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"JnanaSangama", Belgaum -590014, Karnataka.

LAB REPORT
on

COMPUTER NETWORKS

Submitted by

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(1BM20CS207)

in partial fulfillment for the award of the degree of

BACHELOR OF ENGINEERING
in
COMPUTER SCIENCE AND ENGINEERING

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CERTIFICATE

This is to certify that the Lab work entitled "LAB COURSE **COMPUTER NETWORKS**" carried out by **MANASA DANDA ANILKUMAR (1BM20CS207),** who is a 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 **Computer Networks - (20CS5PCCON)** work prescribed for the said degree.

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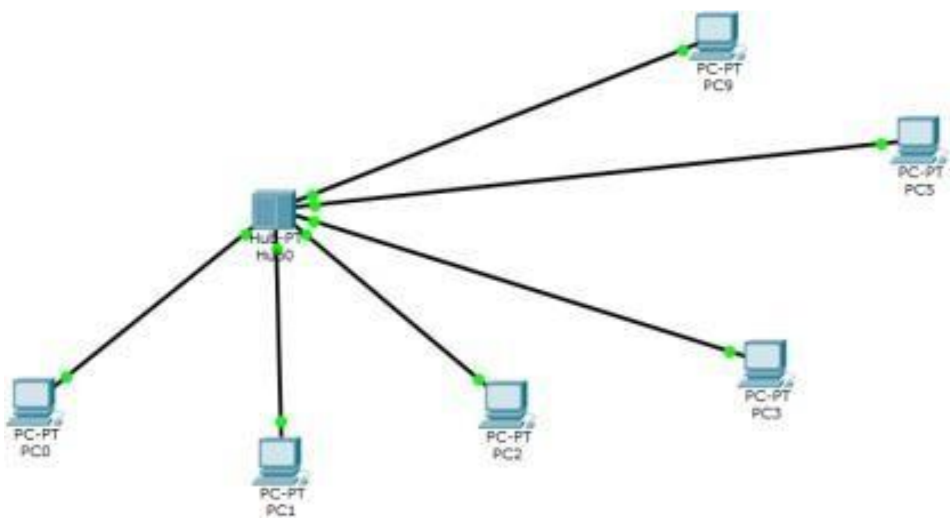
CYCLE - 1

