinPC> ipconfig
Ethernet adapter Local Area Connection:
   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::d0f8:9ff6:4201:7086%11
   Autoconfiguration IPv4 Address  . : 169.254.112.134
   Subnet Mask . . . . . . . . . . . : 255.255.0.0
   Default Gateway . . . . . . . . . :
-------------------------------------------------------------------------
LinuxPC$ ifconfig
eth0      Link encap:Ethernet  HWaddr 00:50:56:af:14:1b
          inet6 addr: fe80::250:56ff:feaf:141b/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:466475604 errors:0 dropped:0 overruns:0 frame:0
          TX packets:403172654 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:2574778386 (2.5 GB)  TX bytes:1618367329 (1.6 GB)
          Interrupt:16
```


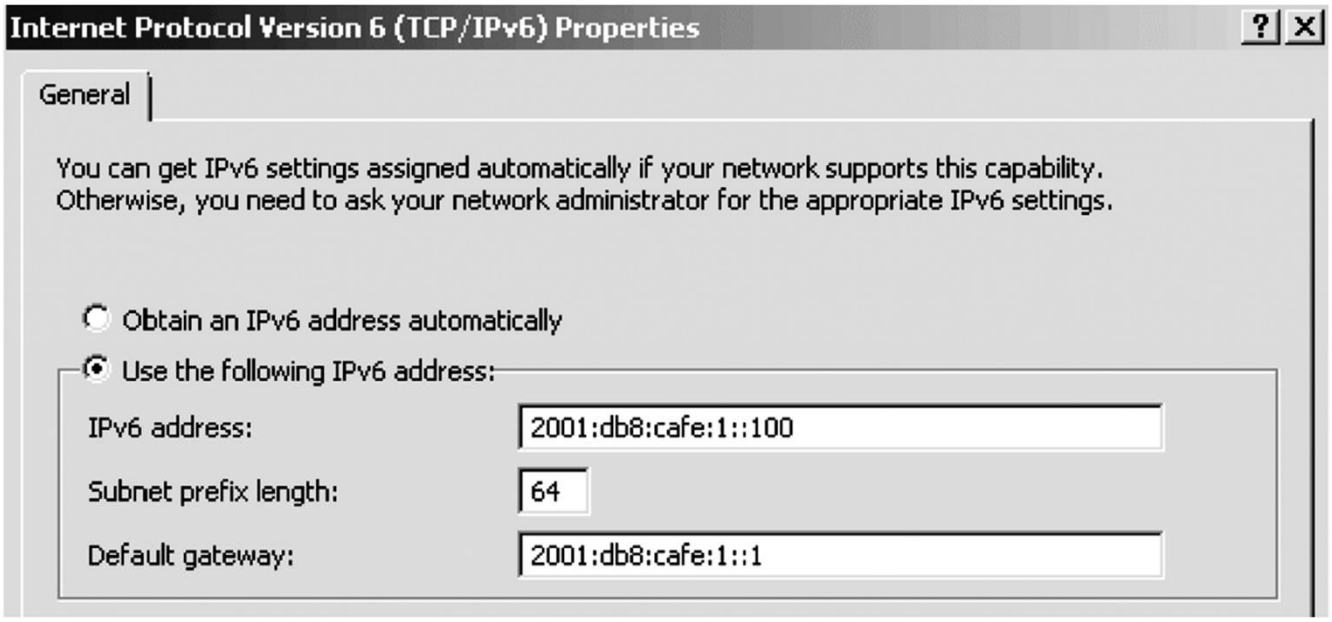

Figure 5-6 *WinPC IPv6 Configuration*

Example 5-8 *IPv6 Configuration on WinPC*

```
WinPC> ipconfig
Ethernet adapter Local Area Connection:
   Connection-specific DNS Suffix  . :
   IPv6 Address. . . . . . . . . . . : 2001:db8:cafe:1::100
   Link-local IPv6 Address . . . . . : fe80::d0f8:9ff6:4201:7086%11
   Autoconfiguration IPv4 Address  . : 169.254.112.134
   Subnet Mask . . . . . . . . . . . : 255.255.0.0
   Default Gateway . . . . . . . . . : 2001:db8:cafe:1::1
```

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Example 5-9 *IPv6 Configuration and Verification on LinuxPC*

