IPv6 Introduction

IPv6 core protocol definition is in RFC 2460
RIPng, EIGRPv6, OSPFv3, ICMPv6, traceroute6, ping6, MP BGP-4 (mulitprotocol BGP v4)
ARP is replaced with NDP

Truncating addresses
4 digits informally a "quartet", so 4*4=16
0000:0000:0000:0000:0000:0000:0000:0000 = 128 bits

The Rules:
Leading 0's can be removed so 003A is 3A
Sets of consecutive 0's can be truncated to one in an address - 0000:0000 to 0:0
Replacing multiple quartets of 0's (0000:0000 with ::) can only be done once.
Doing the 3 in one address should be ok, within those rules
Expanding is easy: inverse the rules and pad out so there are 8 quartets of 4 bits each.

2000:1234:5678:9ABC::/64   prefix length is 64 bits (4 octets, 16 each)
In this way, a "/" prefix notation is almost iike a CIDR - it tells how many bits used.

Given Address	***Expanded Form***	***Address's Prefix***
34BA:B:B:0:5555:0:6060:707/80	34BA:000B:000B:0000:5555:0000:6060:0707	34BA:B:B:0:5555::/80
3124::DEAD:CAFE:FF:FE00:1/80	3124:0000:0000:DEAD:CAFE:00FF:FE00:0001	3124:0:0:DEAD:CAFE::/80
2BCD::FACE:BEFF:FEBE:CAFE/48	2BCD:0000:0000:0000:FACE:BEFF:FEBE:CAFE	2BCD::/48
3FED:F:E0:D00:FACE:BAFF:FE00:0/48	3FED:0000F:00E0:0D00:FACE:BAFF:FE00:0000	3FED:F:E0::/48
210F:A:B:C:CCCC:B0B0:9999:9009/40	210F:000A:000B:000C:CCCC:B0B0:9999:9009	210F:A::/40
34BA:B:B:0:5555:0:6060:707/36	34BA:000B:000B:0000:5555:0000:6060:0707	34BA:B::/36
3124::DEAD:CAFE:FF:FE00:1/60	3124:0000:0000:DEAD:CAFE:00FF:FE00:0001	3124:0:0:DEA0::/60
2BCD::FACE:1:BEFF:FEBE:CAFE/56	2BCD:0000:0000:FACE:0001:BEFF:FEBE:CAFE	2BCD:0:0:FA00::/56
3FED:F:E0:D000:FACE:BAFF:FE00:0/52	3FED:000F:00E0:D000:FACE:BAFF:FE00:0000	3FED:F:E0:D000::/52
3BED:800:0:40:FACE:BAFF:FE00:0/44	3BED:0800:0000:0040:FACE:BAFF:FE00:0000	3BED:800::/44

Global unicasts are initially delegated in blocks by IANA, ARIN etc., and are leased for usage by various service providers. Since there are so many IPv6 addresses, they exist as just a utility for network operation provisioning- there is no recognized range of addresses that is "owned" or has brand recognition (like Google's name server address of 8.8.8.8), you just get any block the size you need from an ISP and move it to another as needed.

2001:db8:2222::/48 -Company A
2001:db8:3333::/48 -Company B
And here are some global unicast versions of subnet and hostnames:
2001:db8:3333:0001::/64 -Company B's subnet 1
2001:db8:3333:0002::/64 -Company B's subnet 2
2001:db8:3333:2::1 -A host in Company B's subnet 2
2001:db8:3333:0003::/64 -Company B's subnet 3
2001:db8:3333:3::10 -A host in Company B's subnet 3
Initially started with 2 or 3; now anything not reserved

Global addresses have the same overall structure:
Global routing prefix (IANA- 48 bits) + subnet bits (16) + interfaceID (typically 64 bits) = 128 bits total
2001:0db8:1111 (48 bits):   0001(16 bits)   :0000:0000:0000:0001 (64 bits)
In this example, subnets would be 0001, 0002, 0003

