Laboratory Experiment # 1

Department of Computer Science
BS Software Engineering
SE-3001L (Computer Networks)
fall 2024

Objectives

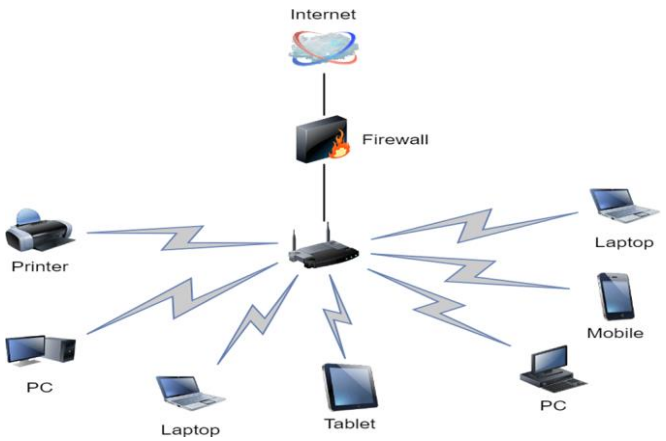
- Introduction of Computer Network Elements
- Understanding the types of Computer Networks
- Understanding the types of Computer Networks Models / Architectures
- Introduction to Cisco Packet Tracer (Simulation Software Package)
- Basic Network Topologies for connecting to peers and check the connectivity status

Computer Network:

A computer network is a system that connects numerous independent computers in order to share information (data) and resources. The integration of computers and other different devices allows users to communicate more easily.

A computer network is a collection of two or more computer systems that are linked together. A network connection can be established using either cable or wireless media. Hardware and software are used to connect computers and tools in any network.

A computer network consists of various kinds of nodes. Servers, networking hardware, personal computers, and other specialized or general-purpose hosts can all be nodes in a computer network. Hostnames and network addresses are used to identify them.



*1. **Graphical Representation of a Computer Network.***

Computer Network Elements

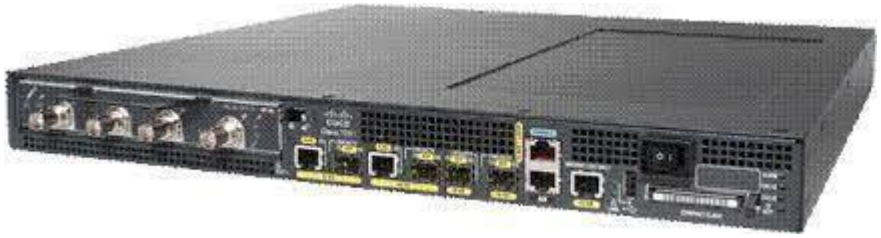
Network Elements refers to the elements a network mostly comprises of the basic elements of a computer network consists of the hardware, software, and protocols. The interrelationship of these basic network elements consists of the entire infrastructure of the computer network. The overall list of the network equipment's could be much longer but the basic computer network elements are as follows:

1. Routers
2. Switches
3. Hubs
4. Network Interface Card (NIC)
5. Cables (Copper, Optical Fiber etc.)
   https://www.youtube.com/watch?v=_NX99ad2FUA

Routers:

In packet-switched networks such as the Internet, a router is a device that determines the next network point to which a packet should be forwarded toward its destination.

Router has two main functions: Routing and Forwarding.



Switch:

In a telecommunications network, a switch is a device that channels incoming data from any of multiple input ports to the specific output port that will take the data toward its intended destination.

Hub Switch

Hub:

A hub is a common connection point for devices in a network. Hubs are commonly used to connect segments of a LAN. A hub contains multiple ports. When a packet arrives at one port, it is copied to the other ports so that all segments of the LAN can see all packets.

NIC (Network Interface Card):

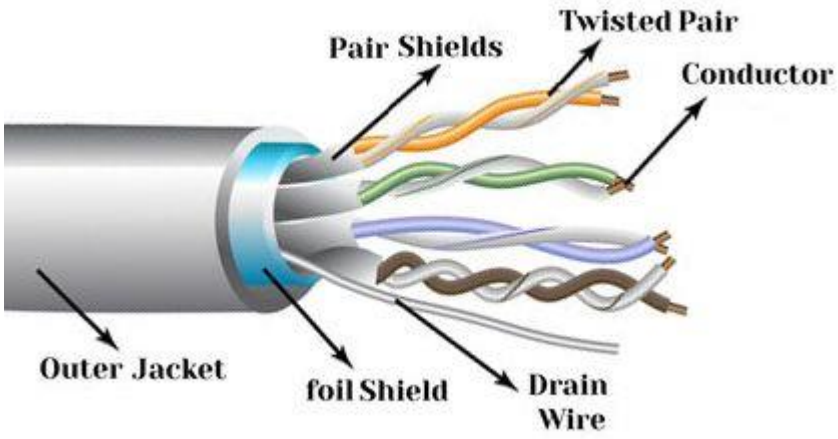
A network interface card (NIC) is a circuit board or card that is installed in a computer so that it can be connected to a network. A network interface card provides the computer with a dedicated, full-time connection to a network. Personal computers and workstations on a local area network (LAN) typically contain a network interface card specifically designed for the LAN transmission technology.

Coaxial cable

Coaxial Cable (or coax cable) is a popular choice for many applications; however, it is mainly used to transmit high-frequency signals. It is made up of a copper conductor with three layers of insulation and shielding that prevent crosstalk from motors, lighting, and other sources of EMI. Many of us are familiar with this cable because it is used for televisions.

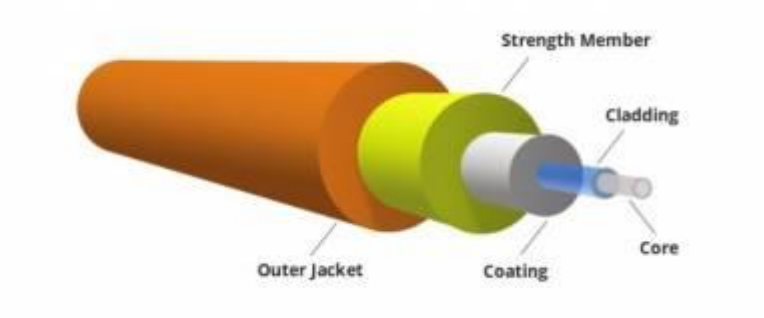
Twisted pair cable

Twisted Pair Cable is often used for telephone communications and most modern Ethernet networks. It is a kind of wiring in which two conductors of a single circuit are twisted together. A pair of wires forms a circuit that can transmit data and the pairs are twisted together to provide protection against crosstalk, the noise generated by adjacent pairs. There are two types of twisted pair cable - unshielded twisted pair (UTP) and shielded twisted pair (STP).