```
Configuring the IPv6 global unicast address
LinuxPC$ ifconfig eth0 inet6 add 2001:db8:cafe:4::400/64

Configuring the IPv6 default gateway address
LinuxPC$ route -A inet6 add default gw 2001:db8:cafe:4::1

Verifying the IPv6 global unicast address
LinuxPC$ ifconfig
eth0      Link encap:Ethernet  HWaddr 00:50:56:af:14:1b
          inet6 addr:0.0.0.6  Bcast:255.255.255.255  Mask:0.0.0.0
          inet6 addr: 2001:db8:cafe:4::400/64 Scope:Global
          inet6 addr: fe80::250:56ff:feaf:141b/64 Scope:Link
<output omitted>

Verifying the IPv6 default gateway
LinuxPC$ ip -6 route show
<output omitted>
default via 2001:db8:cafe:4::1 dev eth0  metric 1
```

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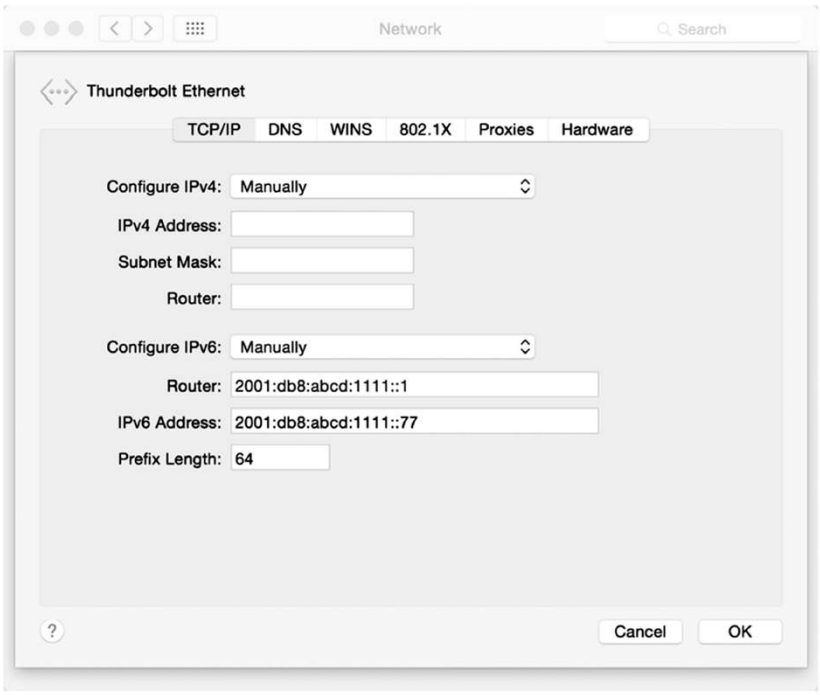

Figure 5-7 *Mac OSX IPv6 Configuration Example*

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Example 5-10 *IPv6 Routing Configuration on R1, R2, and R3*

```
R1(config)# ipv6 unicast-routing
R1(config)# ipv6 route ::/0 2001:db8:cafe:2::2

-----------------------------------------------------------------
R2(config)# ipv6 unicast-routing
R2(config)# ipv6 route 2001:db8:cafe:1::/64 2001:db8:cafe:2::1
R2(config)# ipv6 route 2001:DB8:cafe:4::/64 2001:db8:cafe:3::2

-----------------------------------------------------------------
R3(config)# ipv6 unicast-routing
R3(config)# ipv6 route ::/0 2001:db8:cafe:3::1
```

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Example 5-11 *Verifying Connectivity on Router R1, WinPC, and LinuxPC*

```
R1# ping 2001:db8:cafe:4::400
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:CAFE:4::400, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/4 ms
R1#

