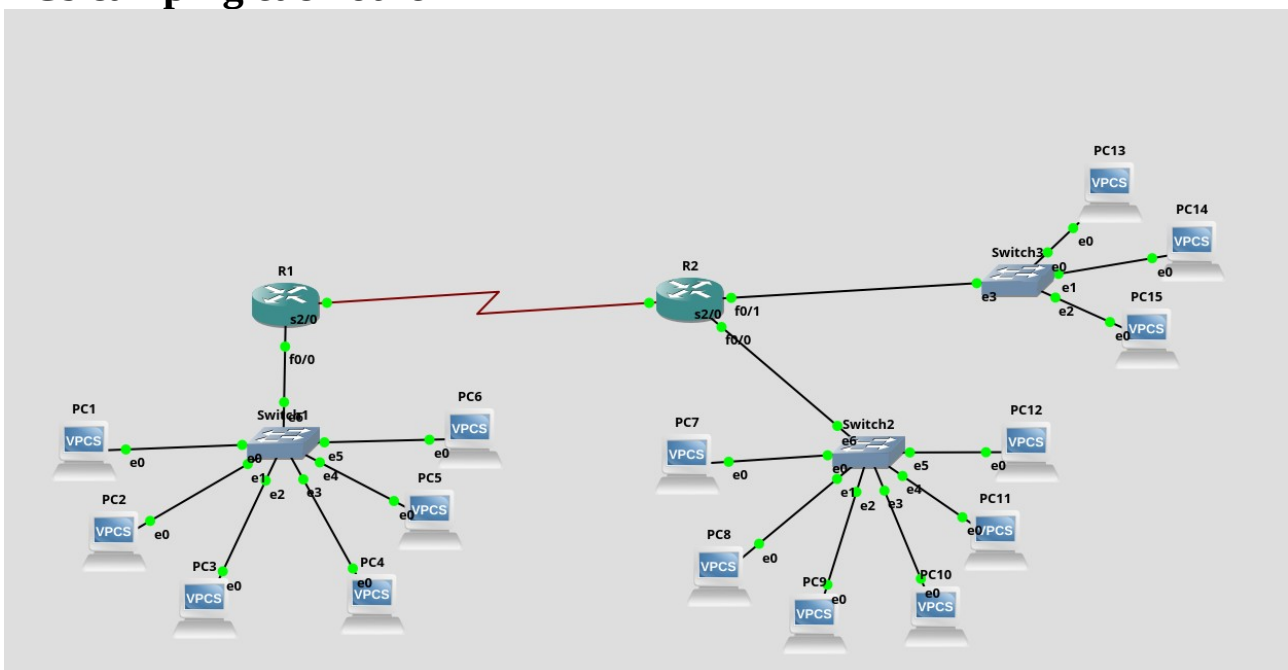# COMPUTER NETWORK

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ROLL NO -14

LAB 8: Advanced IP Configuration Lab: Subnetting, Static Routing

**1)As a network Engineering, you are required to subnet the 192.168.1.0 network to provide IP addresses
to the given network. Show all calculations. What is the Then configure all devices and ensure that
PCs can ping each other**

The pcs are assigned with ip address ,subnet mask and default gateway.

SWITCH1-GATEWAY=192.168.1.1

SWITCH2-GATEWAY=192.168.1.17

SWITCH3-GATEWAY=192.168.1.33

Switch	PC	IP Address	Subnet Mask
Switch 1	PC1	192.168.1.1	255.255.255.240
	PC2	192.168.1.2	255.255.255.240
	PC3	192.168.1.3	255.255.255.240
	PC4	192.168.1.4	255.255.255.240
	PC5	192.168.1.5	255.255.255.240
	PC6	192.168.1.6	255.255.255.240
Switch 2	PC7	192.168.1.17	255.255.255.240
	PC8	192.168.1.18	255.255.255.240
	PC9	192.168.1.19	255.255.255.240
	PC10	192.168.1.20	255.255.255.240
	PC11	192.168.1.21	255.255.255.240
	PC12	192.168.1.22	255.255.255.240
Switch 3	PC13	192.168.1.33	255.255.255.240
	PC14	192.168.1.34	255.255.255.240
	PC15	192.168.1.35	255.255.255.240