Fiber optic cable

Fiber Optic Cable is a type of Ethernet cable that consists of one or more optic fibers that are used to transmit data. Fiber optic cable transmits data as pulses of light go through tiny tubes of glass. The transmission capacity of optical fiber cable is 26,000 times higher than that of twisted pair cable



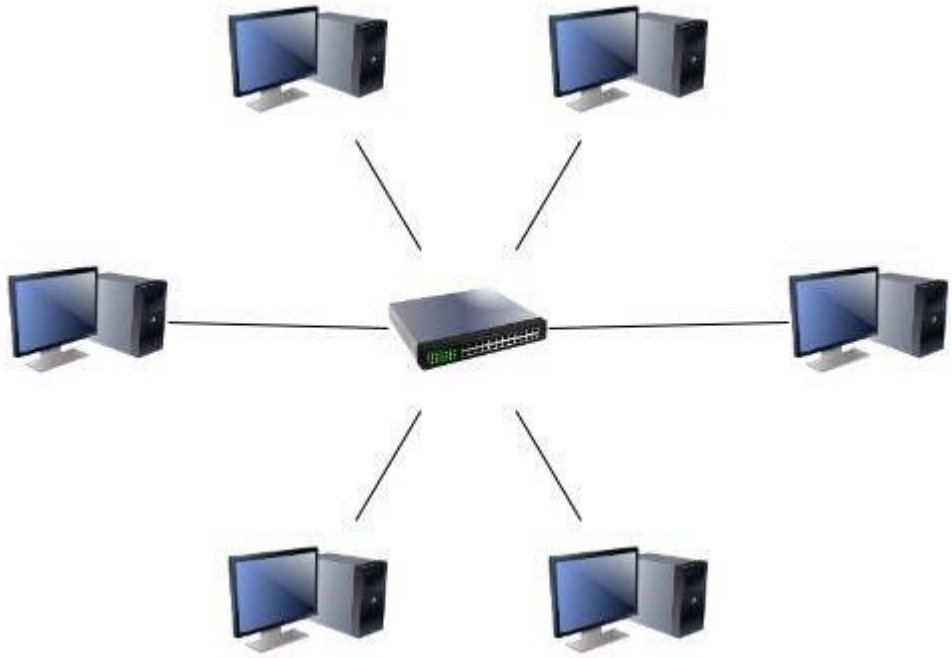
Network Types:

Types of Computer Networks.

- LAN(Local Area Network)
- MAN(Metropolitan Area Network)
- WAN(Wide Area Network)
- PAN(Personal Area Network)

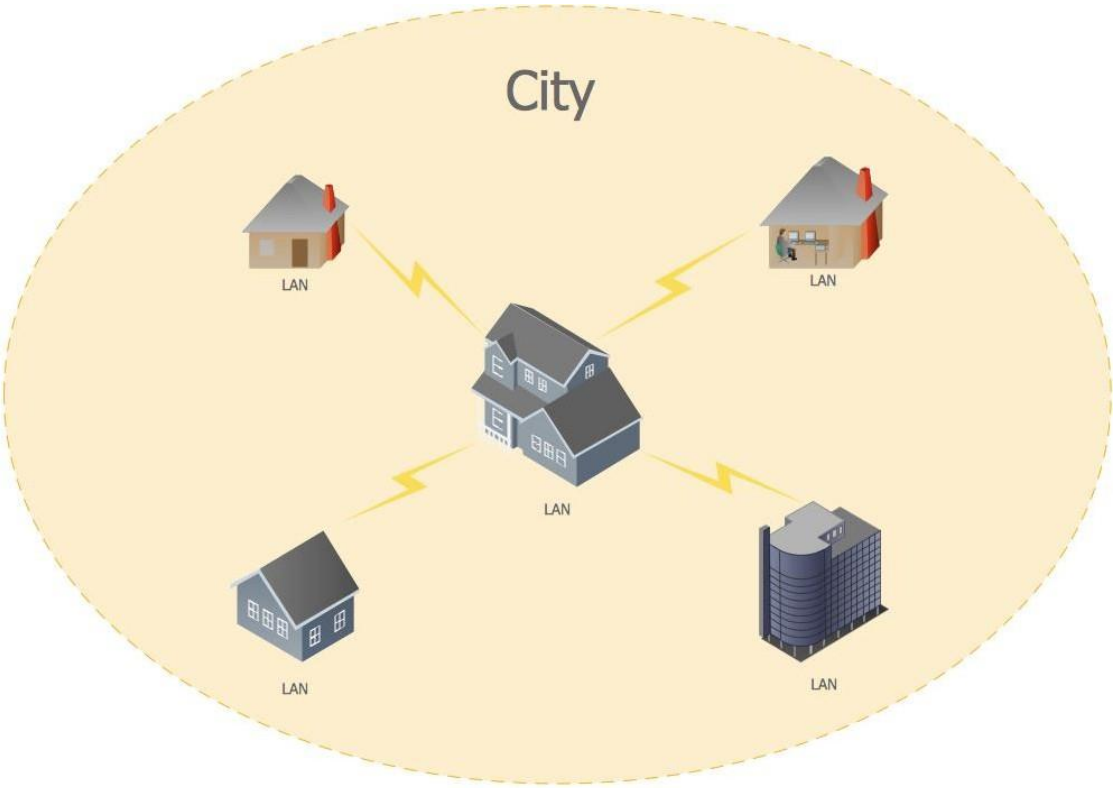
LAN (Local Area Network):

A local area network is a network that connects Local Area Network (LAN) computers and device in a limited geographical area such as a home, school computer laboratory, office building.