------------------------------------------------------------------
WinPC> ping 2001:db8:cafe:4::400
Pinging 2001:db8:cafe:4::400 with 32 bytes of data:
Reply from 2001:db8:cafe:4::400: time=8ms
Reply from 2001:db8:cafe:4::400: time=1ms
Reply from 2001:db8:cafe:4::400: time=1ms
Reply from 2001:db8:cafe:4::400: time=1ms
Ping statistics for 2001:db8:cafe:4::400:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 8ms, Average = 2ms

------------------------------------------------------------------
LinuxPC$ ping6 2001:db8:cafe:1::100
PING 2001:db8:cafe:1::100(2001:db8:cafe:1::100) 56 data bytes
64 bytes from 2001:db8:cafe:1::100: icmp_seq=1 ttl=61 time=6.07 ms
64 bytes from 2001:db8:cafe:1::100: icmp_seq=2 ttl=61 time=1.11 ms
64 bytes from 2001:db8:cafe:1::100: icmp_seq=3 ttl=61 time=1.14 ms
64 bytes from 2001:db8:cafe:1::100: icmp_seq=4 ttl=61 time=1.15 ms
^C
4 packets transmitted, 4 received, 0% packet loss, time 3003ms rtt min/avg/max/
  mdev = 1.114/2.374/6.078/2.138 ms
```


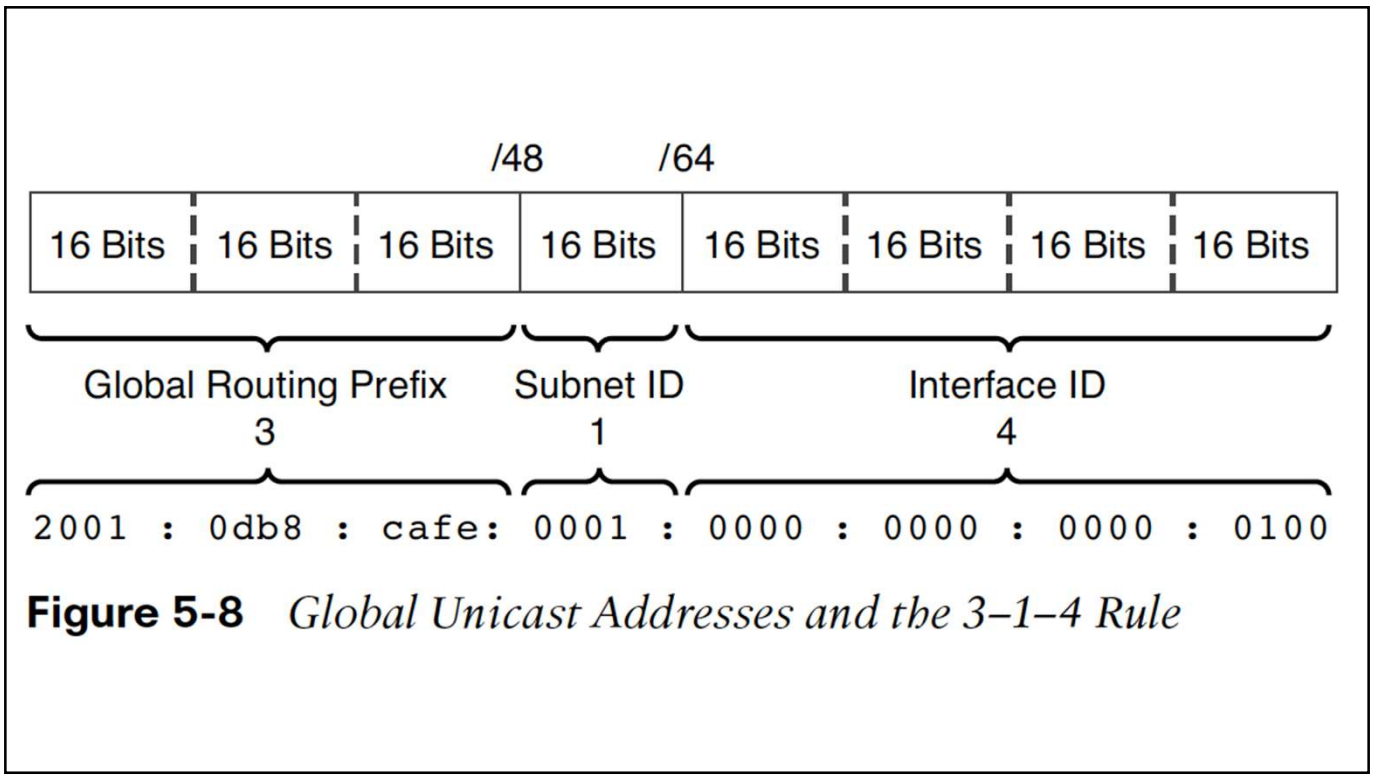

Figure 5-8 *Global Unicast Addresses and the 3–1–4 Rule*

Table 5-3 *Examples of /48 Global Unicast Addresses with the 3–1–4 Technique*

/48 Global Unicast Address	Global Routing Prefix (3)	Subnet ID (1)	Interface ID (4)
