Practical-3

AIM: Allocating IP address to network topologies.

Student should be able to apply IP addresses to

1. Topology: two directly connected computers
2. Topology: four computers connected by switches
3. Topology: two networks connected by Router

Various networking commands:

- ping
- ipconfig
- arp –a
- netstat
- netbios
- tracert
- hostname
- nmap

Reference Videos

1. IP address: https://www.youtube.com/watch?v=ykz4oUPWACw
2. IP address assignment in Video: https://www.youtube.com/watch?v=vcAtxgDsl00
3. Classes of IPv4 address: https://www.youtube.com/watch?v=VkgfyLf1raY

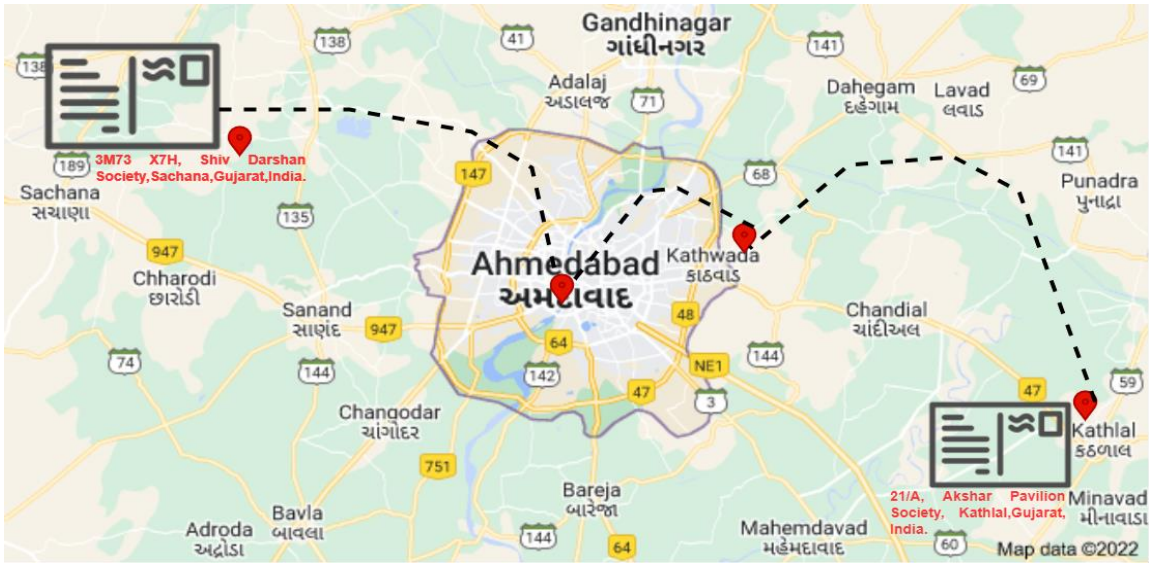
Reference for commands:

1. https://lizardsystems.com/articles/network-command-line-utilities/
2. https://www.youtube.com/watch?v=nH85pddWWAk
3. https://www.youtube.com/watch?v=rurs7cdT5cc&t=7s

Note: While applying IP address, student needs to allocate IP address as per his/her student ID. For Example, if student ID is 22cs005 then IP address allocation for the first network should start with 5.0.0.0. For subsequent networks, it should start with ID+1 i.e. 6.0.0.0, 7.0.0.0 and so on.

Refer to the following scenarios and let's understand What is an IP Address and Purpose of IP Address.

Scenario : 1



In this first scenario, an envelope is sent from sachana to kathlal. But there was some check point like ahmedabad, kathwada and then the envelope is delivered to kathlal.

Justify the following statement.

