শিক্ষা নিয়ে গড়বো দেশ তথ্য-প্রযুক্তির বাংলাদেশ

Bangabandhu Sheikh Mujibur Rahman Digital University, Bangladesh

LAB REPORT-08

COURSE NO.-ICT 4256
COURSE TITLE-COMPUTER NETWORKING LAB

SUBMITTED BY

Mehrin Farzana
ID: 2101013
Department of IRE
Session :2021-2022
Bangabandhu Sheikh Mujibur Rahman Digital University, Bangladesh

SUBMITTED TO

Md.Toukir Ahmed
Lecturer
Department of IRE, BDU
Bangabandhu Sheikh Mujibur Rahman Digital University, Bangladesh

Date of Submission: 19 May, 2023

Lab Introduction:

In this lab, we'll be learning about classless IP addresses, subnetting and how to implement it using Cisco Packet Tracer.

Objectives:

- To learn what classless IP addresses are
- To learn what subnetting is
- How classless IP addressing is used in subnetting
- How to configure subnets
- Importance of subnetting

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Experiment No.: 1

Experiment Title: Subnetting.

Objectives:

- To learn what classless IP addresses are
- To learn what subnetting is
- How a class full IP address is converted into a classless IP address in favour of subnetting
- How classless IP addressing is used in subnetting
- How to configure subnets

Discussion:

When a network is divided into multiple smaller networks, the process is called subnetting.
Here we take an IP address, classless or class-full, and borrow some bits from it's host portion and use them as network bits, or to be exact, subnetwork bits.

Methodology:

- Create the network topology.
- Configuration of the Network Nodes.
- Choose the Statistics.
- Run the Simulation.
- Analysis of the Results.

Working procedure:

1. Giving the geometric shape of the topology

Taken devices:
a. Six PCs
b. Two 2960-24TT switches
c. One 2911 Router

Connecting 6 PCs to 2 switches, 3 per each, and then connecting the 2 switches to a router with straight through copper cable, as they are different typed devices.

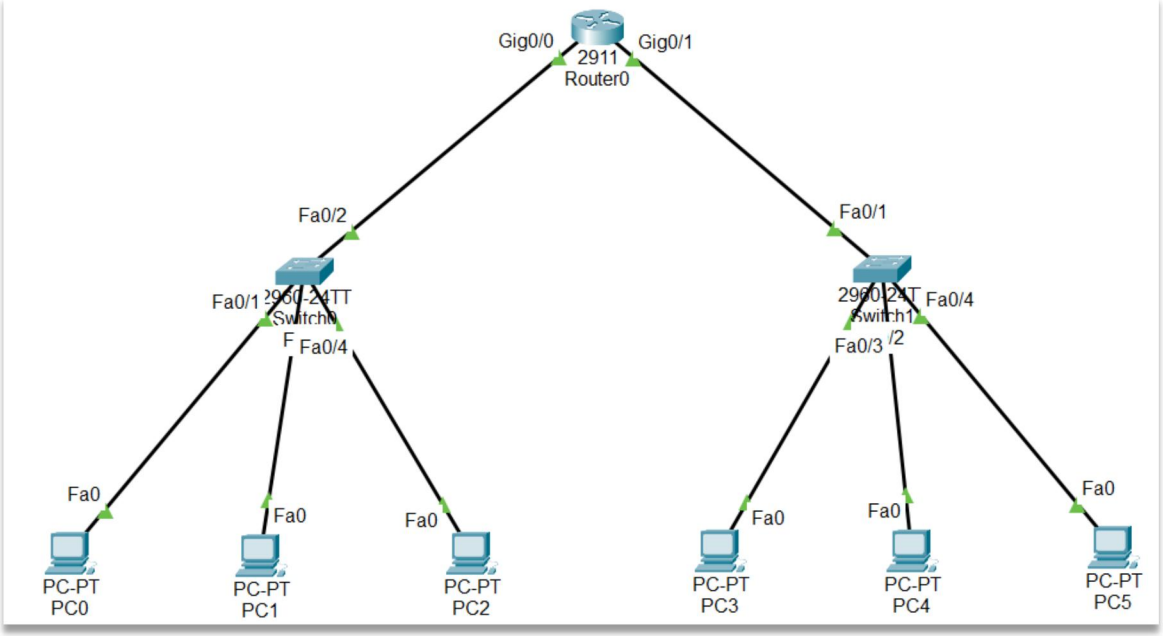

Fig 1.1: Simulating the topology using CPT.

2. Configuring the devices

Here we have taken a class C IP address for subnetting;
Given network address: 192.168.0.0
Subnet mask: 255.255.255.0

Since we have 2 LANs, we only need 2 subnetting addresses.
We know, $2^1 = 2$
Therefore, we only need to take 1 bit from the host portion of our initial class C IP address.
As a class C IP address already has 24 bits from the left , meaning, 3 octets fixed for it's network portion, we take 1 bit from the 4th octet for subnetting.

8 bits	8 bits	8 bits	1 bit	7 bits
Network bits			Subnet bit	Host bits

Now,
Network address: 192.168.0.0/25
Subnet mask: 255.255.255.128
Number of possible subnets: $2^1 = 2$
Number of hosts per subnet: $2^7 - 2 = 126$
Subnet range: 192.168.0.0 - 192.168.0.127
192.168.0.128 - 192.168.0.255

2.1. Configure the PCs with the following IP addresses and Subnet Masks
Here the Subnet Masks have to be manually added.

Host	IP Address	Subnet Mask	Default Gateway
PC0	192.168.0.1	255.255.255.128	192.168.0.4
PC1	192.168.0.2	255.255.255.128	192.168.0.4
PC2	192.168.0.3	255.255.255.128	192.168.0.4
PC3	192.168.0.129	255.255.255.128	192.168.0.132
PC4	192.168.0.130	255.255.255.128	192.168.0.132
PC5	192.168.0.131	255.255.255.128	192.168.0.132

2.2. Configure the router with the following IP addresses and Subnet Masks

Host	Port	IP Address	Subnet Mask
Router1	Gig0/0	192.168.0.4	255.255.255.128
	Gig0/1	192.168.0.132	255.255.255.128

3. Sending data across PCs

3.1. Connection tests across PCs

Ping PCs by there IP addresses from another PC in Command Prompt. If connection is there, four replies will come.

Command: ping<space>'IP address of some other PC'

For first time communication, some packets may be lost.

