

TNE20003 – Internet and Cybersecurity for Engineering Applications

Portfolio Task – Lab 5 Pass Task

Aims:

- To observe and investigate the functionality of the TCP and UDP protocols at the transport layer.
- Observe NAT at work and understand the translation process

Preparation:

- View ["Transport Layer Services"](#) & ["NAT & DHCP"](#)

Due Date:

- Your Task will be assessed via an online quiz. You must score the required minimum to pass the test. You will be allowed a number of attempts to pass the test at the grade level you attempt. You are encouraged to complete the test at the end of the lab but if you do not, you must complete it before your next lab class.

Task 1.

Build the network provided in figure 1 with Cisco Packet Tracer

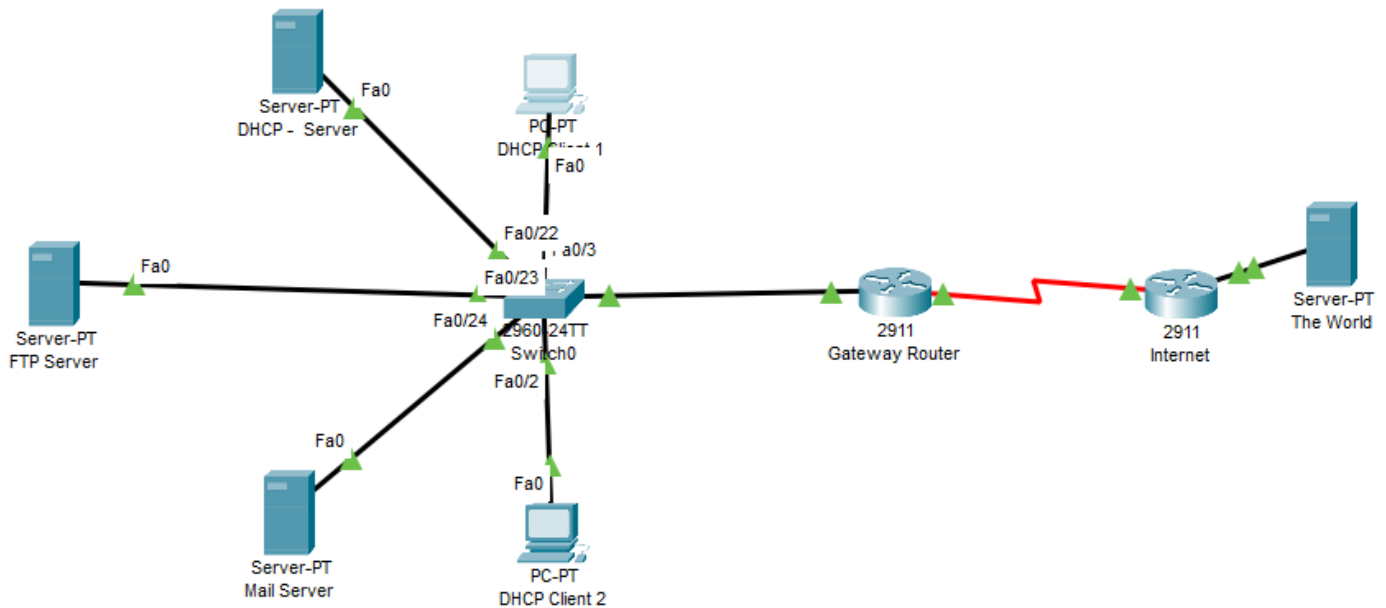
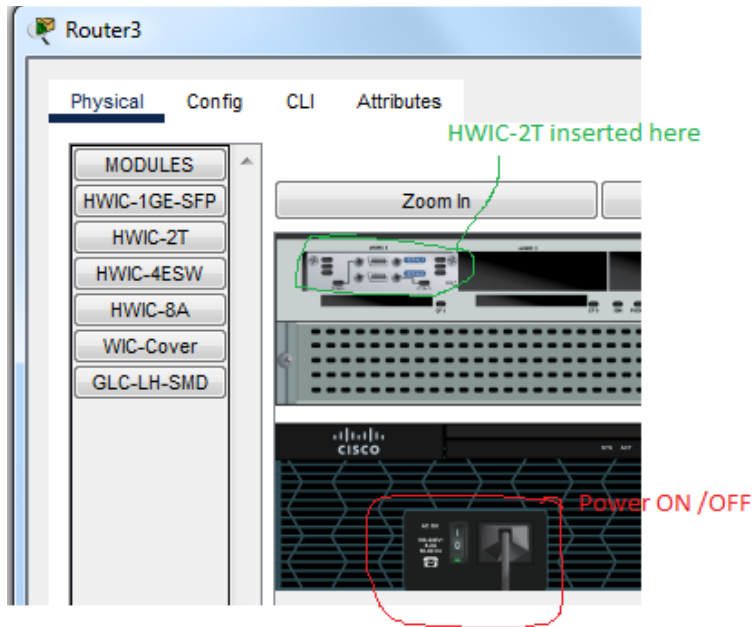