Unique Local Unicast Addresses are like private IPv4 addresses

FD (8 bits) - GlobalID (pseudorandom 40bits) - subnet 16 bits - remaining 64 bits for interface
You prefix with /48 and then add the subnet (64 total) and interface (the last 64 bits)
- FD00:1:1:0001::/64 would be a sample unique local
- FD + 00:1234:5678: + 9ABC:DEF1:2345:6789:ABCD

Static Unicast Address Configuration
Generating a Unique Interface ID using EUI-64 is usually done for us just by assigning the address with:
ipv6 address 2001:db8:1111:1::/64 eui-64

EUI-64 creates the interface ID part as follows:
Split the 6-byte (12-hex) MAC address in two halfs, and insert FFFE in between the two
Invert the seventh bit of the interface ID. Examples:

Interface MAC address is aa12:bcbc:1234
101010***1***0 represents the first 8 bits of the MAC address (aa) - when inverting the 7th bit it becomes 101010***0***0.
The answer is A8 and the EUI-64 address: 2001:0db8:0:1:a812:bcff:febc:1234 EUI-64

MAC address 0c0c:dede:1234
0c is 000011***0***0 in the first 8 bits of the MAC address, which then becomes 000011***1***0 when flipping the 7th bit.
The answer is then 0e and the EUI-64 address: 2001:0db8:0:1:0e0c:deff:fede:1234 EUI-64

MAC address 0b34:ba12:1234
0b in binary is 000010***1***1, the first 8 bits of the MAC address, which then becomes 000010***0***1.."
The answer is 09, and the IPv6 EUI-64 address: 2001:0db8:0:1:0934:baff:fe12:1234 EUI-64

```
interface GigabitEthernet0/0
  ipv6 address 2001:db8:1111:1::/64 eui-64
interface serial0/0/0
  ipv6 address 2001:db8:1111:2::/64 eui-64
show ipv6 interface brief
    GigabitEthernet0/0 [up/up]
        FE80::1FF:FE01:101                  <---link local, employing EUI64
        2001:DB8:1111:1:0:1FF:FE01:101    <---EUI64 global unicast address
    Serial0/0 [up/up]
        FE80::1FF:FE01:101
        2001:DB8:1111:2:0:1FF:FE01:101
```

Link-Local Addresses (LLA)
Auto-generated - interferfaces can create their own LLA
Common uses - Overhead protocols (NDP) and next-hop address
Forwarding scope is the local link only - (for within a subnet)
Unicast, represent a single host. Always starts with the same prefix: the first 10 bits are FE80::/10
64 Bits - FE80:0000:0000:0000 + 64 Bits - Interface ID: EUI-64
Second half can be formed with different rules
- EUI-64 (like above)
- Operating Systems use random processes
- Manually configured

<u>Key IPv6 Local-Scope Multicast Addresses</u>

Short Name	***Multicast Address***	***Meaning***	***IPv4 Equivalent***
All-nodes	FF02::1	All nodes (using IPv6)	Subnet Broadcast Address
All-routers	FF02::2	All routers (using IPv6)	None
All-OSPF	FF02::5	All OSPF routers	224.0.0.5

All-OSPF-DR	FF02::6	All OSPF designated routers	224.0.0.6
EIGRPv6 routers	FF02::A	All routers (using EIGRPv6)	224.0.0.10

R1# ***show ipv6 interface GigabitEthernet 0/0***
GigabitEthernet0/0 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::1FF:FE01:101
    [extra info omitted]
  Joined group address(es):
    FF02::1
    FF02::2
    FF02::A
    FF02::1:FF01:101   <---------This host's solicited node multicast

Solicited-Node Multicast Addresses
A multicast address that is link-local in scope
Based on the unicast of the host, and only the last six hex digits
Each host listens for packets sent to ***its*** solicited-node address
Format: [Defined by RFC] + [Last 6 Hex Digits of Unicast]
Example: FF02:0000:0000:0000:0000:0001:FF_ _:_ _ _ _
By design, all hosts with the same last six hex digits use the same address
[FF02::1:FF/108 ?]

