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"JnanaSangama", Belgaum -590014, Karnataka.

LAB REPORT

on

COMPUTER NETWORKS

Submitted by

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in partial fulfillment for the award of the degree of

BACHELOR OF ENGINEERING

in

COMPUTER SCIENCE AND ENGINEERING

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B. M. S. College of Engineering,

Bull Temple Road, Bangalore 560019

(Affiliated To Visvesvaraya Technological University, Belgaum)

Department of Computer Science and Engineering

CERTIFICATE

This is to certify that the Lab work entitled "**COMPUTER NETWORKS**" carried out by **DINESH KUMAR G (1BM20CS043),** who is bonafide student of B.M. **S. College of Engineering.** It is in partial fulfillment for the award of **Bachelor of Engineering in Computer Science and Engineering** of the Visvesvaraya Technological University, Belgaum during the year 2022. The Lab report has been approved as it satisfies the academic requirements in respect of a **Computer Networks- (20CS5PCCON)** work prescribed for the said degree.

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Cycle-1

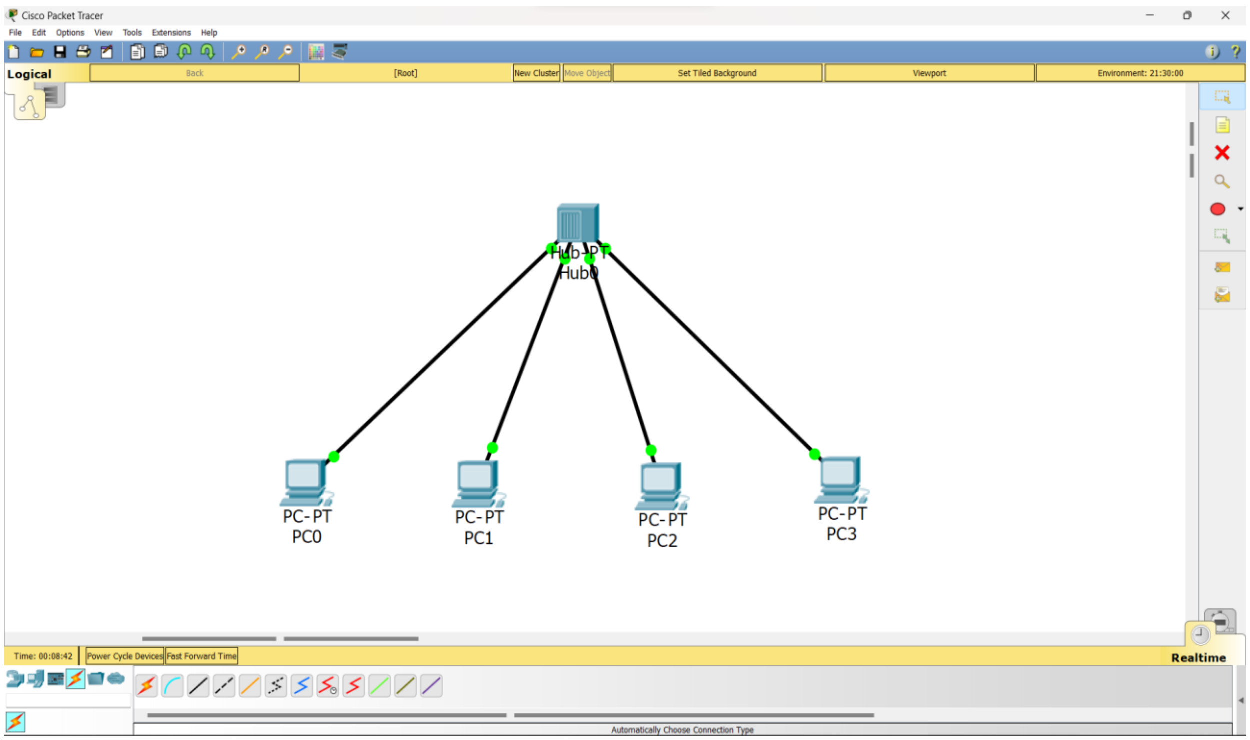
Experiment No 1

Aim

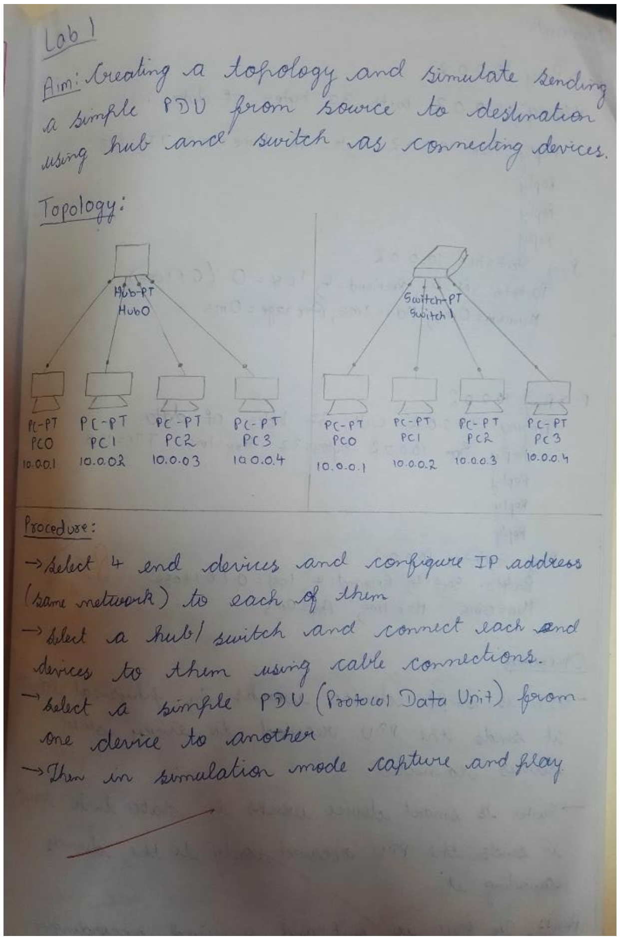
Creating a topology and simulate sending a simple PDU from source to destination using hub and switch as connecting devices.

Hub

Topology



Procedure


Lab 1

Aim: Creating a topology and simulate sending a simple PDU from source to destination using hub and switch as connecting devices.

Topology:

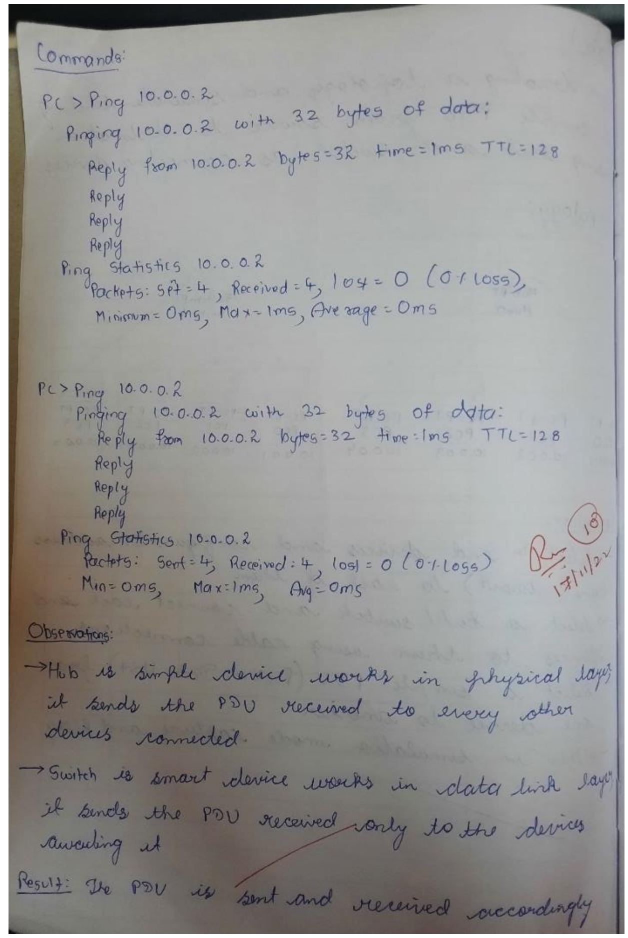
Procedure:

→ Select 4 end devices and configure IP address (same network) to each of them

→ Select a hub/switch and connect each end devices to them using cable connections.

→ Select a simple PDU (Protocol Data Unit) from one device to another

→ Then in simulation mode capture and play


Commands:

PC > Ping 10.0.0.2

Pinging 10.0.0.2 with 32 bytes of data:

Reply from 10.0.0.2 bytes=32 time=1ms TTL=128

Reply

Reply

Reply

Ping Statistics 10.0.0.2

Packets: Sent=4, Received=4, lost=0 (0% loss),

Minimum=0ms, Max=1ms, Average=0ms

PC > Ping 10.0.0.2

Pinging 10.0.0.2 with 32 bytes of data:

Reply from 10.0.0.2 bytes=32 time=1ms TTL=128

Reply

Reply

Reply

Ping Statistics 10.0.0.2

Packets: Sent=4, Received=4, lost=0 (0% loss)

Min=0ms, Max=1ms, Avg=0ms

10

17/1/22

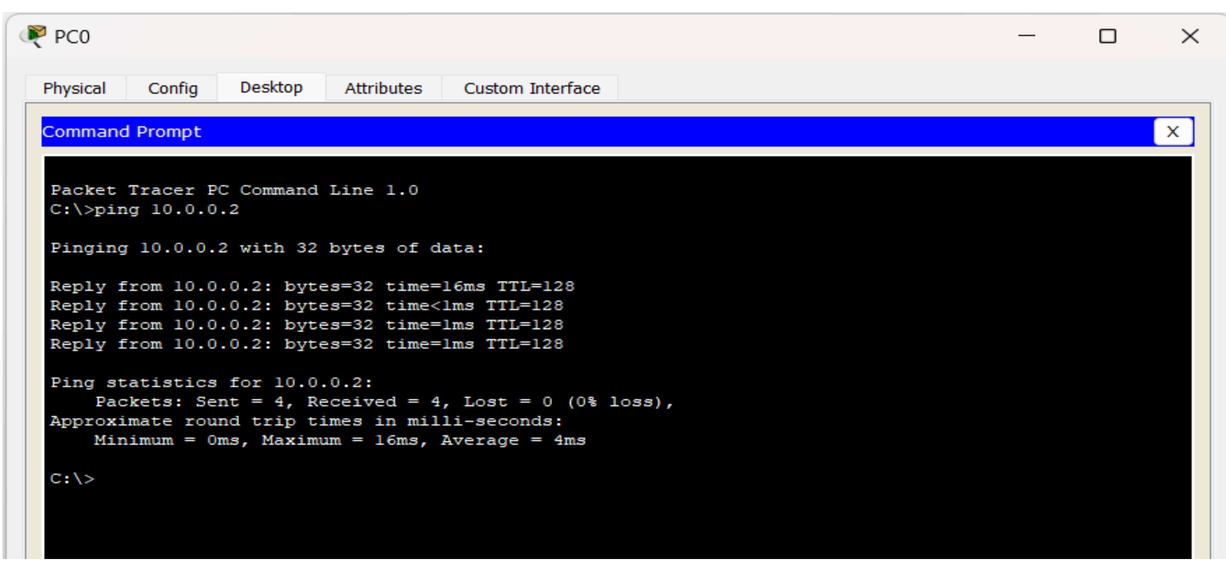
Observations:

→ Hub is simple device works in physical layer it sends the PDU received to every other devices connected.

→ Switch is smart device works in data link layer it sends the PDU received only to the devices awaiting it

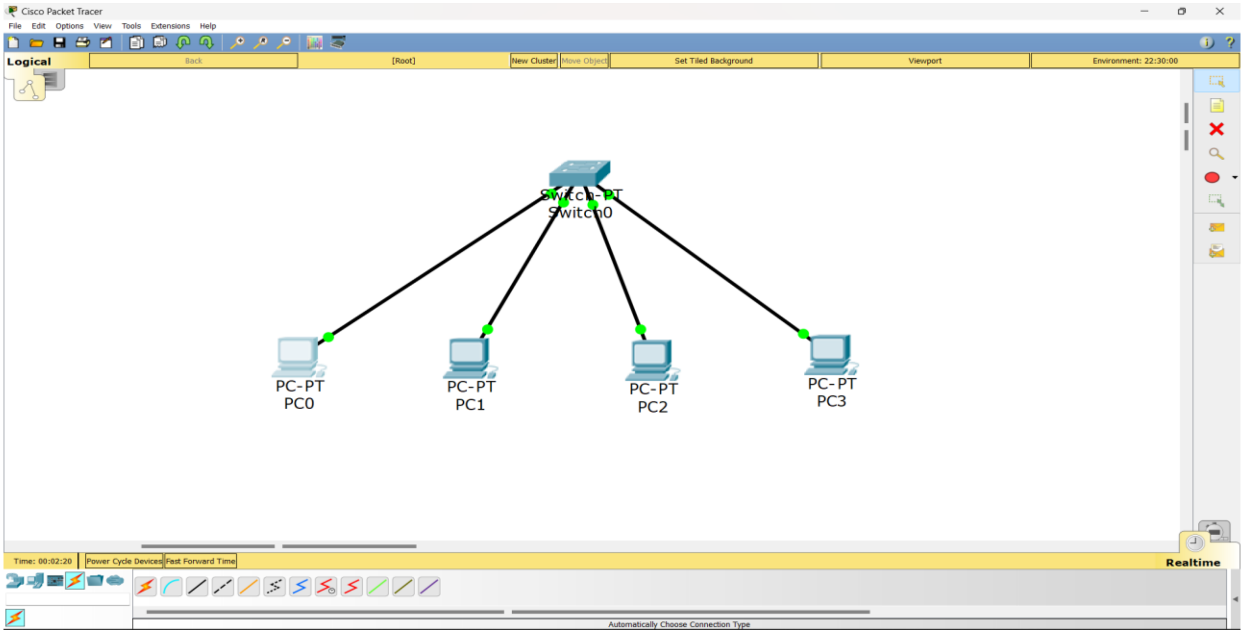
Result: The PDU is sent and received accordingly