ROUTER 1 AND ROUTER 2 CONFIGURATION

```
≡                          R1                    _   □   ×

et0/0, changed state to up
Router(config)#config t
                  ^
% Invalid input detected at '^' marker.

Router(config)#int s2/0
Router(config-if)#ip address 10.0.0.1 255.255.255.240
Router(config-if)#no shut
Router(config-if)#exit
Router(config)#
*Mar  1 00:46:04.011: %LINK-3-UPDOWN: Interface Serial2/0, changed state to up
*Mar  1 00:46:05.015: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0,
 changed state to uppXTERM
                  ^
% Invalid input detected at '^' marker.

Router(config)#ip route 192.168.1.16 255.255.255.240 10.0.0.2
Router(config)#ip route 192.168.1.33  255.255.255.240 10.0.0.2
%Inconsistent address and mask
Router(config)#ip route 192.168.1.33 255.255.255.240 10.0.0.2
%Inconsistent address and mask
Router(config)#ip route 192.168.1.32 255.255.255.240 10.0.0.2
Router(config)#
```

```
=                          R2                      _   □   ✕
outer(config)#
Mar  1 00:47:35.835: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state t
 up
Mar  1 00:47:36.835: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthern
t0/0, changed state to up
outer(config)#int f0/1
outer(config-if)#ip address 192.168.1.33 255.255.255.240
outer(config-if)#no shut
outer(config-if)#ip address 192.168.1.33 255.255.255.240
outer(config-if)#ip address 192.168.1.33 255.255.255.240
Mar  1 00:48:07.863: %LINK-3-UPDOWN: Interface FastEthernet0/1, changed state t
 up
Mar  1 00:48:08.863: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthern
nt f0/0
outer(config-if)#ip address 192.168.1.33 255.255.255.240
 192.168.1.32 overlaps with FastEthernet0/1
outer(config-if)#no shut
outer(config-if)#exit
outer(config)#int s2/0
outer(config-if)#ip address 10.0.0.2 255.255.255.240
outer(config-if)#no shut
outer(config-if)#exit
outer(config)#ip route 192.168.1.0 255.255.255.240 10.0.0.1
outer(config)#
```

TRYING TO PING PCS FOR CHECKING THE WORKING OF THE
NETWORK


```
=                          PC1                     _   □   ✕
Trying ::1...
Connected to localhost.
Escape character is '^]'.

VPCS> ip 192.168.1.18
Checking for duplicate address...
PC1 : 192.168.1.18 255.255.255.0

VPCS> ip 192.168.1.2 255.255.255.240 192.168.1.1
Checking for duplicate address...
PC1 : 192.168.1.2 255.255.255.240 gateway 192.168.1.1

VPCS> ping  192.168.1.18

192.168.1.18 icmp_seq=1 timeout
84 bytes from 192.168.1.18 icmp_seq=2 ttl=62 time=124.760 ms
84 bytes from 192.168.1.18 icmp_seq=3 ttl=62 time=128.116 ms
84 bytes from 192.168.1.18 icmp_seq=4 ttl=62 time=116.385 ms
84 bytes from 192.168.1.18 icmp_seq=5 ttl=62 time=126.208 ms

VPCS> []
```
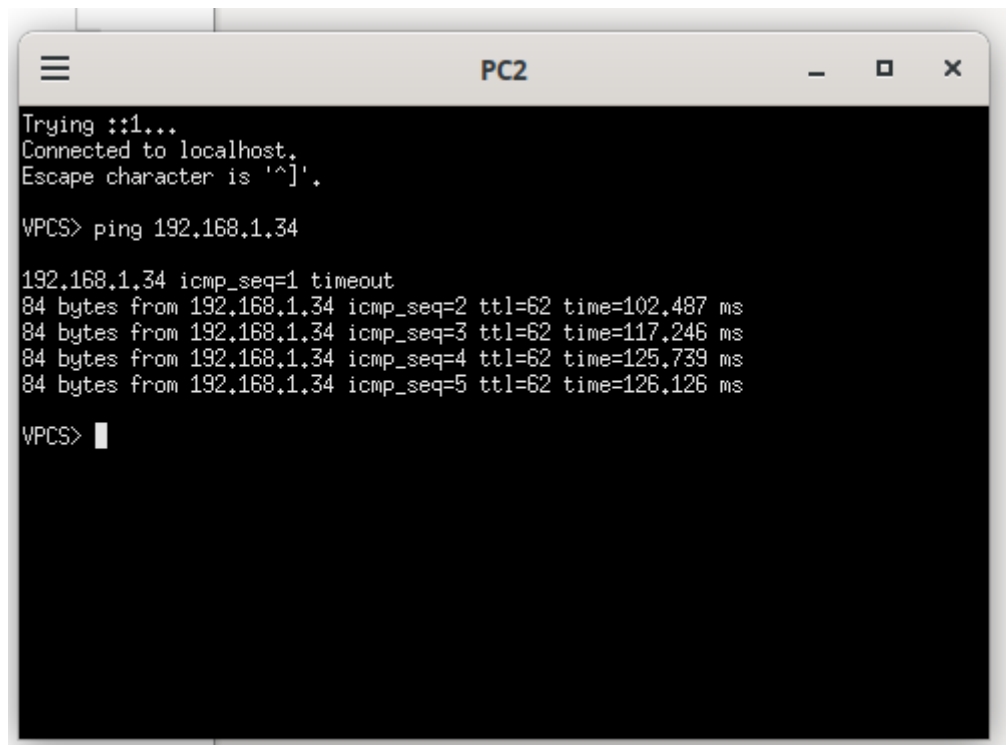
```
                          PC2   _ □ ×
Trying ::1...
Connected to localhost.
Escape character is '^]'.

VPCS> ping 192.168.1.34

192.168.1.34 icmp_seq=1 timeout
84 bytes from 192.168.1.34 icmp_seq=2 ttl=62 time=102.487 ms
84 bytes from 192.168.1.34 icmp_seq=3 ttl=62 time=117.246 ms
84 bytes from 192.168.1.34 icmp_seq=4 ttl=62 time=125.739 ms
84 bytes from 192.168.1.34 icmp_seq=5 ttl=62 time=126.126 ms

VPCS> █
```