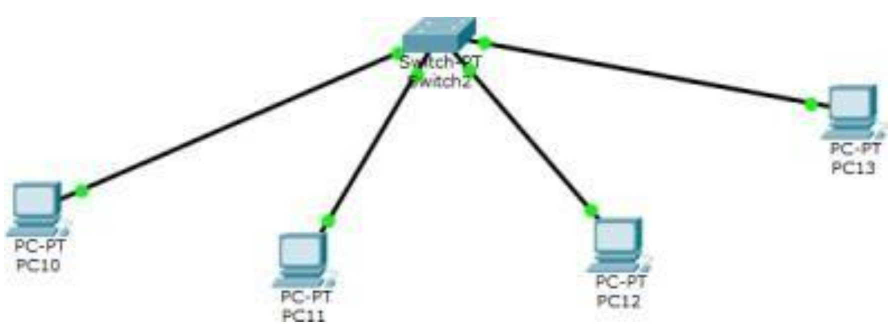
Experiment No-1

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

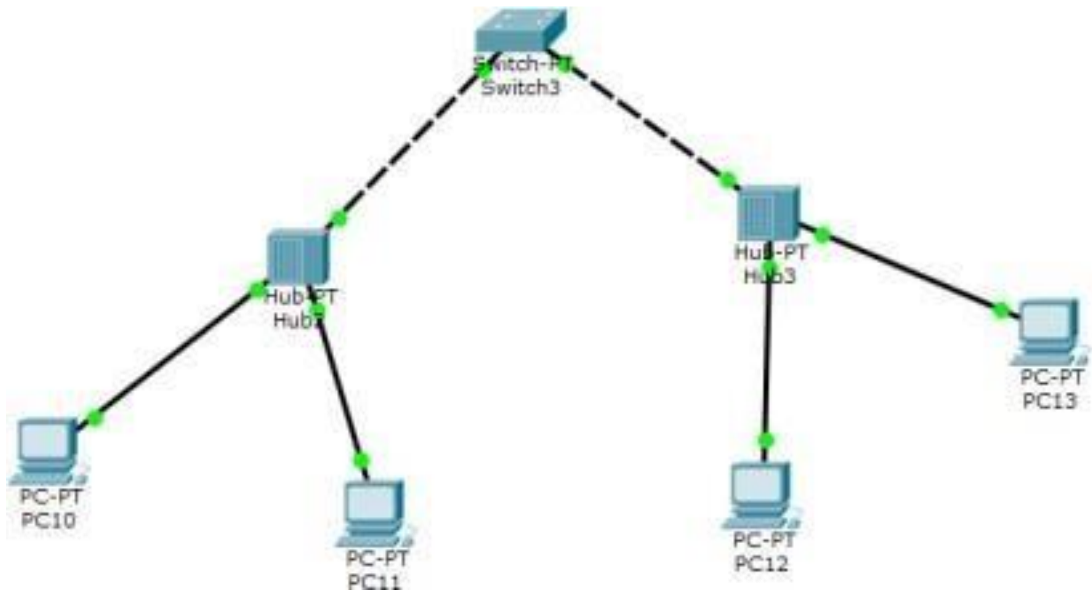
1. PC and Hub



2. PC and Switch



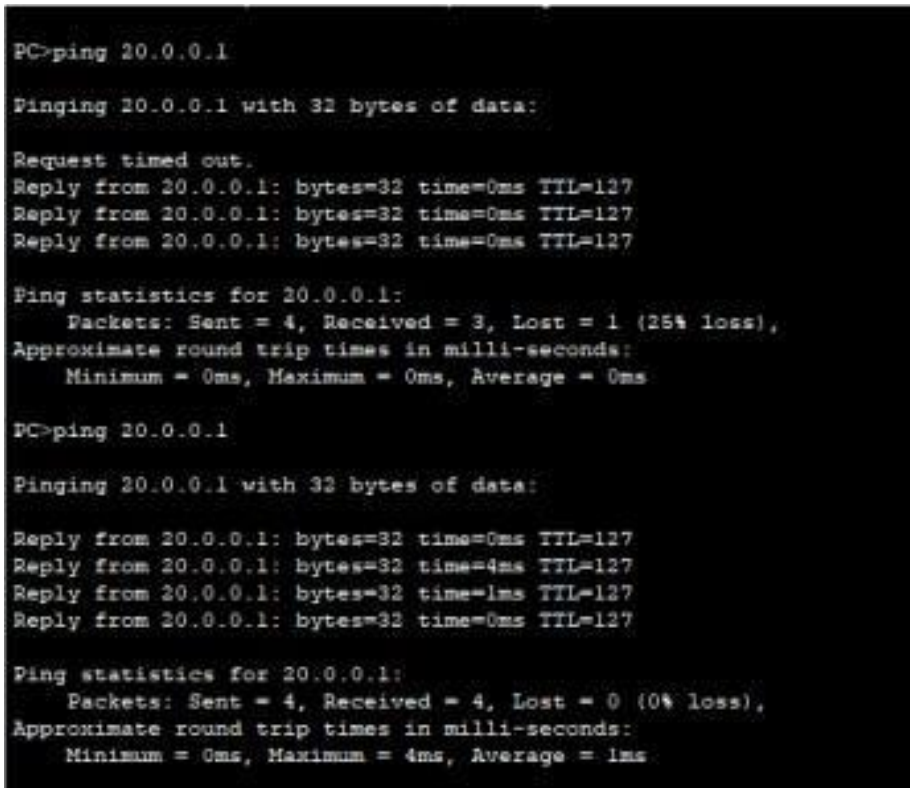
3. PCs with a combination of Switch and Hub



Procedure:

- Put all the devices(PCs, Hubs and Switches) needed for the experiment on the screen by looking at the topology.
- Choose the correct wire and make the Connection as shown in the topology
- Give ip address to all the devices
- Ping from one pc to all other pc in the network to make sure that the connection is correct.

