# I. READING PRACTICE

**[](http://ezinearticles.com/?expert=William_King)**

**1. Role of Information Technology in Growth of Business**

By [*William King*](http://ezinearticles.com/?expert=William_King)

Information technology (IT) refers to the management and use of information using computer-based tools. It includes acquiring, processing, storing, and distributing information. Most commonly it is a term used to refer to business applications of computer technology, rather than scientific applications. The term is used broadly in business to refer to anything that ties into the use of computers.

Mostly businesses today create data that can be stored and processed on computers. In some cases the data must be input to computers using devices such as keyboards and scanners. In other cases the data might be created electronically and automatically stored in computers.

Small businesses generally need to purchase software packages, and may need to contract with IT businesses that provide services such as hosting, marketing web sites and maintaining networks. However, larger companies can consider having their own IT staffs to develop software, and otherwise handle IT needs in-house. For instance, businesses working with the federal government are likely to need to comply with requirements relating to making information accessible.

Theconstant upgrade in information technology, along with increasing global competition, is adding difficulty and hesitation of several orders of scale to the business and trade. One of the most widely discussed areas in recent business literature is that of new organizational network structures that hold survival and growth in an environment of growing complexity.

Effective implementation of information technology would decrease liability by reducing the cost of expected failures and increase flexibility by reducing the cost of adjustment. The businesses reaction to the environment remains to be the vital determinant for its effectiveness. The capabilities and flexibilities of computer-communication systems make them gradually more appropriate to businesses by being able to respond to any specific information or communication requirement.

Information Technology is having impact on all trade industries and businesses, in service as well as in manufacturing. It is affecting workers at all levels of organizations, from the executives to middle management and clerks. Information technology is increasingly becoming a basic factor of all types of technologies such as craft, engineering, routine, and non-routine.

The advances in Information Technology would result in remarkable decline in the costs of synchronization that would lead to new, concentrated business structures. It enables the business to respond to the new and urgent competitive forces by providing effective management of interdependence.

In the near future businesses would be facing a lack and a redundancy of information called information glut. To solve the information-glut companies will need to introduce methods for selective thinning out of information. Improvements in telecommunications will make it easier to control business units dispersed over different parts of the world. Advances in telecommunications, would result in increased distance-communication. Indirect communication would be preferred for well-structured information for routine, preprogrammed and decision processes.

*William King is the director of* [*UK Wholesale*](http://www.uk-wholesaler.co.uk/)*,* [*UK Wholesalers*](http://www.wholesalepages.co.uk/) *and* [*Dropshippers Directory*](http://www.aidandtrade.com/)*. He has 18 years of experience in the marketing and trading industries and has been helping retailers and startups with their product sourcing, promotion, marketing and supply chain requirements.*

**Terminal Questions**

**Explain the use of the following hardware components in multimedia.**

1. What is the role of IT in business?

2. How is the data input in such information?

3. How small and large companies cover their needs deal with information?

4. What is the perspective of IT in the future businesses?

5. What will the companies do when the information-glut happened?

**2. THE CONCEPT OF MULTIMEDIA**

****

**INTRODUCTION**

Asthe name suggests, multimedia is a set of more than one media element used to produce a concrete and more structured way of communication. In other words multimedia is simultaneous use of data from different sources. These sources in multimedia are known as media elements. With growing and very fast changing information technology, Multimedia has become a crucial part of computer world. Its importance has realized in almost all walks of life, may it be education, cinema, advertising, fashion and what not.

Throughout the 1960s, 1970s and 1980s, computers have been restricted to dealing with two main types of data - words and numbers. But the cutting edge of information technology introduced faster system capable of handling graphics, audio, animation and video. And the entire world was taken aback by the power of multimedia.