Special addresses used by routers:
:: (all 0's) signify unknown/ unspecified address Used when a host’s own address is not yet known
::1 loopback - 127 binary 0s with a single 1

Neighbor Discovery Protocol (NDP):
<u>Router discovery - available routers in the same subnet</u>
- Router solicitation (RS) - Over FF02::1 (all routers MC), asks routers to "sound off"
- Router advertisements (RA) - Over FF02::1 (all nodes MC), router replies with link-local address, other info

<u>Neighbor MAC discovery, NDP replaces ARP</u>
- Neighbor Solicitation (NS, like an ARP request) and Neighbor Advertisement (NA, like an ARP reply)
- Duplicated Address Detection (DAD) uses NS requests and NA replies to keep track of unicasts

(SLAAC uses NS/NAs in DAD to do DHCP autoconfig)

Dynamic Unicast Address Configuration
Routers can be configured to use dynamic addresses
Two methods: interface FastEthernet0/0
    ipv6 address dhcp   <------Using Stateful DHCP
    ipv6 address autoconfig   <------- Using Stateless Address Autoconfiguration (SLAAC)

Regular DHCPv6
DHCP client sends out a solicitation using it's own link-local as the source address, and the "All-DHCP-Agents" MC - ff02::1:2) as it's destination

<u>Configuring R1 to be a DHCP relay:</u>
interface GigabitEthernet0/0
  ipv6 dhcp relay destination 2001:db8:1111:3::8
R1# show ipv6 interface g0/0
GigabitEthernet0/0 is up, line protocol is up
Joined group address(es):

FF02::1
FF02::2
FF02::A
FF02::1:2 ***<------ this got added for the relay role***
FF02::1:FF00:1

SLAAC: Using Stateless Address Autoconfiguration
Building an IPv6 Address Using SLAAC is easy:
A NDP RS is sent to get an RA to provide the local link prefix
The host then slaps on a EUI-64 or random value for an interface ID
Send out Neighbor Solicitation for DAD process to verify it's unique.

DHCPv6 vs SLAAC?
With stateless SLAAC, you get your DNS servers from the local router, and you don't need to lease an address. With a DHCP server being involved, you can have a lease and state information on a client. You might think DHCP would give more control, but it really doesn't since users can still use SLAAC instead.

CHECK THIS - question in practice set says SLAAC gets NDP to give it prefix length, default router addresses, but that Stateless DHCP provides the DNS servers.

Ping6 and Traceroute6, all the same
Extended is still just "ping" since it asks you the protocol

/128 is a "host route" for the router ip6 address

show ipv6 neighbors
show ipv6 routers -- to show connected routers

sh ipv6 interface GigabitEthernet 0/0

show ipv6 interface brief <--- no prefix length info
show ipv6 interface <--- Full interface details

ipv6 route ::/0
sh ipv6 neigh

Configuring static IP6 on two routers:
!R1
ipv6 unicast-routing <---If not enabled, the router will act like a host and won't route
interface gigabitethernet0/0
 ipv6 address 2001:Ddb8:1111:1::1/64
interface serial0/0/0
 ipv6 address 2001:0db8:1111:0002:0000:0000:0000:0001/64
!R2
ipv6 unicast-routing

interface gigabitethernet0/0
 ipv6 address 2001:db8:1111:3::2/64
interface serial0/0/1
 ipv6 address 2001:db8:1111:2::2/64

#R1 ***show ipv6 route connected***
IPv6 Routing Table - default 5 entries
!Omitted
C 2001:DB8:1111:1::/64 [0/0]
 via GigabitEthernet0/0, directly connected
C 2001:DB8:1111:2::/64 [0/0]
 via Serial0/0/0, directly connected

#R1 ***show ipv6 interface GigabitEthernet 0/0***
GigabitEthernet0/0 is up, line protocol is up
 IPv6 is enabled, link-local address is FE80:1FF:FE01:101
 No virtual link-local address(es):
 Description: LAN at Site 1
 Global unicast address(es):
 2001:DB8:1111:1::1, subnet is 2001:DB8:1111:1::/64
#R1 ***show ipv6 interface s0/0/0***
Serial0/0/0 is up, line protocol is up
 IPv6 is enabled, link-local address is FE80:1FF:FE01:101
 No virtual link-local address(es):
 Description: Link to R2
 Global unicast address(es):
 2001:DB8:1111:2::1, subnet is 2001:DB8:1111:2::/64
#R1 ***show ipv6 interface brief***
GigabitEthernet0/0 [up/up]
 FE80:1FF:FE01:101
 2001:DB8:1111:1::1
GigabitEthernet0/1 [administratively down/down]
 unassigned
Serial0/0 [up/up]
 FE80:1FF:FE01:101
 2001:DB8:1111:2::1

