IPV6:

As we know that IP address is logical address and it is a Network layer address (Layer 3)

IP address Two Type
IP version 4 ---------- 32 Bit address (Decimal)
IP version 6 ---------- 128 Bit address (Hexadecimal) Divided into Eight (16 bits each segments or Blocks)

Why we are going to IPV6 the Main reason is that shortage of IP address V4
To Overcome Shortage of IPV4 we use the following Techniques as given below

- Subnet ting
- NAT

IP V6 Features:

- Simplified Header
- Larger Address Space approx. 34x10^38
- End to End Connectivity (No need for NAT it can connect one IP to other IP directly without NAT)
- Auto Configure IP V6 Support Both State full (DHCP IPV6) and Stateless (Self Configuration) that is Host itself generate IPv6 by adding some bits to it mac address.
- IPsec enable
- No Broadcast
- Fast Forwarding or Routing
- Any Cast Support -------
- Mobility
- Smooth Transition (dual stack, header translation and Tunneling)

IPV6 is of 128 Bits and it has 8 segments and each segment is 16 bits and it is written in Hexadecimal And it is class less and NO Broadcast and Backward Incompatible

Decimal	Hexadecimal	Binary
0	0	0000
1	1	0001
2	2	0010
3	3	0011

4	4	0100
5	5	0101
6	6	0110
7	7	0111
8	8	1000
9	9	1001
10	A	1010
11	B	1011
12	C	1100
13	D	1101
14	E	1110
15	F	1111

Example of IPV6 is X:X:X:X:X:X:X:X

Rules:

1. Remove leading Zeroes
2. If two Block (Segment) Contain consecutive Zeros omit them all and replace with double colon sign (::)
3. (::) is Must be use to represent the largest number of 16 bit sets of zero as possible
4. If there are multiple place where (::) can be used, and the numbers of Zeroes are the same, use (::) on the left most set of Zeroes

A890:FFFF:CDEF: : AB:AF00:A001

A890:FFFF:CDEF:0000:0000:00AB:AF00:A001 = A890:FFFF:CDEF::00AB:AF00:A001

A890:FFFF:CDEF:0000:0000:0000:AF00:A001 =A890:FFFF:CDEF: :AF00:A001

A890:FFFF:CDEF:: AB:AF00:A001

Comparison between IPV4 and IPv6:

IPV4	IPV6
32 Bits Address	128 Bits Address
8 Bits Group	16 Bits Group
4 Groups	8 Groups
Dotted (.) Decimal Notation	Use (:) to Separate Groups
Decimal Number System	Hexadecimal Number System
Classes [A, B, C, D, E]	No Classes
Subnetting Required	No Subnetting Required
No Built-In Security	Built-In Security
Unicast, Multicast, Broadcast	Unicast, Multicast, Anycast, No Broadcast
No Short Form Available	Short Form Available
Manual or DHCP	Manual or Auto configuration or DHCPv6
ICMP	ICMPv6
Broadcast ARP	Multicast Neighbor Finding
Broadcast Yes	Broadcast No

Type of IPV6 Address:

1. Unicast --------- Data Send to Single Host (Range is 2001::)
2. Multicast ---------- Deliver a Data to a group of Destination (Range is FF00::)
3. AnyCast ---------- It is very similar to the Multicast address. Assigning a unicast address to more than one interface makes a unicast address on any cast address packet send to any cast address is delivered to the closest Interface. **Anycast address represents a service rather than a device.Anycast same address can reside on one or more devices providing the same service. Anycast multiple interfaces (hosts) are assigned same Anycast IP address.**

Unicast again divide as given below

Global address ------- It is same like **Public IP address in IPV4 (Range 2000::)** ---- The Range of 2001:: is assigned to the global Registries

Link local address: **Computer is generate itself (Range: FE80::) this address is not routable.**

Unique local address: It is same Like Private IP address in IPV4 (Range FC00::) ------- It is not routable on the Internet

Modified EUI 64:

