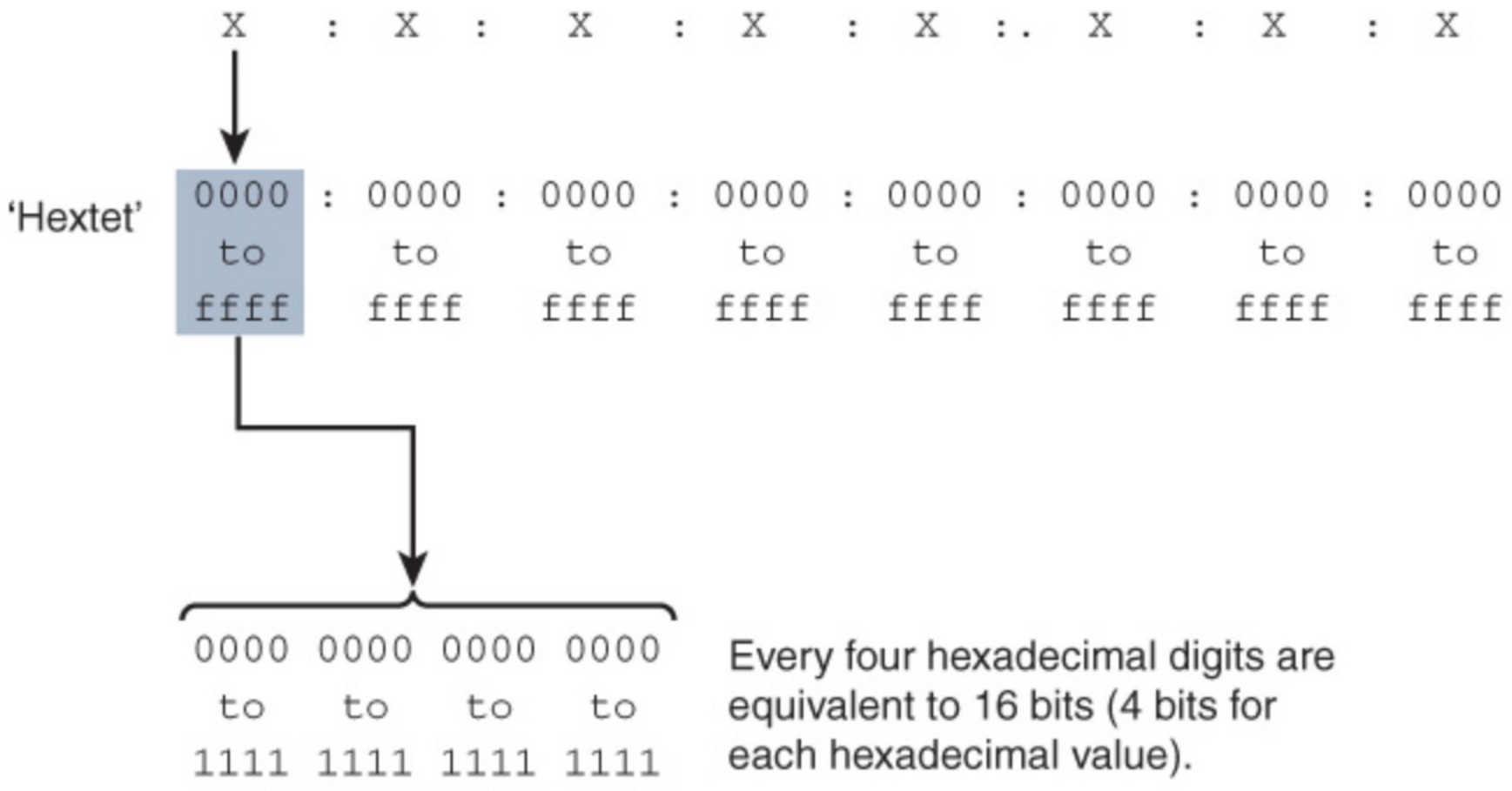
Networking
For everyone

Основы IPv6

IPv6 Addressing

- As described in RFC 4291, the preferred form is x:x:x:x:x:x:x:x
  - Each *x* is a 16-bit section



