Network programming

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Course Contents

TOPIC	LECTURES

- Networking Basics (1)
  - What is the networking?
  - Requirements of networking?
  - Types of network
  - Basic layouts of different types of communication network
  - Benefits of networking
  - Network interface card (NIC)
  - Network topologies
  - proxy server
  - How to Share Files between Two Computers Using LAN Cable (new method)
- Network theory (1)
  - Data communication used in the networks
  - How the communication occurs in the networks?
  - Internetworking devices
  - Network Address
  - Network layers

Course Contents

TOPIC	LECTURES

- BASIC WEB CONCEPT (2)
  - HTTP
  - URI
- WEB APPLICATIONS USING HTML5 (1)
- INTERNET ADDRESSING AND URL PROGRAMMING (2)
  - Internet address programming in java
  - URL programming in java
- JAVA INPUT/OUTPUT STREAMS (STREAM PROGRAMMING) (1)

Course Contents

TOPIC	LECTURES

- SOCKET PROGRAMMING (2)
  - Understanding Ports and Sockets
  - Java Sockets using (TCP)
    - Implementing a Server
    - Implementing a Client
  - Java Sockets using (UDP)
    - Implementing a Server
    - Implementing a Client
- JAVA THREADING (MULTI-THREAD PROGRAMMING) (1)
- PHP (PERSONAL HOME PAGE) (1)
  - PHP (BASICS)
    - LEARN HOW TO PROGRAM IN PHP
  - PHP (MYSQL)
    - A scripting language widely used to write web applications connected to DB.

Course Contents

TOPIC	LECTURES
❑ IOT PROGRAMMING IN JAVA	(1)
• IoT Communication Protocols	
• IoT Platforms	
• Java IoT with Raspberry Pi	
❑ COURSE PROJECT	(1)

COMMENTS ABOUT SCRIPTING LANGUAGE

A **script** or **scripting language** is a computer language with a series of commands within a file that is capable of being executed without being compiled.
Good examples of server side scripting languages include Perl, PHP, and Python.
The best example of a client side scripting language is JavaScript.

Advantages of scripts

- Open source, allowing users to view and edit the **script** if needed.
- Does not require the file to be compiled.
- Easy to learn and write.
- Easy to port between different operating systems.
- Much faster to develop than an actual program - some individuals and companies write scripts as a prototype for actual programs.

Disadvantages of scripts

- Open source, allows others to view source code, which may be prohibited by some companies.
- Requires the user to install an interpreter before the script can be run.
- In some situations, they may be slower than a compiled program.

TEXT BOOK

- Learning network programming with java, by Richard M Reese, 2015.
- An Introduction to Network Programming with Java , Third Edition BY Jan Graba 2013.
- Java Network Programming,4th edition by Elliotte Rusty Harold 2014.
- Java Network Programming and Distributed Computing, by D.Reilly and M.Reilly 2002.

TOOLS/SOFTWARE

- NETBEANS
- XAMPP (PHP SERVER)

NetBeans

- is a popular software development platform, mostly for Java,
- that provides wizards and templates to help developers build applications quickly and easily.
- It includes modular components across a wide range of tools and features an IDE (integrated development environment) that allows developers to create applications using a GUI.
- While NetBeans is primarily a tool for Java developers, it also supports PHP, C and C++ and HTML5.

TOOLS/SOFTWARE

- NETBEANS
- XAMPP (PHP SERVER)

What does XAMPP mean?

- XAMPP a free and open source cross-platform web server package,
- consisting mainly of the Apache HTTP Server, MySQL database, and interpreters for scripts written in the PHP and Perl programming languages.
- XAMPP's name is an acronym for:

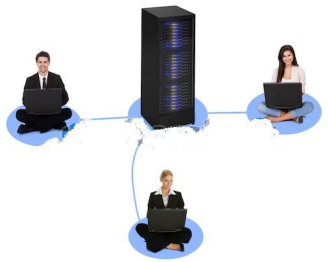
  X :any of the different operating systems (Windows, Linux, Mac OS X), to be read as "cross", meaning cross-platform.

  Apache (HTTP Server)

  MySQL (Database)

  PHP , **P**erl

CHAPTER 1
Networking basics



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OUTLINE

- What is the networking?
- Requirements of networking?
- Types of network.
- Basic layouts of different types of communication network.
- Benefits of networking.
- Network interface card (NIC).
- Network topologies.
- proxy server.
- How to Share Files between Two Computers Using LAN Cable (new method).

What is the Networking

- Networking is a process of connecting two or more computers for sharing.

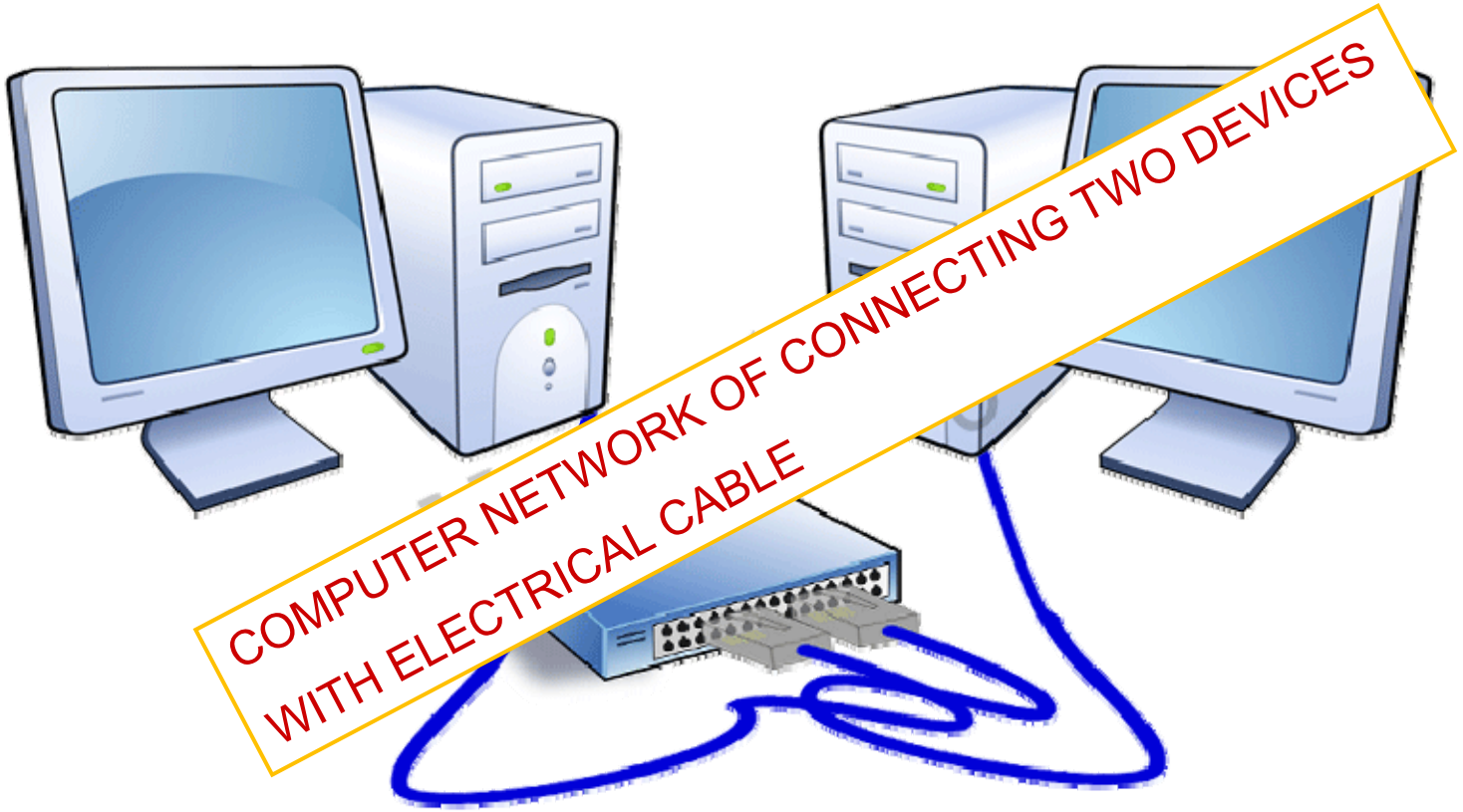
- Through the networking, computers share information such as email, file, documents and resources such as printer, internet and disk storage.

- We will presents a brief overview of what computer networking is…. and how it works…...

Introduction to “Networking”

- Networking has single purpose that is sharing.
- So if you have nothing to share, networking has nothing for you.
- If you share anything, networking is everything for you.
- However the purpose of networking is exchanging the information with highest speed : sharing the information as fast as possible.
- To achieve this goal, networks use electrical cables or wireless radio signals.
- A computer network includes at least two computers as in the following figure.

Introduction to “Networking”



Introduction to “Networking”

- A complex network may have thousands of computers connected via different communication links.
- For example Internet that is the largest computer network.
- Internet interconnects thousands of millions of computing devices including PCs, Laptops, Workstations, Server, Smartphones, tablets, TVs, Webcams,ect.
- In Networking all these devices are known as Hosts or End system or End devices.
- Computer networks use communication links to connect the end devices with each other's.

Introduction to “Networking”

- Communication links use different types of physical medium such as coaxial cable, copper cable, fiber optical cable and radio spectrum.
- Different medium types can transmit data at different rate that is measured in bits/second.
- Every media type has its limit that is measured in speed, distance, signal losses etc.
- When a computer has data for another computer in network it initiates a session for transmission.
- During this process both computers follow the dedicated rules of transmission such as speed of transmission, size of data file, security measurement of transmission, flow control etc.
- These rules are called protocols.

Introduction to “Networking”

- Protocols control the entire data transmission through the network.
- Protocols are defined in various network models such as TCP/IP Layer model, OSI Layer model.
- During the data transmission, computer (sender) break the data file in small pieces.
- These pieces are called segment.
- Each segment properly wrapped with network information. Resulting segments are known as **packets**.
- Packets are sent to the destination computer through the network, where they are reassembled into the original data.

Requirements of Networking

- Every network requires specialized hardware and software.
- in the following we present the essential components for network:

- **Client computers**
  - End devices that users use the program to access the shared resources.
  - Usually they run desktop version of OS such as Window 10, Window 7, and Window XP.
  - Client computers are also known as **workstations**.

Requirements of Networking

- **Server computers**
  - Computers that provide shared resources.
  - Usually they run sever version of OS such as Window Server 8 or 2003, Linux and NetWare.
  - Server computers run many specialized services to control the shared resources.

- **Network interface card(NIC)**
  - NIC is an interface that enables the computer to communicate over the network.
  - Every computer must have a NIC in order to connect with the network.
  - In earlier time it was a separate card and need to be installed on motherboard.
  - All modern computers have it as the integral part of motherboard.

Requirements of Networking

- **Communication links**
  - Communication links are physical or wireless media.
  - Every computer network needs some kind of media to transmit the data.

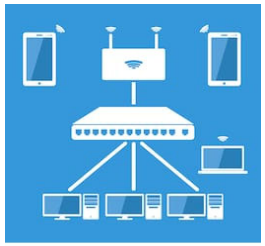
- **Switches**
  - When we have more than two computers in network, we cannot connect them directly.
  - We need a mediator device that allows us to connect all computers together.
  - Switches do this job happily.
  - Each switch contains a certain number of ports.
  - We can use an eight port switch to connect eight computers.

Requirements of Networking

- **Routers**
  - Router is an intermediate device that speaks all language of network.
  - It makes communication between two different networks.

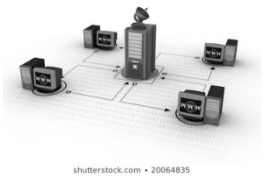
Types of network

- **Local area network (LAN)**



Networks that are small in geographic size spanning a room, floor, building, or campus.

- **Metropolitan area network (MAN)**



Networks that serve an area of 1 to 30 miles, approximately the size of a typical city

- **Wide area network (WAN)**

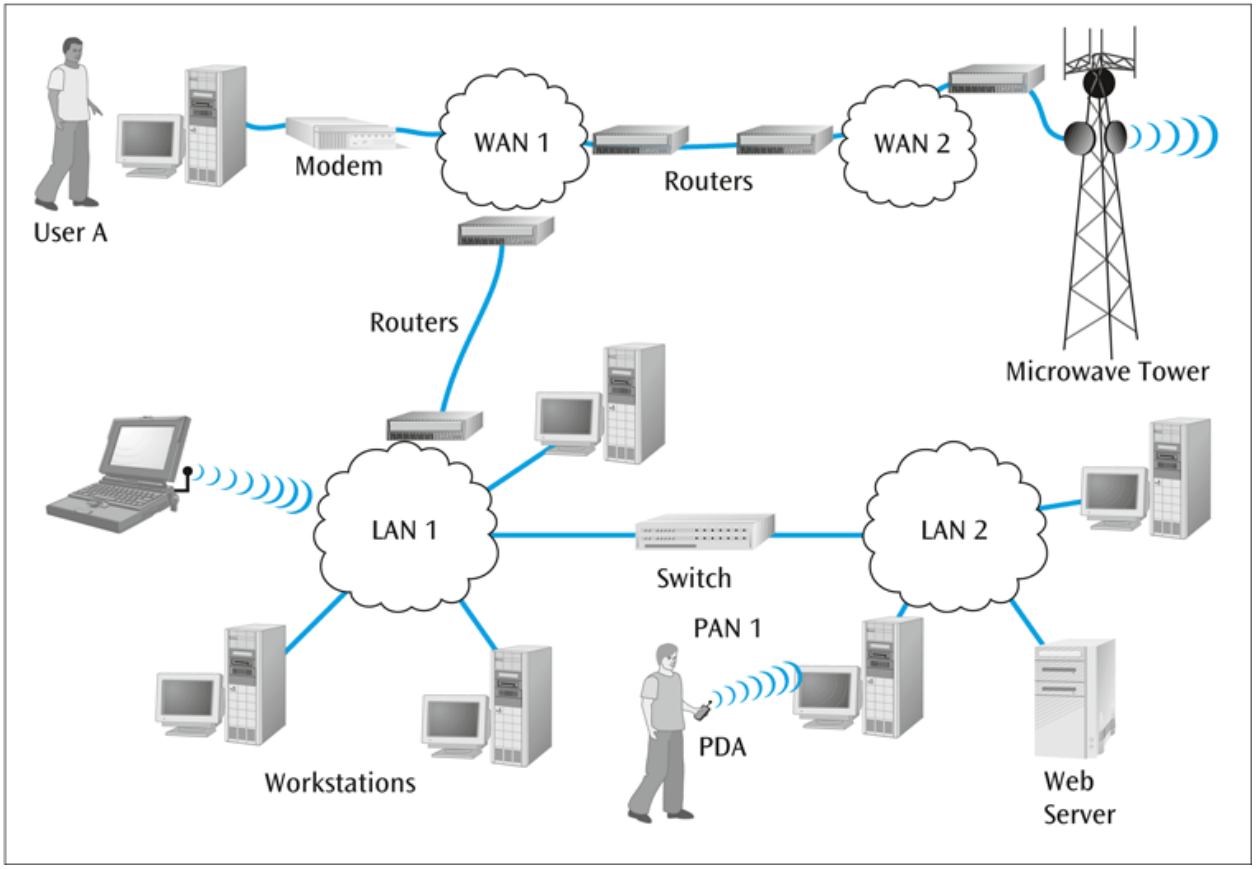
A large network that includes parts of states, multiple states, countries, and the world

- **Personal area network (PAN)**

A network of a few meters, between wireless devices such as PDAs, laptops, and similar devices

Types of network

An overall view of the interconnection between different types Of networks



Communication Networks – Basic Layouts

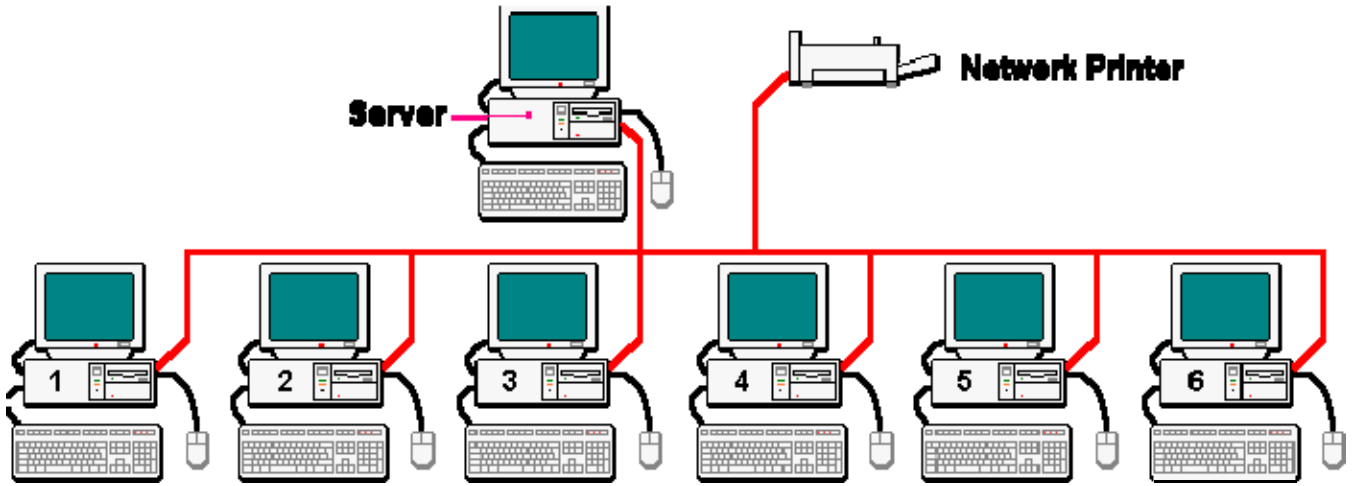
- Microcomputer-to-local area network
- Microcomputer-to-Internet
- Local area network-to-local area network
- Personal area network-to-workstation
- Local area network-to-metropolitan area network

Communication Networks – Basic Layouts (cont.)