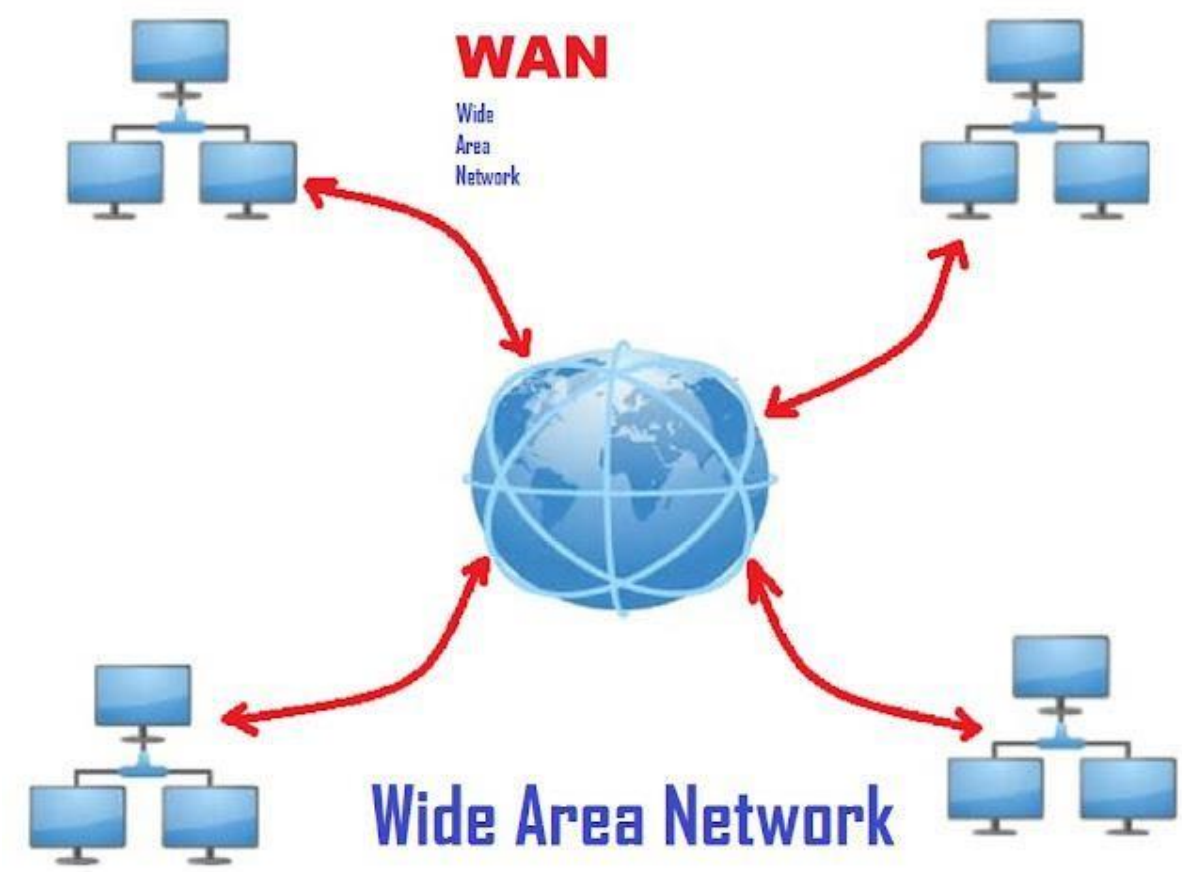
MAN (Metropolitan Area Network):

A metropolitan area network (MAN) is a high speed Metropolitan Area network that connects local area networks in a Network (MAN) metropolitan area such as city or town and handles bulk of communication activity across the region A MAN typically includes one or more LAN but covers a smaller geographic area than a WAN.



WAN (Wide Area Network):

A wide area network is a network that covers a large Wide Area Network geographical area such country or the world (WAN) WAN combines many types of media such as telephone lines, cables and radio wave. A WAN can be one large network or can consist of two or more LANs connected together. The internet is the worlds largest WAN.



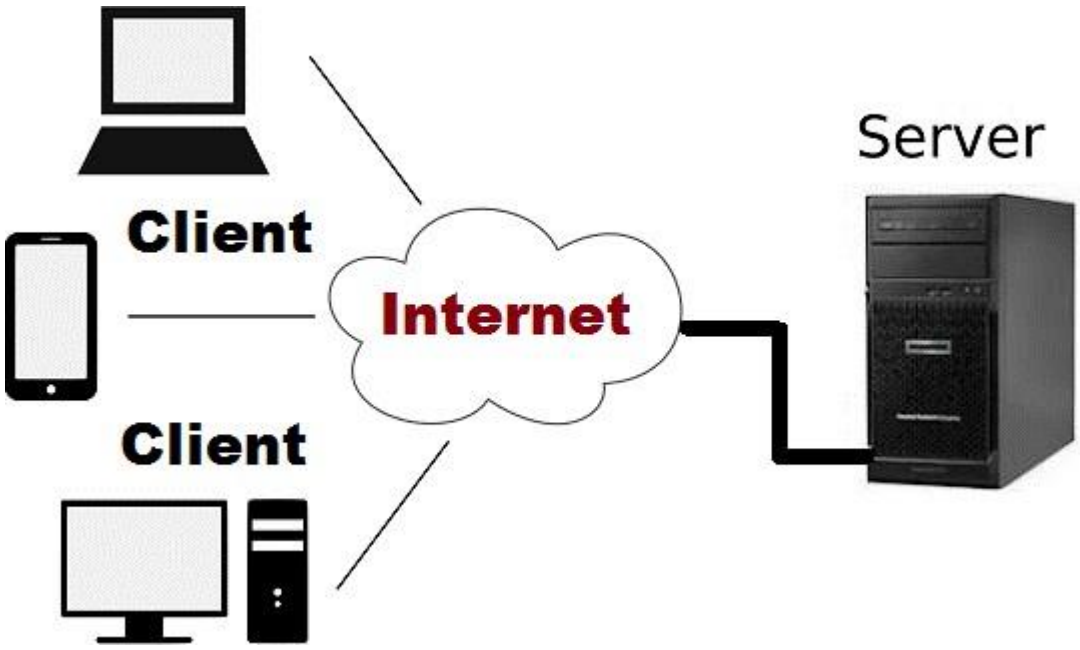
Network Architecture

Network architecture refers to the design and organization of computer networks. It encompasses the hardware, software, protocols, and communication methods used to connect devices in a network and enable data transfer between them. It mainly focuses on the functionality and the strategic techniques used to setup a computer network. It is also referred as a network design or a network model. The two common types of network architecture include:

1. **Server-Client Architecture/Model**
2. **Peer-to-Peer Architecture/Model**

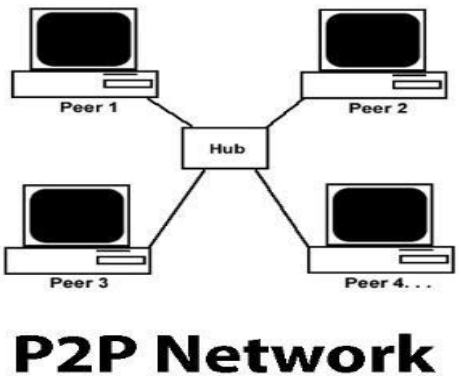
1) Server-Client Architecture/Model

In this architecture/model, there is a central server that provides services or resources to multiple clients. The server manages and controls access to the resources and handles tasks such as authentication and data management. This architecture/model is commonly used in business networks.



