Computer Networks - Lab 02

Straight-Through and Cross-Over Cable, Viewing Network Equipment like Hub, Ethernet Switch, Router and different Cables

OBJECTIVES OF THE LAB

In this lab, we will cover the following:

- Introduction to Computer Networks
- What Is CISCO Packet Tracer?
- Introduction to Transmission Media
- Build a Category 6 (CAT 6) Straight-Through Ethernet network cable
- Build a Category 6 (CAT 6) Cross-Over Ethernet network cable
- Test both cables for good connection using Cable Tester
- Connecting Computers via Switch using Straight Through Cable and Connecting two computers directly via Cross Over Cable
- Introduction to Network Devices

Replace all figures of devices with the real pictures you used during the lab

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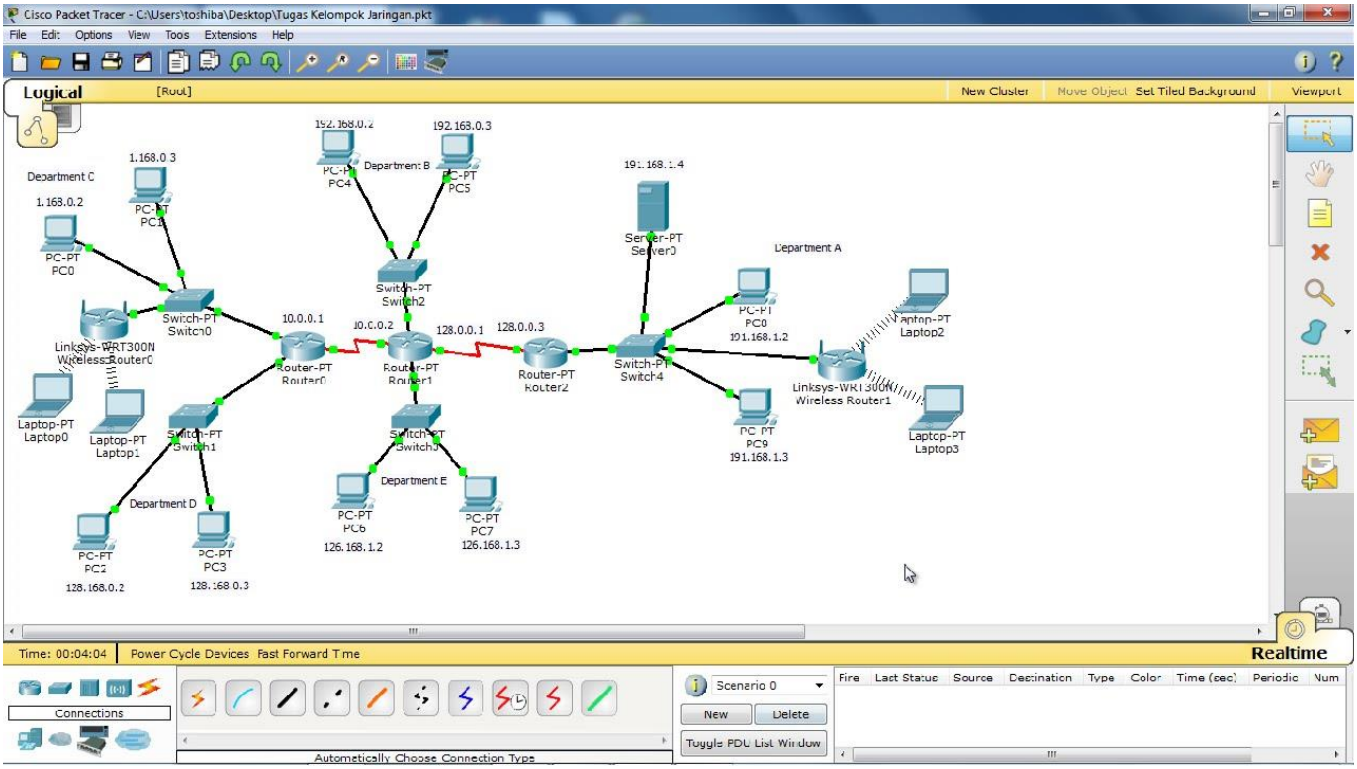
Computer Networks

A computer network is a group of computers that use a set of common communication protocols over digital interconnections for the purpose of sharing resources located on or provided by the network nodes.

