Stevan Burrows
Communications Technology Assignment

Task 1:
Distinguish between analogue and digital signaling and describe the role of a modem in computer communications.

Analogue Signaling

As a technology, analogue is the process of taking an audio or video signal and translating it into electronic pulses. Digital on the other hand is breaking the signal into a binary format where the audio or video data is represented by a series of "1"s and "0"s. Simple enough when it's the device—analogue or digital phone, fax, modem, or likewise—that does all the converting for you.

Analogue technology has been around for decades. It's not that complicated a concept and it's fairly inexpensive to use. That's why we can buy a R100 telephone or watch a few TV stations with the use of a well-placed antenna. The trouble is, analogue signals have size limitations as to how much data they can carry. So with our R100 phones and inexpensive TVs, we only get so much.

Amplitude

Amplitude is the strength of an analogue signal i.e. the higher the amplitude the stronger the signal. Amplitude is usually measured in decibels, but can also sometimes be measured in volts.

Frequency

Frequency is the rate of change in which an analogue signal undergoes each second. It can also be described as the number of vibrations each second. It is measured in Hertz. For example the signal of a man's voice vibrates less times per second than a woman's; hence it has a lower frequency.

Digital Signaling

The newer of the two, digital technology breaks a signal into binary code - a series of "1"s and "0"s—transfers it to the other end where another device (phone, modem or TV) takes all the numbers and reassembles them into the original signal. The beauty of digital is that it knows what it should be when it reaches the end of the transmission. That way, it can correct any errors that may have occurred in the data transfer. This means in most cases, you'll get distortion-free conversations and clearer TV pictures. A good analogy is the comparison between the clarity of an audio CD with that of audio tape.

The nature of digital technology allows it to cram lots of those "1"s and "0"s together into the same space an analogue signal uses.

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Compare your simple home phone with the one you may have at the office. At home you have mute, redial, and maybe a few speed-dial buttons. Your phone at work is loaded with function keys, call transfer buttons, and even voice mail.

The downside of digital is that while it offers better clarity, analogue gives you richer quality. Like any new technology, digital has a few shortcomings. Since devices are constantly translating, coding, and reassembling your voice, you won't get the same rich sound quality as you do with analogue. And for now, digital is still relatively expensive. But slowly, digital devices - like the VCR or the CD - are coming down in cost and coming out in everything from cell phones to satellite dishes.

Phone lines

Analogue telephone lines support standard phones, fax machines, and modems. These are the lines typically found in homes or small offices. Digital lines are found in large, corporate phone systems.

If you were to try to connect your home analogue phone to an office's digital line. When you lifted the receiver, the phone would try to draw an electrical current to operate. Typically this is regulated by the phone company's central office. Since the typical digital phone system has no facilities to regulate the current being drawn through it, your analogue phone can draw too much current --so much that it either fries itself or in rare cases, damages the phone system's line card.

There are digital to analogue adapters that not only let you use analogue equipment in a digital environment, but also safeguard against frying the internal circuitry of your phone, fax, modem, or laptop.

Cordless Telephones

The very nature of digital technology - breaking a signal into binary code and recreating it on the receiving end - gives you clear, distortion-free cordless calls. Cordless phones with digital technology are also able to encrypt all those "1"s and "0"s during transmission so your conversation is safe from eavesdroppers. Plus, more power can be applied to digital signals and thus, you'll enjoy longer range on your cordless phone conversations.

The advantage to analogue cordless phones is that they're a bit cheaper. And the sound quality is richer.

However, when talking about digital and analogue cordless phones, you're talking about the signals being transferred between the handset and its base. The actual phones themselves are analogue devices.

Mobile Phones

Perhaps the most effective use of the digital versus analogue technology is in the booming cellular telephone market. With new phone activations increasing exponentially, the limits of analogue are quickly being realized. Digital cel lular (or GSM) lets significantly more people use their phones within a single coverage area. More data can be sent and received simultaneously by each phone user. Plus, transmissions are more resistant to static and signal fading. And with the all -in-one phones out now - phone, pager, voice mail, internet access - digital phones offer more features than their analogue predecessors.

Task 2:
Describe the main functions of a communications protocol

A protocol is a set of rules which define a format for blocks of data (protocol data units) so that one device in a network can communicate with another, using compatible information. The rules a communications protocol must define consist of...

- *The rate of transmission (in baud or bps)*
- *Whether the transmission is synchronous or asynchronous*
- *Whether the data is to be transmitted in full -duplex or half-duplex mode*

TCP/IP (Transmission Control Protocol/Internet Protocol) is the basic communication language or protocol of the Internet. It can also be used as a communications protocol in a private network (either an intranet or an extranet). When you are set up with direct access to the Internet, your computer is provided with a copy of the TCP/IP program just as every other computer that you may send messages to or get information from also has a copy of TCP/IP.