- EUI stands for Extended Unique Identifier.
- A host can auto-configure its Interface ID by using EUI-64 format.
- First, a host divides its own MAC address into two 24-bits Part.
- Then 16-bit Hex value 0xFFFE is sandwiched into those two Part of MAC address.
- This resulting in Extended Unique Identifier-64 Interface ID.
- To convert EUI-64 ID into IPv6 Interface Identifier.
- The most significant seventh bit of EUI-64 ID is complemented

Example:

00D0.BA0A.390D

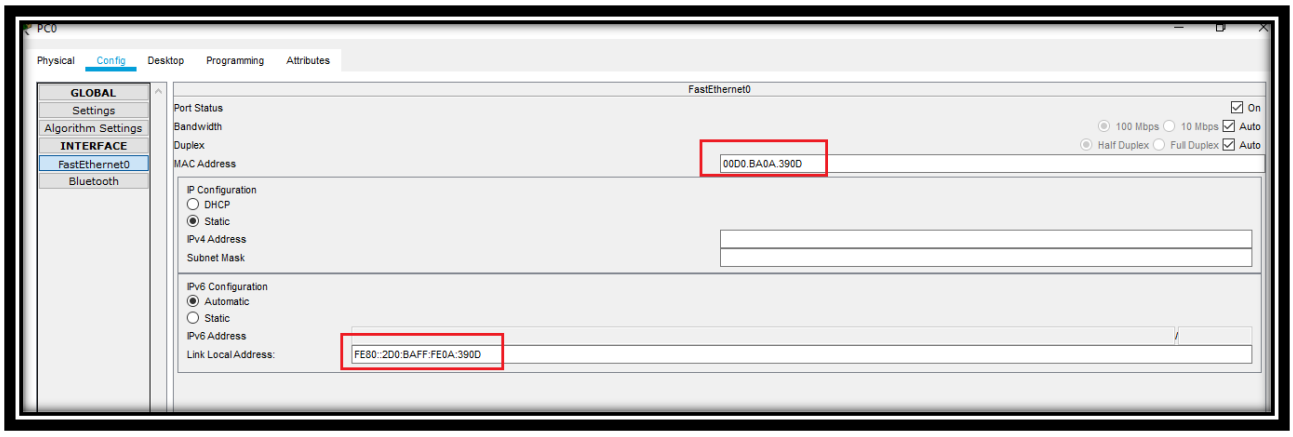
00 D0 BA 0A 39 0D

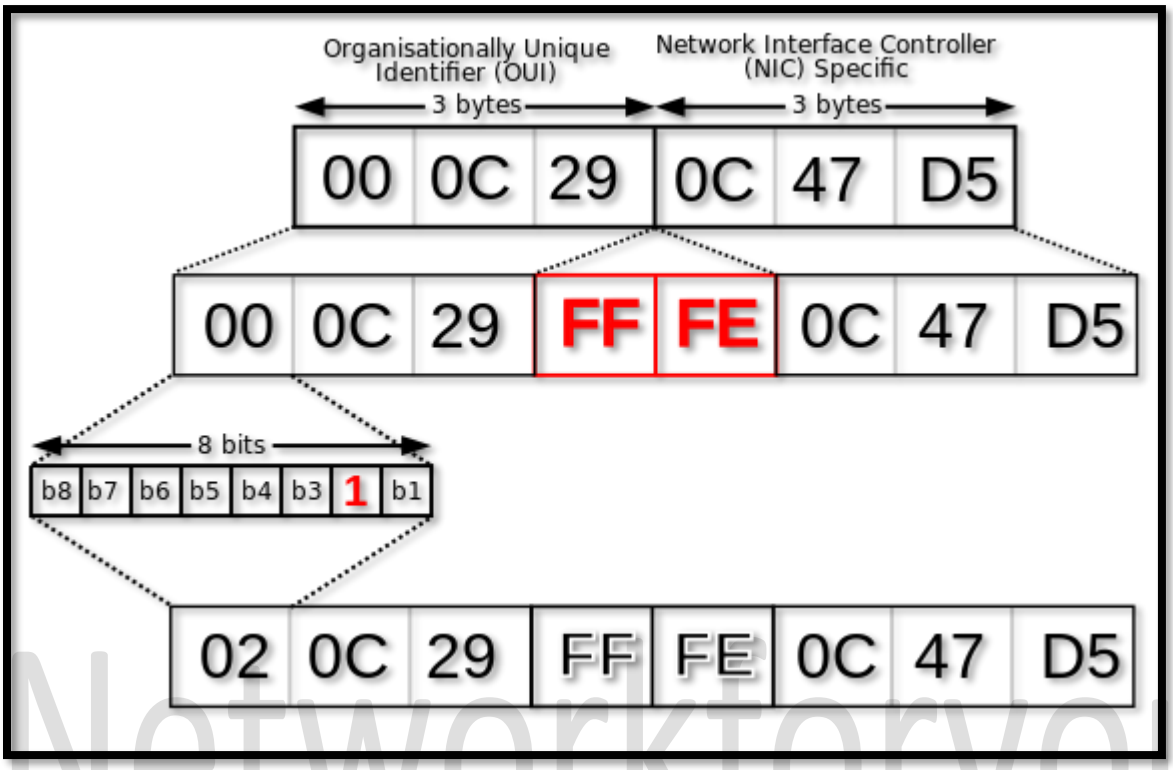
00 D0 BA FF FE 0A 39 0D -------> Divide into Two 24 Bits Part