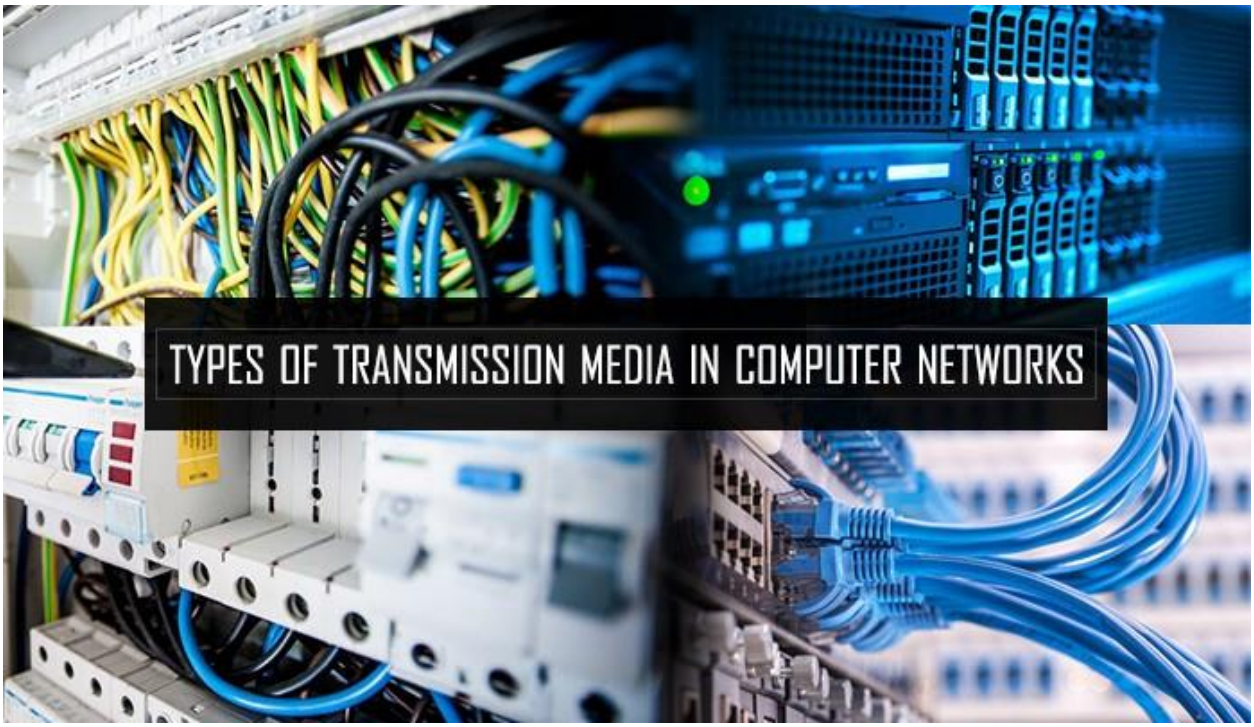
What Is CISCO Packet Tracer?