1. Was there any difficulty faced during sending the envelope from sender to receiver?

Scenario : 2

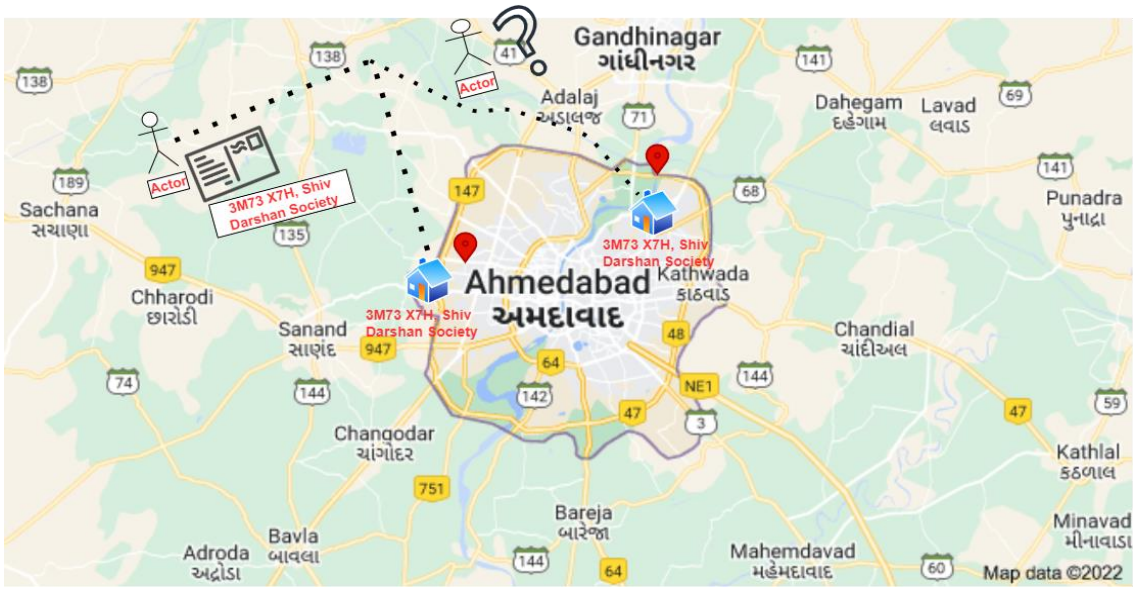
In this second scenario, the sender was located at Ahmedabad and wanted to send a file to the receiver who was located at Gandhinagar. But at the time of sending a file

to the receiver, the receiver's machine was powered off. So, can the receiver receive the file from the sender or not?

Justify the following statement.

2. Was there any difficulty faced during sending the file from sender to receiver? If yes then what would be the solution for it.

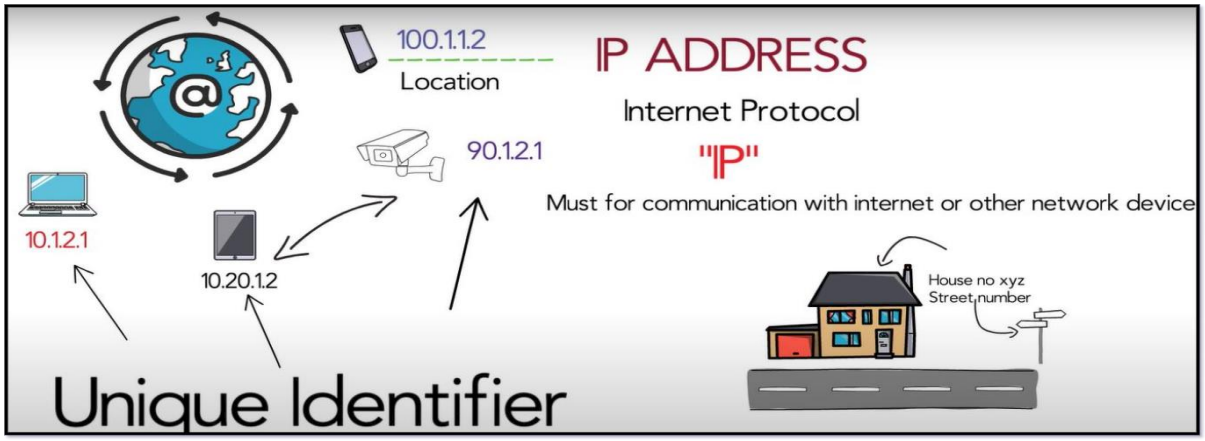
Scenario: 3



Refer the above image, and justify your answer

Question: Can the envelope be sent to the proper destination?

Scenario: 4



An IP address also acts like a return address on postal mail. When a letter you've mailed is delivered to the wrong address, you get the letter back if you include a return address on the envelope. The same holds true for email. When you write to an invalid recipient (such as someone who left their job and no longer has a company email address) your IP address lets the company's mail server send you back a bounce message so that you know your email wasn't sent to the right place.

From the above all scenarios, what would be the conclusion?