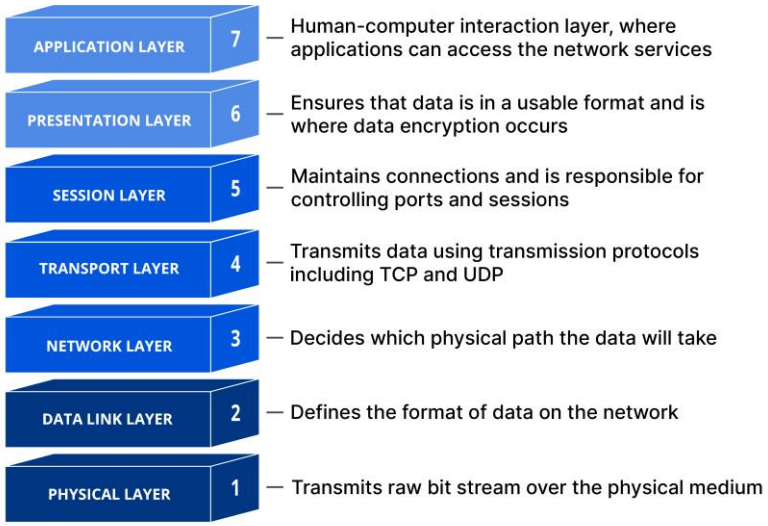
2) Peer-to-Peer Architecture/Model

In this architecture, there are no dedicated servers or clients. Instead, all devices in the network are equal and can act as both a server and a client. Each device shares its resources with other devices and can access resources shared by other devices. This architecture is commonly used in small networks, such as home networks.



OSI model

The OSI model, created in 1984 by ISO(**International Organization for Standardization**) is a reference framework that explains the process of transmitting data between computers. It is divided into **seven layers that work together** to carry out specialised **network functions** , allowing for a more systematic approach to networking.



Private IP	Public IP
Used with LAN or Network	Used on Public Network
Not recognized over Internet	Recognized over Internet
Assigned by LAN administrator	Assigned by Service provider / IANA
Unique only in LAN	Unique Globally
Free of charge	Cost associated with using Public IP
Range – Class A -10.0.0.0 to 10.255.255.255 Class B – 172.16.0.0 to 172.31.255.255 Class C – 192.168.0.0 – 192.168.255.255	Range – Class A -1.0.0.0 to 9.255.255.255 11.0.0.0 – 126.255.255.255 Class B -128.0.0.0 to 172.15.255.255 172.32.0.0 to 191.255.255.255 Class C -192.0.0.0 – 192.167.255.255 192.169.0.0 to 223.255.255.255

Introduction to Cisco Packet Tracer

Cisco Packet Tracer is a network simulation tool developed by Cisco Systems. It allows users to simulate network configurations and troubleshoot issues in a virtual environment.

Packet Tracer supports a wide range of network devices and protocols, including routers, switches, firewalls, and wireless access points. It provides a graphical interface for designing and configuring networks, as well as a command-line interface for more advanced configurations.

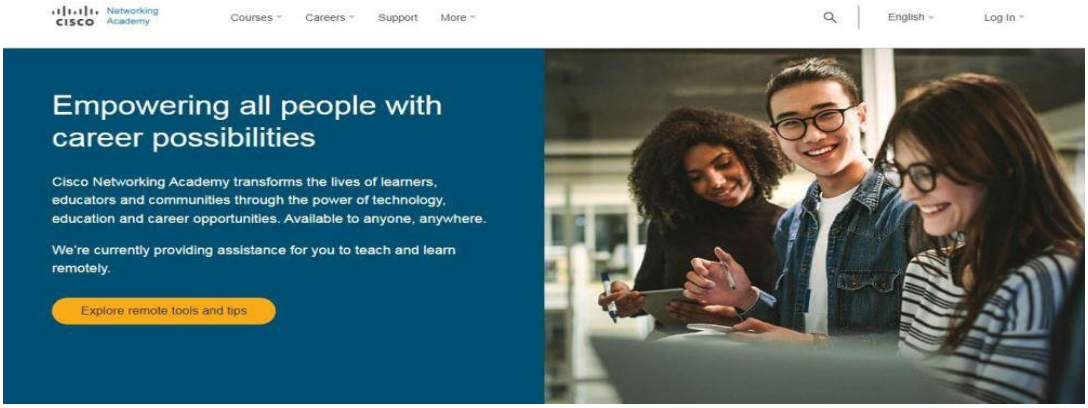
Packet Tracer also includes a variety of pre-built network topologies and labs, as well as a library of network devices and tools. These resources can be used to practice and test various networking concepts and scenarios. In addition to its simulation capabilities, Packet Tracer also supports collaboration and sharing, allowing users to work together on network projects and share their configurations with others.

Packet Tracer is commonly used by students, educators, and network professionals to learn and practice networking concepts and configurations. It is available for free download on the Cisco Networking Academy website.

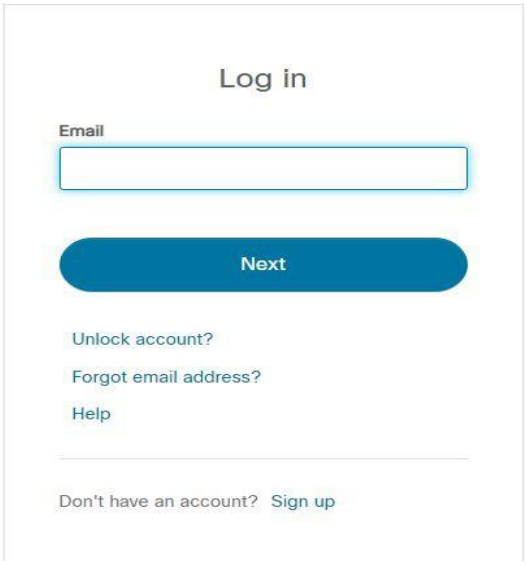
Installation of Cisco Packet Tracer.