00 D0 BA FF FE 0A 39 0D ----------> Then FF FE is sandwiched into those two parts

00000000 D0 BA FF FE 0A 39 0D

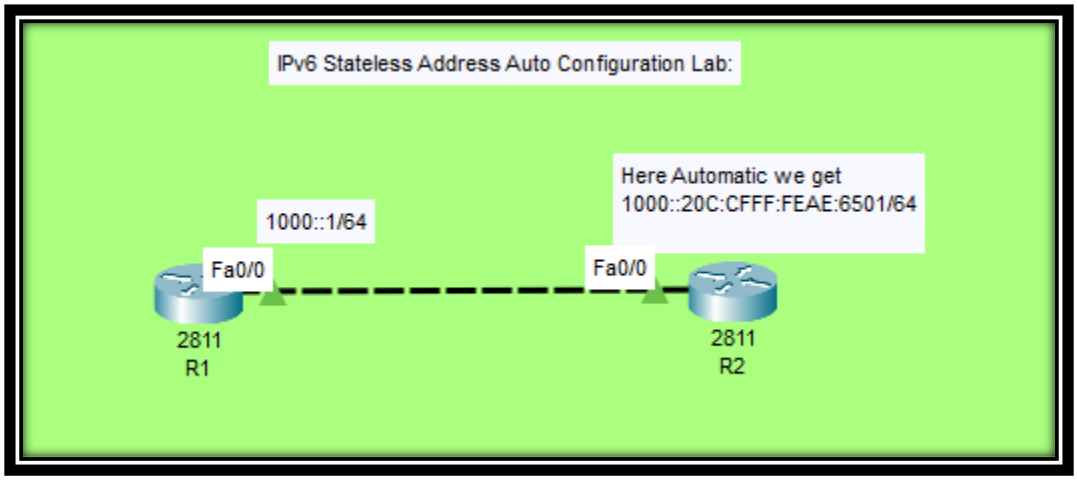
02 D0 BA FF FE 0A 39 0D ----------> The most significant Seventh bits of this id is complemented





Stateless Address Auto Configuration (SLAAC):

- IPv6 Stateless address Autoconfiguration is similar to DHCP in IPv4.
- Stateless Autoconfiguration for IPv6 is like a "Mini-DHCP" server for IPv6.
- Routers running IPv6 give prefix & gateway address to clients looking for IPv6 address.
- SLAAC is a method, which obtain an IPv6 global unicast address without DHCPv6 server.
- Stateless service means there is no server that maintains network address information.
- This is a unique feature only to IPv6 which provides simple "plug & play" networking.
- By default, SLAAC only provide IPv6 address and a default gateway to client devices.
- Nodes listen for ICMPv6 Router Advertisements (RA) messages periodically.