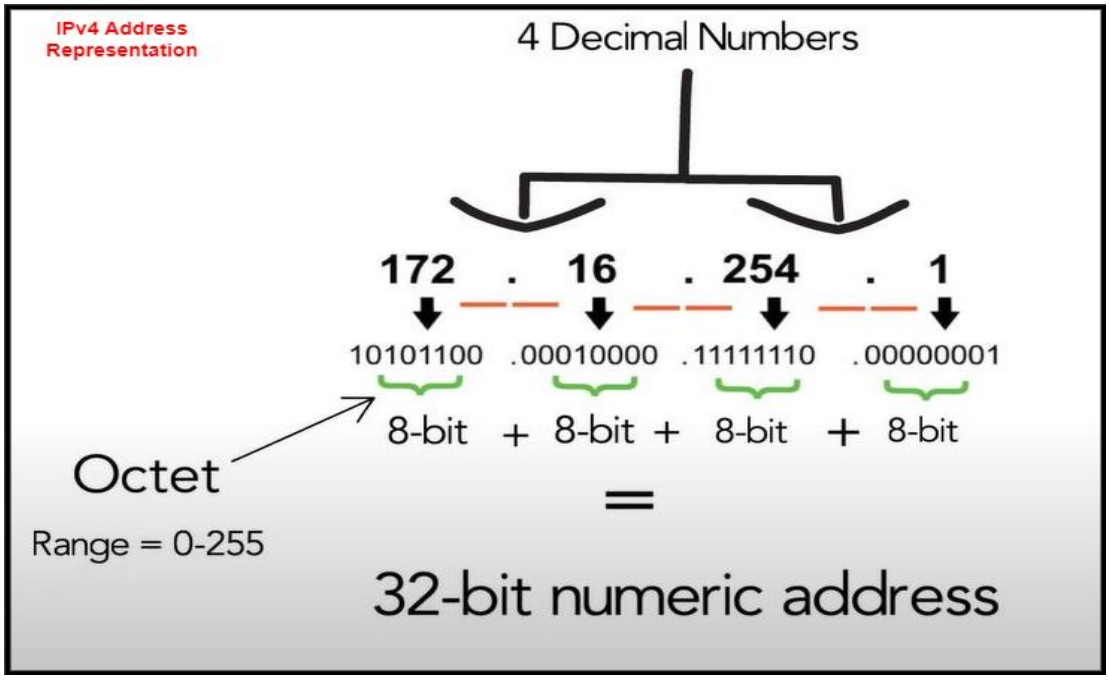
IP Address Types

Basically, there are two primary types of ip address formats used today.