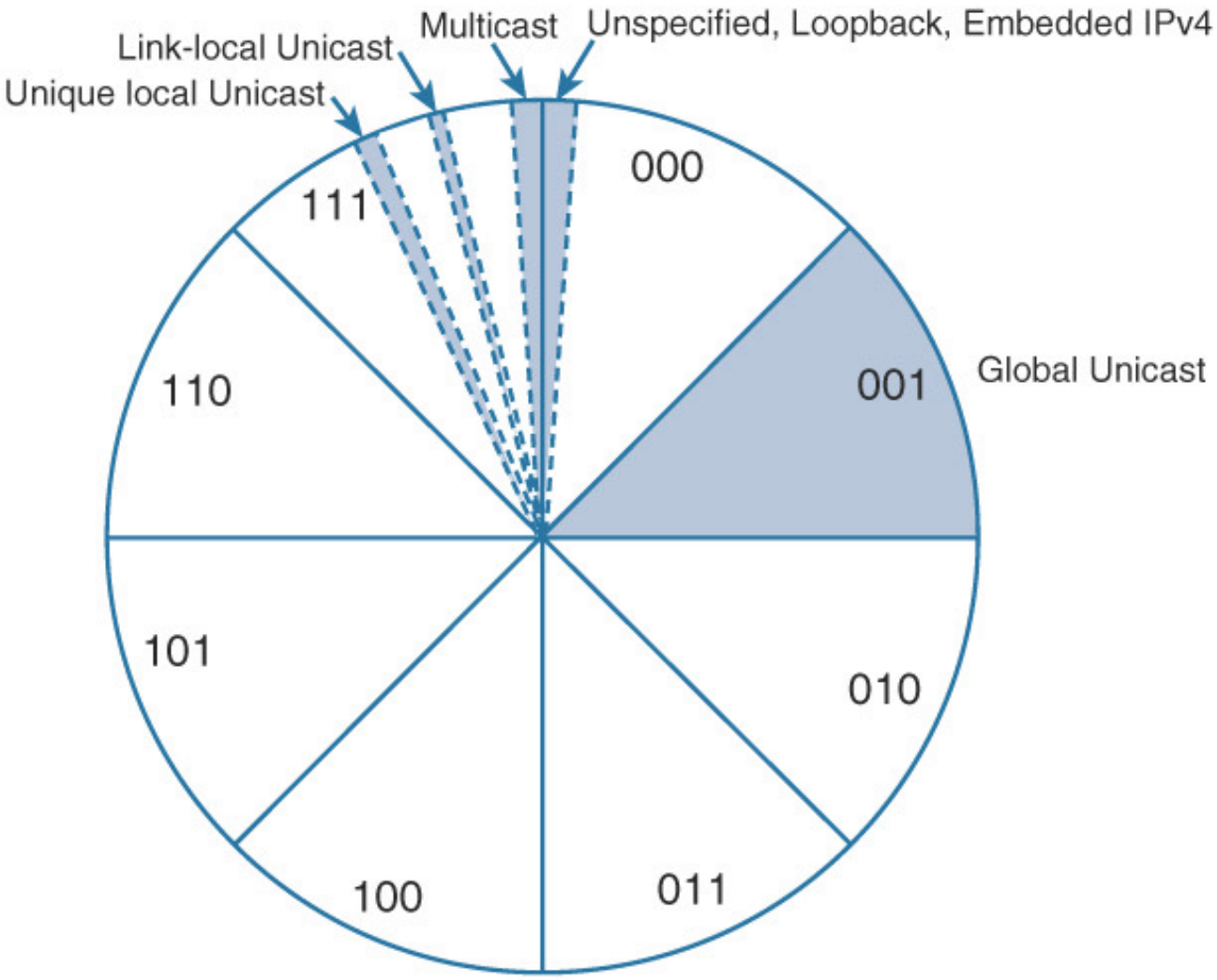
IPv6 Addressing

- RFC 2373 and RFC 5952 provide two helpful rules for reducing the notation involved in the preferred format
- Rule 1: Omit Leading 0s
- Rule 2: Omit All-0s Hextets
- Combining Rule 1 and Rule 2

IPv6 Addressing

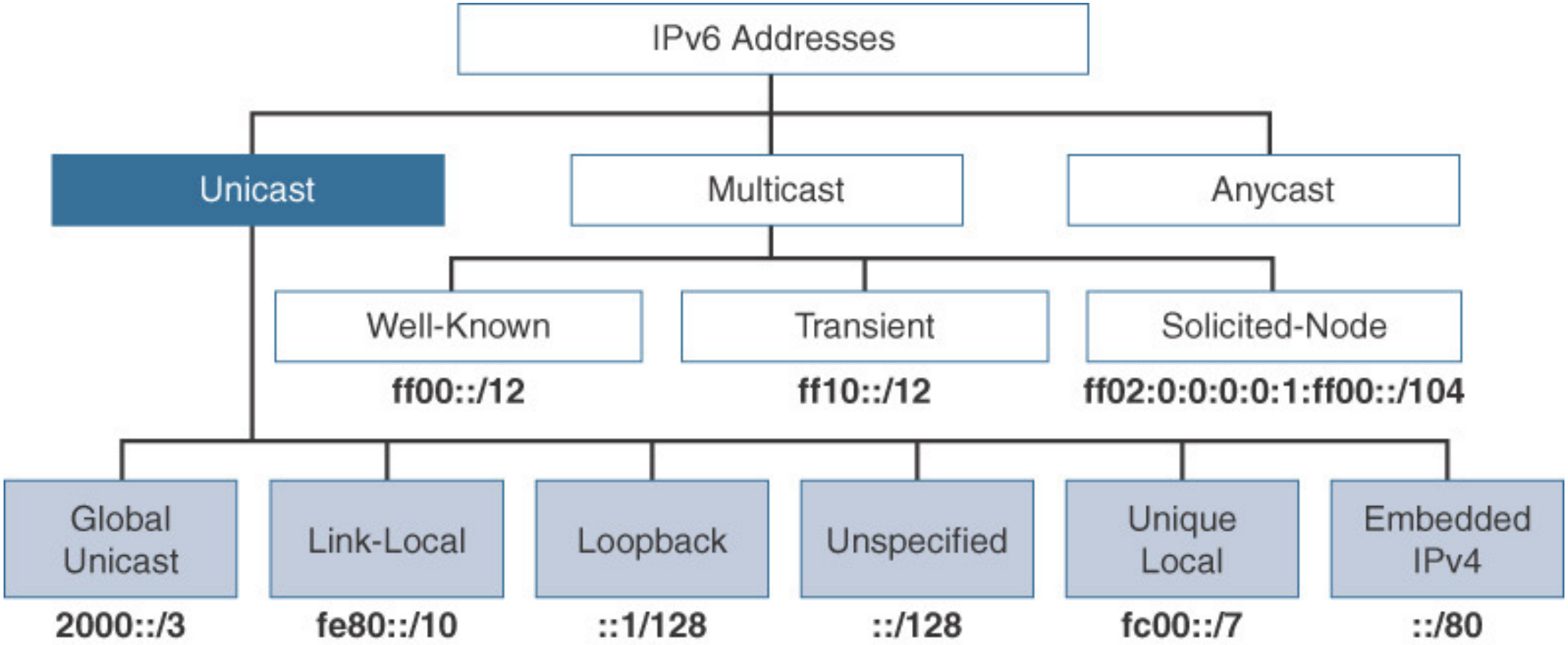
- IPv4, with its 32-bit address space, provides for 4.29 billion
- IPv6 - 340,282,366,920,938,463,463,374,607,431,768,211,456 addresses