Task 3:
Identify the Alternative forms of communication media and provide examples of their use in different forms of network

Cable Modem

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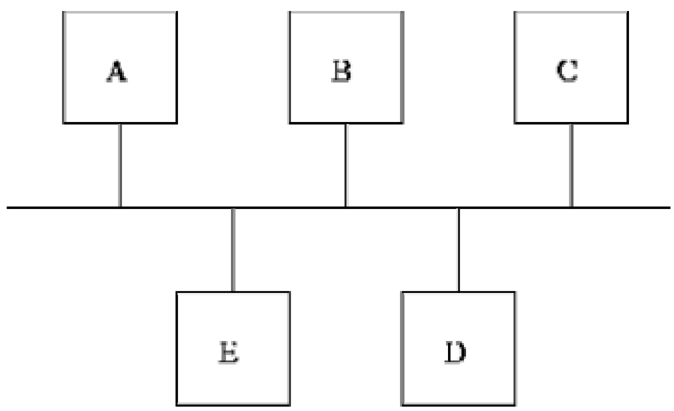
<u>Task 5:</u>
<u>Draw the main LAN Topologies and explain the difference between them in the ways that data flows around the network.</u>

Horizontal Topology (Bus)

The horizontal topology of bus network is shown in figure below. This arrangement is common in local area networks.



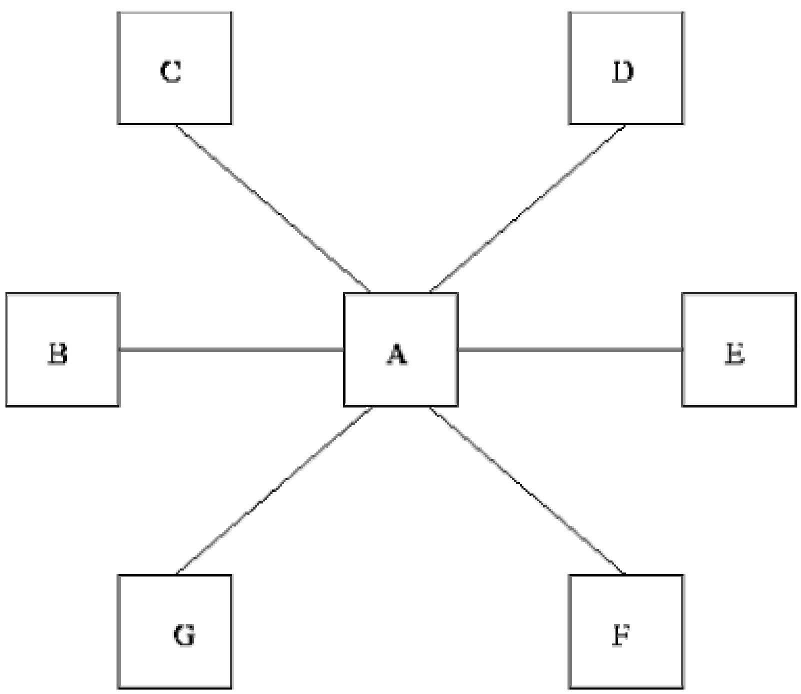
Example of a horizontal network topology

The control of data flow between and among the DTEs is realtively simple as the configuration allows every node to receive every transmission. That is a single DTE broadcasts to every other DTE on the network. The main drawback of this topology stems from the fact that usually only one communications channel exists to service the whole network. If this channel fails then the whole network may fail.

Some vendors provide spare channels for use in the event of channel failure, and others may provide switches that allow the channel to be routed around failed nodes.

<u>Star Topology</u>

The star topology is another widely used structure for data communications systems. One of the major reasons for its continued use is based on historical precedence. The star network was predominant in the 1960s and early 1970s because it was easy to control. An example star network is shown in figure below.



Example of a star network topology

All traffic emanates from the hub of the star. The central site in figure above, labelled A, is in control of all the DTEs attached to it. The central hub is usually a self contained computer and is responsible for routing all traffic to other DTEs and fault isolation. However, like the hierachical structure, this type of network is also prone to bottleneck and failure problems at the central site. Several star networks developed in the 1970s had serious reliability problems because of the centralised nature of the *network. Other systems attempted to solve this problem by providing a redundant backup of the hub node.*

Ring Topology

The ring topology is another popular approach to configuring networks. As illustrate d below the ring topology is so named because of the circular aspect of the data flow.