Output:



```
PC>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=0ms TTL=127
Reply from 20.0.0.1: bytes=32 time=0ms TTL=127
Reply from 20.0.0.1: bytes=32 time=0ms 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

PC>ping 20.0.0.1

Pinging 20.0.0.1 with 32 bytes of data:

Reply from 20.0.0.1: bytes=32 time=0ms TTL=127
Reply from 20.0.0.1: bytes=32 time=4ms TTL=127
Reply from 20.0.0.1: bytes=32 time=1ms TTL=127
Reply from 20.0.0.1: bytes=32 time=0ms TTL=127

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

Experiment No-2

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

Topology:

Procedure:

1. connect PC-0 with Router-0 using copper cross-over cable - fastethernet0/0 2. connect Router-0 to Router-1 using Serial DCE with the connection named as serial2/0, then connect Router1 to Router2 using serial DCE named serial3/0
3. connect Router2 to PC1 using copper cross-over cable - fastethernet1/0 4. set the IP addresses, subnet mask (255.0.0.0 for all PCs and routers) and gateways accordingly.

   a. PC0: IP address = 10.0.0.1 gateway = 10.0.0.10

   b. Router0: gateway1 = 10.0.0.10 gateway2 = 20.0.0.10

   c. Router1: gateway1 = 20.0.0.20 gateway2 = 30.0.0.10

   d. Router2: gateway1 = 30.0.0.20 gateway2 = 40.0.0.10

   e. PC1: IP address = 40.0.0.1 gateway = 40.0.0.10

5. for Router0, the first gateway is set to IP address of 10.0.0.10 which is as same as the gateway of PC0 then set up the connection between the

i. Router0 and the PC0 using the CLI.

ii. Router0 and Router1
iii. Router1 and Router2

iv. Router2 and PC1 using CLI

Do (config-if)#ip route {destination-network} {mask} {next-hop-address} for all the routers

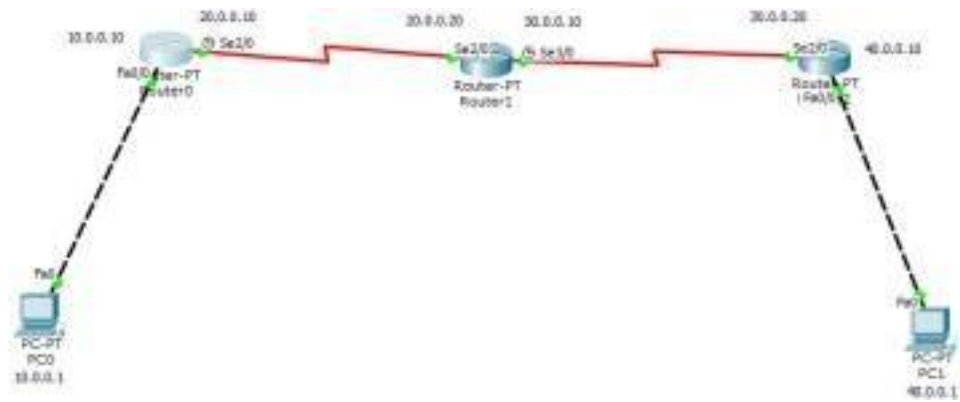
Output:

```
Packet Tracer PC Command Line 1.0
PC>ping 10.0.0.10

Pinging 10.0.0.10 with 32 bytes of data:

Reply from 10.0.0.10: bytes=32 time=1ms TTL=255
Reply from 10.0.0.10: bytes=32 time=0ms TTL=255
Reply from 10.0.0.10: bytes=32 time=0ms TTL=255
Reply from 10.0.0.10: bytes=32 time=0ms TTL=255

Ping statistics for 10.0.0.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

Experiment No-3

Aim : Configuring default route to the Router.

Topology:



Procedure:

- Do the connections as shown in the topology diagram.
- Assign an IP address to all the PCs.
- For router-to-router configuration do:
  - **(config)#ip route 0.0.0.0 0.0.0.0 {Next-hop-Address}**