Output

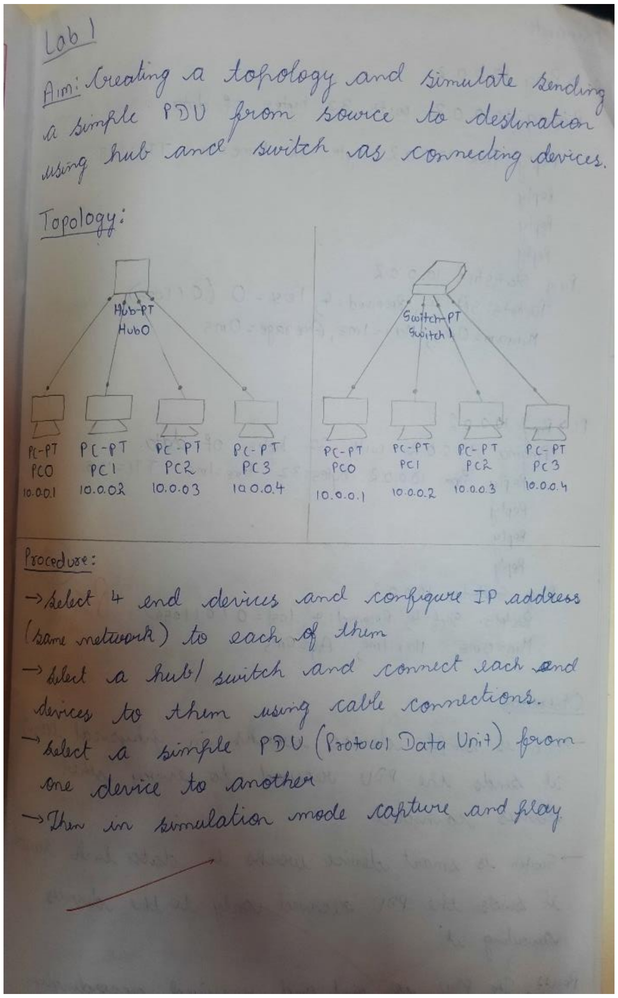


Switch

Topology



Procedure



Lab 1

Aim: Creating a topology and simulate sending a simple PDU from source to destination using hub and switch as connecting devices.

Topology:

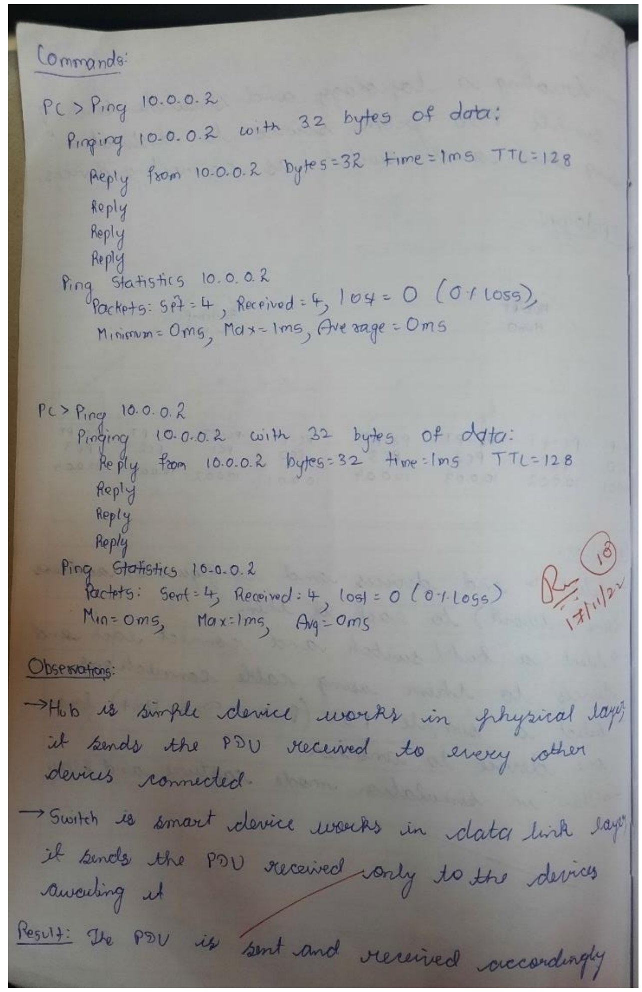
Procedure:

→ Select 4 end devices and configure IP address (same network) to each of them

→ Select a hub/switch and connect each end devices to them using cable connections.

→ Select a simple PDU (Protocol Data Unit) from one device to another

→ Then in simulation mode capture and play



Commands:

PC > Ping 10.0.0.2

Pinging 10.0.0.2 with 32 bytes of data:

Reply from 10.0.0.2 bytes=32 time=1ms TTL=128

Reply

Reply

Reply

Ping Statistics 10.0.0.2

Packets: Sent = 4, Received = 4, lost = 0 (0% loss),

Minimum = 0ms, Max = 1ms, Average = 0ms

PC > Ping 10.0.0.2

Pinging 10.0.0.2 with 32 bytes of data:

Reply from 10.0.0.2 bytes=32 time=1ms TTL=128

Reply

Reply

Reply

Ping Statistics 10.0.0.2

Packets: Sent = 4, Received: 4, lost = 0 (0% loss)

Min = 0ms, Max: 1ms, Avg = 0ms

10 17/11/22

Observations:

→ Hub is simple device works in physical layer it sends the PDU received to every other devices connected.

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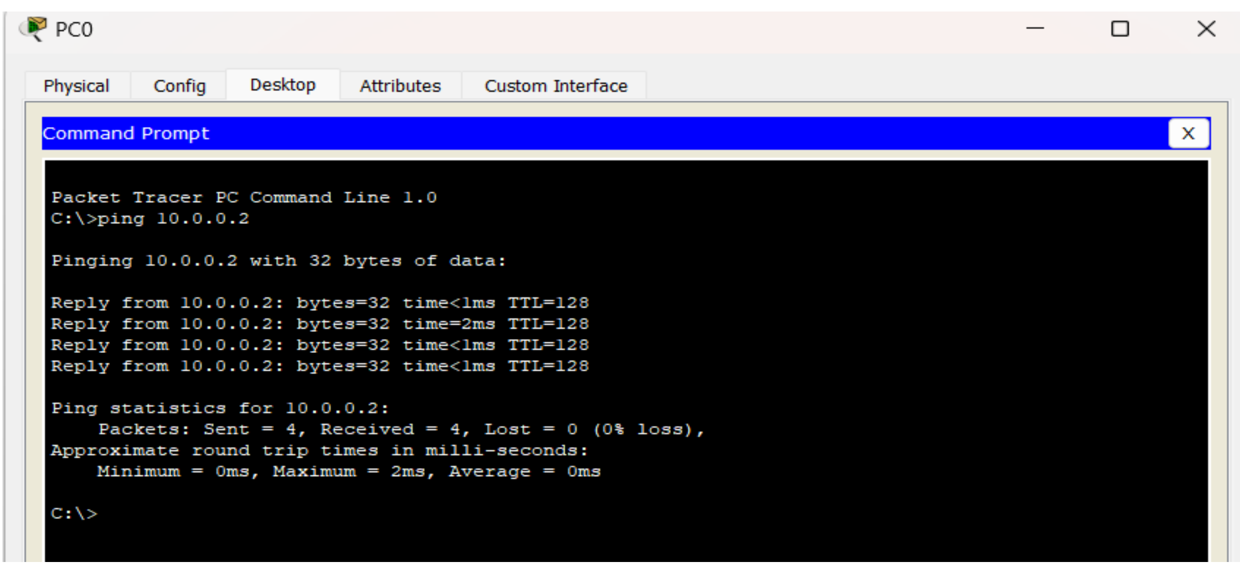
Result: The PDU is sent and received accordingly

Output



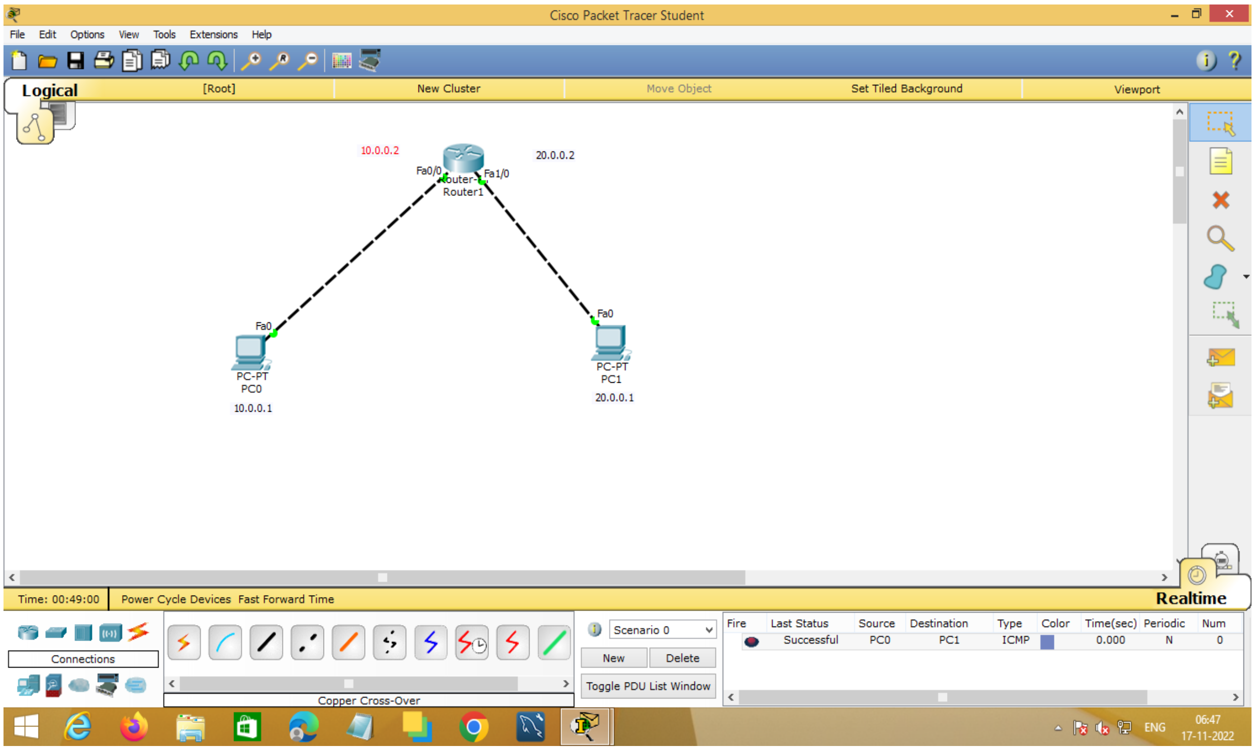

```
Packet Tracer PC Command Line 1.0
C:\>ping 10.0.0.2

Pinging 10.0.0.2 with 32 bytes of data:

Reply from 10.0.0.2: bytes=32 time<1ms TTL=128
Reply from 10.0.0.2: bytes=32 time=2ms TTL=128
Reply from 10.0.0.2: bytes=32 time<1ms TTL=128
Reply from 10.0.0.2: bytes=32 time<1ms TTL=128

Ping statistics for 10.0.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 2ms, Average = 0ms

C:\>
```

Experiment No 2

Aim

Configuring IP address to Routers in Packet Tracer. Exploring the following messages: Ping Responses, Destination unreachable, Request timed out, Reply.

Topology

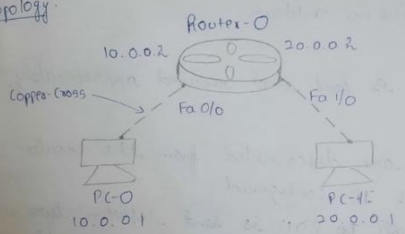


Procedure

Lab 2

Aim: To configure IP address to Routers in Packet tracer. Explore following messages: Ping responses, destination unreachable, Request timed out, Reply.

Topology:



Procedure:

→ Select two end devices and configure IP addresses (different network)

→ Select a router and connect the devices as shown in figure.

→ Configure the IP for router as per the commands.

→ Configure the gateway for two devices (gateway = IP addresses of router for same network)

→ Send a simple PDU between two devices before and after configuring the gateway for the devices.

Commands:

Router > enable

> Router # Configure terminal

> Router (config) # interface Fa 0/0

> Router (config-if) # ip address [ip] [subnet mask]

> Router (config-if) # no shutdown

> exit

Results: The PDU is sent and received appropriately.

Observations:

→ The devices are disconnected from the router until it is IP configured

→ When a simple IP PDU is sent between two devices, request time out occurs because the gateways aren't configured, i.e, the two networks are isolated.