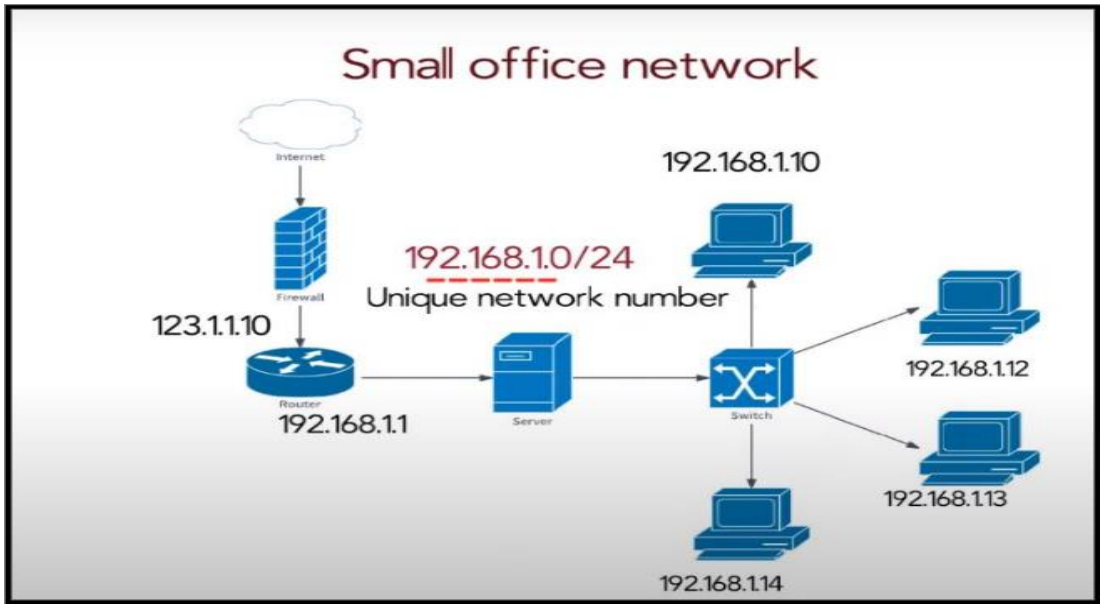
1. IPv4

2. IPv6

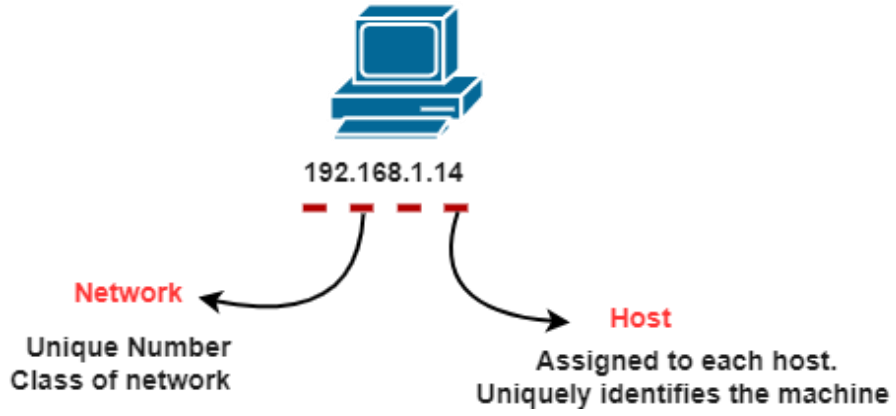
Refer to the following diagrams and let's understand IPv4 Address Representation



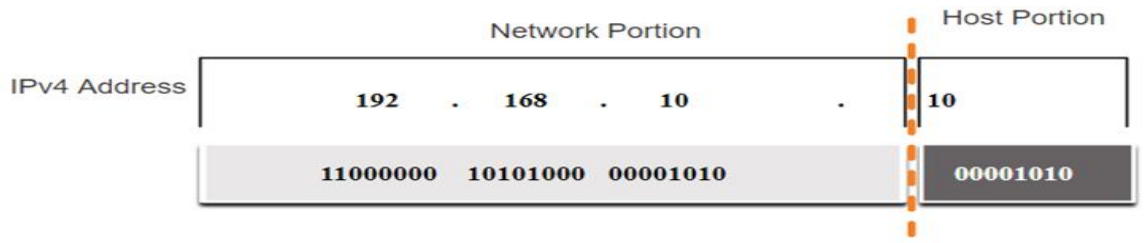
Refer to the following case-study and let's understand IPv4 Address Structure.



In this scenario, representing a small office network, each network running on TCP must have a unique number, and every machine on it must have a unique IP address. An IPv4 address is a 32-bit hierarchical address that is made up of a network portion and a host portion. When determining the network portion versus the host portion, you must look at the 32-bit stream. A subnet mask is used to determine the network and host portions.