Following are the steps required to install Cisco Packet Tracer on your computer:

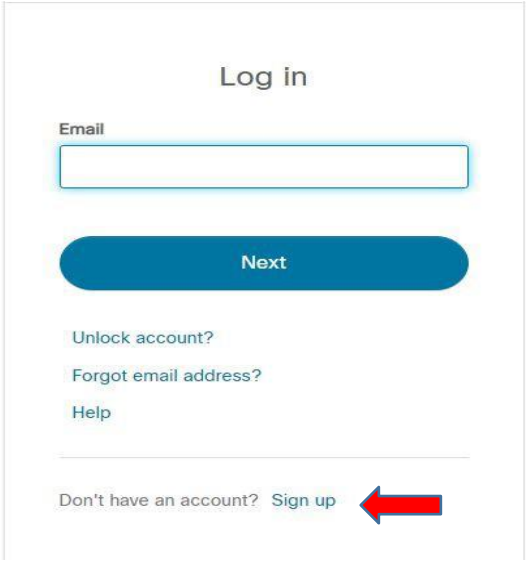
Step 1: Visit the official website of Netacad using any web browser.



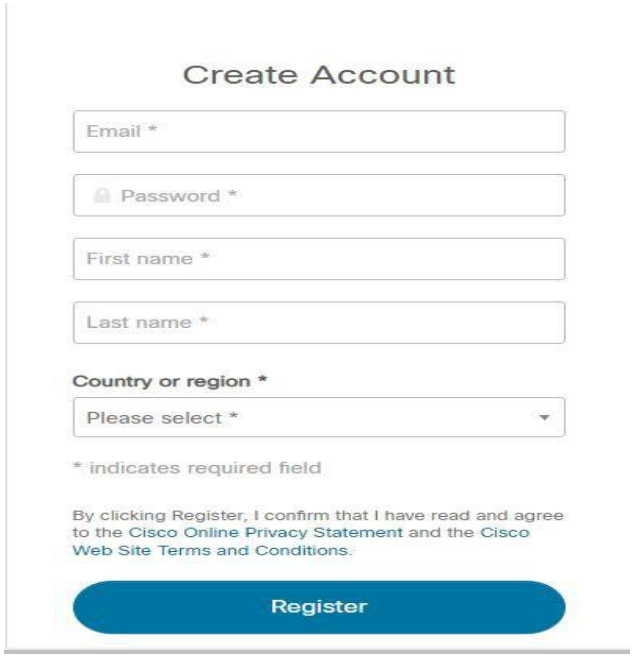
Step 2: Press the login button and select login option.



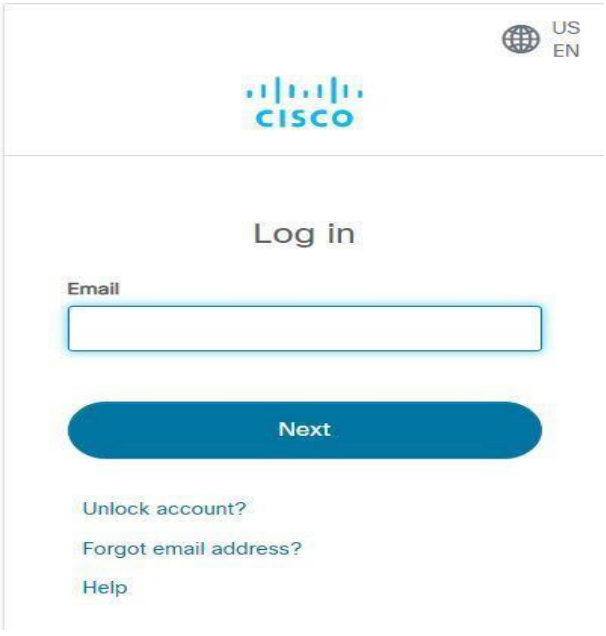
Step 3: Next screen will appear, click on the sign-up option.



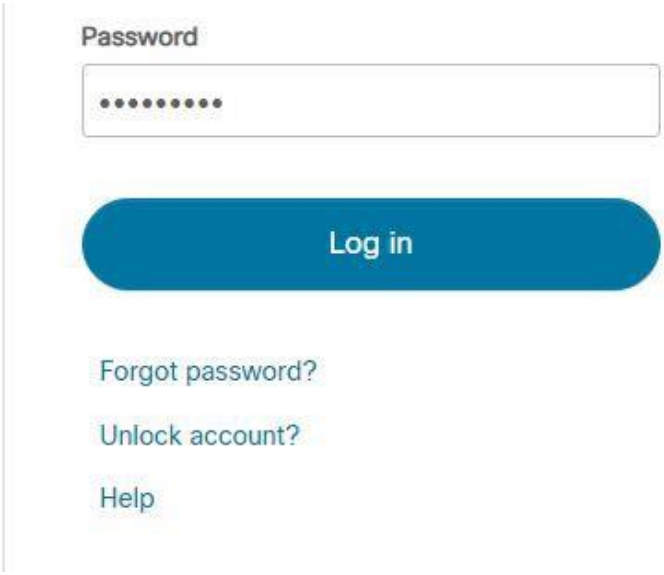
Step 4: Next screen will appear and will ask for email and password and other simple details, fill them and click on Register.



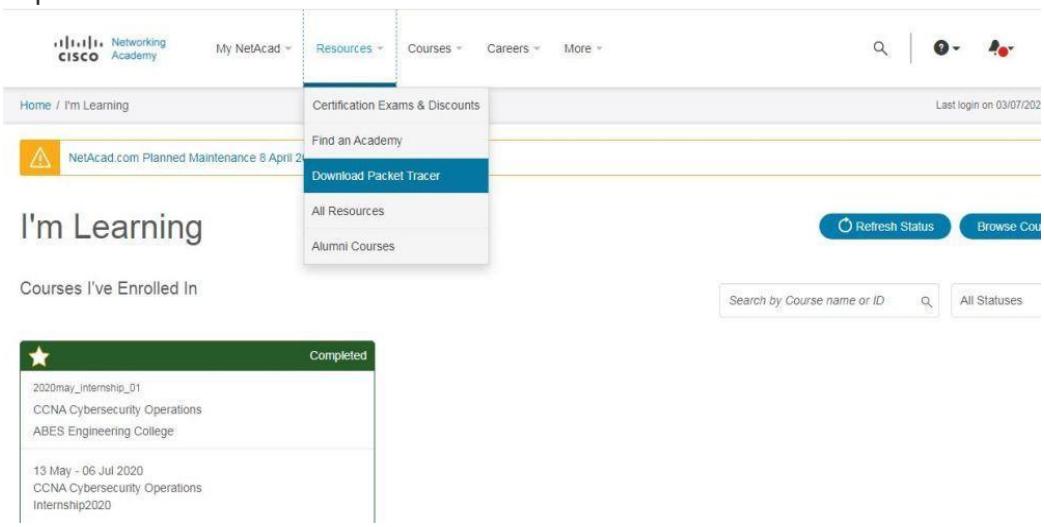
Step 5: Now the login screen appears again so fill in the Email id.