- Local area network-to-wide area network
- Wide area network-to-wide area network
- Sensor-to-local area network
- Satellite and microwave
- Cell phones

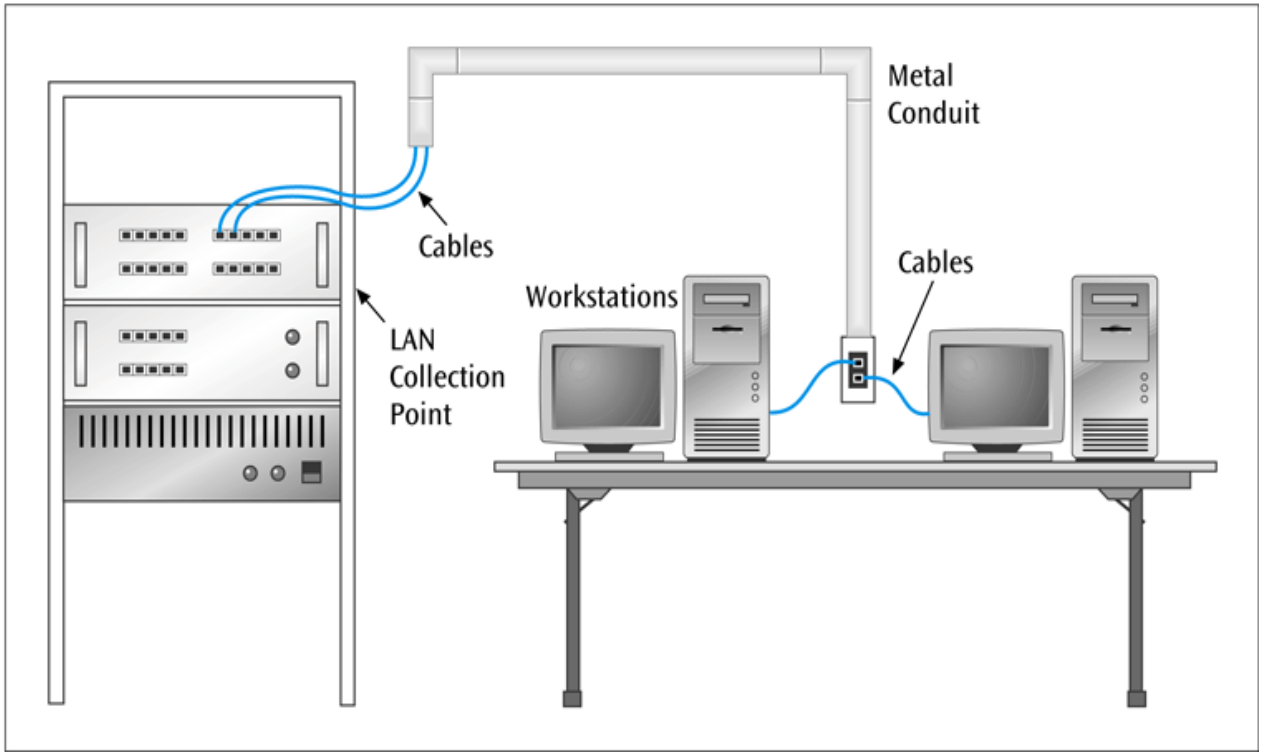
Microcomputer-to-Local Area Network Layout

- Highly common throughout business and academic environments, and now homes
- Typically a medium- to high-speed connection
- Computer (device) requires a NIC (network interface card)
- NIC connects to a hub-like device (switch)



Microcomputer-to-Local Area Network Layout (cont.)

A microcomputer lab, showing the cabling that comes from the back of a workstation and connected to a LAN collection point

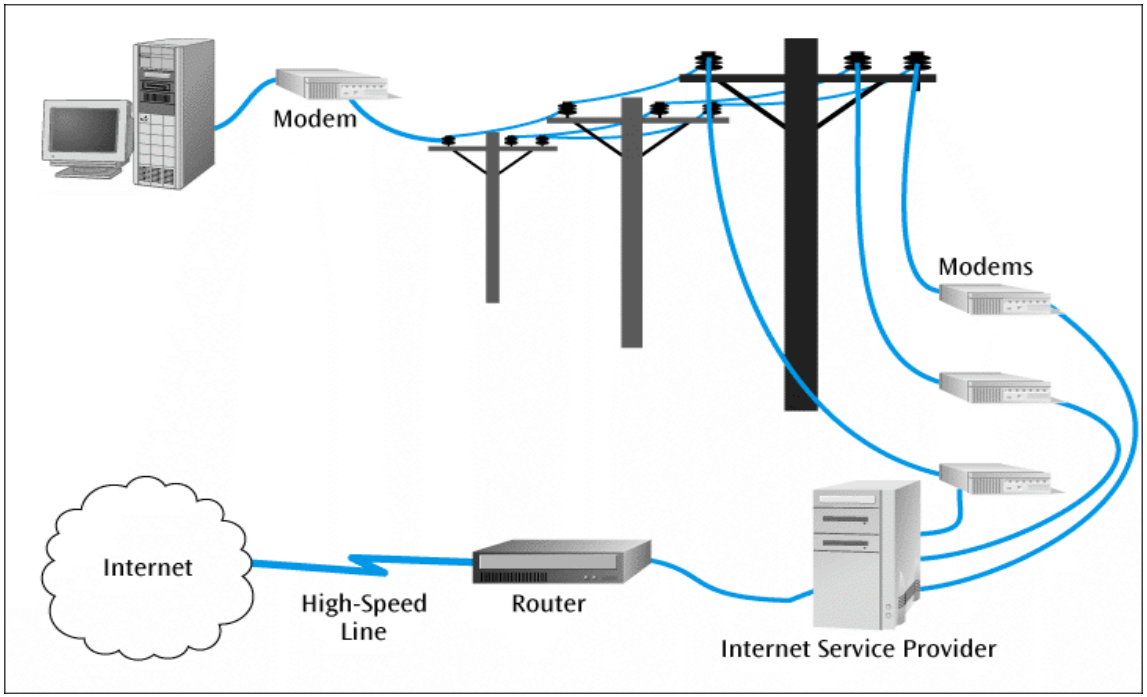


Microcomputer-to-Internet Layout

- Popular with home users and small businesses
- For some, a dial-up modem is used to connect user's microcomputer to an Internet service provider
- Technologies such as DSL are quickly replacing dial-up modems

Microcomputer-to-Internet Layout (cont.)

A microcomputer / workstation sending data over a DSL line to an Internet service provider

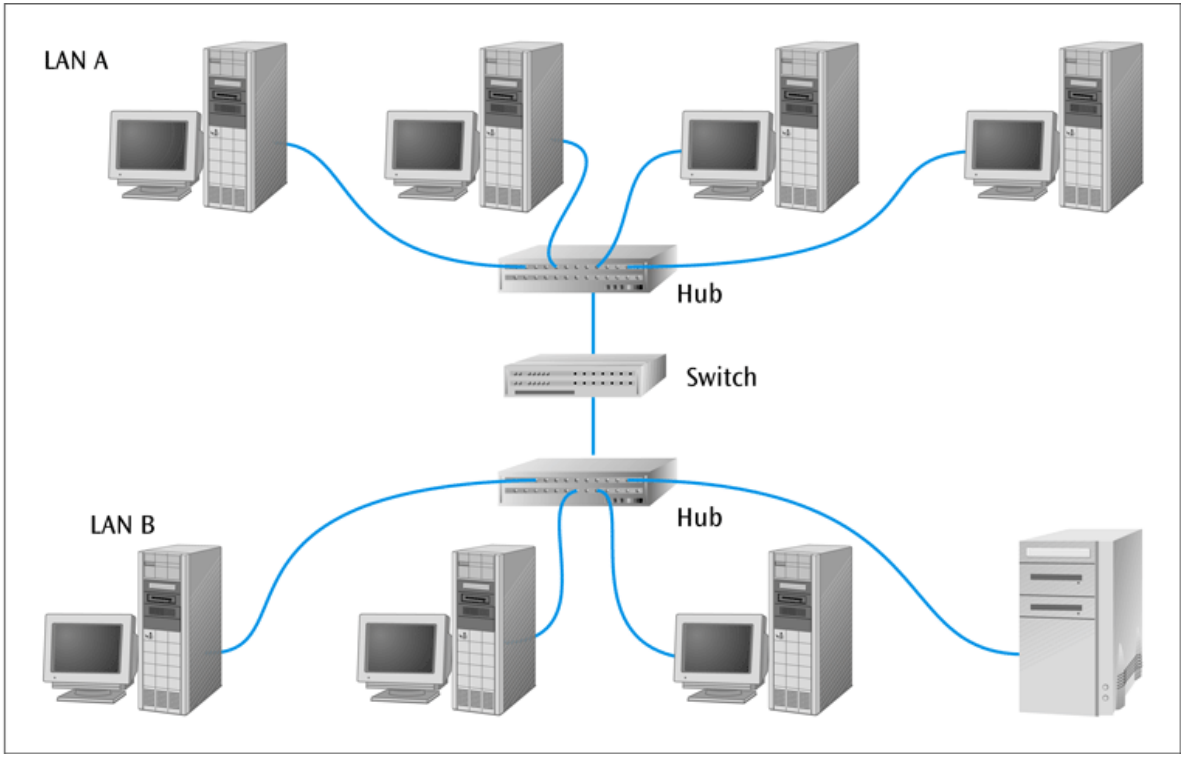


Local Area Network-to-Local Area Network Layout

- Found in systems that have two or more LANs and a need for them to intercommunicate
- A bridge-like device (such as a switch) is typically used to interconnect LANs
- Switch can filter frames

Local Area Network-to-Local Area Network Layout (cont.)

Two local area network connected by switch

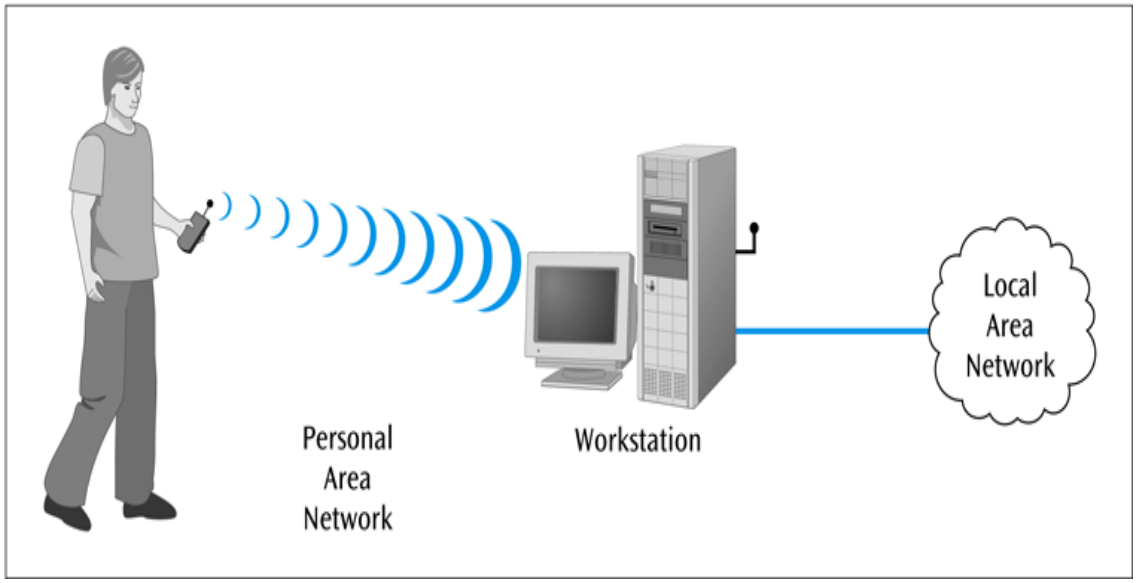


Personal Area Network-to-Workstation Layout

- Interconnects wireless devices such as PDAs, laptops and notebooks, and music playback devices
- Used over short distances such as a few meters

Personal Area Network-to-Workstation Layout (cont.)

