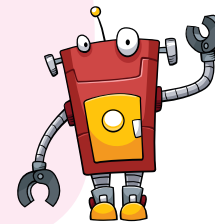




Network Basics

Learning in this chapter

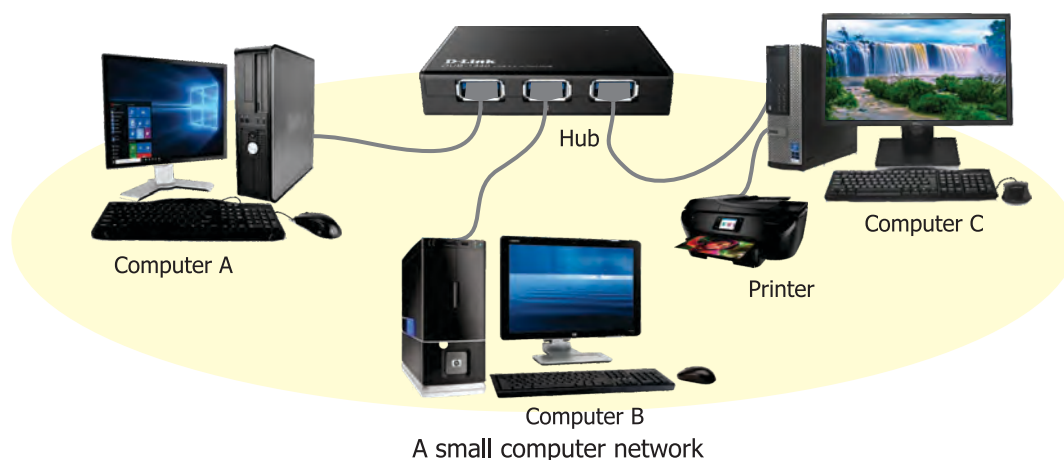
- ❁ What is a computer network?
- ❁ Need and importance of a network
- ❁ Networking components
- ❁ Types of networks
- ❁ Transmission of data in a network
- ❁ Network protocol
- ❁ Network topology
- ❁ Working in a network environment



Computer networks have shrunk the world and brought people together. They have extended the power of a computer beyond the expense of a room. Advancements in networking techniques have made a profound impact in areas of communication and learning. The Internet is an example of a computer network that spreads all across the world. The Internet is also referred to as the worldwide network of computers and it is growing at a rapid rate.

WHAT IS A COMPUTER NETWORK?

A computer network is made up of multiple connected computers and other computing devices that communicate over a wired or wireless medium to share data and other resources. “When multiple computers and other devices are interconnected through a wired or wireless medium to share data and other resources, it is called a computer network”.



In the picture given on the last page network, computers A, B and C are connected together in a network through a network device called a **hub**. Here, computers A and B can also be used to give the print command to the printer attached to the computer C.

There are different kinds of computer networks and they work in different ways. Network may be very small and simple as in a room, or they may be as complex as a global network like the Internet. We need to determine which type of network will best suit our individual or an organizations need.

Therefore we can say that a computer network is an inter-connection of two or more computers in such a way that they can communicate with each other and share data and hardware resources. Each computer in a network is called a **Node** or **workstation**. The process of connecting computers together into a network is called **Networking**.



NEED AND IMPORTANCE OF A NETWORK

The unprecedented growth of information and the need for sharing it quickly, efficiently and reliably while keeping the costs down have given a tremendous boost to computer networking. Here are some of the advantages offered by the networking of computers.

1. **Quick and Efficient Transfer of Data:** A networked environment allows faster, easier and reliable transfer to data files from one computer to the other.

DO YOU KNOW?

When two computers are not networked, data between them is shared by copying data files from one computer onto a storage device (Pen drive, DVD, CD, etc.) and then carrying the storage device to the other computer. This method of data transfer is known as the **sneaker-net**.