IPv6 Addressing



The remaining portions of IPv6 address space are reserved by IETF for future use.

IPv6 Addressing

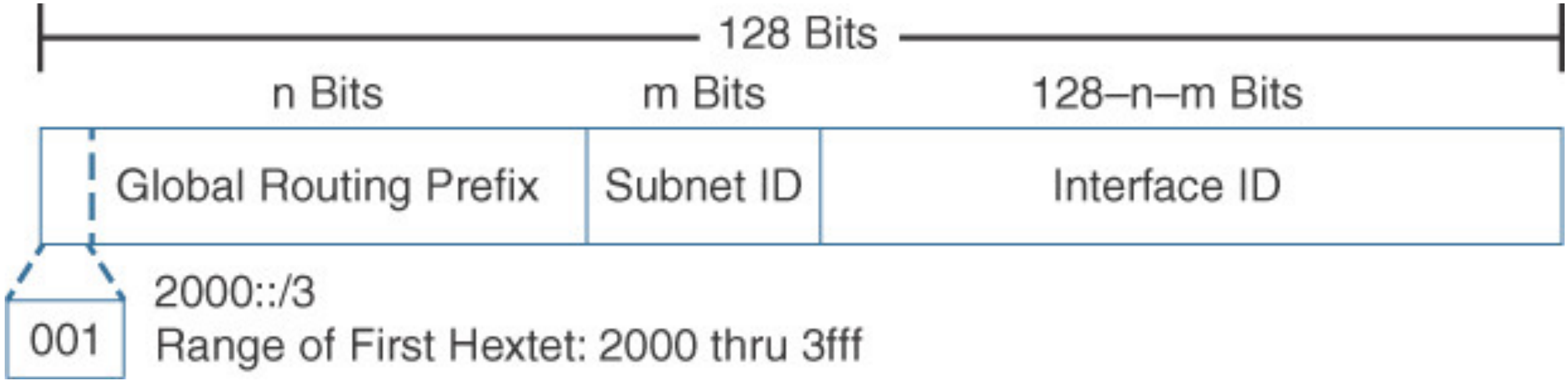


IPv6 Unicast Adresses

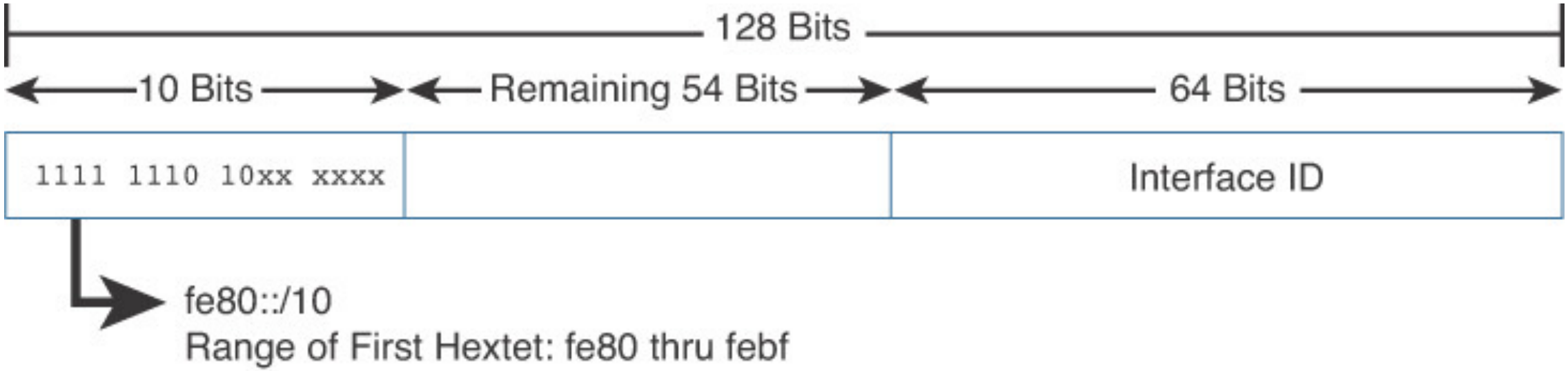
- Global unicast
- Link-local
- Loopback
- Unspecified address
- Unique local
- IPv4 embedded