→ When the gateways are configured and a simple PDU, it is received appropriately at the other network

Output

PC0

Physical | Config | Desktop | Attributes | Custom Interface

Command Prompt

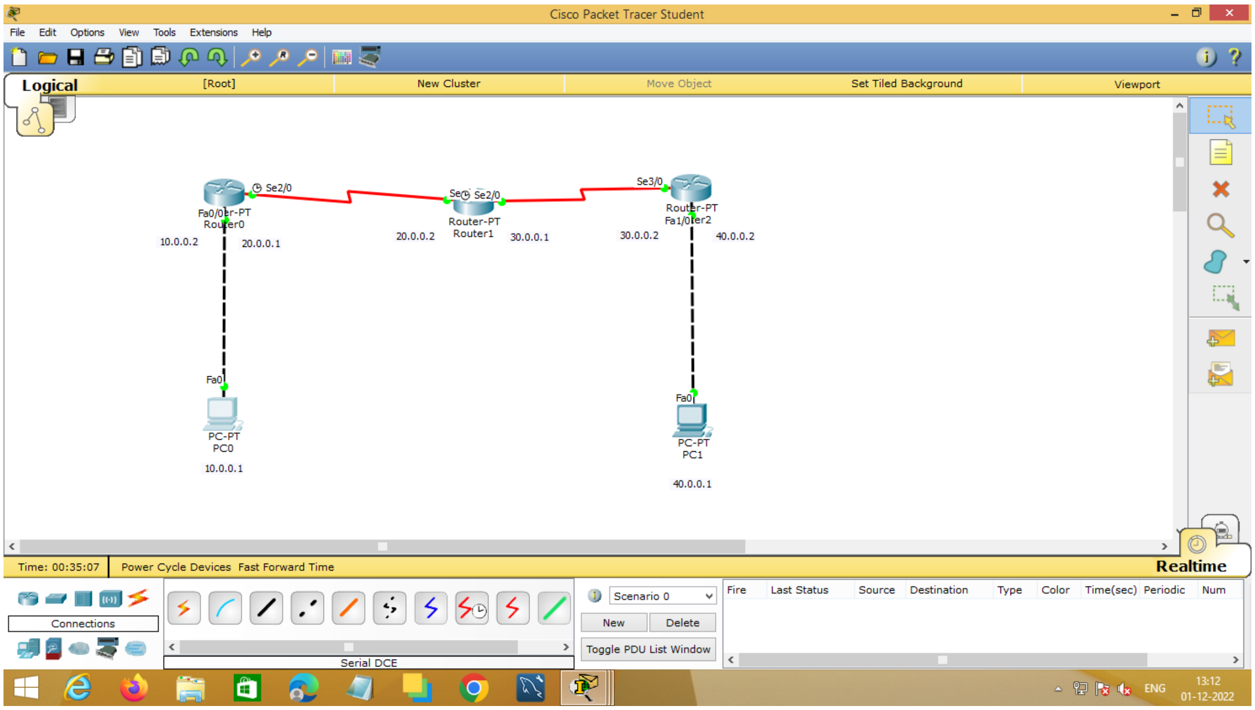
```
Packet Tracer PC Command Line 1.0
C:\>ping 20.0.0.1

Pinging 20.0.0.1 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 20.0.0.1:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>ping 20.0.0.1

Pinging 20.0.0.1 with 32 bytes of data:

Request timed out.
Reply from 20.0.0.1: bytes=32 time<1ms TTL=127
Reply from 20.0.0.1: bytes=32 time<1ms TTL=127
Reply from 20.0.0.1: bytes=32 time<1ms TTL=127

Ping statistics for 20.0.0.1:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

Experiment No 3

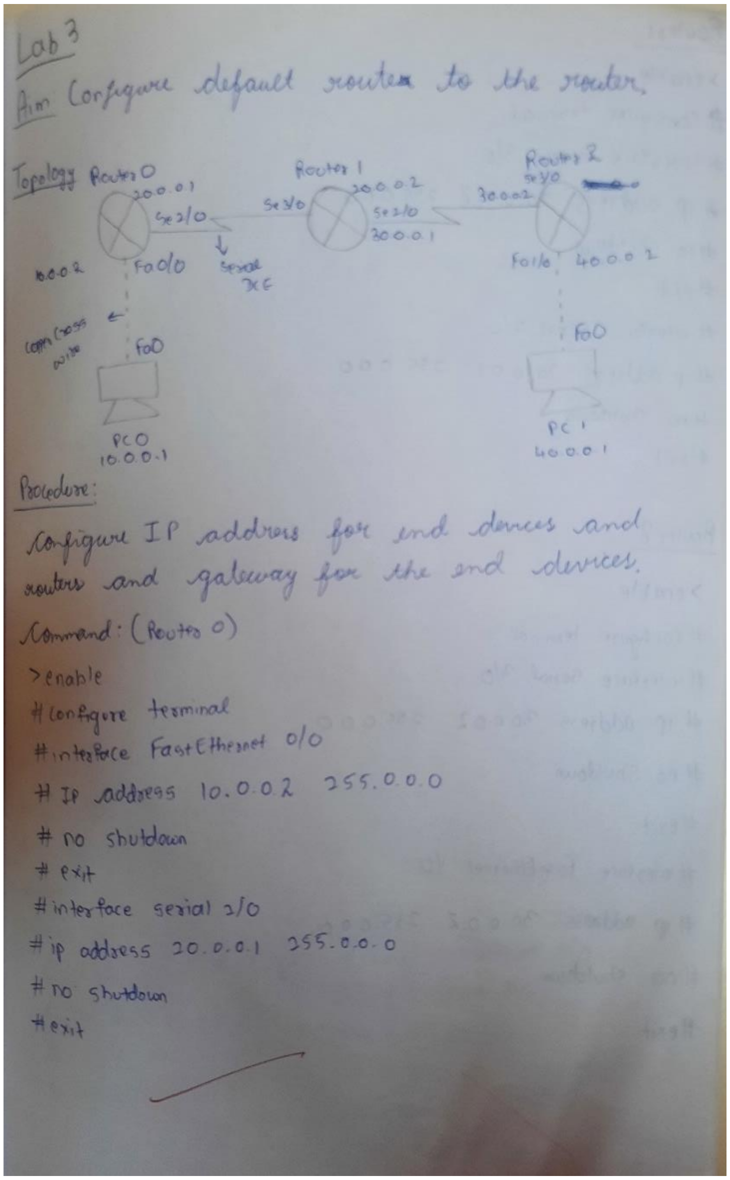
Aim

Configuring default route to the Router

Topology



Procedure



Lab 3

Aim Configure default routes to the router.

Topology Router 0
20.0.0.1
Se 2/0
Fa0/0
Serial DCE
10.0.0.2
copper cross wire
Fa0
PC0
10.0.0.1
Router 1
Se 3/0
20.0.0.2
Se 2/0
30.0.0.1
Router 2
Se 3/0
30.0.0.2
Fa1/0
40.0.0.2
Fa0
PC 1
40.0.0.1

Procedure:

Configure IP address for end devices and routers and gateway for the end devices.

Command: (Router 0)

```
>enable
#configure terminal
#interface FastEthernet 0/0
# IP address 10.0.0.2 255.0.0.0
# no shutdown
# exit
#interface serial 2/0
#ip address 20.0.0.1 255.0.0.0
# no shutdown
#exit
```

Router 1

> enable
configure terminal
interface Serial 3/0
ip address 20.0.0.2 255.0.0.0
no shutdown
exit
interface Serial 2/0
ip address 30.0.0.1 255.0.0.0
no shutdown
exit

Router 2

> enable
configure terminal
interface Serial 3/0
ip address 30.0.0.2 255.0.0.0
no shutdown
exit
interface FastEthernet 1/0
ip address 30.0.0.2 255.0.0.0
no shutdown
exit

Result: (PC0)

PC0 > Ping 40.0.0.1

Pinging 40.0.0.1 with 32 bytes of data

Reply from 10.0.0.2: Destination host unreachable
Reply from 10.0.0.2: Destination host unreachable
Reply from 10.0.0.2: Destination host unreachable
Reply from 10.0.0.2: Destination host unreachable
Reply from 10.0.0.2: Destination host unreachable

Ping Statistics for 40.0.0.1
Packets: Sent = 4, Received = 0, Lost = 4 (100 / Loss)

Command: (Router 0)

> show ip route
Gateway of last router is not set
C 10.0.0.0/8 is directly connected, FastEthernet 0/0
C 20.0.0.0/8 is directly connected, Serial 2/0

> enable
config t
ip route 30.0.0.0 255.0.0 20.0.0.2
ip route 40.0.0.0 255.0.0.0 20.0.0.2
exit
> show ip route
C 10.0.0.0/8 is directly connected, FastEthernet 0/0
C 20.0.0.0/8 is directly connected, Serial 2/0
S 30.0.0.0/8 [1/0] via 20.0.0.2
S 40.0.0.0/8 [1/0] via 20.0.0.2

Router 1

> Show ip route
C 20.0.0.0/8 is directly connected, Serial 3/0
C 30.0.0.0/8 is directly connected, Serial 2/0

> enable
config terminal
ip route 10.0.0.0 255.0.0.0 20.0.0.1
ip route 40.0.0.0 255.0.0.0 30.0.0.2
exit
> Show ip route
C 20.0.0.0/8 is directly connected, Serial 3/0
C 30.0.0.0/8 is directly connected, Serial 2/0
S 10.0.0.0/8 [1/0] via 20.0.0.1
S 40.0.0.0/8 [1/0] via 30.0.0.2

Router 2

> enable
config t
ip route 10.0.0.0 255.0.0.0 30.0.0.1
ip route 20.0.0.0 255.0.0.0 30.0.0.1
exit
> Show ip route
S 10.0.0.0/8 [1/0] via 30.0.0.1
S 20.0.0.0/8 [1/0] via 30.0.0.1
C 30.0.0.0/8 is directly connected, Serial 3/0
C 40.0.0.0/8 is directly connected, FastEthernet 1/0

Observations

Since the static route was not set, destination host was unreachable before.
Now, we set the static route now,

> Ping 40.0.0.1

Pinging 40.0.0.1 with 32 bytes of data

Request Timed Out
Reply from 40.0.0.1; bytes=32 time=22ms TTL=255
Reply from 40.0.0.1; bytes=32 time=22ms TTL=255
Reply from 40.0.0.1; bytes=32 time=22ms TTL=255

Pinging Statistics
Packets: Sent = 4, Received = 3, Lost = 1 (25 / Loss)

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R
1/12/2

Output

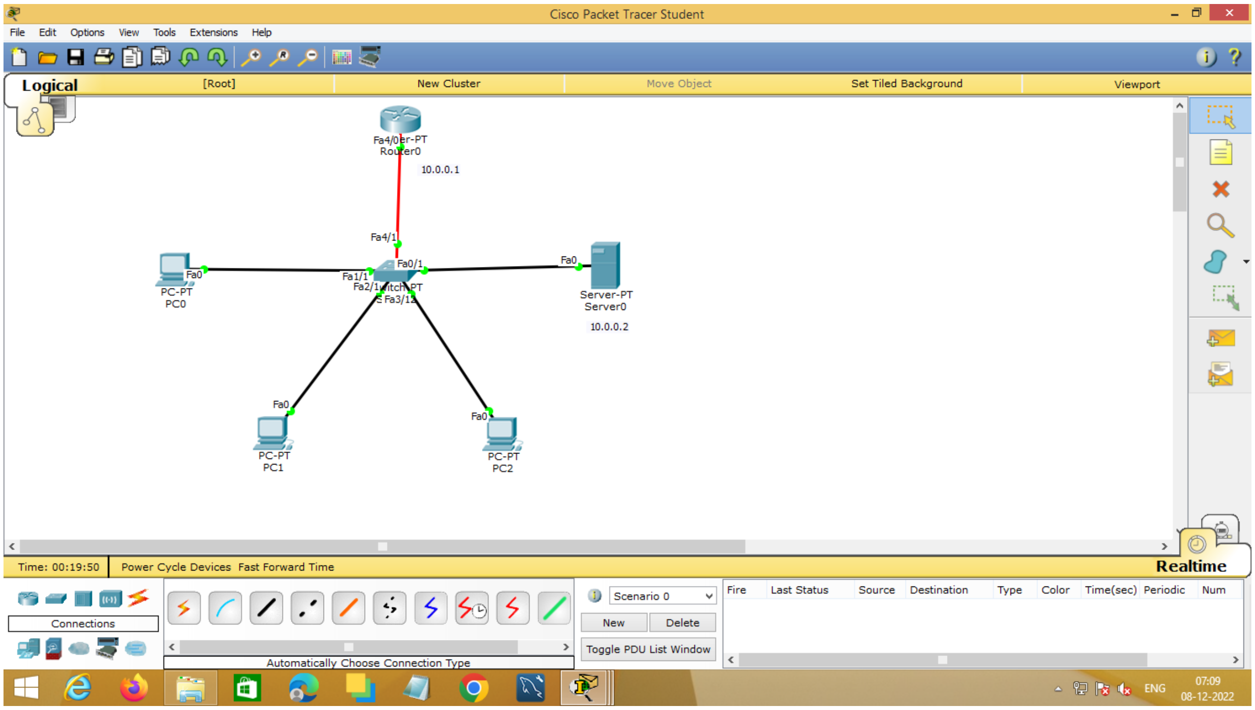
```
Packet Tracer PC Command Line 1.0
C:\>ping 40.0.0.1

Pinging 40.0.0.1 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 40.0.0.1:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>ping 40.0.0.1

Pinging 40.0.0.1 with 32 bytes of data:

Reply from 10.0.0.10: Destination host unreachable.
Reply from 10.0.0.10: Destination host unreachable.
Reply from 10.0.0.10: Destination host unreachable.
Reply from 10.0.0.10: Destination host unreachable.