A user transferring data from a personal digital assistant (PDA) to a workstation attached to a local area network

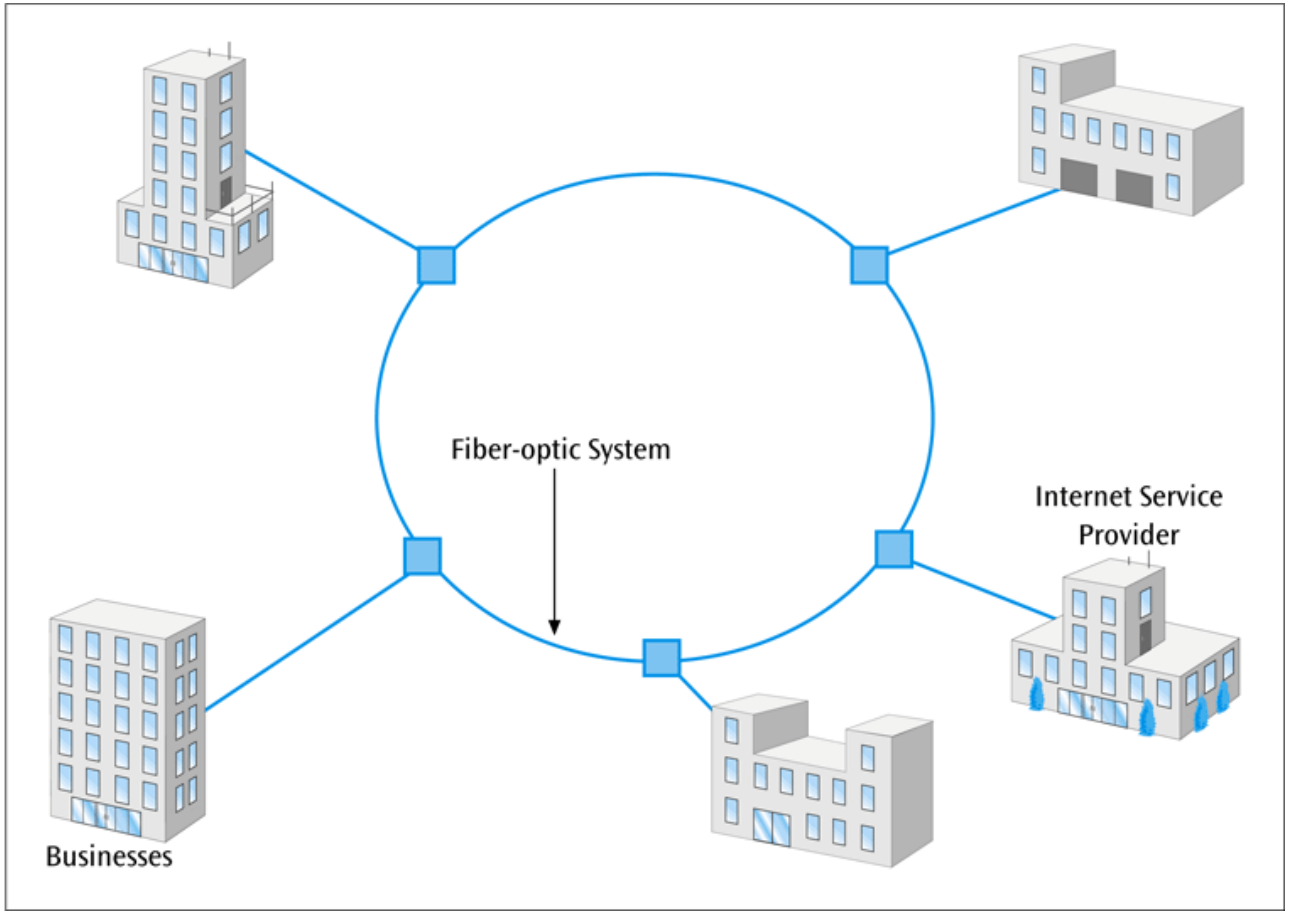


Local Area Network-to-Metropolitan Area Network Layout

- Used to interconnect companies (usually their local area networks) to networks that encompass a city
- High-speed networks with redundant circuits
- Metro Ethernet is latest form of metropolitan LAN

Local Area Network-to-Metropolitan Area Network Layout (cont.)

Businesses interconnected within a large metropolitan area network

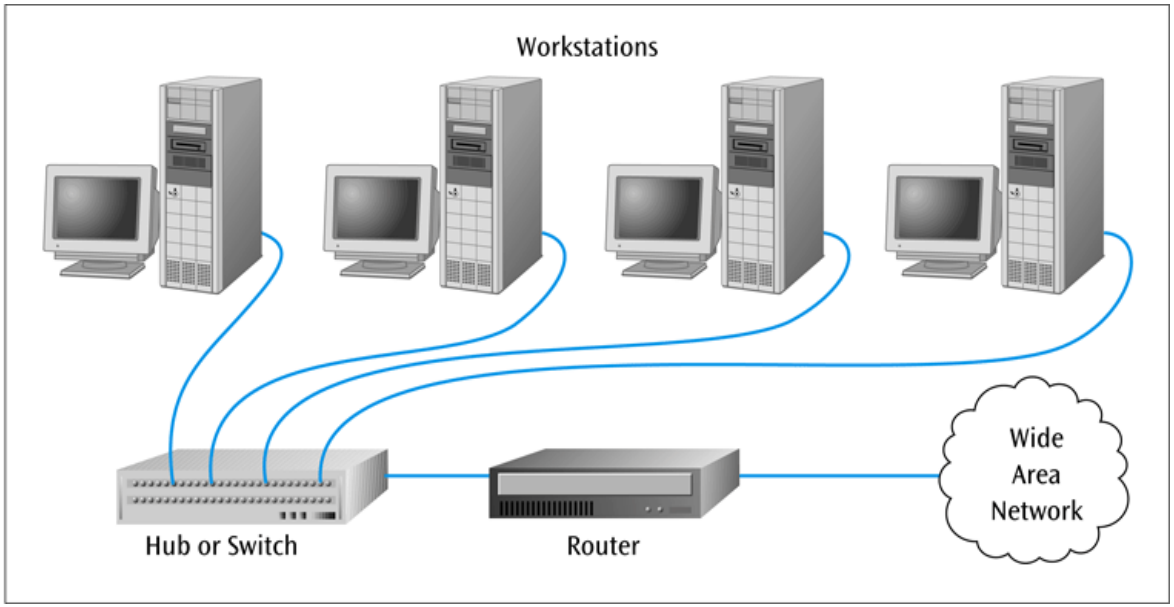


Local Area Network-to-Wide Area Network Layout

- One of the most common ways to interconnect a user on a LAN workstation to the Internet (a wide area network)
- A router is the typical device that performs LAN to WAN connections
- Routers are more complex devices than switches

Local Area Network-to-Wide Area Network Layout (cont.)

Local area network to wide area network configuration



Wide Area Network-to-Wide Area Network Layout

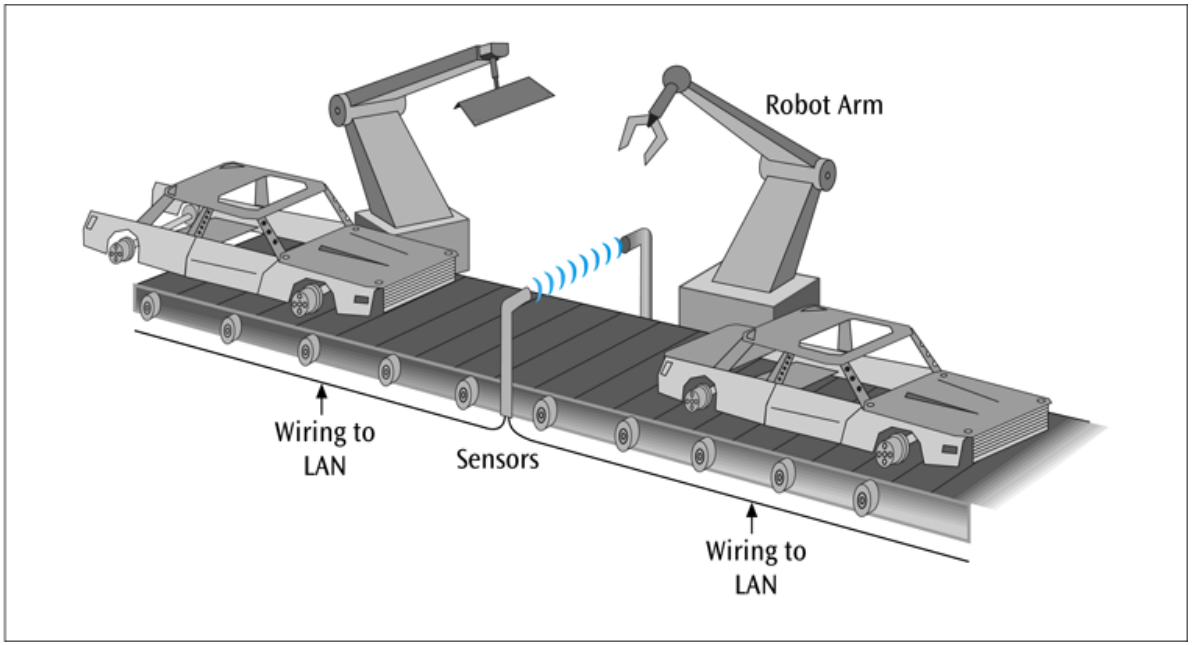
- High-speed routers and switches are used to connect one wide area network to another
- Thousands of wide area networks across all the world, interconnected via these routers and switches

Sensor-to-Local Area Network Layout

- Not all local area networks deal with microcomputer workstations only.
- Often found in industrial and laboratory environments.
- Example: Assembly lines and robotic controls depend heavily on sensor connected to local area networks

Sensor-to-Local Area Network Layout (cont.)

An automobile move down an assembly line and triggers a sensor

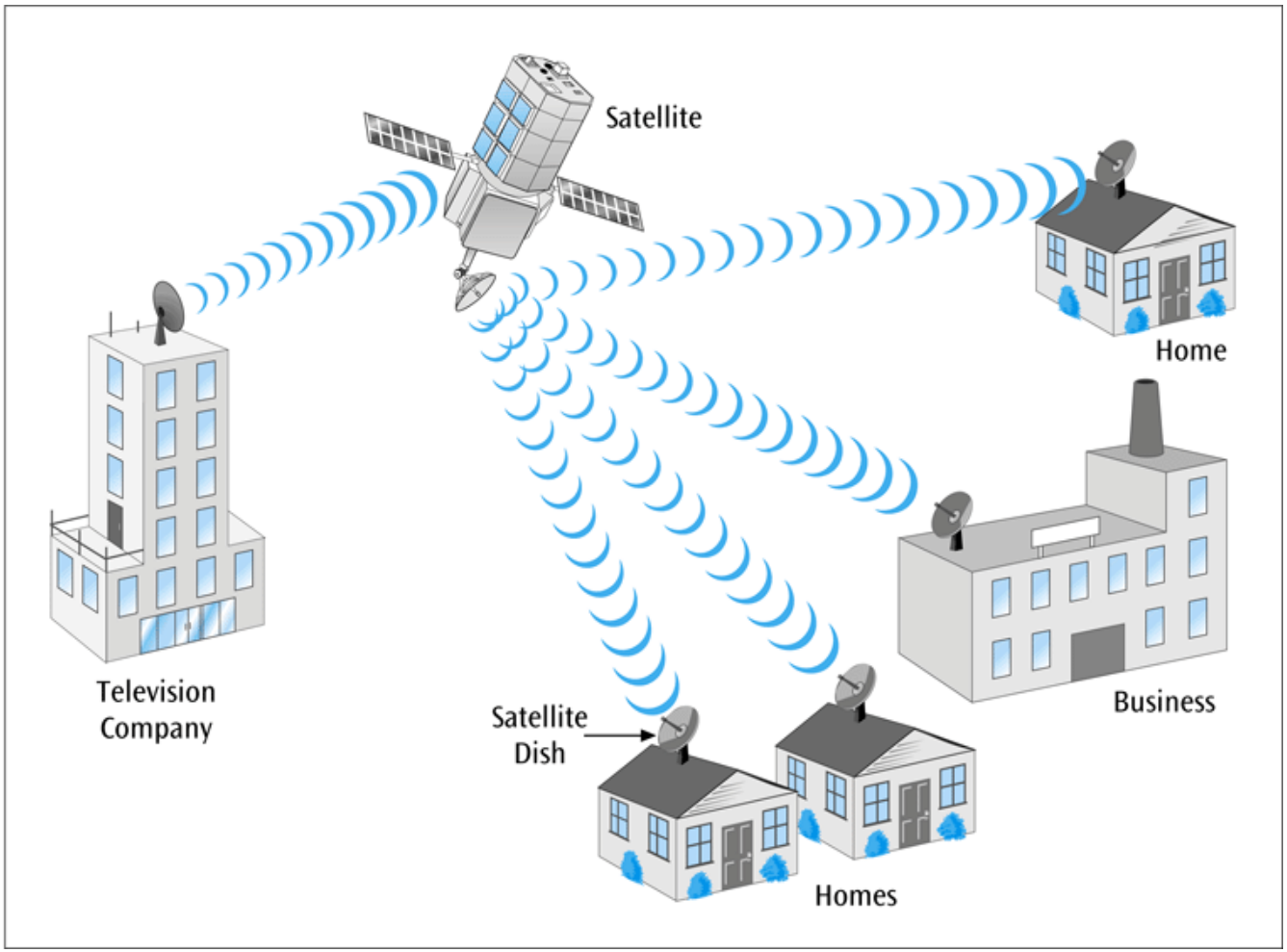


Satellite and Microwave Layout

- Typically long distance wireless connections
- Many types of applications including long distance telephone, television, radio, and wireless data services
- Typically expensive services but many companies offer competitive services.
- Newer shorter-distance services such as Wi-Max

Satellite and Microwave Layout (continued)

Example of a television company using a satellite system to broadcast television services into homes and businesses

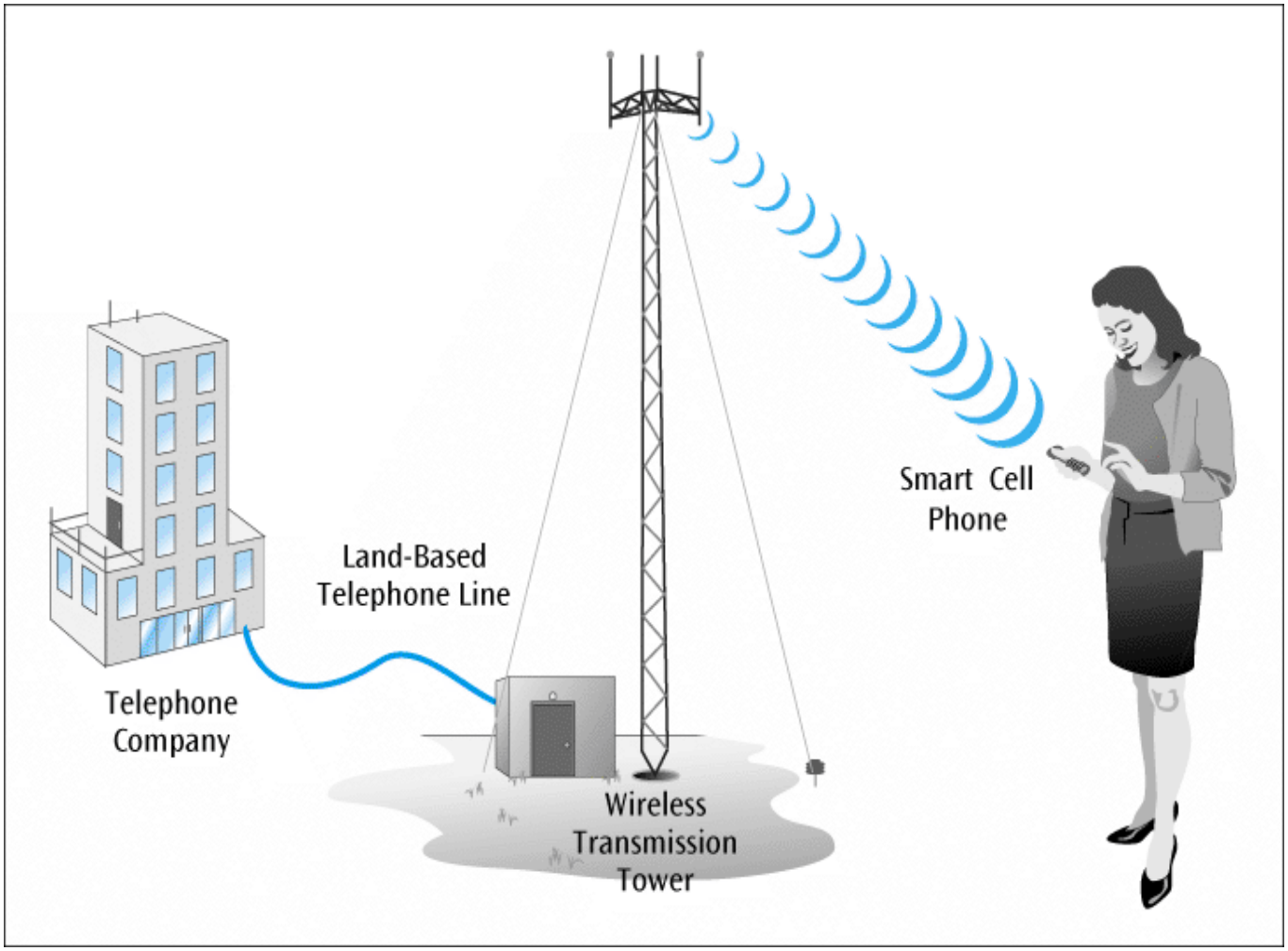


Cell Phone Layout

- Third generation and fourth generation services available in many areas.
- Latest generation includes higher speed data transfers (100s to 1000s of kilobits per second).