Figure 1

Task 2.

1. Implement the network shown in figure 1 above, labelling all devices as in the diagram.

If you need help creating the diagram refer to the instructions in labs 1 & 2. Note that the serial link between **Gateway** router and **Internet** router cannot be connected until you put in HWIC-2T cards into the routers. See pic below for final connected view, but to get to this state you must follow these steps.



- a. On both routers go the physical tab and turn off the power. Then click on the HWIC-2T card under the “modules” and place it as in the pic.
- b. Now turn on the routers and then choose a serial cable from the cable section and connect the 2 routers. Notice the link lights will be red. This is because we have not configured or turned the interfaces on yet. In my picture they have been configured hence they are green.

Private IPv4 space:

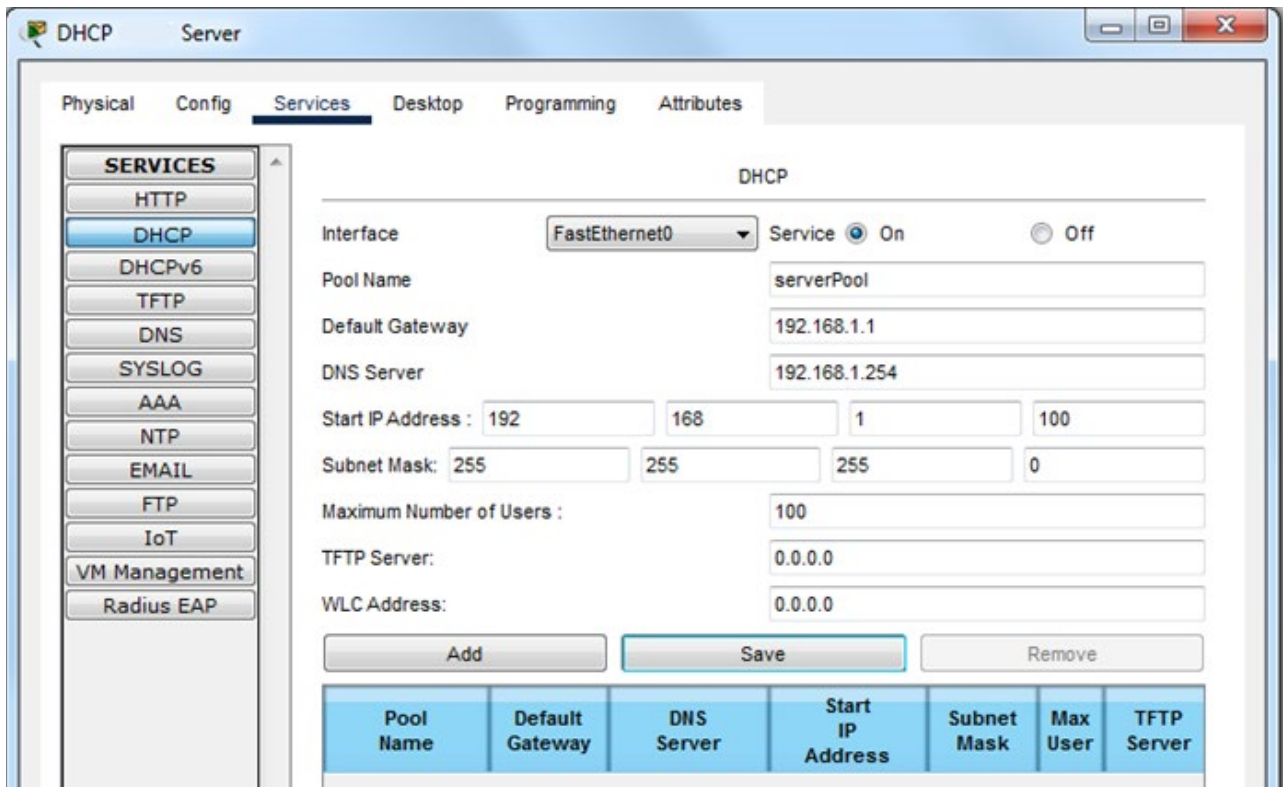
10.0.0.0/8 IP addresses: 10.0.0.0 – 10.255.255.255