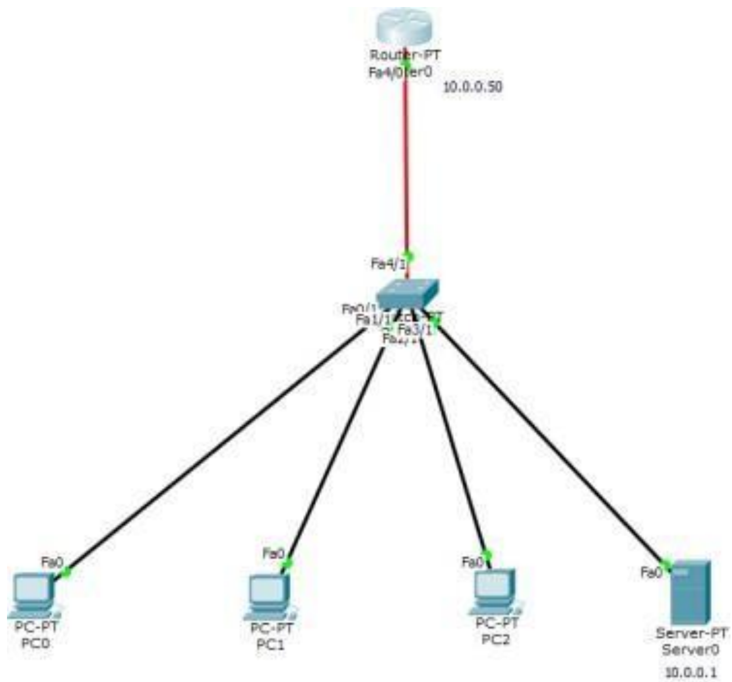
Output:

```
PC>ping 10.0.0.10

Pinging 10.0.0.10 with 32 bytes of data:


Reply from 10.0.0.10: bytes=32 time=50ms TTL=255

Reply from 10.0.0.10: bytes=32 time=0ms TTL=255

Reply from 10.0.0.10: bytes=32 time=0ms TTL=255

Reply from 10.0.0.10: bytes=32 time=0ms TTL=255

Ping statistics for 10.0.0.10:

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

Approximate round trip times in milli-seconds:

    Minimum = 0ms, Maximum = 50ms, Average = 12ms
```

Experiment No-4

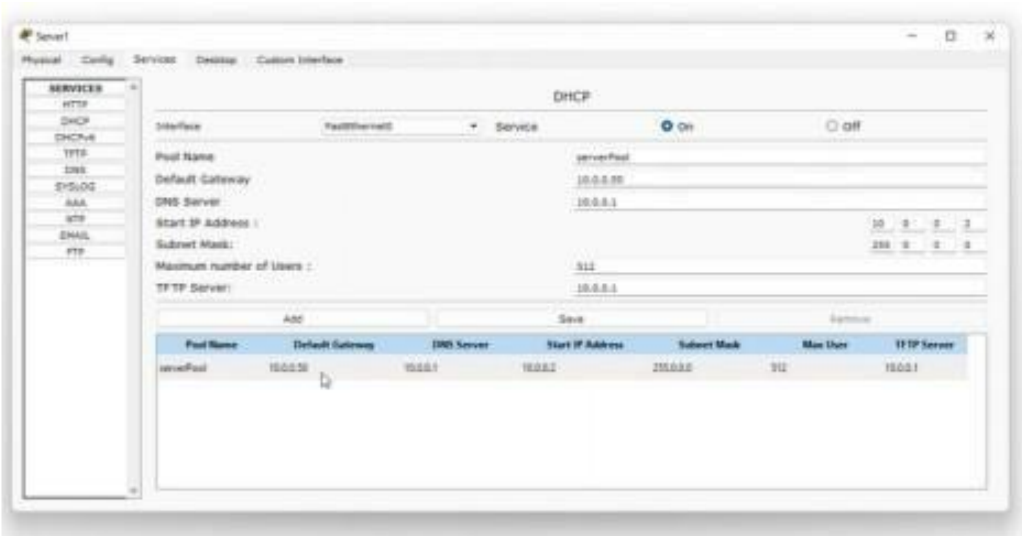
Aim : Configuring DHCP within a LAN in a packet Tracer

Topology:

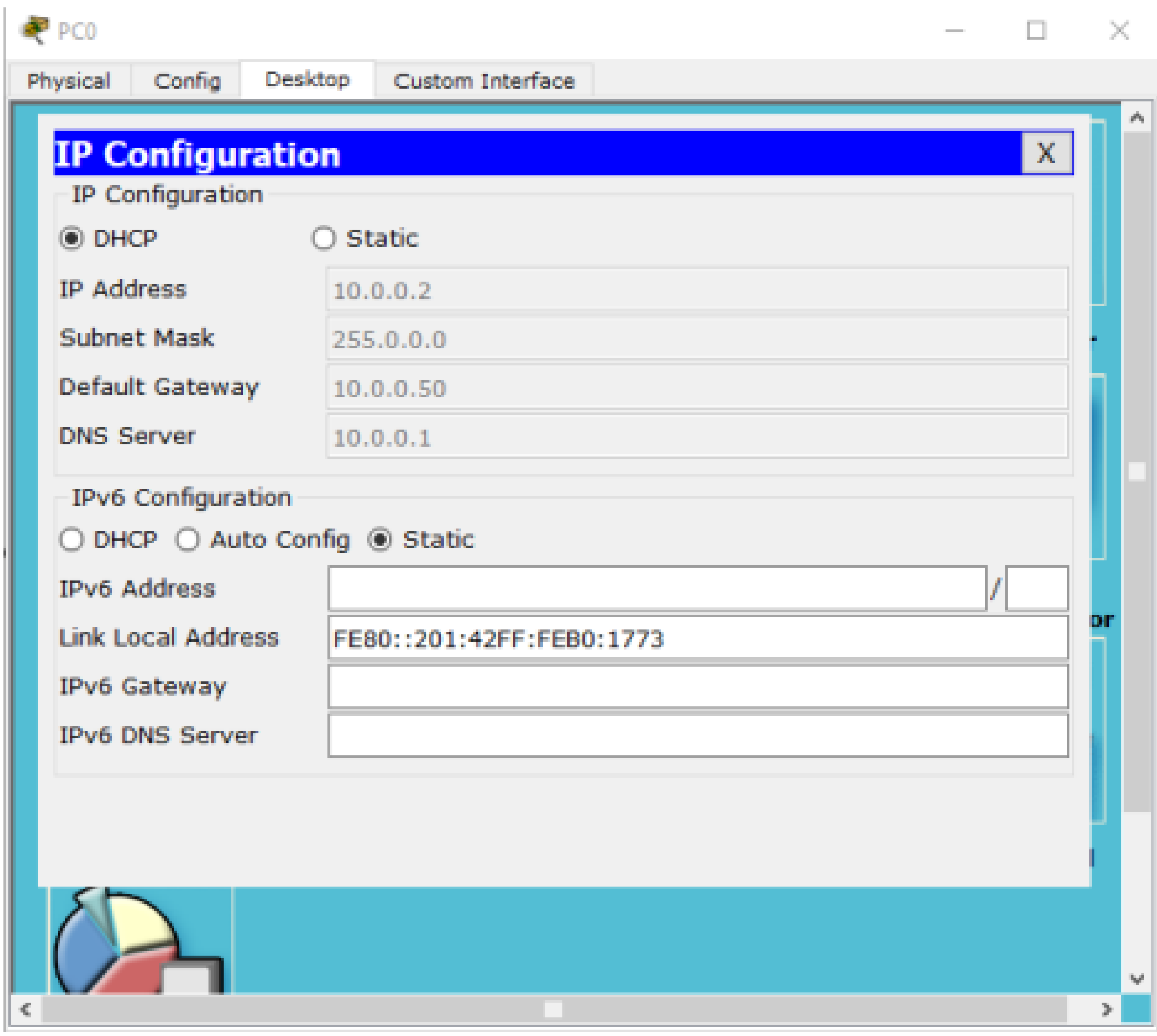


- Do the connection as shown in the topology diagram.

Procedure:



- For DHCP settings go to server and do the following
- For the PCs Go to ip configuration>Select DHCP.