**OBJECTIVES**

After going through this lesson you should be able to

* explain what is multimedia
* understand the importance of individual media elements
* identify different hardware components required to run a multimedia
* appreciate the impact of audio in educational presentation
* describe how visual images, graphics and audio can be added to a presentation
* enhance the capability of multimedia through interactive video impact

**WHAT IS MULTIMEDIA?**

Multimedia is nothing but the processing and presentation of information in a more structured and understandable manner using more than one media such as text, graphics, animation, audio and video. Thus multimedia products can be an academic presentation, game or corporate presentation, information kiosk, fashion-designing etc. Multimedia systems are those computer platforms and software tools that support the interactive uses of text, graphics, animation, audio, or motion video. In other words, a computer capable of handling text, graphics, audio, animation and video is called multimedia computer. If the sequence and timing of these media elements can be controlled by the user, then one can name it as *Interactive Multimedia*.

**DIFFERENT MEDIA ELEMENTS**

**(i) Text**

Inclusion of textual information in multimedia is the basic step towards development of multimedia software. Text can be of any type, may be a word, a single line, or a paragraph. The textual data for multimedia can be developed using any text editor. However to give special effects, one needs graphics software which supports this kind of job. Even one can use any of the most popular word processing software to create textual data for inclusion in multimedia. The text can have different type, size, color and style to suit the professional requirement of the multimedia software.

**(ii) Graphics**

Another interesting element in multimedia is graphics. As a matter of fact, taking into consideration the human nature, a subject is more explained with some sort of pictorial/graphical representation, rather than as a large chunk of text. This also helps to develop a clean multimedia screen, whereas use of large amount of text in a screen make it dull in presentation.

Unlike text, which uses a universal ASCII format, graphics does not have a single agreed format. They have different format to suit different requirement. Most commonly used format for graphics is .BMP or bitmap pictures. The size of a graphics depends on the resolution it is using. A computer image uses *pixel* or *dots* on the screen to form itself. And these dots or pixel, when combined with number of colors and other aspects are called resolution. Resolution of an image or graphics is basically the pixel density and number of colors it uses. And the size of the image depends on its resolution. A standard VGA (Virtual Graphics Arrays) screen can display a screen resolution of 640 ´ 480 = 307200 pixel. And a Super VGA screen can display up-to 1024 ´ 768 = 786432 pixel on the screen. While developing multimedia graphics one should always keep in mind the image resolution and number of colors to be used, as this has a direct relation with the image size. If the image size is bigger, it takes more time to load and also requires higher memory for processing and larger disk-space for storage. However, different graphics formats are available which take less space and are faster to load into the memory.

There are several graphics packages available to develop excellent images and also to compress them so that they take lesser disk-space but use higher resolution and more colors. Packages like Adobe Photo Shop, Adobe Illustrator, Paint Shop Pro etc. are excellent graphics packages. There are Graphics gallery available in CD’s (Compact Disk) with readymade images to suit almost every requirement. These images can directly be incorporated into multimedia development.

**(iii) Animation**

Moving images have an overpowering effect on the human peripheral vision. Followings are few points for its popularity.

**Showing continuity in transitions:**

Animation is a set of static state, related to each other with transition. When something has two or more states, then changes between states will be much easier for users to understand if the transitions are animated instead of being instantaneous. An animated transition allows the user to track the mapping between different subparts through the perceptual system instead of having to involve the cognitive system to deduce the **mappings.**

**Indicating dimensionality in transitions:**

Sometimes opposite animated transitions can be used to indicate movement back and forth along some navigational dimension. One example used in several user interfaces is the use of zooming to indicate that a new object is "grown" from a previous one (e.g., a detailed view or property list opened by clicking on an icon) or that an object is closed or minimized to a smaller representation. Zooming out from the small object to the enlargement is a navigational dimension and zooming in again as the enlargement is closed down is the opposite direction along that dimension.

**Illustrating change over time**

Since animation is a time-varying display, it provides a one-to-one mapping to phenomena that change over time. For example, deforestation of the rain forest can be illustrated by showing a map with an animation of the covered area changing over time.

**Multiplexing the display**

Animation can be used to show multiple information objects in the same space. A typical example is client-side image maps with explanations that pop up as the user moves the cursor over the various hypertext anchors.

**Enriching graphical representations**

Some types of information are easier to visualize with movement than with still pictures. Consider, for example, how to visualize the tool used to remove pixels in a graphics application.