**2)You are a network technician assigned to design and implement a new network for a client. Given the**
**Class C network of 192.168.5.0/24, subnet the network to create the network as shown with the host**
**requirements shown. Show sample hosts and ensure connectivity.**
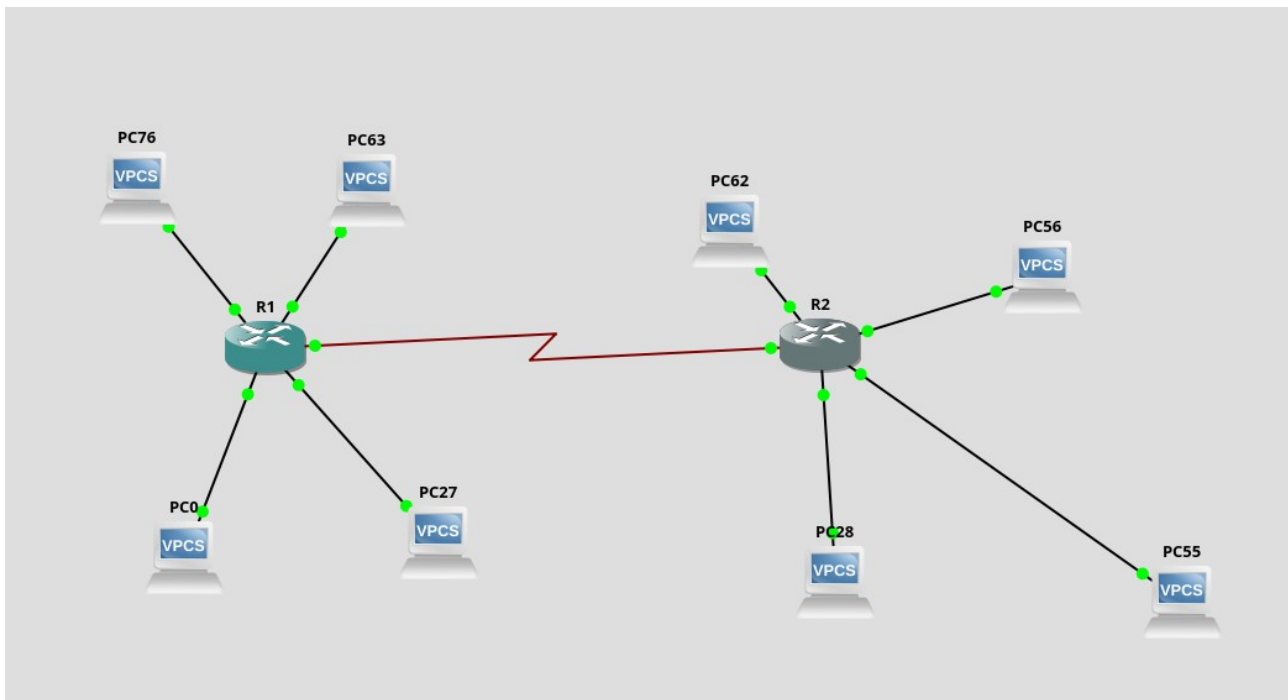
| Set | Subnet | Usable IP Range | Network Address | Broadcast Address | Devices Assigned |
|-----|--------|-----------------|-----------------|-------------------|------------------|
| 1 | 192.168.1.0/27 | 192.168.1.1 to 192.168.1.30 | 192.168.1.0 | 192.168.1.31 | 192.168.1.1 to 192.168.1.28 |
| 2 | 192.168.1.32/27 | 192.168.1.33 to 192.168.1.62 | 192.168.1.32 | 192.168.1.63 | 192.168.1.33 to 192.168.1.60 |
| 3 | 192.168.1.64/28 | 192.168.1.65 to 192.168.1.78 | 192.168.1.64 | 192.168.1.79 | 192.168.1.65 to 192.168.1.78 |
| 4 | 192.168.1.80/28 | 192.168.1.81 to 192.168.1.94 | 192.168.1.80 | 192.168.1.95 | 192.168.1.81 to 192.168.1.87 |