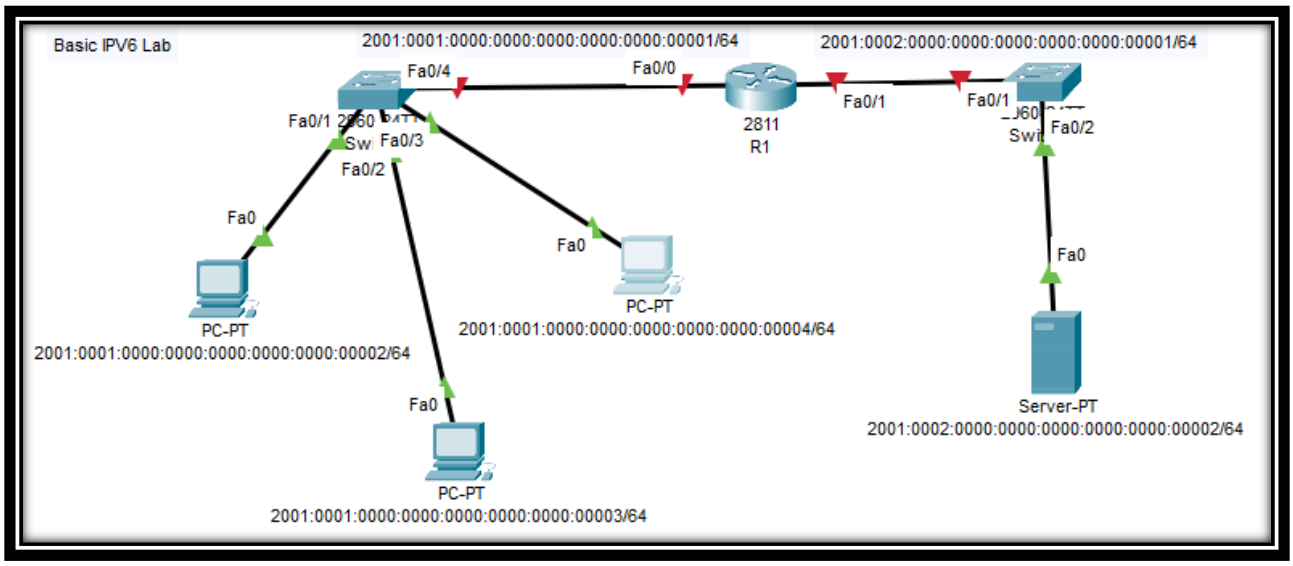


R1 Configuration	R2 Configuration
En Config t Hostname R1 ipv6 unicast-routing interface f0/0 ipv6 add 1000::1/64 ipv6 enable no shutdown	En Config t Hostname R2 ipv6 unicast-routing interface f0/0 ipv6 address autoconfig ipv6 enable no shutdown