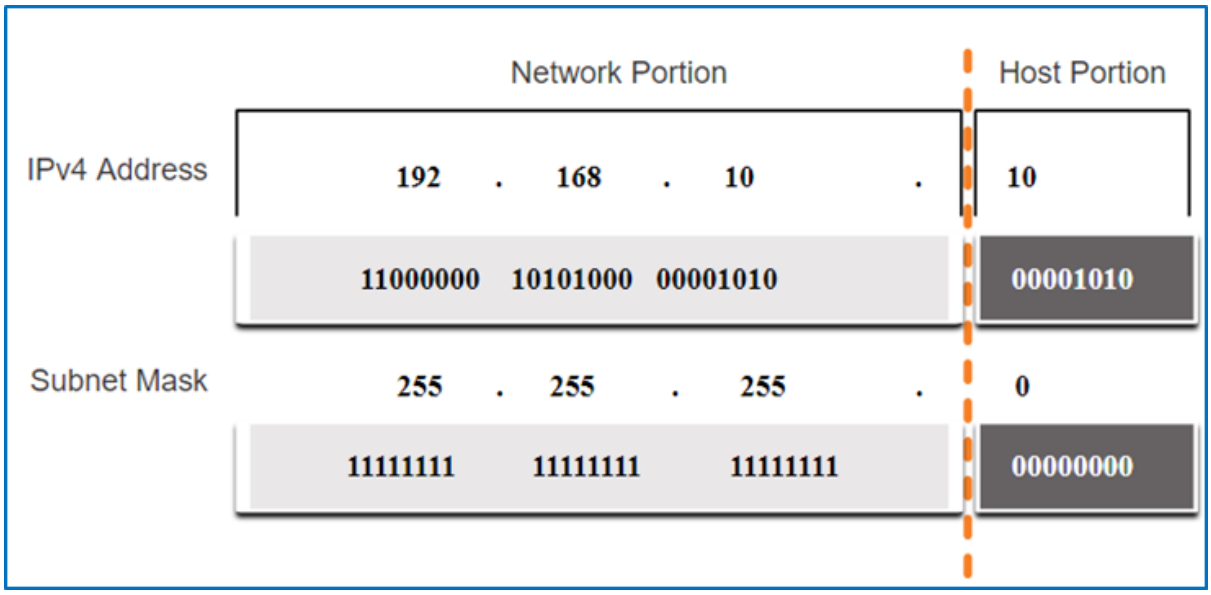


IPv4 Address Structure



IPv4 Address Structure using Binary format

IPv4 Address Structure : Subnet Mask



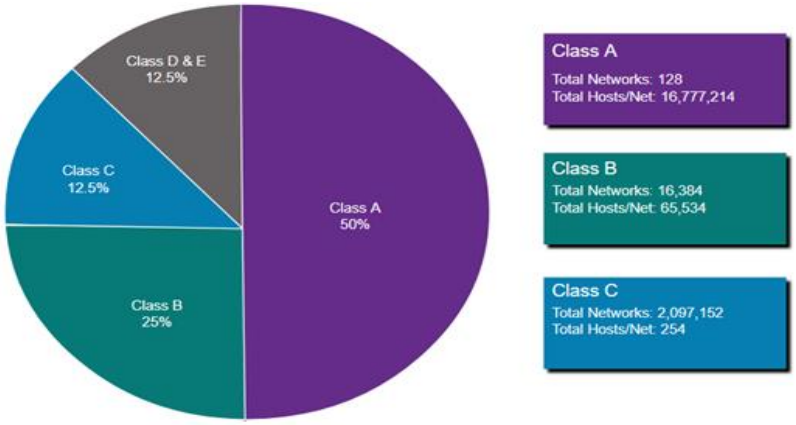
To identify the network and host portions of an IPv4 address, the subnet mask is compared to the IPv4 address bit by bit, from left to right. The actual process used to identify the network and host portions is called ANDing.

IPv4 Address Structure: Prefix Length

A prefix length is a less cumbersome method used to identify a subnet mask address. The prefix length is the number of bits set to 1 in the subnet mask. It is written in “slash notation” therefore, count the number of bits in the subnet mask and prepend it with a slash.

Subnet Mask	32-bit Address	Prefix Length
255.0.0.0	11111111.00000000.00000000.00000000	/8
255.255.0.0	11111111.11111111.00000000.00000000	/16
255.255.255.0	11111111.11111111.11111111.00000000	/24
255.255.255.128	11111111.11111111.11111111.10000000	/25
255.255.255.192	11111111.11111111.11111111.11000000	/26
255.255.255.224	11111111.11111111.11111111.11100000	/27
255.255.255.240	11111111.11111111.11111111.11110000	/28
255.255.255.248	11111111.11111111.11111111.11111000	/29

Types of IPv4 Addresses: Legacy Classful Addressing

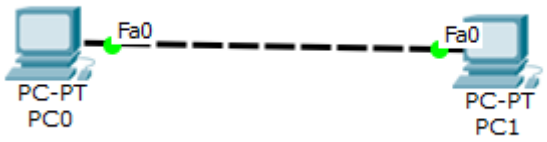


Classful addressing wasted many IPv4 addresses.

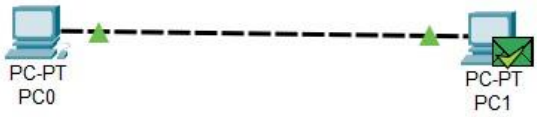
Classful address allocation was replaced with classless addressing which ignores the rules of classes (A, B, C).

CLASS	LEADING BITS	NET ID BITS	HOST ID BITS	NO. OF NETWORKS	ADDRESSES PER NETWORK	START ADDRESS	END ADDRESS
CLASS A	0	8	24	2^7 (128)	2^{24} (16,777,216)	0.0.0.0	127.255.255.255
CLASS B	10	16	16	2^{14} (16,384)	2^{16} (65,536)	128.0.0.0	191.255.255.255
CLASS C	110	24	8	2^{21} (2,097,152)	2^8 (256)	192.0.0.0	223.255.255.255
CLASS D	1110	NOT DEFINED	NOT DEFINED	NOT DEFINED	NOT DEFINED	224.0.0.0	239.255.255.255
CLASS E	1111	NOT DEFINED	NOT DEFINED	NOT DEFINED	NOT DEFINED	240.0.0.0	255.255.255.255

Exercise-1(Note: Start allocation IP address number from PC0)



Redraw above diagram which includes IP address and MAC address. Take IP address and MAC address as per your knowledge. Insert image below.



- Ipconfig: fill table ipconfig of all computers

PC0

Parameter	**Value**
Link local IPV6 Address	FE80 :: 202 : 4AFF : FE9A: D40B
IP address	97.11.1.1
Subnet Mask	255.0.0.0
Default Gateway	0.0.0.0

PC1

Parameter	**Value**
Link local IPV6 Address	FE80 :: 202 : 17FF : FE1B: 8265
IP address	97.11.1.2
Subnet Mask	255.0.0.0
Default Gateway	0.0.0.0

- Ipconfig /all: apply command on command prompt and write parameters and values in the following table.