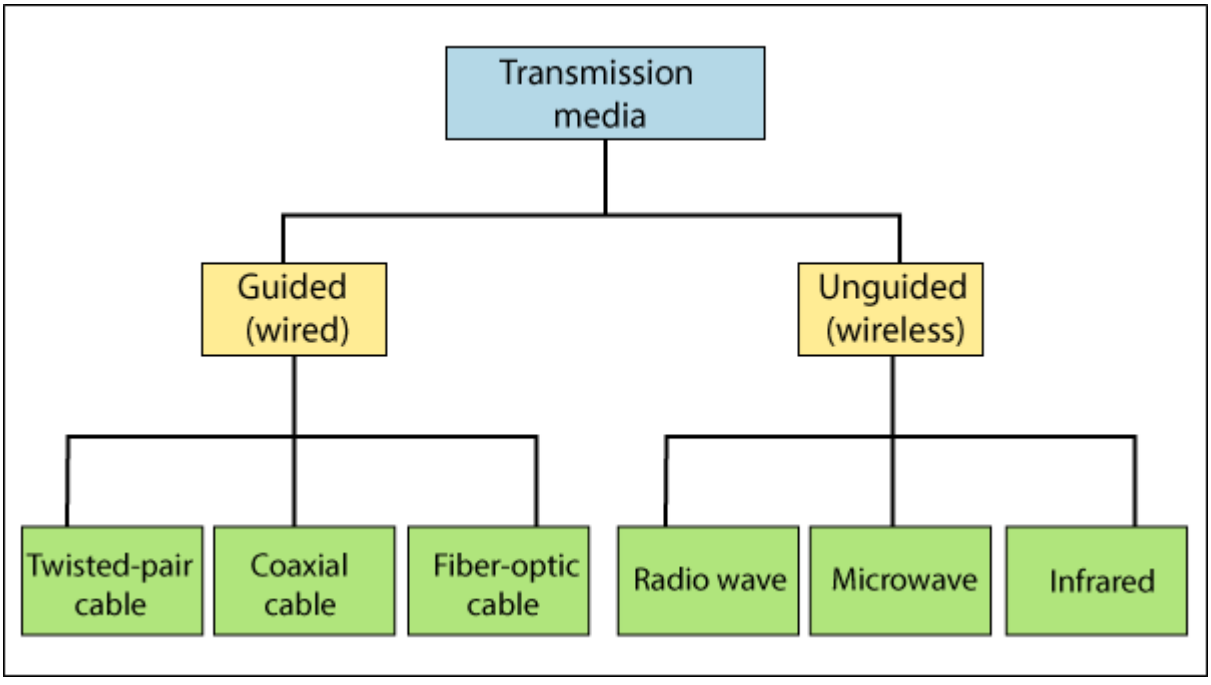
Packet Tracer is a cross-platform visual simulation tool designed by Cisco Systems that allows users to create network topologies and imitate modern computer networks. The software allows users to simulate the configuration of Cisco routers and switches using a simulated command line interface. Packet Tracer makes use of a drag and drop user interface, allowing users to add and remove simulated network devices as they see fit.



TRANSMISSION MEDIA

The transmission media is nothing but the physical media over which communication takes place in computer networks. The transmission of data over transmission media may be unguided (wireless) or guided (wired).


TYPES OF TRANSMISSION MEDIA IN COMPUTER NETWORKS


Transmission media
Guided (wired)
Unguided (wireless)
Twisted-pair cable
Coaxial cable
Fiber-optic cable
Radio wave
Microwave
Infrared

WIRELESS

Wireless transmission is a form of unguided media. Wireless communication involves no physical link established between two or more devices, communicating wirelessly. Wireless signals are spread over in the air and are received and interpreted by appropriate antennas.

When an antenna is attached to electrical circuit of a computer or wireless device, it converts the digital data into wireless signals and spread all over within its frequency range. The receptor on the other end receives these signals and converts them back to digital data.

WIRED

In wired communication a physical link is established between two devices. The link may be of different types.

CABLE

Alternatively referred to as a cord, connector or plug, a cable is one or more wires covered in a plastic covering that connects a computer to a power source or other device.

Networking cables are used to connect one network device to other network devices or to connect two or more computers to share printer, scanner etc. Different types of network cables like Coaxial cable, Optical fiber cable, Twisted Pair cables are used depending on the network's topology, protocol and size. The devices can be separated by a few meters (e.g. via Ethernet) or nearly unlimited distances (e.g. via the interconnections of the Internet).

I. COAXIAL CABLE

Coaxial lines confine the electromagnetic wave to area inside the cable, between the center conductor and the shield. The transmission of energy in the line occurs totally through the dielectric inside the cable between the conductors. Coaxial lines can therefore be bent and twisted (subject to limits) without negative effects, and they can be strapped to conductive supports without inducing unwanted currents in them and though.

The most common use for coaxial cables is for television and other signals with bandwidth of multiple megahertz. Although in most homes coaxial cables have been installed for transmission of TV signals, new technologies (such as the ITU-T G.hn standard) open the possibility of using home coaxial cable for high-speed home networking applications (Ethernet over coax).

Figure 3.2. Coaxial Cable

II. TWISTED PAIR CABLE

A cable made by intertwining two separate insulated wires. There are two twisted pair types: shielded and unshielded. A Shielded Twisted Pair (STP) has a fine wire mesh surrounding the wires to protect the transmission; an Unshielded Twisted Pair (UTP) do not. The use of two wires twisted together helps to reduce crosstalk and electromagnetic induction. While twisted-pair cable is used by older telephone networks and is the least expensive type of local-area network (LAN) cable, most networks contain some twisted-pair cabling at some point along the network.

e.g. CAT6 (Category 6 UTP Cable (computer networks)).