2. **Resource Sharing:** The hardware devices (Printers, Hard disk, CD drives, Scanners, and so on) attached to one computer in a network can be shared by all other computers in that network. A network also allows sharing of software.
3. **Saving of Money:** Since a network allows sharing of hardware and software, it saves a considerable amount of money that would otherwise be spent on buying separate hardware and software for each computer.
4. **Access to Information on Remote Computers:** The Internet allows access to information stored on remote computers. This enables us to do a number of things like booking airline and railway tickets, booking hotel accommodation, payment of electricity bills, and so on sitting on the computer in our home.
5. **Faster, Cheaper and Reliable Communication:** Some special communication software (like Google Talk and MSN Messenger) help in a faster and reliable exchange of messages between network users at a much cheaper cost.

In a computer network backups of important and crucial information may be kept on several machines. So that if one computer is out of order, information can be retrieved from another.



6. **Security:** Sensitive files and programs on a network can be password protected. Then those files can only be accessed by the authorized users (users who know the password). This ensures security of data and sensitive information.

Activity

State whether these statements are 'True' or 'False'.

1. Two or more computers connected together to share information, form a network. _____
2. Networking makes a single hardware device available to all networked computers. _____
3. Transfer of data through a network is also called sneaker-net. _____
4. Networking allows sharing of information but at a very high cost. _____
5. Google Talk is a networking software. _____

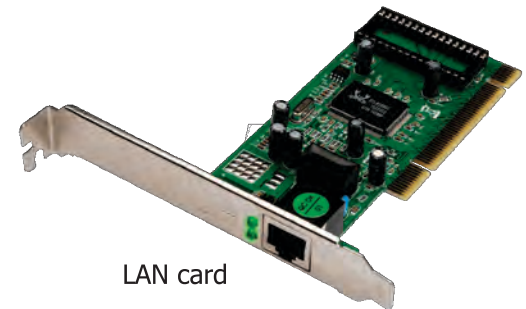


NETWORKING COMPONENTS

Various devices that help us to connect the computers and form a computer network are known as network devices. Let us learn about some commonly used network devices.

Local Area Network (LAN) Card

A **Local Area Network Card** allows a computer to connect to a network through a wired or wireless medium. Each computer in a network must have a LAN card inside it. In fact, any device that is to be connected to a network like printer, scanner, and so on must have a LAN card inside it.



LAN card

Hub and Switch

Hubs and **Switches** are 'boxes' to which computers, printers, and other network devices are connected. Their functions is to direct information around the network, facilitating communication between all the connected devices. A switch is often termed as a 'smart hub'. Hubs are outdated and are seldom used for new installations.



A hub with 8 ports



Two switches each having 24 ports



Router

A **Router** is a networking device used to connect and facilitate transfer of information between two networks. Routers are located at the Gateways where two networks connect. In simple words we can say that a router connects two networks.



Router



Modem

Modem stands for **modulator-demodulator**.

It is an electronic device that is used to connect a computer to the Internet via a telephone line or wireless medium. A Modem converts outgoing digital data from a computer into analog signals so that they can be transmitted via a telephone line. It converts analog signals received from a telephone line into digital data so that computer could understand and process it.

External Modems are connected to the computer externally while Internal Modems are built into a computer.



External modem



Internal modem



TYPES OF NETWORKS

As computers gained importance, the need for networking also increased. Many types of networks came into existence ranging from small networks that connect computers kept in households to large networks that connect computers of large business organizations spread across cities and countries.

Based on the geographical area they cover, networks can be classified into three main types – **Local Area Networks (LANs)**, **Metropolitan Area Networks (MANs)**, **Wide Area Network (WAN)**.

LAN

A **Local Area Network** or **LAN** is a network formed by the inter-connection of computers within a room, building or within a campus over a short distance. Often LAN is a private network belonging to an individual/organization. Because LANs are small networks, generally cables or low power radio waves are used for the connections. The computers in a LAN are mostly connected through Ethernet cables. The data transmission speed in typical LANs ranges from 10 Mbps to 100 Mbps.



