

B.M.S. COLLEGE OF ENGINEERING BENGALURU
Autonomous Institute, Affiliated to VTU



Lab Record

Computer Networks – 23CS5PCCON

Submitted in partial fulfillment for the 5th Semester Laboratory

Bachelor of Engineering
in
Computer Science and Engineering

Submitted by:

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August 2025-December 2025

B.M.S. COLLEGE OF ENGINEERING
DEPARTMENT OF COMPUTER SCIENCE AND
ENGINEERING



CERTIFICATE

This is to certify that the Computer Networks (23CS5PCCON) laboratory has been carried out by Dhanush K(1BM24CS404) during the 5th Semester August 2025-December 2025

Signature of the Faculty Incharge:

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Assistant Professor
Department of Computer Science and Engineering
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Table of Contents

PART - A	
Serial No.	Name of Experiment
1.	Create a topology and simulate sending a simple PDU from source to destination using hub and switch as connecting devices and demonstrate ping message.
2.	Configure DHCP within a LAN and outside LAN.
3.	Configure Web Server, DNS within a LAN.
4.	Configure IP address to routers in packet tracer. Explore the following messages: ping responses, destination unreachable, request timed out, reply.
5.	Configure default route, static route to the Router.
6.	Configure RIP routing Protocol in Routers.
7.	Configure OSPF routing protocol.
8.	To construct a VLAN and make the PC's communicate among a VLAN.
9.	To construct a WLAN and make the nodes communicate wirelessly.
10.	Demonstrate the TTL/ Life of a Packet.
11.	To understand the operation of TELNET by accessing the router in server room from a PC in IT office.
12.	To construct simple LAN and understand the concept and operation of Address Resolution Protocol (ARP).

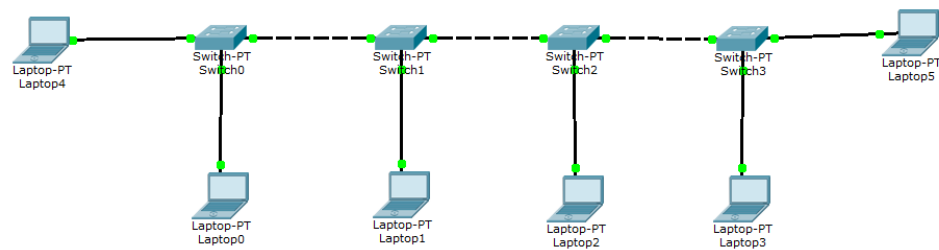
PART – B	
Serial No.	Name of Experiment
1.	Write a program for congestion control using Leaky bucket algorithm.
2.	Using TCP/IP sockets, write a client-server program to make client sending the file name and the server to send back the contents of the requested file if present.
3.	Using UDP sockets, write a client-server program to make client sending the file name and the server to send back the contents of the requested file if present.
4.	Write a program for error detecting code using CRC-CCITT (16-bits).

PART - A

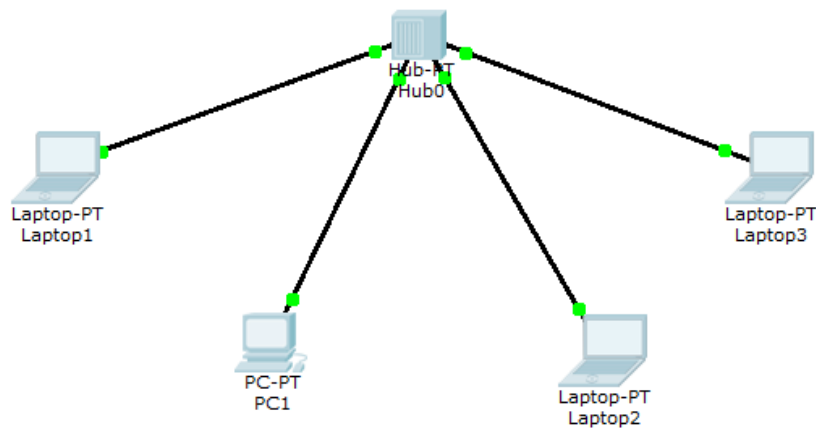
Program 1: Create a topology and simulate sending a simple PDU from source to destination using hub and switch as connecting devices and demonstrate ping message.

Network diagram:

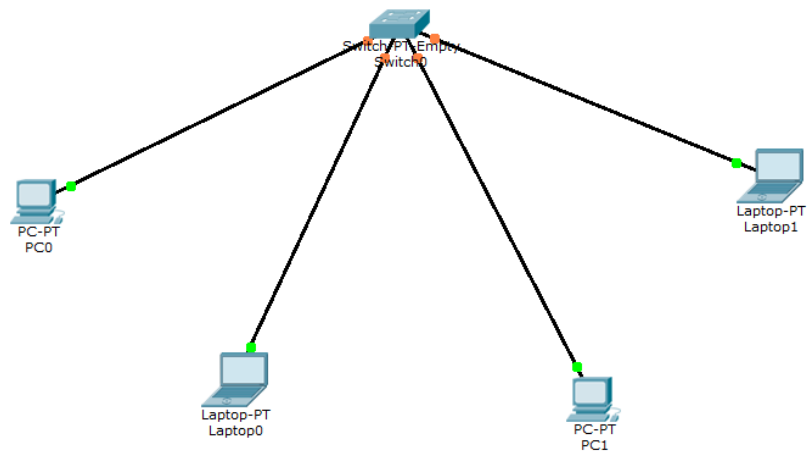
Bus



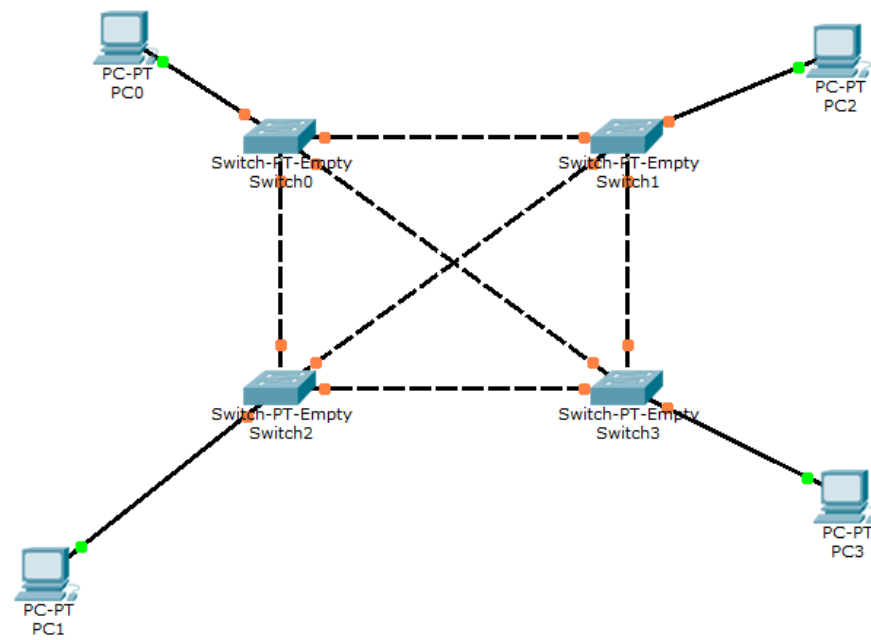
Hub



Switch

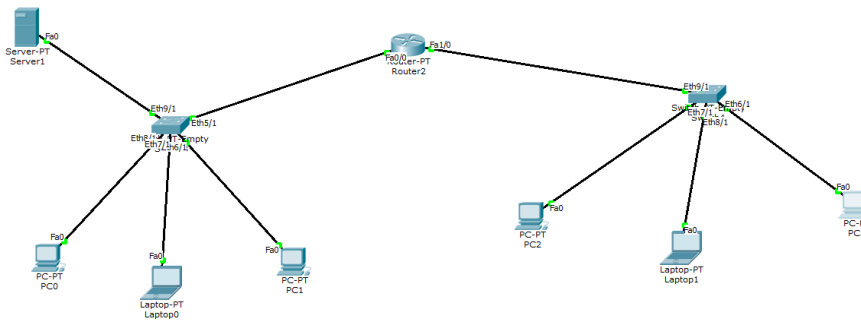


Mesh



Program 2: Configure DHCP within a LAN and outside LAN.