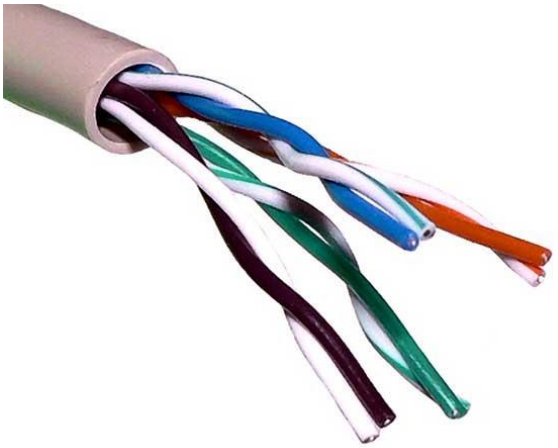


Figure 3.3. CAT6 Twisted pair cable

Q. Write note on CAT2, CAT3, CAT4, CAT5, CAT5e, CAT6, CAT7.

III. FIBER OPTICS

Fiber Optic works on the properties of light. When light ray hits at critical angle it tends to refracts at 90 degree. This property has been used in fiber optic. The core of fiber optic cable is made of high quality glass or plastic. From one end of it light is emitted, it travels through it and at the other end light detector detects light stream and converts it to electric data.

Fiber Optic provides the highest mode of speed. It comes in two modes, one is single mode fiber and second is multimode fiber. Single mode fiber can carry a single ray of light whereas multimode is capable of carrying multiple beams of light.

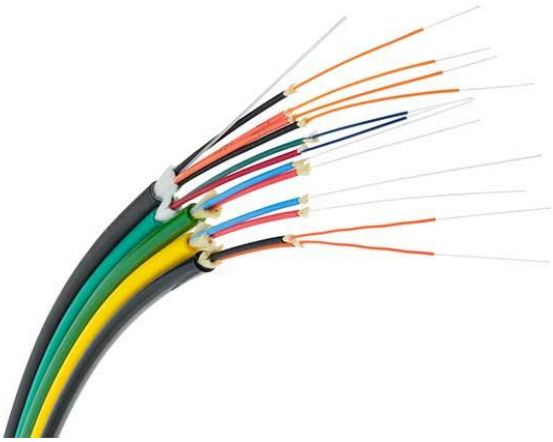


Figure 3.4. Fiber optic

Fiber Optic also comes in unidirectional and bidirectional capabilities. To connect and access fiber optic special type of connectors are used. These can be Subscriber Channel (SC), Straight Tip (ST), or MT-RJ.

STRAIGHT-THROUGH CABLE

A straight-through network cable is just what the name suggests, a cable that passes data straight through from one end to another end. These cables are used for a variety of connections, for instance, connecting a computer to a hub or switch, connecting a computer to a cable/ISDN/DSL modem, and linking switches and hubs together. One such cable connection is shown in Figure 2.1.

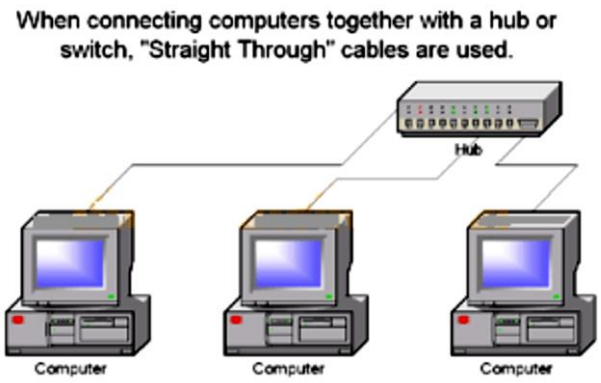


Figure 3.5. Straight-through Cable

Typically the ports on a hub are MDIX ports that allow the machine at the other end to utilize its MDI Port without the need for a crossover cable. Through these ports, hub automatically performs the crossover functions, which are required to properly align the cables with each other. When no hub or switch is used, cable itself must physically perform these crossover functions.