**Visualizing three-dimensional structures**

As you know the computer screen is two-dimensional. Hence users can never get a full understanding of a three-dimensional structure by a single illustration, no matter how well designed. Animation can be used to emphasize the three-dimensional nature of objects and make it easier for users to visualize their spatial structure. The animation need not necessarily spin the object in a full circle - just slowly turning it back and forth a little will often be sufficient. The movement should be slow to allow the user to focus on the structure of the object.

You can also move three-dimensional objects, but often it is better if you determine in advance how best to animate a movement that provides optimal understanding of the object. This pre-determined animation can then be activated by simply placing the cursor over the object. On the other hand, user-controlled movements requires the user to understand how to manipulate the object (which is inherently difficult with a two-dimensional control device like the mouse used with most computers - to be honest, 3D is never going to make it big time in user interfaces until we get a true 3D control device).

**Attracting attention**

Finally, there are a few cases where the ability of animation to dominate the user’s visual awareness can be turned to an advantage in the interface. If the goal is to draw the user’s attention to a single element out of several or to alert the user to updated information then an animated headline will do the trick. Animated text should be drawn by a one-time animation (e.g., text sliding in from the right, growing from the first character, or smoothly becoming larger) and never by a continuous animation since moving text is more difficult to read than static text. The user should be drawn to the new text by the initial animation and then left in peace to read the text without further distraction. One of the excellent software available to create animation is Animator Pro. This provides tools to create impressive animation for multimedia development.

**Video**

Beside animation there is one more media element, which is known as video. With latest technology it is possible to include video impact on clips of any type into any multimedia creation, be it corporate presentation, fashion design, entertainment games, etc.

The video clips may contain some dialogues or sound effects and moving pictures. These video clips can be combined with the audio, text and graphics for multimedia presentation. Incorporation of video in a multimedia package is more important and complicated than other media elements. One can procure video clips from various sources such as existing video films or even can go for an outdoor video shooting.

All video available are in analog format. To make it usable by computer, the video clips are needed to be converted into computer understandable format, i.e., digital format. Both combinations of software and hardware make it possible to convert the analog video clips into digital format. This alone does not help, as the digitized video clips take lots of hard disk space to store, depending on the frame rate used for digitization. The computer reads a particular video clip as a series of still pictures called *frames*. Thus video clip is made of a series of separate frames where each frame is slightly different from the previous one. The computer reads each frame as a bitmap image. Generally there are 15 to 25 frames per second so that the movement is smooth. If we take less frames than this, the movement of the images will not be smooth. To cut down the space there are several modern technologies in windows environment. Essentially these technologies compress the video image so that lesser space is required.

However, latest video compression software makes it possible to compress the digitized video clips to its maximum. In the process, it takes lesser storage space. One more advantage of using digital video is, the quality of video will not deteriorate from copy to copy as the digital video signal is made up of digital code and not electrical signal. Caution should be taken while digitizing the video from analog source to avoid frame droppings and distortion. A good quality video source should be used for digitization.

**Currently, video is good for:**

* promoting television shows, films, or other non-computer media that traditionally have used trailers in their advertising.
* giving users an impression of a speaker’s personality.
* showing things that move. For example a clip from a motion picture. Product demos of physical products are also well suited for video.

**Audio**

Audio has a greater role to play in multimedia development. It gives life to the static state of multimedia. Incorporation of audio is one of the most important features of multimedia, which enhance the multimedia usability to its full potential. There are several types of sound, which can be used in multimedia. They are human voices, instrumental notes, natural sound and many more. All these can be used in any combination as long as they give some meaning to their inclusion in multimedia.

* There are many ways in which these sounds can be incorporated into the computer. For example;
* Using microphone, human voice can directly be recorded in a computer.
* Pre-recorded cassettes can be used to record the sound into computer.
* Instrumental sound can also be played directly from a musical instrument for recording into the computer.

The sound transmitted from these sources is of *analog* nature. To enable the computer to process this sound, they need to be digitized.