2001:0db8:cafe:0001:0000:0000:0000:0001	2001:db8:cafe	0001	0000:0000:0000:0001
2001:0db8:cafe:0004:0000:0000:0000:0400	2001:db8:cafe	0004	0000:0000:0000:0400
2001:0db8:1234:0001:0000:0000:0000:0100	2001:db8:1234	0001	0000:0000:0000:0100
2001:db8:aaaa:9:0:0:0:a	2001:db8:aaaa	0009	0000:0000:0000:000a

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/48 Global Unicast Address	Global Routing Prefix (3)	Subnet ID (1)	Interface ID (4)
2001:db8:aaaa:1::0200	2001:db8:aaaa	0001	0000:0000:0000:0200
2001:db8:aaaa::200	2001:db8:aaaa	0000	0000:0000:0000:0200
2001:db8::abc:0	2001:db8:0000	0000	0000:0000:0abc:0000
2001:db8:abc:1::	2001:db8:abc	0001	0000:0000:0000:0000
2001:db8:deed:450:0123:4567:89ab:cdef	2001:db8:deed	0450	0123:4567:89ab:cdef
2001:db8:deed:5:ffff:ffff:ffff:ffff	2001:db8:deed	0005	ffff:ffff:ffff:ffff

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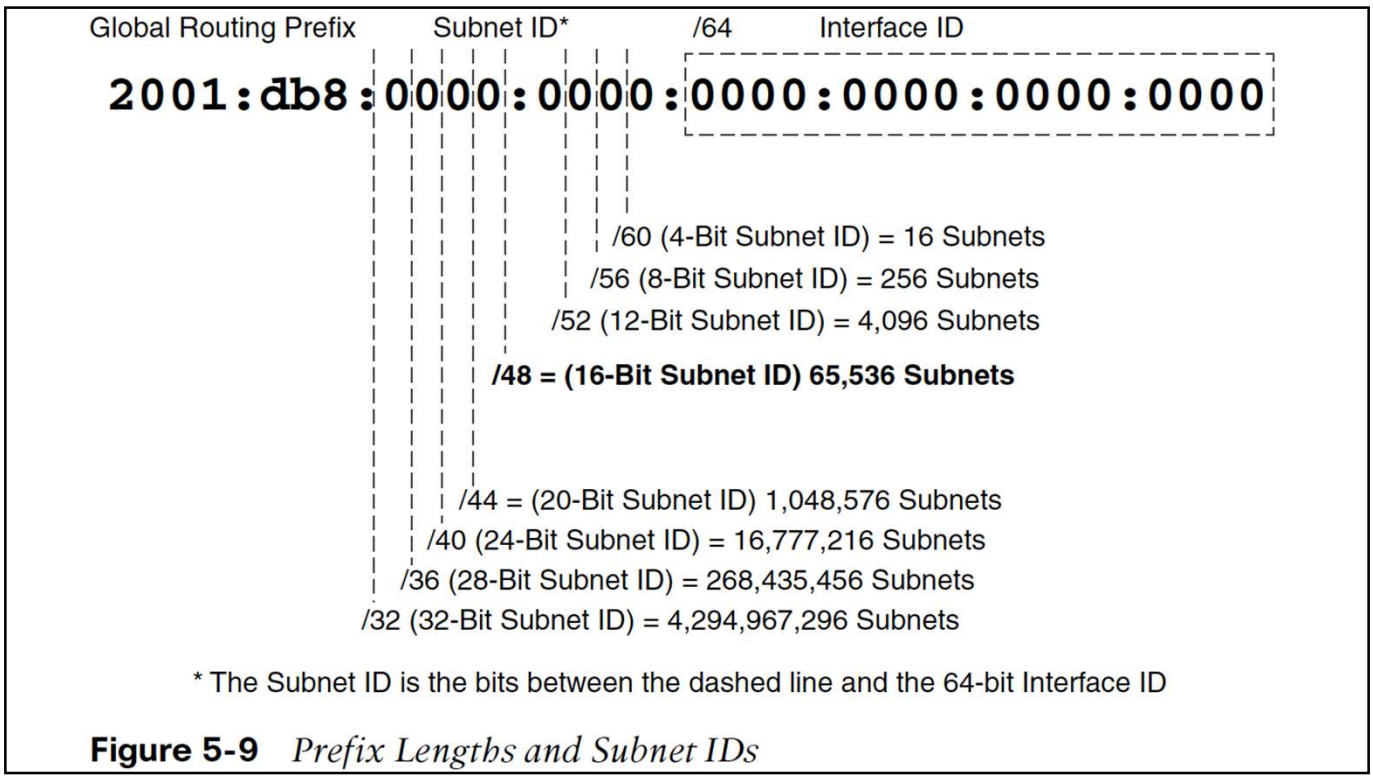

Figure 5-9 *Prefix Lengths and Subnet IDs*

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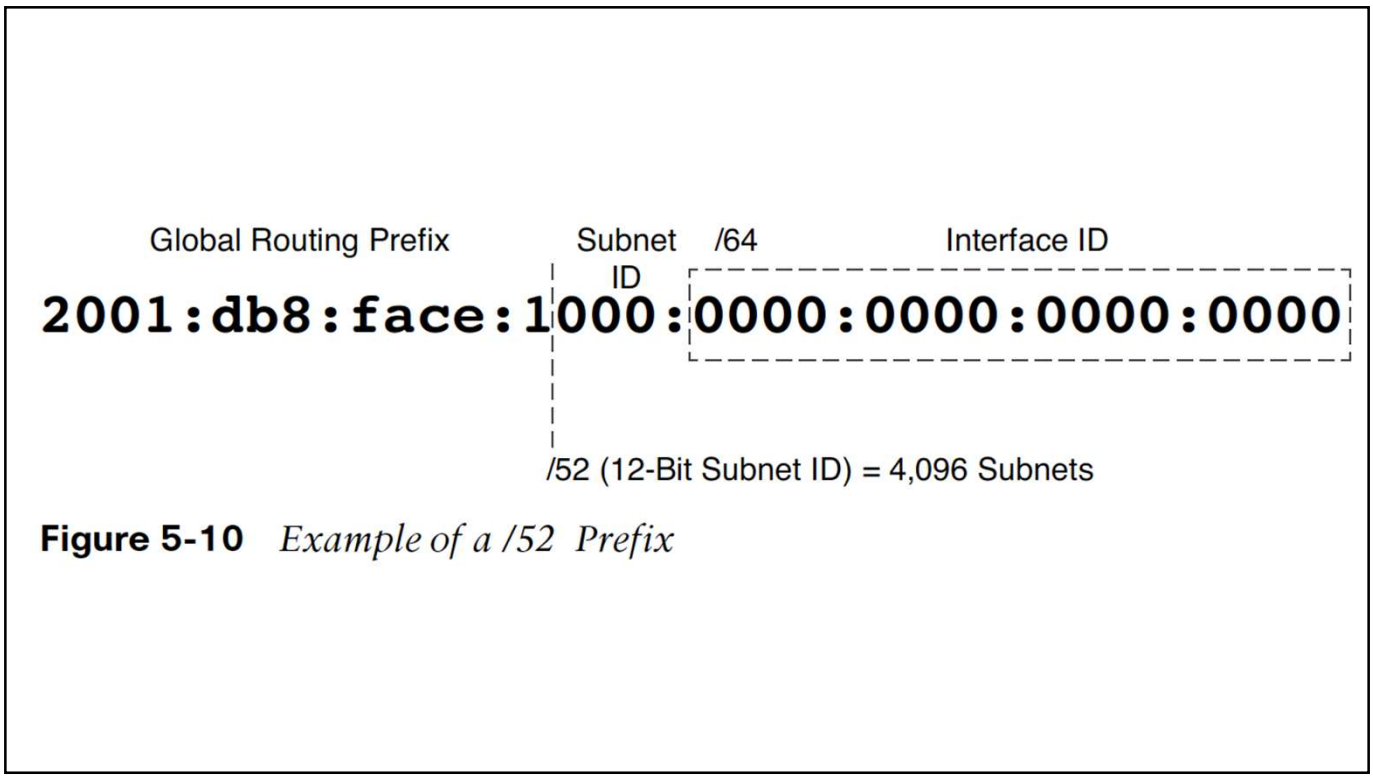

Figure 5-10 *Example of a /52 Prefix*

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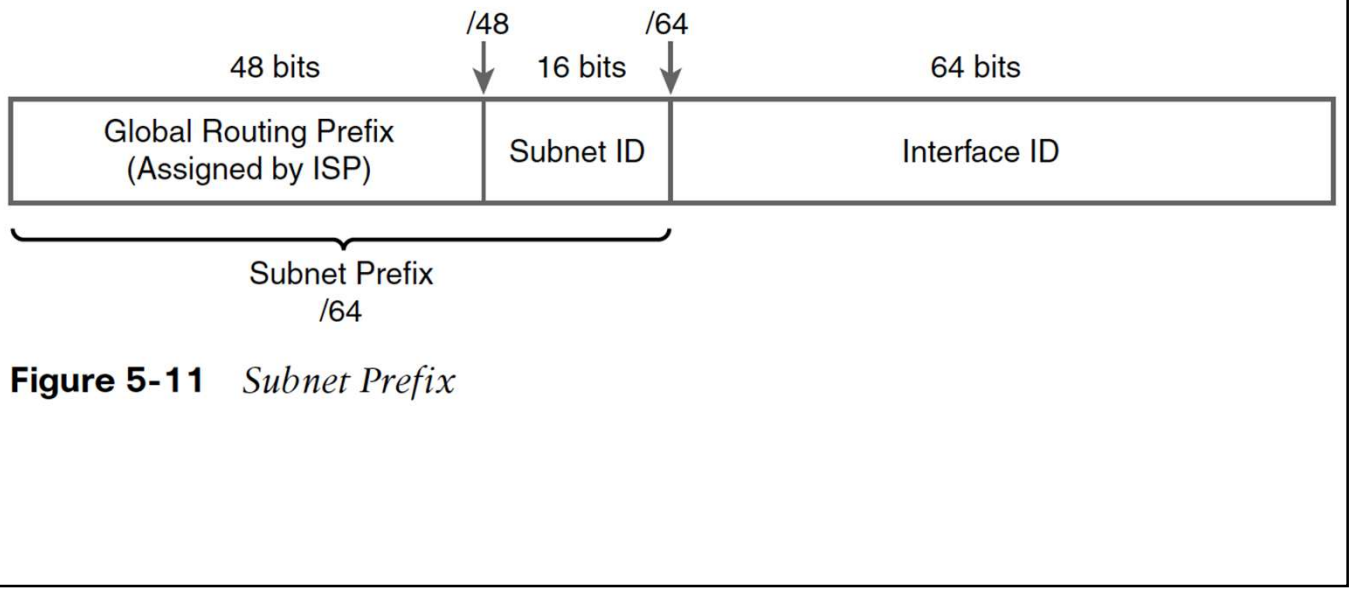

Figure 5-11 *Subnet Prefix*