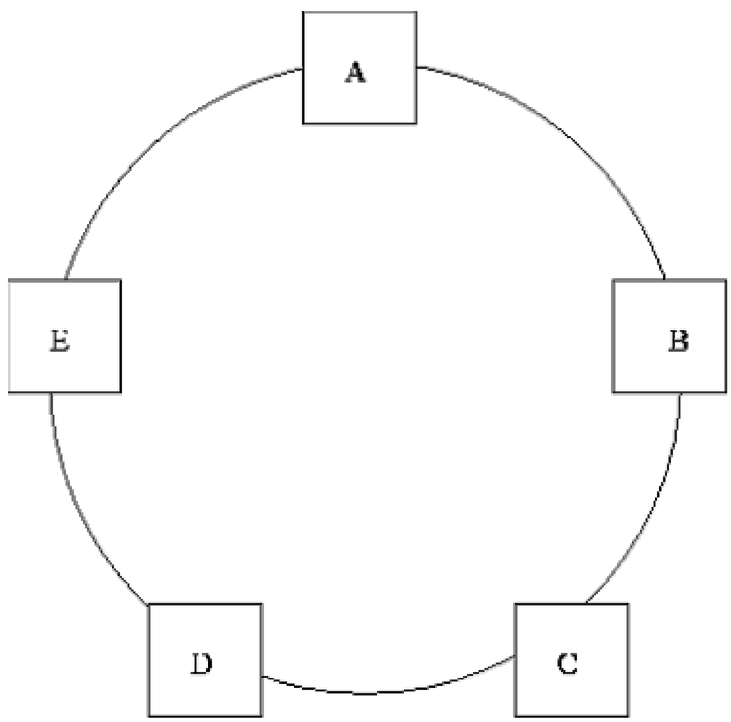


Figure: Example of a ring network topology

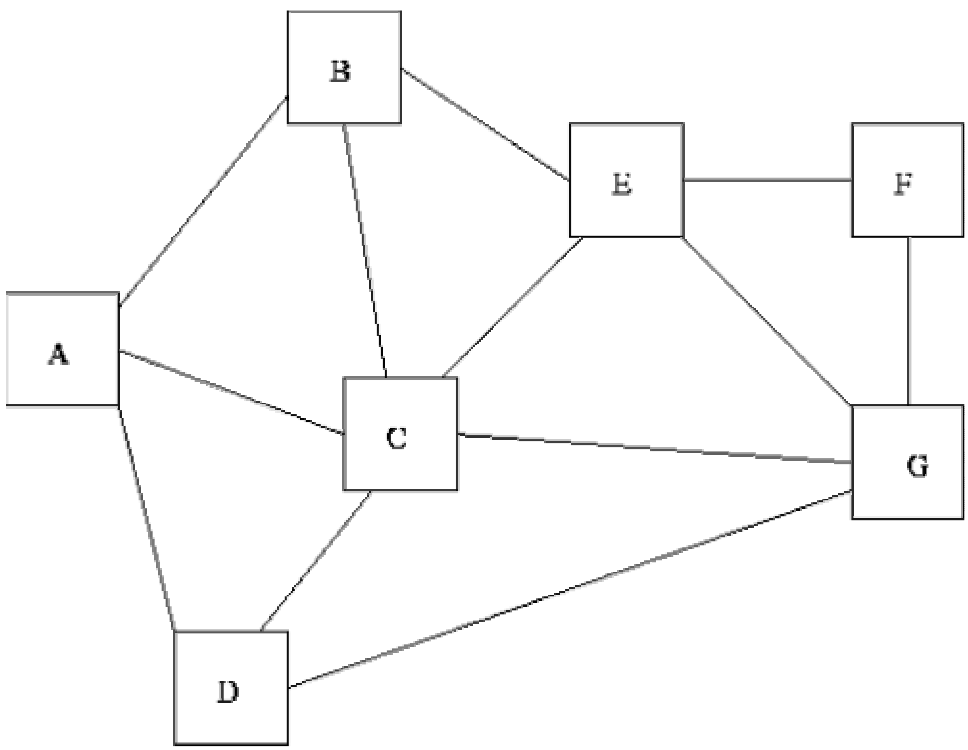
In most instances data flow is in one direction only, with one single node receiving the transmission and relaying it to the next node in the ring. The ring topology is attractive because it is rarely subjected to the bottlenecks associated with hierarchical and star configurations. Moreover, the logic to implement a ring network is relatively simple.

Each node in the network is tasked with a straightforward job of accepting the data and sending it to the DTE attached to it, or sending it back out onto the ring to the next intermediate node. However, like all networks, the ring network suffers from some deficiencies. The primary problem is the use of a single channel to tie together all the nodes in the network. If a channel between two nodes fails, then the entire network is lost. To alleviate this problem, some vendors supply ring networks with backup channels and others provide switches that will route data around a failed node. This increases reliability in the event of channel or node failure.