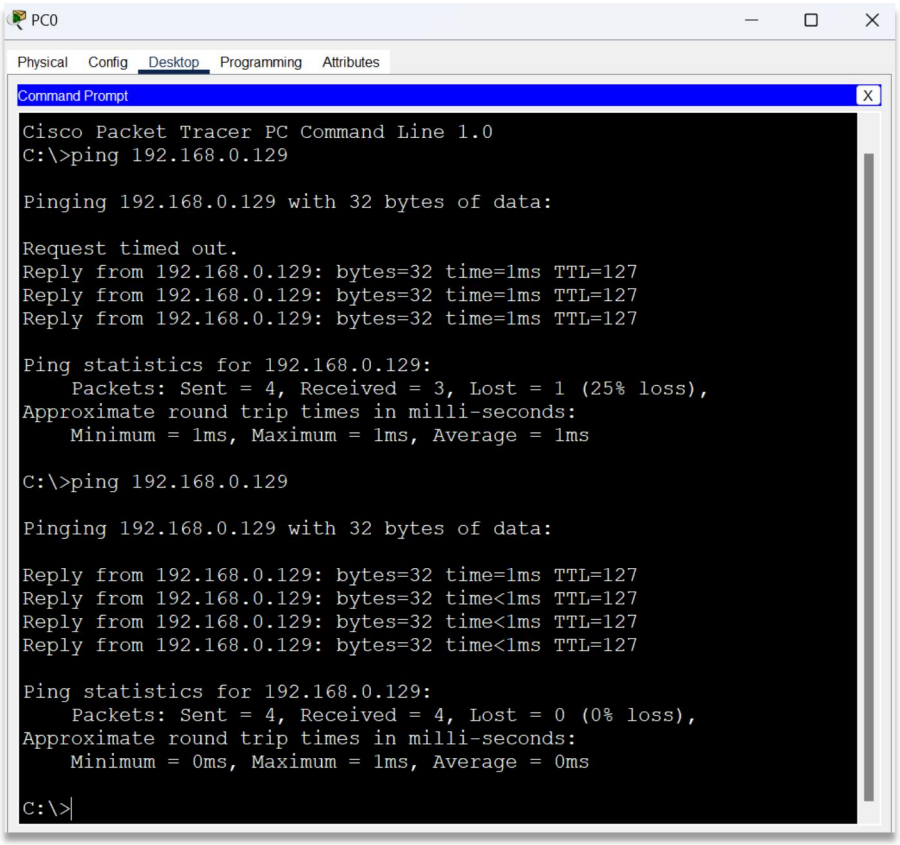

Fig 1.2: Pinging PC3 from PC0

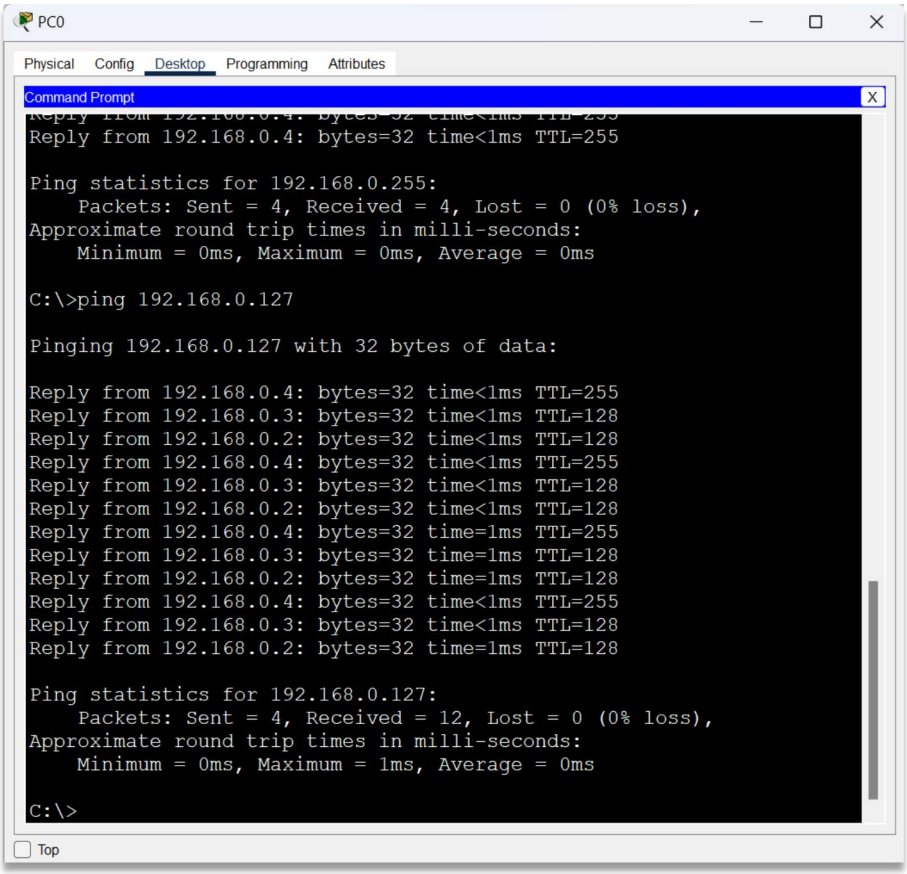

Fig 1.3: Pinging using the broadcast address of Subnet1 from PC0

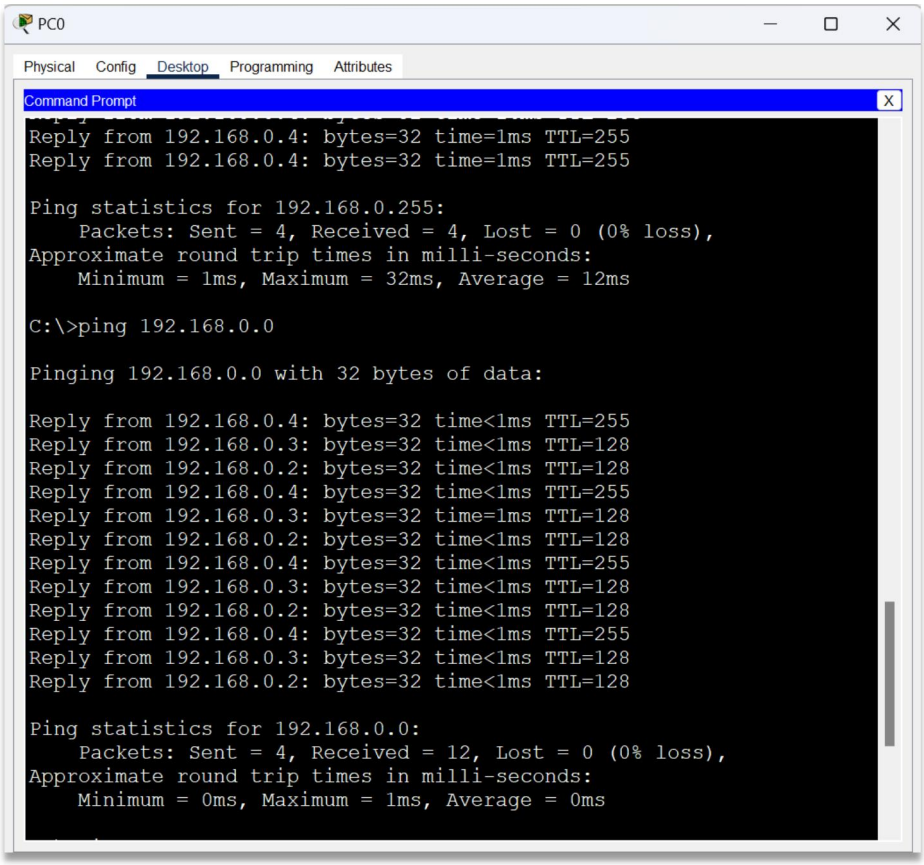

Fig 1.4: Pinging using the subnet address of Subnet1 address of Subnet1 from PC0

Simulation:

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC0	PC3	ICMP		0.000	N	0	(edit)	(delete)
	Successful	PC1	PC4	ICMP		0.000	N	1	(edit)	(delete)
	Successful	PC2	PC5	ICMP		0.000	N	2	(edit)	(delete)

