Gokaraju Rangaraju Institute of Engineering and Technology

(Autonomous)

DATA COMMUNICATIONS
&
COMPUTER NETWORKS
LAB MANUAL

Academic Year: 2019-20

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GOKARAJU RANGARAJUINSTITUTE OF ENGINEERING AND TECHNOLOGY (Autonomous)

DATA COMMUNICATIONS &COMPUTER NETWORKS LAB

Course Code:GR18A2082 **L/T/P/C : 0/0/4/2**

II Year II Semester

SYLLABUS

PART I

Task-1:Introduction to Cisco Packet tracer Simulator

Task-2:Initial Configuration of switch and router

Task-3:Working with static and dynamic IP addressing

Task-4:Design star,bus,ring topology using packet tracer

Task-5:Design a network using NAT and tunnelling concept.

Task-6:Design a wireless LAN

PART II

Task-7:Implement the data link layer framing methods such as character, character stuffingand bit stuffing.

Task-8:Implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 andCRC CCIP.

Task-9:Implement Hamming code

Task-10:Implement Dijkstra‘s algorithm to compute the Shortest path through a graph.

Task-11:Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table art each node using distance vector routing algorithm.

Task-12:Take an example subnet of hosts. Obtain broadcast tree for it.

Text/reference Books:

1. Data Communications and Networking, Behrouz A. Forouzan , Fourth Edition TMH, 2006.

2. Computer Networks, Andrew S Tanenbaum, 4th Edition. Pearson Education, PHI.

3. Data communications and Computer Networks, P.C .Gupta, PHI.

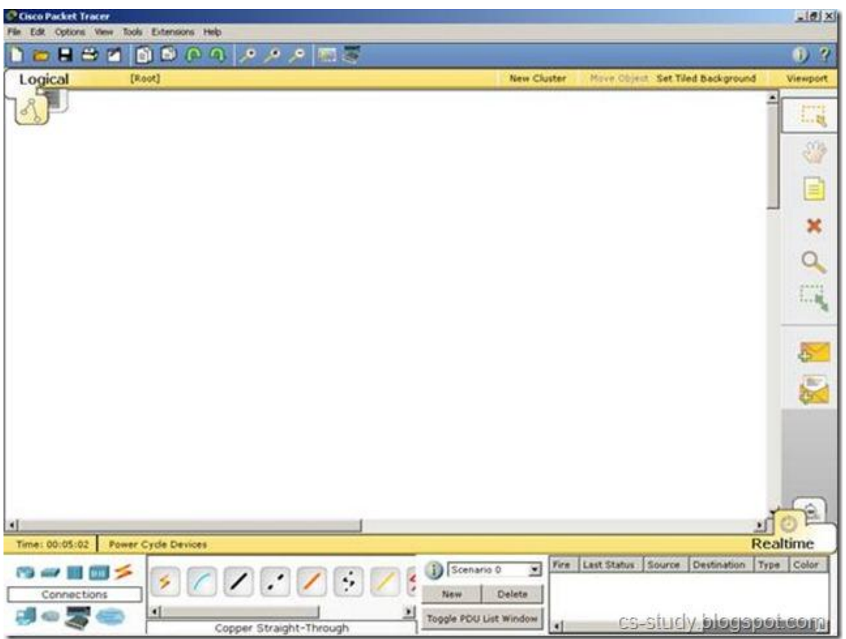
4. An Engineering Approach to Computer Networks, S. Keshav, 2nd Edition, Pearson Education.

Week:1 Introduction to Cisco Packet tracer Simulator

Answer:

The **Introduction to Packet Tracer** course is designed for beginners with no prior networking knowledge. The self-paced course teaches the basic operations of Cisco Packet Tracer, the robust simulation tool used to visualize networks. Multiple hands-on activities focus on everyday examples including networking and Internet of Things (IoT) exposing learners to important concepts while at the same time reinforcing learnings. Whether you want to develop networking knowledge or you plan to take one of the Networking Academy courses that use Packet Tracer, you'll find **Introduction to Packet Tracer** provides valuable tips and best practices for using Cisco Packet Tracer.

- Learn the basic operations of Packet Tracer: - File commands, visualization and configuration of networking devices.
- Simulate the interactions of data traveling through the network.
- Learn to visualize the network in logical and physical modes.
- Reinforce your understanding with extensive hands-on networking and IoT activities.
- Get immediate feedback on your work through built-in quizzes and tests.
- Connect with the global Cisco Networking Academy community.



Week:2 Initial Configuration of Switch and Router

Answer: Initial Configuration of a Switch

If you started the terminal-emulation program before you powered on your switch, the PC or terminal displays the boot loader sequence. You need to press Enter to display the setup program prompt.

Entering the Initial Configuration Information

To set up the switch, you need to assign an IP address and other configuration information necessary for the switch to communicate with the local routers and the Internet. The minimal configuration provided here does not cover most of the features; it simply allows you to perform other configuration tasks using a Telnet connection from your management network. To configure other features and interfaces, see the *Software Configuration Guide for your release.*

IP Settings

You will need this information from your network administrator:

- Switch IP address
- Subnet mask (IP netmask)
- Default gateway (router)
- Enable secret password
- Enable password
- Telnet password

Performing the Initial Configuration

To complete the initial configuration for the switch, follow these steps:

Step 1 At the terminal prompt, enter the enable command to enter privileged exec mode.

Switch> enable

Switch#

Step 2 Set the system time using the clock set command in privileged EXEC mode**.**

Switch# clock set 20:09:01 3 Apr 2006

Step 3 Verify the change by entering the show clock command**.**

Switch# show clock

20:09:06.079 UTC Thu Apr 3 2006

Step 4 Enter the configure terminal command to enter global configuration mode.

Switch# configure terminal

Enter configuration commands, one per line. End with CNTL/Z.

Switch (config) #

Step 5 Configure the system prompt and hostname for the switch, and press Return. To remove the new prompt and return the prompt to its default, use the no hostname command.

Switch (config) # hostname Switch1

Step 6 Use the banner motd global configuration command to set location information in the login banner. You can also set a system contact using this command**.**

Switch1 (config) # banner motd "$Authorized Access Only"$

Or

Switch1 (config) # banner motd "#Authorized Access Only"#

Step 7 Configure an enable secret password, and press Return**.**

The password can be from 1 to 25 alphanumeric characters, can start with a number, is case sensitive, allows spaces, but ignores leading spaces. The secret password is encrypted and the enable password is in plain text.

Switch1 (config) # enable secret Secret Password

Step 8 Configure an enable password, and press Return.

Switch1 (config)# enable password EnablePassword

Step 9 Configure a virtual terminal (Telnet) password, and press Return.

The password can be from 1 to 25 alphanumeric characters, is case sensitive, allows spaces, but ignores leading spaces.

Switch1 (config)# line vty 0 15

Step 10 Configure the interface that connects to the management network. (The IP address and subnet mask shown are for example only. Use an address appropriate for your network.)

Switch1 (config)# ip routing

Switch1 (config)# interface gigabit Ethernet 0/0

Switch1 (config-if) # no switch port

Switch1 (config-if) # no shutdown

Switch1 (config-if) # ip address 10.4.120.106 255.0.0.0

Switch1 (config-if) # exit

Step 11 Exit from global configuration mode

Switch (config) # exit

Switch #

Step 12 View the configuration that you have just created and confirm that it is what you want.

Switch1# show run

hostname Switch1

banner motd Authorized Access Only

Step 13 Configure a default route**.**

Switch1 (config) #ip route 0.0.0.0 0.0.0.0 172.16.1.1

Step 14 Verify the IP information by using the show ip interface brief and show ip route commands.

Switch1# show ip interface brief

Interface IP-Address OK? Method Status Protocol

Vlan1 10.4.220.206 YES manual up up

FastEthernet1 unassigned YES unset up up

!--- Output suppressed.

Switch1# 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 - ISIS level-1, L2 - ISIS level-2, ia - ISIS inter area

*** - candidate default, U - per-user static route, o - ODR**

P - Periodic downloaded static route

Gateway of last resort is 172.16.1.1 to network 0.0.0.0

172.16.0.0/24 is subnetted, 1 subnets

C 172.16.1.0 is directly connected, Vlan1

S* 0.0.0.0/0 [1/0] via 172.16.1.1

Switch1#

Step 15 Save the running configuration:

Switch1# copy system: running-config nvram:startup-config

You have now completed the initial configuration of the switch, so you can now configure other interfaces and features over a network connection without having to directly connect to the console port of the supervisor engine.

Basic Router Configuration

There are a number of basic things that need to be configured on a Cisco router before it can be used for its primary function (routing). These things include configuring Internet Protocol (IP) addresses, hostnames, passwords, interfaces and routing (static or dynamic) among other things. While this article cannot contain all of the possible configuration permutations, it will give you the general configuration steps used.

