

CSC 201 Week Seven Lecture Note

INFORMATION AND COMMUNICATIONS TECHNOLOGY

INFORMATION FLOW

Means of communication between subsystem are:-

- (a) Electronic Communication
- (b) Paper-based Communication
- (c) Oral Communication

Electronic Communication

- Transfer of information between subsystem by computer
- Interfaces between modules of computer systems enables automatic transfer of electronic data.
- This is also possible for one-off messages for example the use of electronic mail

Benefit

- Speed
- Accuracy
- Elimination of much human processing.

Paper-based Communication

- The use of internal memoranda
- Computer Print-outs
- Monthly account packages

Merit

- Permanent hard copy record of transactions
- Cheaper than electronic communication.

Demerit

- There may be a delay in the delivery of information

- The necessary for data transcription increases the risk of error.

Oral Communication

- Face-to-face situation
- By telephone

Advantage

- Only specified or requested information is provided.
- Information can be provided immediately.

Disadvantage

- The scope of error is increased
- There is no permanent record of the communication.

DATA TRANSMISSION

- Data transmission is the process of using a data link.
- Data transmission link might connect
 - 1 A computer and a remote terminals
 - 2 Two computers located some distance from each other.
 - 3 Several processors in a Network, with each computer in the network able to transmit data to any other.

DATA TRANSMISSION MEDIA

Copper wire

- The simplest type of communication channel in use is a telephone line made of copper wire.

Advantage

- Allows straight forward addition of extra nodes.

Disadvantages

- Low Transmission
- Relatively high error rate, because there is only minimal anti-interference screening.

Coaxial Cable

- Similar to domestic television aerial cable.
- Better performance than twisted pair cable
- There is less risk of distortion of data at higher rates of transmission.
- Anti interference screening is better too.
- Heavier grades of cable allow broadband transmission increasing the number of signals which can be carried simultaneously.
- It allows straight forward addition of extra nodes.

Fibre-Optic Cable

- It is interference free.
- It has high data transmission rate (up to 1 billion bits per second)
- It is popular in WANs.
- Less widely used in LANs for two reasons:-
 - (a) It is relatively high cost option
 - (b) Does not support addition of nodes, which makes it unsuitable for ring-type LANs.

Transmission is essentially in one direction, hence, not suitable for BUS type LANs.

- Data is transmitted in the form of light, through very fine glass fibers.
- TRANSDUCERS convert electrical pulses to light and back again at each end of the cable.

Advantages

- High bandwidth support high transmission rates.
- Low cross-talk (interference between adjacent cables)
- No interference from external electrical sources
- High reliability
- No danger from electricity, heat or sparks

MICROWAVE

Microwaves are Ultra High Frequency (UHF) radio signals

- Microwaves can be transmitted between radio transmitter and receivers which are in sight of each other.
- Repeaters (Relay Stations) are sited to create a network along which signals can be sent.
- The Ultra High Frequency nature of Microwaves minimises distortions.

SATELITE

- The problem of transmissions over the ocean is overcome by the use of satellites maintains a constant position in relation to the earth's surface (strategic positioning on hills and other high ground); This is referred to as Geosynchronous orbit.
- Radio transmissions are received by the satellite which includes a repeater and an amplifier, to boost the signal, and send it onwards to receivers on another continent.

BANDWIDTH

- Bandwidth determines in part, the amount of data that can be sent down a telecommunication line.
- The range of frequencies that the channel can carry, frequency are measured in cycles per second, or in Hertz.
- There are three range:-
 - (a) Narrow band (up to 300 Hertz)
 - (b) Voice band (300 to 3,000 Hertz)
 - (c) Broad band (over 3,000 Hertz)
- The wider the bandwidth, the greater the number of messages that a channel can carry at any particular time.
- Broad bandwidth enables messages to be transmitted simultaneously.

BIT SERIAL & PARALLEL TRANSMISSION

Data transmission can either be BIT SERIAL or BIT PARALLEL transmission.

Bit Serial Transmission

- Each bit making up a character is sent one after the other down the line.
- This is the most common method.
- The number of bits transmitted per seconds is referred to as BAUD RATE.

Bit Parallel Transmission

Eight lines are required as each bit in a byte is transmitted at the same time over its own channel.

DATA SWITCHING

When the computer user has a number of computers (and terminals) which will transmit data to each other in an irregular and unpredictable way, it would be too expensive to rent dedicated private lines for direct data links, instead a data switch arrangement is used.

A Switch

This is a device for opening, closing or directing an electric circuit.

- A telecommunication link is a circuit like any other. When you are speaking to some over the telephone a circuit exists between the two devices.
- In the telephone network switches connect one set of lines to another.