Output:

```
Packet Tracer PC Command Line 1.0
PC>ping 10.0.0.4

Pinging 10.0.0.4 with 32 bytes of data:

Reply from 10.0.0.4: bytes=32 time=0ms TTL=128
Reply from 10.0.0.4: bytes=32 time=0ms TTL=128
Reply from 10.0.0.4: bytes=32 time=0ms TTL=128
Reply from 10.0.0.4: bytes=32 time=0ms TTL=128

Ping statistics for 10.0.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

Experiment No-5

Aim : Configuring RIP Routing Protocol in Routers.

Topology:

Procedure:

Router enable Router#config t

Router (config)#interface fastethernet0/0

Router (config-if)# ip address 10.0.0.10 255.0.0.0

Router (config-if)#no shut

Router (config-if)#exit

Router (config)#interface serial2/0

Router (config-if)#ip address 20.0.0.10 255.0.0.0

Router (config-if)#encapsulation ppp

Router (config-if)#clock rate 6400 Unknown clock rate

Router (config-if)#clock rate 64000

Router (config-if)#no shut

Router (config) #interface serial2/0 Router

(config-if)#ip address 20.0.0.20 255.0.0.0

Router (config-if)#encapsulation pppRouter
(config-if)#no shut

Router (config) #interface serial 3/0

Router (config-if)# ip address 30.0.0.10 255.0.0.0Router

(config-if)#encapsulation ppp

Router (config-if)#clock rate 64000 Router (config-if)#no shut

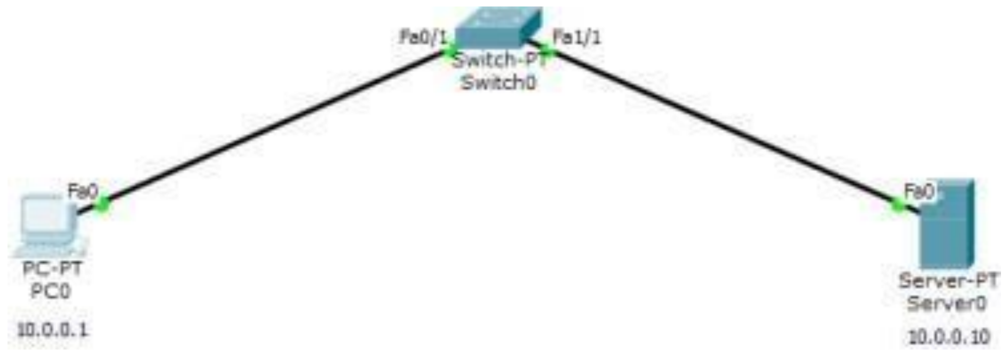
Output:

```
Packet Tracer PC Command Line 1.0

PC>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=12ms TTL=125

Reply from 40.0.0.1: bytes=32 time=6ms TTL=125

Reply from 40.0.0.1: bytes=32 time=14ms 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 = 6ms, Maximum = 14ms, Average = 10ms
```

Experiment No-6

Aim: Demonstration of WEB server and DNS using Packet Tracer.

Topology:



Procedure:

- set up IP address for PC0 and server
- select PC, choose Desktop tab, choose Web Browser and enter 10.0.0.10 IP address, which displays the home page
- select server, choose Services tab, select HTTP and switch it on. CLick the edit button for ìndex.html and edit the file.
- switch the DNS on, and add a domain name - bmsce with the address 10.0.0.10
- search for the domain name in the web browser of the PC.

CYCLE - 2

Program 1: Write a program for error-detecting code using CRC-CCITT (16-bits).

Code :

```
#include <iostream>
#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");
    }
    /* Perform XOR on the msg with the selected polynomial */
    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';
            }
        }
    }
    /* check for errors. return 0 if error detected */
    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 the input message in binary"<< endl;
```

```
        cin >> ip;
crc(ip, op, poly, 1);
cout << "The transmitted message is: " << ip << op + strlen(ip) << endl;
cout << "Enter the recevied message in binary" << endl;
cin >> recv;
if (crc(recv, op, poly, 0))
cout << "No error in data" << endl;
else
cout << "Error in data transmission has occurred" << endl;

return 0;
}
```

Output :

```
/tmp/kiPKSgKXwt.o
Enter the input message in binary
11100011100100000
The transmitted message is: 1110001110010000010011100100100001
Enter the recevied message in binary
1110001110010000010011100100100001
No error in data
```

Program 2 : Write a program for distance vector algorithm to find suitable path for transmission

Code :

```
class Topology:
  def __init__(self, array_of_points):
    self.nodes = array_of_points
    self.edges = []

  def add_direct_connection(self, p1, p2, cost):
    self.edges.append((p1, p2, cost))
    self.edges.append((p2, p1, cost))

  def distance_vector_routing(self):
    import collections
    for node in self.nodes:
      dist = collections.defaultdict(int)
      next_hop = {node: node}
      for other_node in self.nodes:
        if other_node != node:
          dist[other_node] = 100000000 # infinity
      # Bellman Ford Algorithm
      for i in range(len(self.nodes)-1):
        for edge in self.edges:
          src, dest, cost = edge
          if dist[src] + cost < dist[dest]:
            dist[dest] = dist[src] + cost
            if src == node:
              next_hop[dest] =dest
            elif src in next_hop:
              next_hop[dest] = next_hop[src]

      self.print_routing_table(node, dist, next_hop)
      print()

  def print_routing_table(self, node, dist, next_hop):
    print(f'Routing table for {node}:')
    print('Dest \t Cost \t Next Hop')
```