Configuration Modes

Before starting the configuration of a Cisco IOS device, it is important that the person configuring the device has at least a general understanding of Cisco IOS configuration modes. Cisco IOS configuration modes are used to give context to the command being entered. For example, commands that are entered inside interface configuration mode are specific to the interface while commands entered in global configuration mode affect the whole Cisco IOS device. The following list shows some of the most commonly used Cisco IOS configuration modes:

- Global configuration mode (configure terminal at the enable prompt)
- Interface configuration mode (interface *interface* inside global configuration mode)
- Router configuration mode (router *protocol* inside global configuration mode)
- Line configuration mode (line *line* inside global configuration mode)

Steps:

Router#configure terminal

Router (config)#hostname R1

R1(config)#ip domain name cisco.com

R1(config)#enable secret ciscopass

R1(config)#ip route 192.168.1.0 255.255.255.0 10.10.10.1

Router#configure terminal

Router(config) #interface fast Ethernet 0/0

Router(config-if) #ip address 192.168.1.1 255.255.255.0

Router (config-if) #no shutdown

Router#configure terminal

Router(config) #line con 0

Router(config-line) #password Cisco press

Router(config-line)#exec-timeout 5 0

Router(config-line)#line vty 0 4

Router(config-line)#password Cisco press

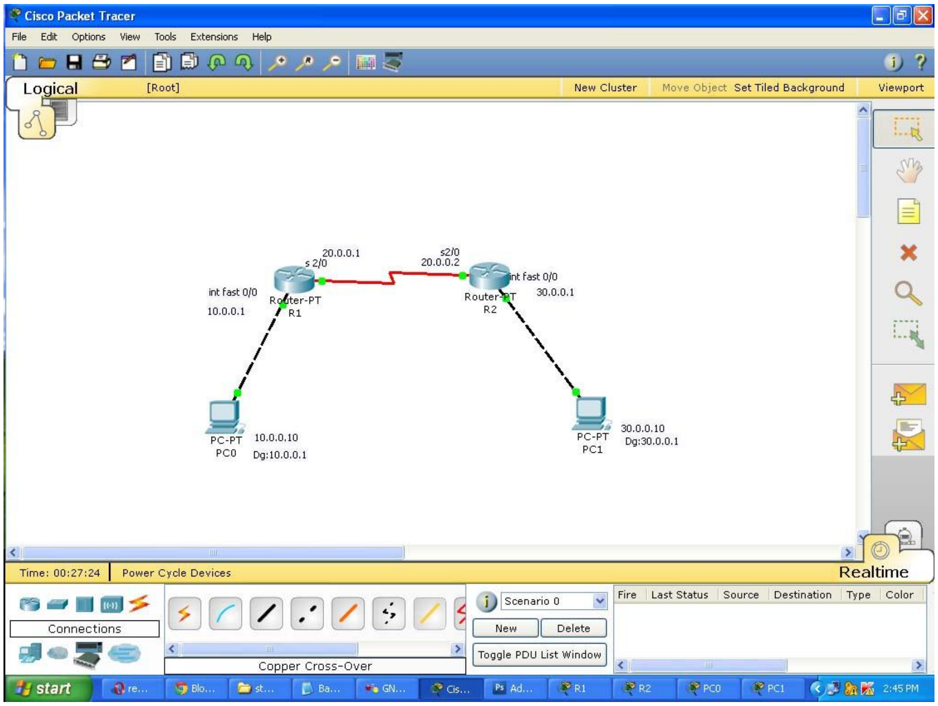
Router (config-line) #login

Router(config-line) #exec-timeout 5 0

Week:3 Working with Static and Dynamic IP addressing

Answer: Static IP Addressing

Steps:
Step 1:First Create a topology like this



Configure ip address to routers go to global configuration mode in R1 and R2 configure connected interfaces

In Router 1

Interface Fastethernet0/0 in global configuration mode

R1(config)#interface fastethernet 0/0
R1(config-if)#ip address 10.0.0.1 255.0.0.0
R1(config-if)#no shutdown
R1(config-if)#exit

Interface Serial 2/0

R1(config)#interface serial 2/0
R1(config-if)#ip address 20.0.0.1 255.0.0.0
R1(config-if)#clock rate 64000
R1(config-if)#encapsulation ppp
R1(config-if)#no shutdown
R1(config-if)#exit

In Router 2

Interface Fastethernet 0/0
R2(config)#interface fastethernet 0/0
R2(config-if)#ip address 30.0.0.1 255.0.0.0
R2(config-if)#no shutdown
R2(config-if)#exit

Interface Serial 2/0

R2(config)#interface serial 2/0
R2(config-if)#ip address 20.0.0.2 255.0.0.0
R2(config-if)#encapsulation ppp
R2(config-if)#no shutdown
R2(config-if)#exit

Step 3: Assign ip address for both Pc's with appropriate ip and subnetmask and default gateway
Step 4: Now configure both router with static route.

By default, Routers Know only directed connected networks here Router 1 know only 10.0.0.0 and 20.0.0.0 it doesn't know the 30.0.0.0 like this R2 doesn't know about 10.0.0.0.So We are going to add Static route to this both router

R1(config)# ip route Destination Network| Destination N/W SubnetMask |Next Hop Address

In Router R1,Just give this command,In this case Destination is 30.0.0.0 and its subnet mask is 255.0.0.0 next hop address is 20.0.0.2
R1(config)#ip route 30.0.0.0 255.0.0.0 20.0.0.2

In Router R2
R2(config)#ip route 10.0.0.0 255.0.0.0 20.0.0.1

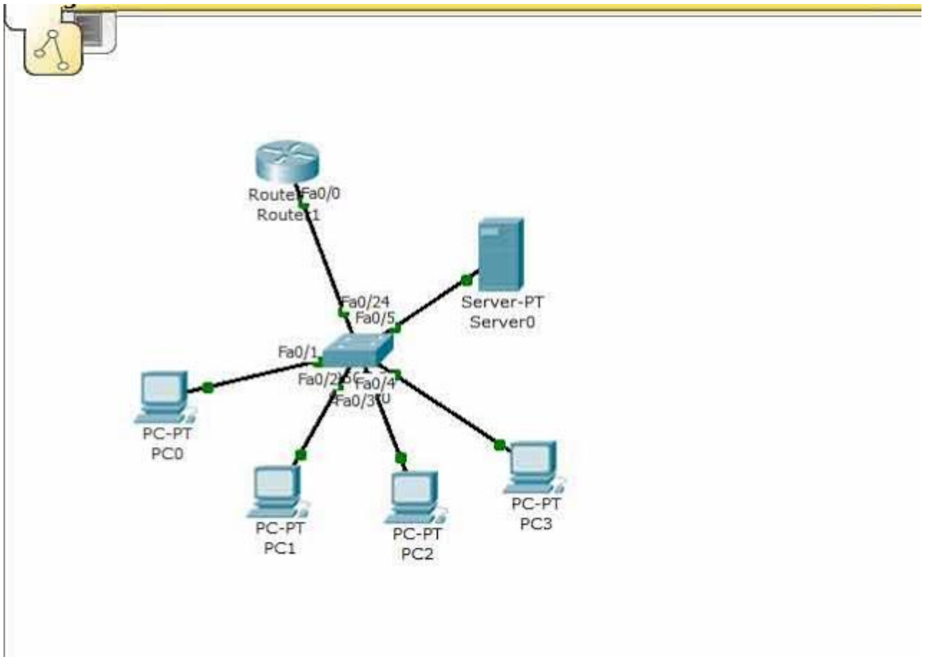
Now both routers know all networks,check by ping ip address of host.

Dynamic IP Addresing

We are going to see how to configure DHCP within a LAN in a packet tracer,
DHCP-Dynamic Host Configuration Protocol
DHCP Process,(DORA)
=>Discover(Client discovers the DHCP Server for Ip request)
=>Offer (DHCP servers offers ip to a client and it will wait for the request from cleint
=>Request (Client reply for requesting offered ip address from dhcp server,sometimes there will be more dhcp servers.So,client receives offer from multiple servers. Client will reply for only one offer.So, other offers will be cancelled and replaced in a pool.)
=>Acknowledgement (Final step from server sending all infromation to client like DNS,Default Gateway,domain name,...)

DHCP Server uses Port 67,Client uses port 68
It uses UDP(User Datagram Protocol).