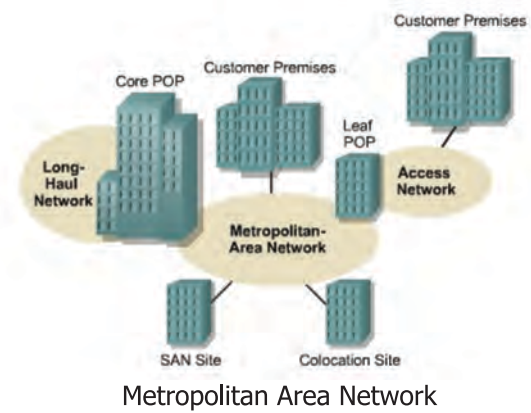
Local Area Network



MAN

When the computers of two or more offices of a company in different areas of a city are connected together, it is called a **Metropolitan Area Network** or **MAN**.

Metropolitan Area Network is larger than a Local Area Network. A MAN is typically owned and operated by a single organization, by a government body or large company. For example, a cable TV network.



WAN

A **Wide Area Network** or **WAN** covers the largest area. It connects computers placed in different cities, countries and even on different continents. The Internet (the biggest network of computers in the world) is an example of a WAN.

Internet also connects to the International Space Station which makes it the first off planet network in the world. The data transmission speed in a WAN is 1 Mbps.



Remember

- Personal Area Network (PAN) is a type of computer network used for data transmission among personal devices belonging to an individual like computer, smart phones, wearable computers and Personal Digital Assistants, and so on.



TRANSMISSION OF DATA IN A NETWORK

Data is transmitted over a network in the form of signals. To make the signals travel from one computer to another, a communication channel is required. This channel can be set up using both wired and wireless networking technologies. The choice of technology for setting up a network depends on the type of data to be transmitted, the speed of transmission and the transmission distance.

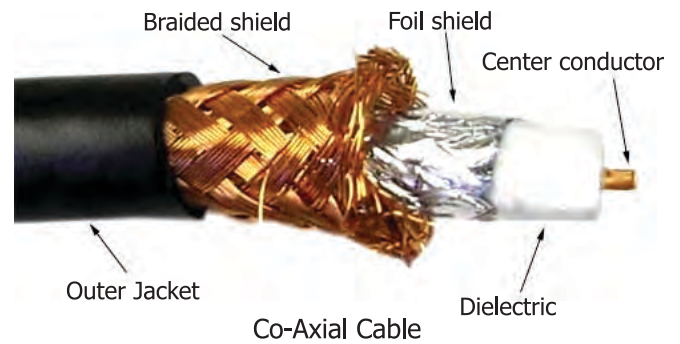
Wired Networking Technology

In **wired networking technology**, data is transmitted through a physical medium such as a wire, hence the name wired. Cable TV networks and telephone networks are examples of wired networks. A Local Network where computers are connected via wires is also an example of a wired network. Different types of wires or cables are used for connecting computers in a wired network. The most important ones are *twisted pair cables*, *coaxial cables* and *fibre optic cables*. Let us learn about them.



Co-Axial Cable

A **coaxial cable** is the same cable that is used for transmitting TV signals from an antenna to the TV sets. It consists of a copper wire core surrounded by insulation, which again is surrounded by an outer covering of a conducting braided wire. The whole apparatus is enclosed in an outer shield.



The core of a coaxial cable carries data signals. The braided wire mesh absorbs stray electrical signals from the adjacent wires to keep the data signals conducted by the core disturbance free. These cables can conduct data signals over long distances with a fast speed and, hence, are used in setting up both small and big LANs.

Ethernet Cable

An **Ethernet cable** is one of the most popular type of network cable used in wired networks. Ethernet cables connect devices on local area networks such as Computers, Routers, Hubs and Switches and so on. Each end of an Ethernet cable has a **jack** with 8 pins, which plugs into the Ethernet port of two different devices to connect them. There are two types of Ethernet cables—*straight through cables and crossover cables*.

- A **Straight through cable** is used to connect a computer to a hub or a switch.
- A **crossover cable** is a special type of cable that is used to connect two computers, directly.