```
        for dest, cost in dist.items():
            print(f'{dest} \t {cost} \t {next_hop[dest]}')
arr=[]
l=int(input("Enter the number of nodes"))
for _ in range (0,l):
arr.append(input("Enter the name of the node"))
t=Topology(arr)
edges=int(input('Enter no. of connections'))
for _ in range(edges):
src,dest,cost=input('Enter [src][dest][cost]').split()
t.add_direct_connection(src,dest,int(cost))
t.distance_vector_routing()
```

Output :

```
Enter the number of nodes 5
Enter the name of the node A
Enter the name of the node B
Enter the name of the node C
Enter the name of the node D
Enter the name of the node E
Enter the number of connections : 8
Enter[src][dest][cost] A B 4
Enter[src][dest][cost] A C 5
Enter[src][dest][cost] B D 6
Enter[src][dest][cost] C E 3
Enter[src][dest][cost] B E 3
Enter[src][dest][cost] E A 7
Enter[src][dest][cost] C D 4
Enter[src][dest][cost] D E 4
Routing table for A:
Dest    Cost    Next Hop
B       4       B
C       5       C
D       9       C
E       7       B
A       0       A

Routing table for B:
Dest    Cost    Next Hop
A       4       A
C       6       E
D       6       D
E       3       E
B       0       B

Routing table for C:
Dest    Cost    Next Hop
A       5       A
B       6       E
D       4       D
E       3       E
C       0       C

Routing table for D:
Dest    Cost    Next Hop
A       9       C
B       6       B
C       4       C
E       4       E
D       0       D

Routing table for B:
Dest    Cost    Next Hop
A       7       A
B       3       B
C       3       C
D       4       D
E       0       E
```

Program 3 : Implement Djikstra's algorithm to compute the shortest path for a given topology

Code :

```
#include<stdio.h>
void  dijkstras();
int c[10][10],n,src;
void main()
 {
int i,j;
printf("\nenter the no of vertices:\t");
scanf("%d",&n);
printf("\nenter the cost matrix:\n");
 for(i=1;i<=n;i++)
 {
  for(j=1;j<=n;j++)
   scanf("%d",&c[i][j]);
 }
 printf("\nenter the source node:\t");
 scanf("%d",&src);
 dijkstras();
 getch();
 }
void dijkstras()
 {
int vis[10],dist[10],u,j,count,min;
for(j=1;j<=n;j++)
  {
   dist[j]=c[src][j];
  }
  for(j=1;j<=n;j++)
  {
   vis[j]=0;
  }
  dist[src]=0;
  vis[src]=1;
  count=1;
  while(count!=n)
  {
   min=9999;
   for(j=1;j<=n;j++)
```

```
   {
    if(dist[j]<min&&vis[j]!=1)
     {
      min=dist[j];
      u=j;
     }
   }
  vis[u]=1;
  count++;
  for(j=1;j<=n;j++)
   {
    if(min+c[u][j]<dist[j]&&vis[j]!=1)
     {
      dist[j]=min+c[u][j];
     }
   }
 }
 printf("\nthe shortest distance is:\n");
 for(j=1;j<=n;j++)
 {
  printf("\n%d---- >%d=%d",src,j,dist[j]);
 }
}
```

Output :

```
Enter the number of vertices : 5
Enter the cost matrix :
99 3  99 7  99
3  99 4  2  99
99 4  99 5  6
7  2  5  99 4
99 99 6  4  99

Enter the source node : 1
The shortest disctance is

1-->1=0
1-->2=3
1-->3=7
1-->4=5
1-->5=9
```

Program 4 : Write a program for congestion control using Leaky bucket algorithm.

Code :