Fig 1.5: Successful packets travel across PCs

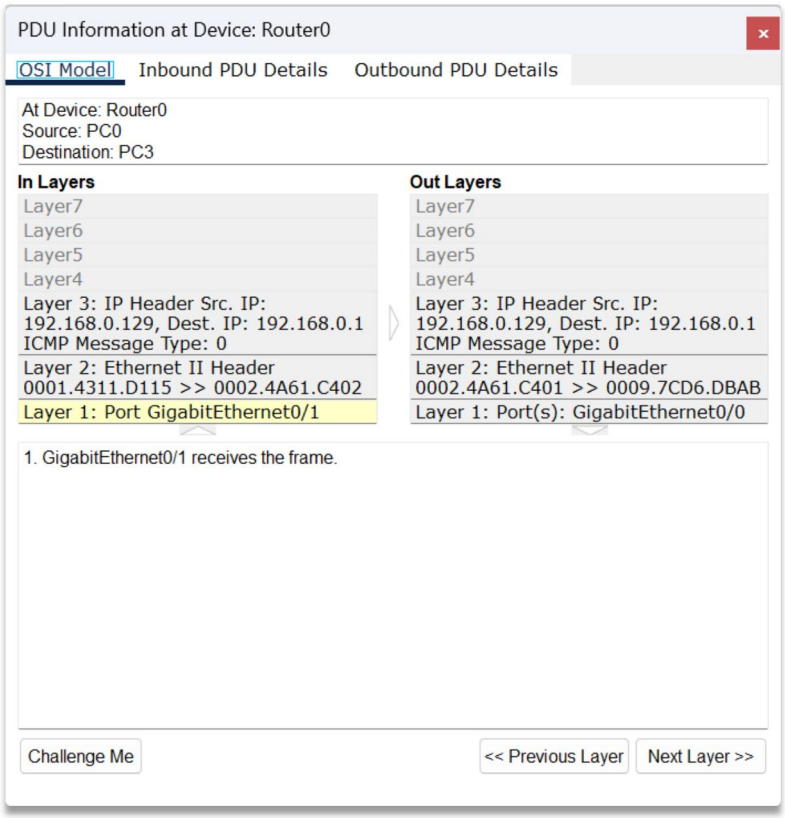

Fig 1.6: PDU information at the OSI model at Router1

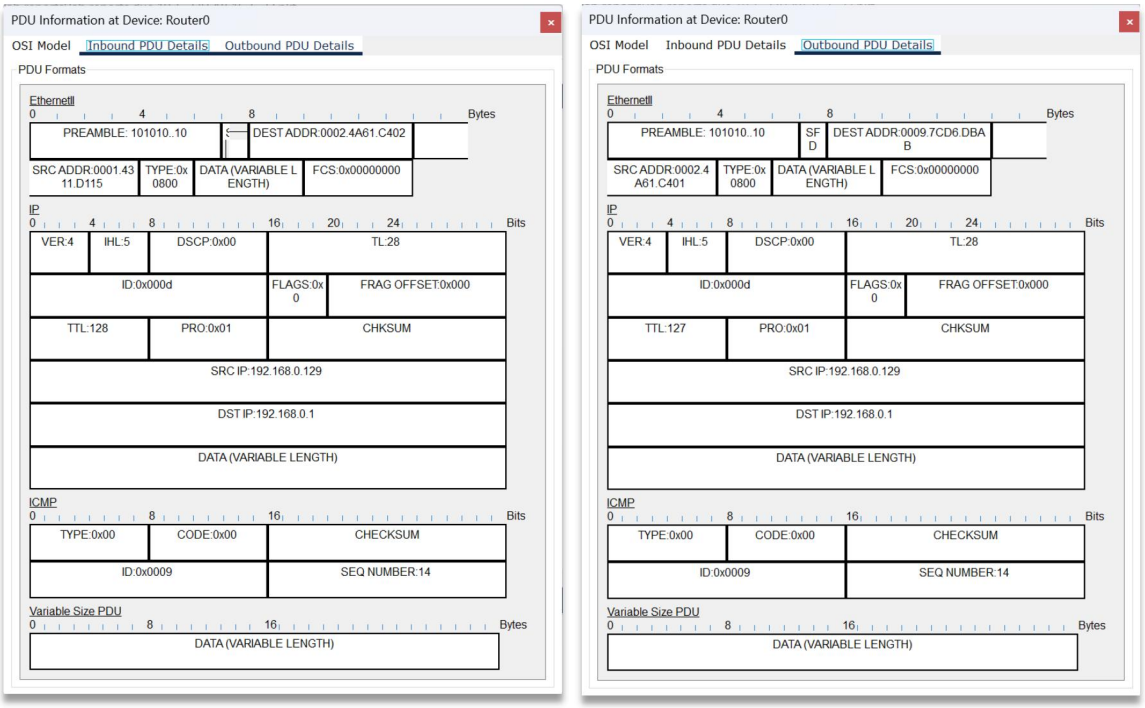

Fig 1.7: Inbound and Outbound Protocol data unit details at Router0

Conclusion:

Subnetting allows to create multiple networks using a single network address.

Benefits of subnetting;
1. Less network traffic
2. High performance of network
3. Easy to manage
4. Network can e elaborated
5. Easy to divide the network
6. Save of cost of buying more network addresses
7. Convenient
8. Allows isolated localization of a LAN

Caution:

- During device configuration,
  - It is very important to note the range of IP addresses in a given subnet. The subnet address of a subnet must be different from other subnets connected to that router. Otherwise, the addresses will overlap and the network won't be successfully established.
  - One must manually input the proper subnet masks

Experiment No.: 2

Experiment Title: Subnetting using a class C IP address.

Objectives:

- To learn what classless IP addresses are
- To learn what subnetting is
- How a class full IP address is converted into a classless IP address in favour of subnetting
- How classless IP addressing is used in subnetting
- How to configure subnets

Discussion:

When a network is divided into multiple smaller networks, the process is called subnetting.

Here we take an IP address, classless or class-full, and borrow some bits from it's host portion and use them as network bits, or to be exact, subnetwork bits.

Methodology:

- Create the network topology.
- Configuration of the Network Nodes.
- Choose the Statistics.
- Run the Simulation.
- Analysis of the Results.

Working procedure:

1. Giving the geometric shape of the topology

Taken devices:
a. Six PCs
b. Two 2960-24TT switches
c. One 2911 Router

Connecting 6 PCs to 2 switches, 3 per each, and then connecting the 2 switches to a router with straight through copper cable, as they are different typed devices.

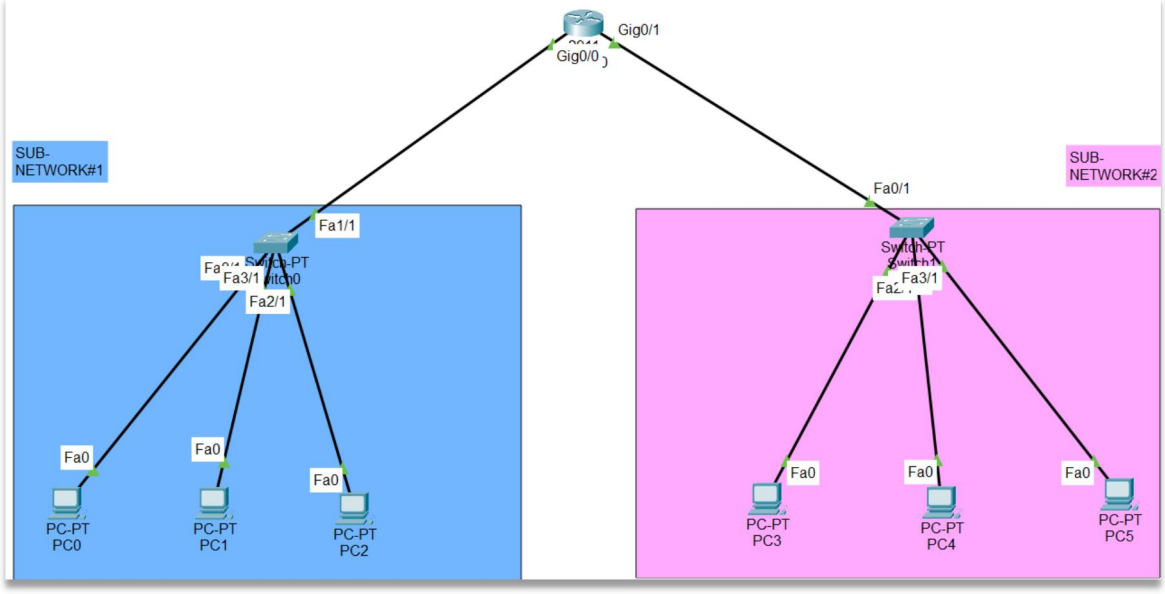

Fig 2.1: Simulating the topology using CPT.

2. Configuring the devices

Here we have taken a class C IP address for subnetting;
Given network address: 192.168.10.0
Subnet mask: 255.255.255.0

Since we have 2 LANs, we only need 2 subnetting addresses.
We know, $2^1 = 2$
Therefore, we only need to take 1 bit from the host portion of our initial class C IP address.
As a class C IP address already has 24 bits from the left , meaning, 3 octets fixed for it's network portion, we take 1 bit from the 4^{th} octet for subnetting.

8 bits	8 bits	8 bits	1 bit	7 bits
Network bits			Subnet bit	Host bits

Now,
Network address: 192.168.10.0/25
Subnet mask: 255.255.255.128
Number of possible subnets: $2^1 = 2$
Number of hosts per subnet: $2^7 - 2 = 126$
Subnet range: 192.168.10.0 - 192.168.10.127
192.168.10.128 - 198.162.10.255

2.1. Configure the PCs with the following IP addresses and Subnet Masks
Here the Subnet Masks have to be manually added.

Host	IP Address	Subnet Mask	Default Gateway
PC0	192.168.10.1	255.255.255.128	192.168.10.4
PC1	192.168.10.2	255.255.255.128	192.168.10.4
PC2	192.168.10.3	255.255.255.128	192.168.10.4
PC3	192.168.10.129	255.255.255.128	192.168.10.132
PC4	192.168.10.130	255.255.255.128	192.168.10.132
PC5	192.168.10.131	255.255.255.128	192.168.10.132

2.2. Configure the router with the following IP addresses and Subnet Masks

Host	Port	IP Address	Subnet Mask
Router1	Gig0/0	192.168.10.4	255.255.255.128
	Gig0/1	192.168.10.132	255.255.255.128

3. **Sending data across PCs**

3.1. Connection tests across PCs

Ping PCs by there IP addresses from another PC in Command Prompt. If connection is there, four replies will come.