172.16.0.0/12 IP addresses: 172.16.0.0 – 172.31.255.255

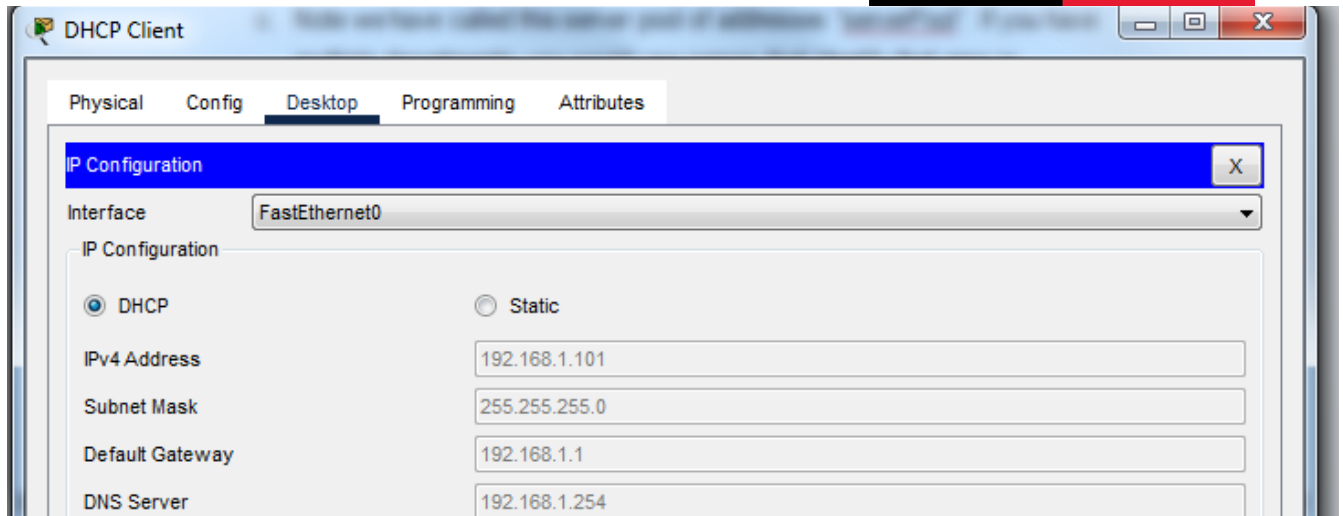
192.168.0.0/16 IP addresses: 192.168.0.0 – 192.168.255.255

Task 3.