```
#include <iostream>
#include <vector>
#include <bits/stdc++.h>

using namespace std;

int main()
{
   int sum=0,pkt,leak = 10;
   int choice;
   vector <int> bucket;
   int cap = 50;
   while(true){
   cout<<"1. Add packet\n2. No packets\n3. Exit\nEnter choice : ";
   cin>>choice;
   switch(choice){
      case 1 :
      cout<<"Enter pkt : ";
      cin>>pkt;
      if(pkt>cap-sum)
         cout<<"Bucket OverFlow"<<endl;
      else{
      bucket.push_back(pkt);
      sum = accumulate(bucket.begin(), bucket.end(), 0);
      cout<<"\nBefore leak"<<endl;
      cout<<"sum = "<<sum<<" leak = "<<leak<<endl;
      }
      bucket.push_back(-leak);
      sum = accumulate(bucket.begin(), bucket.end(), 0);
      if(sum<0)
         sum=0;
      cout<<"\nAfter leak"<<endl;
      cout<<"sum = "<<sum<<" leak = "<<leak<<endl;
      break;

      case 2:
      if(sum>leak){
```

```
        bucket.push_back(-leak);
        sum = accumulate(bucket.begin(), bucket.end(), 0);
        cout<<"sum = "<<sum<<" leak = "<<leak<<endl;
        }
        else if(sum<leak){
           sum = 0;
           cout<<"sum = "<<sum<<" leak = "<<leak<<endl;
        }
        else{
           bucket.push_back(-leak);
           sum = accumulate(bucket.begin(), bucket.end(), 0);
           cout<<"sum = "<<sum<<endl;
           cout<<"\nBucket Empty"<<endl;
        }break;

        case 3:
        cout<<"\nexit";
        exit(0);
        break;
        default : cout<<"wrong choice\n";
     }
     }

   return 0;
}
```

```
1. Add packet
2. No packets
3. Exit
Enter choice : 1
Enter pkt : 15

Before leak
sum = 15 lead = 10
After leak
sum = 5 leak = 10

1. Add packet
2. No packets
3. Exit
Enter choice : 1
Enter pkt : 20

Before leak
sum = 25 lead = 10
After leak
sum = 15 leak = 10

1. Add packet
2. No packets
3. Exit
Enter choice : 2
sum = 5 leak = 10

1. Add packet
2. No packets
3. Exit
Enter choice : 2
sum = 0 leak = 10

1. Add packet
2. No packets
3. Exit
Enter choice : 1
Enter pkt : 99
Bucket Overflow
After leak
sum = 0 leak = 10

1. Add packet
2. No packets
3. Exit
Enter choice : 1
Enter pkt : 15

Before leak
sum = 15 lead = 10
After leak
sum = 5 leak = 10

1. Add packet
2. No packets
3. Exit
Enter choice : 3
```

Output :

Program 5 : 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="127.0.0.1"
serverPort = 12000
serverSocket = socket(AF_INET,SOCK_STREAM)
serverSocket.bind((serverName,serverPort))
serverSocket.listen(1)
while 1:
   print ("The server is ready to receive")
   connectionSocket, addr = serverSocket.accept()
   sentence = connectionSocket.recv(1024).decode()

file=open(sentence,"r")
l=file.read(1024)

connectionSocket.send(l.encode())
print ('\nSent contents of ' + sentence)
file.close()
connectionSocket.close()
```

Client :

```
from socket import *
serverName = '127.0.0.1'
serverPort = 12000
clientSocket = socket(AF_INET, SOCK_STREAM)
clientSocket.connect((serverName,serverPort))
sentence = input("\nEnter file name: ")
clientSocket.send(sentence.encode())
filecontents = clientSocket.recv(1024).decode()
print ('\nFrom Server:\n')
print(filecontents)
clientSocket.close()
```

Output :

```
Enter file name : hello.cpp

From server:

#include<iostream>
using namespace std;
int main(){
    int n;
    cin>>n;
    cout<<n<<endl;
    return 0;
}
```

```
The server is ready to recieve

Sent contents of hello.cpp
The server is ready to recieve
```

Program 6 : 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((gethostname(),  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 = gethostname()
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()
```

Output :

```
Enter file name  hello.cpp
From Server : b'#include<iostream>\nusingnamespace std;\nint main(){\n
    int n;\n    cin>>n;\n    cout<<n<<endl;\n    return 0;\n}


The server is ready to recieve
sent back to client #include<iostream>
using namespace std;
int main(){
    int n;
    cin>>n;
    cout<<n<<endl;
    return 0;
}
```