Ethernet cables provide high speed data transmission at a reasonably low cost and, hence, are very popular for setting up a wired network.



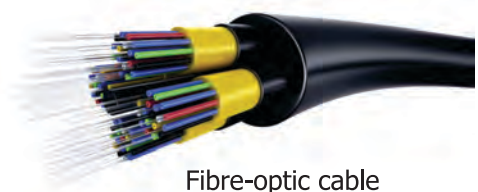
Ethernet Cable



Ethernet cables plug into the Ethernet port

Fiber-Optic Cable

A Fiber-optic cable is a technology that uses glass (or plastic) threads (fibres) to transmit data. A fibre optic cable consists of a bundle of glass threads, each of which is capable of transmitting messages modulated onto light waves.



Fibre-optic cable

Fibre-optic cables have several advantages over traditional metal wires:



- Fibre-optic cables have a much greater bandwidth than metal wires. This means that they can carry more data.
 - Fibre optic cables are less prone to interference from electrical devices than metal wires.
 - Fibre optic cables are much thinner and lighter than metal wires.
 - Data can be transmitted in the digital form. It need not be converted into the analog form.
- The main disadvantage of fibre optic is that these cables are expensive to install. In addition, they are more fragile than wire and are difficult to splice.

Fibre-optic is a particularly popular technology for local-area networks. In addition, telephone companies are steadily replacing traditional telephone lines with fibre-optic cables. In future, almost all communications will employ fibre optics.

Wireless Networking Technology

The **wireless networking technology**, as the name suggests uses no wires or physical media for connecting computers. It, instead, uses electromagnetic waves (like infrared, microwave and radio waves) for transmission of data. There are different wireless technologies available these days to set up a network. The choice of a technology depends on distance and speed of transmission required. Let us learn about some wireless networking technologies that are commonly used these days.

Infrared Technology

Infrared Technology allows computing devices to communicate via short-range wireless signals. With infrared, computers can transfer files and other digital data bi-directionally. The infrared transmission technology used in computers is similar to that used in consumer product remote control units like television remotes and game remotes.



Infrared Wireless Communication

Unlike Wi-Fi and Bluetooth technologies, infrared network signals cannot penetrate walls or other obstructions and work only in the direct “line of sight.”

Bluetooth Technology

Bluetooth is a wireless protocol used to wirelessly link phones, computers and other network devices over short distances, typically up to 30 feet (10 metres). Compared to Wi-Fi, Bluetooth networking is much slower, more limited in range, and supports fewer devices. Some devices using this technology are Bluetooth Printers, Bluetooth keyboards, Bluetooth cameras, Bluetooth Mouse, Bluetooth headsets and Bluetooth mobiles.



A Bluetooth enabled keyboard



Wireless LANs

A **Wireless Local Area Network** or **WLAN** links devices over a short distance via a wireless technology that uses *radio* waves to establish connections. Each computer connected into a WLAN has a small antennae in its *Network Interface Card*. Data signals transmitted by these antennae, are picked up and routed by a wireless network switch known as the *Access Point*.

With the increasing use of laptops and notebook computers, WLANs have become very popular. This is because they make it possible for users to move around within a local coverage area and still be connected to the network.

A wireless technology known as **Wi-Fi** or **Wireless Fidelity** is used for setting up high speed WLANs over a distance of upto 30 metres.



Wireless MANs

A **Wireless MAN** or a **Wireless Metropolitan Area Network** is a type of wireless network that connects several wireless LANs over a city or metropolitan area. A wireless technology known as the *WiMAX* or *Wireless Interoperability for Microwave Access* is used for setting up wireless MANs within a radius of 50 km.

Wireless WANs

A **Wireless WAN** or a **Wireless Wide Area Network** is a network that connects computers over a large geographical area. These networks may be used for connecting various branch offices of a business organizations situated in different cities or countries.



Remember

- **Global System for Mobile Communication** or **GSM** is a wireless technology that is used by most mobile phones to communicate with each other.
- **Infrared Communication** is a wireless technology that allows mobile phones, laptops and other digital devices to communicate with each other and transfer data over short distances.
- **Bluetooth** is also a wireless technology that allows a bluetooth-enabled device communicate with other bluetooth-enabled digital devices.