More recently, network suppliers have taken to producing ring networks with two rings, so that the network will still be able to function in the event of channel failure.

Mesh Topology

The mesh topology has been used more frequently in recent years.



Example of a mesh network topology

Its primary attraction is its relaive immunity to bottle necks and channel/node failures. Due to the multiplicity of paths from the DTEs and DSEs, traffic can easily be routed around failed or busy nodes. Given that this approach is very expensive in comparison to other topologies, some users will still prefer t he reliability of the mesh *network to that of others (especially for networks that only have a few nodes that need to be connected together).*

Task 6: Identify and describe the basic roles of a range of interconnection devices

Hubs

A hub is a small rectangular box, often constructed mainly of plastic, which receives its power from an ordinary wall outlet. A hub joins multiple computers (or other network devices) together to form a single network segment. On this network segment, all computers can communicate directly with each other. Ethernet hubs are by far the most common type, but hubs for other types of networks (such as USB) also exist.

A hub includes a series of ports that each accepts a network cable. Small hubs network four computers. They contain four or sometimes five ports (the fifth port being reserved for "uplink" connections to another hub or similar device). Larger hubs contain eight, 12, 16, and even 24 ports.

Key Features of Hubs

Hubs classify as Layer 1 devices in the OSI model. At the physical layer, hubs can support little in the way of sophisticated networking. Hubs do not read any of the data passing through them and are not aware of a packet's source or destina tion. Essentially, a hub simply receives incoming packets, possibly amplifies the electrical signal, and broadcasts these packets out to all devices on the network (including the one that sent the packet!).

Technically speaking, three different types of hubs exist:

- *passive*
- *active*
- *intelligent*

Passive hubs do not amplify the electrical signal of incoming packets before broadcasting them out to the network. Active hubs, on the other hand, will perform this function -- a function that is also present in a different type of dedicated network device called a repeater. Some people use the terms concentrator when referring to a passive hub and multi-port repeater when referring to an active hub.

Intelligent hubs add extra features to an active hub that are of particular importance to businesses. An intelligent hub typically is stackable (built in such a way that multiple units can be placed one on top of the other to conserve space). It also typically includes remote management support via SNMP and virtual LAN (VLAN) support.

Hubs are a very popular device for small networks because of their low cost.

Switches

*A **switch** is a small device that joins multiple computers together at a low-level network protocol layer. Technically, switches operate at layer two (Data Link Layer) of the OSI model.*

Switches look nearly identical to hubs, but a switch generally contains more "intelligence" (and a slightly higher price tag) than a hub. Unlike hubs, switches are capable of inspecting the data packets as they are received, determining the source and destination device of that packet, and forwarding that packet appropriately. By delivering messages only to the connected device that it was intended for, switches conserve network bandwidth and offer generally better performance than hubs.

Like hubs, switches primarily are available for Ethernet, come in a range of port configurations starting with the four- and five-port models, and support 10 Mbps Ethernet, 100 Mbps Ethernet, or both.

Routers

*A **router** is a physical device that joins multiple networks together. Technically, a router is a "layer 3 gateway," meaning that it connects networks (as gateways do), and that it operates at the network layer of the OSI model.*

The home networker typically uses an Internet Protocol (IP) router, IP being the most common OSI network layer protocol. An IP router such as a DSL or cable modem router joins the home's local area network (LAN) to the wide-area network (WAN) of the Internet. By maintaining configuration information in a piece of storage called the "routing table," routers also have the ability to filter traffic, either incoming or outgoing, based on the IP addresses of senders and receivers. Some routers allow the home networker to update the routing table from a Web browser interface.

DSL and cable modem routers typically combine the functions of a router with those of a switch in a single unit.

Task 7:

Distinguish between the Internet and the World Wide Web and describe a rabge of services they provide

The Internet and the Web are related, but are really two separate things. The Internet is the collection of all computers and networks that carry and transmit information, based on telecommunications protocols. The Web is based on one of these protocols known as HTTP (Hypertext Transfer Protocol). In simple terms the Web is the collection of documents and information that are held on, and sent through, the Internet.

The internet is a much larger thing than the World Wide Web. Basically, the internet is a term which can be applied to any and every thing working on IP, which means internet protocol. IP is a system of standards of communication between computers which has been developing along with the internet. It provides a common basic language for each of the many types of machines connected to the internet. The internet includes the devices which transmit and receive data, the devices which help route data, and the physical media which carry the data from place to place, and even the data itself.