## Summary

- **Set 1**: 28 devices
- **Set 2**: 28 devices
- **Set 3**: 14 devices
- **Set 4**: 7 devices

ASSIGNING IP ADDRESS AND SUBNET FOR THE PCS

```
Trying ::1...
Connected to localhost.
Escape character is '^]'.

Welcome to Virtual PC Simulator, version 0.8c
Dedicated to Daling.
Build time: Oct 16 2018 17:01:10
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For more information, please visit wiki.freecode.com.cn.

Press '?' to get help.

Executing the startup file


PC0> ip 192.168.1.1 255.255.255.224
Checking for duplicate address...
PC1 : 192.168.1.1 255.255.255.224

PC0>
```



```
Trying ::1...
Connected to localhost.
Escape character is '^]'.

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For more information, please visit wiki.freecode.com.cn.

Press '?' to get help.

Executing the startup file
```



```
Trying ::1...
Connected to localhost.
Escape character is '^]'.

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For more information, please visit wiki.freecode.com.cn.

Press '?' to get help.

Executing the startup file


PC28> ip 192.168.1.33 255.255.255.224
Checking for duplicate address...
PC1 : 192.168.1.33 255.255.255.224

PC28>
```

```
≡                        PC55                    —   □   ×

Trying ::1...
Connected to localhost.
Escape character is '^]'.

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Press '?' to get help.

Executing the startup file
```

```
≡                        PC56                    —   □   ×

Trying ::1...
Connected to localhost.
Escape character is '^]'.

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Press '?' to get help.

Executing the startup file


PC56> ip 192.168.1.81 255.255.255.240
Checking for duplicate address...
PC1 : 192.168.1.81 255.255.255.240

PC56> []
```
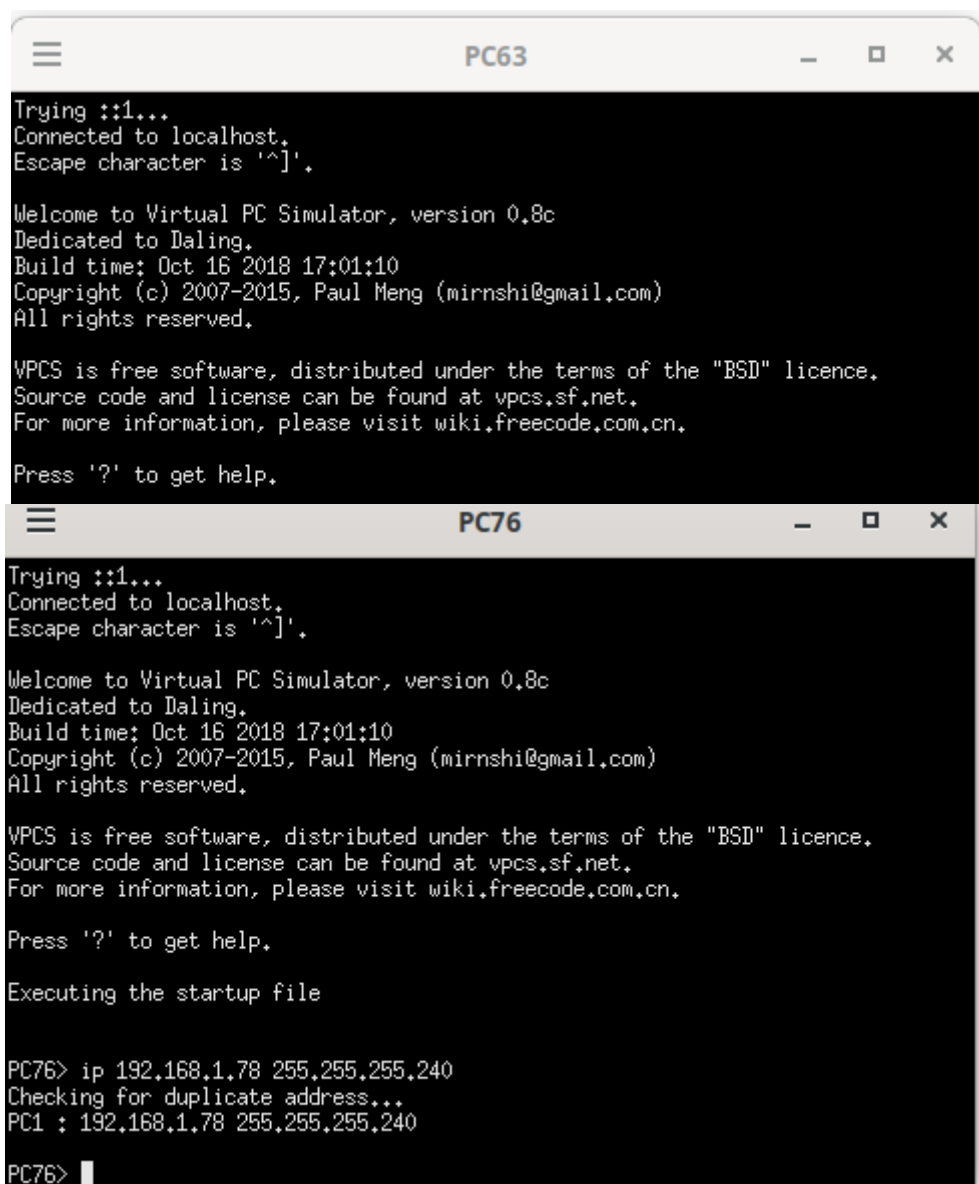
PC63

```
Trying ::1...
Connected to localhost.
Escape character is '^]'.

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Press '?' to get help.
```