Cell Phone Layout (cont.)

An example of a PDA connected to a wireless telephone system to transmit and receive data



Benefits of Networking

- Networking is used for sharing information.
- Networking allows us to share three main things:
  - information,
  - resources,
  - applications.

- **Information sharing**
  - By Networking it is easy to share the information across the network.
  - you can send or receive data files from many computers.
  - you can communicate with each other in network via messaging application for example email service, chat service etc.
  - you can store data in a centralized sever for easy management.

Benefits of Networking

➢Resources Sharing

- Certain computer resources can be shared in the network such as hard disk, printer, scanner, modem etc.
- This allows us to track the uses of resources.
  - For example a network administrator can setup a printer server and share it in network.
  - Then the user can use printer server for printing and administrator needs only to monitor the print server.

Benefits of Networking

- **Application Sharing**
  - Application sharing is the most common in companies.
  - Companies may have business application that needs to be used by several users.
  - networking make the application sharing is possible.
  - It allows several users to work together on a single application.

Network Interface Card (NIC)

- In the list of networking devices, NIC stands on first place.
- Without this device, networking cannot be done.
- This is also known as network adapter card, Ethernet Card and LAN card.
- NIC allows our PC to communicate with other PCs.
- Basically it converts data transmission technology as in the following.
- PC uses parallel data transmission technology to transmit data between its internal parts while the media that connects this PC with other PCs uses serial data transmission technology.
- NIC converts parallel data stream into serial data stream and vice versa.

Network Interface Card (NIC)

- Usually all modern PCs have integrated NICs in motherboard.
- NICs are also available separately.
- For desktop or server system they are available in adapter format which can be plugged into the available slots of motherboard.
- For laptop or other small size devices they available in PCMCIA (Personal Computer Memory Card International Association) card format which can be inserted in PCMCIA slots.

Network Interface Card (NIC)

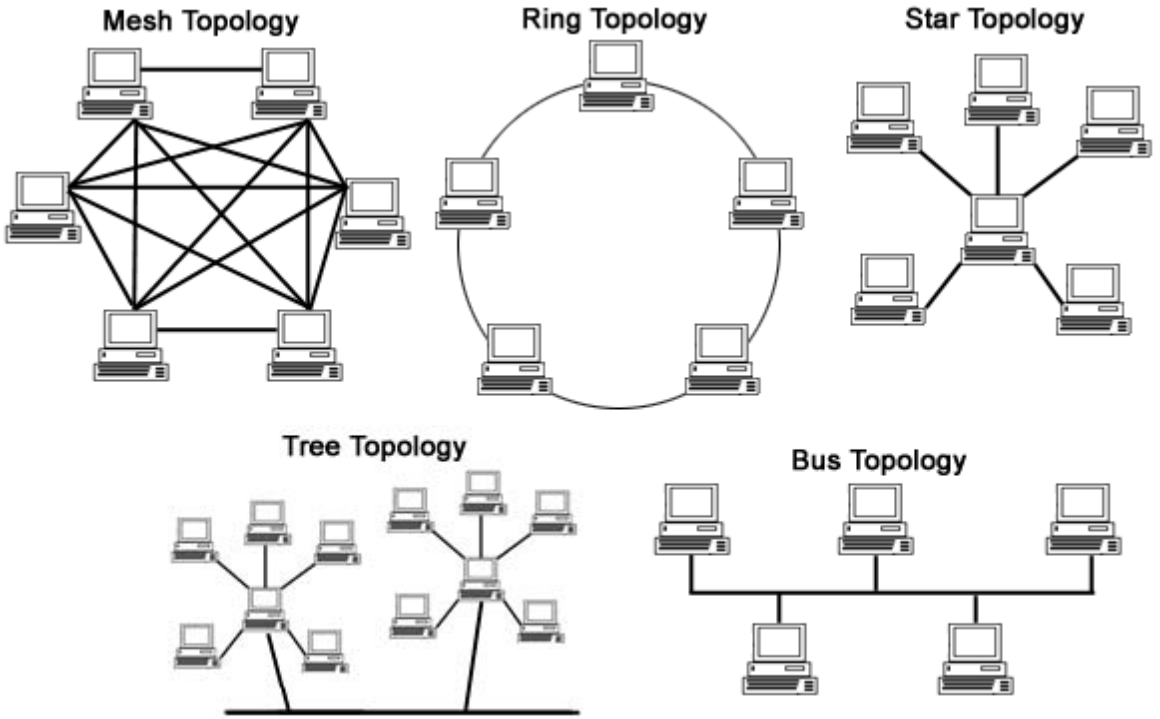
Network Interface Card (NIC)

25G fiber NIC card typically operates at the physical or data link layer and has a unique physical address (MAC address). In addition, the 25G fiber NIC card has one or two SFP28 ports (small form-factor pluggable port) on the side panel, which is mainly used to connect the optical module to the switch.

The 25G fiber NIC card is mainly used for the connection between the servers and the switches.

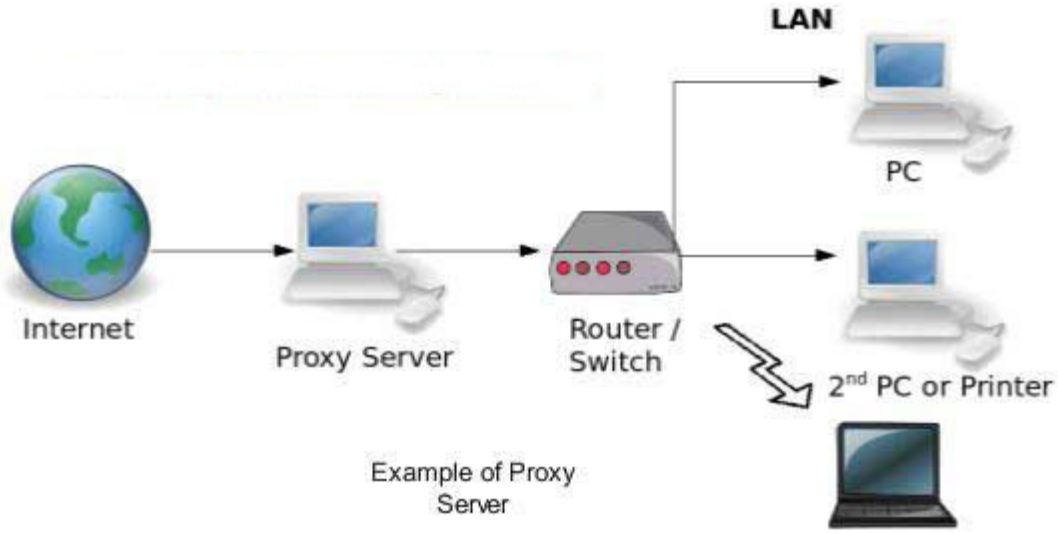
Network topologies and types of networks

- The term network topology describes how the devices are connected in terms of a geometric graph.
- Devices are represented as vertices, and their connections are represented as edges on the graph.
- Typical network configurations include the bus topology, mesh topology, ring topology, star topology, tree topology and hybrid topology.



Proxy

- Proxy can be a dedicate device or software.
- Proxy is used to hide the internal network from external world.
- If we use proxy then there would be no direct communication between internal network and external network.
- All communication will go through the proxy.
- External computer will be able to access only proxy.
- Thus Proxy makes tampering with an internal system from the external network more difficult.



Example of Proxy Server

proxy servers work and determine how they protect personal and make information safe from hacker exploits.

Proxy

- When using a proxy server, the user is connected to the server, not the Web site in their browser, because the proxy acts as a client on behalf of the user.
- It uses one of its own IP addresses to request the page from the server located on the Internet.
- Once the page is returned, the proxy server forwards it to the user, isolating them from the Internet.
- If the proxy server is also a cache server, it will first look in its local cache of previously downloaded Web pages to see if it can find the requested page.
- If it finds the page, it sends it to the user.
- This avoids the need to forward the request to the Internet.
- If one or more sites are frequently requested, it is likely they are saved in the proxy's cache.
- Therefore, when pages are requested from these sites, users receive improved response times.

Share Files Between Two Computers Using LAN Cable

Step 1: Connect Both PCs With LAN Cable

Step 2: Enable Network Sharing on Both PCs

Step 3: Setup Static IP

Step 4: Share a folder

Share Files Between Two Computers Using LAN Cable

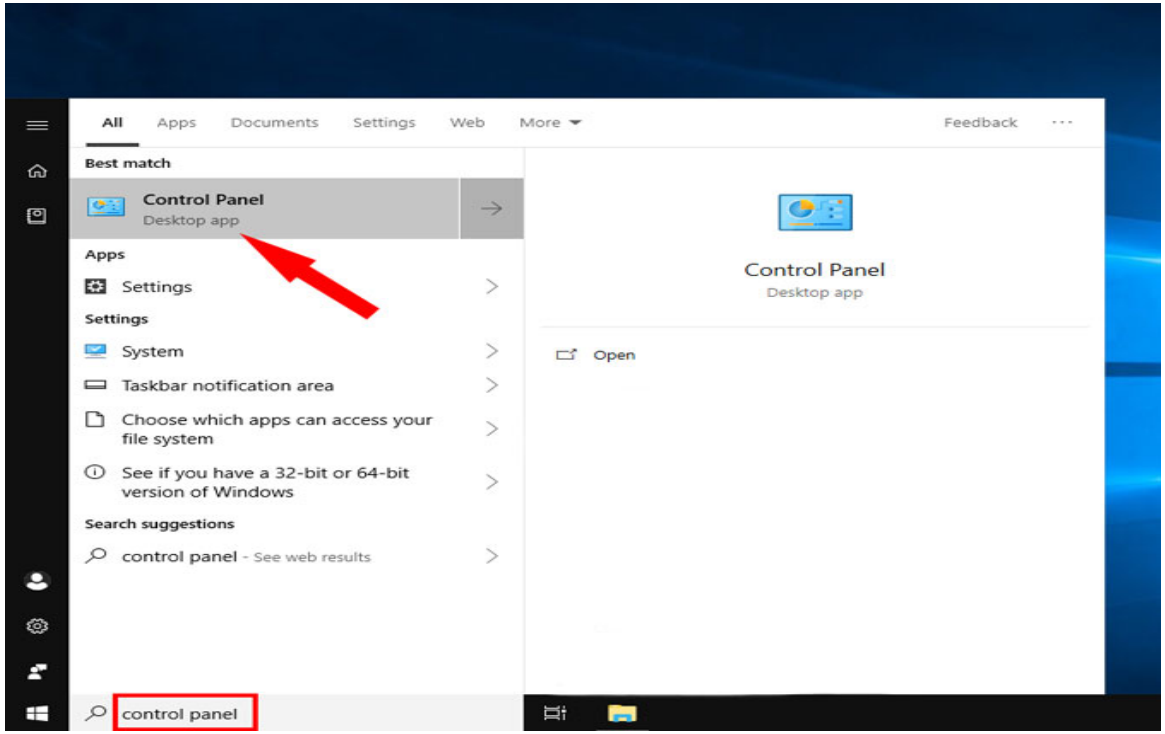
Step 1: Connect Both PCs With LAN Cable

Connect both computers to a LAN cable. You can use any LAN cable (crossover cable)

Share Files Between Two Computers Using LAN Cable

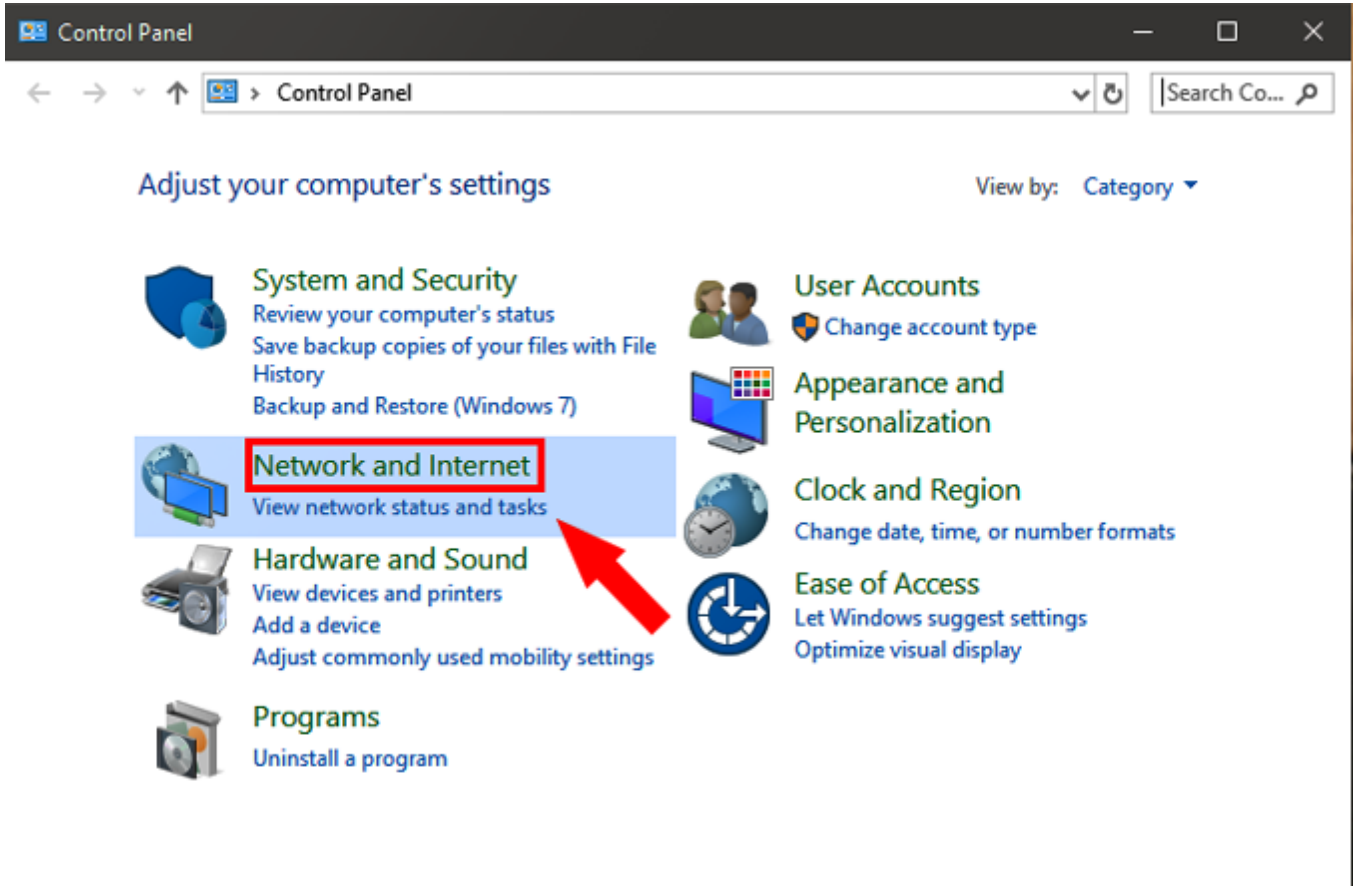
Step 2: Enable Network Sharing on Both PCs

Now that you have physically connected both PCs with a LAN cable, we have to turn on Network Sharing on both computers to exchange files between them



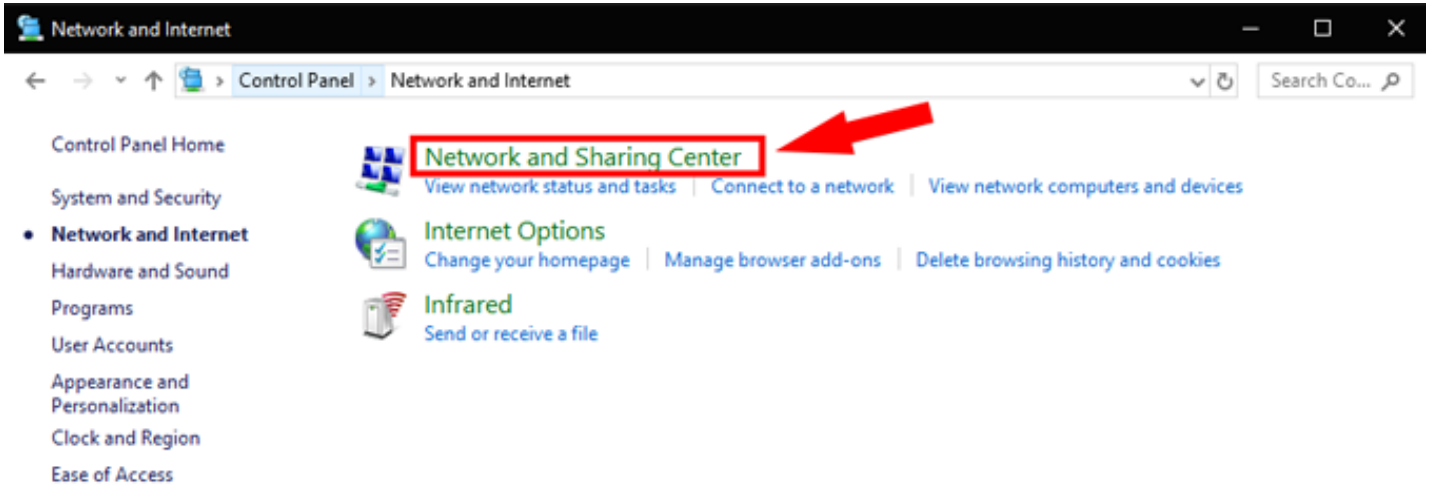
Share Files Between Two Computers Using LAN Cable

To enable sharing, once the Control Panel window opens, click on Network and Internet.



