CSG1105 Workshop Four

1 Introduction

This week we are going to explore aspects of IP (Internet Protocol) and Routing. These are all features of the Inter-network Layer. This layer is responsible for addressing, efficient delivery of packets and fragmentation of packets as necessary. ARP, which was explored last module is associated with this layer as is ICMP, the Internet Control Management Protocol.

2 Exercise: PC Network Settings

2.1 Windows

- Open a command prompt
- Issue the command `ipconfig`
- Find your active adapter and look at the IP address, the Subnet mask and the Default Gateway.

2.2 OS X

- From the Applications->Utilities folder, run the terminal App
- Issue the command `ifconfig`
- Find your active adapter and look at the IP address and the Subnet Mask
- Use the command `route get default` to get the default gateway address

2.3 Questions

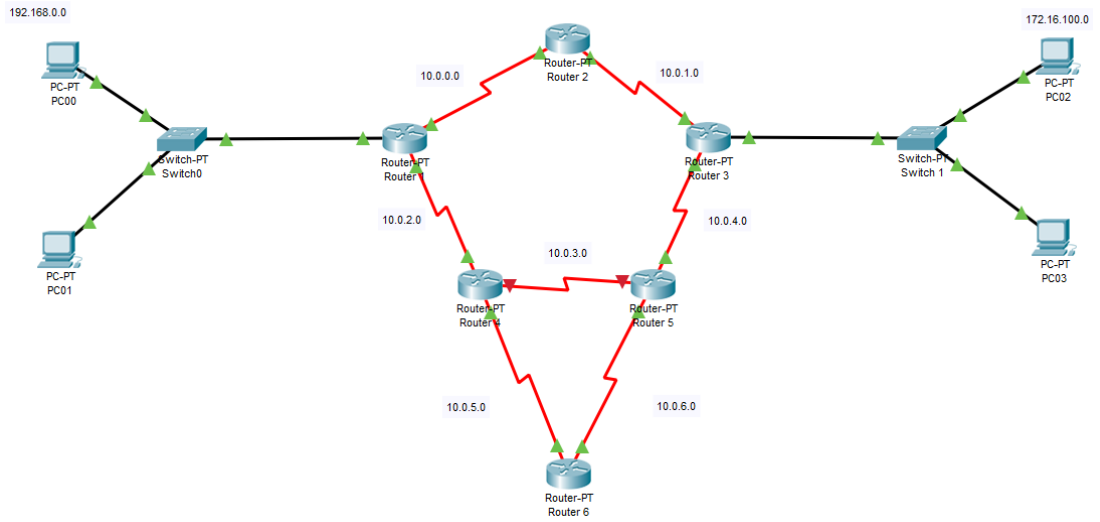
- Use the IP address and Netmask to calculate the Network Address and Host number. What are they?
- Look at your Gateway. Does it conform to the convention of either first in range or last in range?
- What is the broadcast address for your network?

3 EXERCISE: ROUTING

Routers require configuration of the router and routing table (see Module 4 lecture) unlike switches where the MAC Table is buit Automatically. The routing table is built once the administrator has assigned IP addresses to relevant interfaces
In this exercise, we will be using the CISCO Packet Tracer tool to model a small network. **Please see the separate instructions for creating a CISCO One Identity Account require to use Packet Tracer.**

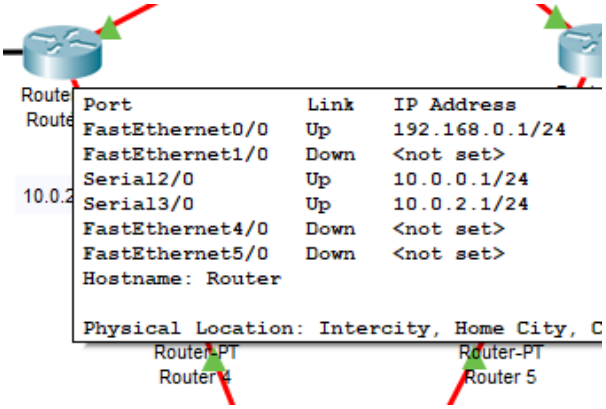
3.1 The following network is a model in CISCO Packet Tracer

We have a two switched networks, each connected to a local router. The two local routers are connected using serial links to other routers. Each link between the routers has it's own subnet. For simplicity, these are all /24 networks, even though only four addresses are required for each of these links and could be assigned a /30.

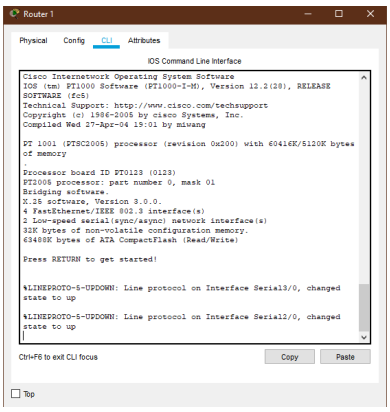


The routers have been configured by a network administrator with appropriate IP addresses for selected interfaces. A routing protocol has also been configured (RipV2).

1. Run CISCO Packet Tracer
2. Load the RoutedNetwork.pkt file
3. You should see a network matching the diagram
4. PCs on the left switched network have been allocated IPs in the 192.168.0.0/24 network
5. PCs on the right switched network have been allocated an IPs in the 172.16.100.0/24 network
6. Hover over each of the PCs. You should see that the default gateway has been allocated for each.
7. Hover over Router1. You should see that the IP address of Fa0/0 matches the default gateway of the PCs. The two serial links Se2/0, Se3/0 each have an IP and connect to another router.