As all of us know that sound is a repeated pattern of pressure in the air and a microphone converts a sound wave into an electrical wave. The clarity of sound, the final output depends entirely on the shape and frequency of the sound wave. When digitized (recording into computer), the error in sound can be drastically reduced. Audio need to be converted into digital format to produce digitized audio in order to use them in multimedia. And these digitized sounds again can be re-converted into analog form so that the user can hear them though the speakers.

Musical Instrument Digitization Interface or MIDI provides a protocol or a set of rules, using which the details of a musical note from an instrument is communicated to the computer. But MIDI data is not digitized sound. It is directly recorded into the computer from musical instruments, whereas digitized audio is created from the analog sound. The quality of MIDI data depends upon the quality of musical instrument and the sound system. A MIDI file is basically a list command to produce the sound. For example, pressing of a guitar key can be represented as a computer command. When the MIDI device processes this command, the result will be the sound from the guitar. MIDI files occupy lesser space as compared to the digitized audio and they are editable also.

The main benefit of audio is that it provides an exclusive channel that is separate from that of the display. Speech can be used to offer commentary or help without obscuring information on the screen. Audio can also be used to provide a sense of place or mood. Mood-setting audio should employ very quiet background sounds in order not to compete with the main information for the user’s attention. Music is probably the most obvious use of sound. Whenever you need to inform the user about a certain work of music, it makes much more sense to simply play it than to show the notes or to try to describe it in words.

**1) State whether the following statements is True or False.**

(a) A computer capable of handling text, graphics, audio, animation and video is called multimedia computer.

(b) MIDI data is digitized sound.

(c) Animation can be used to emphasize the three-dimensional nature of objects.

(d) Most commonly used format for graphics is .BMP or bitmap pictures.

(e) If the sequence and timing of these multimedia elements can be controlled by the user, then one can name it as Non-Interactive Multimedia.

**3. NETWORK TOPOLOGY**

**Network topology** is the arrangement of the various elements ([links](https://en.wikipedia.org/wiki/Data_link), [nodes](https://en.wikipedia.org/wiki/Node_%28networking%29), etc.) of a [computer network](https://en.wikipedia.org/wiki/Computer_network).Essentially, it is the topological structure of a network and may be depicted physically or logically. *Physical topology* is the placement of the various components of a network, including device location and cable installation, while [*logical topology*](https://en.wikipedia.org/wiki/Logical_topology) illustrates how data flows within a network, regardless of its physical design. Distances between nodes, physical interconnections, transmission rates, or signal types may differ between two networks, yet their topologies may be identical.

An example is a [local area network](https://en.wikipedia.org/wiki/Local_area_network) (LAN): Any given node in the LAN has one or more physical links to other devices in the network; graphically mapping these links results in a geometric shape that can be used to describe the physical topology of the network. Conversely, mapping the data flow between the components determines the logical topology of the network.

## Topology

There are two basic categories of network topologies: physical topologies and logical topologies.

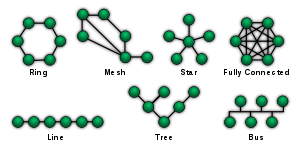
The cabling layout used to link devices is the physical topology of the network. This refers to the layout of [cabling](https://en.wikipedia.org/wiki/Structured_cabling), the locations of nodes, and the interconnections between the nodes and the cabling. The physical topology of a network is determined by the capabilities of the network access devices and media, the level of control or fault tolerance desired, and the cost associated with cabling or telecommunications circuits.

The logical topology in contrast, is the way that the signals act on the network media, or the way that the data passes through the network from one device to the next without regard to the physical interconnection of the devices. A network's logical topology is not necessarily the same as its physical topology. For example, the original [twisted pair Ethernet](https://en.wikipedia.org/wiki/Twisted_pair_Ethernet) using [repeater hubs](https://en.wikipedia.org/wiki/Repeater_hub) was a logical bus topology with a physical star topology layout. [Token Ring](https://en.wikipedia.org/wiki/Token_Ring) is a logical ring topology, but is wired as a physical star from the [Media Access Unit](https://en.wikipedia.org/wiki/Media_Access_Unit).