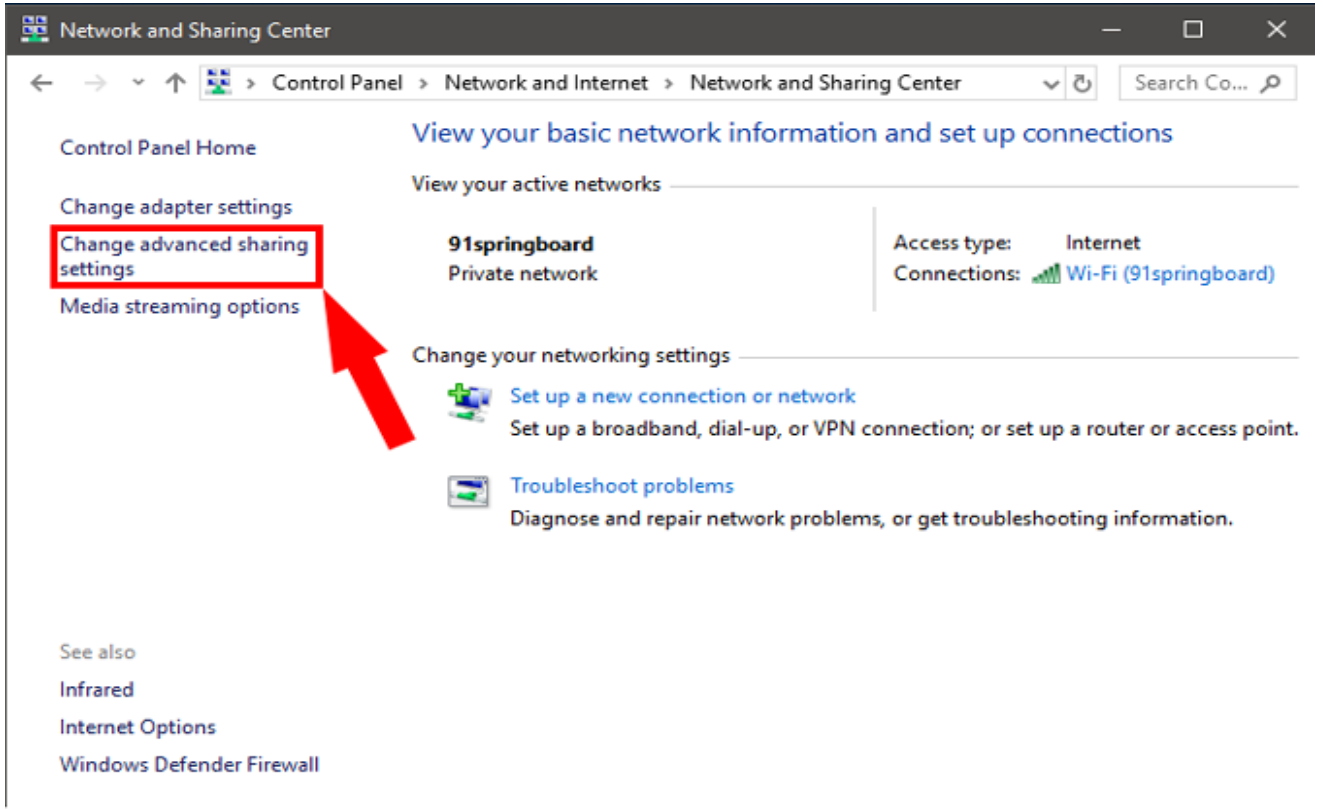
Share Files Between Two Computers Using LAN Cable

In the next dialogue box, open Network and Sharing Center. Alternatively.



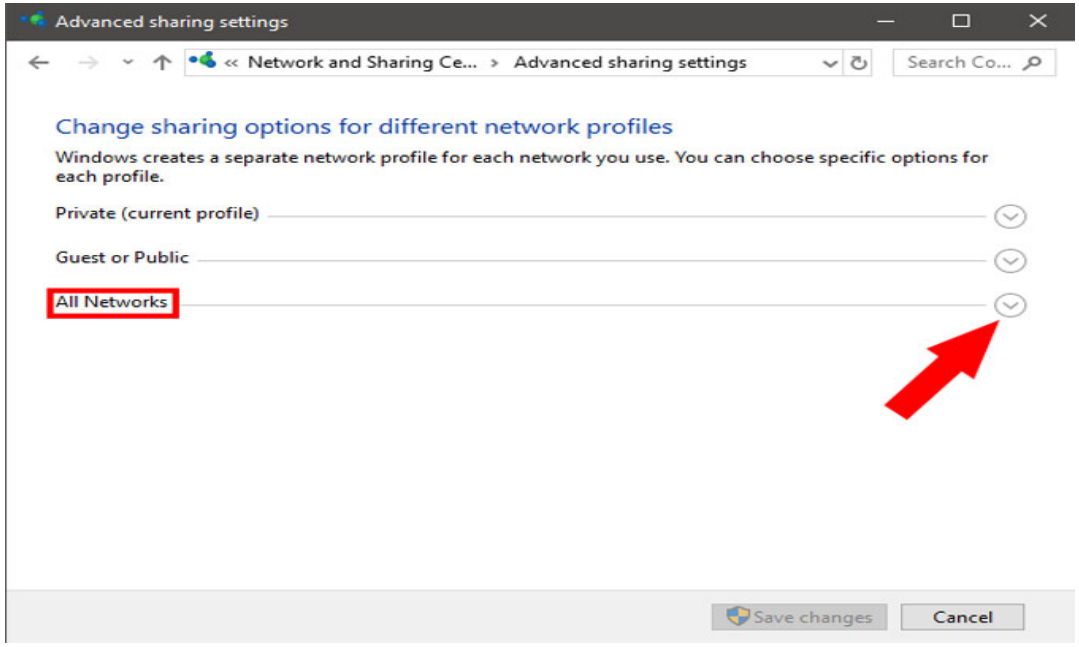
Share Files Between Two Computers Using LAN Cable

On the left-hand side of ‘Network and Sharing Center’ window, click on “Change advanced sharing settings”.



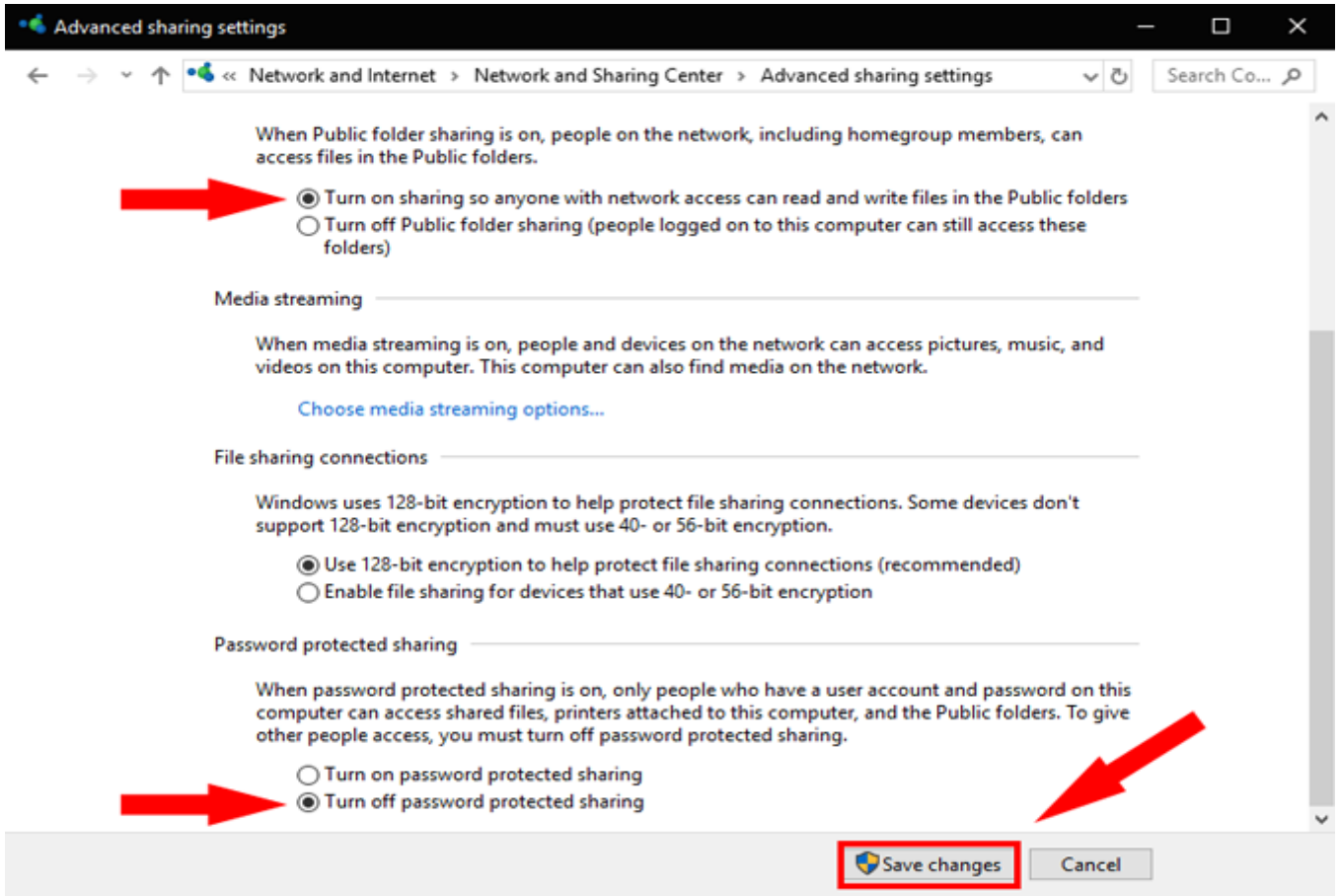
Share Files Between Two Computers Using LAN Cable

Here, you'll find three networks – Public, Private and All Network. Public Network is for places like airports and coffee shops, Private network is for an organization or your home network and All Network comprises of both. we'll recommend you choose "**All Networks**".



Share Files Between Two Computers Using LAN Cable

Next, To avoid more configuration, just **Turn off password protected sharing**. Once done, click Save Changes



Share Files Between Two Computers Using LAN Cable

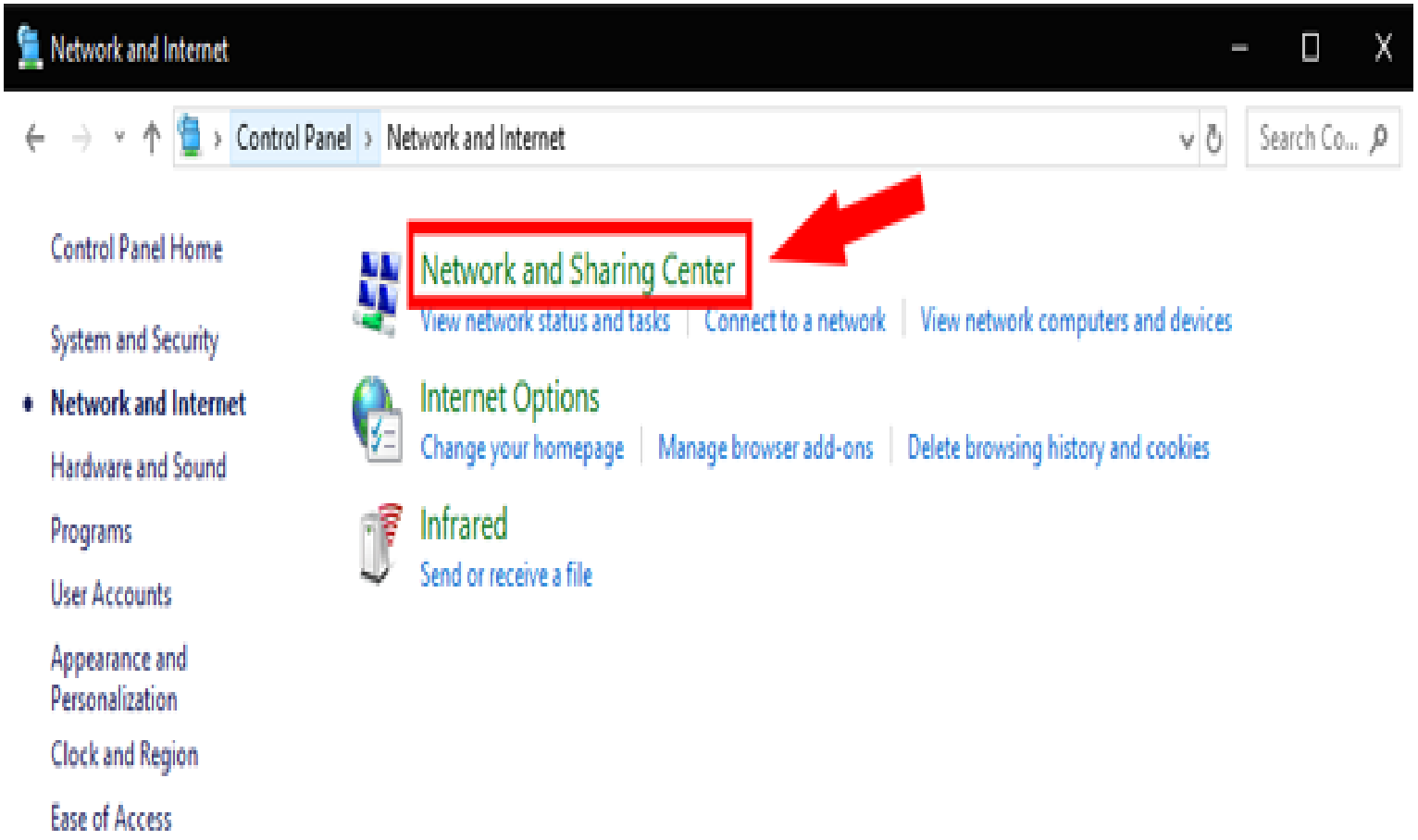
Step 3: Setup Static IP

We will do this by setting a static IP address of the same class. Just like the previous step, you need to do this on both PCs. The following are the steps.