Network diagram:



Configuration:

PC3

IP Configuration

IP Configuration

☒ DHCP ☐ Static

IP Address: 192.168.20.4

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.20.1

DNS Server:

IPv6 Configuration

☐ DHCP ☐ Auto Config ☒ Static

IPv6 Address: /

Link Local Address: FE80::2E0:F9FF:FE4A:42DA

IPv6 Gateway:

IPv6 DNS Server:

Web Browser

Cisco IP Communicator

Server1

Physical Config Desktop Custom Interface

IP Configuration

Interface: FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IP Address: 192.168.10.2

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.10.1

DNS Server:

IPv6 Configuration

☐ DHCP ☐ Auto Config ☒ Static

IPv6 Address: /

Link Local Address: FE80::201:63FF:FE6E:5EBE

IPv6 Gateway:

IPv6 DNS Server:

Web Browser

```
PT 1001 (PTSC2005) processor (revision 0x200) with 60416K/5120K bytes of memory
.
Processor board ID PT0123 (0123)
PT2005 processor: part number 0, mask 01
Bridging software.
X.25 software, Version 3.0.0.
4 FastEthernet/IEEE 802.3 interface(s)
2 Low-speed serial(sync/async) network interface(s)
32K bytes of non-volatile configuration memory.
63488K bytes of ATA CompactFlash (Read/Write)

--- System Configuration Dialog ---

Continue with configuration dialog? [yes/no]: no

Press RETURN to get started!

Router>enable
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int Fa0/0
Router(config-if)#ip address 192.168.10.1 255.255.255.0
Router(config-if)#ip helper-address 192.168.10.2
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

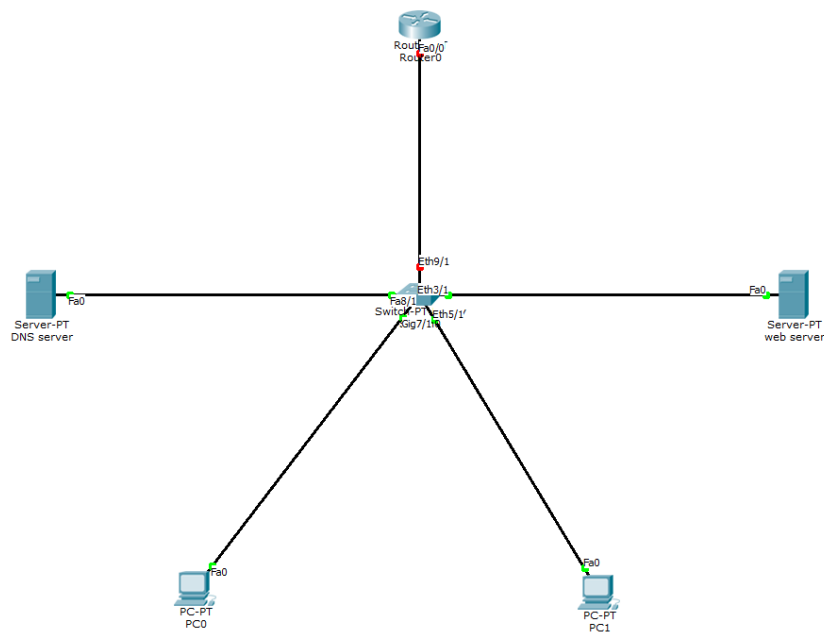
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
do write memory
Building configuration...
[OK]
Router(config-if)#exit
Router(config)#int Fa1/0
Router(config-if)#ip address 192.168.20.1 255.255.255.0
Router(config-if)#ip helper-address 192.168.10.2
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet1/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet1/0, changed state to up
do write memory
Building configuration...
[OK]
Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
write memory
Building configuration...
[OK]
Router#%IP-4-DUPADDR: Duplicate address 192.168.10.1 on FastEthernet0/0, sourced
by 000A.4166.1664
```

Program 3: Configure Web Server, DNS within a LAN.

Network diagram:



Configuration:

PC0

Physical Config Desktop Custom Interface

Web Browser

URL <http://www.letslearn.com/helloworld.html> Go Stop

Hello, world! Welcome to CN Lab

Back

PC1

Physical Config Desktop Custom Interface

Command Prompt

```
Packet Tracer PC Command Line 1.0
PC>ping 192.168.1.5

Pinging 192.168.1.5 with 32 bytes of data:

Reply from 192.168.1.6: bytes=32 time=0ms TTL=128
Reply from 192.168.1.6: bytes=32 time=0ms TTL=128
Reply from 192.168.1.6: bytes=32 time=0ms TTL=128
Reply from 192.168.1.6: bytes=32 time=2ms TTL=128

Ping statistics for 192.168.1.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 3ms, Average = 1ms

PC>ping 192.168.1.6

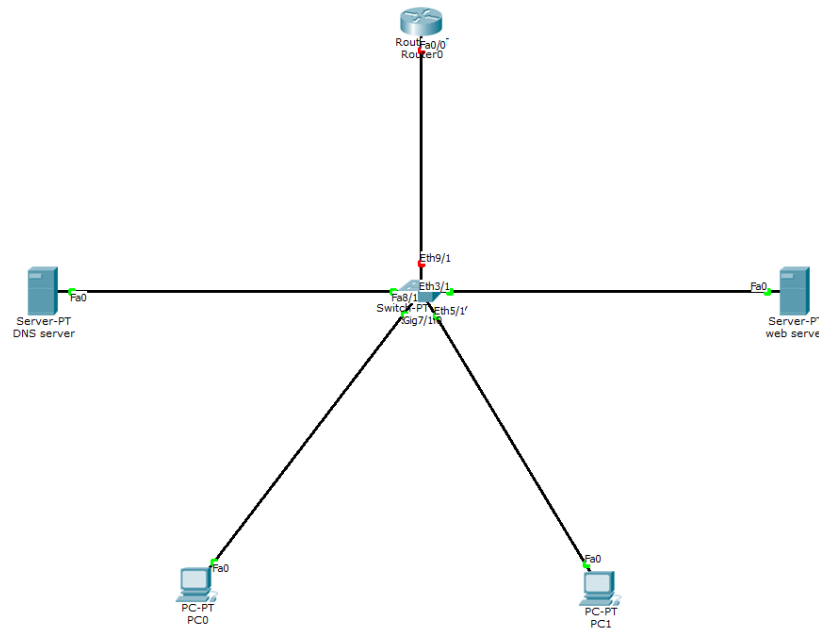
Pinging 192.168.1.6 with 32 bytes of data:

Reply from 192.168.1.6: bytes=32 time=0ms TTL=128
Reply from 192.168.1.6: bytes=32 time=0ms TTL=128
Reply from 192.168.1.6: bytes=32 time=0ms TTL=128
Reply from 192.168.1.6: bytes=32 time=0ms TTL=128

Ping statistics for 192.168.1.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
```


Program 4: Configure IP address to routers in packet tracer. Explore the following messages: ping responses, destination unreachable, request timed out, reply.