PC0

Parameter	**Value**
DHCP server	0.0.0.0
DHCPv6 IAID	-
DHCPv6 Client DUID	00-01-00-01-5B-90-3C-5C-00-02-4A-9A-D4-0B
DNS Servers	0.0.0.0

PC1

Parameter	**Value**
DHCP server	0.0.0.0
DHCPv6 IAID	-
DHCPv6 Client DUID	00-01-00-01-84-A1-A9-0A-00-02-17-1B-82-65
DNS Servers	0.0.0.0

- Arp –a: before ping, write output of command from PC0 and PC1 computers

PC0

Parameter	**Value**
Internet Address	97.11.1.2
Physical Address	0002. 171b. 8265
Type	dynamic

PC1

Parameter	**Value**
Internet Address	97.11.1.1
Physical Address	0002.4a9a.d40b
Type	dynamic

- Ping from PC0 to PC1 and vice versa and insert snap of output here.

```
C:\>ping 94.11.1.2

Pinging 94.11.1.2 with 32 bytes of data:

Reply from 94.11.1.2: bytes=32 time=16ms TTL=128
Reply from 94.11.1.2: bytes=32 time<1ms TTL=128
Reply from 94.11.1.2: bytes=32 time<1ms TTL=128
Reply from 94.11.1.2: bytes=32 time<1ms TTL=128

Ping statistics for 94.11.1.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 16ms, Average = 4ms
```

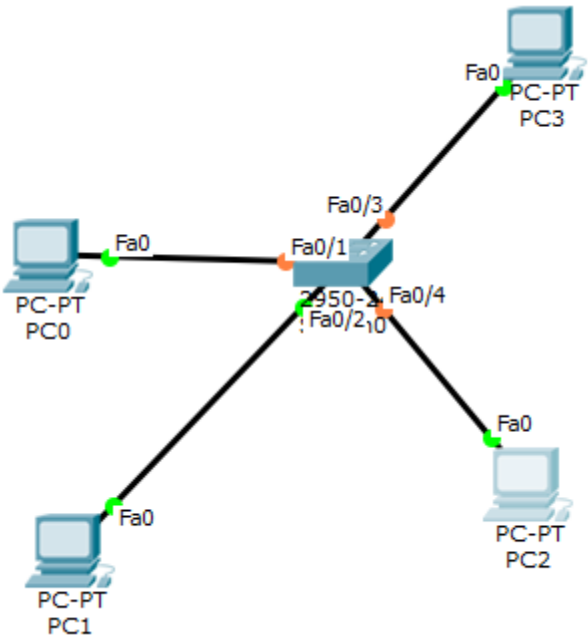
```
C:\>ping 94.11.1.1

Pinging 94.11.1.1 with 32 bytes of data:

Reply from 94.11.1.1: bytes=32 time=4ms TTL=128
Reply from 94.11.1.1: bytes=32 time=2ms TTL=128
Reply from 94.11.1.1: bytes=32 time=2ms TTL=128
Reply from 94.11.1.1: bytes=32 time=2ms TTL=128

Ping statistics for 94.11.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 4ms, Average = 2ms
```

- Arp –a: after ping, insert snap (below) of output of command from all computers

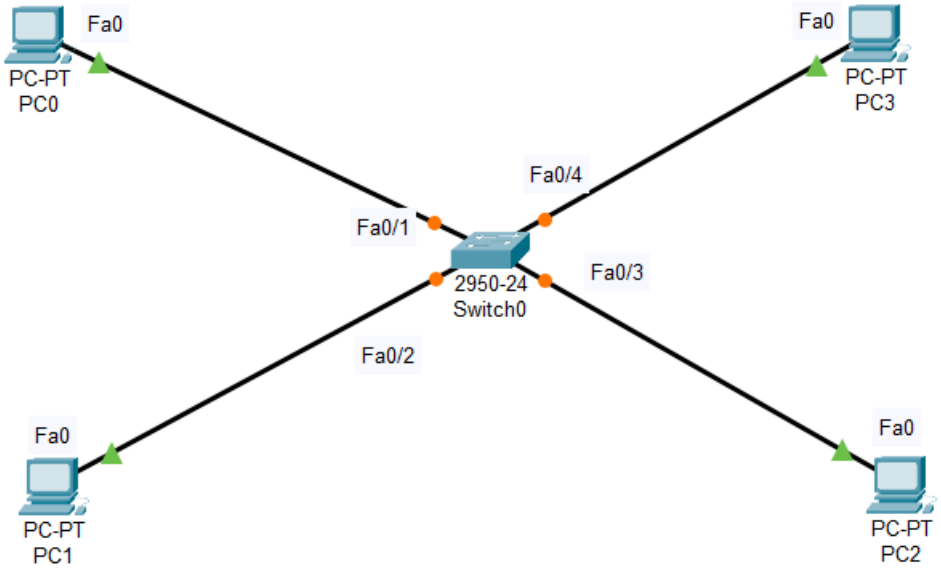
```
C:\>arp -a
  Internet Address      Physical Address      Type
  94.11.1.2             0002.171b.8265        dynamic

C:\>
```

```
C:\>arp -a
  Internet Address      Physical Address      Type
  94.11.1.1             0002.4a9a.d40b        dynamic

C:\>
```