http://freeccnalab.com/
http://www.packettracerlab.com/
http://www.packettracernetwork.com/labs/packettracerlabs.html
https://boubakr92.wordpress.com/2013/09/16/ccna-cheat-sheet-part-1/

ipv6 address <command>
ipv6 address
sh ipv6 route

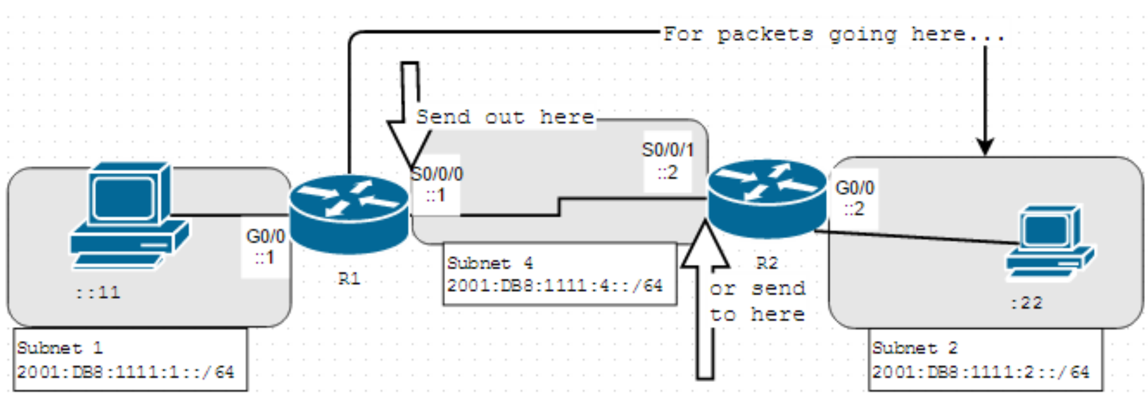
- ***Adding IPv6 Routes to Routing Tables***
  - Configuration of IPv6 addresses on working interfaces
  - Direct configuration of a static route

- Configuration of a routing protocol on routers that share the same link
- ***Rules for Connected and Local Routes***
    - Routers create routes based on each unicast address on an interface
        - Router creates a route for the subnet (a connected route)
        - Router creates a host route (/128) for the router IPv6 address
    - Routers do not create routes based on the LLA for the interface
    - Routers remove the connected and local routes if the interface fails
        - Re-adds when the interface is up/up

ipv6 unicast-routing
!
interface serial0/0/0
ipv6 address 2001:db8:1111:4::1/64
!
interface serial0/0/1
ipv6 address 2001:db8:1111:5::1/64
!
interface gigabitethernet0/0
ipv6 address 2001:db8:1111:1::1/64

<u>Before adding static or OSPF routes:</u>
show ipv6 route
!Omitted
Codes: C - connected, L - local....
!Omitted
C 2001:db8:1111:1::/64 [0/0]
via GigabitEthernet0/0, directly connected
!Omitted
C 2001:db8:1111:4::/64 [0/0]
via Serial0/0/0, directly connected
!Omitted
C 2001:db8:1111:5::/64 [0/0]
via Serial0/0/1, directly connected