Ping statistics for 40.0.0.1:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>ping 40.0.0.1

Pinging 40.0.0.1 with 32 bytes of data:

Request timed out.
Reply from 40.0.0.1: bytes=32 time=10ms TTL=125
Reply from 40.0.0.1: bytes=32 time=10ms TTL=125
Reply from 40.0.0.1: bytes=32 time=10ms TTL=125

Ping statistics for 40.0.0.1:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 10ms, Maximum = 10ms, Average = 10ms

C:\>
```

Experiment No 4

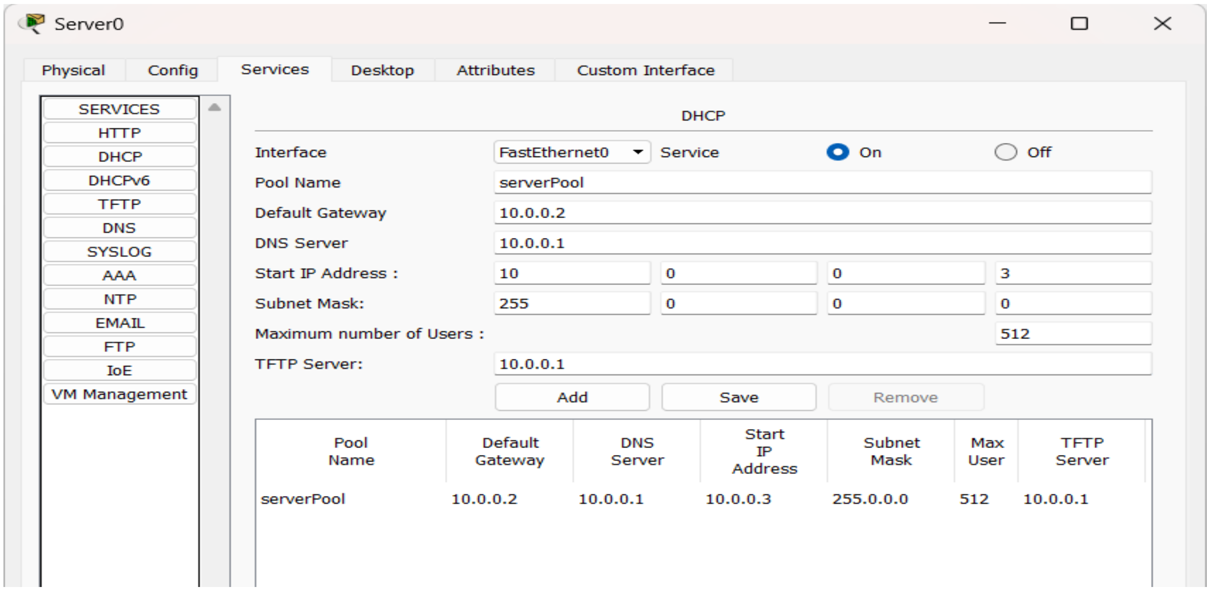
Aim

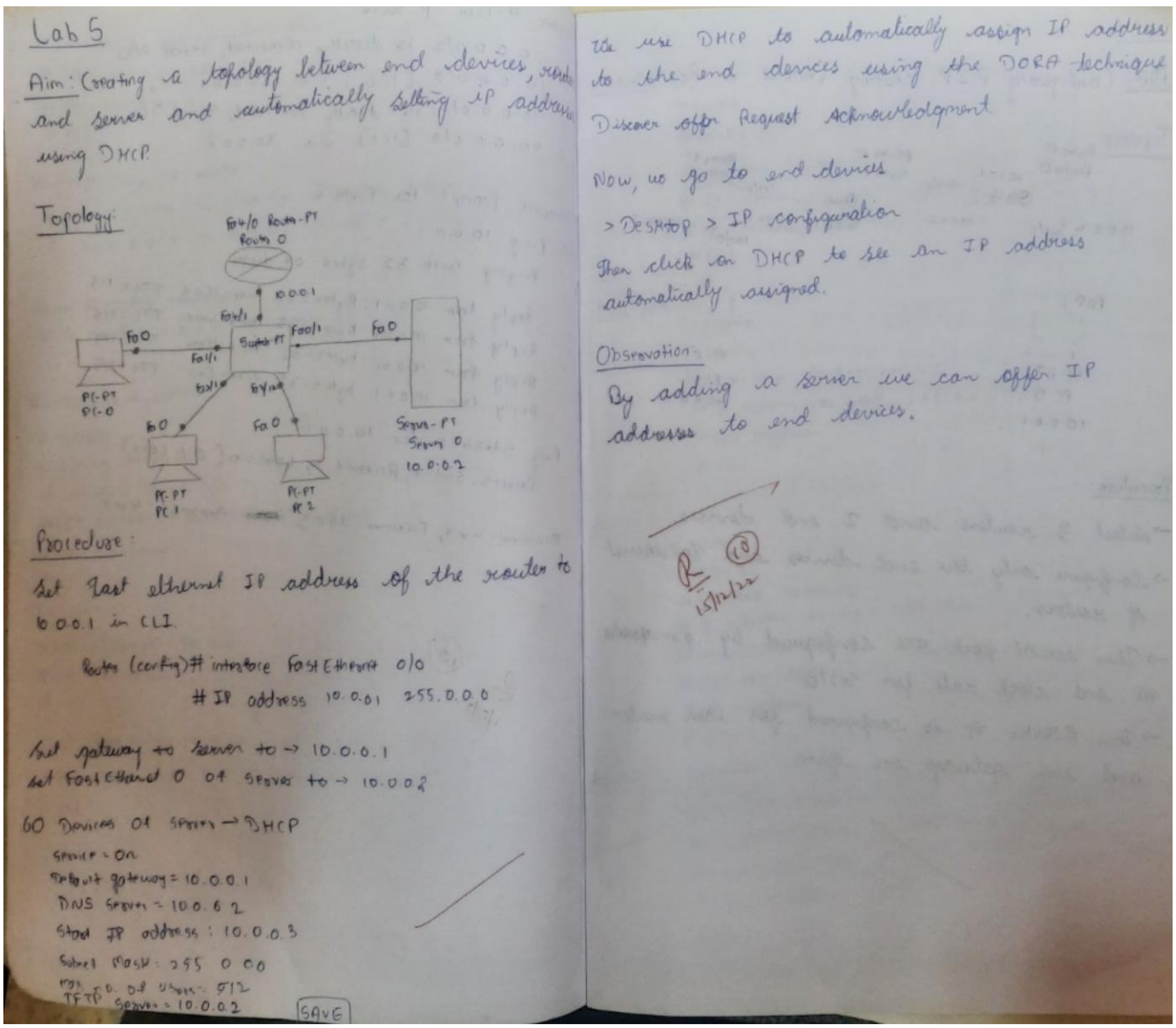
Configuring DHCP within a LAN in a packet Tracer

Topology



Procedure





Lab 5

Aim: Creating a topology between end devices, router and server and automatically setting IP address using DHCP

Topology:

Procedure:

Set fast ethernet IP address of the router to 10.0.0.1 in CLI.

Router (config)# interface FastEthernet 0/0
IP address 10.0.0.1 255.0.0.0

Set gateway to server to → 10.0.0.1
Set FastEthernet 0 of server to → 10.0.0.2

Go Devices Of Server → DHCP
Service = On
Default gateway = 10.0.0.1
DNS Server = 10.0.0.2
Start IP address : 10.0.0.3
Subnet Mask : 255.0.0.0
Max. no. of Users : 512
TFTP Server = 10.0.0.2
SAVE

to use DHCP to automatically assign IP address to the end devices using the DORA technique
Discover offer Request Acknowledgment

Now, we go to end devices
> Desktop > IP configuration
Then click on DHCP to see an IP address automatically assigned.

Observation

By adding a server we can offer IP addresses to end devices.

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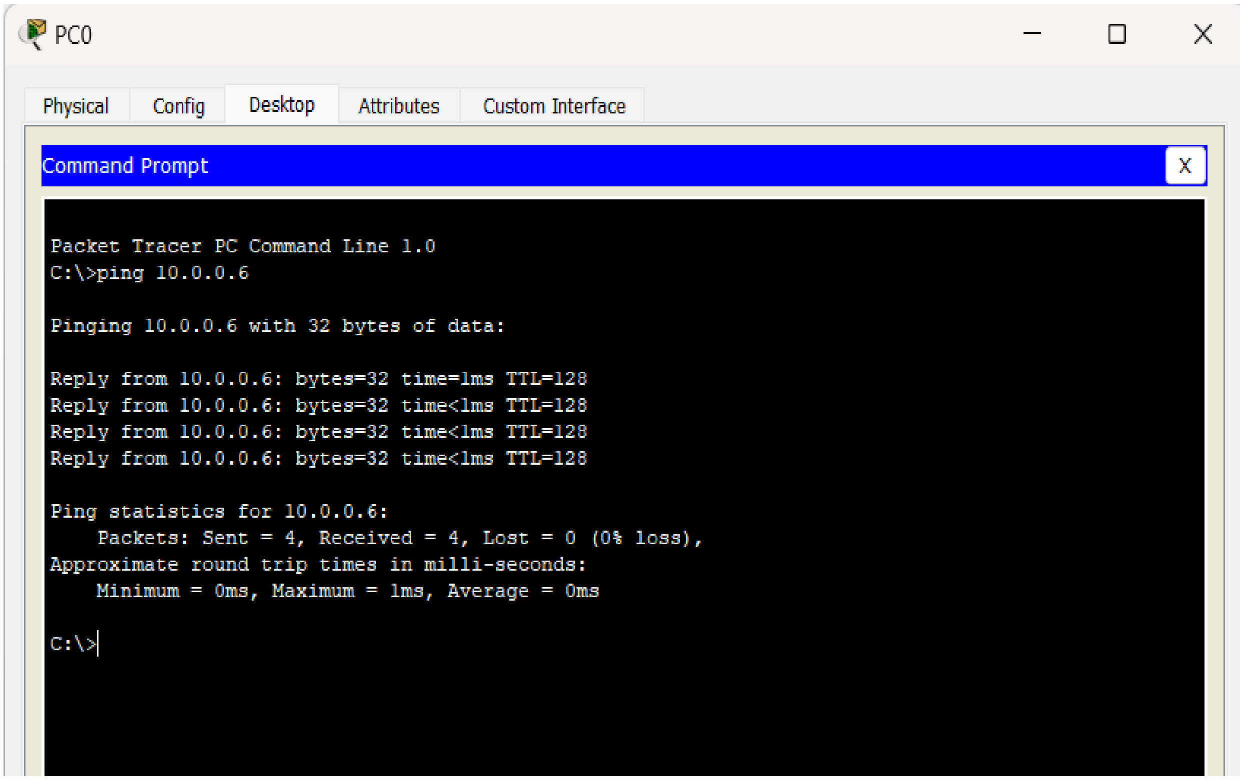
15/12/22

Output

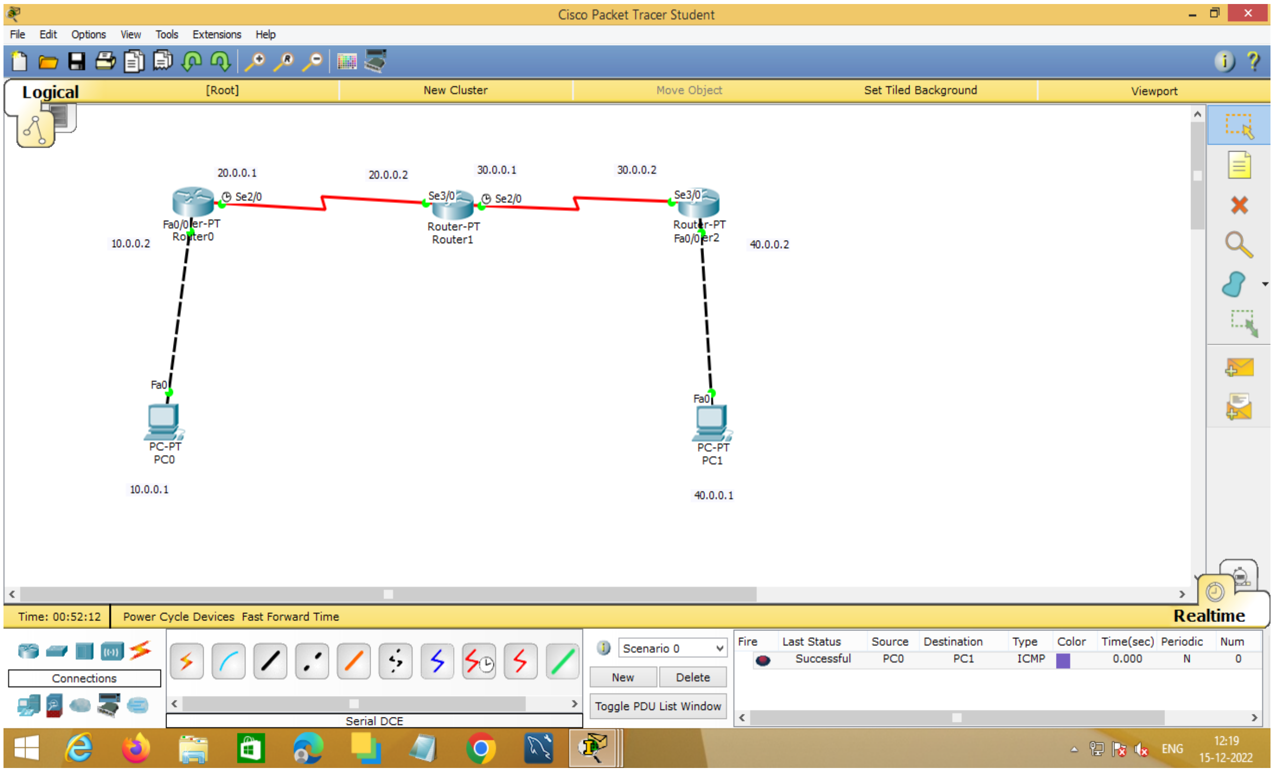

PC0
Physical
Config
Desktop
Attributes
Custom Interface
Command Prompt
X
Packet Tracer PC Command Line 1.0
C:\>ping 10.0.0.6
Pinging 10.0.0.6 with 32 bytes of data:
Reply from 10.0.0.6: bytes=32 time=1ms TTL=128
Reply from 10.0.0.6: bytes=32 time<1ms TTL=128
Reply from 10.0.0.6: bytes=32 time<1ms TTL=128
Reply from 10.0.0.6: bytes=32 time<1ms TTL=128
Ping statistics for 10.0.0.6:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 1ms, Average = 0ms
C:\>

Experiment No 5

Aim

Configuring RIP Routing Protocol in Routers

Topology

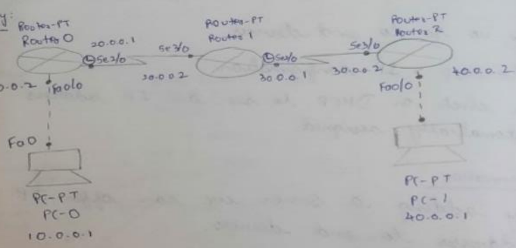


Procedure

Lab 6

Aim: Configuring RIP Routing Protocol in Routers.

Topology:



Procedure:

→ Select 3 routers and 2 end devices.

→ Configure only the end devices and fast ethernet of routers.

→ Then serial port are configured by encapsulation PPP and clock rate for Se2/0.

→ Then #router rip is configured for each router and then gateways are given.

Commands

Router 0