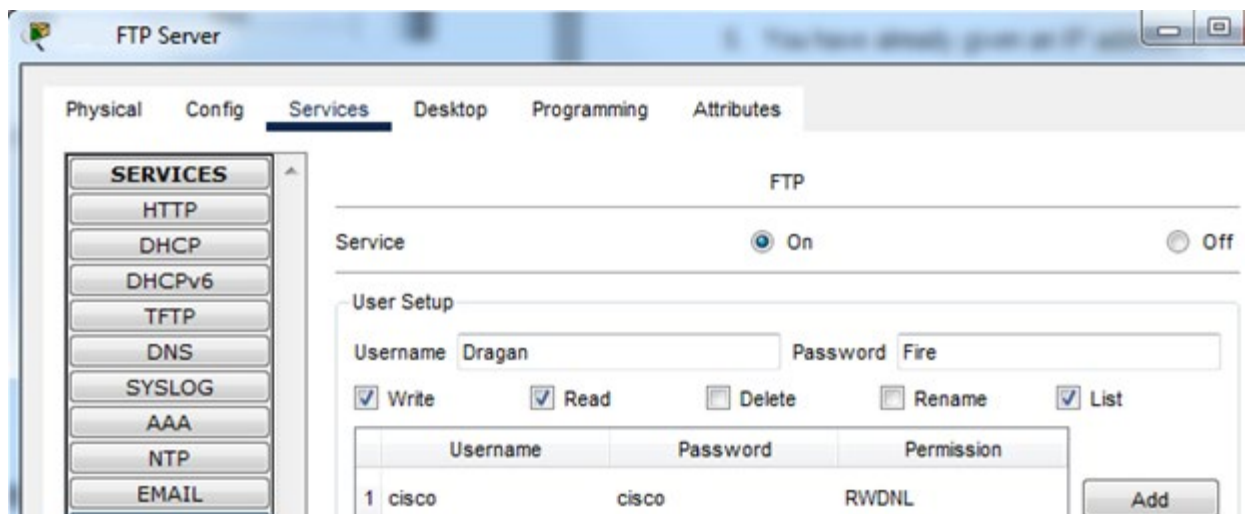
1. Click on the **Gateway** router and assign it the address of 192.168.1.1/24
2. Click on the **Mail** server and assign it the address of 192.168.1.253/24
3. Click on the **DHCP** server and assign it the address of 192.168.1.254/24
 - a. Whilst in the DHCP server configure the DHCP service. Under the “**Services**” tab choose “**DHCP**” as in the pic below and fill out of the details as shown in the pic.



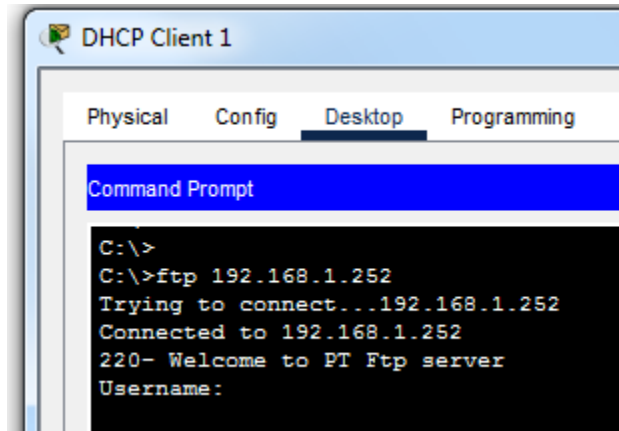
- b. Note that we are setting up specific IP addresses to important servers which are not part of the range of IP addresses used in the DHCP pool. Our pool will start at 192.168.1.100 and we will allow a maximum of 100 users to get an IP at any one time. If user 101 requests an IP address they will be rejected until one of the used 100 IP addresses gets released.
- c. Note we have called this server pool of IP addresses “**serverPool**”. If you have multiple departments you might use names that identify those areas ie EngineeringPool, AccountingPool,
- d. Now test to see if the server works. Go to **DHCP Client 1** and under the **Desktop** tab click on **IP Configuration** and then choose **DHCP** as in the picture below.



- e. Observe that PC has the IP address of 192.168.1.1XX (where XX=00 to 99). In addition, it has been given the identity of the **Default Gateway & DNS Server**.
 - f. Go to the command prompt and ping to the **Mail** server to see you have connectivity. If it doesn't work troubleshoot to fix the problem.
 - g. Repeat **d-f** on **DHCP Client 2** and again verify that an IP address is assigned and that Client 2 can ping all other devices in that LAN.
4. Click on the **FTP** server and assign it the address 192.168.1.252/24
- a. Once the **FTP** server is addressed go to the "**Services**" tab and then click "**FTP**".
 - b. Ensure that the service is "**ON**" and then add a new user with the **username Dragan** and **password Fire** with the permissions to read, write and list files as in the picture below.



- c. Now go to **DHCP Client 1** and open up a command prompt and in that prompt type “**ftp 192.168.1.252**”. You should see the following output.



- d. Enter the username and password that we created and you should be in. Type “**dir**” to see what files are available for copying.
- e. If you want you can use the “**get**” to copy files from the ftp server onto your PC or the “**put**” command to upload files onto the ftp server. Try “getting” one file and observe that it appears in your PC.