The logical classification of network topologies generally follows the same classifications as those in the physical classifications of network topologies but describes the path that the *data* takes between nodes being used as opposed to the actual *physical* connections between nodes. The logical topologies are generally determined by network protocols as opposed to being determined by the physical layout of cables, wires, and network devices or by the flow of the electrical signals, although in many cases the paths that the electrical signals take between nodes may closely match the logical flow of data, hence the convention of using the terms *logical topology* and *signal topology* interchangeably.

Logical topologies are often closely associated with [Media Access Control](https://en.wikipedia.org/wiki/Media_Access_Control) methods and protocols. Logical topologies are able to be dynamically reconfigured by special types of equipment such as [routers](https://en.wikipedia.org/wiki/Router_%28computing%29) and switches.

The study of network topology recognizes eight basic topologies: ***point-to-point, bus, star, ring or circular, mesh, tree, hybrid, or daisy chain.***

[](https://en.wikipedia.org/wiki/File:NetworkTopologies.svg)

***Diagram of different network topologies***

### Point-to-point

The simplest topology with a dedicated link between two endpoints. Switched [point-to-point](https://en.wikipedia.org/wiki/Point-to-point_%28telecommunications%29) topologies are the basic model of conventional [telephony](https://en.wikipedia.org/wiki/Telephony). The value of a permanent point-to-point network is unimpeded communications between the two endpoints. The value of an on-demand point-to-point connection is proportional to the number of potential pairs of subscribers and has been expressed as [Metcalfe's Law](https://en.wikipedia.org/wiki/Metcalfe%27s_Law).

1. **Permanent (dedicated)**

Easiest to understand, of the variations of point-to-point topology, is a point-to-point [communications channel](https://en.wikipedia.org/wiki/Channel_%28communications%29) that appears, to the user, to be permanently associated with the two endpoints. A child's [tin can telephone](https://en.wikipedia.org/wiki/Tin_can_telephone) is one example of a *physical dedicated* channel.

Within many [switched telecommunications systems](https://en.wikipedia.org/wiki/Circuit_switching), it is possible to establish a permanent circuit. One example might be a telephone in the lobby of a public building, which is programmed to ring only the number of a telephone dispatcher. "Nailing down" a switched connection saves the cost of running a physical circuit between the two points. The resources in such a connection can be released when no longer needed, for example, a television circuit from a parade route back to the studio.

1. **Switched:**

Using [circuit-switching](https://en.wikipedia.org/wiki/Circuit-switching) or [packet-switching](https://en.wikipedia.org/wiki/Packet-switching) technologies, a point-to-point circuit can be set up dynamically and dropped when no longer needed. This is the basic mode of conventional telephony.

### [D:\UMK\HANDOUT N RPKPS TI UMK\journal IT\Network topology - Wikipedia, the free encyclopedia_files\220px-BusNetwork.svg.png](https://en.wikipedia.org/wiki/File:BusNetwork.svg)Bus (Bus Networking)

**Bus network topology**

In local area networks where bus topology is used, each node is connected to a single cable by the help of interface connectors. This central cable is the backbone of the network and is known as the bus (thus the name). A signal from the source travels in both directions to all machines connected on the bus cable until it finds the intended recipient. If the machine address does not match the intended address for the data, the machine ignores the data. Alternatively, if the data matches the machine address, the data is accepted. Because the bus topology consists of only one wire, it is rather inexpensive to implement when compared to other topologies. However, the low cost of implementing the technology is offset by the high cost of managing the network. Additionally, because only one cable is utilized, it can be the [single point of failure](https://en.wikipedia.org/wiki/Single_point_of_failure).