Network diagram:



Configuration:

```
PC>ping 192.168.1.101
Pinging 192.168.1.101 with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.

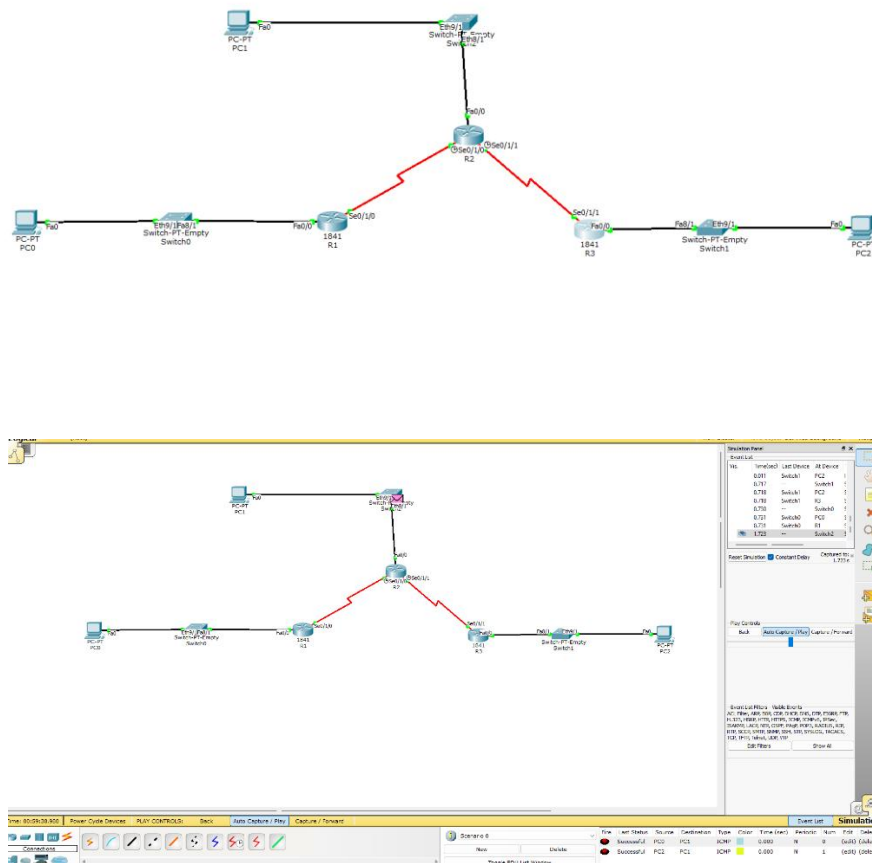
Ping statistics for 192.168.1.101:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

PC>ping 192.168.1.6
Pinging 192.168.1.6 with 32 bytes of data:
Reply from 192.168.1.6: bytes=32 time=5ms TTL=128
Reply from 192.168.1.6: bytes=32 time=0ms TTL=128
Reply from 192.168.1.6: bytes=32 time=0ms TTL=128
Reply from 192.168.1.6: bytes=32 time=0ms TTL=128

Ping statistics for 192.168.1.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 5ms, Average = 1ms
```

Program 5: Configure default route, static route to the Router.

Network diagram:



Configuration:

The image displays three screenshots of network configuration interfaces. The top-left screenshot shows the 'IP Configuration' window for PC0, where the 'Static' radio button is selected. The IP Address is 192.168.10.10, Subnet Mask is 255.255.255.0, and Default Gateway is 192.168.10.1. The bottom-left screenshot shows the 'IP Configuration' window for PC1, also with 'Static' selected. The IP Address is 192.168.20.10, Subnet Mask is 255.255.255.0, and Default Gateway is 192.168.20.1. The right screenshot shows the 'IOS Command Line Interface' for Router R1. It displays the output of the 'show ip route' command, showing a routing table with entries for 172.16.0.0/30, 172.16.1.0, 192.168.10.0/24, 192.168.20.0/24, and 192.168.30.0/24. The interface also shows the configuration of the router, including the 'enable' command and the 'show ip route' command.

PC0 IP Configuration

IP Configuration

☐ DHCP ☒ Static

IP Address: 192.168.10.10

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.10.1

DNS Server:

IPv6 Configuration

☐ DHCP ☐ Auto Config ☒ Static

IPv6 Address: /

Link Local Address: FE80::230:F2FF:FE57:D640

IPv6 Gateway:

IPv6 DNS Server:

R1 IOS Command Line Interface

```
Router>vr
Translating "vr"...domain server (255.255.255.255)
* Unknown command or computer name, or unable to find computer address

Router>enable
Router#
Building configuration...
[OK]

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

172.16.0.0/30 is subnetted, 2 subnets
C    172.16.1.0 is directly connected, Serial0/1/0
S    172.16.2.0 (1/0) via 172.16.1.2
C    192.168.10.0/24 is directly connected, FastEthernet0/0
S    192.168.20.0/24 (1/0) via 172.16.1.2
S    192.168.30.0/24 (1/0) via 172.16.1.2
Router#
Router#
```

PC1 IP Configuration

IP Configuration

☐ DHCP ☒ Static

IP Address: 192.168.20.10

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.20.1

DNS Server:

IPv6 Configuration

☐ DHCP ☐ Auto Config ☒ Static

IPv6 Address: /

Link Local Address: FE80::260:47FF:FE06:5514

IPv6 Gateway:

IPv6 DNS Server:

Continue with configuration dialog? [yes/no]: no

Press RETURN to get started!

```
Router>enable
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#show ip
R2(config)#int Se0/1/0
R2(config-if)#ip address 172.16.1.2 255.255.255.252
R2(config-if)#no shutdown

R2(config-if)#
*LINK-6-CHANGED: Interface Serial0/1/0, changed state to up
*LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to up

exit
R2(config)#int Fa0/0
R2(config-if)#ip address 192.168.20.1 255.255.255.0
R2(config-if)#no shutdown

R2(config-if)#
*LINK-6-CHANGED: Interface FastEthernet0/0, changed state to up
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

exit
R2(config)#int Se0/1/1
R2(config-if)#ip address 172.16.2.1 255.255.255.252
R2(config-if)#no shutdown

*LINK-6-CHANGED: Interface Serial0/1/1, changed state to down
R2(config-if)#exit
R2(config)#exit
R2#
*SYS-5-CONFIG_1: Configured from console by console
write memory
Building configuration...
[OK]
R2#
*LINK-6-CHANGED: Interface Serial0/1/1, changed state to up
*LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/1, changed state to up
```