Global Unicast Address

- Global Routing Prefix
- Subnet ID
- Interface ID



Link-Local Unicast Address



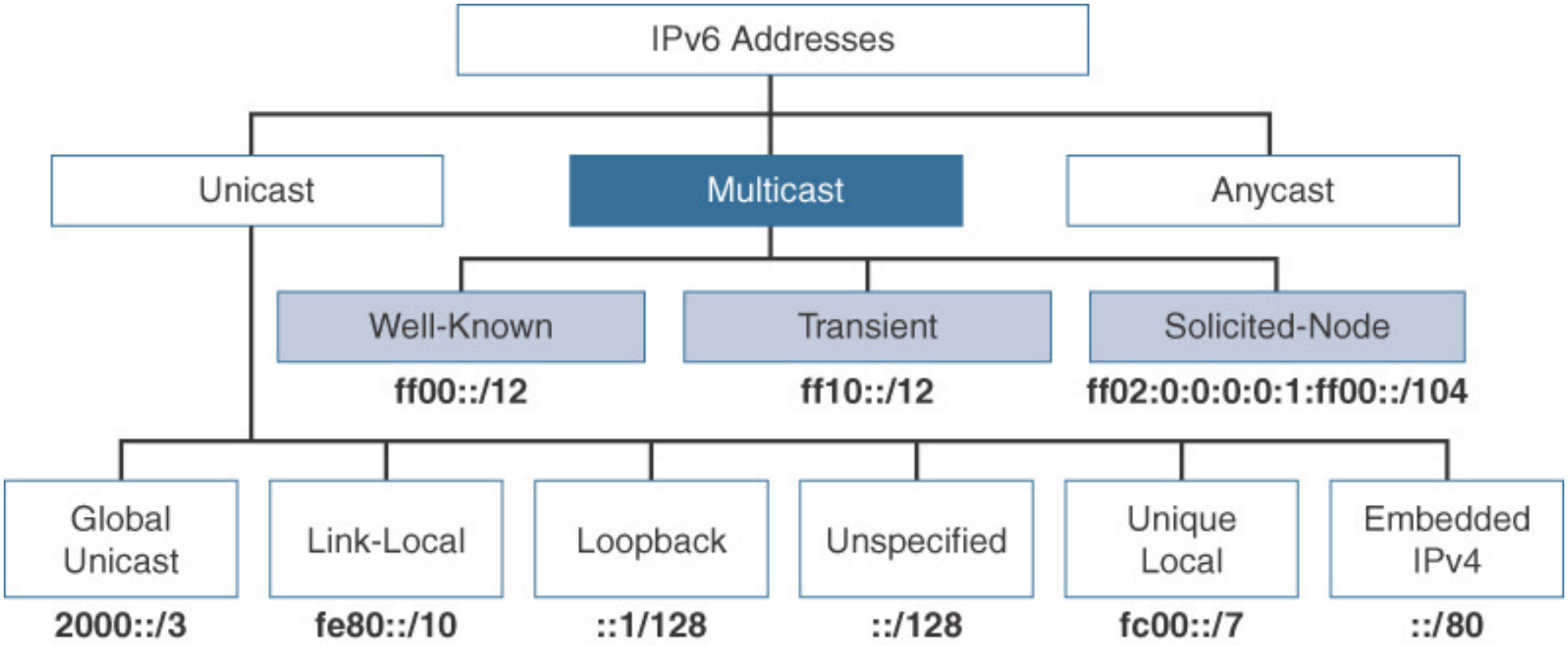
Link-Local Unicast Address

- device must have an IPv6 link-local address
- Link-local addresses are not routable off the link
- Link-local addresses only have to be unique on the link
- There can be only one link-local address per interface

Link-Local Unicast Address

- Devices dynamically (automatically) create their own link-local IPv6 address upon startup
- Link-local addresses can be manually configured
- When a device starts up, before it obtains a GUA address, the device uses its IPv6 link-local address as its source address to communicate with other devices on the network
- Devices use the router’s link-local address as their default gateway address
- IPv6 routing table entries populated from dynamic routing protocols use the IPv6 link-local address as the next-hop address

MULTICAST ADDRESSES



Well-Known Multicast Addresses

- ff02::1:
  - All IPv6 devices
- ff02::2:
  - All IPv6 routers
- ff02::5:
  - All OSPFv3 routers
- ff02::a:
  - All EIGRP (IPv6) routers