About Cabling

The two most common UTP (Unshielded Twisted-Pair) network standards are the 10 Mbps (10BASE-T Ethernet) and the 100 Mbps (100BASE-TX Fast Ethernet). In order for a cable to properly support 100 Mbps transfers, Category 5 (or CAT 5) twisted pair cable must be used. This type of low loss extended frequency cable will support 10 Base-T, 100 Base-T and the newer 100VG-AnyLAN applications. Other types of cabling include Category 3 that supports data rates up to 16 Mbps, and Category 1 that only supports data rates up to 1Mbps.

Tools Required

The tools required to do this lab are:

- CAT 6 network cable
- RJ-45 Connectors
- Cable Cutter
- Crimping tool, &
- Cable tester.

Figure 3.6. Tools Required for Cabling

Procedure

Well, the wire has two sides. Let's call one side … Side A and the other side … Side B. Do the following steps with Side A of the wire.

1. Remove the plastic cover from the cable up to two inches. You will see 4 twisted pairs (total 8 wires). In each twisted pair, one wire will be colored and the other will be white. For example, one will be Green and the other will be White having Green marks. The latter is called Green-White. Similarly there will be Brown wire twisted with Brown-White, Blue wire twisted with Blue-White, Orange twisted with Orange-White. This can be seen in Figure 2.3.

Figure 3.7. Cable Pairs

2. Untwist the wires and make them smooth (don't remove the plastic covers from the metal wires).

3. Arrange the wires in the order: Orange-White, Orange, Green-White, Blue, Blue-White, Green, Brown-White, and Brown. The order is important since there is a wiring standard defined by the Telecommunications Industry Association (TIA) [http://www.tiaonline.org].
4. It's called the EIA/TIA-568 Commercial Building Telecommunications Wiring Standard, and you can find more information on it here: http://www.digitaldelivery.com/Standards.htm#s5
5. Cut the wires in straight fashion and insert in the RJ-45 Jack.
6. Using the Crimping tool, punch it properly. Perform Step 1-5 for Side B.

CROSS-OVER CABLE

A cross-over network cable is used to connect two computers directly. It is also used when you connect two hubs/Switches with a normal port on both hubs/Switches. (In other words, the cross cable is used relatively in a rare case.). It is used to connect similar devices.

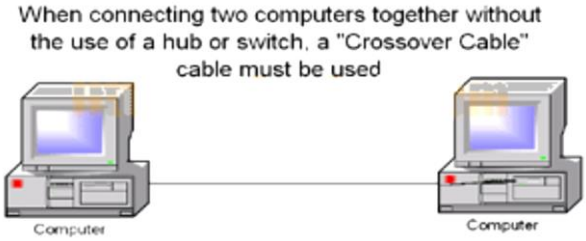


Figure 3.8. Cross-Over Cable

Tools Required

Same as used for making Straight-Through Cable.

Procedure

Side A

Perform Steps 1-5 mentioned above for making straight-through cable.

Side B

Arrange the wires as: green-white, green, orange-white, blue, blue-white, orange, brown-white, and brown. And punch it properly.

For Straight cables *For Cross cables*

Pin #	Side A	Side B	Pin #	Side A	Side B
1	orange-white	orange-white	**1**	orange-white	green-white
2	Orange	Orange	**2**	Orange	green
3	green-white	green-white	**3**	green-white	orange-white
4	Blue	Blue	**4**	Blue	blue
5	blue-white	blue-white	**5**	blue-white	blue-white
6	Green	Green	**6**	Green	orange
7	brown-white	brown-white	**7**	brown-white	brown-white
8	Brown	Brown	**8**	Brown	brown

Table 3.1 Straight-Through & Cross-Over Cable Connections

TESTING CABLES

Once both cables are ready, test it to make sure it works by means of a cable tester. Insert the two ends of the cable into the jacks on the tester and watch the lights. If they all light up, wire has a good connection and ready to use.

CABLE TESTER

A cable tester is a device that is used to test the strength and connectivity of a particular type of cable or other wired assemblies. There are a number of different types of cable testers, each able to test a specific type of cable or wire (some may be able to test different types of cables or wires). The cable tester can test whether a cable or wire is set up properly, connected to the appropriate source points, and if the communication strength between the source and destination is strong enough to serve its intended purpose. The picture is an example of a cable tester from TRENDnet.