5. Observe the transport layer at work.

- a. In PT click on Simulation and then under the filters section choose All/None until no filters are chosen. Then only activate the **FTP**, **TCP** and **UDP** filters. Then click the Realtime mode on PT.
- b. Go to **DHCP Client 1** and under the **Desktop** tab click on command prompt and type “**ftp 192.168.1.252**”. You should see the picture below. Notice the PC is waiting for you to enter the username and the PT is in Realtime mode. Now enter the simulation mode and then enter the username “**Dragan**”. Observe what happens in the events field.

The screenshot displays a network topology in Packet Tracer. On the left, a PC-PT (DHCP Client 1) is connected to a switch (S6024TT) via Fa0/22. The switch is connected to a Gateway Router (2911) via Fa0/23. The router is connected to another switch (S6024TT) via Fa0/24. This second switch is connected to a PC-PT (DHCP Client 2) via Fa0/2. The DHCP Client 1 window shows a command prompt where the user has entered 'ipconfig' and received the following output:

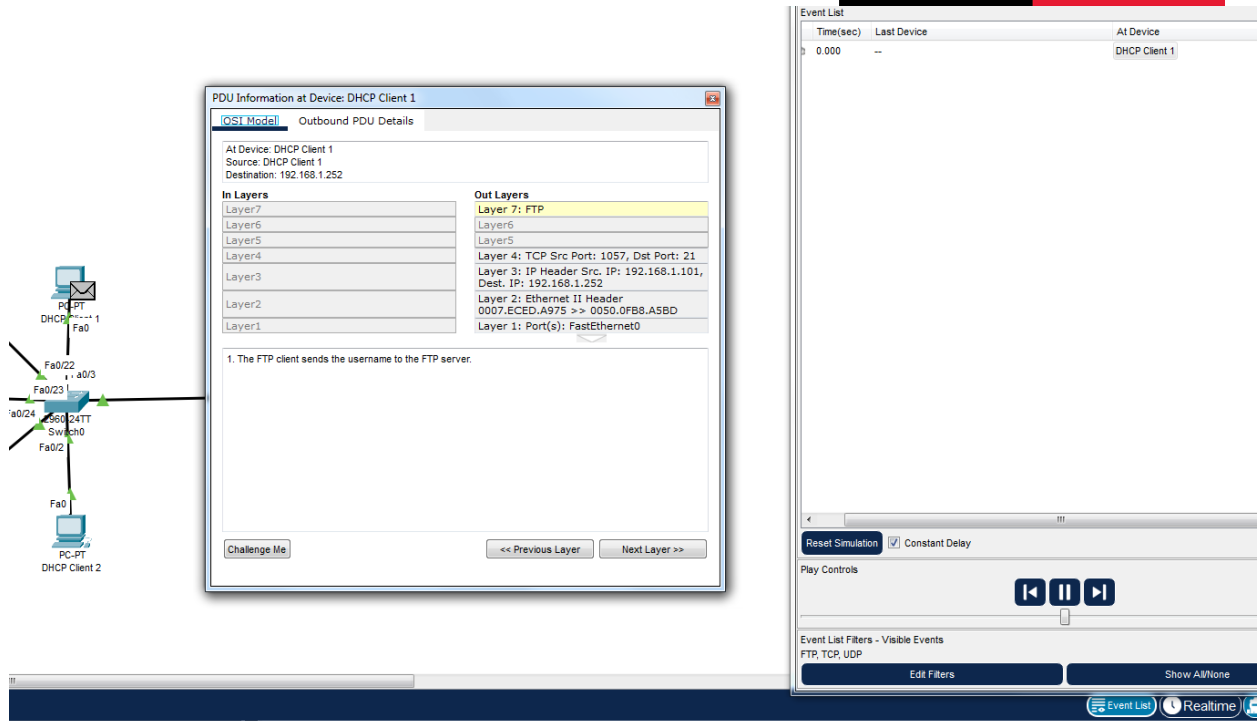
```


C:\>ipconfig
IP Configuration
Ethernet adapter Local Area Connection 1:
. . . . .
C:\>

```

The Simulation Panel window shows the Event List, which is currently empty. The Play Controls section includes buttons for Reset Simulation, Constant Delay, and Play Controls. The Event List Filters section shows 'Visible Events' as 'FTP, TCP, UDP'.