1. To set up a Static IP, open Control Panel, browse to Network and Internet and click on **Network Sharing Center**. Alternatively, you can also right-click on the Start Menu and select Network Connections.

Share Files Between Two Computers Using LAN Cable

Step 3 (cont.): Setup Static IP



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On the next window, you will see the active connections which should be Ethernet, since both PCs are connected with a physical LAN cable. Click on the Ethernet link. A new dialog box will open, here click on the Properties button.

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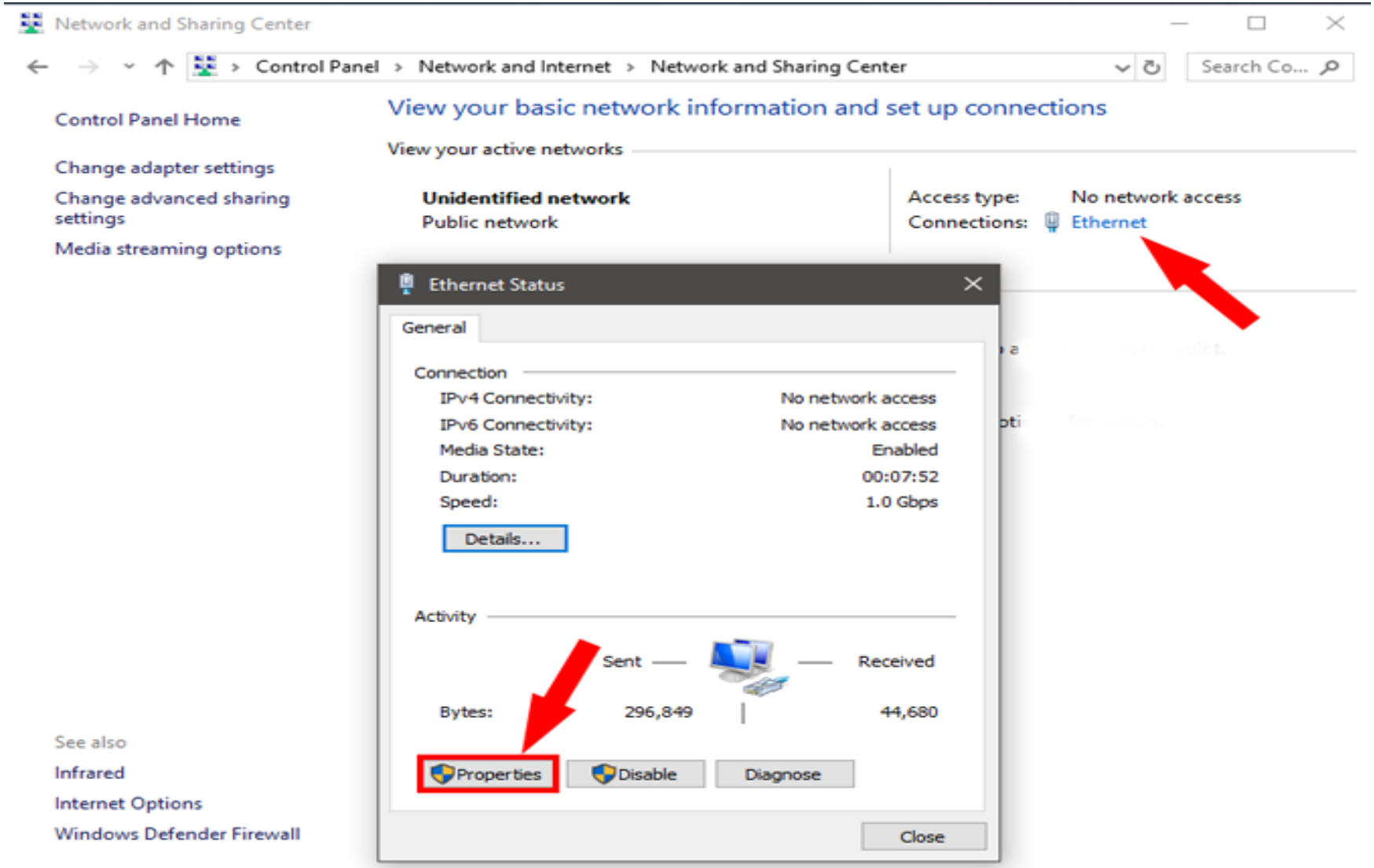
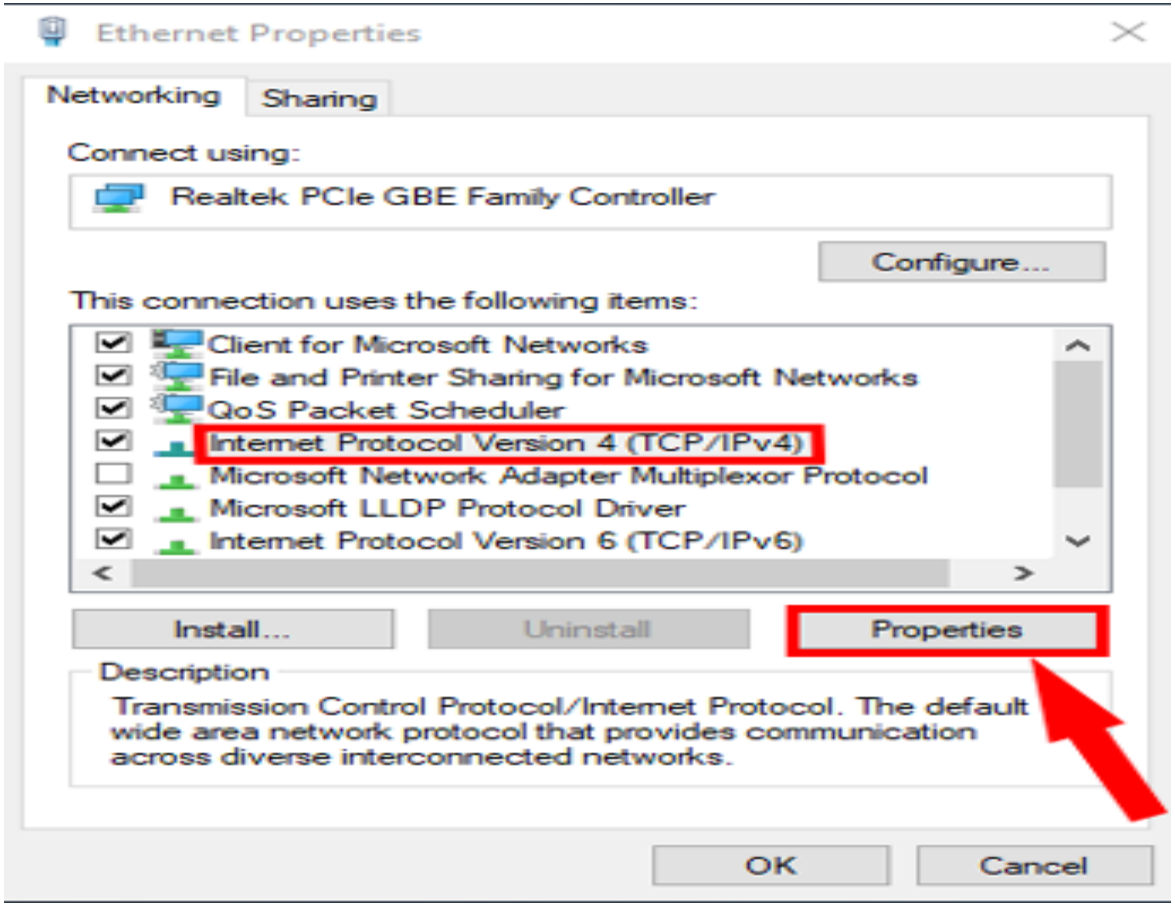


Share Files Between Two Computers Using LAN Cable

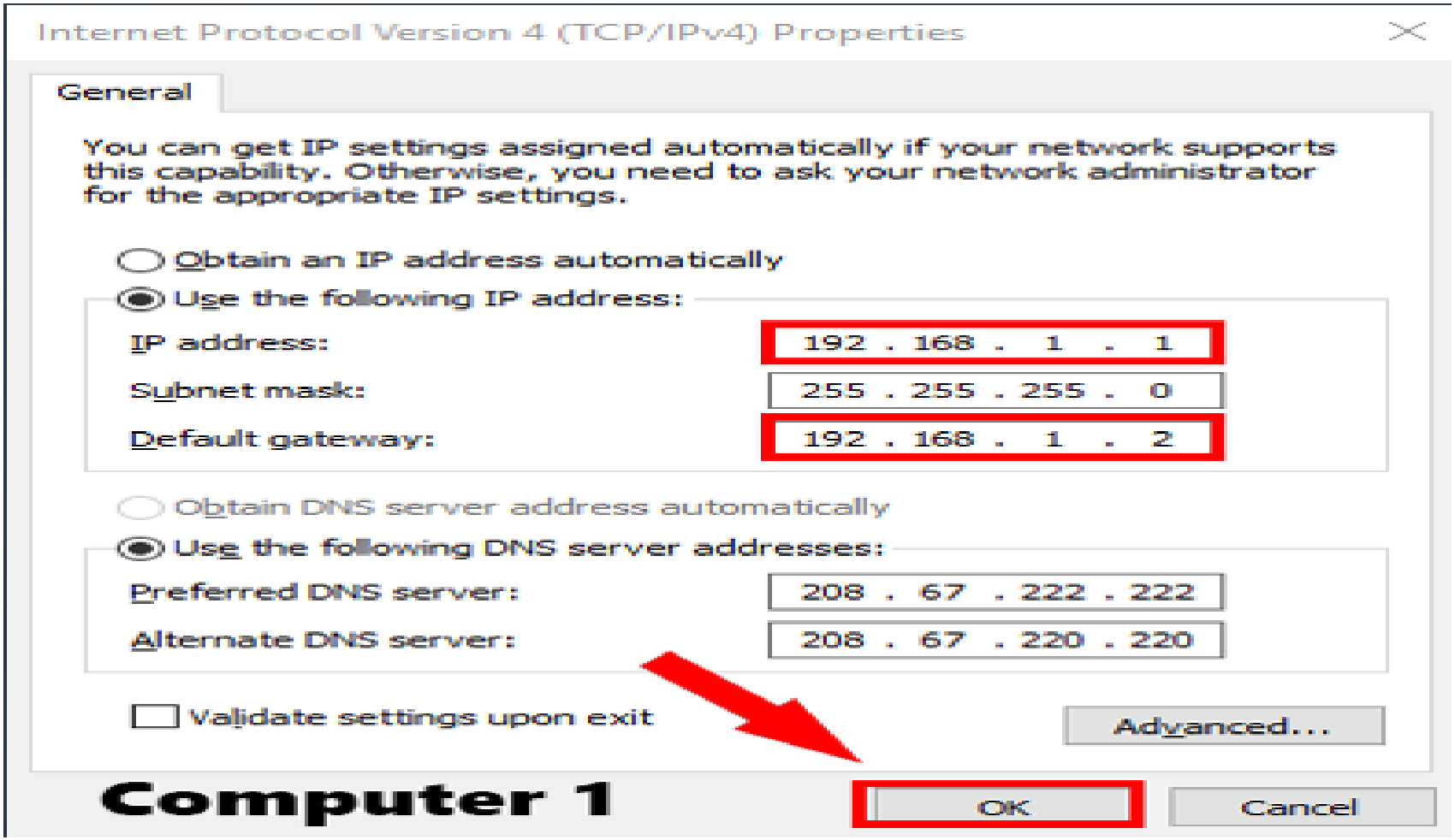
select “Internet Protocol Version 4 (TCP/IPv4)”. Now, click on Properties. This will open another dialogue box.



Share Files Between Two Computers Using LAN Cable

Here, you need to configure the two PCs with different IP settings.
On computer 1, select the option “Use the following IP address.”
and, put the following values
IP Address: 192.168.1.1
Subnet mask: 225.225.225.0
Default gateway: 192.168.1.2

Share Files Between Two Computers Using LAN Cable



Share Files Between Two Computers Using LAN Cable

On the second computer, do similar steps, but flip the IP address and Default gateway values
IP address: 192.168.1.2
Subnet mask: 225.225.225.0
Default gateway: 192.168.1.1

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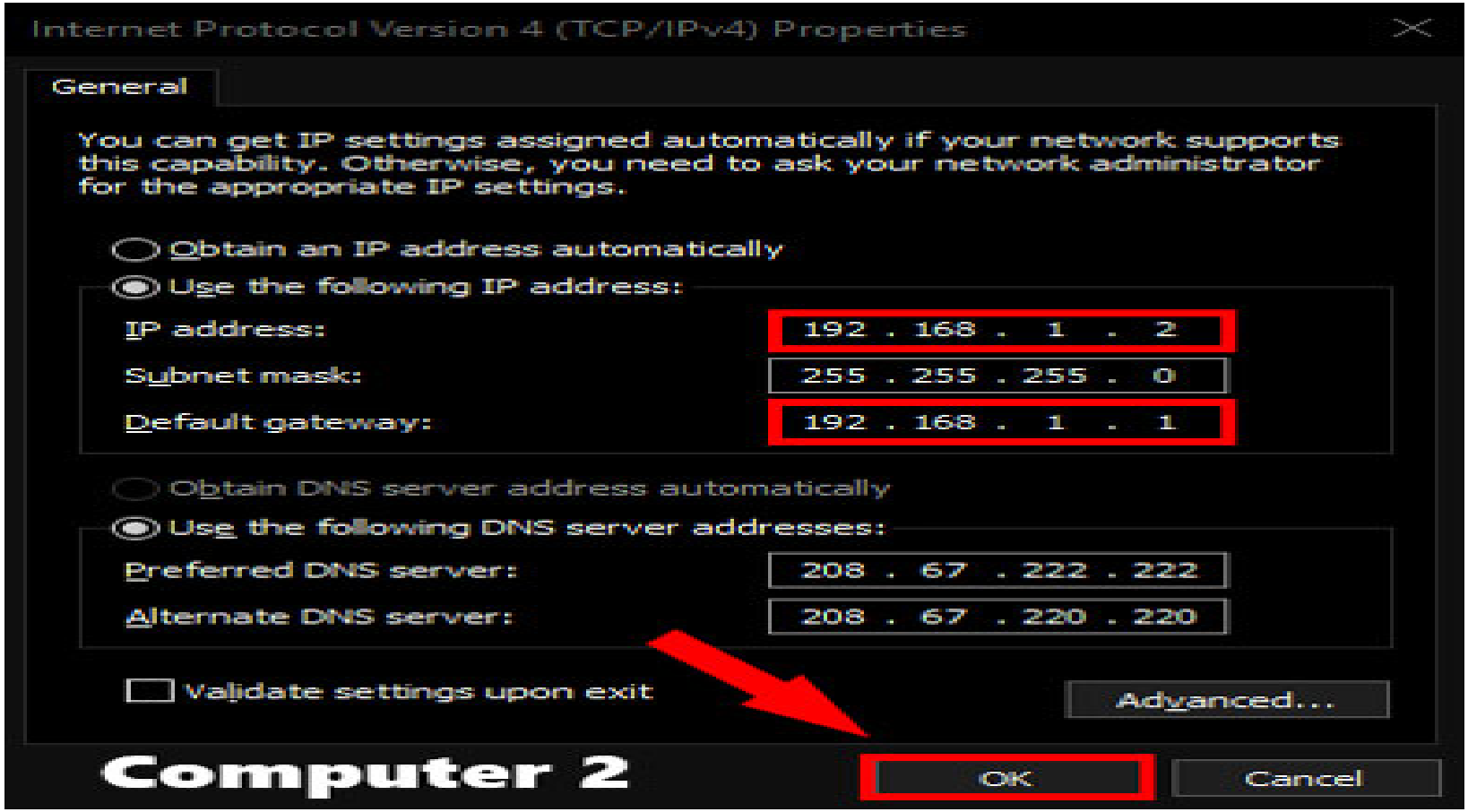

Share Files Between Two Computers Using LAN Cable

What we are doing is keeping the subnet mask the same and changing the IP address.
Next, open your Window's File Explorer and click on Network tab at the left side of the window.