Figure 3.9. TRENDnet Cable tester

NETWORKING DEVICES

HUB

When referring to a network, a hub is the most basic networking device that connects multiple computers or other network devices together. Unlike a network switch or router, a network hub has no routing tables or intelligence on where to send information and broadcasts all network data across each connection. Most hubs can detect basic network errors such as collisions, but having all information broadcast to multiple ports can be a security risk and cause bottlenecks. In the past network hubs were popular because they were much cheaper than a switch and router, but today most switches do not cost much more than a hub and are a much better solution for any network.

Figure 3.10. Dlink 7 port HUB

SWITCH

On a network, a switch is a hardware device that filters and forwards packets through the network, but often not capable of much more. The first network device that was added to the Internet was a switch called the IMP, which helped send the first message on October 29, 1969. A network switch is more advanced than a hub but not as advanced as a router. The picture shows an example of a NETGEAR 5 port switch.

Figure 3.11. NETGEAR 5 Port Switch

ROUTER

A hardware device designed to take incoming packets, analyze the packets, moving the packets to another network, converting the packets to another network interface, dropping the packets, directing packets to the appropriate locations, and performing any other number of other actions. The picture shows the Linksys BEFSR11 router and is what most home routers resemble.

Figure 3.12. Linksys BEFSR11 Router

A router has a lot more capabilities than other network devices such as a hub or a switch that are only able to perform basic network functions. For example, a hub is often used to transfer data between computers or network devices, but does not analyze or do anything with the data it is transferring. Routers however can analyze the data being sent over a network, change how it is packaged and send it to another network or over a different network. For example, routers are commonly used in home networks to share a single Internet connection with multiple computers.

Q. What is difference between Hub, Switch and Router?

What should I buy for my network, Hub, Switch or Router?

This question really depends on how you plan on using your network. For most users, a wireless network router is our recommendation. A wireless router allows wireless devices (e.g. your smartphone, tablet, wireless laptop) to connect to your network and because it is a router it also allows all devices to connect to the Internet.

If cost is a concern and you only want to connect a few computers to each other, a switch is the ideal solution since they are cheaper than a router.

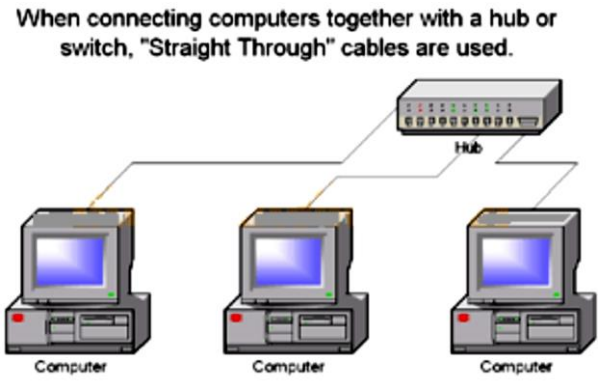
In some situations you may need more than one router or switch. If you are in a big area such as an office you may need a router to connect all the computers to the Internet or other network and then use other routers, switches, or access points to connect other parts of the building to the same network.

Q. List networking hardware vendors?

The Top 10 Intent-Based Networking Vendors Set to Disrupt Businesses in 2020

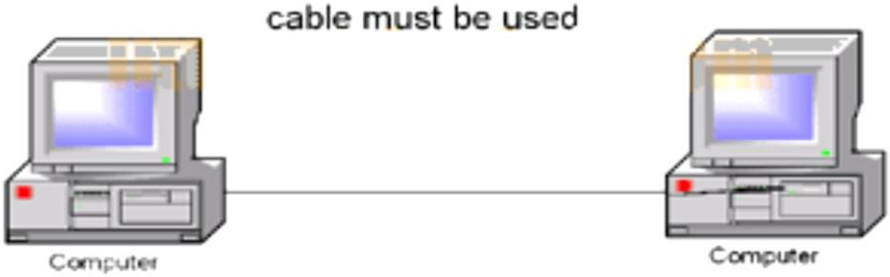
- Cisco. Finally, Cisco is probably the most notable company focused on IBN these days. ...
- Juniper. Juniper is a business making significant headway in the realm of IBN. ...
- Apstra. ...
- Huawei. ...
- Veriflow Systems. ...
- Indeni. ...
- Intentionet. ...
- Avi Networks.