PC76

```
Trying ::1...
Connected to localhost.
Escape character is '^]'.

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Dedicated to Daling.
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Press '?' to get help.

Executing the startup file


PC76> ip 192.168.1.78 255.255.255.240
Checking for duplicate address...
PC1 : 192.168.1.78 255.255.255.240

PC76>
```

ADDITIONAL EXERCISE

You are a network technician assigned to design and implement a new network for a client. The client
has a Class C network of 192.168.5.0/24 and needs to create multiple subnets to meet the following
requirements:
1. LAN-A connected to Router0 needs to support a minimum of 30 hosts.
2. LAN-B connected to Router1 needs to support a minimum of 20 hosts.
3. LAN-C connected to Router2 needs to support a minimum of 10 hosts.
4. Each router will be interconnected with serial links.
5. Ensure there are sufficient subnets for future expansion and additional connections.
Requirements:
• Subnet the 192.168.5.0/24 network to meet the given requirements.
• Assign IP addresses to each device. Assign IP addresses to the routers' interfaces connected
to the LANs.
• Ensure that each LAN has enough IP addresses for the required hosts.
• Verify connectivity between all devices with static routing.
Network Layout:

1. Router0:

o LAN-A

o Serial link to Router1

o Serial link to Router2

2. Router1:

o LAN-B

o Serial link to Router0

o Serial link to Router2

3. Router2:

o LAN-C

o Serial link to Router0

o Serial link to Router1

Questions:

1. Subnet Calculation:

o How many subnets are needed to meet the requirements?

o What is the subnet mask for each LAN?List the subnets and their ranges.

2. IP Address Assignment:

o What IP address will you assign to Router0's interface connected to LAN-A?

o What IP address will you assign to Router1's interface connected to LAN-B?

o What IP address will you assign to Router2's interface connected to LAN-C?

o Provide sample IP addresses for at least two hosts in each LAN.

o What IP addresses will you assign to the serial interfaces connecting the routers?