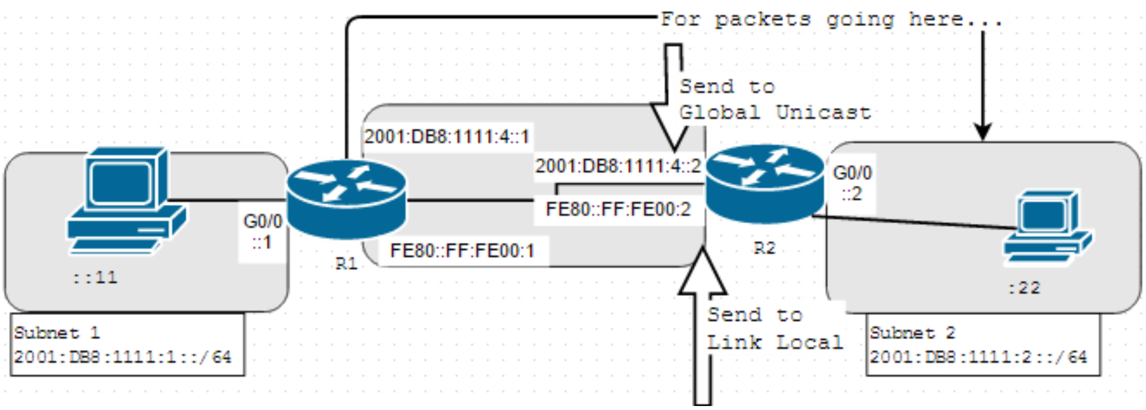
show ipv6 route local
!Omitted
L 2001:db8:1111:1::1/128 [0/0]



<u>ADD</u>

!Static route on router R1
R1(config)# ***ipv6 route 2001:db8:1111:2::/64 s0/0/0***
!Static route on router R2
R2(config)# ***ipv6 route 2001:db8:1111:1::/64 s0/0/1***

<u>VERIFY</u>
R1(config)# ***show ipv6 route static***
S 2001:db8L1111L2LL/64 [1/0]
via Serial0/0/0, directly connected
R1(config)# ***show ipv6 route 2001:db8:1111:2::22***
Routing entry for 2001:db8:1111:2::/64
Known via "static", distance 1, metric 0
Route count is 1/1, share count 0
Routing paths:
directly connected via Serial0/0/0
Last updated 00:01:29 ago



Static Routes Using Next-Hop IPv6 Address: Using Unicast or Link-Local as Next-Hop Address

!First command is on R1, listing R2's global unicast
R1(config)#***ipv6 route 2001:db8:1111:2::/64 2001:db8:1111:4::2***
!This command is on R2, listed R1's global unicast
R2(config)#***ipv6 route 2001:db8:1111:1::/64 2001:db8:1111:4::1***
!Verify routes with ***show ipv6 route static***

!First command is on R1, listing R2's link local address
R1(config)#***ipv6 route 2001:db8:1111:2::/64 s0/0/0 FE80:FF:FE00:2***
!This command is on R2, listed R1's link local address
R2(config)#***ipv6 route 2001:db8:1111:1::/64 s0/0/1 FE80:FF:FE00:1***
!Verify routes with ***show ipv6 route static***

- ***Static Default Routes***
    - Tells the router what to do when a packet does not match a route
        - Without a default route, router discards packet
        - With a default route, router forwards packet to the default route

!Forward out B1's S0/0/1 local interface...
B1(config)#***ipv6 route ::0 S0/0/1***
!Static Default Route
B1#***show ipv6 route static***
!Omitted

S ::/0 [1/0]

- Migration from OSPFv2 to OSPFv3
  - Before IPv6, the company supports IPv4 using OSPFv2
  - Company plans to use a dual-stack approach
  - Companies add OSPFv3 configuration to all the routers
    - OSPFv2 support stays in place

<u>*OSPFv2 Indirectly Enables OSPF on the Interface*</u>
<u>and *OSPFv3 Configuration Directly Enables OSPF*</u>

router ospf 1
  router-id 1.1.1.1
  network *10.0.0.0 0.255.255.255 area 0*   *<--- indirectly enable on int*
interface s0/0/0
  ip address *10.1.1.1 255.255.255.0*

ipv6 router ospf 1
  router-id 1.1.1.1
interface s0/0/0
  ipv6 ospf 1 area 0   <----- directly enable on int