Command: ping<space>'IP address of some other PC'

For first time communication, some packets may be lost.

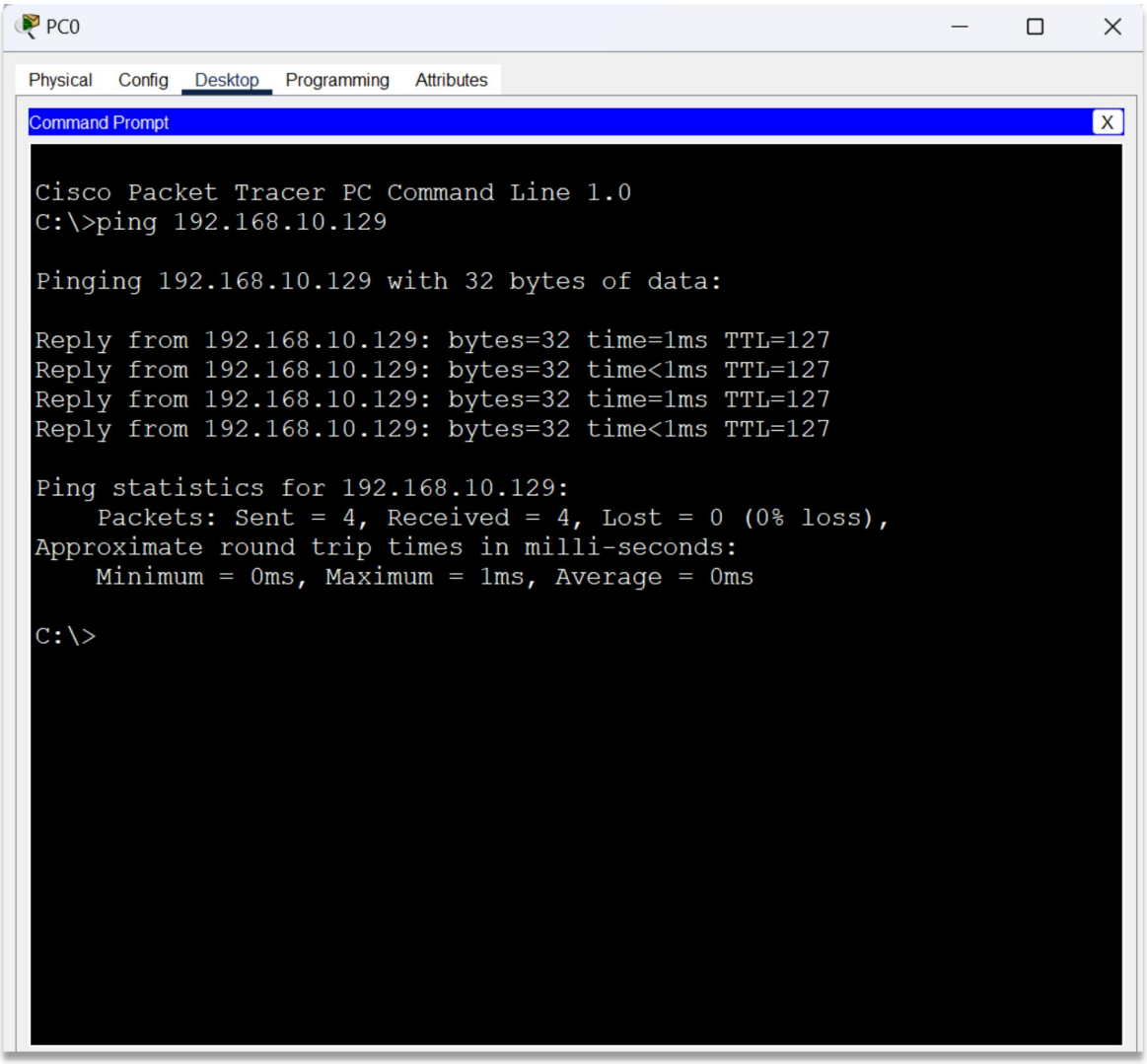

Fig 2.2: Pinging PC3 from PC0

Simulation:

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC0	PC3	ICMP		0.000	N	0	(edit)	(delete)
	Successful	PC1	PC4	ICMP		0.000	N	1	(edit)	(delete)
	Successful	PC2	PC5	ICMP		0.000	N	2	(edit)	(delete)

Fig 21.3: Successful packets travel across PCs

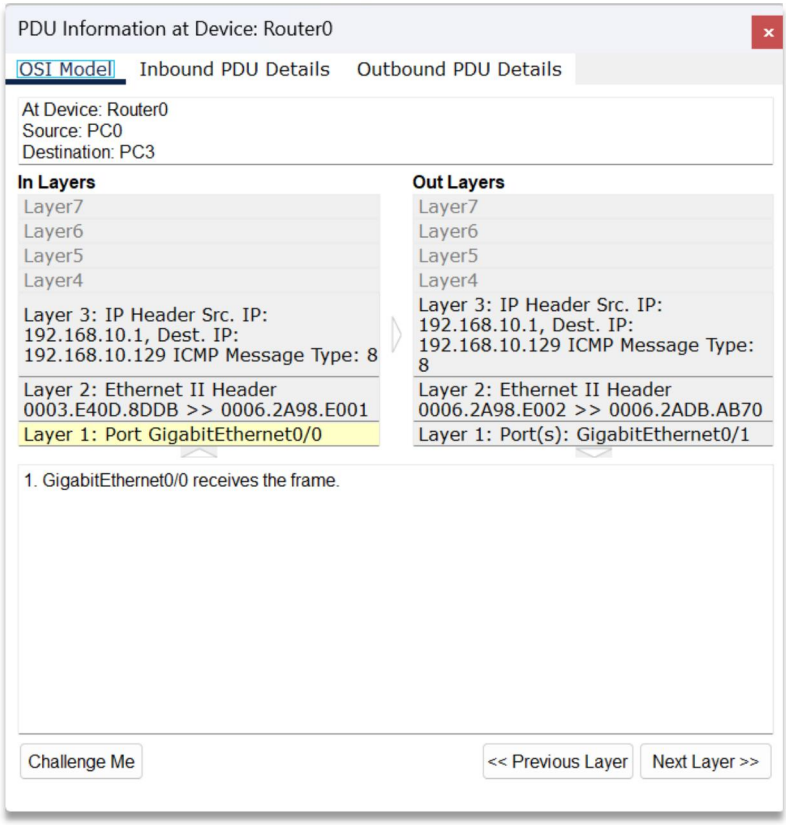

Fig 2.4: PDU information at the OSI model at Router1

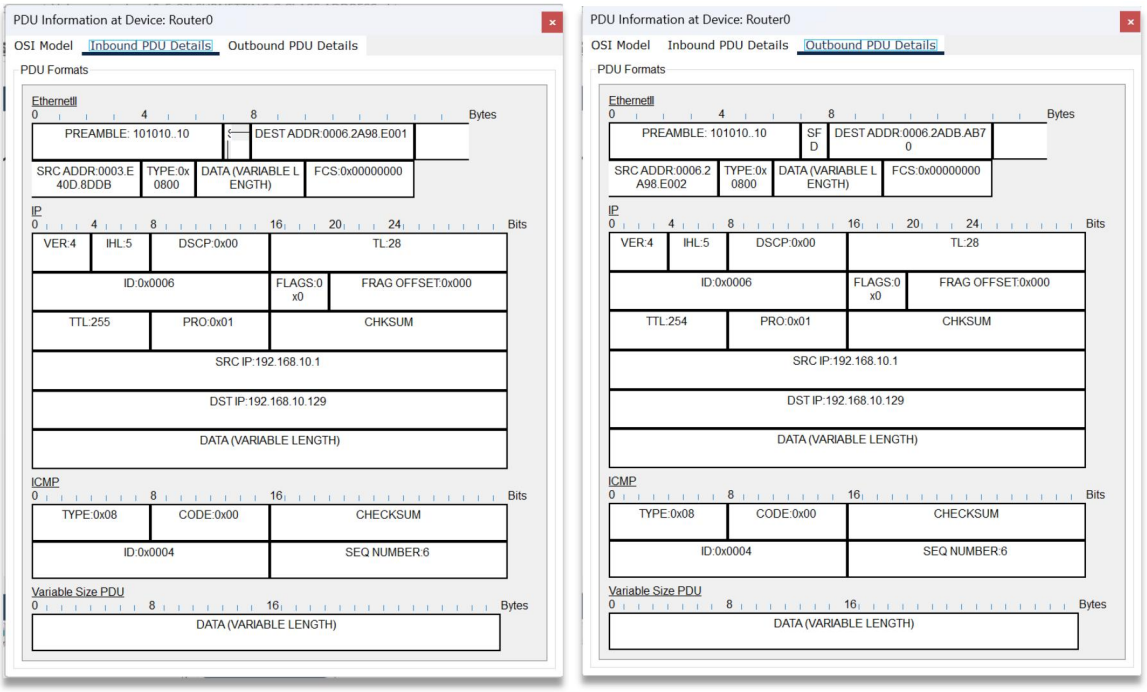

Fig 2.5: Inbound Protocol data unit details at Router0

Conclusion:

Subnetting allows to create multiple networks using a single network address.

Benefits of subnetting;
9. Less network traffic
10. High performance of network
11. Easy to manage
12. Network can be elaborated
13. Easy to divide the network
14. Save of cost of buying more network addresses
15. Convenient
16. Allows isolated localization of a LAN

Caution:

- During device configuration,
  - It is very important to note the range of IP addresses in a given subnet. The subnet address of a subnet must be different from other subnets connected to that router. Otherwise, the addresses will overlap and the network won't be successfully established.
  - One must manually input the proper subnet masks

Experiment No.: 3

Experiment Title: Subnetting using a class B IP address.

Objectives:

- To learn what classless IP addresses are
- To learn what subnetting is
- How a class full IP address is converted into a classless IP address in favour of subnetting
- How classless IP addressing is used in subnetting
- How to configure subnets

Discussion:

When a network is divided into multiple smaller networks, the process is called subnetting.

Here we take an IP address, classless or class-full, and borrow some bits from it's host portion and use them as network bits, or to be exact, subnetwork bits.

Methodology:

- Create the network topology.
- Configuration of the Network Nodes.
- Choose the Statistics.
- Run the Simulation.
- Analysis of the Results.

Working procedure:

1. Giving the geometric shape of the topology

Taken devices:
a. Six PCs
b. Three 2960-24TT switches
c. Two 2911 Routers

Connecting 6 PCs to 3 switches, 2 per each, and then connecting the Switch0 with Router0 and Switch1, Switch2 with Router 1 and then connecting the 2 routers with each other with straight through copper cable, as they are different typed devices.

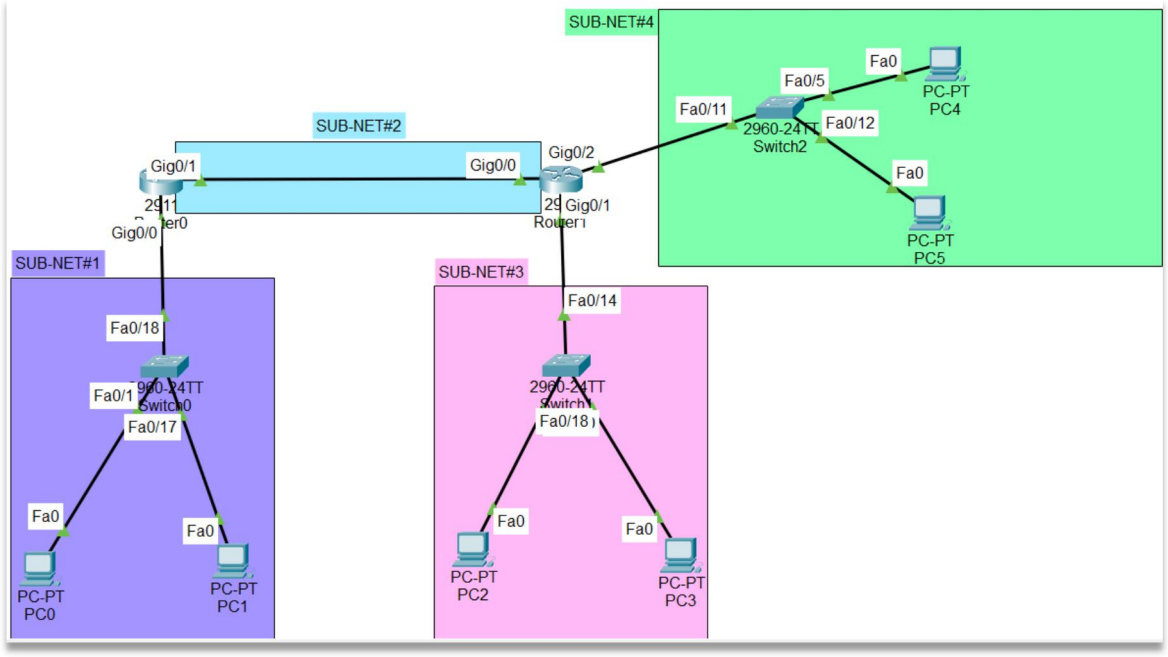

Fig 3.1: Simulating the topology using CPT.

2. **Configuring the devices**

Here we have taken a class B IP address for subnetting;
Given network address: 172.16.0.0
Subnet mask: 255.255.0.0

We will be taking 4 bits for subnetting
We know, $2^4 = 16$

Since we have 4 LANs, we only need 4 subnetting addresses.
As a class B IP address already has 16 bits from the left , meaning, 2 octets fixed for it's network portion, we take 4 bits from the 3rd octet for subnetting.

8 bits	8 bits	4 bits	12 bits
Network bits		Subnet bits	Host bits

Now,
Network address: 172.16.0.0/20
Subnet mask: 255.255.240.0
Number of possible subnets: $2^4 = 16$
Number of hosts per subnet: $2^{12} - 2 = 4094$

Subnet range: 172.16.0.0 - 172.16.15.255
172.16.16.0 - 172.16.31.255
172.16.32.0 - 172.16.47.255
172.16.48.0 - 172.16.63.255

2.1. Configure the PCs with the following IP addresses and Subnet Masks

Host	IP Address	Subnet Mask	Default Gateway
PC0	172.16.0.1	255.255.240.0	172.16.0.3
PC1	172.16.0.2	255.255.240.0	172.16.0.3
PC2	172.16.32.1	255.255.240.0	172.16.32.3
PC3	172.16.32.2	255.255.240.0	172.16.32.3
PC4	172.16.48.1	255.255.240.0	172.16.48.3
PC5	172.16.48.2	255.255.240.0	172.16.48.3

2.2. Configure the routers with the following IP addresses and Subnet Masks

Host	Port	IP Address	Subnet Mask
Router0	Gig0/0	172.16.0.3	255.255.240.0
	Gig0/1	172.16.16.1	255.255.240.0
Router1	Gig0/0	172.16.16.2	255.255.240.0
	Gig0/1	172.16.32.3	255.255.240.0
	Gig0/2	172.16.48.3	255.255.240.0

2.3. Configure the static routes of the routers with the following Network IP addresses and Subnet Masks and Next Hop IP addresses

Host	#Route	Network IP	Subnet Mask	Next Hop's IP
Router 0	1	172.16.32.0	255.255.240.0	172.16.16.2
	2	172.16.48.0	255.255.240.0	172.16.16.2
Router 1	1	172.16.0.0	255.255.240.0	172.16.16.1

Note, Even though using RIP is far more convenient than using Static Routing; the drawback of RIP is that it is only applicable for class-full IP addresses.

3. **Sending data across PCs**

3.1. Connection tests across PCs

Ping PCs by there IP addresses from another PC in Command Prompt. If connection is there, four replies will come.

Command: ping<space>'IP address of some other PC'

For first time communication, some packets may be lost.