Exercise-2: (Note: Start allocation IP address number from PC0)



Redraw above diagram which includes IP address and MAC address. Take IP address and MAC address as per your instruction. Insert image below.



- Ipconfig: fill table ipconfig of all computers
  PC0

Link local IPV6 Address	FE80: :2D0 : FFFF : FEAD: 30B8
IP address	97.1.1.1
Subnet Mask	255.0.0.0
Default Gateway	0.0.0.0

PC1

Link local IPV6 Address	FE80: :201 : 97FF : FE6A: CA3B
IP address	97.1.1.2
Subnet Mask	255.0.0.0
Default Gateway	0.0.0.0

PC2

Link local IPV6 Address	FE80: :2E0 : A3FF : FEED: 32E4
IP address	97.1.1.3
Subnet Mask	255.0.0.0
Default Gateway	0.0.0.0

PC3

Link local IPV6 Address	FE80: :260 : 5CFF : FE89: 8E8C
IP address	97.1.1.4
Subnet Mask	255.0.0.0
Default Gateway	0.0.0.0

- Ipconfig /all: apply command on command prompt and write parameters and values in following table.

  PC0

Parameter	**Value**
DHCP server	0.0.0.0
DHCPv6 IAID	-
DHCPv6 Client DUID	00-01-00-01-9C-B1-AD-D1-00-DO-FF-AD-30-B8
DNS Servers	0.0.0.0

  PC1

Parameter	**Value**
DHCP server	0.0.0.0
DHCPv6 IAID	-
DHCPv6 Client DUID	00-01-00-01-5B-90-3C-5C-00-02-4A-6A-C4-3B
DNS Servers	0.0.0.0

  PC2

Parameter	**Value**
DHCP server	0.0.0.0
DHCPv6 IAID	-
DHCPv6 Client DUID	00-01-00-01-5B-90-3C-5C-00-02-A3-ED-32-E4
DNS Servers	0.0.0.0

  PC3

Parameter	**Value**
DHCP server	0.0.0.0
DHCPv6 IAID	-
DHCPv6 Client DUID	00-01-00-01-B0-D8-CB-5C-00-02-4A-89-8E-BC
DNS Servers	0.0.0.0

- Arp –a: before ping write/snap of output of command from all computers

```
C:\>arp -a
No ARP Entries Found
C:\>
```

- Ping from PC0 to PC1 and vice versa and get the output here.

```
C:\>ping 97.1.1.1

Pinging 97.1.1.1 with 32 bytes of data:

Reply from 97.1.1.1: bytes=32 time<1ms TTL=128
Reply from 97.1.1.1: bytes=32 time<1ms TTL=128
Reply from 97.1.1.1: bytes=32 time=4ms TTL=128
Reply from 97.1.1.1: bytes=32 time<1ms TTL=128

Ping statistics for 97.1.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 4ms, Average = 1ms
```

- Arp –a: after ping write/snap of output of command from all computers
- PC0

```
C:\>arp -a
  Internet Address      Physical Address      Type
  97.1.1.1              0002.174c.02c8        dynamic
  97.1.1.2              0030.a318.be6a        dynamic
```

- PC1

```
C:\>arp -a
  Internet Address      Physical Address      Type
  97.1.1.0              0001.c78c.0e7a        dynamic
  97.1.1.2              0030.a318.be6a        dynamic
```

- PC2

```
C:\>arp -a
  Internet Address      Physical Address      Type
  97.1.1.0              0001.c78c.0e7a        dynamic
  97.1.1.1              0002.174c.02c8        dynamic
```

- PC3

```
C:\>arp -a
  Internet Address      Physical Address      Type
  97.1.1.0              0001.c78c.0e7a        dynamic
```