Step 6: On the next screen enter the password and press the Login button.



Step 7: Dashboard will initialize, now click on Resources and choose Download Packet Tracer Option.



Step 8: On the next web page choose the operating system to download the packet tracer. Downloading will start automatically.

Windows Desktop Version 8.1.1 English
64 Bit Download 32 Bit Download

Ubuntu Desktop Version 8.1.1 English
64 Bit Download

macOS Version 8.1.1 English
64 bit Download

Previous Versions

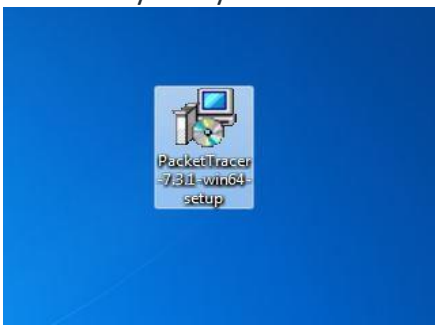
Students should download the same version of Cisco Packet Tracer used in their classroom lab. Please contact your instructor to determine the appropriate version of Cisco Packet Tracer.

Cisco Packet Tracer 7.2.2 will continue to be available for compatibility with CCNA 6 and IoT course activities only.

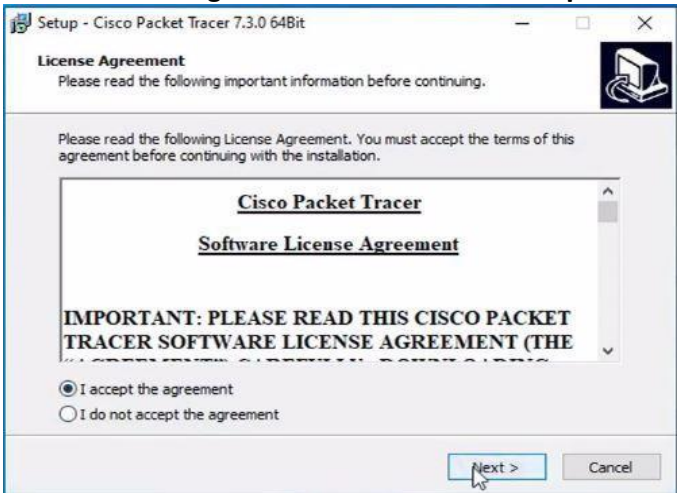
To successfully install and run Cisco Packet Tracer 7.2.2, the following system requirements must be met:

1. Cisco Packet Tracer 7.2.2 (64 bit):
   - Computer with one of the following operating systems: Microsoft Windows 7, 8.1, 10 (64bit), Ubuntu 16.04 LTS (64bit) or macOS 10.11 to 10.12.
   - amd64(x86-64) CPU
   - 4GB of free RAM
   - 1.4 GB of free disk space

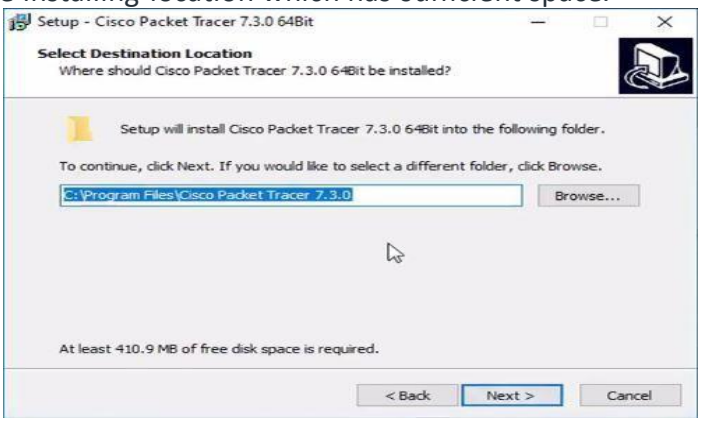
Step 9: Check for the executable file in your system and run it.



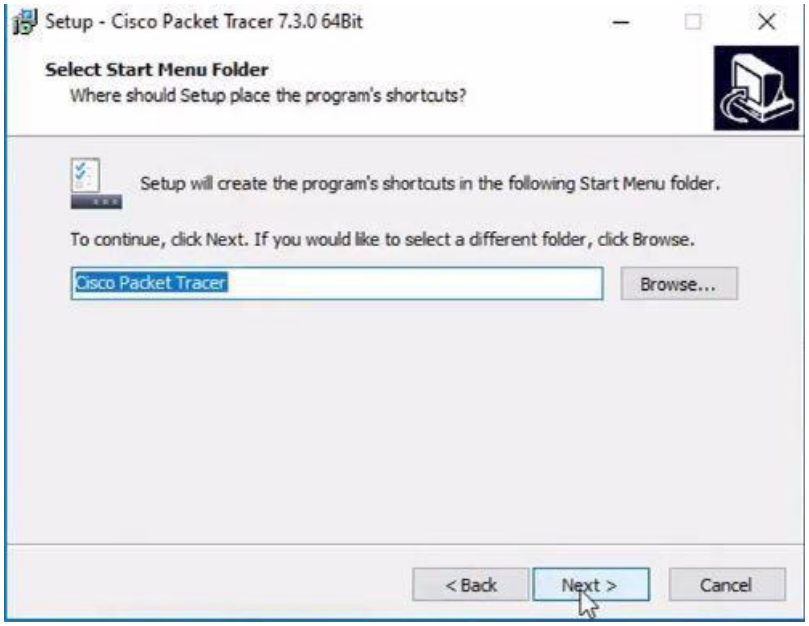
Step 10: Next screen is of License Agreement so Click on **I accept** the license.