Q. Connect the devices as follows and ping to show the connectivity



Q. Connect two computer directly as follows and ping to show the connectivity

When connecting two computers together without the use of a hub or switch, a "Crossover Cable" cable must be used



LAB-03

OBJECTIVES

After these Lab students shall be able to perform

- Setting Router Modes on 2600 Series Routers
- Changing Hostname of the Router
- Configuring Date and Time on the Router (Clock Set Command)
- Setting a banner on the Router
- Displaying the Router's Running-Configuration and Start-Up Configuration
- Enable Password and Enable Secret Password with the Encryption Techniques/Levels
- Line Console Password Implementation on CISCO 2600 Series Router
- What is Telnet? How to Telnet? + Line VTY/Telnet Password

PRE-LAB READING ASSIGNMENT

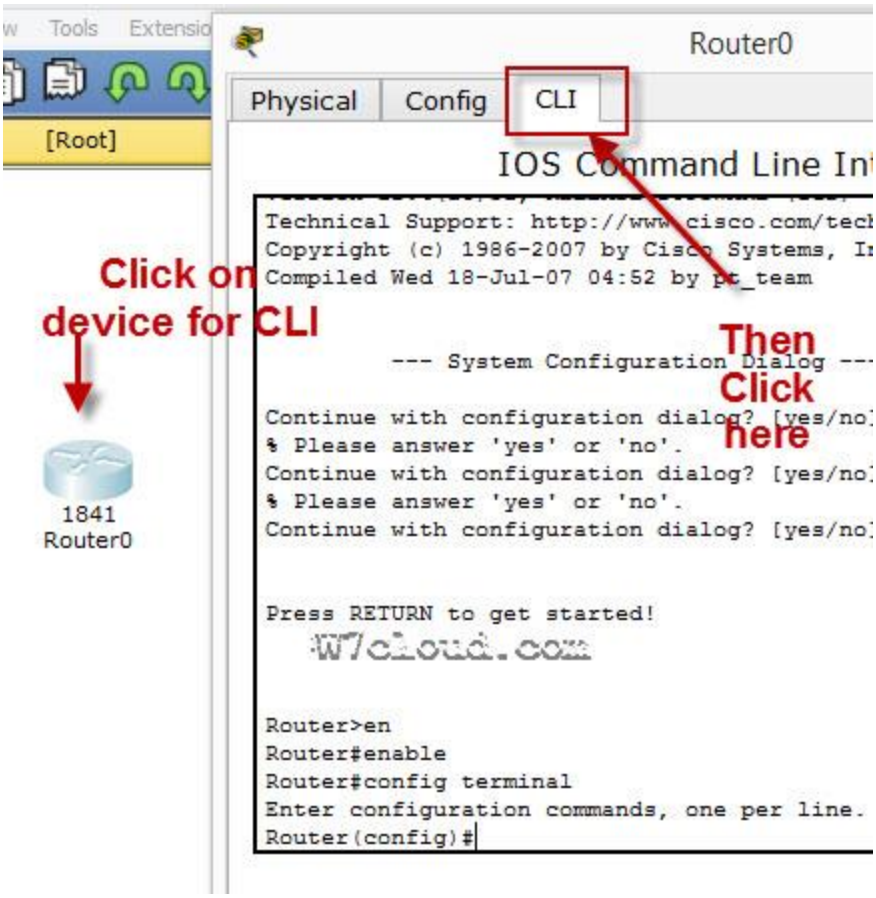
Remember the delivered lecture carefully.

EXPERIMENTS WITH DETAILS

Router>	- User EXEC mode
Router#	- Privileged EXEC mode
Router(config)#	- Configuration mode (notice the # sign indicates this is accessible only at privileged EXEC mode)
Router(config-if)#	- Interface level within configuration mode
Router(config-router)#	- Routing engine level within configuration mode
Router(config-line)#	- Line level (vty, tty, async) within configuration mode

Cisco Router Configuration Step By Step

To configure any device in packet tracer you are required to open or access its CLI. You can do it by clicking any device and then navigating to CLI tab. Once you are at CLI you can perform all Cisco Commands here.



Cisco IOS supports numerous command modes which can be practice with packet tracer, followings are the main command modes of cisco CLI with specific commands to navigate from one mode to other.