- Netstat: write/snap of output of command from all computers

PC0

```
C:\>netstat

Active Connections

  Proto  Local Address          Foreign Address        State
```

PC1

```
C:\>netstat

Active Connections

  Proto  Local Address          Foreign Address        State
```

PC2

```
C:\>netstat

Active Connections

  Proto  Local Address          Foreign Address        State
```

PC3

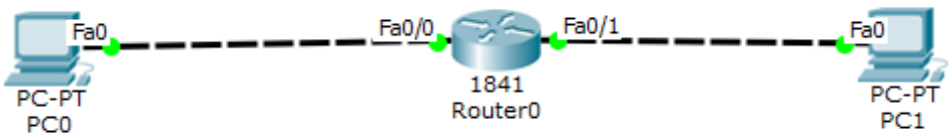
```
C:\>netstat

Active Connections

  Proto  Local Address          Foreign Address        State
```

- show ip route: write/snap of output of command from all computers

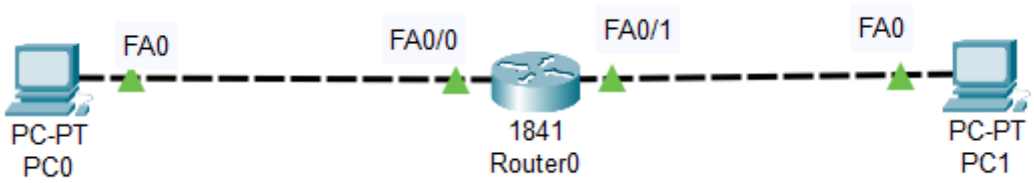
```
C:\>show ip route
Invalid Command.
```

Same output for all computer

Exercise-3 (Note: Start allocation IP address number from PC0)



Redraw above diagram which includes IP address and MAC address. Take IP address and MAC address as per your instruction. Insert image below.



- Ipconfig: fill following table with output of ipconfig of computer.
  PC0

Link local IPV6 Address	FE80::2E0:A3FF:FE9D:597D
IP address	97.1.1.2
Subnet Mask	255.0.0.0
Default Gateway	97.1.1.1

PC1

Parameter	**Value**
Link local IPV6 Address	FE80::210:11FF:FE59:D76B
IP address	23.1.1.2
Subnet Mask	255.0.0.0
Default Gateway	23.1.1.1

- Ipconfig /all: apply command on command prompt and write parameters and values in following table
  PC0

Parameter	**Value**
DHCP server	0.0.0.0
DHCPv6 IAID	-
DHCPv6 Client DUID	00-01-00-01-E9-43-1C-05-00-E0-A3-9D-59-7D
DNS Servers	0.0.0.0

PC1

Parameter	**Value**
DHCP server	0.0.0.0
DHCPv6 IAID	-
DHCPv6 Client DUID	00-01-00-01-DD-04-05-B1-00-10-11-59-D7-6B

DNS Servers	0.0.0.0

- Arp –a: before ping write/snap of output of command from all computers

```
C:\>arp -a
No ARP Entries Found
C:\>
```

- Ping from PC0 to PC1 and vice versa and get the output here.

PC0 – PC1

```
C:\>ping 97.1.1.1

Pinging 97.1.1.1 with 32 bytes of data:

Reply from 97.1.1.1: bytes=32 time=6ms TTL=255
Reply from 97.1.1.1: bytes=32 time<1ms TTL=255
Reply from 97.1.1.1: bytes=32 time<1ms TTL=255
Reply from 97.1.1.1: bytes=32 time<1ms TTL=255

Ping statistics for 97.1.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 6ms, Average = 1ms
```

```
C:\>ping 97.1.1.0

Pinging 97.1.1.0 with 32 bytes of data:

Reply from 97.1.1.0: bytes=32 time<1ms TTL=127
Reply from 97.1.1.0: bytes=32 time<1ms TTL=127
Reply from 97.1.1.0: bytes=32 time<1ms TTL=127
Reply from 97.1.1.0: bytes=32 time<1ms TTL=127

Ping statistics for 97.1.1.0:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

- Arp –a: after ping write/snap of output of command from all computers

PC0

```
C:\>arp -a
  Internet Address      Physical Address      Type
  97.1.1.1              00d0.975a.0486        dynamic
```

PC1

```
C:\>arp -a
  Internet Address      Physical Address      Type
  98.1.1.1              0001.c916.36b8        dynamic
```

- Netstat: write/snap of output of command from all computers

```
C:\>netstat

Active Connections

  Proto  Local Address          Foreign Address        State
```

Same for all computers

- show ip route: write/snap of output of command from all computers

```
C:\>show ip route
Invalid Command.
```

Same for all computers