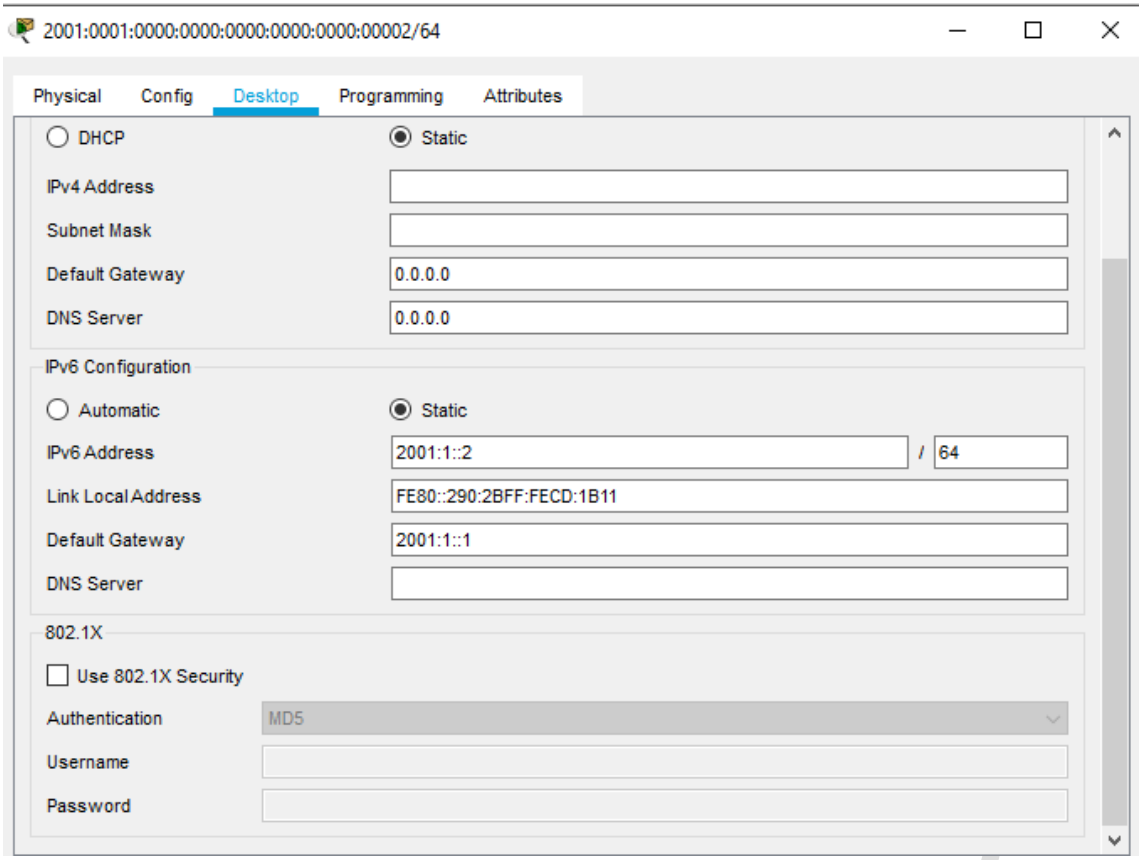
Classless Inter Domain Routing (CIDR)

We can Divide Ip V6 as 64 Network bits and 64 Host bits as given below
Example:
2001:0001:0000:0000:0000:0000:0000:00001/64
2001:0001:0000:0000:0000:0000:0000:00002/64
2001:0002:0000:0000:0000:0000:0000:00001/64
2001:0002:0000:0000:0000:0000:0000:00002/64
2001:0003:0000:0000:0000:0000:0000:00001/64
2001:0003:0000:0000:0000:0000:0000:00001/64

Basic IPV6 Lab:

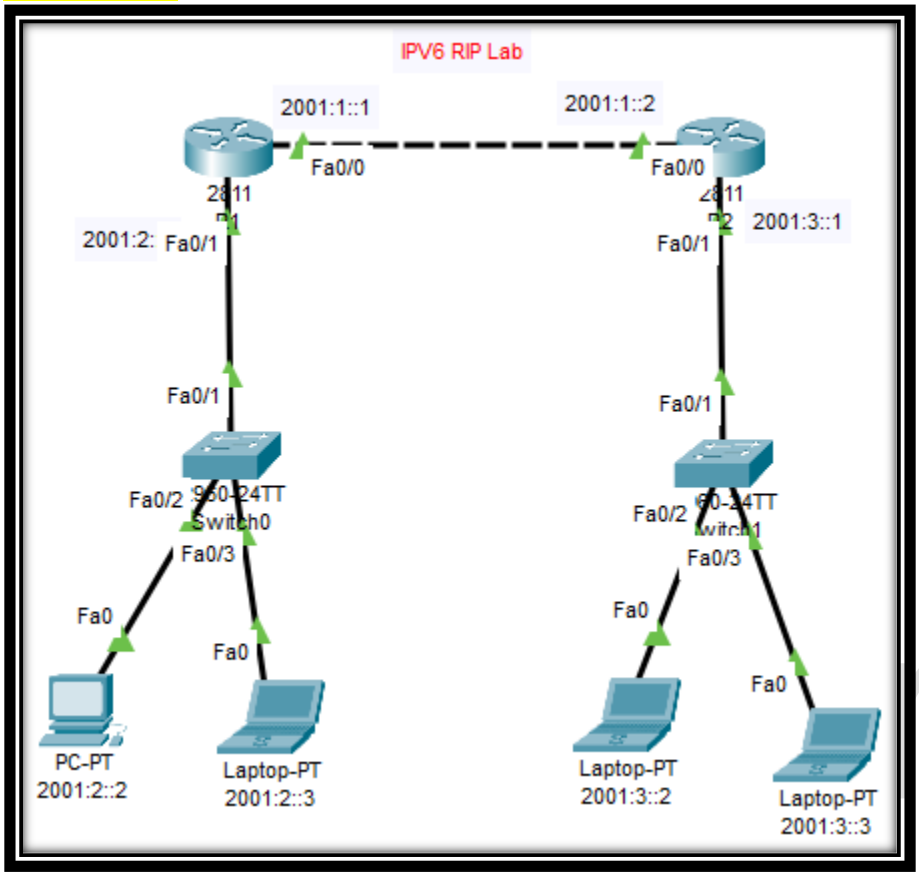


Assign IP address to PCs and Server.
As given below screen short.



Router Configuration (Assigning IPv6 address to Interface)
En **Config t** **Hostname R1** **ipv6 unicast-routing** **Int f0/1** **Ipv6 add 2001:0001:0000:0000:0000:0000:0000:00001/64** **No sh** **Int f0/0** **Ipv6 add 2001:0002:0000:0000:0000:0000:0000:00001/64** **No sh**

IPV6 RIP Lab:

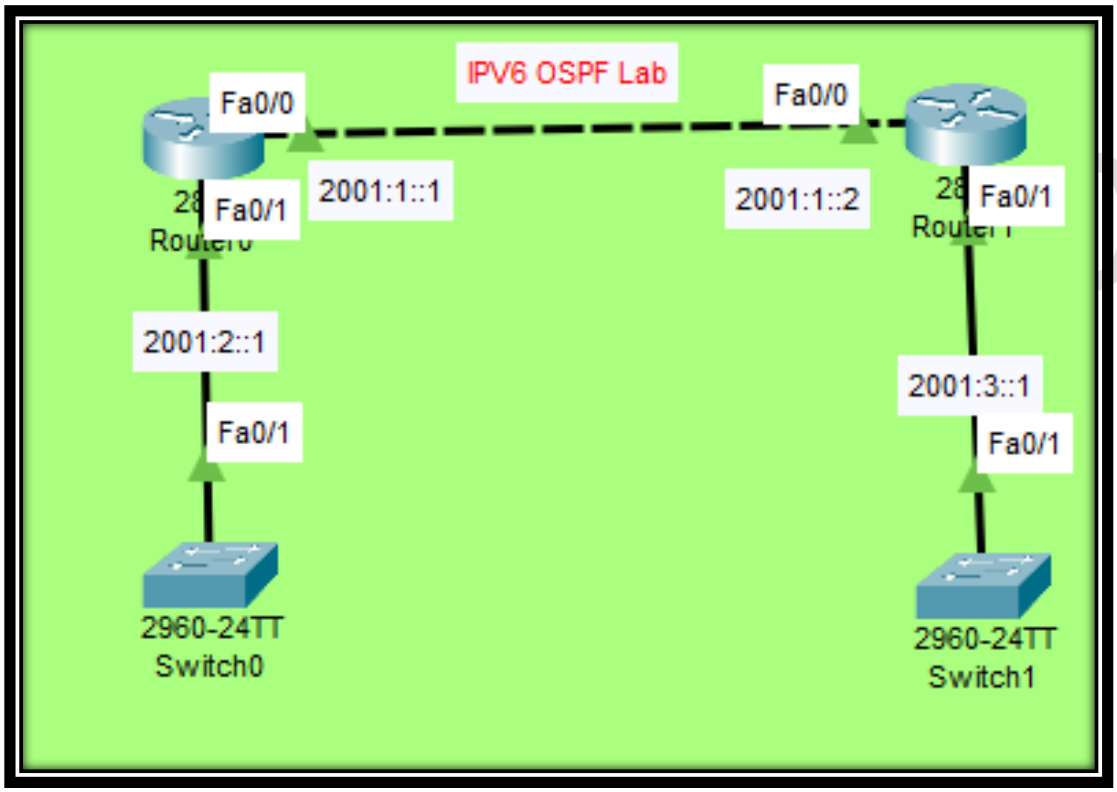


IPV6 RIP Configuration:

R1 Configuration	R2 Configuration
En Config t Hostname R1 ipv6 unicast-routing Int f0/0 Ipv6 add 2001:0001:0000:0000:0000:0000:0000:00001/64 No sh	En Config t Hostname R2 ipv6 unicast-routing Int f0/0 Ipv6 add 2001:0001:0000:0000:0000:0000:0000:00002/64 No sh

Int f0/1 **Ipv6 add** **2001:0002:0000:0000:0000:0000:0000:00001/64** **No sh** **ipv6 router rip abc** **int f0/0** **ipv6 rip abc enable** **int f0/1** **ipv6 rip abc enable**	**Int f0/1** **Ipv6 add** **2001:0003:0000:0000:0000:0000:0000:00001/64** **No sh** **ipv6 router rip abc** **int f0/0** **ipv6 rip abc enable** **int f0/1** **ipv6 rip abc enable**

IPV6 OSPF Lab:



R1 Configuration	R2 Configuration
En Config t Hostname R1 ipv6 unicast-routing Int f0/0 Ipv6 add 2001:0001:0000:0000:0000:0000:0000:00001/64 No sh Int f0/1 Ipv6 add 2001:0002:0000:0000:0000:0000:0000:00001/64 No sh ipv6 router ospf 1 router-id 1.1.1.1 int f0/0 ipv6 ospf 1 area 0 int f0/1 ipv6 ospf 1 area 0	En Config t Hostname R2 ipv6 unicast-routing Int f0/0 Ipv6 add 2001:0001:0000:0000:0000:0000:0000:00002/64 No sh Int f0/1 Ipv6 add 2001:0003:0000:0000:0000:0000:0000:00001/64 No sh ipv6 router ospf 1 router-id 2.2.2.2 int f0/0 ipv6 ospf 1 area 0 int f0/1 ipv6 ospf 1 area 0

Let do some more labs for IPV6.

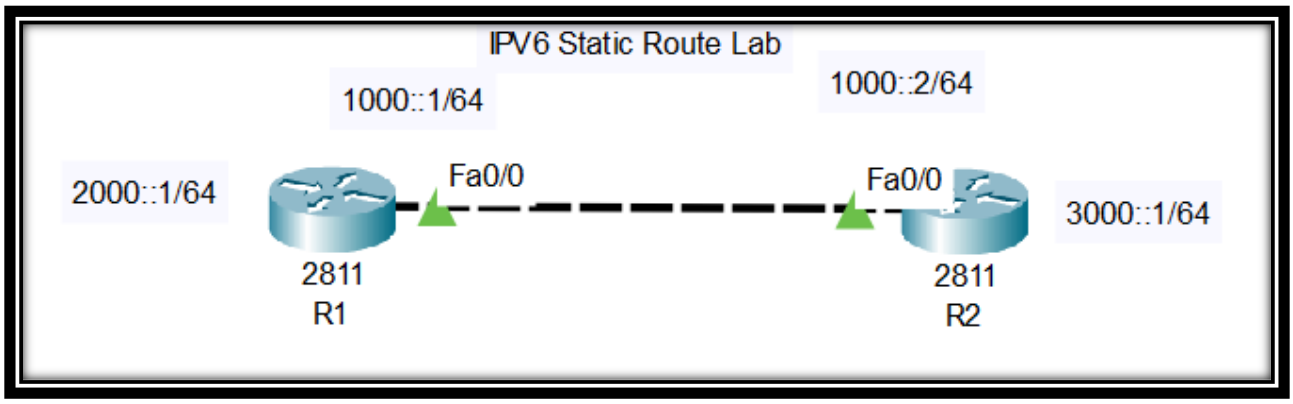
Let see how we can configure static router by using IPV6.

IPV6 Static Routing:

- Same like IPV4 static route we can do IPV6 static route.
- Static IPV6 routes can be used in small networks.
- Where the overhead of a routing protocol is not required.