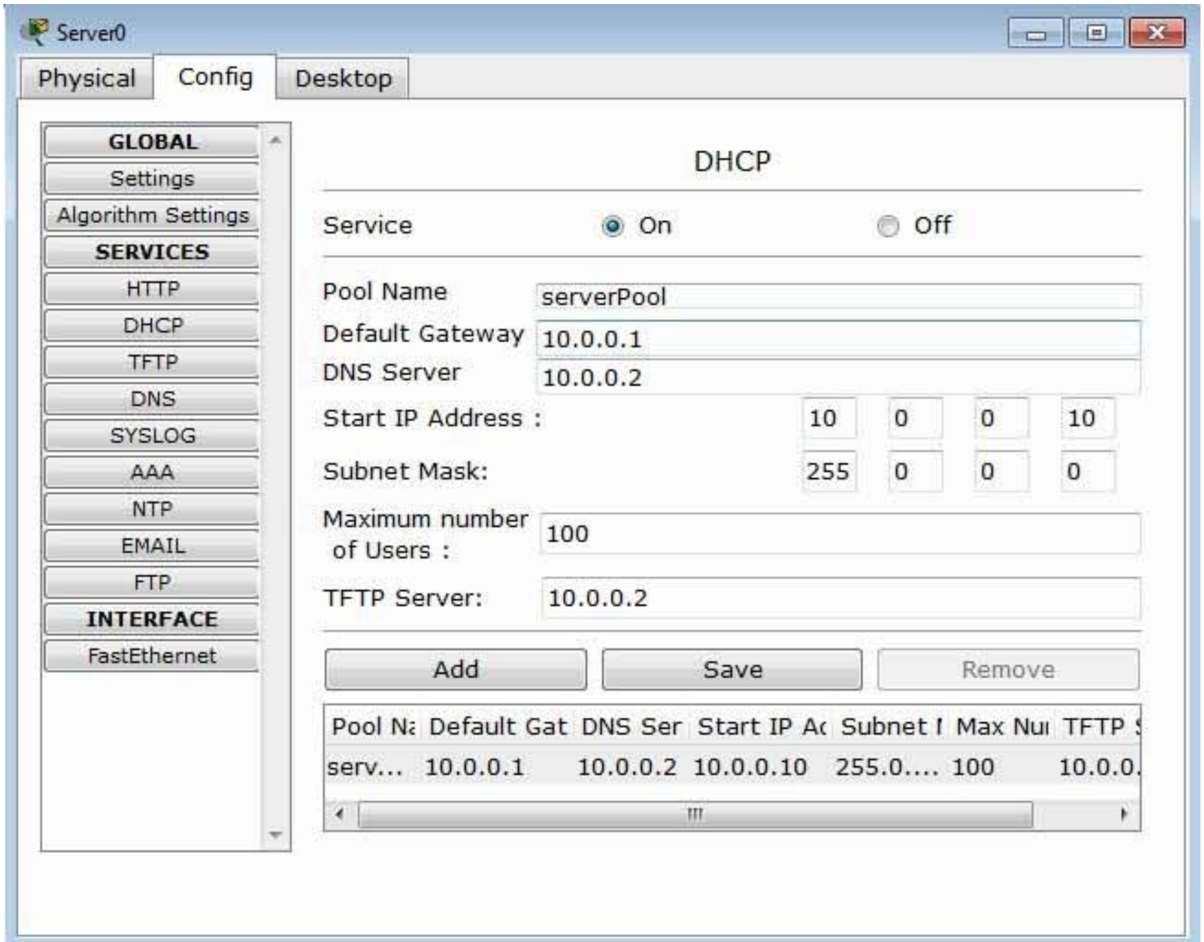
Step 1:Create a LAN like this



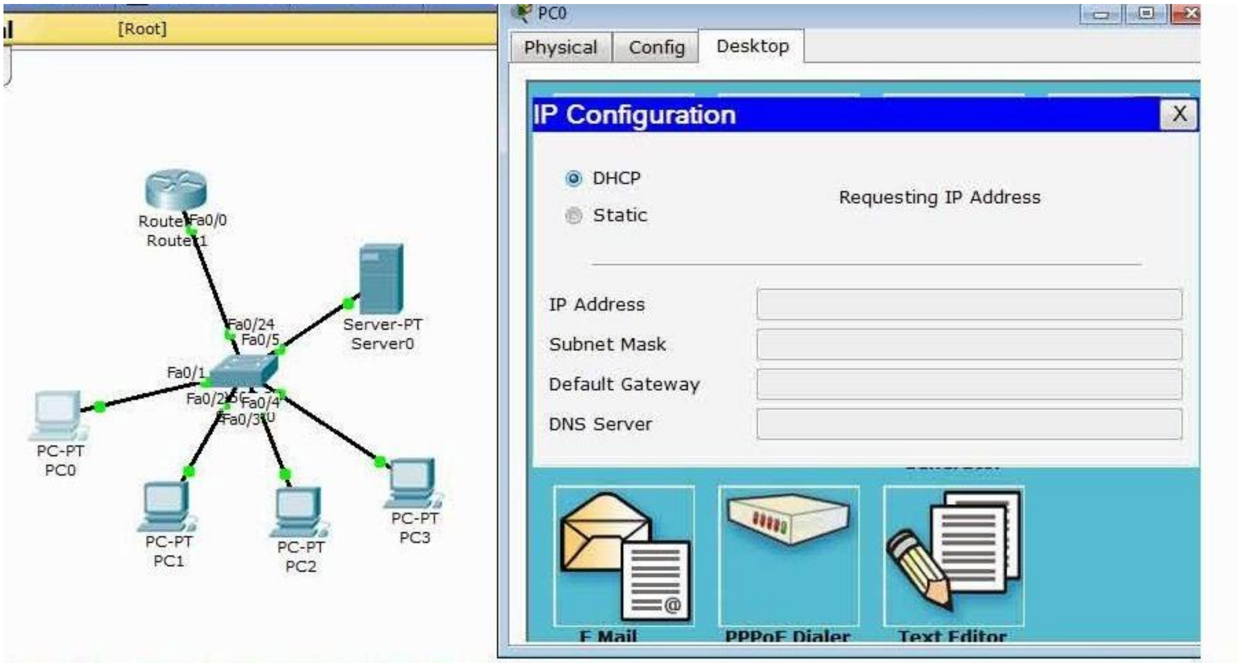
Step 2:Configure router interface with ip 10.0.0.1 and subnet mask 255.0.0.0

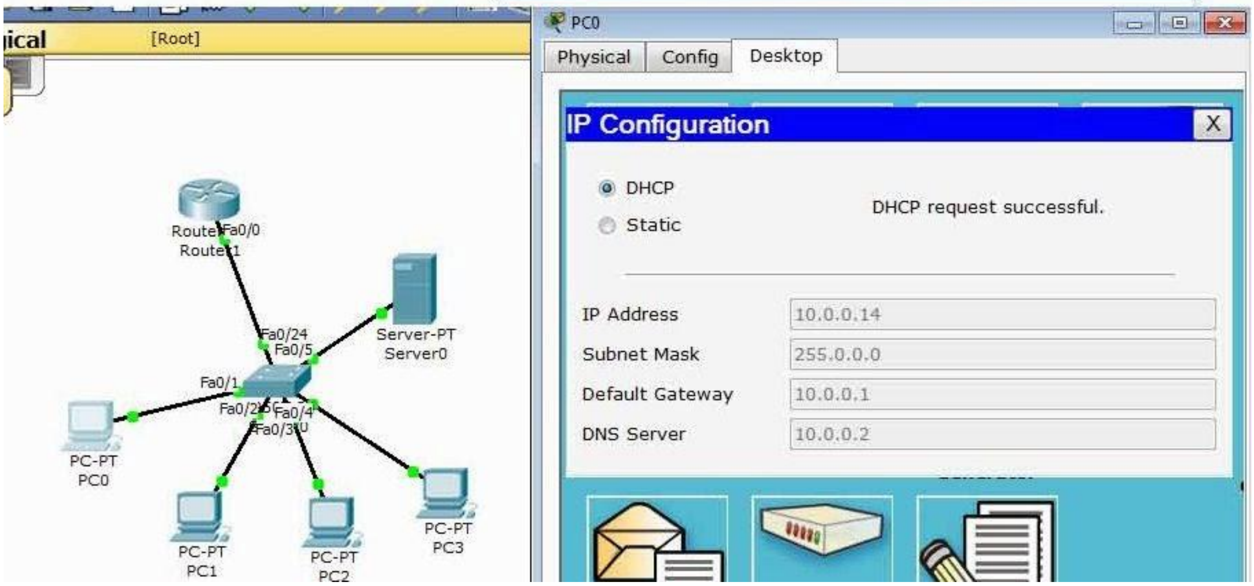
Router>enable
Router#config t
Router(config)#interface fastethernet0/0
Router(config-if)#ip address 10.0.0.1 255.0.0.0
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#

Step 3: Click on server->config,then assign gateway in our example 10.0.0.1
Step 4: Then Click on Fastethernet and assign ip address and subnet mask.I am going to use 10.0.0.2 and subnet mask 255.0.0.0 for our server.
Step 5:Click on DHCP,there you can see default pool,
Step 6:Just give default gate way,here we are using 10.0.0.1.
Step 7:DNS server,Just give our server ip address,10.0.0.2.
Step 8:Then just edit start ip address.I am going to give 10.0.0.10 and subnet mask 255.0.0.0
Step 9:In Maximum Number of Users,Here we are using Class A Network so we can use 1,67,77,216 ip address.just give how many ip address you want in this pool.I am going to give 500
Step 10:Assign TFTP server ip address,just give our server ip address,10.0.0.2.
Step 11: And click on save.



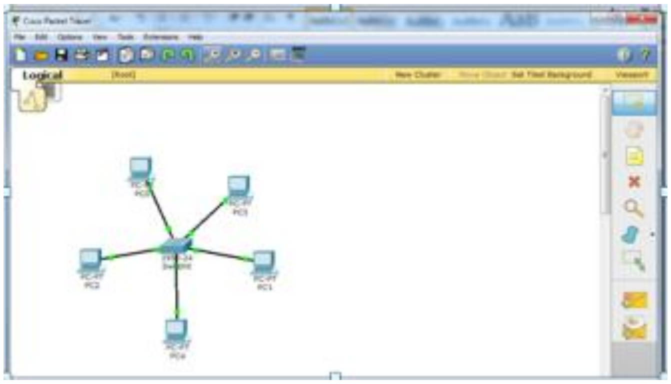
Step 12: Now, Click on any of the PC-> then click on Desktop->Ip configuration,and Choose 'DHCP' wait for some time,if your dhcp request failed then try few more times.This is how you should get.