- ***Configuring Single-Area OSPFv3***
  - OSPFv2:
    - If ***router-id rid*** OSPF subcommand is configured, use it
    - If the RID is not set, check the loopback interfaces with up status
    - Choose the highest numeric IP address
    - If neither are used, router picks highest numeric IPv4 address
  - OSPFv3:
    - Use ***ipv6 router ospf process-id***
    - Ensure the router has an OSPF router ID
      - Configuring the ***router-id id-value*** router subcommand
      - Preconfiguring an IPv4 on any loopback who is up
      - Preconfiguring an IPv4 on any working interface who is up
    - Configure the ***ipv6 ospf process-id area area-number*** on each OSPF interface

ipv6 unicast-routing
interface serial0/0/0
  no ip address
  ipv6 address 2001:db8:1111:4::1/64
!
interface s0/0/1
  no ip address
  ipv6 address 2001:db8:1111:5::1/64
!
interface GigabitEthernet0/0
  no ip address
  ipv6 address 2001:db8:1111:5::1/64
!Enabling OSPFv3 on three interfaces
config t

```
ipv6 router ospf 1
  router-id 1.1.1.1
  interface s0/0/0
  ipv6 ospf 1 area 0
  interface s0/0/1
  ipv6 ospf 1 area 0
  int gi0/0
  ipv6 ospf 1 area 0
  end
```

```
ipv6 unicast-routing
ipv6 router ospf 2
 router-id 2.2.2.2
!
int s0/0/1
 ipv6 address 2001:db8:1111:4::2
 ipv6 ospf 2 area 0
!
int gi0/0
 ipv6 address 2001:db8:1111:2::2
 ipv6 ospf 2 area 0
```

To Display Details About...	***OSPFv2***	***OSPFv3***
OSPF process	show ip ospf	show ipv6 ospf
All sources of routing info	show ip protocols	show ipv6 protocols
Details about OSPF-enabled interfaces	show ip ospf interface	show ipv6 ospf interface
Concise info on OSPF-enabled interfaces	show ip ospf interface brief	show ipv6 ospf interface brief
List of neighbors	show ip ospf neighbor	show ipv6 ospf neighbor
Summary of LSDB	show ip ospf database	show ipv6 ospf database
OSPF-learned routes	show ip route ospf	show ipv6 route ospf

```
R1#show ipv6 ospf
 Routing Process "ospfv3 1" with ID 1.1.1.1
 !Omitted
 Reference bandwidth unit is 100 mbps
   Area BACKBONE 0
     Number of interfaces in this area is 3
!Verifying interfaces
R1# show ipv6 ospf interface brief
Interface       PID Area       Intf ID   Cost    State   Nbrs    F/C
Gi0/0    1      0         3      1       DR      0/0
```

Se0/0/1	1	0	7	64	P2P	1/1
Se0/0/0	1	0	6	64	P2P	1/1

R1# ***show ipv6 protocols***
IPv6 Routing Protocol is “connected”
IPv6 Routing Protocol is “ND”
IPv6 Routing Protocol is “ospf 1”
  Interfaces (Area 0):
    GigabitEthernet0/0
    Serial0/0/1
    Serial0/0/0

!First command is from R1, listing R2 and R2
show ipv6 ospf neighbor

Neighbor ID	Pri	State	Dead Time	Interface ID	Interface
3.3.3.3	0	FULL/ -	00:00:39	6	Serial0/0/1
2.2.2.2	0	FULL/ -	00:00:31	7	Serial0/0/0

!This command is from R2, listing R1 and R3
show ipv6 ospf neighbor

Neighbor ID	Pri	State	Dead Time	Interface ID	Interface
1.1.1.1	0	FULL/ -	00:00:39	6	Serial0/0/1
3.3.3.3	0	FULL/ -	00:00:31	7	Gi0/0

(Verifying OSPFv3 LSDB on R1)
show ipv6 ospf database
OSPFv3 Router with ID (2.2.2.2) (Process ID 2)
Router Link States (Area 0)

ADV Router	Age	Seq#	Fragment ID	Link count	Bits
1.1.1.1	452	0x80000002	0	2	None
2.2.2.2	456	0x80000004	0	2	None
3.3.3.3	457	0x80000005	0	2	None