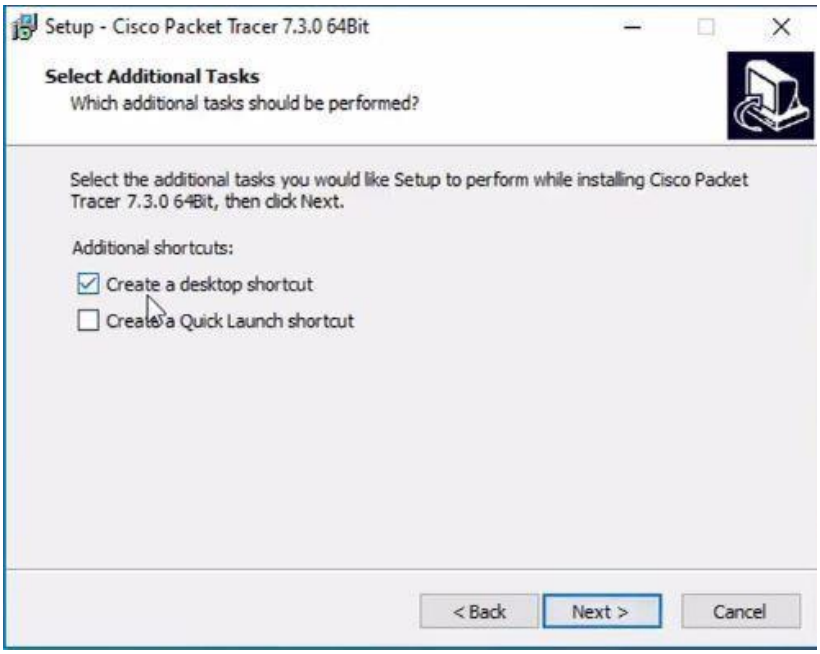
Step 11: Choose the installing location which has sufficient space.



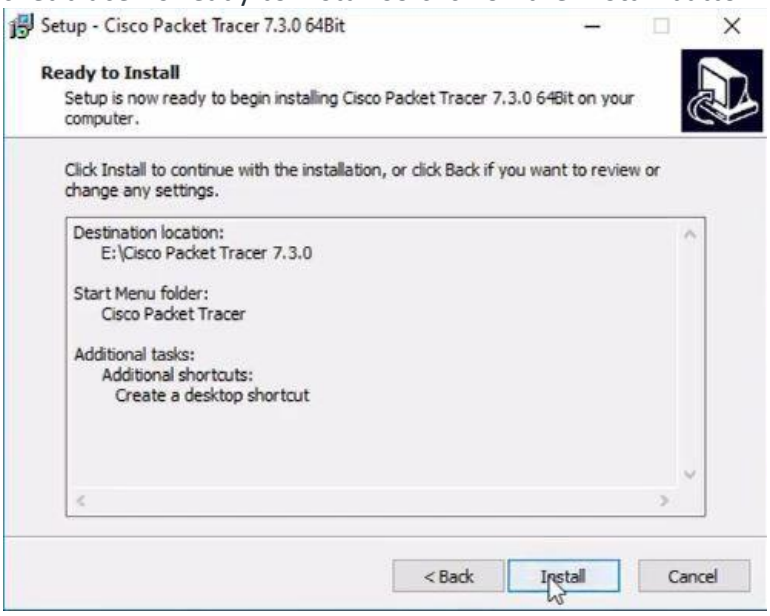
Step 12: Select the start menu folder and click the **Next** button.



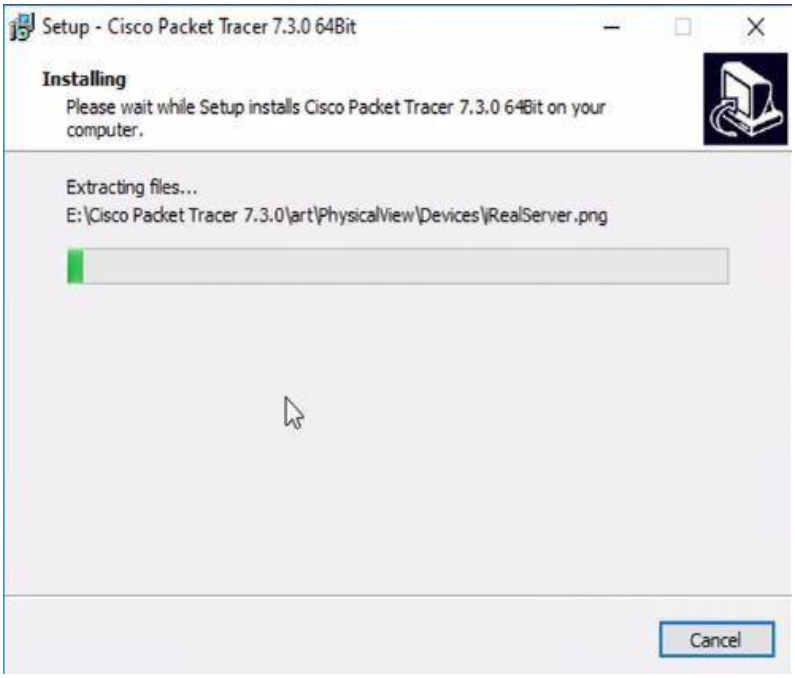
Step 13: Check the box for creating a desktop icon and click on the **Next** button.



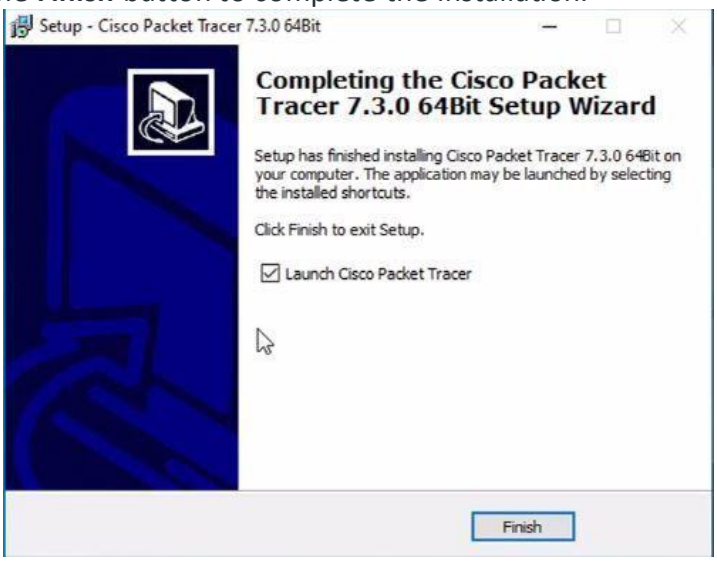
Step 14: Now packet tracer is ready to install so click on the **Install** button.



Step 15: The installation process will start and will hardly take a minute.