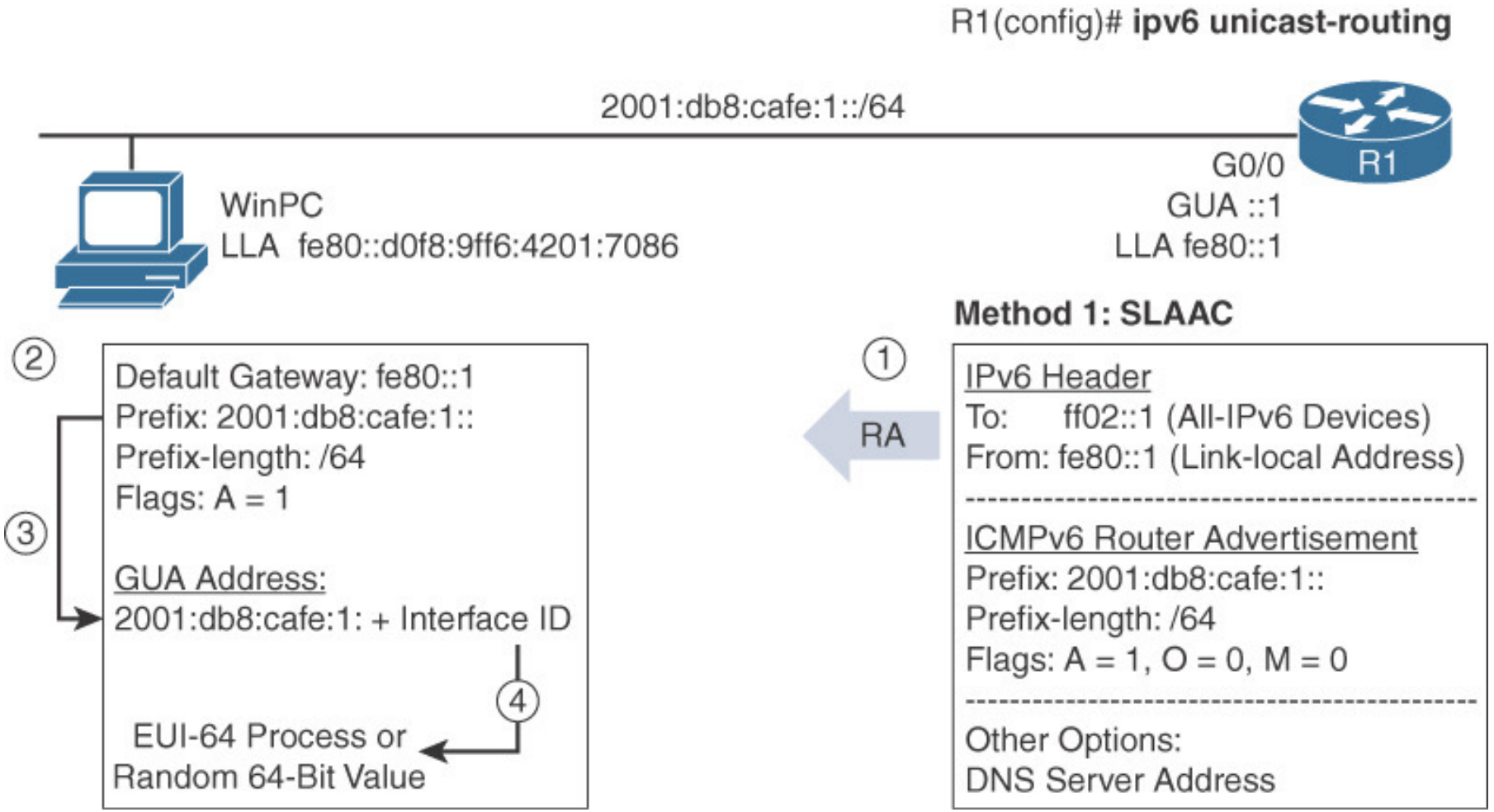
Solicited-Node Multicast Addresses

- used as a more efficient approach to IPv4's broadcast address
- used in Layer 3-to-Layer 2 address resolution, similar to how Address Resolution Protocol (ARP) is used in IPv4
- automatically created using a special mapping of the device's unicast address with the solicited-node multicast prefix ff02:0:0:0:0:1:ff00::/104