Mode	Symbol	How to access this mode	Command for leaving this mode
User EXEC Mode	Router >	Default mode after booting. Press enter for accessing this.	Use **exit** command
Privileged EXEC mode	Router #	Use **enable** command from user exec mode for entering into this mode	exit
Global Configuration mode	Router(config)#	Use **configure terminal** command from privileged exec mode	Exit or Ctrl+Z for user EXEC mode
Interface Configuration	Router(config-if)#	Use **interface <interface name+number>** command from global configuration mode	Use **exit** command to return in global mode

IOS commands are not case sensitive it means that you can use them in uppercase, lowercase, or mixed case, but passwords are case sensitive. Therefore make sure you type it in correctly. In any mode, you can obtain a list of commands available on that mode by entering a question mark (?).

```
Braunch_office_router(config)#router ?
  bgp     Border Gateway Protocol (BGP)
  eigrp   Enhanced Interior Gateway Routing Protocol (EIGRP)
  ospf    Open Shortest Path First (OSPF)
  rip     Routing Information Protocol (RIP)
Braunch_office_router(config)#router
```

How to Change the Cisco Router name

You can change the cisco router name by using command **hostname** in global configuration mode.

```
Router(config)#hostname HR-Router
HR-Router(config)#
```

How to set the Enable password:

You can set the password for protecting enable mode by following command: (Following command will set the password to cisco)

```
Router(config)#enable secret Cisco
Router(config)#exit
Router>en
Password:
Router#
```

How to set the telnet password on Cisco:

You can access the cisco router remotely by VTY lines, these are the Virtual Terminal lines for access router, you can set password on these line by using the following commands:

Router(config)#line vty 0 4
Router(config-line)#password Cisco
Router(config-line)#no login
Above command will set the telnet password to “Cisco”.

How to set the IP address to Cisco interface:

You can set the IP address to any Cisco device interface by using the following commands:

Router(config)#interface <interface name&number>
Router(config-if)#ip address <IP address> <subnet mask>

How to enable a port or interface

Router(config-if)#no shut

Example:

```
Router(config)#interface fastEthernet 4/0
Router(config-if)#ip address 192.168.77.88 255.255.255.0
Router(config-if)#no shut
```

How to check the IP address of all interfaces:

You can use the “**show ip interface brief**” command in Privileged EXEC mode for checking the IP address of all interface of Cisco device.

```
Router#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol

FastEthernet0/0        unassigned      YES NVRAM  administratively down down

FastEthernet1/0        unassigned      YES NVRAM  administratively down down

Serial2/0              unassigned      YES NVRAM  administratively down down

Serial3/0              unassigned      YES NVRAM  administratively down down

FastEthernet4/0        192.168.77.88   YES manual down                  down
```

ROUTER MODES

Router> enable

Note: This command allows you to enter into Privileged exec mode/enable mode, where you can have more options for show and other commands. The next prompt looks like this:

Router#

Router#configure terminal

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

Note: This command allows you to enter into global configuration mode, where you can configure a range of commands. The prompt for this command looks like this:

Router(config)#

Router(config)# exit

Router#exit

Router>

CHANGING HOSTNAME

To specify or modify the host name for the router, global configuration command HOSTNAME is used. HOSTNAME is case sensitive. The host name is used in prompts and default configuration filenames. The factory-assigned default host name is router.

Router> enable

Router#configure terminal

Router(config)#hostname NP

Router(config)# exit

NP#

CONFIGURATION OF DATE & TIME

The system clock runs from the moment the system starts up and keeps track of the current date and the time based on coordinated Universal Time(UTC), also known as Greenwich Mean Time(GMT). The system clock can be set from a number of sources, and in turn can be used to distribute the current time through

various mechanisms to other systems. To manually set the system clock, use one of the formats of the clock set Exec command.

NP#clock set ?

Hh:mm:ss current time

Note : Allow you to see the format of complete command.

NP#clock set 12:15:00 ?

<1-31> Day of the month

Month Month of the year

NP#clock set 12:15:00 17 ?

Month Month of the year

NP#clock set 12:15:00 17 March ?

<1993-2035> Year

NP#clock set 12:15:00 17 March 2021

Verification:

NP#show clock

12:16:56. 441 UTC Wed Mar 17 2021