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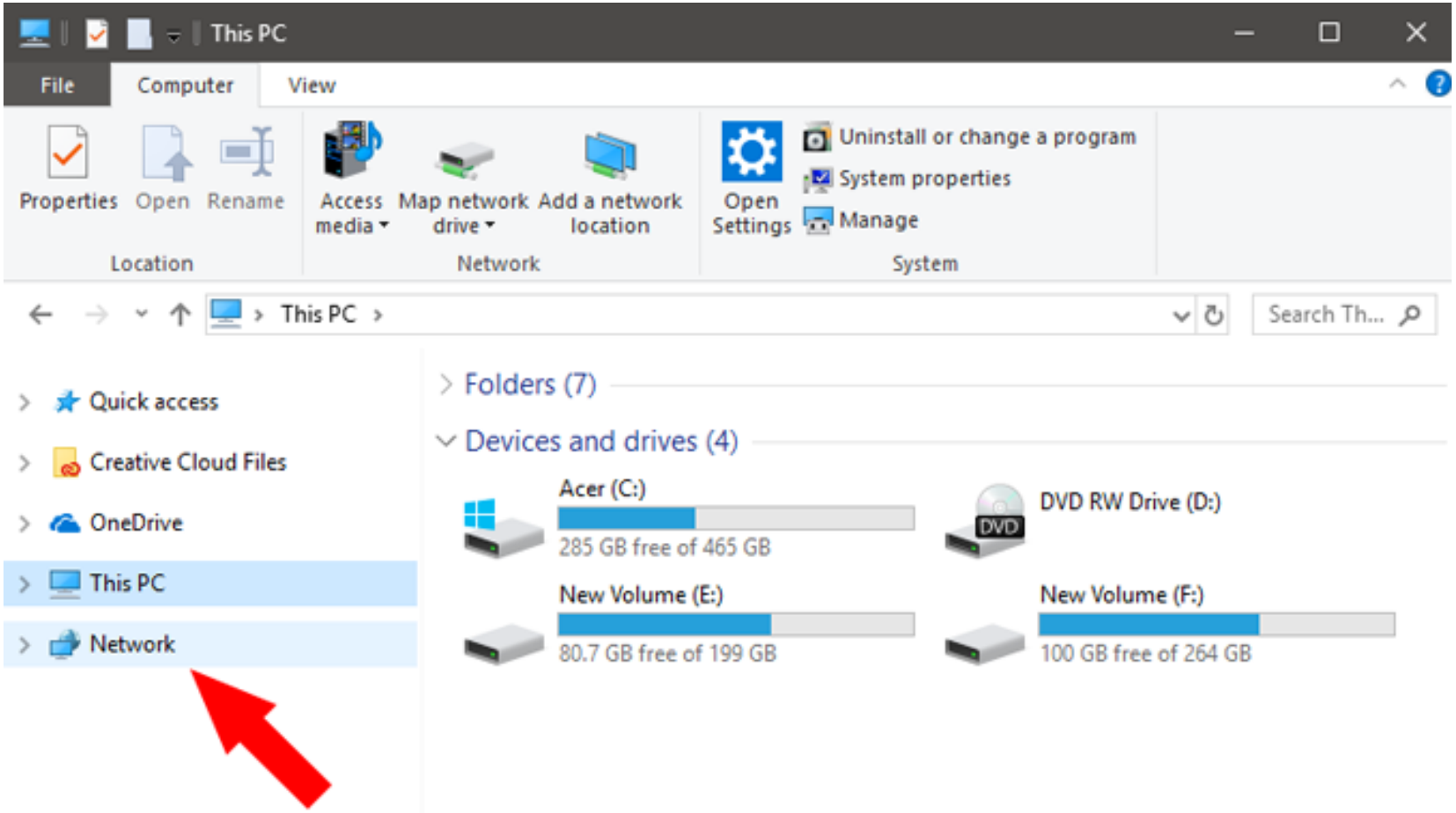
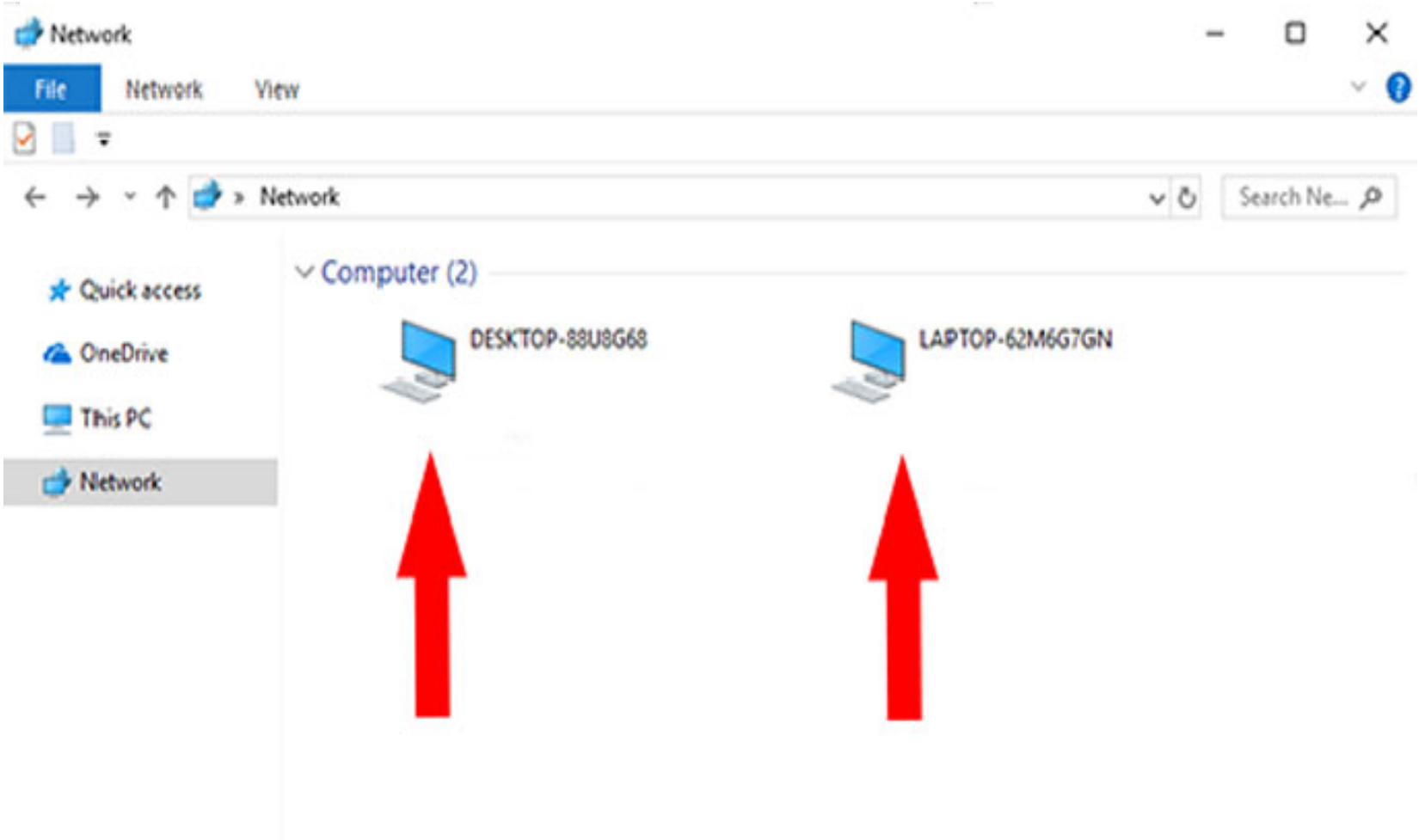


Share Files Between Two Computers Using LAN Cable

If you have set up everything right, both the PCs should appear in this Network window on both computers.
Now, you can just click on the other PC's icon and browse the file.
But wait, you still need to configure one last setting.

Share Files Between Two Computers Using LAN Cable



Share Files Between Two Computers Using LAN Cable

Step 4: Share a folder

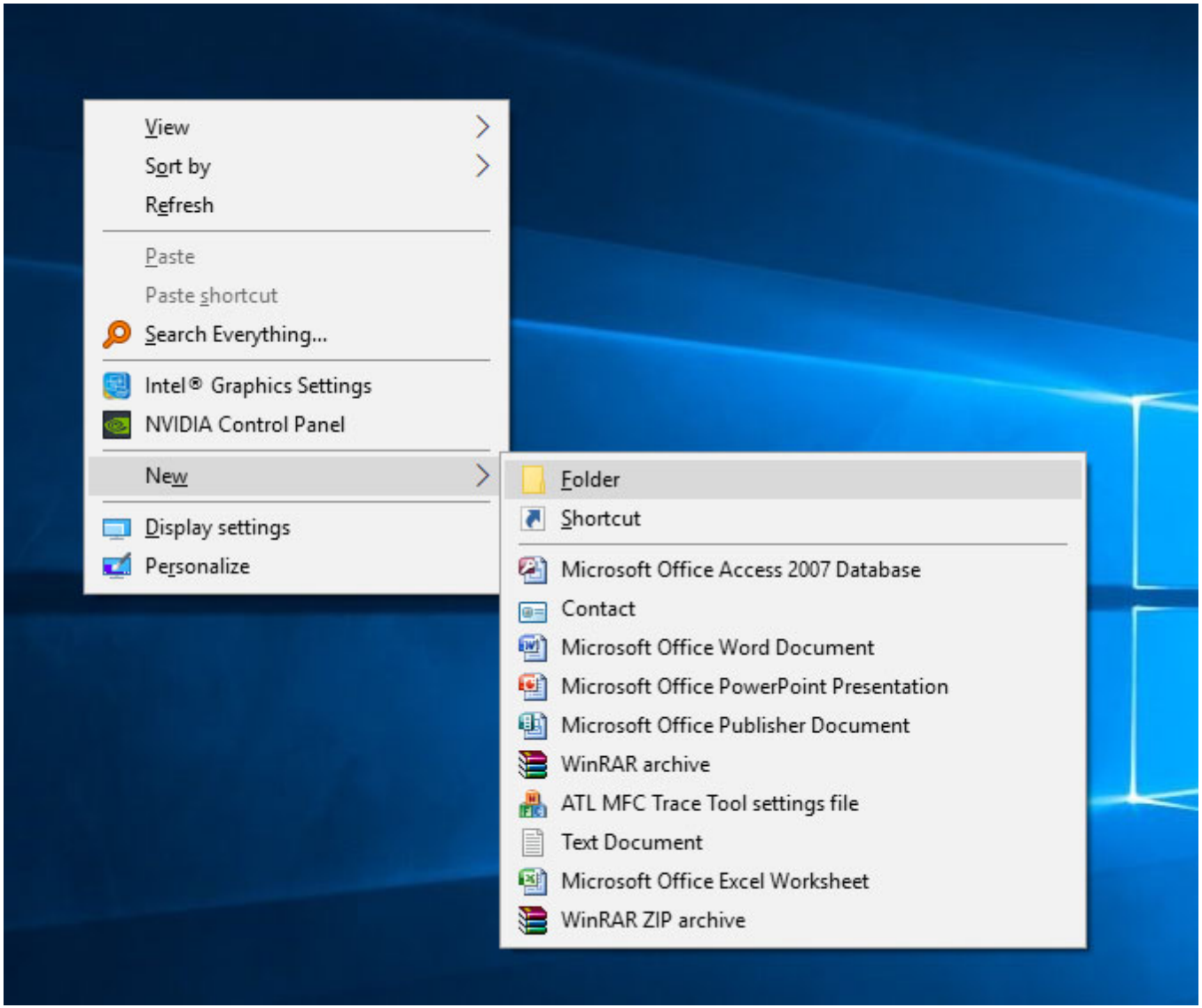
Assuming that you have connected the cable properly, enabled the sharing options, and configured the IP addresses.

Now, it is time to send files from one PC to another.

For that, you first need to share the target folder on LAN.

I'll recommend, you can create a new folder on your desktop, and copy paste all the files that you want to move to another computer in that folder.

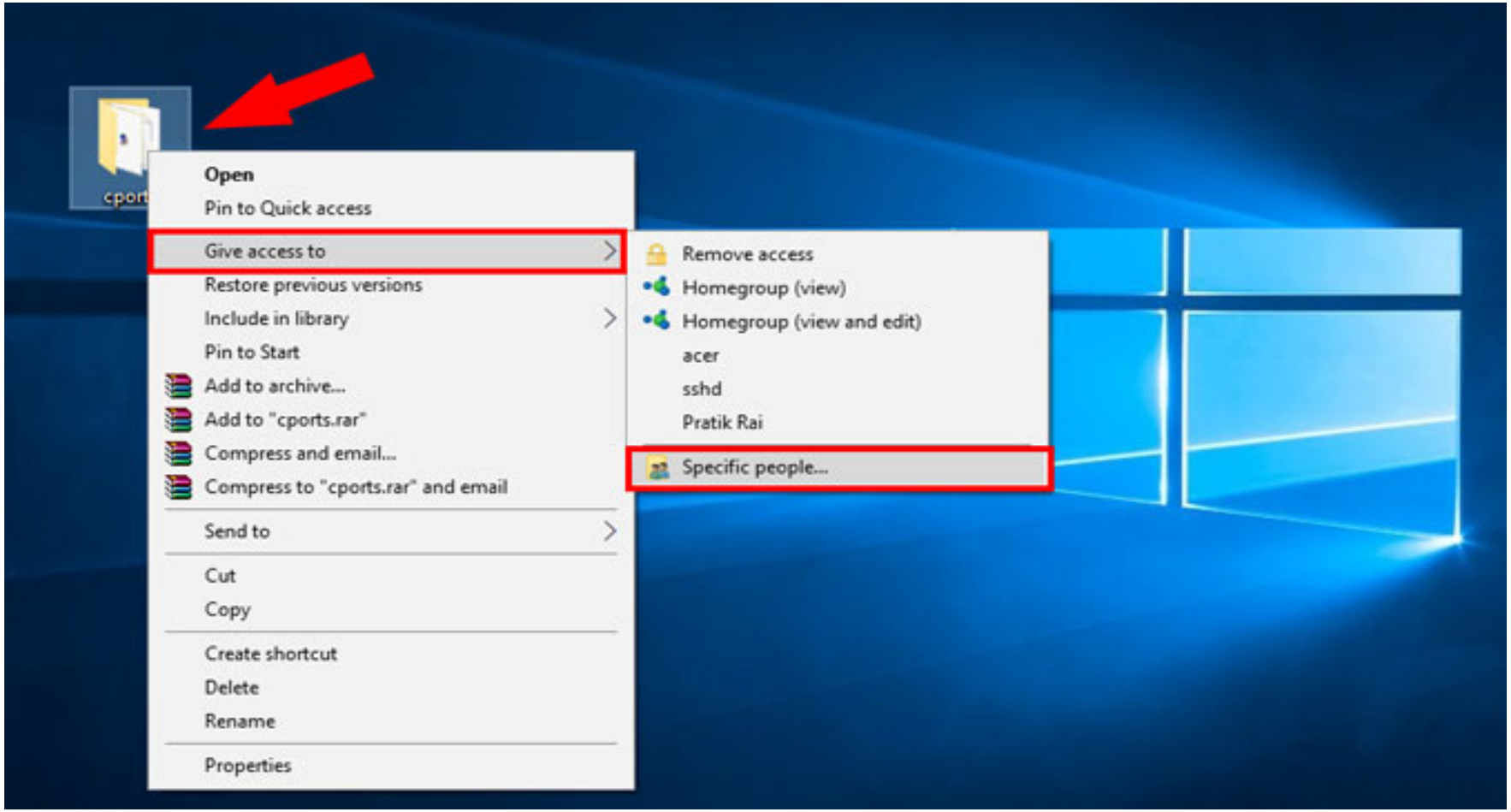
Share Files Between Two Computers Using LAN Cable



Share Files Between Two Computers Using LAN Cable

Next, select the folder you want to share and right-click on it. From the context menu, navigate to “Give access to” and select the option “Specific People.”