[Root]
Router Fa0/0
Router1
Fa0/24
Fa0/5
Server-PT
Server0
Fa0/1
Fa0/2
Fa0/4
Fa0/3
PC-PT
PC0
PC-PT
PC1
PC-PT
PC2
PC-PT
PC3
PC0
Physical
Config
Desktop
IP Configuration
X
DHCP
Static
Requesting IP Address
IP Address
Subnet Mask
Default Gateway
DNS Server
E Mail
PPPoE Dialer
Text Editor

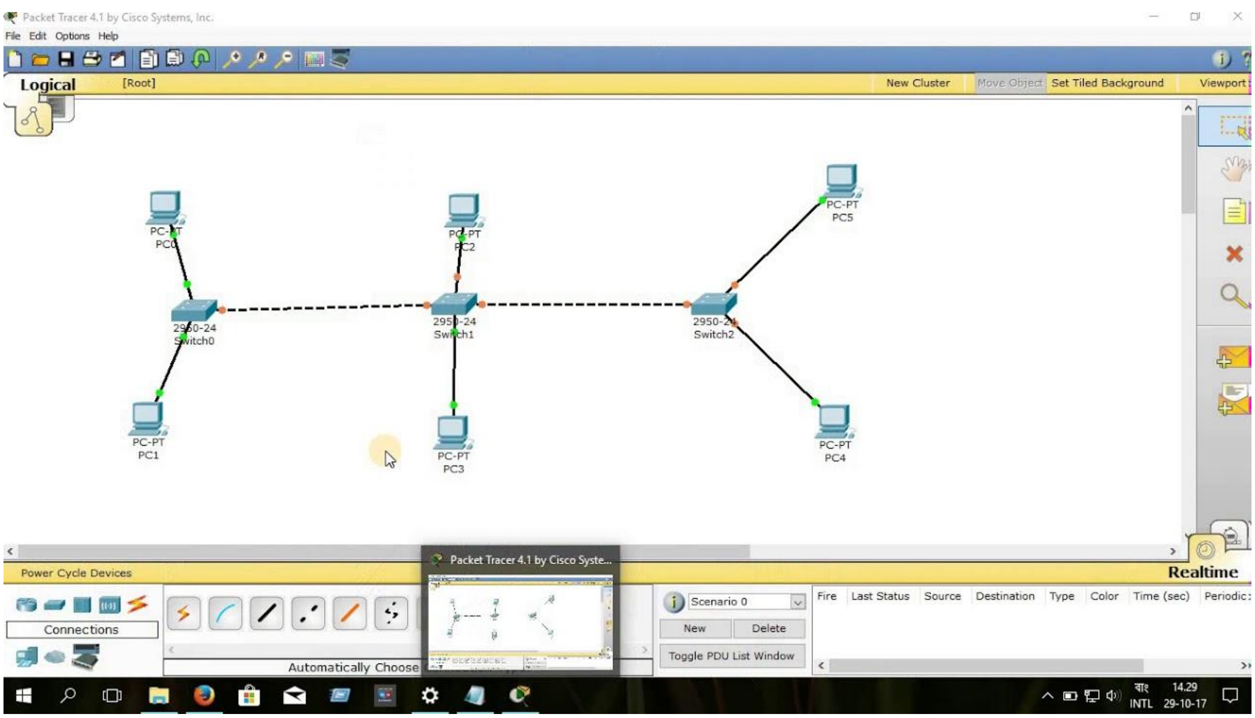

[Root]
Router Fa0/0
Router1
Fa0/24
Fa0/5
Server-PT
Server0
Fa0/1
Fa0/2
Fa0/4
Fa0/3
PC-PT
PC0
PC-PT
PC1
PC-PT
PC2
PC-PT
PC3
PC0
Physical
Config
Desktop
IP Configuration
X
DHCP
Static
DHCP request successful.
IP Address
10.0.0.14
Subnet Mask
255.0.0.0
Default Gateway
10.0.0.1
DNS Server
10.0.0.2

Week:4 Design Star, Bus, Ring Topology using packet tracer

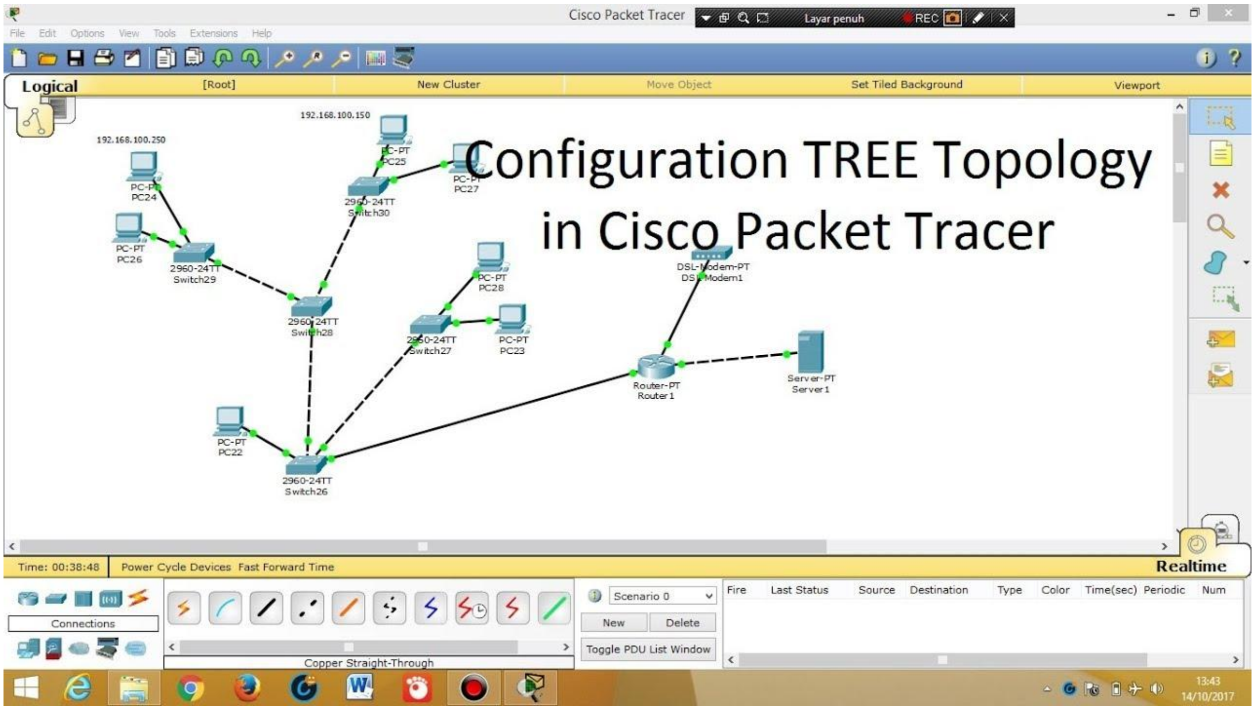
Answer: Star Topology



Bus Topology



Tree Topology

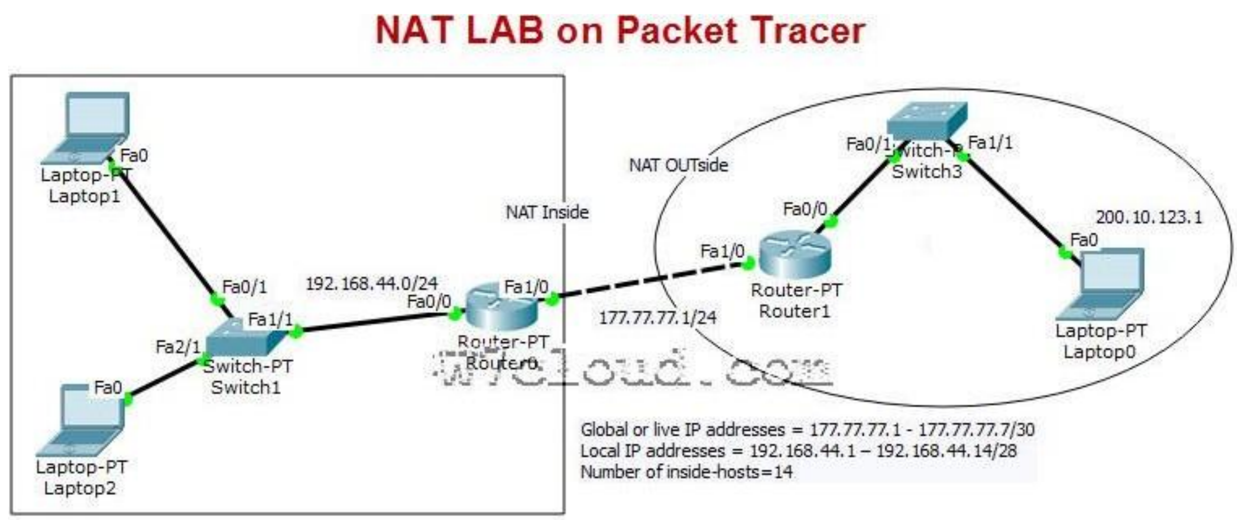


Week:5 Design a network using NAT and Tunneling concept

Answer:

NAT LAB ON PACKET TRACER:

NAT is used for security by reusing IP-addresses. The router on which NAT is configure translates traffic which is accessing internet or coming back to local network. A NAT is the virtualization IP-addresses. This is Simple lab for configuring NAT on packet tracer. Our network diagram consist of two parts, one is the LAN which is define as inside network and other is the internet or public network which will be defined as outside for network address translation (NAT).



Task 1: Configure IP addresses and setting a static default route.

Access the CLI and specify the following IP address configuration on both routers

R1 Config:

Router1(config)#intfa1/0
Router1(config-if)#ip address
177.77.77.10255.255.255.0 Router1(config-if)#noshu
Router1(config)#ip route 192.168.44.0 255.255.255.0 177.77.77.1

R0 config:

Router0(config)#int fa1/0
Router0(config-if)#ip address 177.77.77.1
255.255.255.0 Router0(config-if)#no shut
Router0(config)#int fa0/0
Router0(config-if)#ip address 192.168.44.1
255.255.255.0 Router0(config-if)#no shut
Router0(config)#ip route 200.10.123.0 255.255.255.0 177.77.77.10
Router0(config)#exit

Task 2: Configure NAT on Router0

Step 1: Access the **CLI** on the **Router0**

Step 2: Configure a standard access list using an access list id of **1** and permit any device on subnet 192.168.44.0 /24

Router0(config)#access-list 1 permit 192.168.44.00.0.0.255

Here access list is used to identify which source IPs are going to be translated using NAT, and this example allows any device from the 192.168.44.0network

Step 3: Create a dynamic NAT IP-address pool, this will hold a list of inside global addresses.