PC0

Physical Config Desktop Custom Interface

Command Prompt

Packet Tracer PC Command Line 1.0
PC>ping 192.168.10.1
Pinging 192.168.10.1 with 32 bytes of data:
Reply from 192.168.10.1: bytes=32 time=0ms TTL=255
Reply from 192.168.10.1: bytes=32 time=0ms TTL=255
Reply from 192.168.10.1: bytes=32 time=0ms TTL=255
Reply from 192.168.10.1: bytes=32 time=0ms TTL=255
Ping statistics for 192.168.10.1:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms
PC>ping 192.168.20.1
Pinging 192.168.20.1 with 32 bytes of data:
Reply from 192.168.20.1: bytes=32 time=0ms TTL=254
Reply from 192.168.20.1: bytes=32 time=0ms TTL=254
Reply from 192.168.20.1: bytes=32 time=0ms TTL=254
Reply from 192.168.20.1: bytes=32 time=0ms TTL=254
Ping statistics for 192.168.20.1:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms
PC>ping 192.168.30.1
Pinging 192.168.30.1 with 32 bytes of data:
Reply from 192.168.30.1: bytes=32 time=0ms TTL=253
Reply from 192.168.30.1: bytes=32 time=0ms TTL=253
Reply from 192.168.30.1: bytes=32 time=0ms TTL=253
Reply from 192.168.30.1: bytes=32 time=0ms TTL=253
Ping statistics for 192.168.30.1:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms
PC>

R3

Physical Config CLI

IOS Command Line Interface

Router>conf t
~
! Invalid input detected at '' marker.
Router>conf t
~
! Invalid input detected at '' marker.
Router>
Router>enable
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#show ip
R3(config)#show ip
R3(config)#ip address 172.16.2.2 255.255.255.252
R3(config-if)#no shutdown
R3(config-if)#
!LINK-6-CHANGED: Interface Serial0/1/1, changed state to up
!LINEPROTO-6-UPDOWN: Line protocol on Interface Serial0/1/1, changed state to up
exit
R3(config)#int Fa0/0
R3(config-if)#ip address 192.168.30.1 255.255.255.0
R3(config-if)#no shutdown
R3(config-if)#
!LINK-6-CHANGED: Interface FastEthernet0/0, changed state to up
!LINEPROTO-6-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
o up
exit
R3(config)#exit
R3#
!SYS-5-CONFIG_I: Configured from console by console
write memory
Building configuration...
[OK]
R3#>IP-4-DUPADDR: Duplicate address 192.168.30.1 on FastEthernet0/0, sourced by 00E0.F7B9.C601

PC2

IP Configuration

IP Configuration

☐ DHCP ☒ Static

IP Address 192.168.30.10

Subnet Mask 255.255.255.0

Default Gateway 192.168.30.1

DNS Server

IPv6 Configuration

☐ DHCP ☐ Auto Config ☒ Static

IPv6 Address

Link Local Address FE80::2E0:F7FF:FEB9:C601

IPv6 Gateway

IPv6 DNS Server

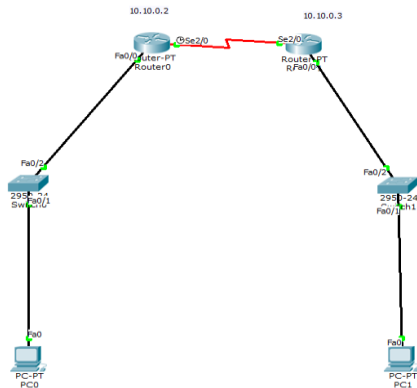
R3>enable
R3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R3(config)#ip route 0.0.0.0 0.0.0.0 Se0/1/1
R3(config)#exit
R3#
!SYS-5-CONFIG_I: Configured from console by console
wr
Building configuration...
[OK]
R3#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
I - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, Ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route

Gateway of last resort is 0.0.0.0 to network 0.0.0.0

172.16.0.0/30 is subnetted, 1 subnets
C 172.16.2.0 is directly connected, Serial0/1/1
C 192.168.30.0/24 is directly connected, FastEthernet0/0
S* 0.0.0.0/0 is directly connected, Serial0/1/1
R3#

Program 6: Configure RIP routing Protocol in Routers.

Network diagram:



Configuration:

The image displays three screenshots from the Cisco Packet Tracer application, showing the configuration of a network.

PC0 Configuration: The "IP Configuration" window is shown. The "Static" radio button is selected. The IP Address is 192.168.1.2, Subnet Mask is 255.255.255.0, and Default Gateway is 192.168.1.1.

Router0 Configuration (FastEthernet0/0): The "Config" window for the FastEthernet0/0 interface is shown. The "Port Status" is "On", "Bandwidth" is "100 Mbps", and "Duplex" is "Full Duplex". The "Equivalent IOS Commands" section shows the following commands:

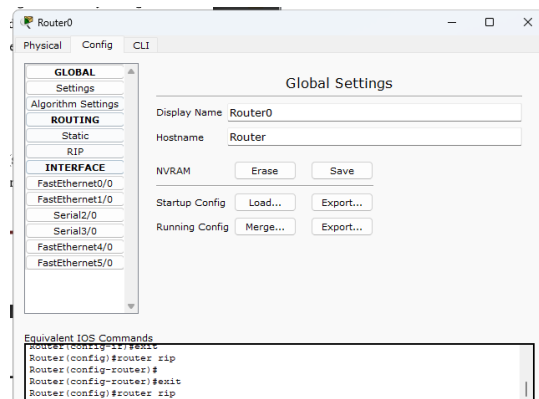
```
Router#configure terminal
Router(config)#interface FastEthernet0/0
Router(config-if)#
```

Router0 Configuration (Serial2/0): The "Config" window for the Serial2/0 interface is shown. The "Port Status" is "On", "Clock Rate" is "64000", and "Duplex" is "Full Duplex". The IP Address is 10.10.0.2 and Subnet Mask is 255.0.0.0. The "Equivalent IOS Commands" section shows the following commands:

```
Router#configure terminal
Router(config)#interface FastEthernet0/0
Router(config-if)#
Router(config)#exit
Router(config)#interface Serial2/0
Router(config-if)#
```

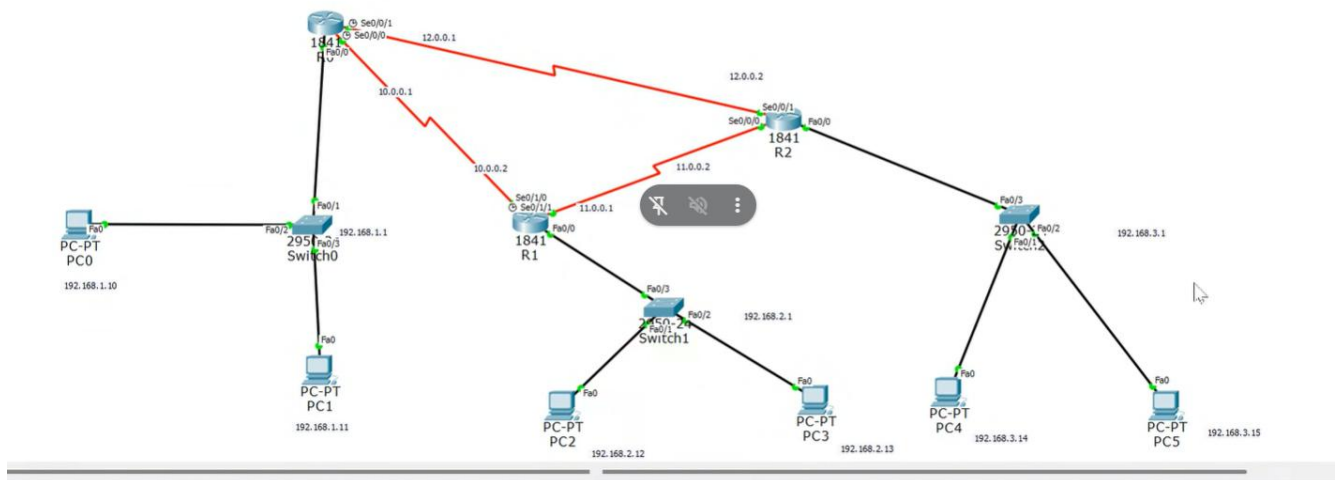
Router0 Configuration (RIP Routing): The "Config" window for the RIP Routing protocol is shown. The "Network" list contains the following entries:

Network Address
10.0.0.0
192.168.1.0



Program 7: Configure OSPF routing protocol.