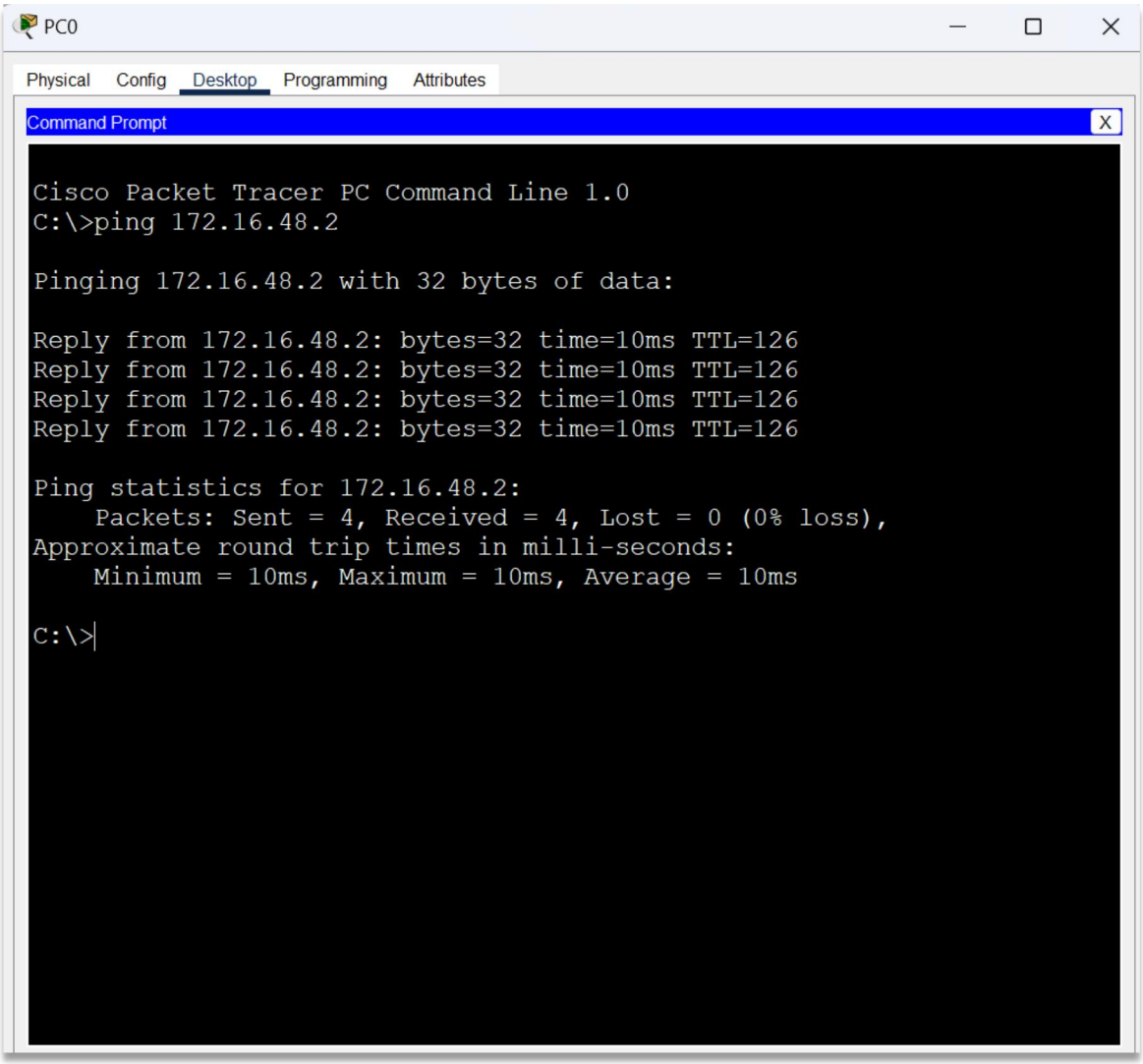

Fig 3.2: Pinging PC5 from PC0

4. Simulation:

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC0	PC5	ICMP		0.000	N	0	(edit)	(delete)
	Successful	PC1	PC4	ICMP		0.000	N	1	(edit)	(delete)
	Successful	PC5	PC3	ICMP		0.000	N	2	(edit)	(delete)

Fig 3.3: Successful packets travel across PCs

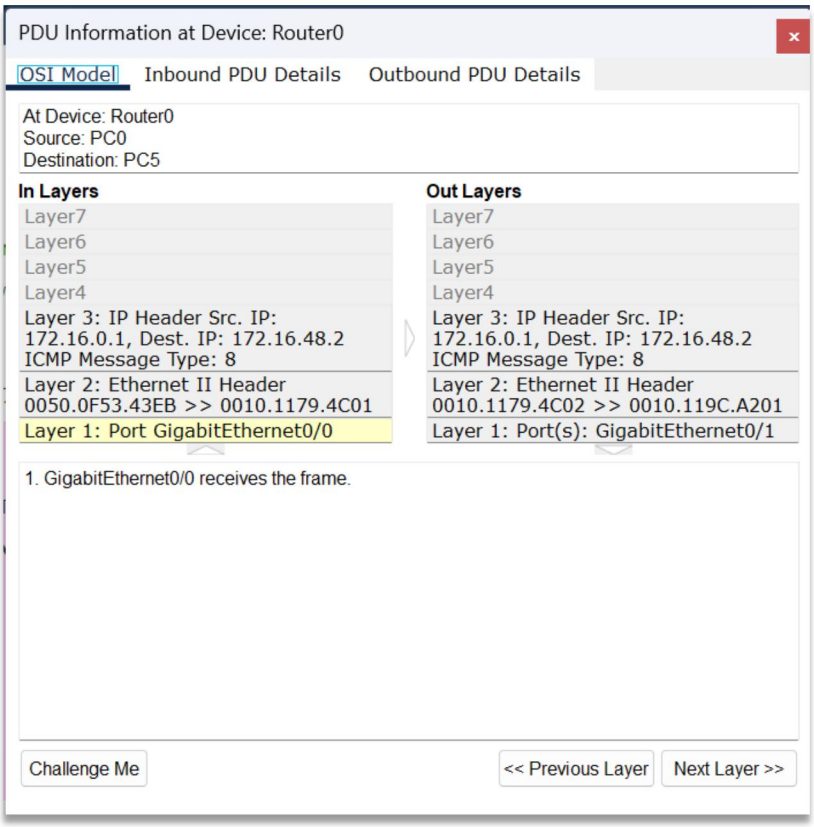

Fig 3.4: PDU information at the OSI model in Router0

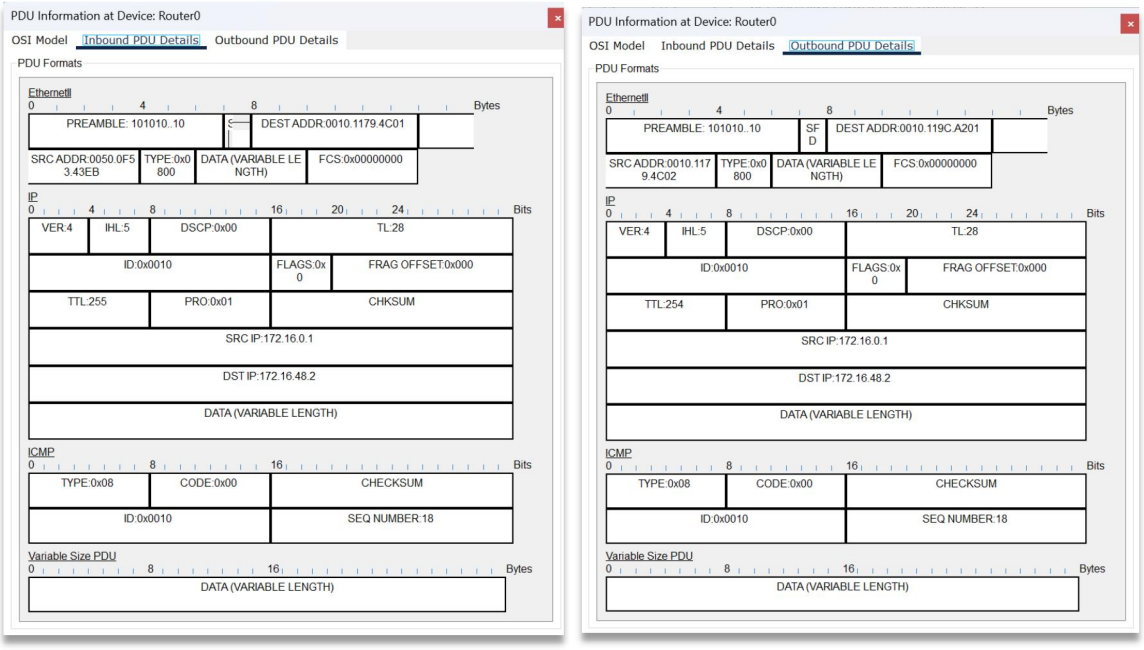

Fig 3.5: Inbound Protocol data unit details at Router0

Conclusion:

Subnetting allows to create multiple networks using a single network address.