Name of Pool:	**NAT-POOL**
Starting IP address	**192.168.44.1**
Ending IP address	**192.168.44.14**
Network mask	**255.255.255.240**

Step:4: Complete this configuration with following commands:

Router0(config)#ip nat pool NAT-POOL 177.77.77.1 177.77.77.7 netmask 255.255.255.240 Router0(config)#ip nat inside source list 1 pool NAT-POOL

For network address translations, we are requires to identify at least two interfaces to be our inside and outside.

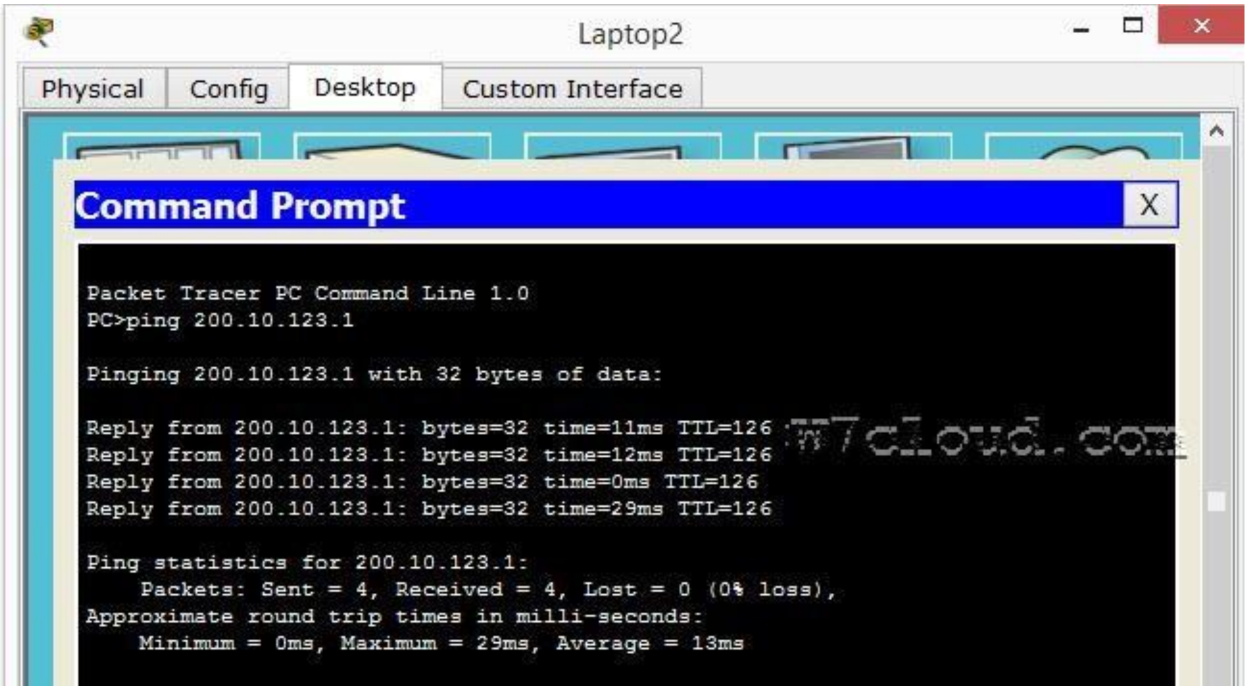
Interface fa0/0 will be our inside interface

Interface fa1/0 our outside interface

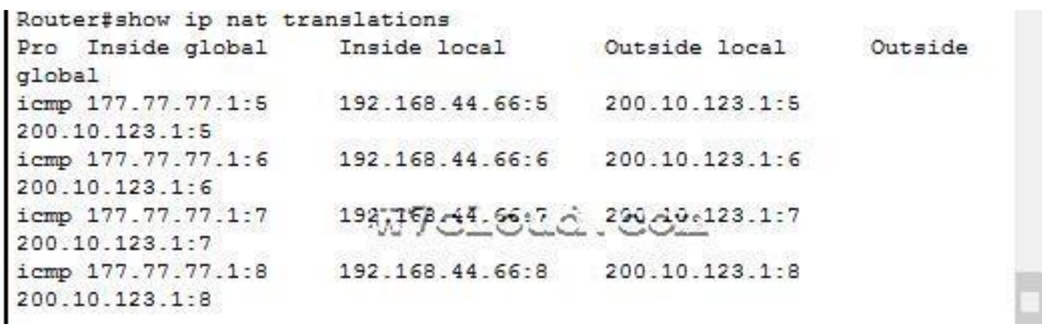
You can use the following commands for configuring inside and outside interfaces.

R0(config)#int fa0/0
R0(config-if)#ip nat
inside R0(config-if)#int
fa1/0 R0(config-if)#ip
nat outside

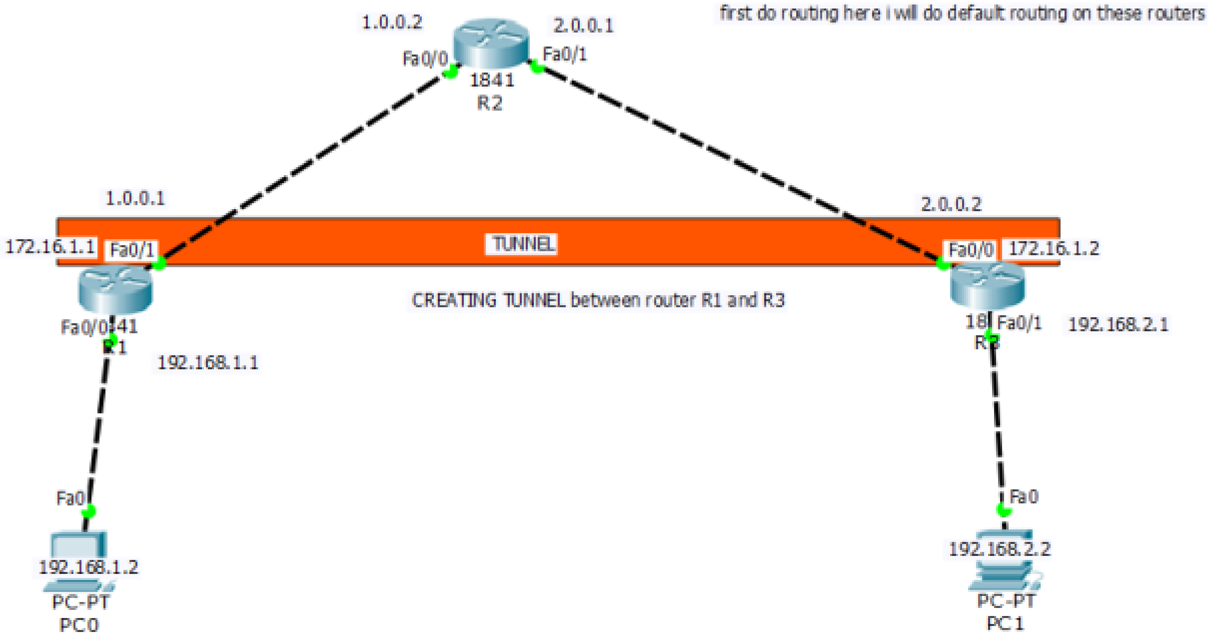
Step6: Testing NAT translation: When we ping from PC1 to PC0 to R1 our original IP address will be translated from a 192.168.44.x to 177.77.77.x.



You can verifiy it after the successful ping from PC1 to PC0 and then use the command "show IP nat translation".



Tunnelling: We will learn how to configure and use vpn on routers.We will learn to create a vpn tunnel between routers for safe communication**.**



Now as you can clearly see i have taken three routers here for showing vpn configuration on routers.This is an example lab showing you how to configure vpn tunnel using cisco packet tracer.

Total network take here are 4.

network 192.168.1.0/24

network 192.168.2.0/24

network 1.0.0.0/8

network 2.0.0.0/8

Now first thing we will do here in this lab is to assign ip address on each and every interface of router and also assign ip address on computers taken here.

CONFIGURATION ON ROUTER R1:

Router>enable

Router#config t

Router(config)#host r1

r1(config)#int fa0/0

r1(config-if)#ip add 192.168.1.1 255.255.255.0

r1(config-if)#no shut

r1(config-if)#exit

r1(config)#int fa0/1

r1(config-if)#ip address 1.0.0.1 255.0.0.0

r1(config-if)#no shut

CONFIGURATION ON ROUTER R2:

Router>enable

Router#config t

Router(config)#host r2

r2(config)#int fa0/0

r2(config-if)#ip add 1.0.0.2 255.0.0.0

r2(config-if)#no shut

r2(config-if)#exit

r2(config)#int fa0/1

r2(config-if)#ip add 2.0.0.1 255.0.0.0

r2(config-if)#no shut

CONFIGURATION ON ROUTER R3:

Router>enable

Router#config t

Router(config)#host r3

r3(config)#int fa0/0

r3(config-if)#ip add 2.0.0.2 255.0.0.0

r3(config-if)#no shut

r3(config-if)#exit

r3(config)#int fa0/1

r3(config-if)#ip add 192.168.2.1 255.255.255.0

r3(config-if)#no shut

Now its time to do routing.here i am going to configure default routing.

DEFAULT ROUTING CONFIGURATION ON ROUTER R1:

r1>enable

r1#config t

Enter configuration commands, one per line. End with CNTL/Z.

r1(config)#ip route 0.0.0.0 0.0.0.0 1.0.0.2

r1(config)#

DEFAULT ROUTING CONFIGURATION ON ROUTER r3:

r3>enable

r3#config t

Enter configuration commands, one per line. End with CNTL/Z.

r3(config)#ip route 0.0.0.0 0.0.0.0 2.0.0.1

r3(config)#

Now check the connection by pinging each other.