Page 7



- e. Here you can see whether TCP or UDP is used as the transport protocol. Also you can see the port numbers.
- f. What is the port number used for FTP? 21
- g. Click on “Outbound PDU details”. What are the source (src) and destination (dst) MAC addresses and IP addresses? What are the src and dst port numbers?
- h. What is the sequence number and the acknowledgment number? seq: 70, ack: 144
- i. What do you see at the bottom of this window? The TCP field
- j. Advance the communication 1 step at a time by pressing the  button in the simulation window. You will see events increase in the events list as the envelope travels between client and FTP server. Once the response from the server reaches the client you should see the same as the picture below:

Simulation Panel

Event List

Vis.	Time(sec)	Last Device	At Device
	0.000	--	DHCP Client 1
	0.001	DHCP Client 1	Switch0
	0.002	Switch0	FTP Server
	0.002	--	FTP Server
	0.003	FTP Server	Switch0
	0.004	Switch0	DHCP Client 1

- Click on the packet circled in red. When it opens up what do you see?
- What has happened to the src and dst port numbers? *inbound PDU: src port: 21; dest port: 1031*
- What are the sequence number and acknowledgment numbers? What can you say about them? Does it make sense? *seq number sent by tcp client: how much data sent for a session
ack number: sent by tcp server: indicate that it has received data and ready for next segment*
- Scroll down to the bottom. What do you see? *TCP field*
- Now go back to the client and put in the password.
- You will have to forward/advance the communication until you get the following output in the events list:

Simulation Panel

Event List

Time(sec)	Last Device	At Device
0.000	--	DHCP Client 1
0.001	DHCP Client 1	Switch0
0.002	Switch0	FTP Server
0.002	--	FTP Server
0.003	FTP Server	Switch0
0.004	Switch0	DHCP Client 1
0.004	--	DHCP Client 1
0.005	DHCP Client 1	Switch0
0.006	Switch0	FTP Server
0.006	--	FTP Server
0.007	FTP Server	Switch0
0.008	Switch0	DHCP Client 1

- Click on the last event and see that you are logged in and ready to view/get/put files.

The ftp response field: code: 220; message: welcome to ftp server

6. Next we will implement and investigate NAT.

- a. On the **Gateway** router type in the following commands as in the picture below:

```
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip nat pool MYNET 200.8.8.1 200.8.8.1 netmask 255.255.255.255
Router(config)#ip nat inside source list 1 pool MYNET overload
```

This configures the real/global address we have bought to be used in the overload mode meaning that each of our connections will have a different port associated with each connection. "MYNET" is a word that you can choose to be anything you want and is only used locally in that router. The line containing the "source list" links to a filter, known as an ACL, which allows us to choose which IP addresses will be translated.

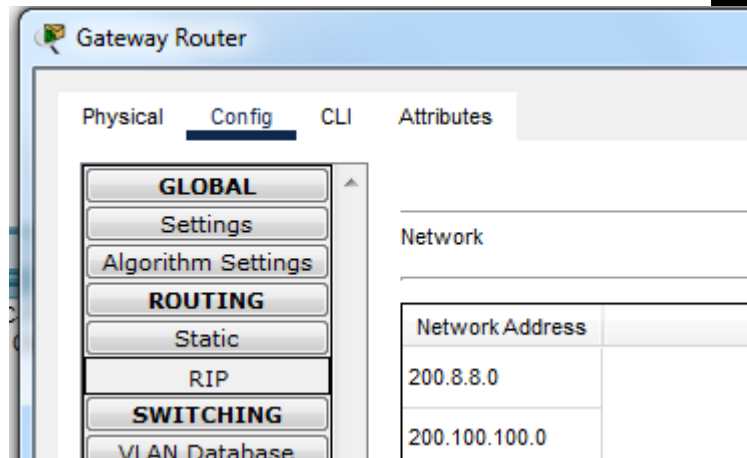
- b. Create the ACL to decide which IPs will be translated. See pic below.

```
Router(config)#access-list 1 permit 192.168.1.100 0.0.0.63
Router(config)#access-list 1 deny any
```