Network diagram:



Configuration:

```

* Initialize Command.
Router(config)#exit
Router#
$SYS-5-CONFIG_I: Configured from console by console
enable
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#network 192.168.1.0 0.0.0.255 area 0
% Invalid input detected at '^' marker.
Router(config-router)#network 192.168.1.1 0.0.0.255 area 0
% Invalid input detected at '^' marker.
Router(config-router)#exit
Router(config)#exit
Router#
$SYS-5-CONFIG_I: Configured from console by console
enable
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#
% Invalid input detected at '^' marker.
Router(config)#router ospf 1
Router(config-router)#

```

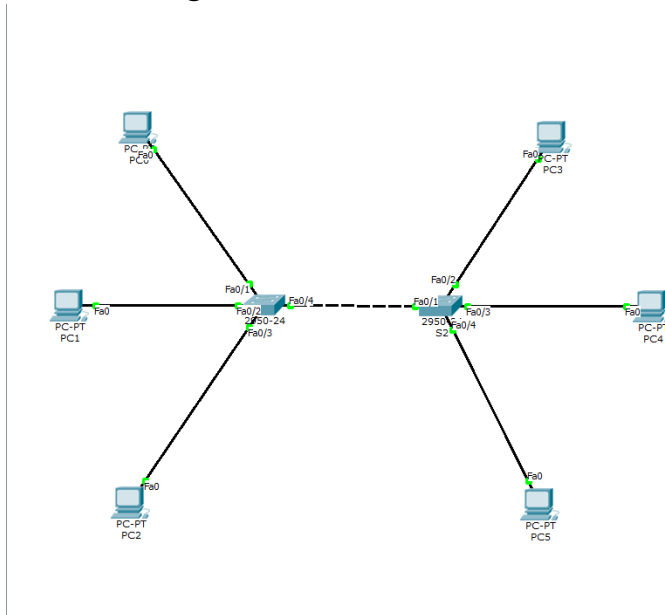
```

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up
Router(config-if)#exit
Router(config)#interface Serial3/0
Router(config-if)#
Router(config)#interface Serial3/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial3/0
Router(config-if)#ip address 11.0.0.1 255.0.0.0
Router(config-if)#no shutdown
Router(config-if)#
%LINEPROTO-5-UPDOWN: Interface Serial3/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0, changed state to up
exit
Router(config)#enable
% Incomplete command.
Router(config)#exit
Router#
$SYS-5-CONFIG_I: Configured from console by console
enable
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#network 192.168.2.0 0.0.0.255 area 0
Router(config-router)#network 10.0.0.0 0.255.255.255 area 0
Router(config-router)#network 11.0.0.0 0.255.255.255 area 0
% Invalid input detected at '^' marker.
Router(config-router)#network 11.0.0.0 0.255.255.255 area 0
Router(config-router)#exit
Router(config-router)#exit
Router#
$SYS-5-CONFIG_I: Configured from console by console
* Building configuration...
[OK]
Router#
00:10:31: %OSPF-6-ADJCHG: Process 1, Nbr 192.168.3.1 on Serial3/0 from LOADING to FULL, Loading Done

```

Program 8: To construct a VLAN and make the PC's communicate among a VLAN.

Network diagram:



Configuration:

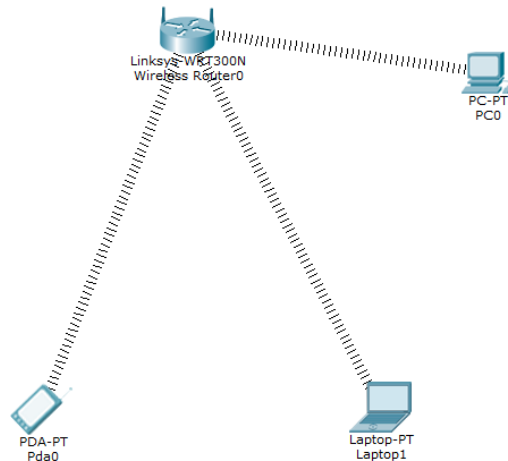
The screenshot displays two command-line interfaces (CLI) for network switches. The left CLI shows the configuration for Switch S1, and the right CLI shows the configuration for Switch S2. Both switches are configured with VLANs 10, 20, and 30, and their interfaces are assigned to these VLANs. The right CLI also shows the configuration for a trunk link between the two switches.

Below the CLIs, a packet capture table is visible, showing a failed ICMP packet from PC0 to PC4.

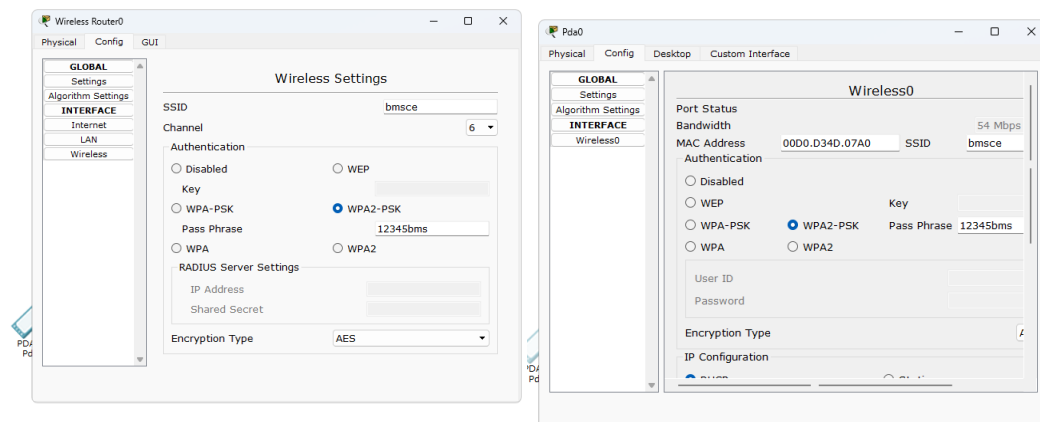
Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete
	Failed	PC0	PC4	ICMP		2.028	N	0	(edit)	(delete)

Program 9: To construct a WLAN and make the nodes communicate wirelessly.

Network diagram:



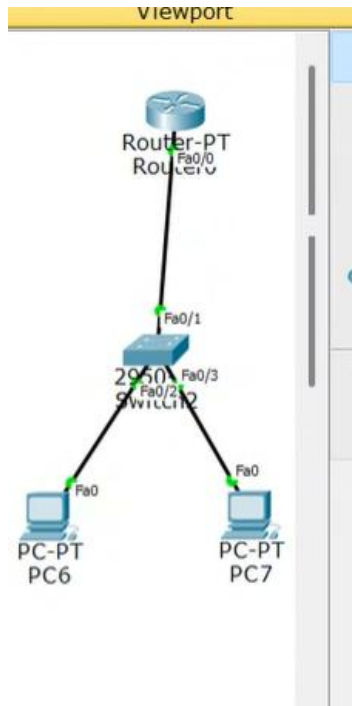
Configuration:



Realtime										
Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete
	Successful	Pda0	Laptop1	ICMP		0.000	N	0	(edit)	(delete)

Program 10: Demonstrate the TTL/ Life of a Packet.

