LABORATORY 1: CISCO PACKET TRACER

Objectives

By the end of the laboratory, students will be

- familiar with the Cisco Packet Tracer software.
- able to set up a simple computer network.
- able to test connectivity between devices in a network.
- aware of the key difference between hubs and switches in the way data packets are forwarded.

Introduction:

Throughout this module you will be using the Cisco Packet Tracer for simulating networks. This approach provides widest range of features and the most realistic experience. It eliminates the restriction imposed by physical equipments that are only available in the labs. You can do the lab experiments as many times as you like, at any place, at any time. You may even explore whatever network configurations that you are curious about, without the worry of damaging the equipment.

Although the Cisco Packet Tracer provides a rich set of protocols, equipment, and features, it only represents a fraction of what is possible with real networking devices. Hence, Packet Tracer is a supplement, not a replacement for experience with real networking equipment. Depending on the course you are doing, you may have chance to deal with real networking equipment in year-2 and year-3 of your course.

You may learn to use the Cisco's Packet Tracer through the Help files built into Packet Tracer, which include an extensive "My First PT Lab" and tutorials. These materials provide step-by-step guidance to use the Packet Tracer to model networks.

Packet Tracer supports two file formats: ".pkt" files (network simulation model files) and ".pka" files (activity files for practice). Your lab experiments are based on ".pkt" files. You can create new or modify existing ".pkt" files. Another format, the ".pka" files (Packet Tracer activity file format), is meant for lab skills assessment activities (e.g. assignment or lab test). When you launch a ".pka" file, the Packet Tracer will provide two buttons at the bottom of the user interface: "Check Results" and "Reset Activity". The "Check Results" button gives you feedback on how much (%) of the activity you have completed. For example, in a Lab Test, this can be considered as your "score". The "Reset Activity" will allow you to start the activity over (i.e. you want to clear your work).

The Cisco Packet Tracer and textbooks published by Cisco Press (as well as other publishers too, very often) use s set of network topology symbols consistently to represent various networking devices. It is convenient to be able to recognise these symbols because many course materials you will come across (either from this module or from the Internet) will assume that you understand what the symbols represent.

Figure 1.1 shows a small collection of the symbols use by Cisco software and Cisco Press publications. For a complete set of network topology symbols in various formats (PDF, Visio, JPG), visit the Cisco web-page:

http://www.cisco.com/web/about/ac50/ac47/2.html

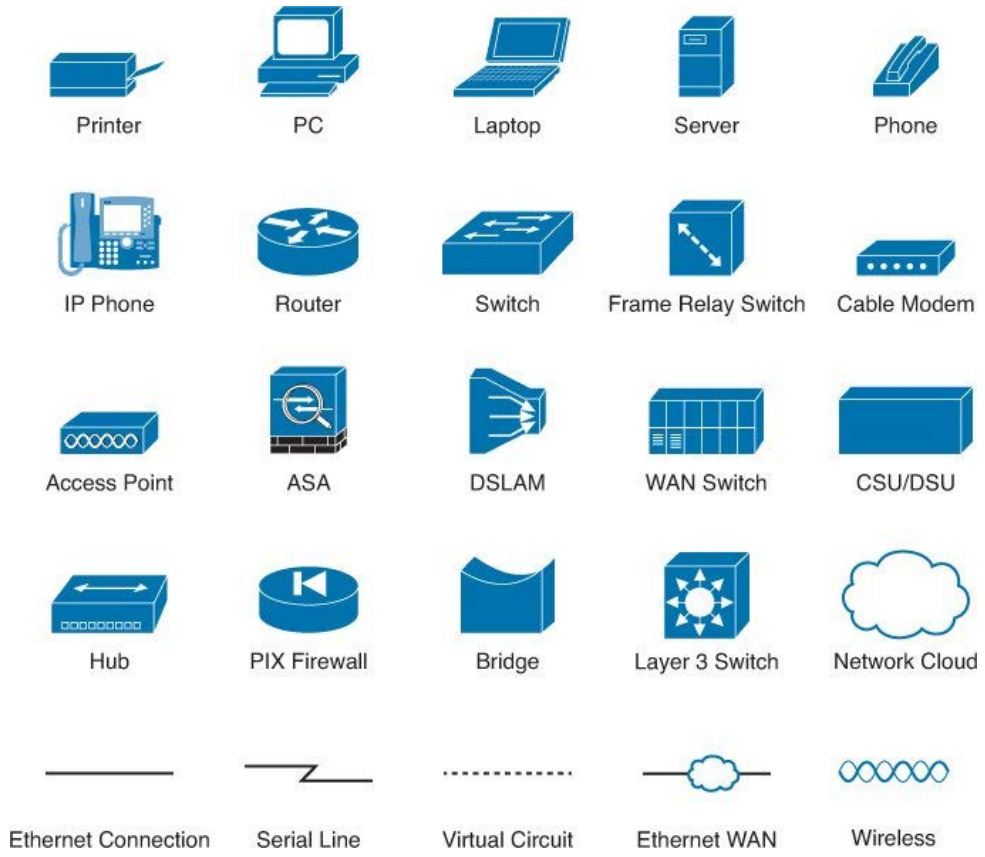

Figure 1.1 - A small collection of the symbols use by Cisco software and Cisco Press publications.

Equipment:

Windows OS laptops
Internet connection
User account and password with Cisco Network Academy

Procedures:

1. Downloading and installation of the Cisco Packet Tracer software

1.1 Make sure that your notebook is connected to the internet.

1.2 Refer to Blackboard to register an account in Cisco Networking Academy (NetAcad) by enrolling into the self-paced course "Introduction to Packet Tracer". Remember to use your SPICE email account (ichat) to register for the account. Check your email for confirmation of the NetAcad account.

1.3 Login to the Cisco Network Academy Programme's web-site at www.netacad.com using your NetAcad account. You are highly encouraged to go through the Introduction to Packet Tracer course at your own time.

1.4 Refer to BlackBoard to download the Packet Tracer software.

1.5 Once downloaded, double-click on the .exe file to install Packet Tracer. Choose the default setting recommended.

1.6 After installation, the Packet Tracer software will be launched automatically. You are required to login using your NetAcad account when using Packet Tracer software. Note that all the lab activities for this module will be using the Packet Tracer software. The graphical user interface shown in the lab instruction may differ due to the different versions of Packet Tracer software.

2. Building a Simple Network

2.1 The diagram below shows the first network simulation you are going to carry out. It consists of two computers, PC0 and PC1.