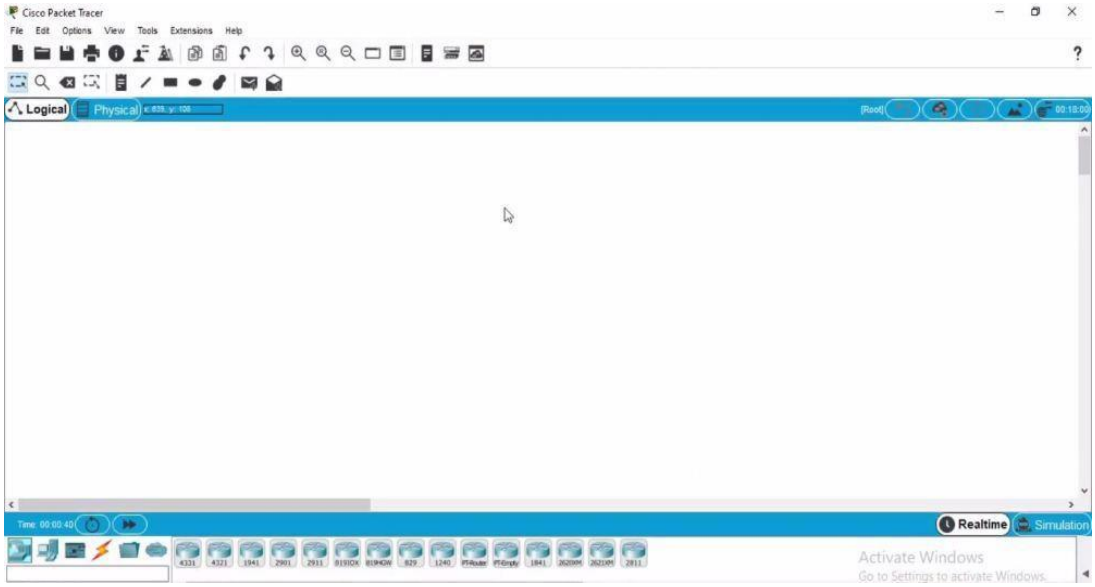


Step 16: Click on the **Finish** button to complete the installation.



Step 17: An icon is created on the desktop so run it.

Step 18: Interface is initialized and the software is ready to use.



We will use Packet tracer version 7.2 or above.

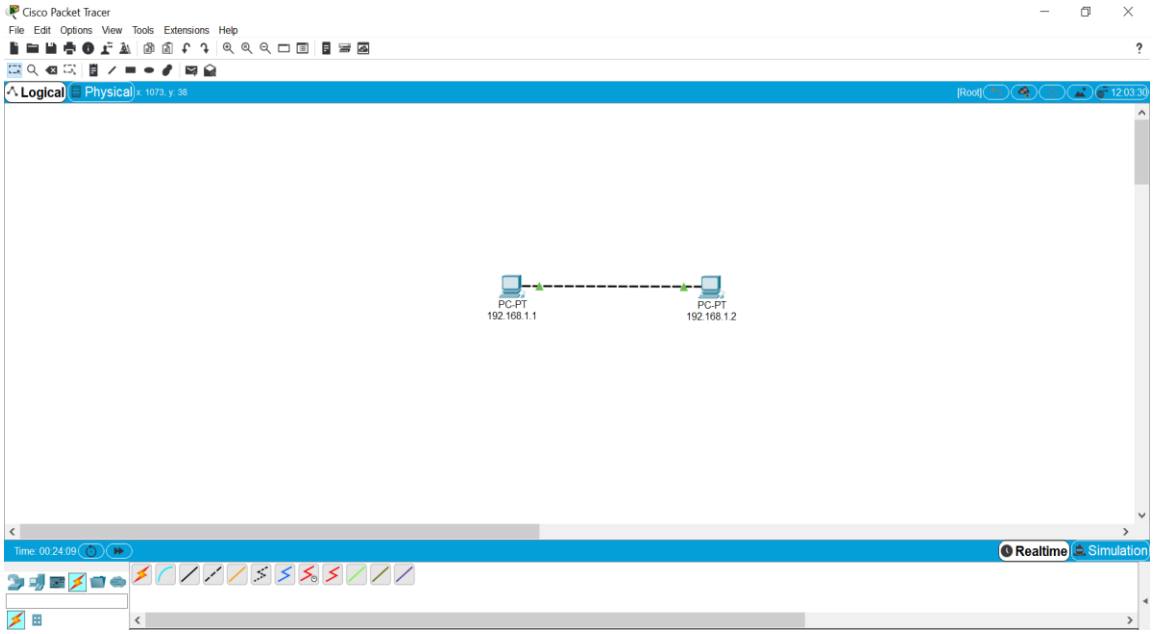
Brief completely in Lab about Cisco Packet Tracer working environment.

TASK 01:

- Connect two peers and check basic connectivity?

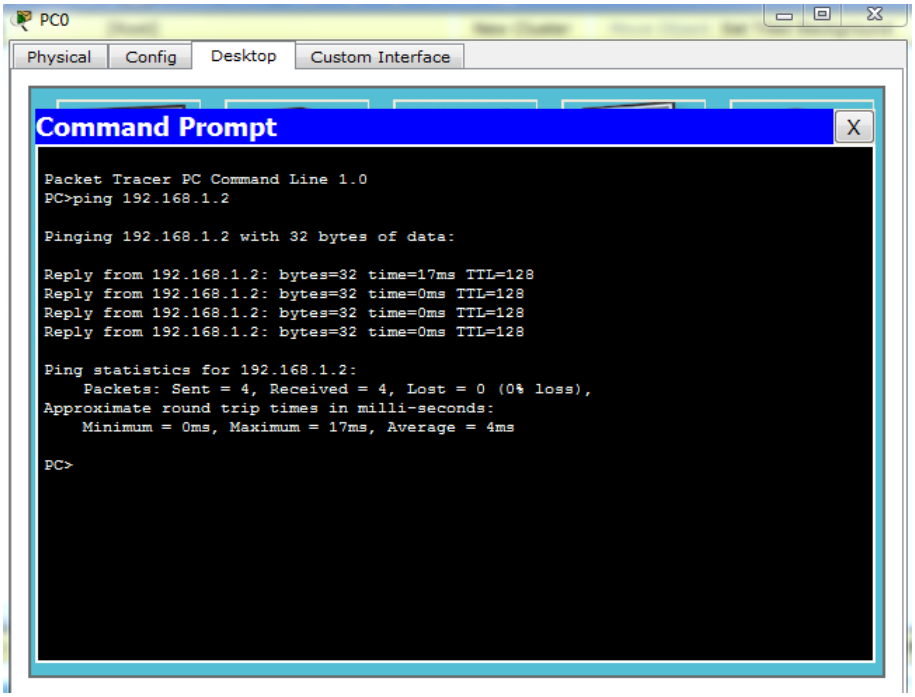
Configurations:

- Make the given topology in Cisco packet tracer and configure each PC as given below.
- Click on PC → Desktop→IP configuration.
- Assign given IP address and subnet mask in the respected fields.



To Check Connectivity:

- Click on PC → Desktop→Command prompt.
- Write →ping 192.168.1.2



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