Activity

Answer the following questions.

1. What is the full form of Wi-Fi? _____
2. Which technology is used to set wireless MANs? _____
3. Which type of cable provides the highest bandwidth? _____
4. Which wireless technology allows us to link phones, computer and other devices over a short range? _____
5. Which is the most popular type of cable for setting up a LAN? _____





NETWORK PROTOCOL

A network protocol defines rules for communication between network devices.

Internet Protocol (IP)

It is the protocol which is used to send data from one computer to another on the Internet. Each computer on the Internet has atleast one IP address that uniquely identifies it from all other computers on the Internet. When you send or receive data, the message gets divided in the form of packets. These packets contain both the sender's and the receiver's IP address. The Internet Protocol just delivers them.

Transmission Control Protocol (TCP)

It is the protocol that puts the packets back in the right order.

HyperText Transfer Protocol (HTTP)

It is a set of rules for transferring files (text, graphic, images, sound, videos and other multimedia files) on the World Wide Web. As soon as a user opens the web browser, the user is indirectly making use of the HTTP.

HTTP is an application protocol that runs on top of the TCP/IP protocols.



Remember

- Transmission Control Protocol and Internet Protocol are together known as TCP/IP.



NETWORK TOPOLOGY

Computers in a network have to be connected in some logical manner. The layout pattern of the interconnections between computers in a network is called **network topology**. Network topology is also referred to as 'network architecture'. Network topology determines the data paths, which may be used between any pair of nodes in the network.

There are three basic topologies :

- Bus Topology** : Bus topology uses one main cable called **bus** to which all nodes are directly connected. The bus act as a backbone for the network. In bus topology, a bus is a single continuous cable. Transmission from any node travels the length of the bus in both directions and can be received by all the other nodes in the network. The bus has **terminators** at either ends which absorbs the signal, removing it from the bus.



Bus Topology

Advantages of Bus Topology

1. It is easy to connect a computer or peripheral device.



2. The cable requirement are relatively small, resulting in lower cost.
3. Failure of one node does not affect the rest of network.

Disadvantages of Bus Topology

1. If the main cable breaks, the entire network goes down.
2. It offers limited flexibility for change.
3. It is difficult to troubleshoot.

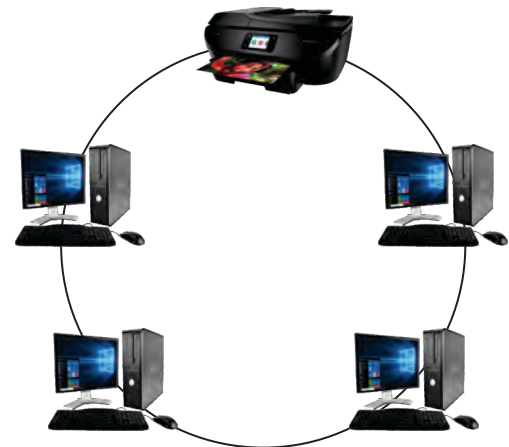
(ii) **Ring Topology** : In ring topology, the computers in the network are connected in a **closed ring** and the data travels in one direction. Each computer is directly connected to the next computer, forming a single pathway for signals through the network.

Advantages of Ring Topology

1. This type of network is easy to install and manage.
2. If there's a problem in the network, it is easy to pin point which connection is defective.