```
>enable
#config t
#interface Fastethernet 0/0
#ip address 10.0.0.2 255.0.0.0
#no shutdown
#exit
```

Router 2

```
>enable
#config t
#interface Fastethernet 0/0
#ip address 40.0.0.2 255.0.0.0
#no shutdown
#exit.
```

Router 0

```
>enable
#config t
#interface serial 2/0
#ip address 20.0.0.1 255.0.0.0
#encapsulation PPP
#clock rate 64000
#no shutdown
#exit
```

Router 1

```
>enable
#config t
#interface serial 3/0
#ip address 20.0.0.2 255.0.0.0
#encapsulation PPP
#no shutdown
#exit
#interface serial 2/0
#ip address 30.0.0.1 255.0.0.0
#encapsulation PPP
#clock rate 64000
#no shutdown
#exit
```

Router 2

```
>enable
#config t
#interface serial 3/0
#ip address 30.0.0.2 255.0.0.0
#encapsulation PPP
#no shutdown
#exit
```

Router 0

```
>enable
#config t
#router rip
#network 10.0.0.0
#network 20.0.0.0
#exit
```

Router 1

```
>enable
#config t
#router rip
#network 20.0.0.0
#network 30.0.0.0
#exit
```

Router 2

```
>enable
#config t
#router rip
#network 30.0.0.0
#network 40.0.0.0
#exit.
```

Observations:

PC0

```
>Ping 40.0.0.1
Pinging 40.0.0.1 with 32 bytes of data:
Reply from 40.0.0.1: bytes=32 time=10ms TTL=125
                              time=2ms
                              time=2ms
                              time=2ms

Ping statistics for 40.0.0.1:
    Packets: Sent=4, Received=4, Lost=0 (0% Loss)
Approximate round trip in milli-seconds
    Minimum=2ms, Maximum=10ms, Average=4ms
```

Output:

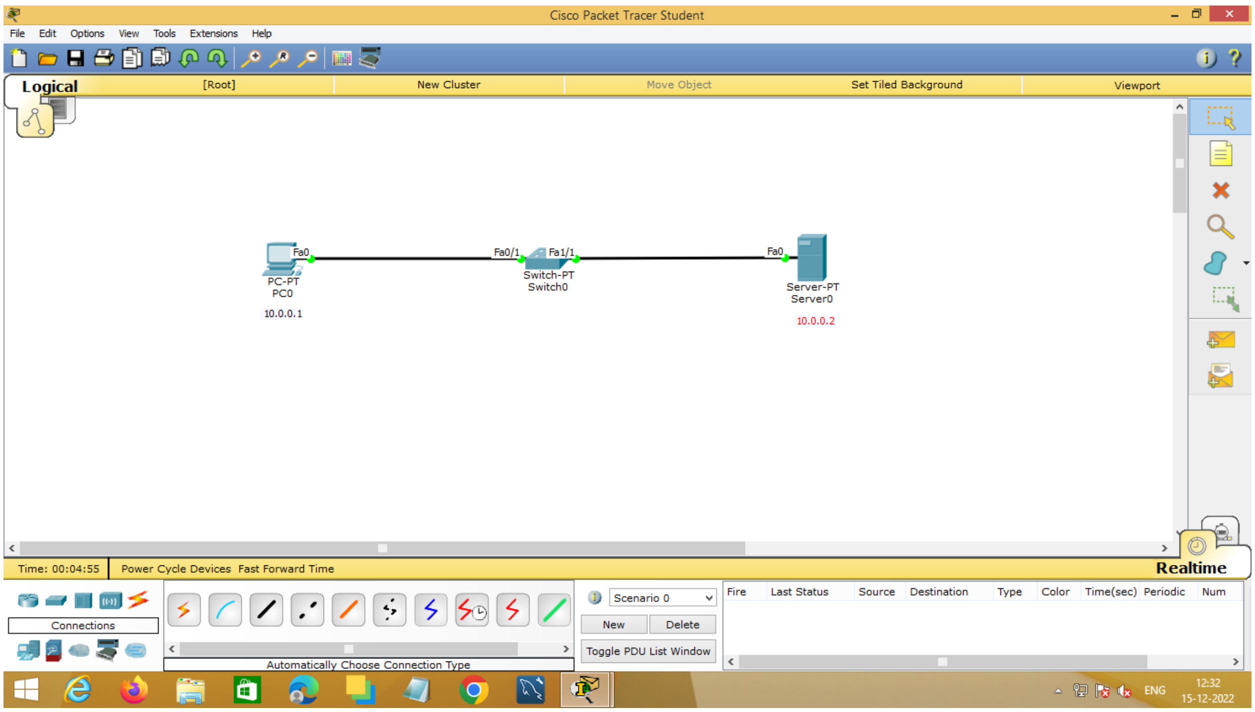
```
C:\>ping 40.0.0.1

Pinging 40.0.0.1 with 32 bytes of data:

Request timed out.
Reply from 40.0.0.1: bytes=32 time=4ms TTL=125
Reply from 40.0.0.1: bytes=32 time=3ms TTL=125
Reply from 40.0.0.1: bytes=32 time=4ms TTL=125

Ping statistics for 40.0.0.1:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 3ms, Maximum = 4ms, Average = 3ms

C:\>
```

Experiment No 6

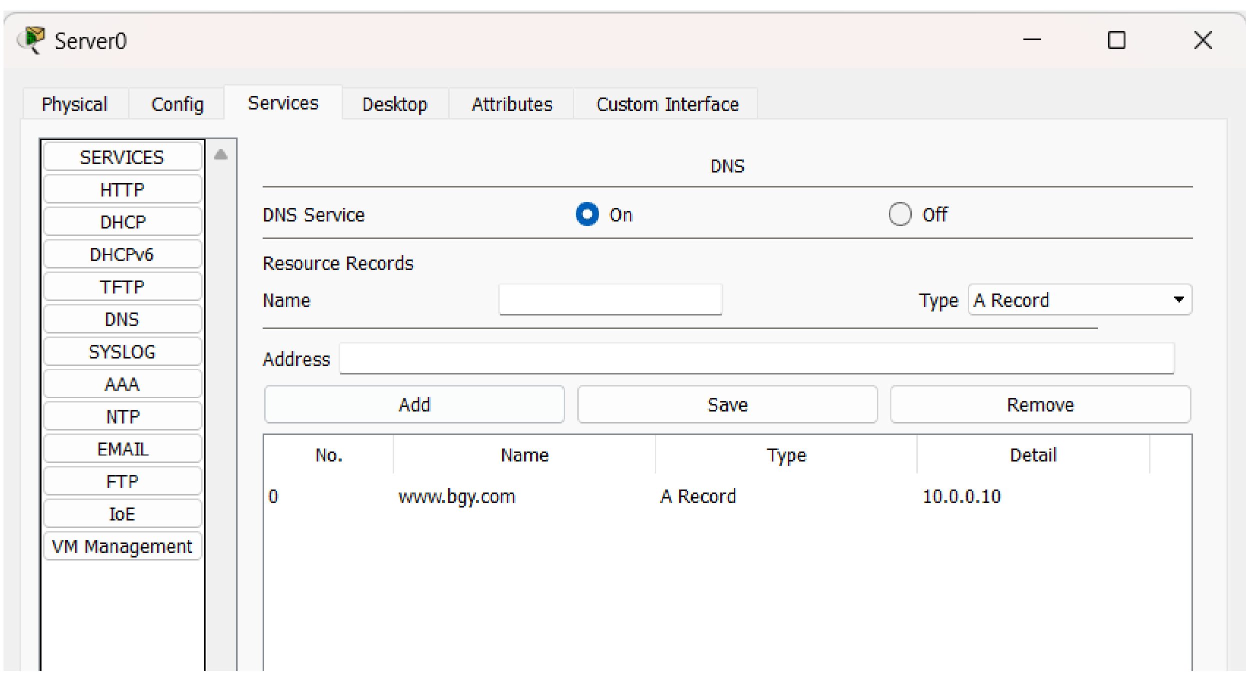
Aim

Demonstration of WEB server and DNS using Packet Tracer

Topology



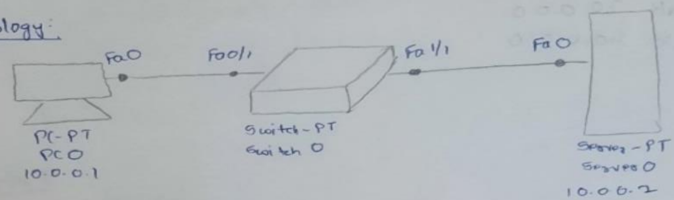
Procedure



Lab 7

Aim: Demonstration of WEB Server and DNS using Packet Tracer

Topology:



Procedure:

→ Connect one end device and one server to a switch

→ Configure the IP address of end device (10.0.0.1) and server (10.0.0.2)

→ Go to services in server and enable HTTP and DNS.

→ Add a domain name (eg. www.abc.com), address name - (Server ip) (10.0.0.2)

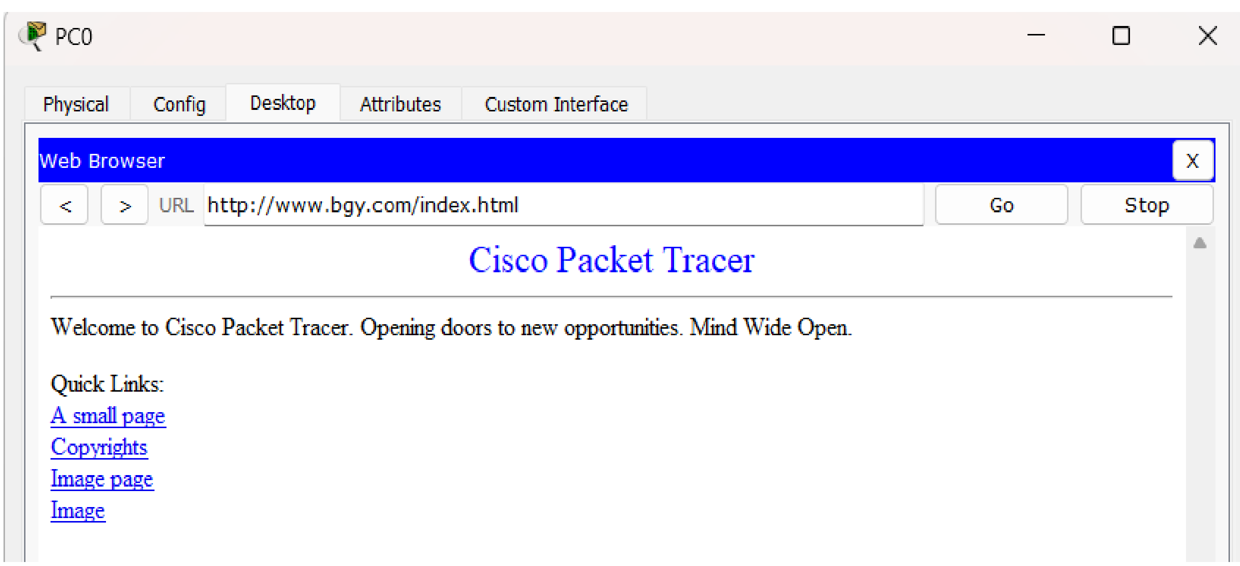
Add and save.

→ Go to web browser in end device and search for added domain name.

→ Try to search for domain name/.....html

Result: The added domain name is accessible

Output



Cycle-2

Experiment No 1

Aim

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

Code

```
#include<bits/stdc++.h>
using namespace std;
void receiver(string data, string key);

string xor1(string a, string b)
{

	string result = "";

	int n = b.length();

	for(int i = 1; i < n; i++)
	{
		if (a[i] == b[i])
			result += "0";
		else
			result += "1";
	}
	return result;
}

string mod2div(string dividend, string divisor)
{
```

```
        int pick = divisor.length();

        string tmp = dividend.substr(0, pick);

        int n = dividend.length();

        while (pick < n)
        {
                if (tmp[0] == '1')
                        tmp = xor1(divisor, tmp) + dividend[pick];
                else
                        tmp = xor1(std::string(pick, '0'), tmp) +
                                dividend[pick];

                pick += 1;
        }
        if (tmp[0] == '1')
                tmp = xor1(divisor, tmp);
        else
                tmp = xor1(std::string(pick, '0'), tmp);

        return tmp;
}

void encodeData(string data, string key)
{
        int l_key = key.length();
```

```
        string appended_data = (data +std::string(l_key - 1, '0'));


        string remainder = mod2div(appended_data, key);


        string codeword = data + remainder;
        cout << "Remainder : "
                << remainder << "\n";
        cout << "Encoded Data (Data + Remainder) :"
                << codeword << "\n";
        receiver(codeword, key);
}
void receiver(string data, string key)
{
        string currxor = mod2div(data.substr(0, key.size()), key);
        int curr = key.size();
        while (curr != data.size())
        {
                if (currxor.size() != key.size())
                {
                        currxor.push_back(data[curr++]);
                }
                else
                {
                        currxor = mod2div(currxor, key);
                }
        }
        if (currxor.size() == key.size())
        {
```