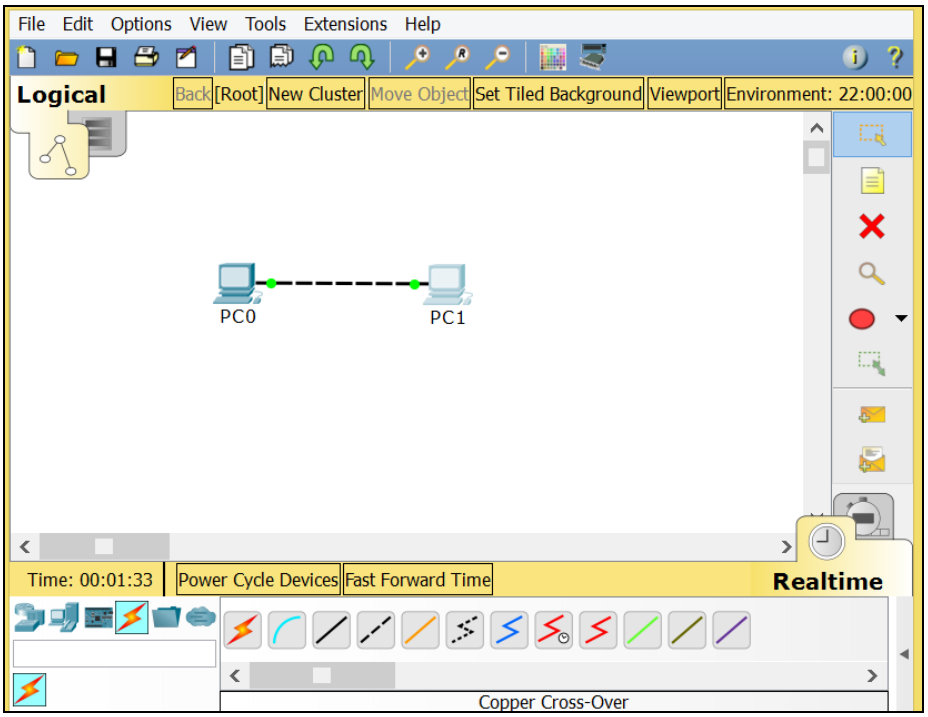

Figure 1.2 - Cisco Packet Tracer software, showing a simple two-computer network.

2.2 The large area that occupies majority of the Packet Tracer software is the **Logical Workplace**. This is the area where devices are placed and connected.

2.3 The lower left portion of the Packet Tracer interface, below the yellow bar, is the interface that you use to select and place devices into the logical workplace. The first box in the lower left contains symbols that represent groups of devices (e.g. Network devices, End devices, Components, Connections,…etc). Move the mouse pointer over these symbols, and observer the name of the group appearing in the text box in the centre.

Question:

Click on the first device-group "Network devices". What is the name of the devices with the symbol  (second row, 4th symbol)?

The symbol represents wireless devices

2.4 If you click on one of these device-group symbols, the specific devices in the group will appear in the box to the right (second box). As you point to the specific devices, a description of the device appears in the text box below the specific devices. There are more devices than the small box area can show, hence there is a horizontal scroll bar above the text box.

Click on each of the groups and study the various devices that are available and their symbols.

Question:

How many devices (symbols) can you find in the group of "Routers" ("Network devices", 1st symbol)?

There are 15 devices

2.5 You are now ready to construct your first Packet Tracer simulated network, comprising of just two computers as depicted in Figure 1.2. You will start by clicking on the device-group symbol (End Devices). Click the symbol to select "Generic PC" and drag your mouse to the Logical Workplace. This will place a "Generic PC" in the Logical Workspace, and it will be automatically named as "PC0" ("PC-PT" is the model of the device).

> If you have picked and placed a wrong device onto the Logical Workspace, you can delete the symbol by clicking on the (Delete) button on the right-hand side of Packet Tracer interface, and then click on the symbol you want to delete.

2.6 Insert the second "Generic PC" to your Logical Workspace. The software will name it as "PC1".

2.7 To link up the two computers, you need a cable (of course, a "virtual" cable in Packet Tracer). Click on the device-group symbol of (Connections), you will find that Packet Tracer provides many different cables. Mouse your mouse over the first few symbols, and record down the name of the cables of 2nd, 3rd and 4th symbols ( ):

The names are Console, Copper straight-through and copper cross-over respectively

2.8 If you know which cable to be used to link up the two computers, go ahead to select it. If you don't know, just click on the symbol ("Automatically choose connection type") and the Packet Tracer will make the right choice for you. After selecting the cable symbol, click on PC0, then PC1 to connect the two computers. Packet Tracer will add a cable between the two computers.

Question:

Which type of cable has been selected by Packet Tracer (i.e. what type of cable is represented by the dotted-line link)?

A copper straight-through cable has been selected

2.9 Place your mouse over PC0 and wait for a short while, a window will pop-up, showing the network configuration of that computer. Under "Port", it will show the type of network interface that the cable is connected to.

Question:

Which interface of PC0 has been selected by Packet Tracer to connect the cable to?

FastEthernet0 was selected

Question:

Do you think your laptop also has an interface equivalent to that of PC0? If "Yes", identify that port on your laptop. If "No", how do you connect your laptop to the network?

Yes, my laptop has an RJ45 port.

2.10 Physically, the two computers are now connected but the network configuration has not been set up, and hence the two computers cannot communicate with one another at the moment.