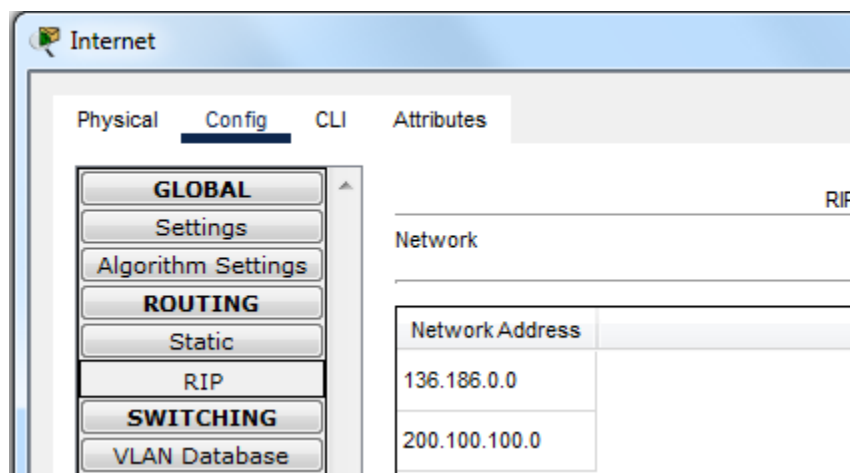
- c. Next we need to tell our system which addresses are private (inside) and which are public (outside). See pic below:

```
Router(config-if)#int s0/3/0
Router(config-if)#ip nat outside
Router(config-if)#int g0/0
Router(config-if)#ip nat inside
```

- d. Let's set up the routing so that traffic from our network can make it's way to **The World** server connected to the **Internet** router. Configure the serial interface S0/3/0 with ip address of 200.100.100.1/24.
- e. The global address we purchased is 200.8.8.1/32. This is what is used when traffic is sent out of our network. Hence this must be advertised to any neighbours that the **Gateway** router is connected to. Configure RIP routing as in the pic below:



- f. Configure the G0/0 interface of the **Internet** router with ip address of 136.186.100.1/24. Then add **The World** server and connect to Fa0/0 with ip address of 136.186.100.2/24 using 136.186.100.1/24 as the gateway address.
- g. Next configure the **Internet** router's serial interface S0/3/0 with the ip address of 200.100.100.2/24. Now configure router rip as shown below:



- h. Lastly on the **Internet** router configure a static route pointing to the public address of 200.8.8.0/24 by issuing the command **ip route 200.8.8.0 255.255.255.0 200.100.100.1**.
- i. With no interesting traffic there should NOT be any translations. Check by issuing the command "**sh ip nat tran**" under the global Router# prompt on the Gateway device. You should see this:

```
Router#sh ip nat tran
Router#
```

- j. Now let's generate some traffic by pinging from one of the DHCP clients to **The World** server located at 136.186.100.2.

```

C:\>ping 136.186.100.2

Pinging 136.186.100.2 with 32 bytes of data:

Request timed out.
Reply from 136.186.100.2: bytes=32 time=1ms TTL=126
Reply from 136.186.100.2: bytes=32 time=1ms TTL=126
Reply from 136.186.100.2: bytes=32 time=1ms TTL=126

Ping statistics for 136.186.100.2:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:\>

```

- k. Let us check the translation table again by issuing the command “**sh ip nat tran**” on the **Gateway** router. What do you see???? It should be something similar to the pic below.

```

Router#sh ip nat tran
Pro  Inside global      Inside local          Outside local          Outside global
icmp 200.8.8.1:63         192.168.1.101:63     136.186.100.2:63     136.186.100.2:63
icmp 200.8.8.1:64         192.168.1.101:64     136.186.100.2:64     136.186.100.2:64
icmp 200.8.8.1:65         192.168.1.101:65     136.186.100.2:65     136.186.100.2:65
icmp 200.8.8.1:66         192.168.1.101:66     136.186.100.2:66     136.186.100.2:66

```

**SAVE THIS FILE IF YOU WANT TO DO THE CREDIT OR
DISTINCTION TASK & for lab 6 as well!!**

~~~~~ End of Lab ~~~~~