Share Files Between Two Computers Using LAN Cable



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In the File Sharing window, choose **Everyone** from the drop-down menu. Click on the **Add** button next to it and finally hit the Share button.

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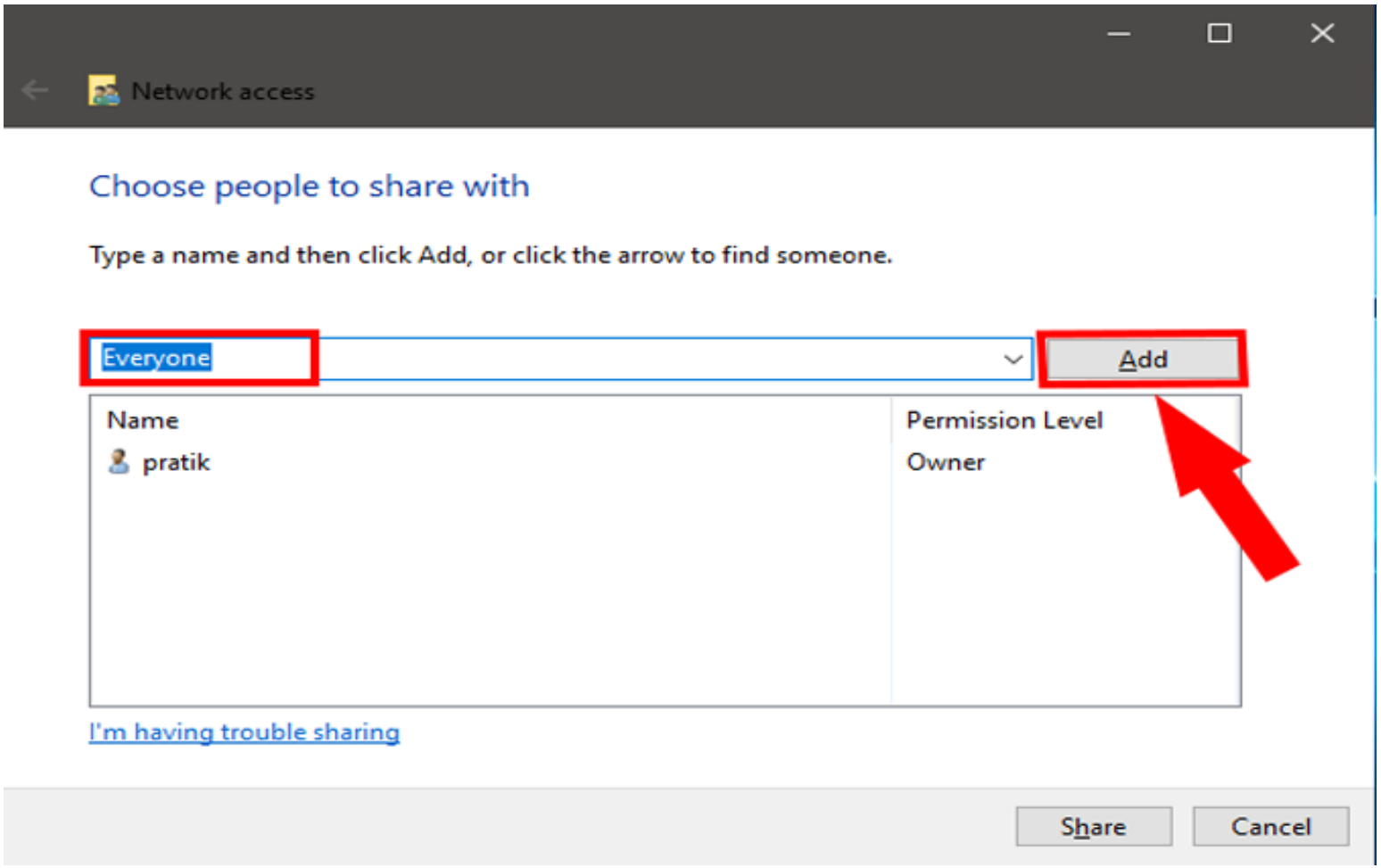
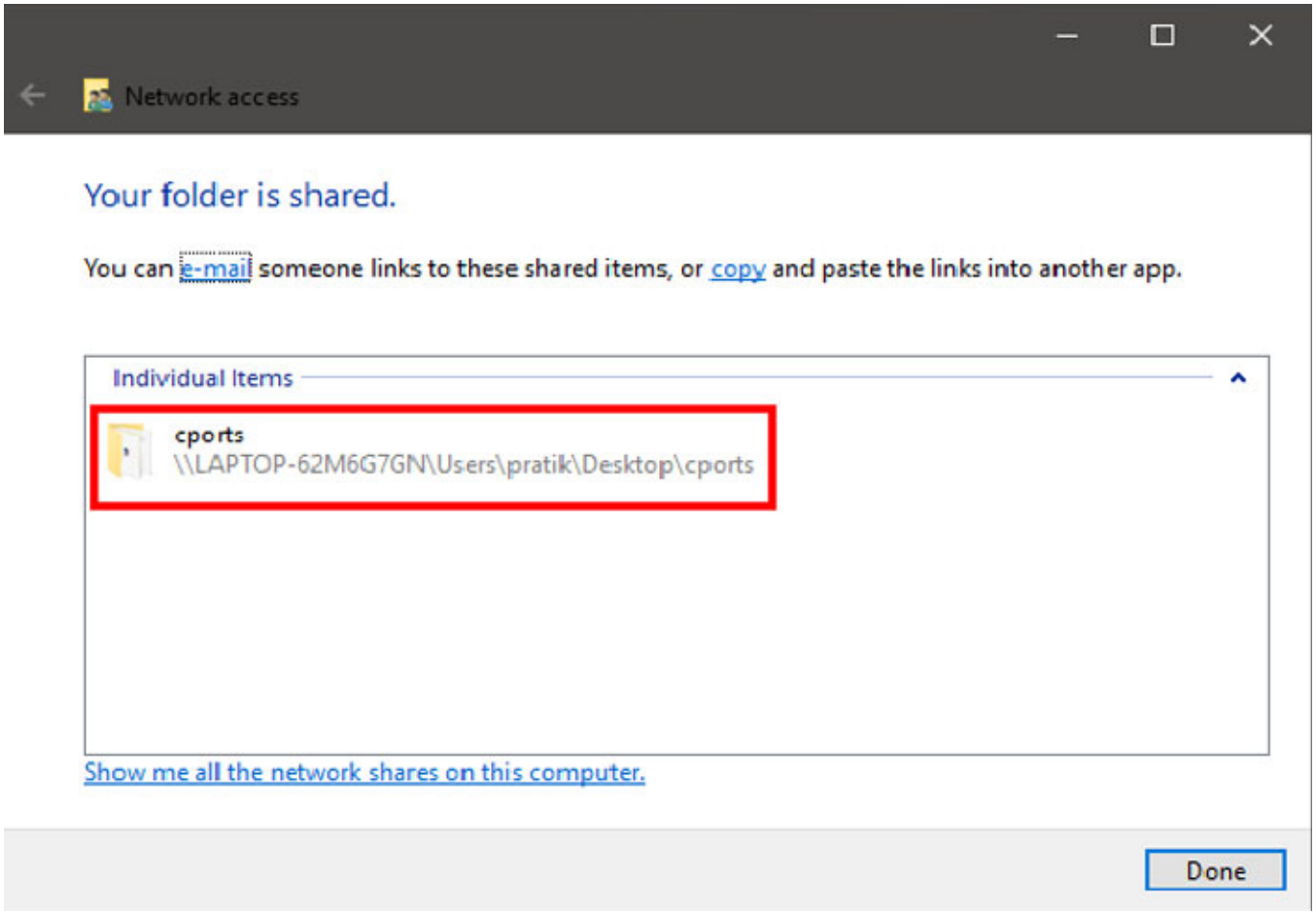


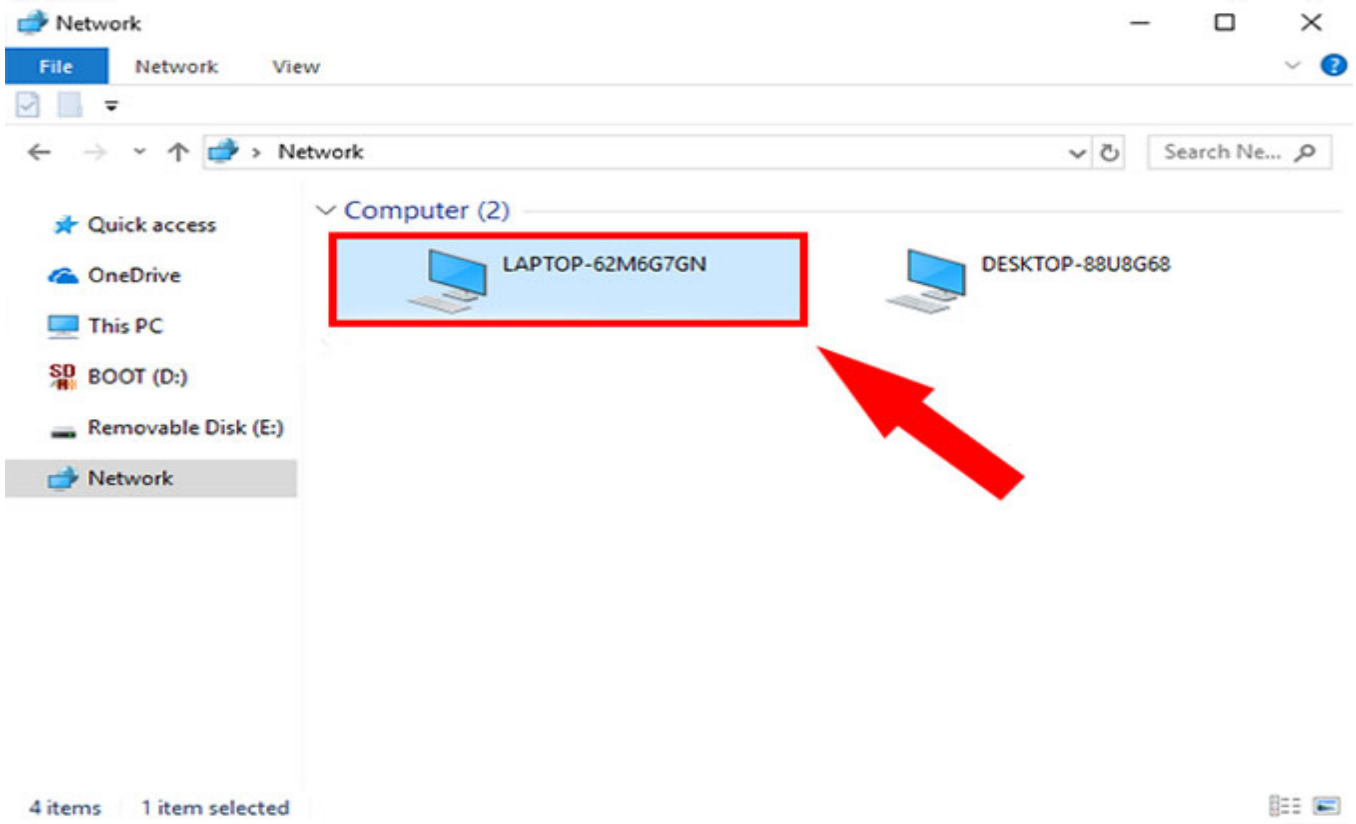
Share Files Between Two Computers Using LAN Cable

Once you have shared it, the next window will show you the network location of the folder.



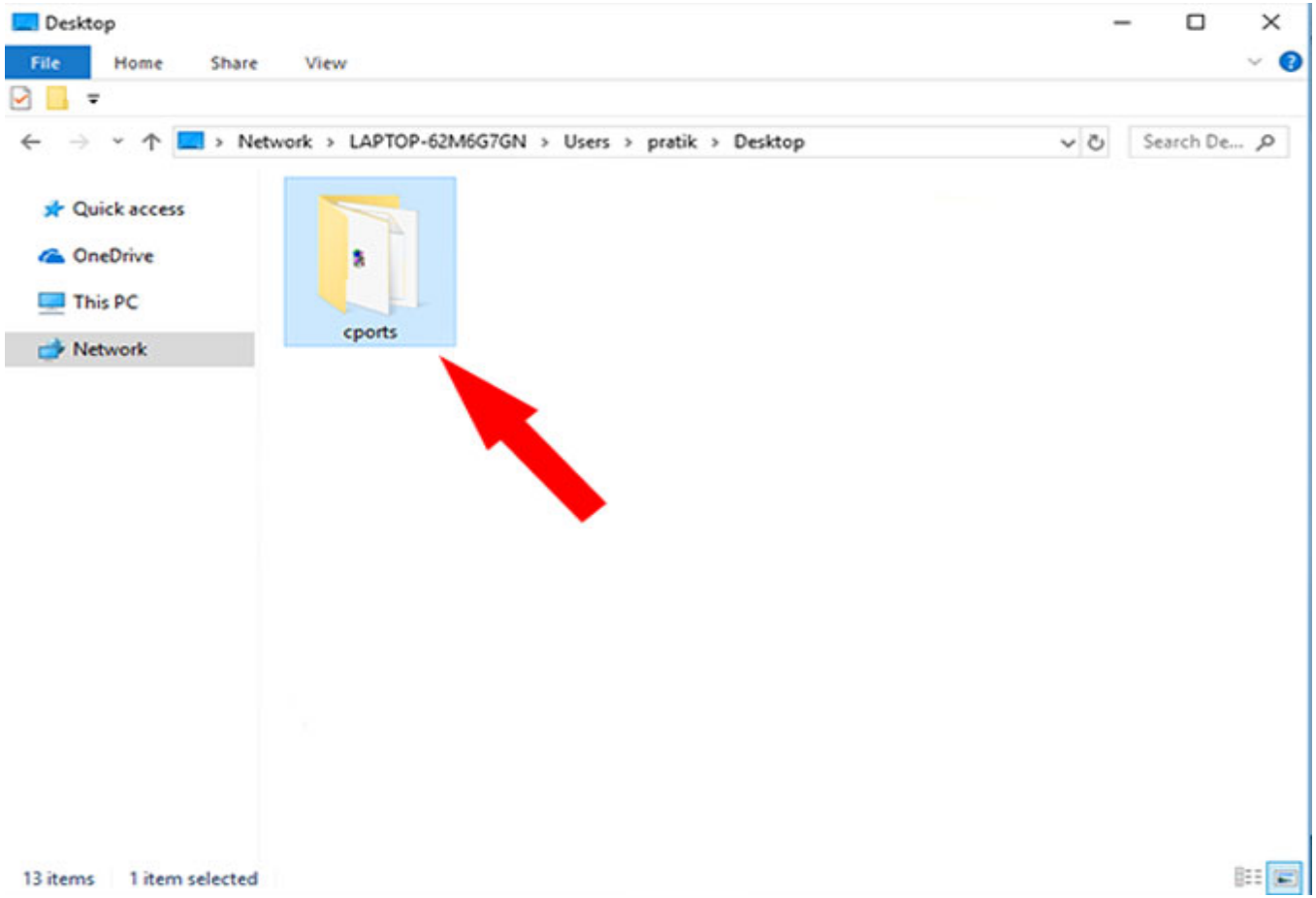
Share Files Between Two Computers Using LAN Cable

That's it. Just go back to the other PC from where you want to access the file, open the Networks panel and click on the other computer's name.



Share Files Between Two Computers Using LAN Cable

Here, you will see the folder you just shared. From there, just open the folder and transfer the files and folders as you normally do



End

End