Network diagram:



Configuration:

PDU Information at Device: PC7

OSI Model Inbound PDU Details Outbound PDU Details

PDU Formats

Ethernet II

0	4	8	14	19	Byte
PREAMBLE: 101010...1011		DEST MAC: 0090.2BED.691C		SRC MAC: 0040.0BD2.0CE5	
TYPE: 0x800		DATA (VARIABLE LENGTH)		FCS: 0x0	

IP

0	4	8	16	19	31	Bits
IHL: 5		DSCP: 0x0		TL: 28		
ID: 0x9		0x0		0x0		
TTL: 255		PRO: 0x1		CHKSUM		
SRC IP: 192.168.1.2						
DST IP: 192.168.1.3						
OPT: 0x0				0x0		
DATA (VARIABLE LENGTH)						

ICMP

0	8	16	31	Bits	
TYPE: 0x8		CODE: 0x0		CHECKSUM	

PDU Information at Device: PC7

OSI Model Inbound PDU Details Outbound PDU Details

PDU Formats

Ethernet II

0	4	8	14	19	Byte
PREAMBLE: 101010...1011		DEST MAC: 0040.0BD2.0CE5		SRC MAC: 0090.2BED.691C	
TYPE: 0x800		DATA (VARIABLE LENGTH)		FCS: 0x0	

IP

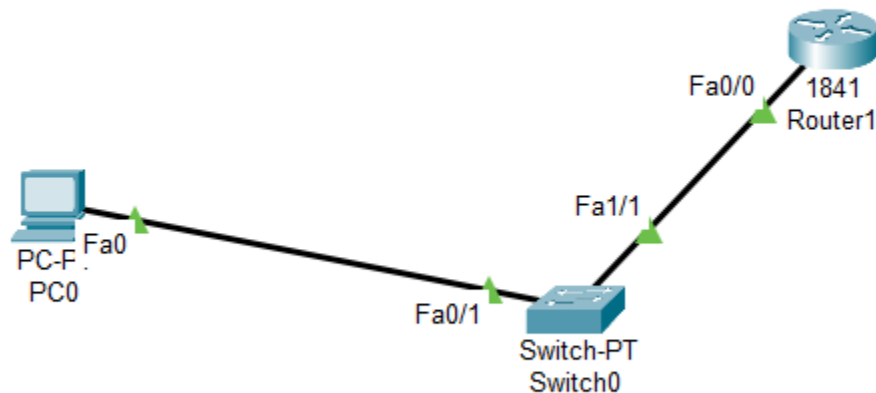
0	4	8	16	19	31	Bits
IHL: 5		DSCP: 0x0		TL: 28		
ID: 0x9		0x0		0x0		
TTL: 128		PRO: 0x1		CHKSUM		
SRC IP: 192.168.1.3						
DST IP: 192.168.1.2						
OPT: 0x0				0x0		
DATA (VARIABLE LENGTH)						

ICMP

0	8	16	31	Bits	
TYPE: 0x0		CODE: 0x0		CHECKSUM	

Program 11: To understand the operation of TELNET by accessing the router in server room from a PC in IT office.

Network diagram:



Configuration:

```
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#enable secret rp
Router(config)#int Fa 0/0
Router(config-if)#int address 192.168.1.1 255.255.255.0
^
% Invalid input detected at '^' marker.

Router(config-if)#ip address 192.168.1.1 255.255.255.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

Router(config-if)#
Router(config-if)#line vty
^
% Invalid input detected at '^' marker.

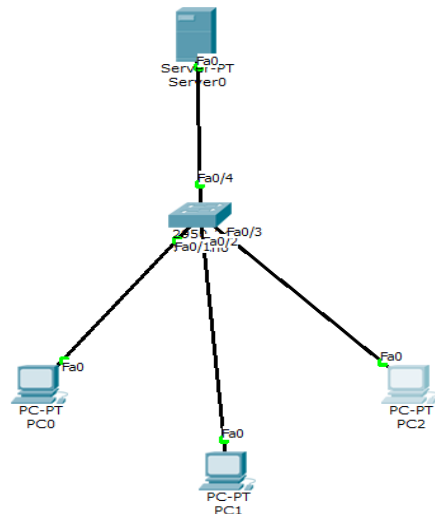
Router(config-if)#line vty
^
% Invalid input detected at '^' marker.

Router(config-if)#line vty
^
% Invalid input detected at '^' marker.

Router(config-if)#exit
Router(config)#line vty
% Incomplete command.
Router(config)#login
% Incomplete command.
Router(config)#enable secret rp
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
enable
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#enable secret rp
```

Program 12: To construct simple LAN and understand the concept and operation of Address Resolution Protocol (ARP).

Network diagram:



Configuration:

The image shows two screenshots from a Cisco Packet Tracer environment. The left screenshot displays the 'IP Configuration' window for PC0. It shows the 'Static' IP configuration selected, with the following details:

- IP Address: 192.168.11.1
- Subnet Mask: 255.255.255.0
- Default Gateway: (empty)
- DNS Server: 192.168.11.4

The IPv6 configuration section shows 'Static' selected with a Link Local Address of FE80::260:70FF:FE86:B1A2. The right screenshot shows the 'Logical' view of the network topology in Packet Tracer, which matches the network diagram above. Below the topology view, there is an 'ARP Table for PC0' window with the following structure:

IP Address	Hardware Address	Interface
------------	------------------	-----------

```
PC0
Physical Config Desktop Custom Interface

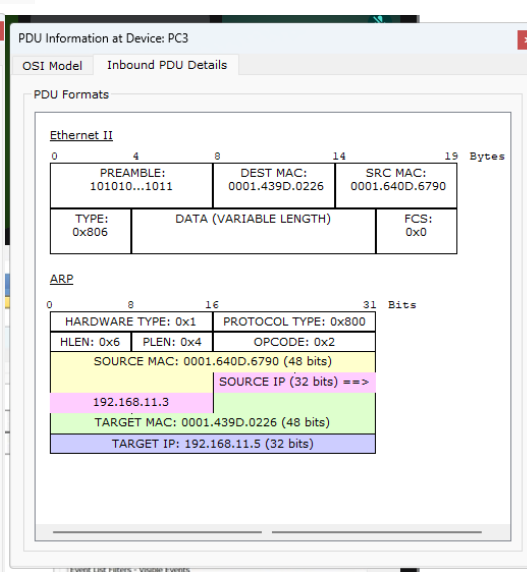
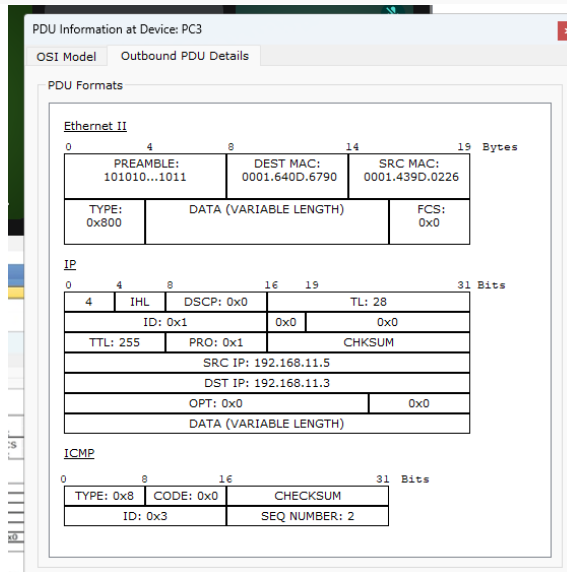
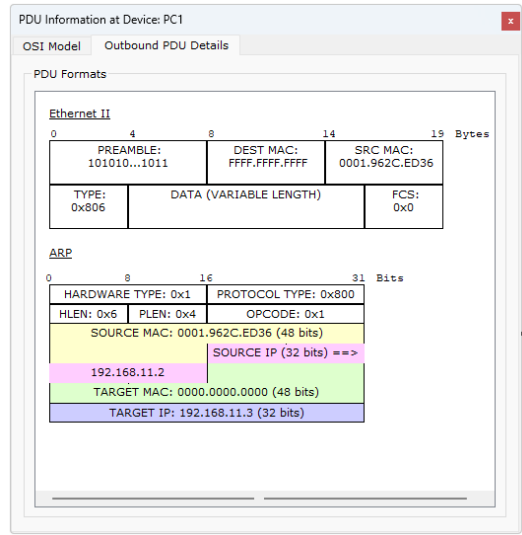
Command Prompt
Packet Tracer PC Command Line 1.0
PC>ARP -A
Internet Address      Physical Address      Type
192.168.11.2          0001.962c.ed36        dynamic

PC>PING 192.168.11.4
Pinging 192.168.11.4 with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.11.4:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

PC>PING 192.168.11.4
Pinging 192.168.11.4 with 32 bytes of data:
Reply from 192.168.11.4: bytes=32 time=1ms TTL=128
Reply from 192.168.11.4: bytes=32 time=0ms TTL=128
Reply from 192.168.11.4: bytes=32 time=0ms TTL=128
Reply from 192.168.11.4: bytes=32 time=0ms TTL=128

Ping statistics for 192.168.11.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
PC>
```



PART - B

Program 1: Write a program for congestion control using Leaky bucket algorithm.

```
Code: #include<stdio.h>
int min(int x, int y) {
    return (x < y) ? x : y;
}
int main() {
    int drop = 0, mini, nsec, cap, count = 0, i, inp[25], process;
    printf("Enter the bucket size: ");
    scanf("%d", &cap);
    printf("Enter the processing rate: ");
    scanf("%d", &process);
    printf("Enter the number of seconds you want to simulate: ");
    scanf("%d", &nsec);
    for (i = 0; i < nsec; i++) {
        printf("Enter the size of the packet entering at %d sec: ", i + 1);
        scanf("%d", &inp[i]);
    }
    printf("\n Second | Packet Received | Packet Sent | Packet Left | Dropped \n");
    printf("-----\n");
    for (i = 0; i < nsec; i++) {
        count += inp[i];
        if (count > cap) {
            drop = count - cap;
            count = cap;
        }
        printf("%6d | %15d |", i + 1, inp[i]);
        mini = min(count, process);
        printf(" %11d |", mini);

        count -= mini;
        printf(" %11d | %7d\n", count, drop);

        drop = 0;
    }
    while (count != 0) {
        i++;
        if (count > cap) {
            drop = count - cap;
            count = cap;
        }
        printf("%6d | %15d |", i, 0);
        mini = min(count, process);
        printf(" %11d |", mini);

        count -= mini;
        printf(" %11d | %7d\n", count, drop);
    }
}
```

```

    }
    return 0;
}

```

OUTPUT:

```

Enter the bucket size: 5
Enter the processing rate: 2
Enter the number of seconds you want to simulate: 3
Enter the size of the packet entering at 1 sec: 5
Enter the size of the packet entering at 2 sec: 4
Enter the size of the packet entering at 3 sec: 3

Second | Packet Received | Packet Sent | Packet Left | Dropped
-----|-----|-----|-----|-----
1 | 5 | 2 | 3 | 0
2 | 4 | 2 | 3 | 2
3 | 3 | 2 | 3 | 1
4 | 0 | 2 | 1 | 0
5 | 0 | 1 | 0 | 0

Process returned 0 (0x0) execution time : 21.548 s
Press any key to continue.

```

Program 2: Using TCP/IP sockets, write a client-server program to make client sending the file name and the server to send back the contents of the requested file if present.

Code:

Server:

```

#include <stdio.h>

#include <stdlib.h>

#include <string.h>

#include <unistd.h>

#include <sys/types.h>

#include <sys/socket.h>

#include <netinet/in.h>

int main(int argc, char *argv[])
{
    int sockfd, newsockfd, portno, n;

    char buffer[256], line[2000], filedata[20000];

    struct sockaddr_in serv, cli;

    socklen_t len;

```

```
FILE *fp;
if (argc < 2) {
    printf("Error: No port number provided.\nUsage: ./server <port>\n");
    exit(1);
}
sockfd = socket(AF_INET, SOCK_STREAM, 0);
if (sockfd < 0) {
    perror("Socket creation failed");
    exit(1);
}
memset(&serv, 0, sizeof(serv));
portno = atoi(argv[1]);
serv.sin_family = AF_INET;
serv.sin_addr.s_addr = INADDR_ANY;
serv.sin_port = htons(portno);
if (bind(sockfd, (struct sockaddr *)&serv, sizeof(serv)) < 0) {
    perror("Bind failed");
    exit(1);
}
listen(sockfd, 5);
printf("Server: Waiting for connection...\n");
len = sizeof(cli);
newsockfd = accept(sockfd, (struct sockaddr *)&cli, &len);
if (newsockfd < 0) {
    perror("Accept failed");
    exit(1);
}
```

```
memset(buffer, 0, sizeof(buffer));
n = read(newsockfd, buffer, sizeof(buffer) - 1);
if (n < 0) {
    perror("Error reading file name");
    exit(1);
}
printf("Server received file request: %s\n", buffer);
fp = fopen(buffer, "r");
if (fp == NULL) {
    printf("Server: File not found.\n");
    write(newsockfd, "File not found", 15);
    close(newsockfd);
    close(sockfd);
    return 0;
}
printf("Server: File found. Reading...\n");
memset(filedata, 0, sizeof(filedata));
while (fgets(line, sizeof(line), fp) != NULL) {
    strcat(filedata, line);
}
fclose(fp);
n = write(newsockfd, filedata, strlen(filedata));
if (n < 0)
    perror("Error writing to socket");
printf("Transfer complete.\n");
```



```
    close(newsockfd);
    close(sockfd);
    return 0;
}
```

Client:

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <unistd.h>
#include <sys/types.h>
#include <sys/socket.h>
#include <netinet/in.h>
int main(int argc, char *argv[])
{
    int sockfd, portno, n;
    char filename[256], filedata[20000];
    struct sockaddr_in serv;
    if (argc < 2) {
        printf("Error: No port number provided.\nUsage: ./client <port>\n");
        exit(1);
    }
    sockfd = socket(AF_INET, SOCK_STREAM, 0);
    if (sockfd < 0) {
        perror("Socket creation failed");
        exit(1);
    }
    memset(&serv, 0, sizeof(serv));
```