Question:

What "network configuration" do you think that needs to be done in order to allow the two computers to communicate?

The IP address needs to be configured.

2.11 To start the network configuration for PC0, click on it and a new device configuration Window will pop-up. Select "Config → FastEthernet0". In the "IP Address" box, enter "192.168.1.100". In the "Subnet Mask" box, enter "255.255.255.0" (in fact, Packet Tracer is so helpful that when you click on the "Subnet Mask", it is automatically entered for you).

2.12 Click on the 'cross button" () at the top of the device configuration window bar to close the window. Move your mouse over PC0 and stay there for a short while. A window will pop-up, showing the network configuration of PC0. Observe the text under "IP Address" column and record down what you see.

'192.168.1.100/24' was observed

2.13 Repeat Step 2.11 for PC1, but this time enter "192.168.1.101" for the IP Address.

2.14 You are now done with necessary network configuration for the two computers to communicate. To verify that the communication channel is working (we call this "***Verify the connectivity***"), click on **PC0**, and select "Desktop → Command Prompt". A "black" (DOS prompt) window will appear. Click inside the DOS prompt window, your cursor will start blinking next to the "PC>" prompt. This is where you enter the DOS commands.

2.15 Enter "ping 192.168.1.101" and press "ENTER". This command will make PC0 "ping" PC1. The process of "pinging" sends out four short messages from PC0 to PC1 (i.e. from 192.168.1.100 to 192.168.1.101). When PC1 receives each message from PC0, it replies with a short message. When PC0 receives the reply from PC1, it shows it as "Reply from 192.168.1.101: bytes=32 time=…..".

2.16 PC0 should receive four replies from PC1. If it does, then the connectivity between the two computers is verified as "working".

2.17 From PC1, try to ping PC0 and observe what message shown by PC1. Record down the first message.

Pinging 192.168.1.100 with 32 bytes of data:

2.18 So far what you have been using the Packet Tracer in "Realtime" mode. You will now switch to "Simulation" mode to see how data packets are sent between the two computers. On the right-hand side of the Packet Tracer interface, find the pair of symbols as shown below:

Figure 1.3 – Two symbols (buttons) used for switching the Packet Tracer between "Realtime" mode (left) and "Simulation" mode (right).

2.19 Click on the symbol on the right to switch to "Simulation" mode. An additional window will appear in Packet Tracer interface. Click on the "Auto Capture / Play" button.

2.20 Click on PC0. The DOS prompt window will pop up again. Move it away from the Logical Workspace so that it does not block the two computers (you are going to observe some animation there).

2.21 In the DOS prompt window, enter "ping 192.168.1.101". As soon as you press "ENTER", observe the animation in the Logical Workspace area. You should see PC0 sending a "letter" (message) to PC1, and PC1 replies with another message. This is the "Simulation" mode of Packet Tracer.

2.22 Switch back to "Realtime" mode.

2.23 You can save your network simulation file by clicking on "File → Save As …". Pick a location in your hard-disk and save the file as "Lab1_network1.pkt".

3. Using Switch in Computer Networks

3.1 In Step 2, you learnt to construct a simple network with only two computers. If your network has more than two computers, you may need to use a hub or switch to link up the computers.

3.2 Figure 1.4 shows the next network you are going to simulate. The device linking the three computers is a Cisco 2950-24 Switch.