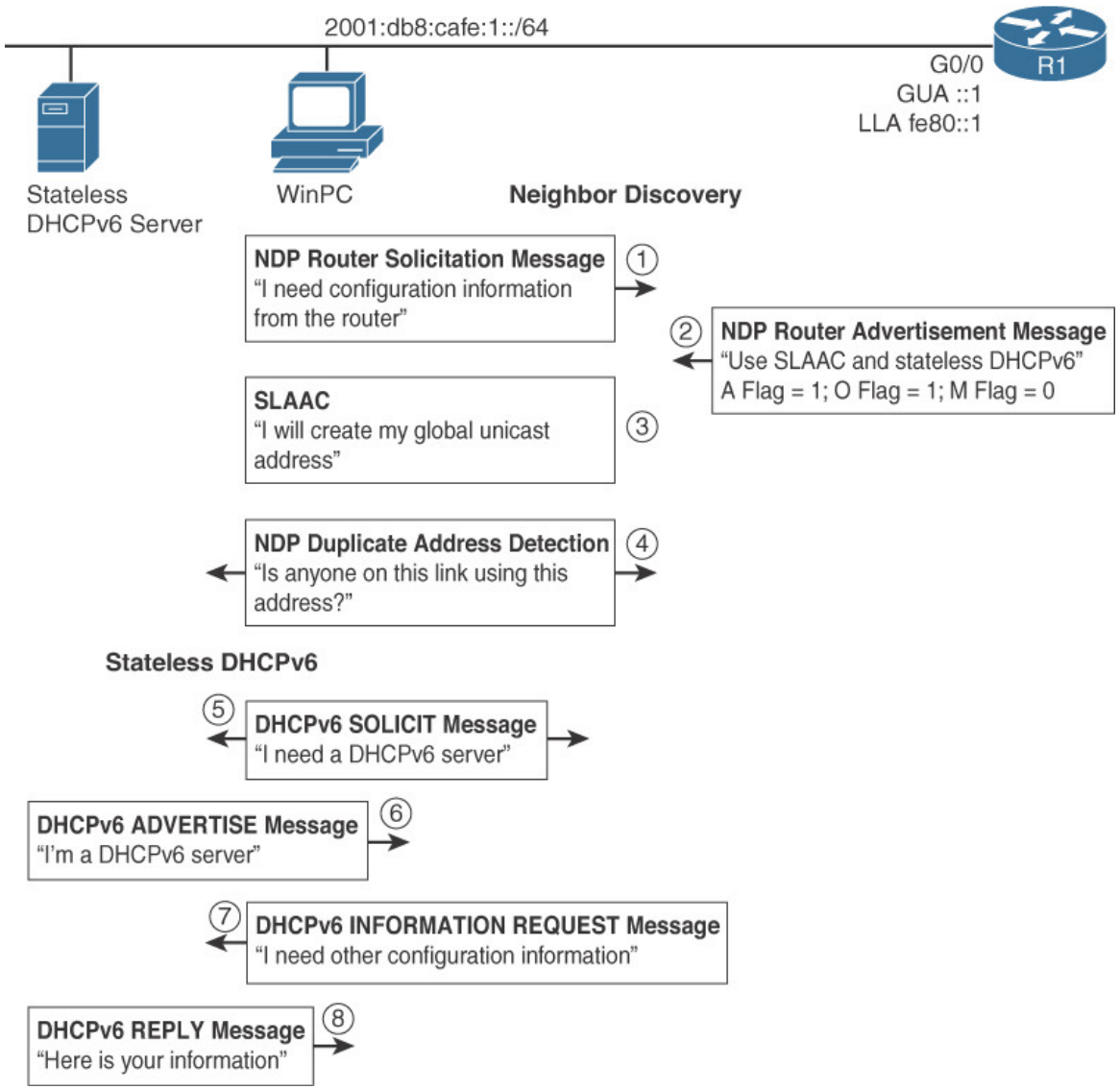
Dynamic Addressing

- Method 1: Stateless Address Autoconfiguration (SLAAC)
- Method 2: SLAAC and a stateless DHCPv6 server
- Method 3: Stateful DHCPv6 server

Method 1: SLAAC



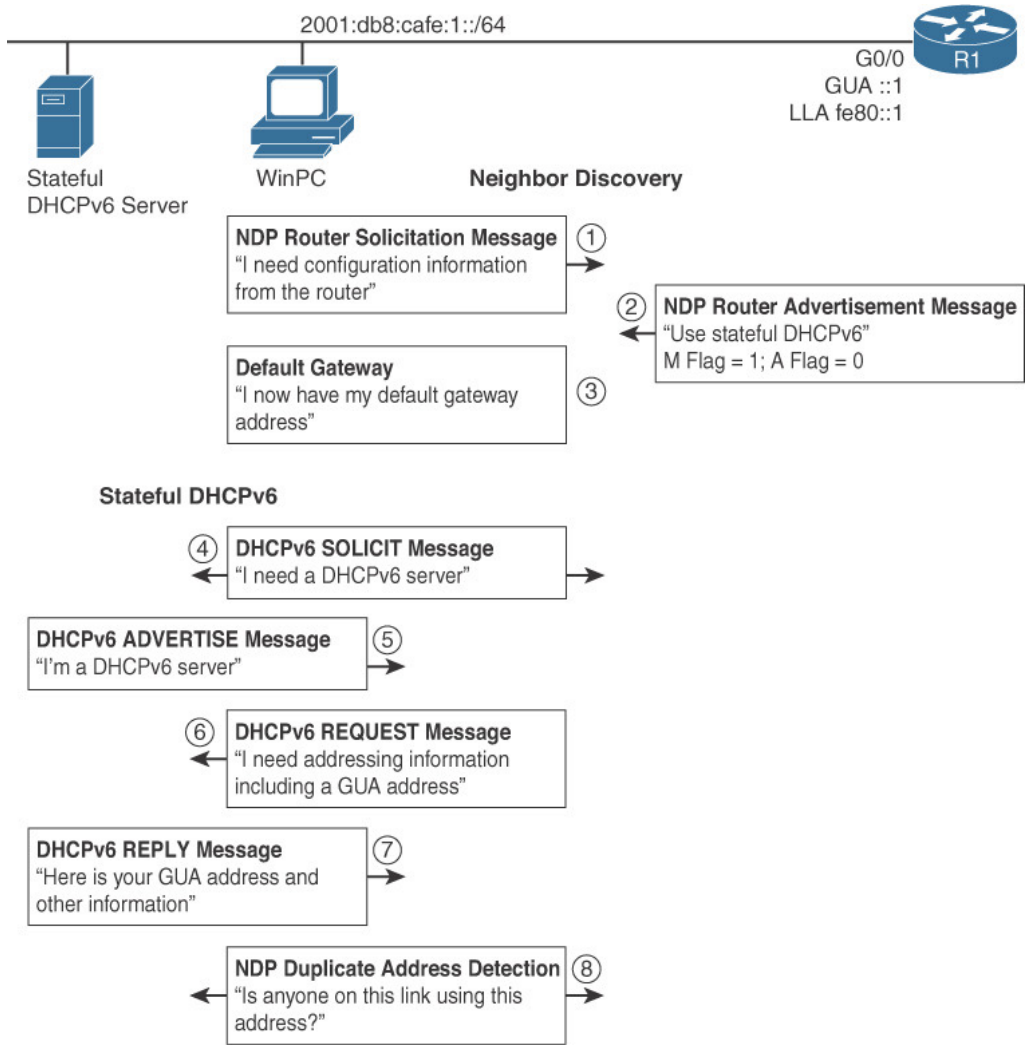
Method 2: stateless DHCPv6 server



! Configure the stateless DHCPv6 server pool
R1(config)# **ipv6 dhcp pool STATELESS-DHCPv6**
R1(config-dhcpv6)# **dns-server 2001:db8:cafe:1::8888**
R1(config-dhcpv6)# **domain-name example.com**
R1(config-dhcpv6)# **exit**

! Set the O flag to 1 and enable DHCPv6 service
R1(config)# **interface gigabitethernet 0/0**
R1(config-if)# **ipv6 nd other-config-flag**
R1(config-if)# **ipv6 dhcp server STATELESS-DHCPv6**
R1(config-if)#