Disadvantages of Ring Topology

1. It requires more complicated control software.
2. Failure of one node results in the failure of the entire network.



Ring Topology

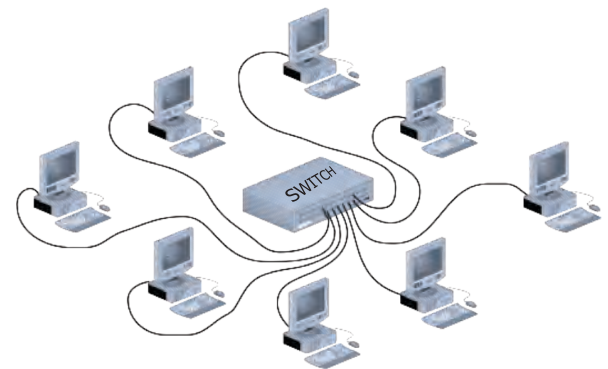
(iii) **Star Topology** : In star topology, each computer is connected to a central hub called **switch** using a point-to-point connection. The central hub can be a computer server that manages the network or it can be a much simpler device that only makes the connections between computers over the network possible.

Advantages of Star Topology

1. Star topology has low startup cost.
2. It is easy to add new nodes to the network.
3. If one connection between a computer and switch fails, the other connections remain intact.

Disadvantage of Star Topology

1. The system crucially depends on the central switch. If it fails, the entire network goes down.



Star topology



POINTS to Recall

- A network is the inter-connection of two or more computers to facilitate sharing of information and other resources.
- On the basis of geographical area, networks can be classified into three main types — LAN, MAN and WAN.
- The things you need to set up a basic network are a computer with network interface cards, connecting media, hub and a network operating system.
- Wireless networks are computer networks established without using wires.
- Some of the technologies used for setting a wireless network are Bluetooth, Infrared, Wi-Fi, WiMax and so on.
- A network protocol defines rules for communication between network devices.
- The art of connecting different computers in a network is known as topology.



TERMS to Learn

- **Network** : Inter-connection of two or more computers for sharing information.
- **Networking** : Process of connecting computers into a network.
- **Sneaker-net** : Transfer of data between computers using portable storage devices like pen drives and CDs.
- **HUB** : A networking device that connects computers in a LAN and help with the transfer of data between them.
- **Switch** : An advanced type of hub used to connect computers in a Local Area Network.
- **Router** : A networking device used to connect two networks.



Multiple Choice Questions

A. Tick (✓) the correct answer.

- What is a computer in a LAN called?

a. Workstation	<input type="radio"/>	b. Server	<input type="radio"/>	c. Node	<input type="radio"/>
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- Which technology is generally used for setting up wireless LANs

a. WiMAX	<input type="radio"/>	b. Wi-Fi	<input type="radio"/>	c. GSM	<input type="radio"/>
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- Which wireless technology is used for connectly digital devices over short distances?

a. GSM	<input type="radio"/>	b. Infrared	<input type="radio"/>	c. NIC	<input type="radio"/>
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3. In _____ topology, the nodes are connected in the shape of closed loop.
 - a. BUS
 - b. STAR
 - c. RING
4. Which network connects computers placed in different areas of a city?
 - a. LAN
 - b. MAN
 - c. WAN
5. A network _____ defines rules for communication between network devices.
 - a. Protocol
 - b. Topology
 - c. MAN

B. Fill in the blanks with the help of given hints.

1. _____ technology allows computing devices to communicate via short-range wireless signals.
2. The _____ is a networking device that connects computers in a Local Area Network.
3. A _____ has a port where the network cable plugs in.
4. Computers on a university campus are connected by a _____.
5. A _____ topology has minimal line cost.
6. A wireless technology known as _____.

HINTS: MAN, Hub, NIC, Infrared, Star, Wi-Fi

C. Write 'T' for True statements and 'F' for False statements in the .

1. A computer network sometimes can also be called an electronic network.
2. A Wide Area Network (WAN) is the same as the Internet.
3. Each computer in a LAN is called a node.
4. A protocol is needed in the interactions among networked computers.
5. Routers are located at the Gateways where two networks connect.
6. Network cards are used to physically attach a computer to a network.