(from R2)
show ipv6 route ospf
IPv6 Routing Table - default - 9 entries
!Omitted
O 2001:DB8:1111:1::/64 [110/65]
      via FE80::FF:FE00:1, serial0/0/1

ipv6 unicast routing -- for static routing
:4::1/64
:5::1/64
:5::1/64
2001:db8:1111

show ipv6 route [local l static l   ]
show ipv6 route (address) to show info specific to that route
ipv6 route (address) s0/0 (next hop) --add to table - can be link local or global unicast of destination port

static default routes
ipv6 route ::0 s0/0/1
S ::0 will show up in routing table
(::0 any address)

same: router ospf 1, router-id 1.1.1.1 - you should consider rid to be required in ipv6
OSPF instead of indirectly enabling on interfaces ipv6 has to have "ipv6 ospf 1 area 0"
(no "network ip mask area command for router part)

ch 27-29

Address Description Available Scopes
ff0X::1 All nodes address, identify the group of all IPv6 nodes Available in scope 1 (interface-local) and 2 (link-local):

ff01::1 → All nodes in the interface-local
ff02::1 → All nodes in the link-local

ff0X::2 All routers Available in scope 1 (interface-local), 2 (link-local) and 5 (site-local):

ff01::2 → All routers in the interface-local
ff02::2 → All routers in the link-local
ff05::2 → All routers in the site-local

ff02::5	OSPFIGP	2 (link-local)
ff02::6	OSPFIGP Designated Routers	2 (link-local)
ff02::9	RIP Routers	2 (link-local)
ff02::a	EIGRP Routers	2 (link-local)
ff02::d	All PIM Routers	2 (link-local)
ff02::1a	All RPL Routers	2 (link-local)
ff0X::fb	mDNSv6	Available in all scopes
ff0X::101	All Network Time Protocol (NTP) servers	Available in all scopes
ff02::1:1	Link Name	2 (link-local)
ff02::1:2	All-dhcp-agents	2 (link-local)
ff02::1:3	Link-local Multicast Name Resolution	2 (link-local)
ff05::1:3	All-dhcp-servers	5 (site-local)
ff02::1:ff00:0/104	Solicited-node multicast address. See below	2 (link-local)
ff02::2:ff00:0/104	Node Information Queries	2 (link-local)

NAT*: s=172.16.2.2, d=192.168.2.1->10.1.1.1 [1]

Notice the last line's asterisk (*). This means the packet was translated and fast-switched to the destination. ***Fast-switching aka cache-based switching aka "route one switch many"*** - this process is used on Cisco routers to create a cache of layer 3 routing information to be accessed at layer 2 so packets can be forwarded quickly through a router without the routing table having to be parsed for every packet. As packets are packet switched (looked up in the routing table), this information is stored in the cache for later use if needed for faster routing processing. Note the count in brackets- it shows that after 3 or 4 exchanges, fast switching was turned on for this pair of hosts.

Before a host can send ICMP (ping) packets to another device, it needs to learn the MAC address of the destination device so it first sends out an ARP Request. In fact, the first ping packet is dropped because the router cannot create a complete packet without learning the destination MAC address.

no ip http server -- Shuts off the Cisco http interface (if available)
no service tcp-small-servers - and - no service udp-small-servers
These commands disabled these services: echo (7), discard (9), daytime (13), chargen (19)
These are disabled by default in Cisco IOS 12 and later.
See [http://www.cisco.com/c/en/us/support/docs/ip/access-lists/13608-21.html] for more info on shutting down services.

```
router ospf 1
  router-id 1.1.1.1
  network 10.0.0.0 0.255.255.255 area 0     <--- indirectly enable on int
interface s0/0/0
  ip address 10.1.1.1 255.255.255.0

ipv6 router ospf 1
  router-id 1.1.1.1
interface s0/0/0
  ipv6 ospf 1 area 0     <----- directly enable on int
```

Router(config)# ipv6 unicast-routing
- ipv6 unicast-routing must be the first IPv6 command executed on the router.