8. Click on Router1
9. A window will open giving details of the router. Click on the **CLI** tab

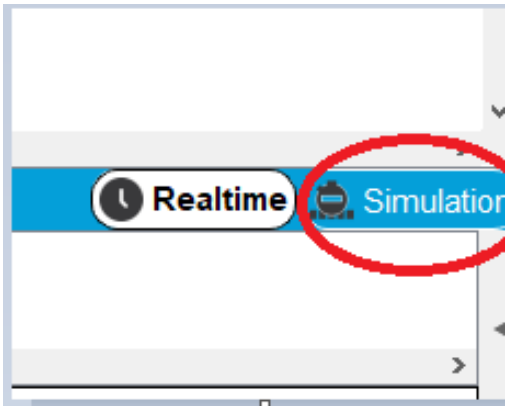


10. Click in the terminal window and press "Enter" (most commands will require you to press "enter")
11. The terminal will display a **Router>** prompt
12. At this prompt, type `enable`. The prompt will change to **Router#** indicating you're logged in as an administrator (There would normally be a password)
13. Type `show run`
14. this will display the running configuration of the router. Press the space bar to page through the display
15. You will see the IP addresses set to the Fast Ethernet and Serial interfaces
16. You will also see the setup of the RIPv2 routing protocol.

```
router rip
version 2
network 10.0.0.0
network 192.168.0.0
```

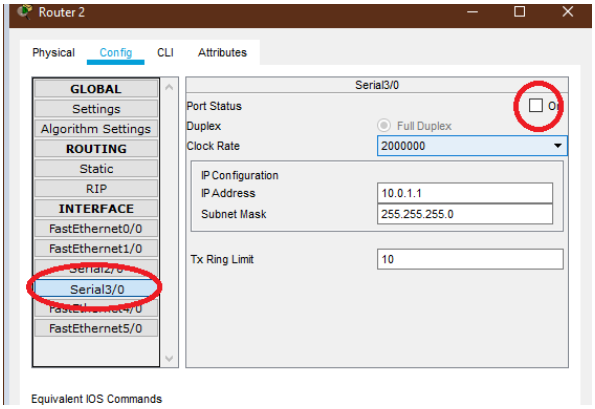
17. When the CLI prompt returns to `router#`, enter the command `show ip route`. This will display the routing table. Entries preceded by the letter "C" indicate a directly connected network, entries preceded by the letter "R" indicate a route provided by RIPv2. There are no static routes
18. Close the Router1 window

19. Click on the simulation button at the bottom left of the screen **CLI** tab



20. This will open the Simulation Panel
21. As per Workshop Three, select the envelope icon to send a packet from PC00 on the left, to PC02 on the right.
22. Unlike in Realtime mode, the simulation will proceed slowly. We can single-step each of the packet's journey by clicking on the button circled below

23. **NOTE:** The first packet you send may be preceded by an ARP request. If this happens, the first ping may fail, and you will need to send another.
24. Note that the packet travels via the shortest path between the two hosts
25. Note that you are also able to click on the packet at any point to see the different frame types used to encapsulate the packet.
26. Keep clicking the button until the ping packet returns to the sending PC.
27. Click on the "Realtime" button
28. Click on Router2 and select the "Config" tab
29. Disable the Serial 3/0 interface by selecting it and removing the check from the "On" box



30. Close the Router 2 window and Click "Simulation"
31. Repeat sending the packet from PC00 to PC02. What is different?
32. Repeat the procedure disabling Serial 6 on Router 5. What is different?
33. Re-enable Serial 3 on Router 2 by Restoring the check in the "On" box
34. Repeat sending the packet from PC00 to PC02. What is different?
35. Explore all of the routers on the network to get a clear understanding of the configuration.

4 USING TRACEROUTE

1. Note: This exercise is best done Off-Campus as ICMP is blocked by the Gateway
2. Traceroute is a program that identifies the routers on a path between two hosts
3. Traceroute operates by sending a ping (an ICMP Echo packet) with a TTL (Time to Live) of 1. Time to Live prevents packets from endlessly circling the Internet by dropping a packet when the TTL is exceeded. The ICMP protocol returns a "TTL exceeded" message from the first router.
4. The next ping is sent with a TTL of two which bounces of the second route. This is followed by TTL=3 and so on until the destination is reached.
5. From the Windows command prompt: type `tracert` **`target site`**
6. From the OS X terminal App: type `traceroute` **`target site`**
7. An example is given below

```
c:\Users\grif>tracert www.bom.gov.au

Tracing route to www.bom.gov.au [23.48.121.181]
over a maximum of 30 hops:

1 <1 ms <1 ms <1 ms mymodem [192.168.0.1]
2 7 ms 8 ms 9 ms gateway.wb02.perth.asp.telstra.net [58.162.xx.yyy]
3 7 ms 6 ms 6 ms 144.130.216.206
4 8 ms 8 ms 7 ms 172.18.243.5
5 17 ms 20 ms 26 ms 203.46.69.129
6 6 ms 6 ms 7 ms a23-48-121-181.deploy.static.akamaitechnologies.com [23.48.121.181]

Trace complete.
```