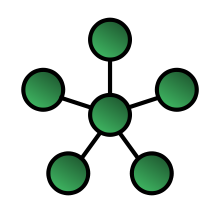
1. **Linear bus**

The type of network topology in which all of the nodes of the network are connected to a common transmission medium which has exactly two endpoints (this is the 'bus', which is also commonly referred to as the [backbone](https://en.wikipedia.org/wiki/Backbone_network), or [trunk](https://en.wikipedia.org/wiki/Trunk_%28telecommunications%29)) – all [data](https://en.wikipedia.org/wiki/Data) that is [transmitted](https://en.wikipedia.org/wiki/Transmitted) between nodes in the network is transmitted over this common transmission medium and is able to be [received](https://en.wikipedia.org/wiki/Receiver_%28Information_Theory%29) by all nodes in the network simultaneously.

**Note:** When the electrical signal reaches the end of the bus, the signal is reflected back down the line, causing unwanted interference. As a solution, the two endpoints of the bus are normally terminated with a device called a [terminator](https://en.wikipedia.org/wiki/Electrical_termination) that prevents this reflection.

1. **Distributed bus**

The type of network topology in which all of the nodes of the network are connected to a common transmission medium which has more than two endpoints that are created by adding branches to the main section of the transmission medium – the physical distributed bus topology functions in exactly the same fashion as the physical linear bus topology (i.e., all nodes share a common transmission medium).

[](https://en.wikipedia.org/wiki/File:StarNetwork.svg)

### Star (Star Networking)

***Star network topology***

In local area networks with a star topology, each network host is connected to a central hub with a point-to-point connection. So it can be said that every computer is indirectly connected to every other node with the help of the hub. In Star topology, every node (computer workstation or any other peripheral) is connected to a central node called hub, router or switch. The switch is the server and the peripherals are the clients. The network does not necessarily have to resemble a star to be classified as a star network, but all of the nodes on the network must be connected to one central device. All traffic that traverses the network passes through the central hub. The hub acts as a [signal repeater](https://en.wikipedia.org/wiki/Repeater). The star topology is considered the easiest topology to design and implement. An advantage of the star topology is the simplicity of adding additional nodes. The primary disadvantage of the star topology is that the hub represents a single point of failure.

1. **Extended star**

A type of network topology in which a network that is based upon the physical star topology has one or more repeaters between the central node and the peripheral or 'spoke' nodes, the repeaters being used to extend the maximum transmission distance of the point-to-point links between the central node and the peripheral nodes beyond that which is supported by the transmitter power of the central node or beyond that which is supported by the standard upon which the physical layer of the physical star network is based.

If the repeaters in a network that is based upon the physical extended star topology are replaced with hubs or switches, then a hybrid network topology is created that is referred to as a physical hierarchical star topology, although some texts make no distinction between the two topologies.

1. **Distributed Star**

A type of network topology that is composed of individual networks that are based upon the physical star topology connected in a linear fashion – i.e., 'daisy-chained' – with no central or top level connection point (e.g., two or more 'stacked' hubs, along with their associated star connected nodes or 'spokes')

### [D:\UMK\HANDOUT N RPKPS TI UMK\journal IT\Network topology - Wikipedia, the free encyclopedia_files\220px-RingNetwork.svg.png](https://en.wikipedia.org/wiki/File:RingNetwork.svg)Ring (Ring networking)

***Ring network topology***

A network topology is set up in a circular fashion in such a way that they make a closed loop. This way data travels around the ring in one direction and each device on the ring acts as a repeater to keep the signal strong as it travels. Each device incorporates a receiver for the incoming signal and a transmitter to send the data on to the next device in the ring. The network is dependent on the ability of the signal to travel around the ring. When a device sends data, it must travel through each device on the ring until it reaches its destination. Every node is a critical link. In a ring topology, there is no server computer present; all nodes work as a server and repeat the signal. The disadvantage of this topology is that if one node stops working, the entire network is affected or stops working.

### Mesh (Mesh networking)

The value of fully meshed networks is proportional to the exponent of the number of subscribers, assuming that communicating groups of any two endpoints, up to and including all the endpoints, is approximated by [Reed's Law](https://en.wikipedia.org/wiki/Reed%27s_Law).