-----These set up the router config:
Router(config)# ipv6 router rip RIP01
---------------- OR ----------------
Router1(config)#ipv6 router osfp 10
Router1(config-rtr)#router-id 1.1.1.1
---------------- OR ----------------
Router1(config)#ipv6 router eigrp 12
Router1(config-rtr)#no shutdown

Router(config)# interface fastethernet0/0
Router(config-if)# ipv6 address 2001:1cc1:dddd:2::/64 eui-64
- IPv6 isn't enabled by default on any interfaces

----- In IPv6, you have to direcctly specify on the interface it's routing-type "membership"
Router(config-if)# ipv6 rip RIP01 enable
---------------- OR ----------------
Router1(config-if)#ipv6 ospf 10 area 0.0.0.0
---------------- OR ----------------
Router1(config-if)#ipv6 eigrp 12

The 12 is AS#. The routing process must be turned on like an interface with "no shutdown"

```
ipv6 unicast-routing
!
ipv6 router ospf 2
 router-id 2.2.2.2
!
interface serial0/0/0
no ip address
 ipv6 address 2001:db8:1111:4::1/64
ipv6 ospf 2 area 0
!
interface serial0/0/1
 no ip address
 ipv6 address 2001:db8:1111:5::1/64
ipv6 ospf 2 area 0
!
interface GigabitEthernet0/0
 no ip address
 ipv6 address 2001:db8:1111:1::1/64
ipv6 ospf 2 area 0
```

Note that all the OSPFv3 commands use the exact same commands as those for IPv4, except they use **ipv6** instead of the **ip** parameter.

ip ospf	**show ipv6 ospf**
show ip protocols	**show ipv6 protocols**
show ip ospf interface	**show ipv6 ospf interface**
show ip ospf interface brief	**show ipv6 ospf interface brief**
show ip ospf neighbor	**show ipv6 ospf neighbor**
show ip ospf database	**show ipv6 ospf database**
show ip route ospf	**show ipv6 route ospf**

To set up a static DNS resolution table on the router, use the ipv6 host command;
You can also specify a DNS server with the **ip name-server** command:
Router(config)# ipv6 host hostname [port_#] ipv6_address1 [ipv6_address2…]
Router(config)# ip name-server DNS_server_IPv6_address

ipv6 route prefix/length next-hop-address	Global command to define an IPv6 static route to a next- hop router IPv6 address.
ipv6 route prefix/length outgoing-interface	Global command to define an IPv6 static route, with packets forwarded out the local router interface listed in the command.

Command	Description
ipv6 route prefix/length next-hop-address outgoing-interface	Global command to define an IPv6 static route, with both the next-hop address and local router outgoing interface listed in the command.
ipv6 route ::/0 {[next-hop-address] [outgoing-interface]}	Global command to define a default IPv6 static route, with the forwarding details (outgoing interface, next-hop address) working the same way as the nondefault versions of the **ipv6 route** command.
ipv6 router ospf process-id	Enters OSPFv3 configuration mode for the listed process.
router-id id	OSPF subcommand that statically sets the router ID.
ipv6 ospf process-id **area** area-number	Interface subcommand that enables OSPFv3 on the interface, for a particular process, and defines the OSPFv3 area.
passive-interface type number	OSPF subcommand that tells OSPF to be passive on that interface or subinterface.
passive-interface default	OSPF subcommand that changes the OSPF default for interfaces to be passive instead of active (not passive).
no passive-interface type number	OSPF subcommand that tells OSPF to be active (not passive) on that interface or subinterface.

Table 29-6 Chapter 29 EXEC Command Reference

Command	Description
show ipv6 route [**ospf**]	Lists routes in the routing table learned by OSPFv3.
show ipv6 ospf	Shows routing protocol parameters and current timer values for OSPFv3, and the OSPFv3 router ID.
show ipv6 ospf interface brief	Lists one line of output per OSPFv3-enabled interface, with basic settings listed, like OSPFv3 process, area number, and interface cost.
show ipv6 ospf neighbor [neighbor-RID]	Lists neighbors and current status with neighbors, per interface, and optionally lists details for the router ID listed in the command.
show ipv6 ospf database	Lists a summary of the LSAs in the local router's LSDB, listing one line for each LSA.
show ipv6 protocols	Lists briefer information than the IPv4 **show ip protocols** command, primarily listing all means through which a router can learn or build IPv6 routes, and interfaces on which a routing protocol is enabled.