First we go to router r1 and ping with router r3:

r1#ping 2.0.0.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 2.0.0.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 26/28/33 ms

Now we go to router r3 and test network by pinging router r1 interface.

r3#ping 1.0.0.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 1.0.0.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 25/28/32 ms

Note: You can clearly see both router pinging each other successfully.

NOW CREATE VPN TUNNEL between R1 and R3:

FIRST CREATE A VPN TUNNEL ON ROUTER R3:

r1#config t

r1(config)#interface tunnel 10

r1(config-if)#ip address 172.16.1.1 255.255.0.0

r1(config-if)#tunnel source fa0/1

r1(config-if)#tunnel destination 2.0.0.2

r1(config-if)#no shut

NOW CREATE A VPN TUNNEL ON ROUTER R3:

r3#config t

r3(config)#interface tunnel 100

r3(config-if)#ip address 172.16.1.2 255.255.0.0

r3(config-if)#tunnel source fa0/0

r3(config-if)#tunnel destination 1.0.0.1

r3(config-if)#no shut

Now test communication between these two routers again by pinging each other:

1#ping 172.16.1.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.1.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 30/32/36 ms

r1#

r3#ping 172.16.1.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.1.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 33/45/83 ms

Now do routing for created VPN Tunnel on Both Router R1 and R3:

r1(config)#ip route 192.168.2.0 255.255.255.0 172.16.1.2

r3(config)#ip route 192.168.1.0 255.255.255.0 172.16.1.1

TEST VPN TUNNEL CONFIGURATION:

Now i am going to router R1 and test whether tunnel is created or not.

r1#show interfaces Tunnel 10

Tunnel10 is up, line protocol is up (connected)

Hardware is Tunnel

Internet address is 172.16.1.1/16

MTU 17916 bytes, BW 100 Kbit/sec, DLY 50000 usec,

reliability 255/255, txload 1/255, rxload 1/255

Encapsulation TUNNEL, loopback not set

Keepalive not set

Tunnel source 1.0.0.1 (FastEthernet0/1), destination 2.0.0.2

Tunnel protocol/transport GRE/IP

Key disabled, sequencing disabled

Checksumming of packets disabled

Tunnel TTL 255

Fast tunneling enabled

Tunnel transport MTU 1476 bytes

Tunnel transmit bandwidth 8000 (kbps)

Tunnel receive bandwidth 8000 (kbps)

Last input never, output never, output hang never

Last clearing of "show interface" counters never

Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 1

Queueing strategy: fifo

Output queue: 0/0 (size/max)

5 minute input rate 32 bits/sec, 0 packets/sec

5 minute output rate 32 bits/sec, 0 packets/sec

52 packets input, 3508 bytes, 0 no buffer

Received 0 broadcasts, 0 runts, 0 giants, 0 throttles

0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort

0 input packets with dribble condition detected

52 packets output, 3424 bytes, 0 underruns

0 output errors, 0 collisions, 0 interface resets

0 unknown protocol drops

0 output buffer failures, 0 output buffers swapped out

Now going to Router R3 and test VPN Tunnel Creation:

r3#show interface Tunnel 100

Tunnel100 is up, line protocol is up (connected)

Hardware is Tunnel

Internet address is 172.16.1.2/16

MTU 17916 bytes, BW 100 Kbit/sec, DLY 50000 usec, reliability 255/255, txload 1/255, rxload 1/255

Encapsulation TUNNEL, loopback not set

Keepalive not set

Tunnel source 2.0.0.2 (FastEthernet0/0), destination 1.0.0.1

Tunnel protocol/transport GRE/IP

Key disabled, sequencing disabled

Checksumming of packets disabled

Tunnel TTL 255

Fast tunneling enabled

Tunnel transport MTU 1476 bytes

Tunnel transmit bandwidth 8000 (kbps)

Tunnel receive bandwidth 8000 (kbps)

Last input never, output never, output hang never

Last clearing of "show interface" counters never

Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 1

Queueing strategy: fifo

Output queue: 0/0 (size/max)

5 minute input rate 32 bits/sec, 0 packets/sec

5 minute output rate 32 bits/sec, 0 packets/sec

52 packets input, 3424 bytes, 0 no buffer

Received 0 broadcasts, 0 runts, 0 giants, 0 throttles

0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort

0 input packets with dribble condition detected

53 packets output, 3536 bytes, 0 underruns

0 output errors, 0 collisions, 0 interface resets

0 unknown protocol drops

HOW TO TRACE THE VPN TUNNEL PATH?

Now if you want to check what path vpn tunnel is using just go to any of the computer i.e pc

and then ping anothr pc located in different network.And then trace the path using tracert.
Its result will show the path followed by VPN Tunnel created by you.

PC>ipconfig

FastEthernet0 Connection:(default port)

Link-local IPv6 Address.........: FE80::2E0:8FFF:FE0B:AEB2

IP Address......................: 192.168.2.2

Subnet Mask.....................: 255.255.255.0

Default Gateway.................: 192.168.2.1

PC>ping 192.168.1.2

Pinging 192.168.1.2 with 32 bytes of data:

Reply from 192.168.1.2: bytes=32 time=61ms TTL=126

Reply from 192.168.1.2: bytes=32 time=55ms TTL=126

Reply from 192.168.1.2: bytes=32 time=55ms TTL=126

Reply from 192.168.1.2: bytes=32 time=57ms TTL=126

Ping statistics for 192.168.1.2:

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

Approximate round trip times in milli-seconds:

Minimum = 55ms, Maximum = 61ms, Average = 57ms

PC>tracert 192.168.1.2

Tracing route to 192.168.1.2 over a maximum of 30 hops:

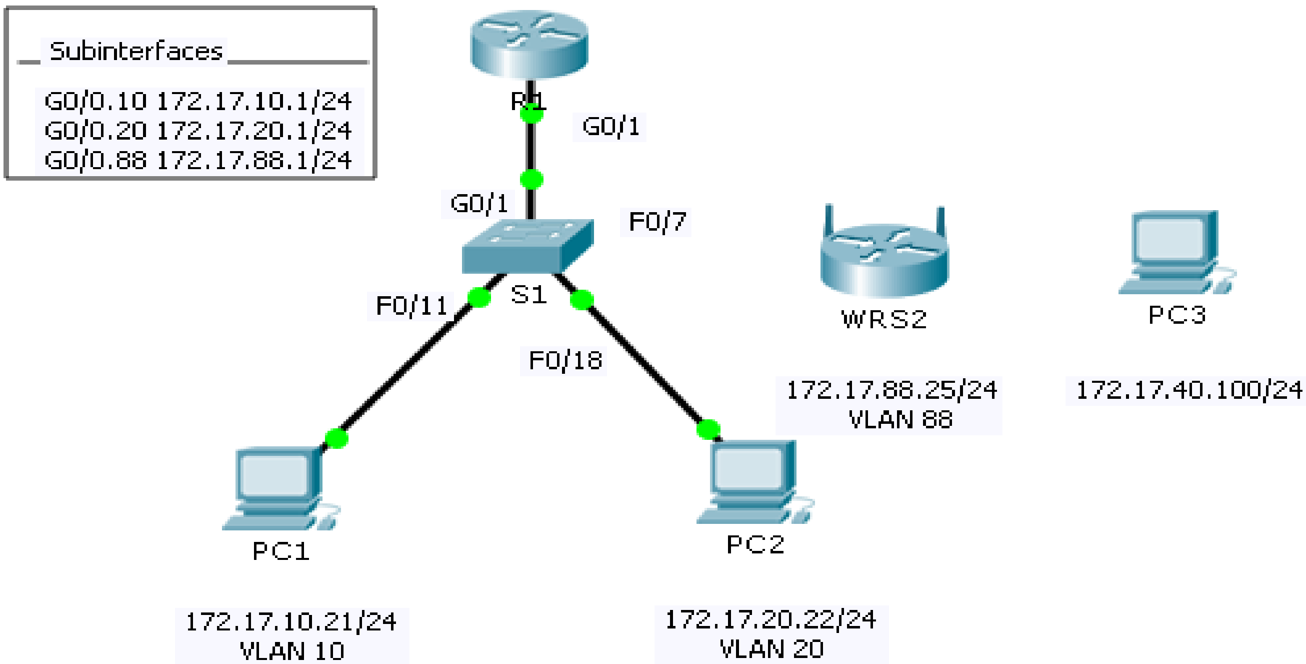
1 3 ms 0 ms 18 ms 192.168.2.1

2 35 ms 30 ms 30 ms 172.16.1.1

3 65 ms 59 ms 60 ms 192.168.1.2

Trace complete.

Week 6: Design a wireless LAN



Answer:

Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	G0/0.10	172.17.10.1	255.255.255.0	N/A
	G0/0.20	172.17.20.1	255.255.255.0	N/A
	G0/0.88	172.17.88.1	255.255.255.0	N/A
PC1	NIC	172.17.10.21	255.255.255.0	172.17.10.1
PC2	NIC	172.17.20.22	255.255.255.0	172.17.20.1
PC3	NIC	DHCP Assigned	DHCP Assigned	DHCP Assigned
WRS2	NIC	172.17.88.25	255.255.255.0	172.17.88.1

Objectives

Part 1: Configure a Wireless

Router Part 2: Configure a

Wireless Client Part 3: Verify

Connectivity

Scenario

In this activity, you willconfigure a Linksys wireless router, allowing for remote access from PCs as well as wireless connectivity with WPA2 security. You will manually configure PC wireless connectivity byentering the Linksys router SSID andpassword.

Part1: Configure a Wireless Router

Step 1: Connect the Internet interface of WRS2 toS1.

Connect the **WRS2** Internet interface to the **S1** F0/7 interface.