Method 3: Stateful DHCPv6



! Configure the stateful DHCPv6 server pool
R1(config)# **ipv6 dhcp pool STATEFUL-DHCPv6**
R1(config-dhcpv6)# **address prefix 2001:db8:cafe:1:deed::/80**
R1(config-dhcpv6)# **dns-server 2001:db8:cafe:1::8888**
R1(config-dhcpv6)# **domain-name example.com**
R1(config-dhcpv6)# **exit**

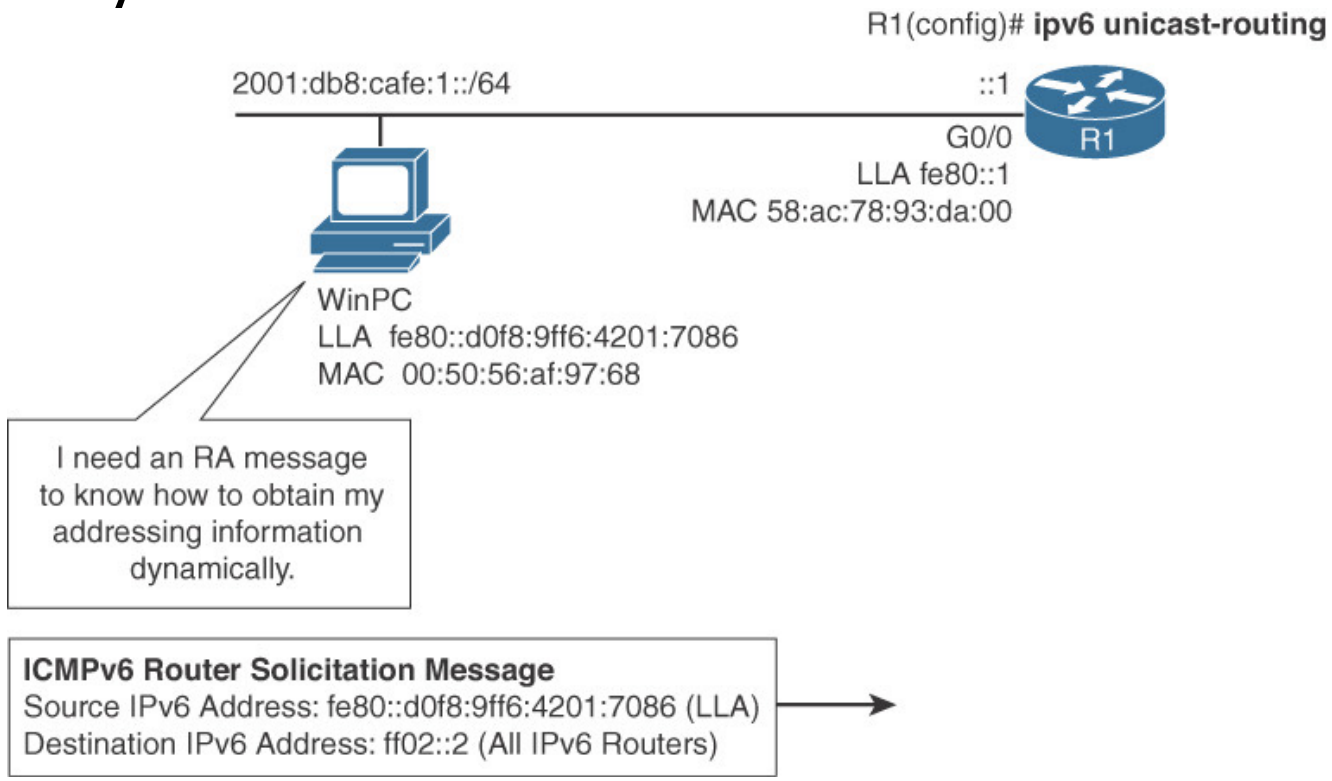
! Set the M flag to 1, the A flag to 0 and enable DHCPv6 service on the interface
R1(config)# **interface gigabitethernet 0/0**
R1(config-if)# **ipv6 nd managed-config-flag**
R1(config-if)# **ipv6 nd prefix 2001:db8:cafe:1::/64 no-autoconfig**
R1(config-if)# **ipv6 dhcp server STATEFUL-DHCPv6**

ICMPv6 Neighbor Discovery

- Router–device messages used for dynamic address allocation:
  - Router Solicitation (RS) message
  - Router Advertisement (RA) message
- Device–device messages used for address resolution:
  - Neighbor Solicitation (NS) message
  - Neighbor Advertisement (NA) message
- Router–device messages used for better first-hop selection:
  - Redirect message