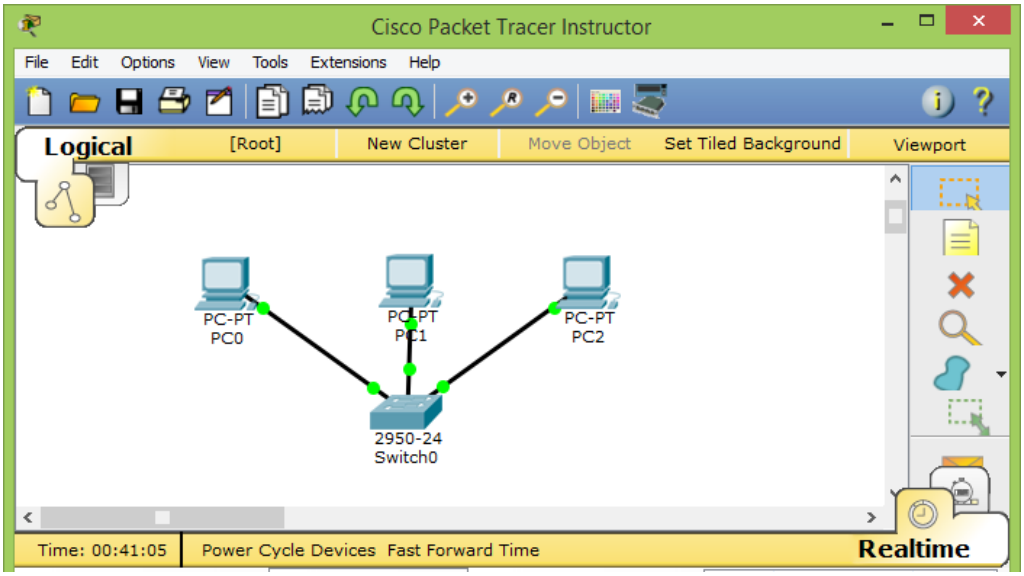

Figure 1.4 - A three-computer network with a switch.

3.3 In the Packet Tracer, Press "Ctrl-N" to create a new network simulation. Insert the devices as shown in Figure 1.4. Link up the devices with the help of Packet Tracer to select the correct type of cables.

Question:

Which type of cable has been selected by Packet Tracer (i.e. what type of cable is represented by the solid-line link)?

A copper straight through was connected

3.4 Move the mouse over the switch and remains there. A window will pop up, showing a list of ports available on the switch.

Question:

How many physical ports does this switch have (excluding the "VLAN1")?

There are 24 FastEthernet0 ports.

Question:

Which physical ports have been automatically chosen by Packet Tracer to be used for connections to the three computers?

FastEthernet0 Ports 1,2 and 3 were selected.

3.5 Configure the three computers with parameters as shown in Table 1.1 below:

Computer	IP Address	Subnet Mask
PC0	192.168.1.100	255.255.255.0
PC1	192.168.1.101	255.255.255.0
PC2	192.168.1.102	255.255.255.0

Table 1.1 – Network configuration parameters for the three computers in Figure 1.4.

3.6 Test the connectivity among the computers using the "ping" utility.

3.7 Switch from "Realtime" mode to "Simulation" mode and repeating the pinging. Observe how the data packets are forwarded.

Question:

When pinging from PC0 to PC1, is there any pinging message being sent from PC0 to PC2?

During pinging, no Internet control message protocol(ICMP) messages travelled from PC0 to PC2.