Solution)

1. Subnet Calculation

Subnets Needed

- **LAN-A**: Needs at least 30 hosts
- **LAN-B**: Needs at least 20 hosts
- **LAN-C**: Needs at least 10 hosts
- **Inter-router Links**: We need to consider IP addresses for serial links

Host Calculation and Subnetting

1. **LAN-A (30 hosts)**:

- Minimum subnet size: 32 hosts (2^5 = 32, where 5 bits are used for hosts)
- Subnet Mask: `/27` (255.255.255.224)
- Subnet: `192.168.5.0/27`
- Usable Range: `192.168.5.1` to `192.168.5.30`
- Broadcast Address: `192.168.5.31`

2. **LAN-B (20 hosts)**:

- Minimum subnet size: 32 hosts (2^5 = 32)
- Subnet Mask: `/27`
- Subnet: `192.168.5.32/27`
- Usable Range: `192.168.5.33` to `192.168.5.62`
- Broadcast Address: `192.168.5.63`

3. **LAN-C (10 hosts)**:

- Minimum subnet size: 16 hosts (2^4 = 16)
- Subnet Mask: `/28`
- Subnet: `192.168.5.64/28`
- Usable Range: `192.168.5.65` to `192.168.5.78`
- Broadcast Address: `192.168.5.79`

Inter-router Links

- To connect the routers, we can use point-to-point links with a `/30` subnet which provides 2 usable IPs.
- We can assign:
    - **Link between Router0 and Router1**: `192.168.5.80/30` (Usable: `192.168.5.81` and `192.168.5.82`)
    - **Link between Router0 and Router2**: `192.168.5.84/30` (Usable: `192.168.5.85` and `192.168.5.86`)
    - **Link between Router1 and Router2**: `192.168.5.88/30` (Usable: `192.168.5.89` and `192.168.5.90`)

Subnet	Subnet Mask	Usable IP Range	Broadcast Address
LAN-A	/27	192.168.5.1 to 192.168.5.30	192.168.5.31
LAN-B	/27	192.168.5.33 to 192.168.5.62	192.168.5.63
LAN-C	/28	192.168.5.65 to 192.168.5.78	192.168.5.79
R0-R1 Link	/30	192.168.5.80 to 192.168.5.83	192.168.5.83
R0-R2 Link	/30	192.168.5.84 to 192.168.5.87	192.168.5.87
R1-R2 Link	/30	192.168.5.88 to 192.168.5.91	192.168.5.91

2) IP Address Assignment

Router Interfaces

- **Router0** (LAN-A):
    - Interface IP: `192.168.5.1`
- **Router1** (LAN-B):
    - Interface IP: `192.168.5.33`
- **Router2** (LAN-C):
    - Interface IP: `192.168.5.65`

Sample Host IP Addresses

- **LAN-A (Router0)**:

    - Host 1: `192.168.5.2`
    - Host 2: `192.168.5.3`
- **LAN-B (Router1)**:

    - Host 1: `192.168.5.34`
    - Host 2: `192.168.5.35`
- **LAN-C (Router2)**:

    - Host 1: `192.168.5.66`
    - Host 2: `192.168.5.67`

Serial Interfaces IP Assignment

- **Router0 to Router1**:

    - Router0 Serial Interface: `192.168.5.81`

- Router1 Serial Interface: `192.168.5.82`
- **Router0 to Router2**:
  - Router0 Serial Interface: `192.168.5.85`
  - Router2 Serial Interface: `192.168.5.86`
- **Router1 to Router2**:
  - Router1 Serial Interface: `192.168.5.89`
  - Router2 Serial Interface: `192.168.5.90`

Device	IP Address
Router0 (LAN-A)	192.168.5.1
Router1 (LAN-B)	192.168.5.33
Router2 (LAN-C)	192.168.5.65
Host 1 (LAN-A)	192.168.5.2
Host 2 (LAN-A)	192.168.5.3
Host 1 (LAN-B)	192.168.5.34
Host 2 (LAN-B)	192.168.5.35
Host 1 (LAN-C)	192.168.5.66
Host 2 (LAN-C)	192.168.5.67
R0-R1 Serial Interface	192.168.5.81
R1-R0 Serial Interface	192.168.5.82
R0-R2 Serial Interface	192.168.5.85
R2-R0 Serial Interface	192.168.5.86
R1-R2 Serial Interface	192.168.5.89
R2-R1 Serial Interface	192.168.5.90