Step 2: Configure the Internet connectiontype.

a. Click **WRS2 > GUI**tab.

b. Set the **Internet Connection type** to **Static IP**.

c. Configure the IP addressing according to the AddressingTable.

Step 3: Configure the networksetup.

a. Scroll down to **Network Setup**. For the **Router IP** option, set the IP address to **172.17.40.1** andthe subnet mask to **255.255.255.0**.

b. Enable the DHCPserver.

c. Scroll to the bottom of the page and click **SaveSettings**.

Step 4: Configure wireless access andsecurity.

a. At the top of the window, click **Wireless**. Set the **Network Mode** to **Wireless-N Only** and change the SSID to**WRS_LAN**.

b. Disable **SSID Broadcast** and click **SaveSettings**.

c. Click the **Wireless Security**option.

d. Change the **Security Mode** from **Disabled** to **WPA2 Personal**.

e. Configure **cisco123** as thepassphrase.

f. Scroll to the bottom of the page and click **SaveSettings**.

Part2: Configure a WirelessClient

Step 1: Configure PC3 for wirelessconnectivity.

Because SSID broadcast is disabled, you must manually configure **PC3** with the correct SSID and passphrase to establish a connection with the router.

a. Click **PC3** >**Desktop** >**PCWireless**.

b. Click the **Profiles**tab.

c. Click**New**.

d. Name the new profile **WirelessAccess**.

e. On the next screen, click **Advanced Setup**. Then manually enter the SSID of **WRS_LAN** on **Wireless Network Name**. Click **Next**.

f. Choose **Obtain network settings automatically (DHCP)** as the network settings, and then click**Next**.

g. On **Wireless Security**, choose **WPA2-Personal** as the method of encryption and click**Next**.

h. Enter the passphrase **cisco123** and click**Next**.

i. Click **Save** and then click **Connect toNetwork**.

Step 2: Verify PC3 wireless connectivity and IP addressing configuration.

The **Signal Strength** and **Link Quality** indicators should show that you have a strongsignal. Click **More Information** to see details of the connection including IP addressing information. Close the **PC Wireless** configurationwindow.

Part 3: Verify Connectivity

All the PCs should have connectivity with one another.

Part-II: COMPUTER NETWORKS

Program: Implement the data link layer framing methods such as character, character stuffing and bit stuffing.

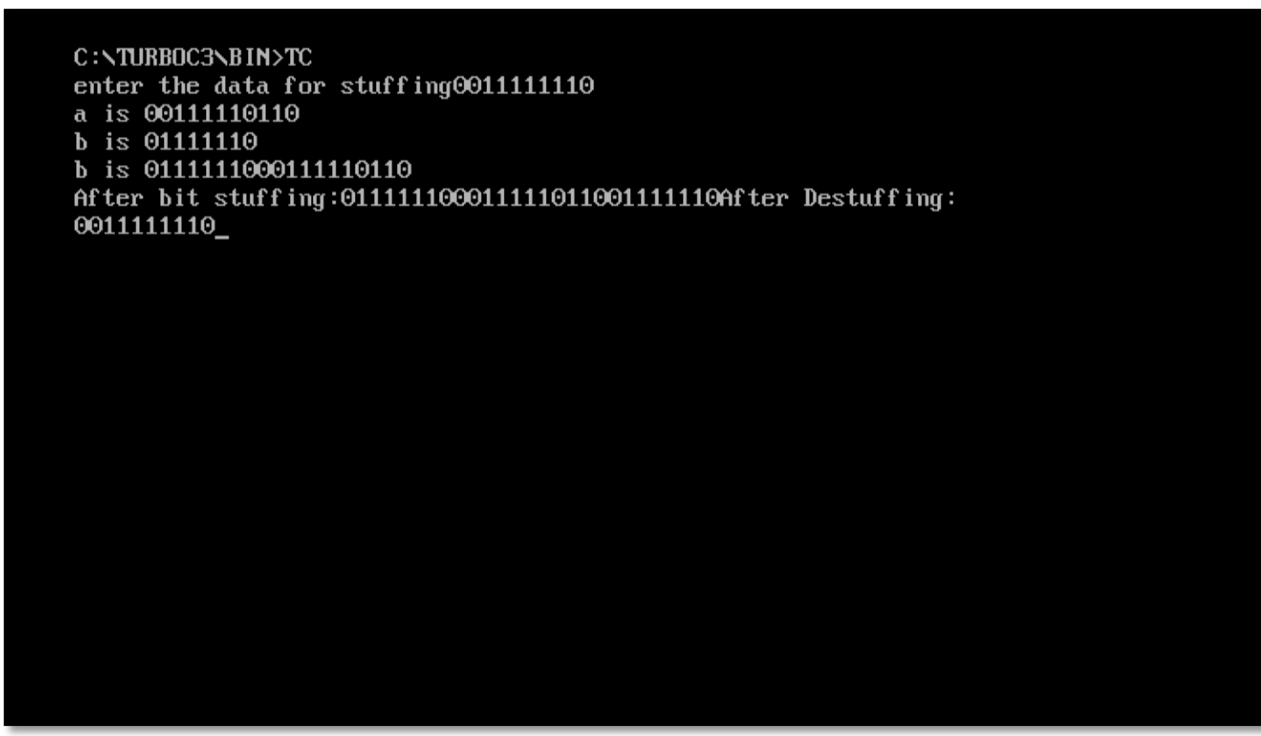
Program:BIT STUFFING

```
#include<stdio.h>
#include<string.h>
int main()

{
int n,m,x,i,j=0,t,k;
char a[100],b[150];
printf("enter the data for stuffing");
scanf("%s",a);
n=strlen(a);
for(i=0;i<strlen(a);i++)
{
if(a[i]=='1')
j++;
else
j=0;
if(j==5)
{
for(k=strlen(a);k>i;k--)
{
a[k+1]=a[k];
}
a[i+1]='0';
}
}
printf("a is %s\n",a);
strcpy(b,"01111110");
printf("b is %s\n",b);
strcat(b,a);
printf("b is %s\n",b);
strcat(b,"01111110");
```

```
printf("After bit stuffing:%s",b);
n=strlen(b);
for(i=8;i<n-8;i++)
{
if (b[i]=='1' && b[i+1]=='1' && b[i+2]=='1' && b[i+3]=='1' && b[i+4]=='1')
{
n=n-1;
for(j=i+5;j<n;j++)
b[j]=b[j+1];
i=i+5;
}
}
printf("After Destuffing:\n");
for(i=8;i<n-8;i++)
printf("%c",b[i]);
}
```

Output:



Program: Character Stuffing

```
#include<stdio.h>

#include<string.h>

void main()

{

int j,l,m,c,k;

char a[50],b[50];

printf("Enter the string:");

scanf("%s",a);

strcpy(b,"DLESTX");

m=strlen(a);

for(j=0;j<m;j++)

{

if(a[j]=='D'&& a[j+1]=='L' && a[j+2]=='E')

{

//c=j+3;

for(l=0;l<3;l++)

{

for(k=m;k>j+3;k--)

{

a[k]=a[k-1];

}

m++;

}

a[j+3]='D';

a[j+4]='L';

a[j+5]='E';

j+=5;
```

```
}
}
strcat(b,a);
strcat(b,"DLEETX");
printf("\n%s",b);
printf("\nReceiver side:");
m=strlen(a);
for(j=0;j<m;j++)
{
if(a[j]=='D'&& a[j+1]=='L'&& a[j+2]=='E')
{
for(l=0;l<3;l++)
{
for(k=j;k<m;k++)
a[k]=a[k+1];
}
j=j+2;
}
}
printf("\n%s",a);
}
```

Output:

C:\TURBOC3\BIN>TC
Enter the string:computercradle
DLESTXcomputercradleDLEETX
Receiver side:
computercradle_

2. Implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP.

Program: CRC-12,16,CCITT

```
#include<stdio.h>
#include<stdlib.h>
#include<string.h>
void crc();
char a[50],b[50],c[50],newm[50];
int x,y,i=0,j,k,n,s,flag=0;
void main()
{
printf("Enter the data:\n");
scanf("%s",a);
n=strlen(a);
k=n;
printf("\nEnter your choice:\n1.CRC-12\n2.CRC-16\n3.CRC-CCIT\n");
scanf("%d",&x);
printf("\nAfter adding EDC code,the data is:");
switch(x)
{
case 1:strcpy(b,"1100000001111");
strcat(a,"000000000000");
k=k+12;s=13;
break;
case 2:strcpy(b,"11000000000000101");
strcat(a,"0000000000000000");
k=k+16;s=17;
break;
case 3:strcpy(b,"10001000000100001");
strcat(a,"0000000000000000");
k=k+16;s=17;
break;
default:printf("Wrong choice..!");
exit(0);
}
crc();
for(i=0;i<n;i++)
```

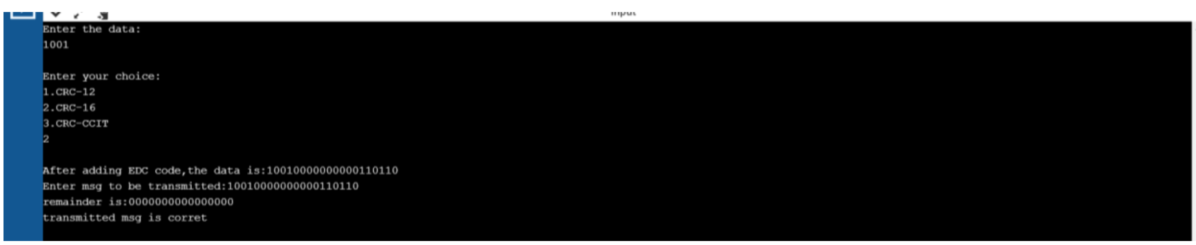
```
printf("%c",a[i]);
printf("\nEntermsg to be transmitted:");
scanf("%s",newm);
strcpy(a,newm);
crc();
printf("remainder is:");
for(i=0;i<n;i++)
printf("%c",c[i]);
printf("\n");
for(i=n-s;i<n;i++)
if(a[i]!='0')
{
flag=1;
break;
}
if(flag==1)
printf("the message contains an error");
else
printf("transmitted msg is corret");
}
void crc()
{
for(i=0;i<s;i++)
c[i]=a[i];
i=s;
while(i<k+1)

{
if(c[0]=='1')
for(j=0;j<s;j++)
{
if(c[j]==b[j])
c[j]='0';
else
c[j]='1';
}
if(c[0]=='0')
```