D. Write full forms of the following.

- | | |
|-----------------|-------------------|
| (i) Wi-Fi _____ | (iv) WAN _____ |
| (ii) MAN _____ | (v) HTTP _____ |
| (iii) NIC _____ | (vi) TCP/IP _____ |

E. Very Short Answer Questions.

1. Which device is used to connect one network to another network?

2. Name the device that converts analog signals to digital signals and vice-versa.

3. Which device is used to connects computer and other devices to form a network?



4. Name the world's largest computer network.

F. Short Answer Questions.

1. What is a node?

2. Define Protocol.

3. What is a topology?

4. What is Modem?

5. Name the types of network on the basis of geographical area.

6. What is Infrared technology?

G. Long Answer Questions.

1. What is a computer network? Write any two benefits of using it.

2. Differentiate between LAN and WAN.

3. What is meant by Ethernet Cable?

4. Write the advantages and disadvantages of the following :

a. Bus topology

b. Star topology

c. Ring topology

5. What is a wireless network? How is a Network Interface Card in a wired LAN different from one used in a wireless LAN?



Activity Time

1. Make a chart showing the working of the Internet technology.
2. Collect the information about Hubs and switches using Internet. Prepare a chart to describe the difference between them.

Practical 1: Setting up a HomeGroup in Windows 8.

If you have two or more computers or Windows devices in your home you can connect them together to share files and other resources like printers, using the HomeGroup feature.

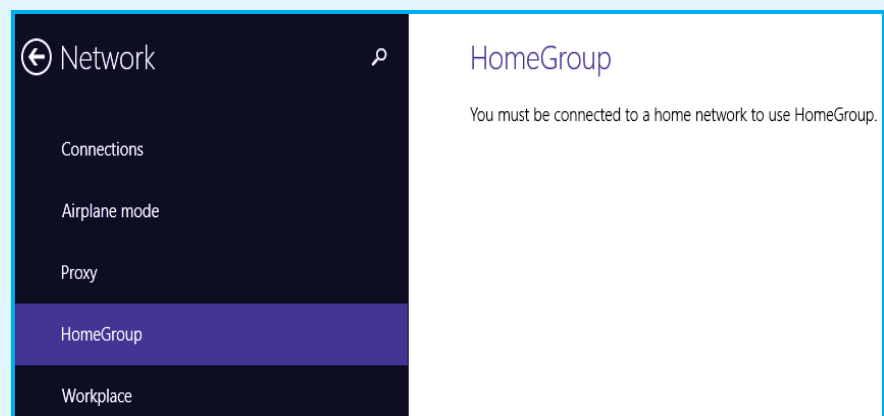
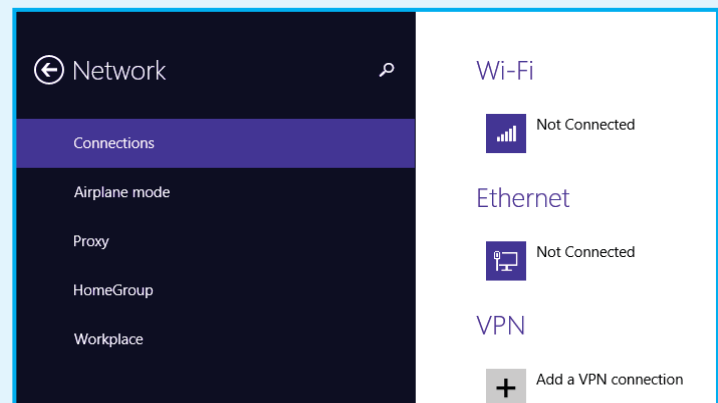
1. Open the **PC settings app** by clicking on its icon in the Tools group on the Apps view screen.
2. Click on the **Network** option in the PC settings pane.
3. Click on the **HomeGroup** option in the Network pane.
4. Click on the **Create** button under HomeGroup section in the right pane.

...Windows creates a homegroup and asks you to choose the things such as documents, music, pictures, videos and printers to be shared with the HomeGroup computers/devices.

5. Turn the buttons ON/OFF as per your requirements.
6. Note down the password (a mixture of numbers and letters) of your HomeGroup network.

...This password is needed for other users in your HomeGroup network to access to the shared resources.

7. To leave the created HomeGroup click on the **Leave** button.
8. Close the app by clicking on the Close button.



Remember

- You can also use the Control Panel to set up a homegroup in Windows 8.