```
            currxor = mod2div(currxor, key);
        }
        if (currxor.find('1') != string::npos)
        {
            cout << "there is some error in data" << endl;
        }
        else
        {
            cout << "correct message recieved" << endl;
        }
}
int main()
{

        string data = "1011101";
        string key = "100010000001";

        encodeData(data, key);

        return 0;
}
```

Observation:

Lab 8: CRC checksum 16-bit program implementation.

divisor(16-bit): 10001000000100001

std polynomial g(x) divisor: $x^{16} + x^{12} + x^5 + 1$ CRC-16-bit

Code:

```
#include<bits/stdc++.h>
#include<string.h>
using namespace std;
int crc(char *ip, char *op, char *poly, int mode)
{
    strcpy(op,ip);
    if(mode)
    {   for(int i=1; i<strlen(poly);i++)
            strcat(op,'0');
    }
    for(int i=0; i<strlen(ip);i++)
    {   if(op[i]=='1')
        {   for(int j=0; j<strlen(poly);j++)
            {   if(op[i+j]==poly[j])
                    op[i+j]='0';
                else
                    op[i+j]='1';
            }
        }
    }
    for(int i=0; i<strlen(op);i++)
    {       if(op[i]=='1')
                return 0;
    }   ~~return~~
        return 1
}
int main()
{
    char ip[50],op[50],recv[50];
    char poly[]="10001000000100001";
    cout<<"Enter ip msg in binary"<<endl;
    cin>>ip;
    crc(ip,op,poly,1);
    cout<<"Transmitted msg:"<<ip<<op+strlen(ip)<<endl;
    cout<<"Enter received msg in binary"<<endl;
    cin>>recv;
    if(crc(recv,op,poly,0))
        cout<<"no error in data"<<endl;
    else
        cout<<"Error occurred"<<endl;
    return 0;
}
```

Output:

Enter msg in binary: 1010101010000000

The transmitted msg is. 10101010100000000110001100011110l

Enter received msg in binary

1010101010000000

No error in data

Output

```
Remainder : 10001011000
Encoded Data (Data + Remainder) :101110110001011000
correct message recieved


...Program finished with exit code 0
Press ENTER to exit console.
```

Experiment No 2

Aim

Write a program for distance vector algorithm to find suitable path for transmission.

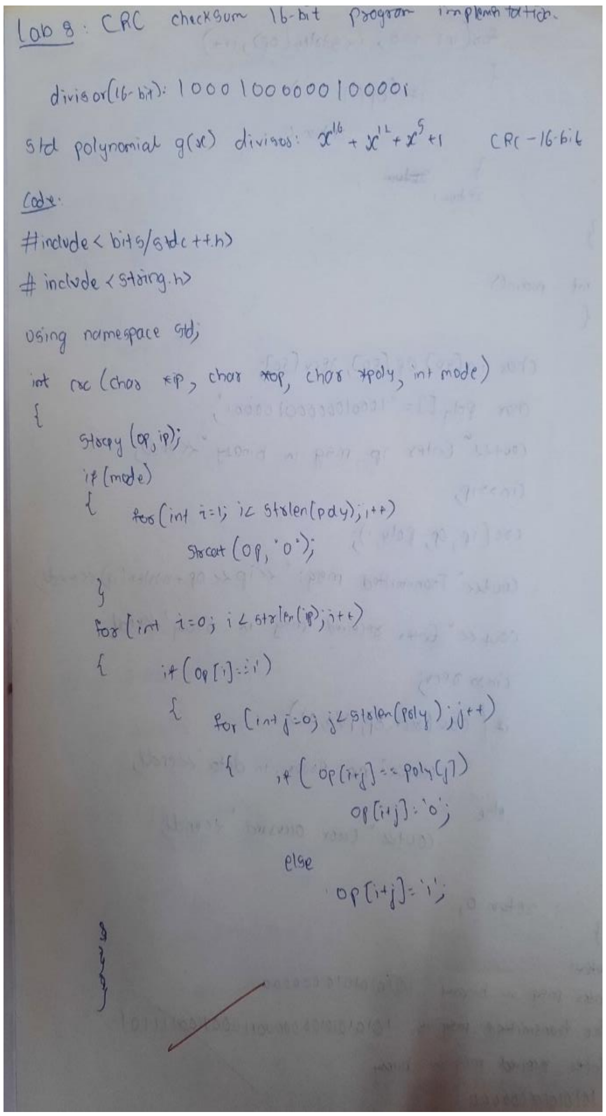
Code

```
#include<stdio.h>


#define INF  99999
#define n 5


void printSolution(int g[n])
{
    printf("Hop count         : ");
    for(int j=0;j<n;j++)
    {
        if(g[j] == INF)
            printf("INF\t");
        else
            printf("%d\t",g[j]);
    }
    printf("\n");
}


void findShortestPath(int dist[][n])
{


    for(int k=0;k<n;k++)
    {
        for(int i=0;i<n;i++)
```

```
        {
          for(int j=0;j<n;j++)
          {
            if(dist[i][j] > dist[i][k] + dist[k][j]
            &&(dist[i][k] != INF && dist[k][j] != INF))
            {
              dist[i][j] = dist[i][k] + dist[k][j];
            }
          }
        }
      }

      char c = 'A';
      for(int i=0; i<n; i++ )
      {
        printf("Router table entries for router %c:\n", c);
        printf("Destination router: A\tB\tC\tD\tE\n");
        printSolution(dist[i]);
        c++;
      }
    }

    int main()
    {
      int graph[][n] = { {0,   1,  1, INF, INF},
                {1,  0,  INF,  INF, INF},
                {1, INF, 0, 1,  1},
                {INF, INF, 1, 0, INF},
```

```
                {INF, INF, 1, INF, 0}};

    findShortestPath(graph);
    return 0;
}
```

Observation:

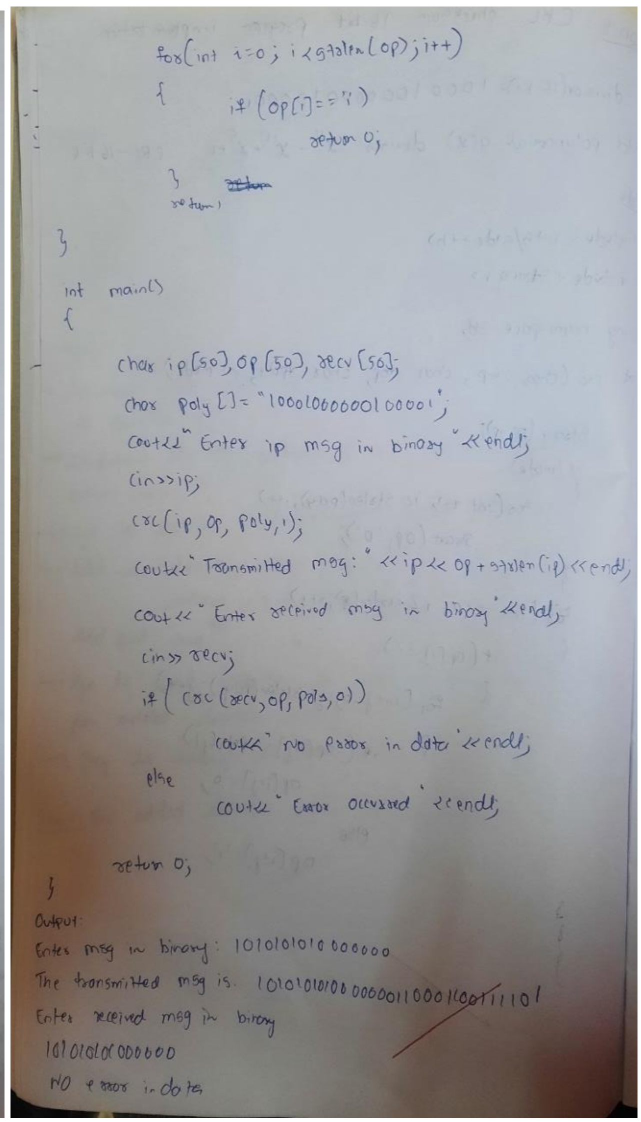

Lab 8: CRC checksum 16-bit program implementation.

divisor(16-bit): 10001000000100001

std polynomial g(x) divisor: $x^{16}+x^{12}+x^{5}+1$ CRC-16-bit

Code:

```
#include<bits/stdc++.h>
#include<string.h>
using namespace std;
int crc(char *ip, char *op, char *poly, int mode)
{
    strcpy(op, ip);
    if(mode)
    {   for(int i=1; i<strlen(poly); i++)
            strcat(op, "0");
    }
    for(int i=0; i<strlen(ip); i++)
    {   if(op[i]=='1')
        {   for(int j=0; j<strlen(poly); j++)
            {   if(op[i+j]==poly[j])
                    op[i+j]='0';
                else
                    op[i+j]='1';
            }
        }
    }
```



```
    for(int i=0; i<strlen(op); i++)
    {   if(op[i]=='1')
            return 0;
    }
    return 1;
}
int main()
{
    char ip[50], op[50], recv[50];
    char poly[]="10001000000100001";
    cout<<"Enter ip msg in binary"<<endl;
    cin>>ip;
    crc(ip, op, poly, 1);
    cout<<"Transmitted msg:"<<ip<<op+strlen(ip)<<endl;
    cout<<"Enter received msg in binary"<<endl;
    cin>>recv;
    if(crc(recv, op, poly, 0))
        cout<<"no error in data"<<endl;
    else
        cout<<"Error occured"<<endl;
    return 0;
}
```

Output:

Enter msg in binary: 1010101010000000

The transmitted msg is. 10101010100000000110001100011101

Enter received msg in binary

1010101010000000

NO error in data

Output:

```
Router table entries for router A:
Destination router: A    B       C       D       E
Hop count         : 0    1       1       2       2
Router table entries for router B:
Destination router: A    B       C       D       E
Hop count         : 1    0       2       3       3
Router table entries for router C:
Destination router: A    B       C       D       E
Hop count         : 1    2       0       1       1
Router table entries for router D:
Destination router: A    B       C       D       E
Hop count         : 2    3       1       0       2
Router table entries for router E:
Destination router: A    B       C       D       E
Hop count         : 2    3       1       2       0


...Program finished with exit code 0
Press ENTER to exit console.
```

Experiment No 3

Aim

Implement Dijkstra's algorithm to compute the shortest path for a given topology.

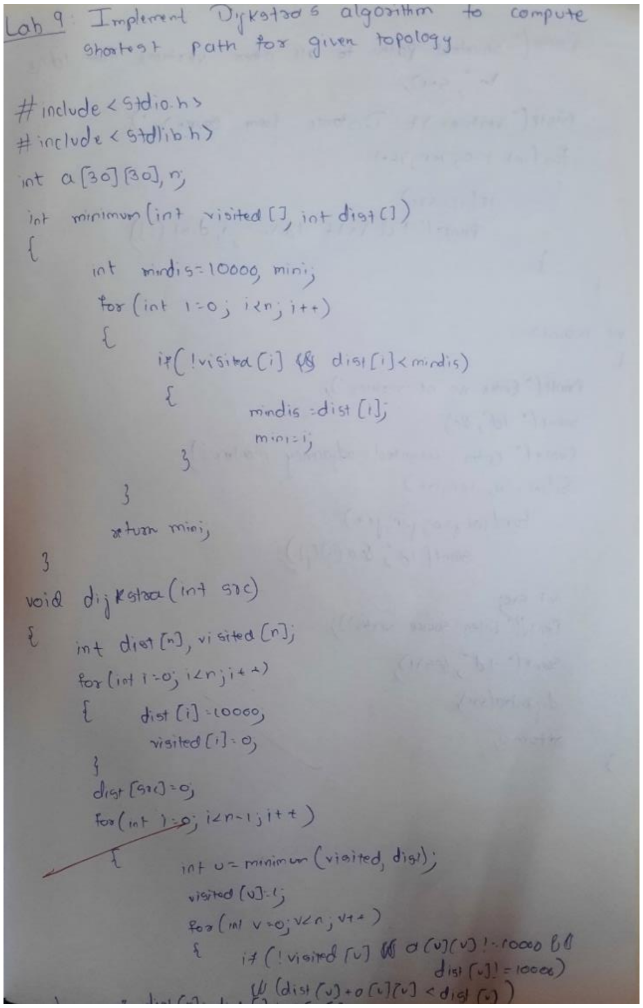
Code