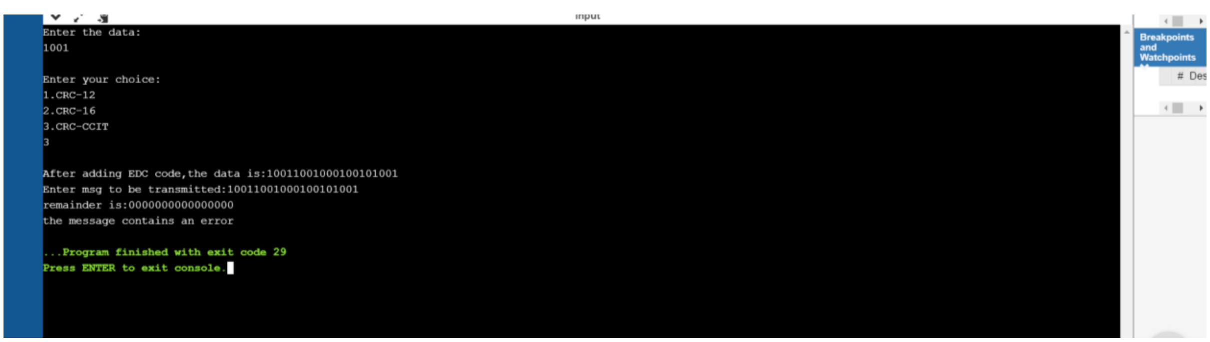
```
{
for(j=0;j<s;j++)
c[j]=c[j+1];
c[s-1]=a[i];
i++;
}
}
for(i=0;i<s-1;i++)
{
a[n]=c[i];
n++;
}
}
```

OUTPUT 1:

OUTPUT 2:



OUTPUT 3:



3. Implement Dijkstra's algorithm to compute the Shortest path through a graph.

Program:

```
#include<stdio.h>
#define IN 99
#define N 100
int dijsktra(int cost[][N], int source, int target, int n);
int dijsktra(int cost[][N],int source,int target, int n)
{
int dist[N]={0},prev[N]={0},selected[N]={0},i,m,min,start,d,j=0;
char path[N] = {0};
for(i=1;i<=n;i++)
{
dist[i] = IN;

prev[i] = -1;
}
start = source;
selected[start]=1;
dist[start] = 0;

while(selected[target] ==0)
{
min = IN;
m = 0;
for(i=1;i<=n;i++)
{
d = dist[start]+cost[start][i];
if(d<dist[i]&&selected[i]==0)

{
dist[i] = d;
prev[i] = start;
 }
if(min>dist[i] && selected[i]==0)
{
min = dist[i];
m = i;
```

```
 }
}
start = m;
selected[start] = 1;
}
 start = target;
 j = 0;

while(start != -1)
{
path[j++] = start;
start = prev[start];
}

printf("shortest path\n");
for(i=0;i<j;i++)
{
if(i==j-1)
printf("%d", path[i]);
else
printf("%d->", path[i]);
 }
return dist[target];
}
void main()
{
int cost[N][N],i,j,w,ch,co;
int source,target,x,y;
int n=0;
printf("\tShortest Path Algorithm(DIJKSRTRA's ALGORITHM\n\n");
printf("\n\t Note: Give weight as 99 if no path exits. 99 = INFINITY \n \n");
printf("Enter No of Nodes:");
scanf("%d", &n);
printf("\n");
 for(i=1;i<=n;i++)
for(j=1;j<=n;j++)
cost[i][j] = IN;
```

```
printf("enter the weight of the path between nodes:\n");
for(x=1;x<=n;x++)
{
for(y=x+1;y<=n;y++)
{
printf("%d and %d: ",x,y);
scanf("%d",&w);
cost [x][y] = cost[y][x] = w;
}
printf("\n");
 }

printf("Enter the source:");
scanf("%d", &source);
printf("\nEnter the target:");
scanf("%d", &target);
co = dijsktra(cost,source,target, n);
printf("\nShortest Path(Cost): %d",co);
}
```

OUTPUT :

4. Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table at each node using distance vector routing algorithm. Take an example subnet of hosts. Obtain broadcast tree for it.

Program

```
#include<stdio.h>
struct node
{
unsigned dist[20];

unsigned from[20];
}

rt[10];
int main()
{
int dmat[20][20];

int n,i,j,k,count=0;
printf("\nEnter the number of nodes : "); scanf("%d",&n);
printf("Enter the cost matrix :\n"); for(i=0;i<n;i++)
for(j=0;j<n;j++)
{
scanf("%d",&dmat[i][j]);

dmat[i][i]=0;

rt[i].dist[j]=dmat[i][j];

rt[i].from[j]=j;
}
do
{
count=0;

for(i=0;i<n;i++)

for(j=0;j<n;j++)

for(k=0;k<n;k++)
if(rt[i].dist[j]>dmat[i][k]+rt[k].dist[j])
```

```
{
rt[i].dist[j]=rt[i].dist[k]+rt[k].dist[j];

rt[i].from[j]=k;
count++;
}
}

while(count!=0); for(i=0;i<n;i++)
{
printf("\nState value for router %d is \n",i+1); for(j=0;j<n;j++)
{
printf("\nnode %d via %d Distance%d",j+1,rt[i].from[j]+1,rt[i].dist[j]);
}
}
printf("\n");
}
```

Output:

5. Using RSA algorithm Encrypt a text data and Decrypt the same.

Program:

```
#include<stdio.h>
#include<stdlib.h>
#include<math.h>
#include<string.h>
long int p,q,n,t,flag,e[100],d[100],temp[100],j,m[100],en[100],i;
char msg[100];
int prime(long int);
void ce();
long int cd(long int);
void encrypt();
void decrypt();
int main()
{
 printf("\nENTER FIRST PRIME NUMBER\n");
 scanf("%ld",&p);
 flag=prime(p);
 if(flag==0)
 {
  printf("\nWRONG INPUT\n");
  exit(1);
 }
 printf("\nENTER ANOTHER PRIME NUMBER\n");
 scanf("%ld",&q);
 flag=prime(q);
 if(flag==0||p==q)
 {
  printf("\nWRONG INPUT\n");
  exit(1);
 }
 printf("\nENTER MESSAGE\n");
 fflush(stdin);
```

```
 scanf("%s",msg);
 for(i=0;msg[i]!=NULL;i++)
  m[i]=msg[i];
 n=p*q;
 t=(p-1)*(q-1);
 ce();
 printf("\nPOSSIBLE VALUES OF e AND d ARE\n");
 for(i=0;i<j-1;i++)
  printf("\n%ld\t%ld",e[i],d[i]);
 encrypt();
 decrypt();
 return 0;
}

int prime(long int pr)
{
 int i;
 j=sqrt(pr);
 for(i=2;i<=j;i++)
 {
  if(pr%i==0)
   return 0;
 }
 return 1;
}

void ce()
{
 int k;
 k=0;
 for(i=2;i<t;i++)
        {
            if(t%i==0)
                continue;
                flag=prime(i);
            if(flag==1&&i!=p&&i!=q)
```

```
            {
               e[k]=i; flag=cd(e[k]);
               if(flag>0)
  {
   d[k]=flag;
   k++;
  }
  if(k==99)
   break;
  }
 }
}

long int cd(long int x)
{
 long int k=1;
 while(1)
 {
  k=k+t;
  if(k%x==0)
   return(k/x);
 }
}

void encrypt()
{
 long int pt,ct,key=e[0],k,len;
 i=0;
 len=strlen(msg);
 while(i!=len)
 {
  pt=m[i];
  pt=pt-96;
  k=1;
  for(j=0;j<key;j++)
  {
```

```
   k=k*pt;
   k=k%n;
  }
  temp[i]=k;
  ct=k+96;
  en[i]=ct;
  i++;
 }
 en[i]=-1;
 printf("\nTHE ENCRYPTED MESSAGE IS\n");
 for(i=0;en[i]!=-1;i++)
  printf("%c",en[i]);
}

void decrypt()
{
 long int pt,ct,key=d[0],k;
 i=0;
 while(en[i]!=-1)
 {
  ct=temp[i];
  k=1;
  for(j=0;j<key;j++)
  {
   k=k*ct;
   k=k%n;
  }
  pt=k+96;
  m[i]=pt;
  i++;
 }
m[i]=-1;
 printf("\nTHE DECRYPTED MESSAGE IS\n");
 for(i=0;m[i]!=-1;i++)
  printf("%c",m[i]);
}
```

Output:

```
C:\TURBOC3\BIN>TC

ENTER FIRST PRIME NUMBER
5

ENTER ANOTHER PRIME NUMBER
7

ENTER MESSAGE
proprogramming

POSSIBLE VALUES OF e AND d ARE

11      11
13      13
17      17
THE ENCRYPTED MESSAGE IS
kbokbo¦ba{{dn¦
THE DECRYPTED MESSAGE IS
proprogramming
```