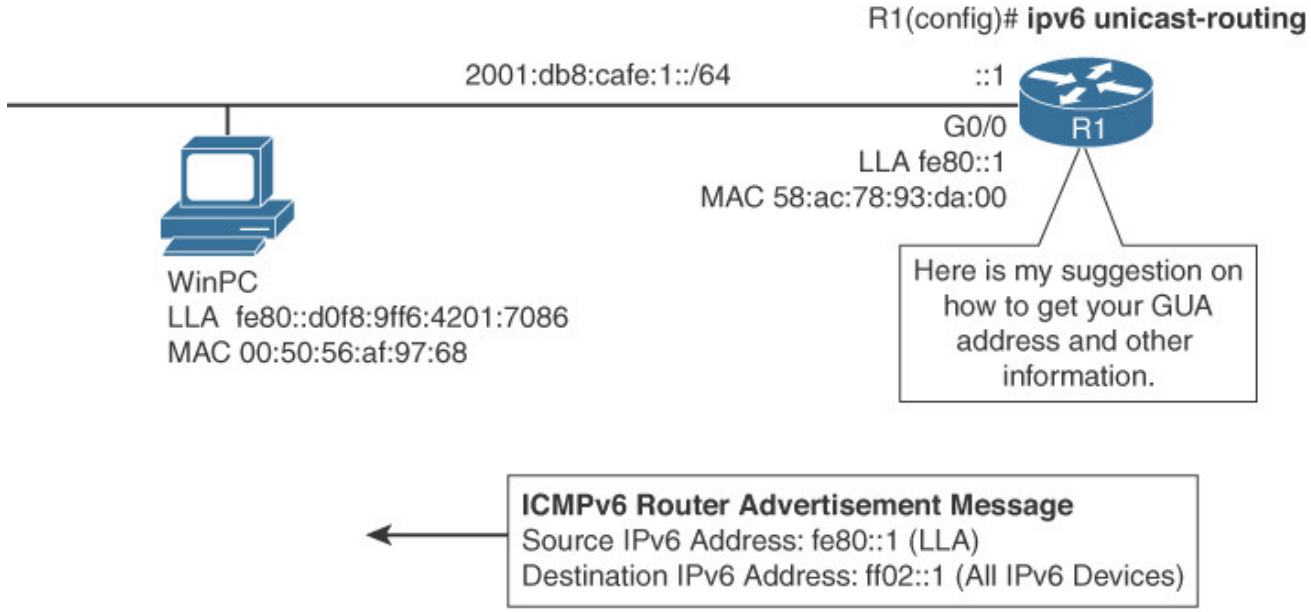
Router Solicitation Message

- A host sends a Router Solicitation message when it needs to know how to dynamically obtain its addressing information. This typically occurs during startup and is the default on most host operating systems



Router Advertisement Message

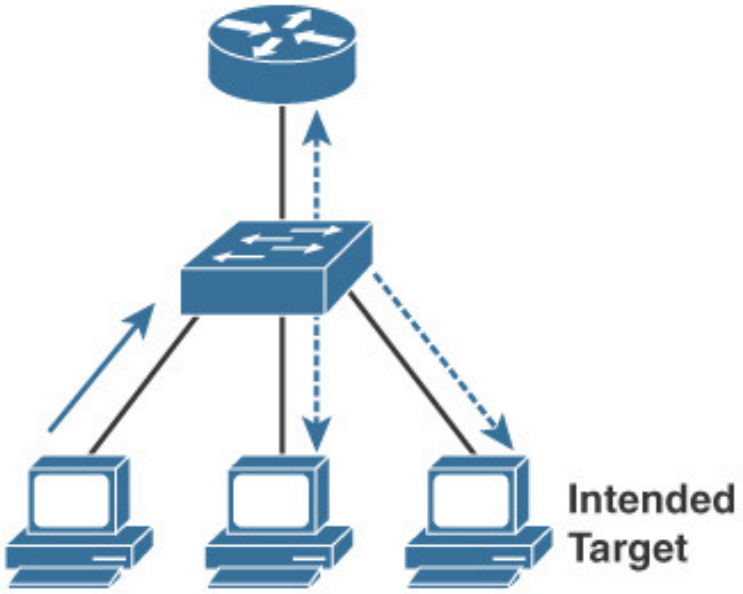
- A Cisco router sends Router Advertisement messages every 200 seconds The RA message is a suggestion to obtain addressing information dynamically. This information in the RA message includes prefix, default router, and other configuration information



Router can be configured to send RA message as unicast in response to RS message.

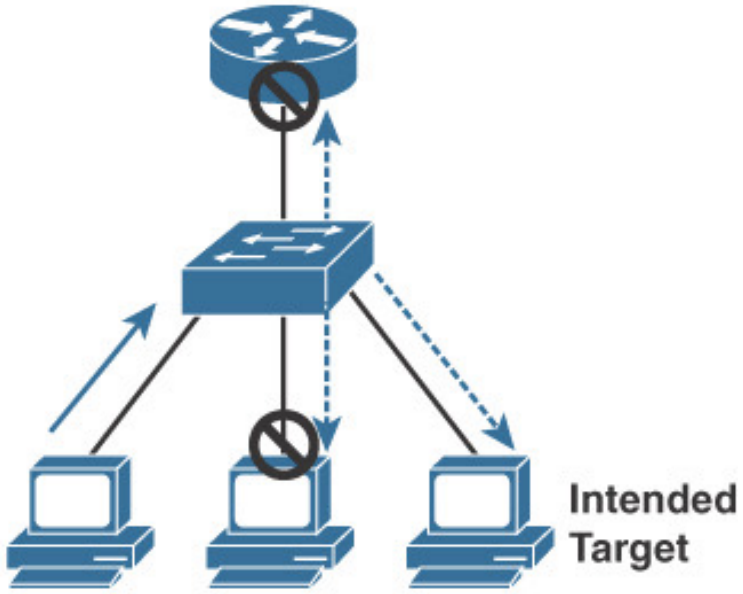
Neighbor Solicitation

ARP Request in IPv4



Ethernet broadcast: Data must be passed to the ARP process to determine if the device is the intended target.

ICMPv6 Neighbor Solicitation Message



Ethernet multicast: NIC card can determine whether it needs to pass the data to IPv6.

Networking For everyone