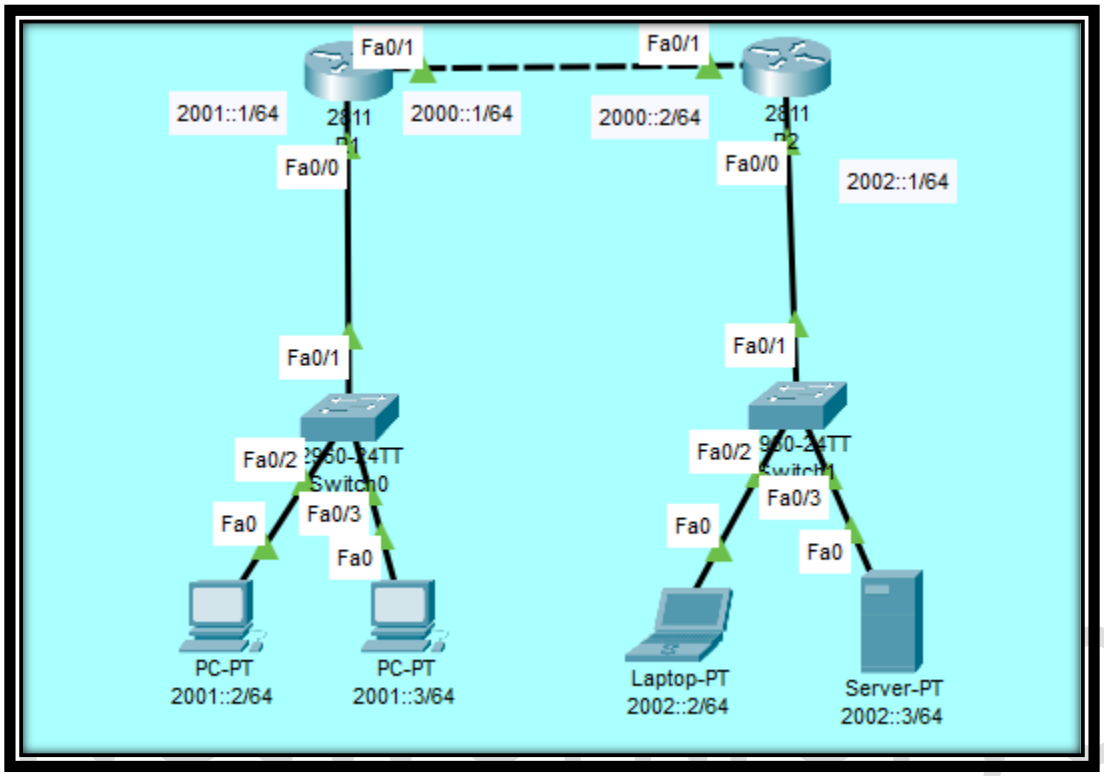
Example:
IPV6 Route Newtwork ID and subnet mask and next hop.

IPV6 Static Route Lab:



R1 Configuration	R2 Configuration
en config t hostname R1 ipv6 unicast-routing int f0/0 IPv6 add 1000::1/64 no sh int lo 0 IPv6 add 2000::1/64 no sh ipv6 route 0::/0 1000::2 ------- this is for Default Route ipv6 route 3000::/64 1000::2 --------- this is for Static Route or Network Router How we can check sh ipv6 route sh ipv6 route static	en config t hostname R2 ipv6 unicast-routing int f0/0 IPv6 add 1000::2/64 no sh int lo 0 IPv6 add 3000::1/64 no sh ipv6 route 0::/0 1000::1 ------- this is for Default Route ipv6 route 2000::/64 1000::1 --------- this is for Static Route or Network Router

IPV6 EIGRP Lab:



R1 Configuration	R2 Configuration
en Config t hostname R1 ipv6 unicast-routing int fa0/1 ipv6 add 2000::1/64 no shut int f0/0 ipv6 add 2001::1/64 no shut ipv6 router eigrp 10 eigrp router-id 1.1.1.1 no shut exit	en Config t hostname R2 ipv6 unicast-routing int f0/1 ipv6 add 2000::2/64 no shut int fa0/0 ipv6 add 2002::1/64 no shut ipv6 router eigrp 10 no shutdown eigrp router-id 2.2.2.2

int fa0/0 ipv6 eigrp 10 int f0/1 ipv6 eigrp 10	exit int fa0/0 ipv6 eigrp 10 int f0/1 ipv6 eigrp 10