```
#include <stdio.h>
#include <stdlib.h>


void dijkstra(int graph[10][10],int V)
{
    int distance[V], predefine[V], visited[V];
    int startnode, count, min_distance, nextnode, i, j;
    printf("\nEnter the start node: ");
    scanf("%d", &startnode);
    for(i=0; i<V; i++) {
        distance[i] = graph[startnode][i];
        predefine[i] = startnode;
        visited[i] = 0;
    }
    distance[startnode] = 0;
    visited[startnode] = 1;
    count = 1;
    while(count<V-1) {
        min_distance = 99;
        for(i=0; i<V; i++) {
            if(distance[i] < min_distance && visited[i]==0)
            {
                min_distance = distance[i];
```

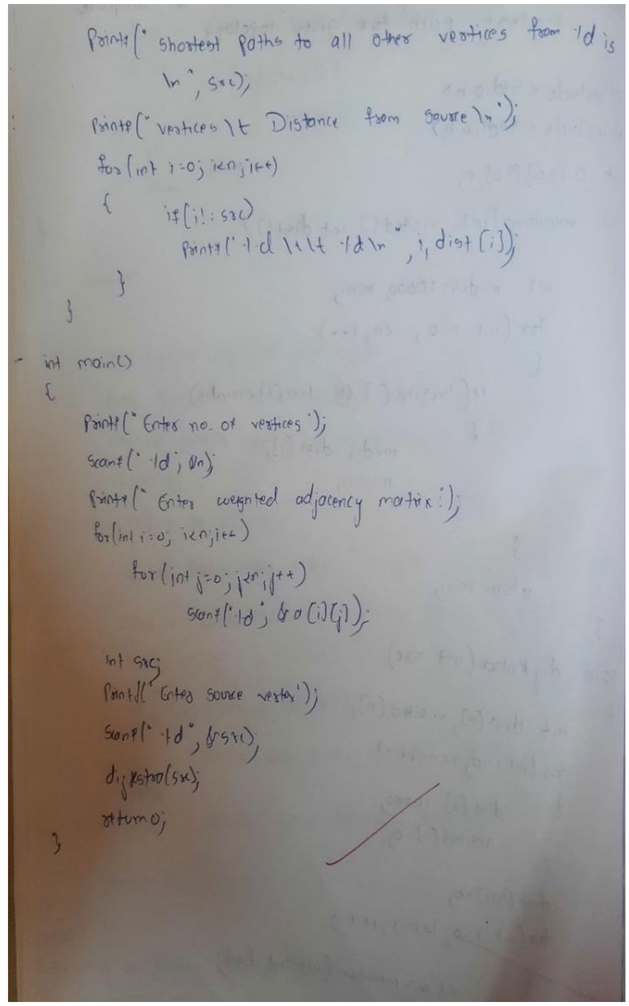
```
                nextnode = i;
            }
        }
        visited[nextnode] = 1;
        for(i=0;i<V;i++)
        {
            if(visited[i] == 0)
            {
                if((min_distance + graph[nextnode][i]) < distance[i])
                {
                    distance[i] = min_distance + graph[nextnode][i];
                    predefine[i] = nextnode;
                }
            }
        }
        count = count + 1;
    }
    for(i=0;i<V;i++) {
        if(i!=startnode) {
            printf("\nDistance of node %d = %d", i, distance[i]);
            printf("\nPath = %d",i);
            j = i;
            do
            {
                j = predefine[j];
                printf(" <- %d",j);
            } while (j != startnode);
        }
```

```
    }
}
int main()
{
    int i, j;
    int V;
    printf("Enter the number of vertices: ");
    scanf("%d", &V);
    int graph[V][V];
    printf("\nEnter the cost/weight matrix: \n");
    for(i=0; i<V; i++) {
        for(j=0;j<V;j++) {
            scanf("%d", &graph[i][j]);
        }
    }
    dijkstra(graph, V);
    return 0;
}
```

Observation:



```
Lab 9: Implement Dijkstra's algorithm to compute
       shortest path for given topology

#include<stdio.h>
#include<stdlib.h>
int a[30][30],n;
int minimum(int visited[], int dist[])
{
    int mindis=10000, mini;
    for(int i=0; i<n; i++)
    {
        if(!visited[i] && dist[i]<mindis)
        {
            mindis=dist[i];
            mini=i;
        }
    }
    return mini;
}
void dijkstra(int src)
{   int dist[n], visited[n];
    for(int i=0; i<n; i++)
    {   dist[i]=10000;
        visited[i]=0;
    }
    dist[src]=0;
    for(int i=0; i<n-1; i++)
    {   int u=minimum(visited, dist);
        visited[u]=1;
        for(int v=0; v<n; v++)
        {   if(!visited[v] && a[u][v]!=10000 &&
                  dist[u]!=10000
               && (dist[u]+a[u][v] < dist[v]))
```



```
    printf("shortest paths to all other vertices from %d is
          \n", src);
    printf("vertices \t Distance from source \n");
    for(int i=0; i<n; i++)
    {   if(i!=src)
            printf("%d \t\t %d \n", i, dist[i]);
    }
}
int main()
{
    printf("Enter no. of vertices");
    scanf("%d", &n);
    printf("Enter weighted adjacency matrix:");
    for(int i=0; i<n; i++)
        for(int j=0; j<n; j++)
            scanf("%d", &a[i][j]);
    int src;
    printf("Enter source vertex");
    scanf("%d", &src);
    dijkstra(src);
    return 0;
}
```

Output:

```
Enter the number of vertices: 5

Enter the cost/weight matrix:
0 10 99 5 7
10 0 1 2 99
99 1 0 9 4
5 2 9 0 99
7 99 4 99 0

Enter the start node: 0

Distance of node 1 = 5
Path = 1 <- 4 <- 3 <- 0
Distance of node 2 = 5
Path = 2 <- 4 <- 3 <- 0
Distance of node 3 = 5
Path = 3 <- 0
Distance of node 4 = 5
Path = 4 <- 3 <- 0

...Program finished with exit code 0
Press ENTER to exit console.
```

Experiment No 4

Aim

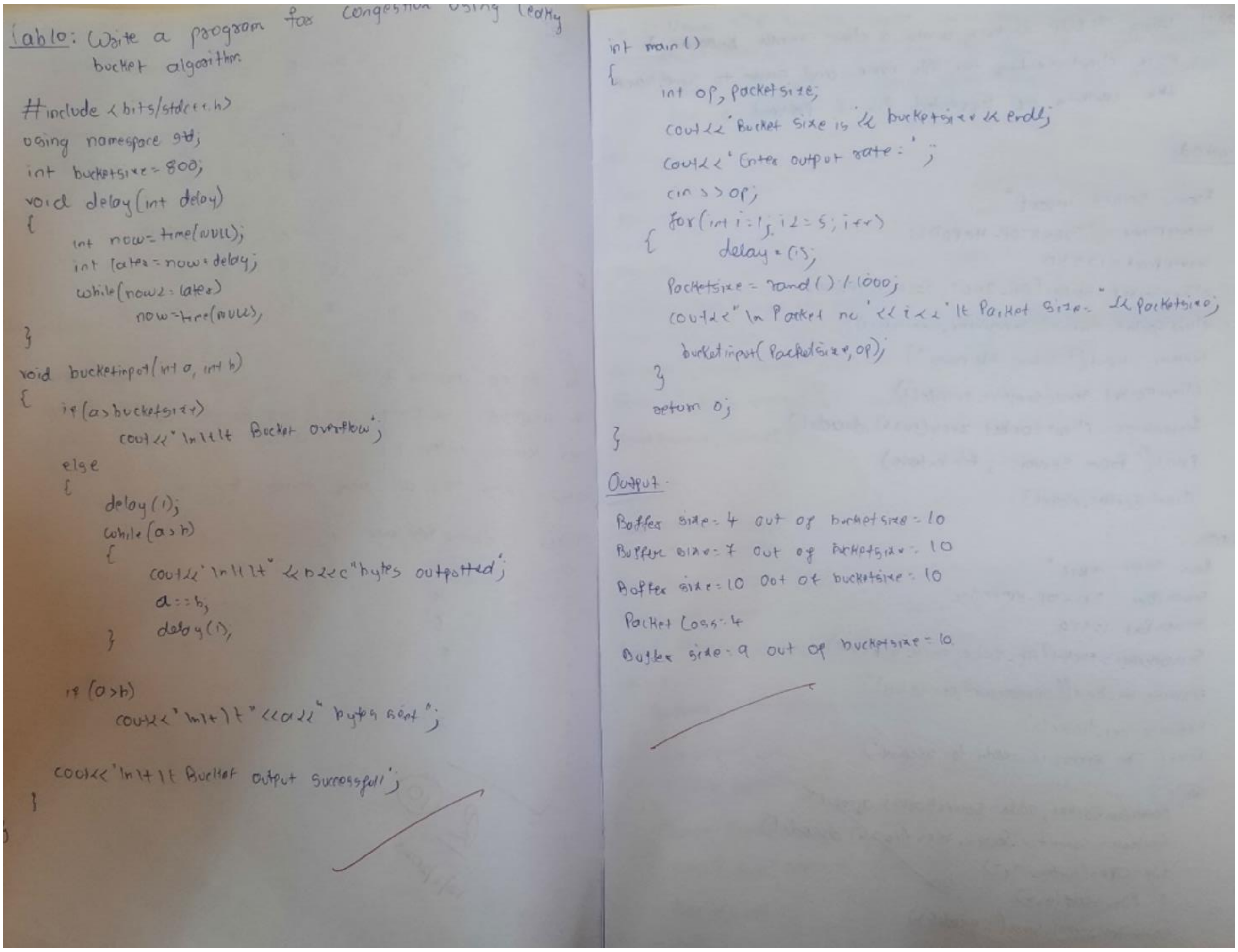
Write a program for congestion control using Leaky bucket algorithm

Code

```
#include <bits/stdc++.h>
using namespace std;
int main()
{
        int no_of_queries, storage, output_pkt_size;
        int input_pkt_size, bucket_size, size_left;
        storage = 0;
        no_of_queries = 4;
        bucket_size = 10;
        input_pkt_size = 4;
        output_pkt_size = 1;
        for (int i = 0; i < no_of_queries; i++) //
        {
                size_left = bucket_size - storage;
                if (input_pkt_size <= size_left) {
                        // update storage
                        storage += input_pkt_size;
                }
                else {
                        printf("Packet loss = %d\n", input_pkt_size);
                }
                printf("Buffer size= %d out of bucket size= %d\n",
                        storage, bucket_size);
```

```
            storage -= output_pkt_size;
      }
      return 0;}
```

Observation:


Lab10: Write a program for congestion using leaky bucket algorithm

```
#include <bits/stdc++.h>
using namespace std;
int bucketsize = 800;
void delay(int delay)
{
    int now=time(NULL);
    int later=now+delay;
    while(now<=later)
        now=time(NULL);
}
void bucketinput(int a, int b)
{
    if(a>bucketsize)
        cout<<"\n\t\t Bucket overflow";
    else
    {
        delay(1);
        while(a>b)
        {
            cout<<"\n\t\t"<<b<<"bytes outputted";
            a-=b;
            delay(1);
        }
    if(a>b)
        cout<<"\n\t\t"<<a<<" bytes sent";
    cout<<"\n\t\t Bucket output successful";
}
int main()
{
    int op, packetsize;
    cout<<"Bucket size is "<< bucketsize << endl;
    cout<<"Enter output rate : ";
    cin>>op;
    for(int i=1; i<=5; i++)
    {
        delay(1);
        packetsize = rand() % 1000;
        cout<<"\n Packet no "<<i<<"\t Packet size= "<<packetsize;
        bucketinput(packetsize, op);
    }
    return 0;
}
```

Output

Buffer size= 4 out of bucketsize= 10
Buffer size= 7 out of bucketsize= 10
Buffer size= 10 out of bucketsize= 10
Packet loss= 4
Buffer size= 9 out of bucketsize= 10

Output:

```
Buffer size= 4 out of bucket size= 10
Buffer size= 7 out of bucket size= 10
Buffer size= 10 out of bucket size= 10
Packet loss = 4
Buffer size= 9 out of bucket size= 10
```

Experiment No 5

Aim

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

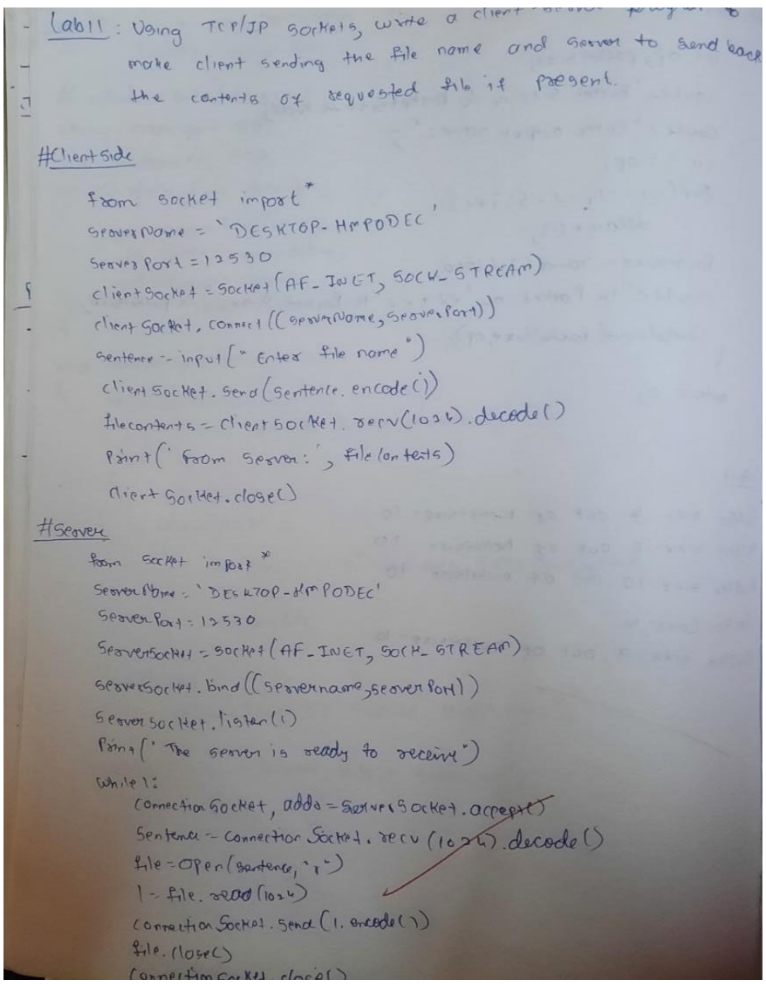
Server:

```
from socket import *
serverName = ''
serverPort = 12530
serverSocket = socket(AF_INET,SOCK_STREAM)
serverSocket.bind((serverName,serverPort))
serverSocket.listen(1)
print("The server is ready to receive")
while 1:
    connectionSocket, addr = serverSocket.accept()
    sentence = connectionSocket.recv(1024).decode()
    try:
        file = open(sentence,"r")
        l = file.read(1024)
        connectionSocket.send(l.encode())
        file.close()
    except Exception as e:
        message = "No such file exist"
        connectionSocket.send(message.encode())
    connectionSocket.close()
```

Client:

```
from socket import *
serverName = '192.168.1.104'
serverPort = 12530
clientSocket = socket(AF_INET, SOCK_STREAM)
clientSocket.connect((serverName,serverPort))
sentence = input("Enter file name")
clientSocket.send(sentence.encode())
filecontents = clientSocket.recv(1024).decode()
print ('From Server:', filecontents)
clientSocket.close()
```

Observation:



Lab11: Using TCP/IP sockets, write a client-server program to make client sending the file name and server to send back the contents of requested file if present.

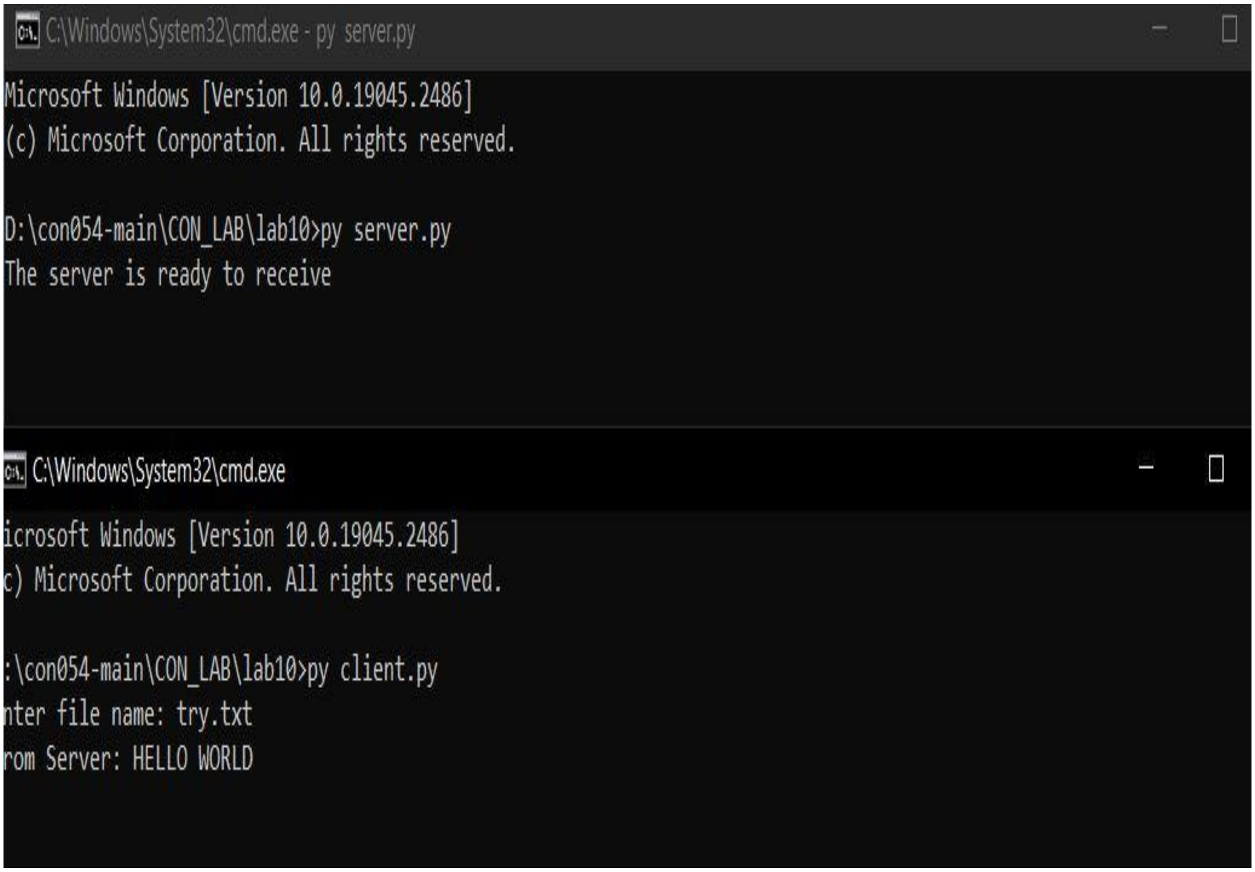
#Client Side

```
from socket import *
serverName = 'DESKTOP-HMPODEC'
Server Port = 12530
clientSocket = socket(AF_INET, SOCK_STREAM)
clientSocket.connect((serverName, serverPort))
sentence = input("Enter file name")
clientSocket.send(sentence.encode())
filecontents = clientSocket.recv(1024).decode()
Print('from server:', filecontents)
clientSocket.close()
```

#Server

```
from socket import *
ServerName = 'DESKTOP-HMPODEC'
ServerPort = 12530
ServerSocket = socket(AF_INET, SOCK_STREAM)
serverSocket.bind((servername, serverPort))
ServerSocket.listen(1)
Print('The server is ready to receive')
While 1:
    ConnectionSocket, addr = ServerSocket.accept()
    Sentence = ConnectionSocket.recv(1024).decode()
    file = open(sentence, "r")
    l = file.read(1024)
    ConnectionSocket.send(l.encode())
    file.close()
    ConnectionSocket.close()
```

Output


C:\Windows\System32\cmd.exe - py server.py
Microsoft Windows [Version 10.0.19045.2486]
(c) Microsoft Corporation. All rights reserved.
D:\con054-main\CON_LAB\lab10>py server.py
The server is ready to receive
C:\Windows\System32\cmd.exe
icrosoft Windows [Version 10.0.19045.2486]
c) Microsoft Corporation. All rights reserved.
:\con054-main\CON_LAB\lab10>py client.py
nter file name: try.txt
rom Server: HELLO WORLD

Experiment No 6

Aim

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:

```
from socket import *
serverPort = 12000
serverSocket = socket(AF_INET, SOCK_DGRAM)
serverSocket.bind(("127.0.0.1", serverPort))
print("The server is ready to receive")
while 1:
    sentence,clientAddress = serverSocket.recvfrom(2048)

    file=open(sentence,"r")
    l=file.read(2048)

    serverSocket.sendto(bytes(l,"utf-8"),clientAddress)
    print("sent back to client",l)
    file.close()
```

Client:

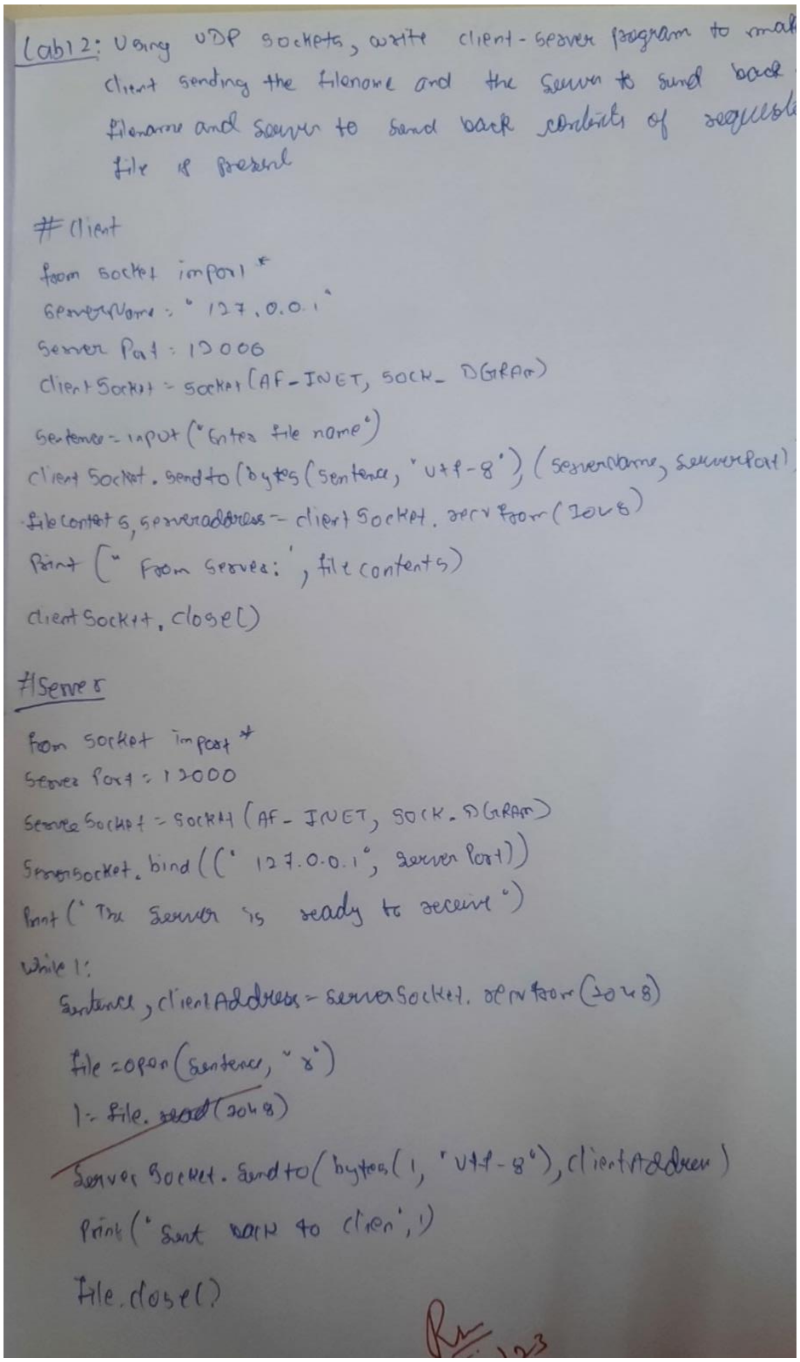
```
from socket import *
serverName = "127.0.0.1"
serverPort = 12000
clientSocket = socket(AF_INET, SOCK_DGRAM)

sentence = input("Enter file name")
clientSocket.sendto(bytes(sentence,"utf-8"),(serverName, serverPort))
```

filecontents,serverAddress = clientSocket.recvfrom(2048)

print ('From Server:', filecontents)

clientSocket.close()

Observation:



Lab12: Using UDP sockets, write client-server program to make client sending the filename and the server to send back filename and server to send back contents of requested file if present

#client

from socket import *
serverName = "127.0.0.1"
Server Port = 12000
clientSocket = socket(AF_INET, SOCK_DGRAM)
Sentence = input("Enter file name")
clientSocket.sendto(bytes(sentence, "utf-8"), (serverName, serverPort))
filecontents, serveraddress = clientSocket.recvfrom(2048)
Print ("From Server:", filecontents)
clientSocket.close()

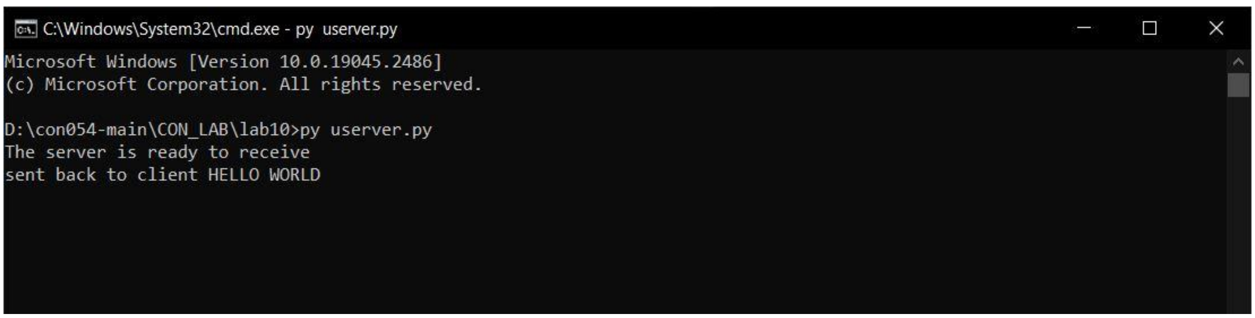
#Server

from socket import *
Server Port = 12000
ServerSocket = socket(AF_INET, SOCK_DGRAM)
ServerSocket.bind(("127.0.0.1", serverPort))
Print ("The Server is ready to receive")
While 1:
Sentence, clientAddress = serverSocket.recvfrom(2048)
file = open(sentence, "r")
l = file.read(2048)
ServerSocket.sendto(bytes(l, "utf-8"), clientAddress)
Print ("Sent back to client", l)
File.close()

Output


Select C:\Windows\System32\cmd.exe - py userver.py
Microsoft Windows [Version 10.0.19045.2486]
(c) Microsoft Corporation. All rights reserved.
D:\con054-main\CON_LAB\lab10>py userver.py
The server is ready to receive


C:\Windows\System32\cmd.exe
Microsoft Windows [Version 10.0.19045.2486]
(c) Microsoft Corporation. All rights reserved.
D:\con054-main\CON_LAB\lab10>py uclient.py
Enter file name: try.txt
From Server: b'HELLO WORLD\n\n'
D:\con054-main\CON_LAB\lab10>


C:\Windows\System32\cmd.exe - py userver.py
Microsoft Windows [Version 10.0.19045.2486]
(c) Microsoft Corporation. All rights reserved.
D:\con054-main\CON_LAB\lab10>py userver.py
The server is ready to receive
sent back to client HELLO WORLD