Benefits of subnetting;
17. Less network traffic
18. High performance of network
19. Easy to manage
20. Network can be elaborated
21. Easy to divide the network
22. Save of cost of buying more network addresses
23. Convenient
24. Allows isolated localization of a LAN

Caution:

- During device configuration,
  - It is very important to note the range of IP addresses in a given subnet. The subnet address of a subnet must be different from other subnets connected to that router. Otherwise, the addresses will overlap and the network won't be successfully established.
  - One must manually input the proper subnet masks

Experiment No.: 4

Experiment Title: Subnetting using a class C IP address.

Objectives:

- To learn what classless IP addresses are
- To learn what subnetting is
- How a class full IP address is converted into a classless IP address in favour of subnetting
- How classless IP addressing is used in subnetting
- How to configure subnets

Discussion:

When a network is divided into multiple smaller networks, the process is called subnetting.

Here we take an IP address, classless or class-full, and borrow some bits from it's host portion and use them as network bits, or to be exact, subnetwork bits.

Methodology:

- Create the network topology.
- Configuration of the Network Nodes.
- Choose the Statistics.
- Run the Simulation.
- Analysis of the Results.

Working procedure:

1. Giving the geometric shape of the topology

Taken devices:
a. Four PCs
b. Two 2960-24TT switches
c. One 2911 Router

Connecting 4 PCs to 2 switches, 2 per each, and then connecting the 2 switches to a router with straight through copper cable, as they are different typed devices.

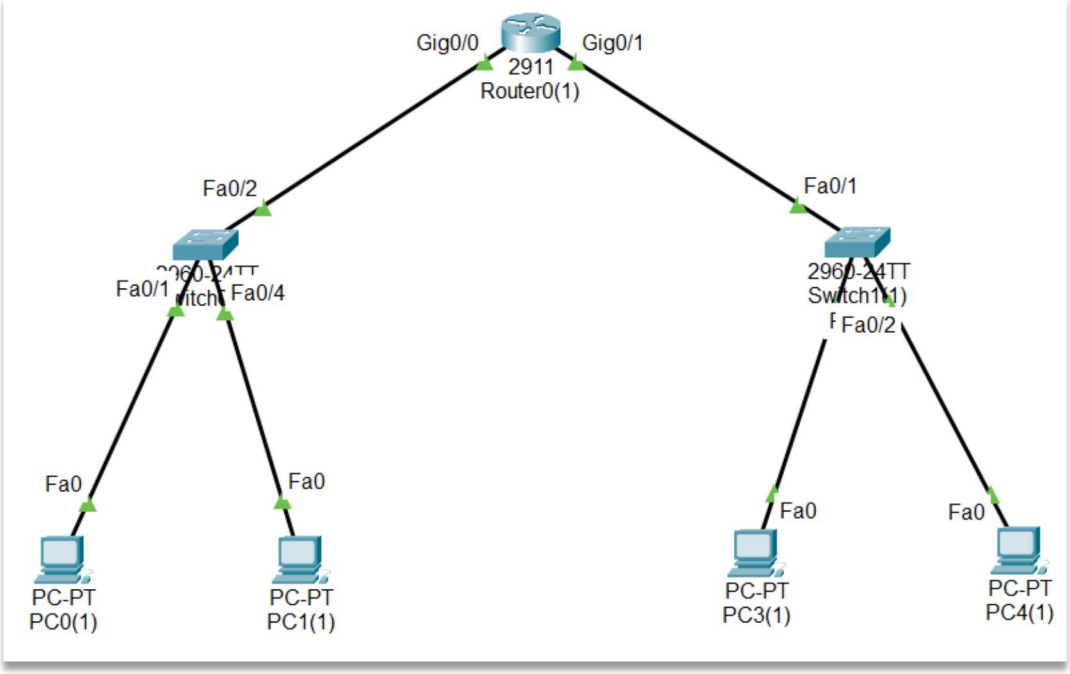

Fig 4.1: Simulating the topology using CPT.

2. **Configuring the devices**

Here we have taken a class A IP address for subnetting;
Given network address: 1.0.0.0
Subnet mask: 255.0.0.0

Since we have 2 LANs, we only need 2 subnetting addresses.
We know, $2^1 = 2$
Therefore, we only need to take 1 bit from the host portion of our initial class A IP address.
As a class A IP address already has 8 bits from the left , meaning, 1 octet fixed for it's network portion, we take 1 bit from the 2nd octet for subnetting.

8 bits	1 bit	7 bits	8 bit	8 bits
Network bits	Subnet bit	Host bits		

Now,
Network address: 1.0.0.0/9
Subnet mask: 255.128.0.0
Number of possible subnets: $2^1 = 2$
Number of hosts per subnet: $2^{23} - 2 = 8388606$
Subnet range: 1.0.0.0 - 1.127.255.255
1.128.0.0 - 1.255.255.255

2.1. Configure the PCs with the following IP addresses and Subnet Masks
Here the Subnet Masks have to be manually added.

Host	IP Address	Subnet Mask	Default Gateway
PC0	1.0.0.1	255.128.0.0	1.0.0.3
PC1	1.0.0.2	255.128.0.0	1.0.0.3
PC2	1.128.0.1	255.128.0.0	1.128.0.3
PC3	1.128.0.2	255.128.0.0	1.128.0.3

2.2. Configure the router with the following IP addresses and Subnet Masks

Host	Port	IP Address	Subnet Mask
Router1	Gig0/0	1.0.0.3	255.128.0.0
	Gig0/1	1.128.0.3	255.128.0.0

3. **Sending data across PCs**

3.1. Connection tests across PCs

Ping PCs by there IP addresses from another PC in Command Prompt. If connection is there, four replies will come.

Command: ping<space>'IP address of some other PC'

For first time communication, some packets may be lost.