#### [D:\UMK\HANDOUT N RPKPS TI UMK\journal IT\Network topology - Wikipedia, the free encyclopedia_files\220px-NetworkTopology-FullyConnected.png](https://en.wikipedia.org/wiki/File:NetworkTopology-FullyConnected.png)Fully connected network

***Fully connected mesh topology***

In a *fully connected network*, all nodes are interconnected. (In [graph theory](https://en.wikipedia.org/wiki/Graph_theory) this is called a [complete graph](https://en.wikipedia.org/wiki/Complete_graph).) The simplest fully connected network is a two-node network. A fully connected network doesn't need to use [packet switching](https://en.wikipedia.org/wiki/Packet_switching) or [broadcasting](https://en.wikipedia.org/wiki/Broadcasting_%28networks%29). However, since the number of connections grows quadratically with the number of nodes:

c= \frac{n(n-1)}{2}.\,

This makes it impractical for large networks.

#### [D:\UMK\HANDOUT N RPKPS TI UMK\journal IT\Network topology - Wikipedia, the free encyclopedia_files\220px-NetworkTopology-Mesh.svg.png](https://en.wikipedia.org/wiki/File:NetworkTopology-Mesh.svg)Partially connected network

***Partially connected mesh topology***

In a partially connected network, certain nodes are connected to exactly one other node; but some nodes are connected to two or more other nodes with a point-to-point link. This makes it possible to make use of some of the redundancy of mesh topology that is physically fully connected, without the expense and complexity required for a connection between every node in the network.

### Hybrid

Hybrid networks combine two or more topologies in such a way that the resulting network does not exhibit one of the standard topologies (e.g., bus, star, ring, etc.). For example, a [tree network](https://en.wikipedia.org/wiki/Tree_network) (or *star-bus network*) is a hybrid topology in which [star networks](https://en.wikipedia.org/wiki/Star_network) are interconnected via [bus networks](https://en.wikipedia.org/wiki/Bus_network). However, a tree network connected to another tree network is still topologically a tree network, not a distinct network type. A hybrid topology is always produced when two different basic network topologies are connected.

A *star-ring* network consists of two or more ring networks connected using a [multistation access unit](https://en.wikipedia.org/wiki/Media_Access_Unit) (MAU) as a centralized hub.

Snowflake topology is a star network of star networks.

Two other hybrid network types are *hybrid mesh* and *hierarchical star*.

### Daisy chain

Except for star-based networks, the easiest way to add more computers into a network is by [daisy-chaining](https://en.wikipedia.org/wiki/Daisy_chain_%28electrical_engineering%29), or connecting each computer in series to the next. If a message is intended for a computer partway down the line, each system bounces it along in sequence until it reaches the destination. A daisy-chained network can take two basic forms: linear and ring.

* A [**linear topology**](https://en.wikipedia.org/wiki/Linear_bus_topology) puts a two-way link between one computer and the next. However, this was expensive in the early days of computing, since each computer (except for the ones at each end) required two receivers and two transmitters.
* By connecting the computers at each end, a [**ring topology**](https://en.wikipedia.org/wiki/Ring_topology) can be formed. An advantage of the ring is that the number of transmitters and receivers can be cut in half, since a message will eventually loop all of the way around. When a [node](https://en.wikipedia.org/wiki/Node_%28networking%29) sends a message, the message is processed by each computer in the ring. If the ring breaks at a particular link then the transmission can be sent via the reverse path thereby ensuring that all nodes are always connected in the case of a single failure.

## CENTRALIZATION

The [**star topology**](https://en.wikipedia.org/wiki/Star_network) reduces the probability of a network failure by connecting all of the peripheral nodes (computers, etc.) to a central node. When the physical star topology is applied to a logical bus network such as [Ethernet](https://en.wikipedia.org/wiki/Ethernet), this central node (traditionally a [hub](https://en.wikipedia.org/wiki/Network_hub)) rebroadcasts all transmissions received from any peripheral node to all peripheral nodes on the network, sometimes including the originating node. All peripheral nodes may thus communicate with all others by transmitting to, and receiving from, the central node only. The [failure](https://en.wikipedia.org/wiki/Failure) of a [transmission line](https://en.wikipedia.org/wiki/Transmission_line) linking any peripheral node to the central node will result in the isolation of that peripheral node from all others, but the remaining peripheral nodes will be unaffected. However, the disadvantage is that the failure of the central node will cause the failure of all of the peripheral nodes.