3.8 Switch back to "Realtime" mode and save your network simulation as "Lab1_network2.pkt".

4. Difference between Hubs and Switches

4.1 Construct the network shown in Figure 1.5. Take note that a new network device of type "Hub-PT" has been introduced.

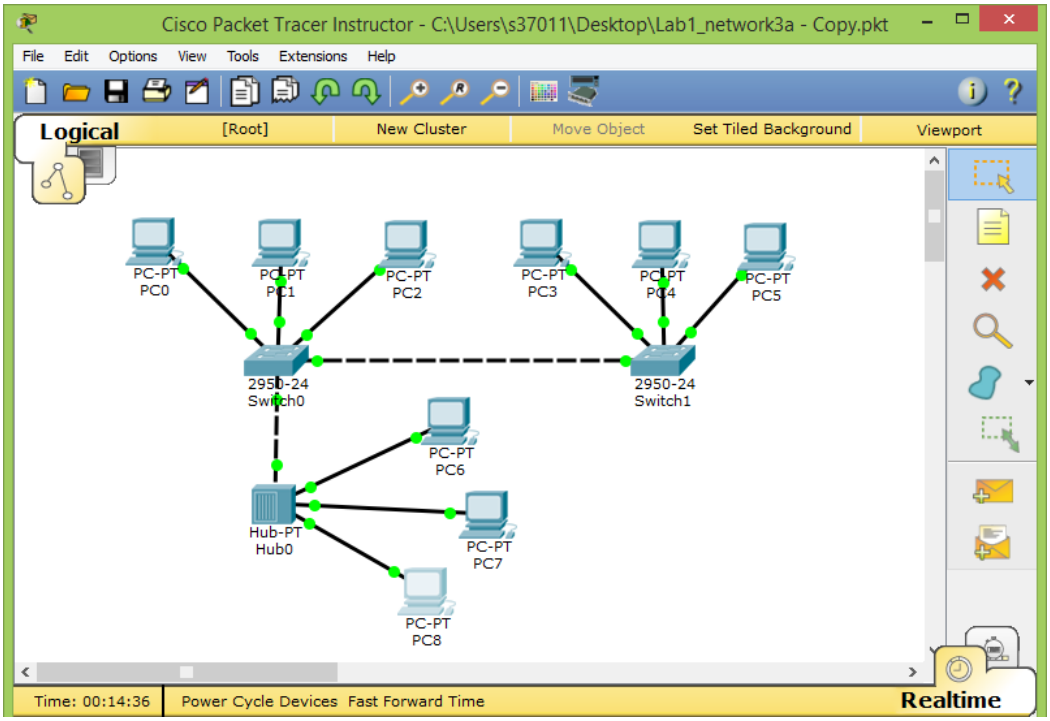

Figure 1.5 - A network for comparing hubs and switches.

4.2 Configure the nine computers with parameters as shown in Table 1.2 below:

Computer	IP Address	Subnet Mask
PC0	192.168.1.100	255.255.255.0
PC1	192.168.1.101	255.255.255.0
PC2	192.168.1.102	255.255.255.0
PC3	192.168.1.103	255.255.255.0
PC4	192.168.1.104	255.255.255.0
PC5	192.168.1.105	255.255.255.0
PC6	192.168.1.106	255.255.255.0
PC7	192.168.1.107	255.255.255.0
PC8	192.168.1.108	255.255.255.0

Table 1.2 – Network configuration parameters for Figure 1.5.

4.3 Test the connectivity between the pairs of computers listed in Table 1.3 using the "ping" utility. Make sure that each connectivity test is successful.

Computer 1	Computer 2	"Ping" successful?
PC0	PC3	Yes / No
PC0	PC6	Yes / No
PC3	PC0	Yes / No
PC3	PC6	Yes / No
PC6	PC0	Yes / No
PC6	PC3	Yes / No

Table 1.3 – Connectivity tests to be conducted.

4.4 Switch from "Realtime" mode to "Simulation" mode.

4.5 Ping from PC0 to PC3 and observe the data packet forwarding animation.

Question:

When pinging from PC0 to PC3, is there any pinging message being sent from PC0 to PC4 and PC5?

During pinging, no ICMP messages travelled from PC0 to PC4 and PC5.

4.6 Ping from PC0 to PC6 and observe the data packet forwarding animation.

Question:

When pinging from PC0 to PC6, is there any pinging message being sent from PC0 to PC7 and PC8?

During pinging, ICMP messages travelled from PC0 to PC7 and PC8. However PC7 and PC8 rejected the message.

Question:

Comparing what you observe in Step 4.5 and Step 4.6, what can you say about the data packet forwarding behaviour of hubs and switches? What is the key difference?

Switches sent messages only to the target destination, whereas hubs will send messages to all destinations connected to it.

4.7 Ping from PC6 to PC0 and observe the data packet forwarding animation.

Question:

When pinging from PC6 to PC0, is there any pinging message being sent from PC6 to PC7 and PC8?

During pinging, ICMP messages travelled from PC6 to PC7 and PC8. However PC7 and PC8 rejected the message.

4.8 Switch back to "Realtime" mode and save your network simulation as "Lab1_network3.pkt".