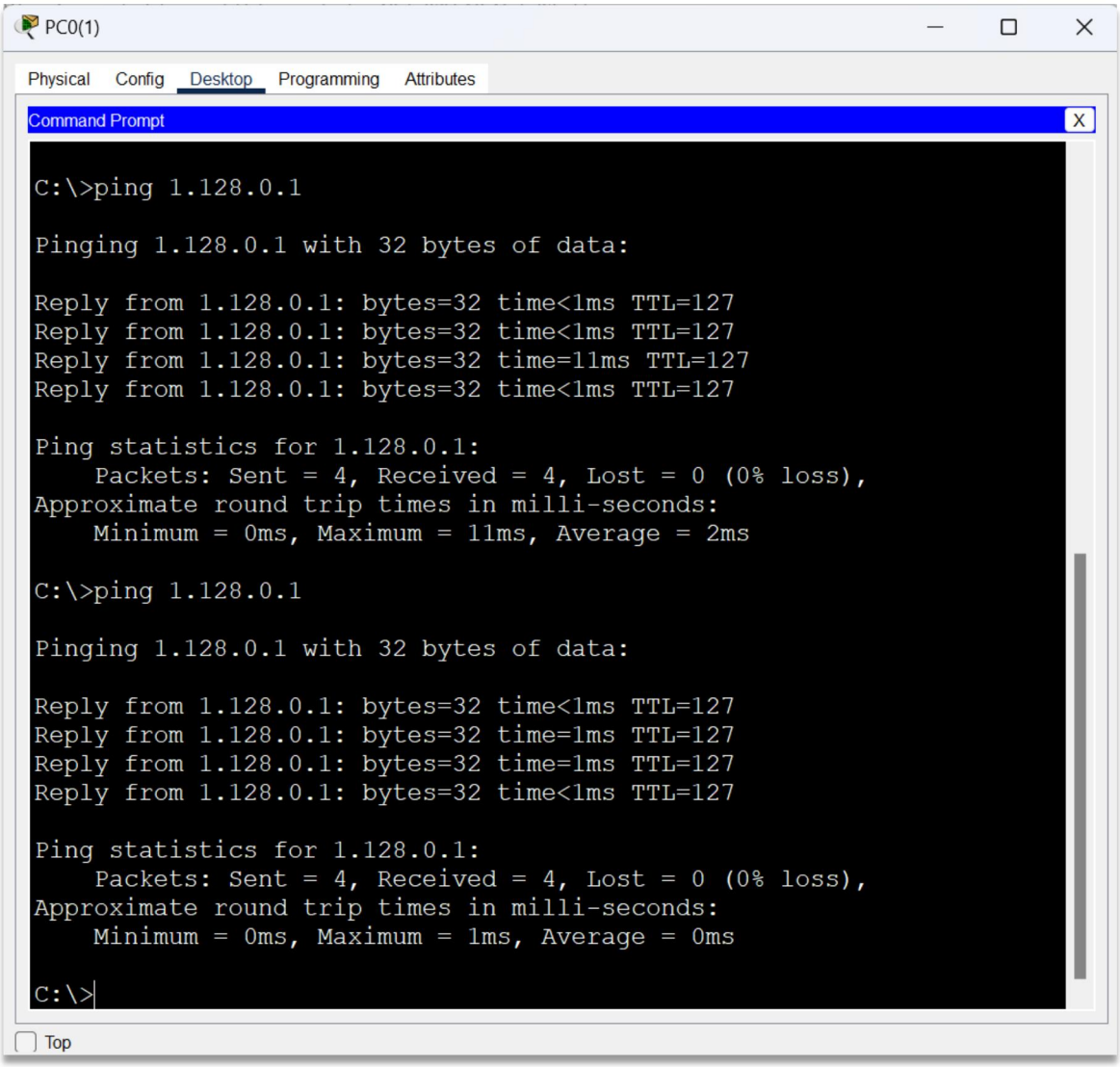

Fig 4.2: Pinging PC3(1) from PC0(1)

Simulation:

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC0(1)	PC3(1)	ICMP		0.000	N	0	(edit)	(delete)
	Successful	PC0(1)	PC4(1)	ICMP		0.000	N	1	(edit)	(delete)
	Successful	PC1(1)	PC3(1)	ICMP		0.000	N	2	(edit)	(delete)

Fig 4.3: Successful packets travel across PCs

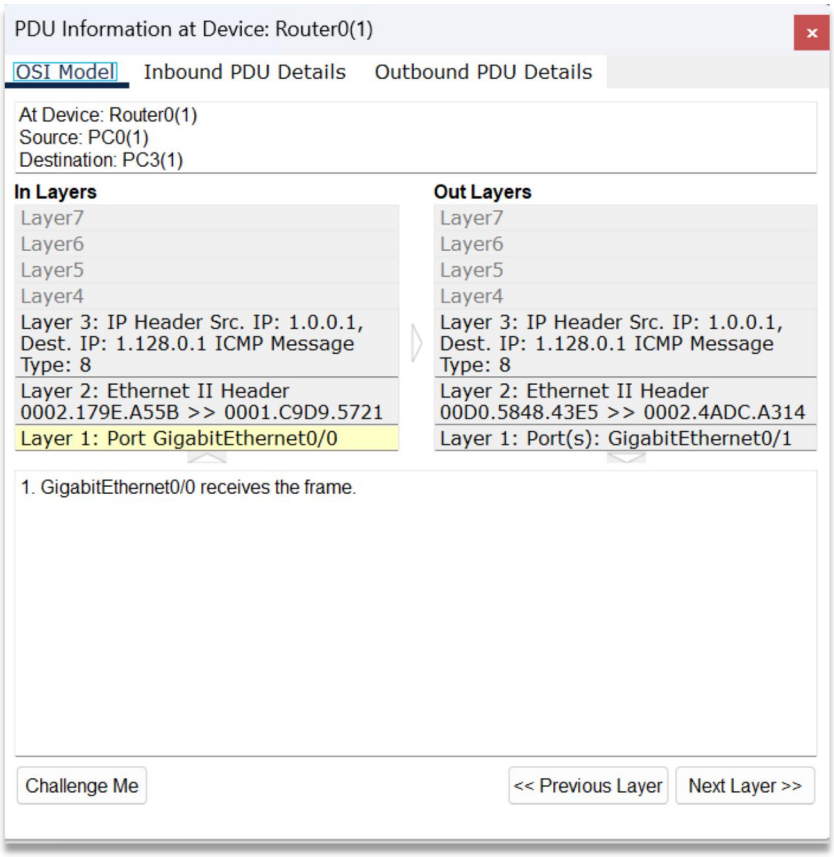

Fig 4.4: PDU information at the OSI model at Router1

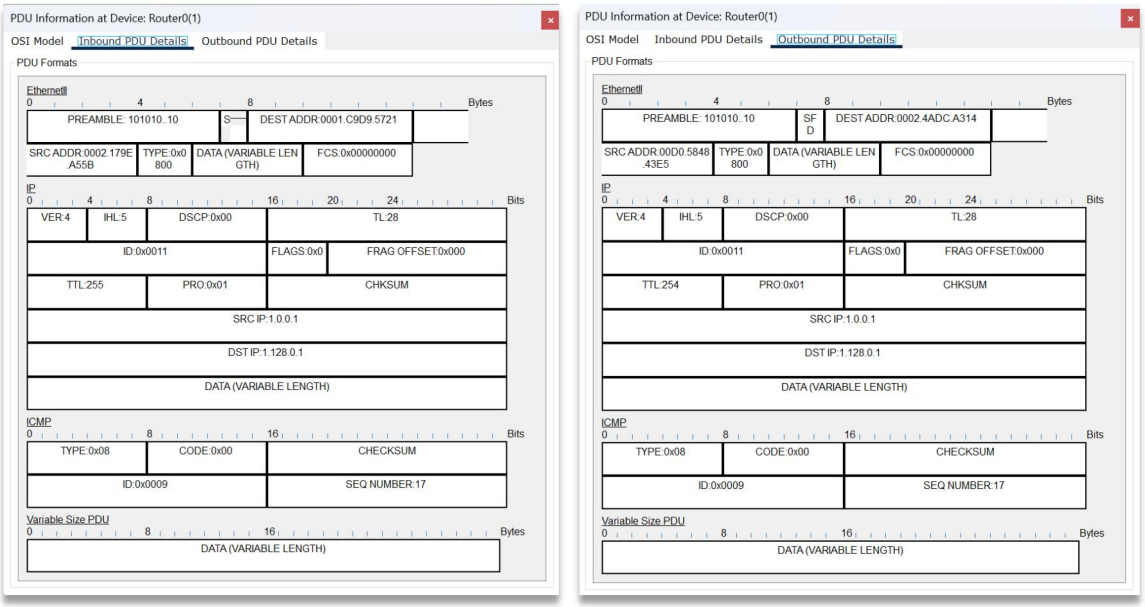

Fig 4.5: Inbound Protocol data unit details at Router0

Conclusion:

Subnetting allows to create multiple networks using a single network address.

Benefits of subnetting;

1. Less network traffic
2. High performance of network
3. Easy to manage
4. Network can be elaborated
5. Easy to divide the network
6. Save of cost of buying more network addresses
7. Convenient
8. Allows isolated localization of a LAN

Caution:

- During device configuration,
  - It is very important to note the range of IP addresses in a given subnet. The subnet address of a subnet must be different from other subnets connected to that router. Otherwise, the addresses will overlap and the network won't be successfully established.
  - One must manually input the proper subnet masks

Lab Conclusion:

From this lab we got to know about,

- Subnetting
  - The process of dividing a network into smaller manageable networks.
  - Taking a single network address and converting it into multiple sub-network addresses.
- Subnetting using a class C IP address
  - A class C IP address has 3 octets reserved for network id and only 1 octet for host id. There for it's not ideal for subnetting a big network.

- Subnetting using a class B IP address
  - A class B IP address has 2 octets reserved for network id and 2 octets for host id. There for it's okay for subnetting a big network.

- Subnetting using a class A IP address
  - A class A IP address has 1 octet reserved for network id and 3 octets for host id.
  - There for it's ideal for subnetting a big network.

- In case of subnetting, the subnet masks must be manually input and Static Routing have to be used instead of RIP or Dynamic Routing.