If the central node is *passive*, the originating node must be able to tolerate the reception of an [echo](https://en.wikipedia.org/wiki/Echo_%28phenomenon%29) of its own transmission, delayed by the two-way [round trip](https://en.wikipedia.org/wiki/Round-trip_time) [transmission time](https://en.wikipedia.org/wiki/Transmission_time) (i.e. to and from the central node) plus any delay generated in the central node. An *active* star network has an active central node that usually has the means to prevent echo-related problems.

A [**tree topology**](https://en.wikipedia.org/wiki/Tree_topology) (a.k.a. **hierarchical topology**) can be viewed as a collection of star networks arranged in a [hierarchy](https://en.wikipedia.org/wiki/Hierarchy). This [tree](https://en.wikipedia.org/wiki/Tree_%28graph_theory%29) has individual peripheral nodes (e.g. leaves) which are required to transmit to and receive from one other node only and are not required to act as repeaters or regenerators. Unlike the star network, the functionality of the central node may be distributed.

As in the conventional star network, individual nodes may thus still be isolated from the network by a single-point failure of a transmission path to the node. If a link connecting a leaf fails, that leaf is isolated; if a connection to a non-leaf node fails, an entire section of the network becomes isolated from the rest.

To alleviate the amount of network traffic that comes from broadcasting all signals to all nodes, more advanced central nodes were developed that are able to keep track of the identities of the nodes that are connected to the network. These [network switches](https://en.wikipedia.org/wiki/Network_switch) will "learn" the layout of the network by "listening" on each port during normal data transmission, examining the [data packets](https://en.wikipedia.org/wiki/Data_packets) and recording the address/identifier of each connected node and which port it is connected to in a [lookup table](https://en.wikipedia.org/wiki/Lookup_table) held in memory. This lookup table then allows future transmissions to be forwarded to the intended destination only.

## DECENTRALIZATION

In a [**mesh**](https://en.wikipedia.org/wiki/Mesh_networking) **topology** (i.e., a [partially connected mesh](https://en.wikipedia.org/wiki/Network_topology#Partial_mesh) topology), there are at least two nodes with two or more paths between them to provide redundant paths to be used in case the link providing one of the paths fails. This decentralization is often used to compensate for the single-point-failure disadvantage that is present when using a single device as a central node (e.g., in star and tree networks). A special kind of mesh, limiting the number of hops between two nodes, is a [hypercube](https://en.wikipedia.org/wiki/Hypercube). The number of arbitrary fork in mesh networks makes them more difficult to design and implement, but their decentralized nature makes them very useful. In 2012 the IEEE published the [Shortest path bridging](https://en.wikipedia.org/wiki/Shortest_path_bridging) protocol to ease configuration tasks and allows all paths to be active which increases bandwidth and redundancy between all devices.

This is similar in some ways to a [**grid network**](https://en.wikipedia.org/wiki/Grid_network), where a linear or ring topology is used to connect systems in multiple directions. A multidimensional ring has a [toroidal](https://en.wikipedia.org/wiki/Torus) topology, for instance.

A [**fully connected network**](https://en.wikipedia.org/wiki/Fully_connected_network), **complete topology**, or [**full mesh topology**](https://en.wikipedia.org/wiki/Network_topology#Full_mesh) is a network topology in which there is a direct link between all pairs of nodes. In a fully connected network with n nodes, there are **n(n-1)/2** direct links. Networks designed with this topology are usually very expensive to set up, but provide a high degree of reliability due to the multiple paths for data that are provided by the large number of redundant links between nodes. This topology is mostly seen in [military](https://en.wikipedia.org/wiki/Military) applications.

**ASSIGNMENT**

**1) Paraphrase the text about topology above in your own English!**