```

portno = atoi(argv[1]);
serv.sin_family = AF_INET;
serv.sin_port = htons(portno);
serv.sin_addr.s_addr = INADDR_ANY; // connecting to same machine
if (connect(sockfd, (struct sockaddr *)&serv, sizeof(serv)) < 0) {
    perror("Server not responding");
    exit(1);
}
printf("Enter file path: ");
scanf("%s", filename);
n = write(sockfd, filename, strlen(filename));
if (n < 0)
    perror("Error writing filename");
memset(filedata, 0, sizeof(filedata));
n = read(sockfd, filedata, sizeof(filedata) - 1);
if (n < 0)
    perror("Error reading data from server");
printf("\n--- File Content ---\n%s\n", filedata);
close(sockfd);
return 0;
}

```

Output:

```
$ cc socketserver.c
```

```
$ ./a.out 1025
```

server:

waiting for connection

server received:/home/aps/cse.txt

```
server:/home/aps/cse.txt found
opening and reading..
reading..
..reading complete
transfer complete
$ cc socketclient.c
$ ./a.out 1025
Enter the file with complete path
/home/aps/cse.txt
Reading..
..
client: display content of /home/aps/cse.txt
..
Welcome to the CSE department.....
2)
$ cc fserver.c
$ ./a.out
error:no port no
usage:
/server port no
$ cc fclient.c
$ ./a.out
Err:no port no.
usage:
./client portno
ex:./client 7777
```

Program 3: Using UDP sockets, write a client-server program to make client sending the file name and the server to send back the contents of the requested file if present.

Code:

Server:

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <unistd.h>
#include <sys/types.h>
#include <sys/socket.h>
#include <netinet/in.h>
```

```
int main(int argc, char *argv[])
{
    int sockfd, portno, n;
    char buffer[1024];
    struct sockaddr_in servaddr, cliaddr;
    socklen_t len;

    if (argc < 2) {
        printf("Usage: ./server <port>\n");
        exit(1);
    }

    portno = atoi(argv[1]);
```

```
sockfd = socket(AF_INET, SOCK_DGRAM, 0);  
if (sockfd < 0) {  
    perror("Socket creation failed");  
    exit(1);  
}
```

```
memset(&servaddr, 0, sizeof(servaddr));  
memset(&cliaddr, 0, sizeof(cliaddr));
```

```
servaddr.sin_family = AF_INET;  
servaddr.sin_addr.s_addr = INADDR_ANY;  
servaddr.sin_port = htons(portno);
```

```
if (bind(sockfd, (struct sockaddr *)&servaddr, sizeof(servaddr)) < 0) {  
    perror("Bind failed");  
    exit(1);  
}
```

```
printf("UDP Server: Waiting for data...\n");
```

```
len = sizeof(cliaddr);  
memset(buffer, 0, sizeof(buffer));
```

```
n = recvfrom(sockfd, buffer, sizeof(buffer)-1, 0,  
             (struct sockaddr *)&cliaddr, &len);  
if (n < 0) {  
    perror("Receive failed");
```

```

        exit(1);
    }

    printf("Received from client: %s\n", buffer);

    // Echo back the same data
    n = sendto(sockfd, buffer, strlen(buffer), 0,
               (struct sockaddr *)&cliaddr, len);
    if (n < 0)
        perror("Send failed");

    close(sockfd);
    return 0;
}

```

Client:

```

#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <unistd.h>
#include <sys/types.h>
#include <sys/socket.h>
#include <netinet/in.h>

int main(int argc, char *argv[])
{
    int sockfd, portno, n;
    char buffer[1024];

```

```
struct sockaddr_in servaddr;
socklen_t len;

if (argc < 2) {
    printf("Usage: ./client <port>\n");
    exit(1);
}

portno = atoi(argv[1]);

sockfd = socket(AF_INET, SOCK_DGRAM, 0);
if (sockfd < 0) {
    perror("Socket creation failed");
    exit(1);
}

memset(&servaddr, 0, sizeof(servaddr));

servaddr.sin_family = AF_INET;
servaddr.sin_port = htons(portno);
servaddr.sin_addr.s_addr = INADDR_ANY; // local machine

printf("Enter message to send: ");
scanf("%s", buffer);

len = sizeof(servaddr);
```

```

n = sendto(sockfd, buffer, strlen(buffer), 0,
           (struct sockaddr *)&servaddr, len);
if (n < 0) {
    perror("Send failed");
    exit(1);
}

memset(buffer, 0, sizeof(buffer));

n = recvfrom(sockfd, buffer, sizeof(buffer)-1, 0,
             (struct sockaddr *)&servaddr, &len);
if (n < 0) {
    perror("Receive failed");
    exit(1);
}

printf("Server replied: %s\n", buffer);
close(sockfd);
return 0;
}

```

Output:

1)

UDP Server: Waiting for data...

Received from client: Hello UDP Server!

2)

Enter message to send: Hello UDP Server!

Server replied: Hello UDP Server!

Program 4: Write a program for error detecting code using CRC-CCITT (16-bits).

```
Code: #include <stdio.h>
#include <string.h>
#include <stdlib.h>

int main() {
    char rem[50], a[50], s[50], c, msj[50], gen[30];
    int i, genlen, t, j, flag = 0, k, n;

    printf("Enter the generator polynomial: ");
    fgets(gen, sizeof(gen), stdin);
    gen[strcspn(gen, "\n")] = '\0';
    printf("Generator polynomial is CRC: %s\n", gen);

    genlen = strlen(gen);
    k = genlen - 1;

    printf("Enter the message: ");
    n = 0;
    while ((c = getchar()) != '\n') {
        msj[n] = c;
        n++;
    }
    msj[n] = '\0';

    for (i = 0; i < n; i++) {
        a[i] = msj[i];
    }
    for (i = 0; i < k; i++) {
        a[n + i] = '0';
    }
    a[n + k] = '\0';

    printf("\nMessage polynomial appended with zeros:\n");
    puts(a);

    for (i = 0; i < n; i++) {
        if (a[i] == '1') {
            t = i;
            for (j = 0; j <= k; j++) {
                a[t] = (a[t] == gen[j]) ? '0' : '1';
                t++;
            }
        }
    }

    for (i = 0; i < k; i++) {
        rem[i] = a[n + i];
    }
}
```

```

rem[k] = '\0';

printf("The checksum appended:\n");
puts(rem);
printf("\nThe message with checksum appended:\n");
for (i = 0; i < n; i++) {
    a[i] = msj[i];
}
for (i = 0; i < k; i++) {
    a[n + i] = rem[i];
}
a[n + k] = '\0';
puts(a);

n = 0;
printf("Enter the received message: ");
while ((c = getchar()) != '\n') {
    s[n] = c;
    n++;
}
s[n] = '\0';
for (i = 0; i < n; i++) {
    if (s[i] == '1') {
        t = i;
        for (j = 0; j <= k; j++, t++) {
            s[t] = (s[t] == gen[j]) ? '0' : '1';
        }
    }
}

for (i = 0; i < k; i++) {
    rem[i] = s[n + i];
}
rem[k] = '\0';
for (i = 0; i < k; i++) {
    if (rem[i] == '1') {
        flag = 1;
    }
}

if (flag == 0) {
    printf("Received polynomial is error-free.\n");
} else {
    printf("Received polynomial has an error.\n");
}

return 0;
}

```

OUTPUT:

Enter the generator polynomial: 10011

Generator polynomial is CRC: 10011

Enter the message: 1101011011

Message polynomial appended with zeros:

11010110110000

The checksum appended:

1110

The message with checksum appended:

11010110111110

Enter the received message: 11010110111110

Received polynomial is error-free.

Process returned 0 (0x0) execution time : 20.417 s

Press any key to continue.

|