CIRCUIT SWITCHING

- It is a wasteful use of the telephone line. This is because, gaps in transmission of message, when the line is idle, could be used by somebody else.
- Similarly, you may wish to transmit your data at a time when there is nobody on the other end of the line to receive it.

MESSAGE SWITCHING

- Requires no direct physical connection between sender and receiver before communication can take place.
- The message is stored on a central computer or switching station before being forwarded to another switching and ultimately to its destination.
- A message can be sent even though the destination is not able at that time to receive it.
- It is also known as the STORE-AND FORWARD TECHNIQUE.

A PACKET SWITCHING

- (a) A data message is divided up into Packets of data of a fixed length, usually 128 bytes, and transmitted through the Network in these separate packets.
- Each packet contains control data, which identifies the sender of the message and the address of the Recipient.
 - The first packet opens a route (or Virtual Circuit) from source to destination, which the others will follow.
- (b) The Packet Switching Network (PSN) is a network of processors.
- Each processor receives packets of data from another processor in the Network, and redirects them to the next processor along the chain to the eventual recipient.
- (c) At the 'local' end of the PSN link (i.e. the end near the recipient of the message) the packets of data are reassembled into their full message, which is transmitted to the recipient.
- If terminals are asynchronous, they will be connected to the packet switching network by a packet assembler/disassembler (PAD).

For example: Let source A send a message to destination B, and source Y sends a message to destination Z. Each message is split into two packets.

MODES OF TRANSMISSION

There are three modes of transmission each will require different types of equipment (at increasing cost).

- (a) Simplex

This is transmission in one direction only. A computer can be used to send out messages to a terminal but the terminal cannot send data back e.g. remote printer or screen.

(b) Half Duplex

This is transmission in both directions but not simultaneously.

(c) Full Duplex

This is transmission in both directions simultaneously.

SYNCHRONOUS AND ASYNCHRONOUS DATA TRANSMISSION

Asynchronous Transmission

- One character is sent at a time
- Each character is preceded with a start bit and ended by a stop bit with the bits of the character coming in between.
- The receiving device at the end of the line recognise a start signal which activates a clock and then reads the bits that follows and it comes to a stop signal which turns the clock off.
- Micro computers normally use asynchronous transmission

Advantage

- It is efficient and economical provided that very large quantity of data are not being transmitted.

Synchronous Transmission

- There is no start and stop signals in between data transmission sine data is transmitted between sending and receiving machine at a constant rate.
- The rate of transmission is controlled by the computer's internal clock.

Advantage

- It is less error-prone than asynchronous transmission.

Disadvantage

- It needs more expensive equipment

Example

- Many mainframe normally use synchronous transmission, and can only communicate in asynchronous mode by adding special items of equipment.

DATA TRANSMISSION EQUIPMENT

The data transmission equipment used to connect terminals to a computer consist of:-

- MODEMS
- MULTIPLEXORS

MODEM

- Computer stores and uses data in discrete digital (or bit) form.
- The telephone Network handles data in Analog or Wave form.
- Therefore, for data transmission in analog (or wave) form through the telephone network to be possible, there has to be a device at each of the telephone line, that can:-
 - Covert (MOdulate) the data from digital form to wave form, and
 - DEModulate from wave/ analog form to digital form, depending on whether the data being sent out or received along the telephone line.
- This converting data is done by device called MODEM

Acoustic couplers

- It is an outdated form of modem
- Used to link the user to the telephone network via his telephone handler to establish communication links.
- It fits into rubber cups in the coupler.

MULTIPLEXORS

- This is used where it is necessary to send data from several sources down a single line at the same time.
- It codes the data in a special way so that it can be sorted out at its destination.

- Where several terminals and local micros are link to the control computer the multiplexor is an essential piece of Hardware handling the input/output and reducing line charges (as only one line, rather than several is necessary).

Definition

A device that enables a computer to receive data or transmit data through a number of channels at the same time.

It is a device that permits several independent signals to share a common signal parts.

Function

- Multiplexor stops the data from one source being mixed up with the data from another.
- Front-End-Processor can perform this task, hence acting as a multiplexor.
- A multiplexor at the terminal end of a data line, perhaps where several terminals are close together and all use the same CPU, is to sort out the data message to and from each terminal and thus enable the terminals co share the same data link to the CPU(e.g. private wire).

TIME DECISION MULTIPLEXOR

This is when a device is allocated specific time slots in which to use it.

FREQUENCY DIVISION MULTIPLEXOR

This is when the transmission medium is divided into a number of channels of smaller bandwidth.

LINE CONCENTRATION

- This is a device that enables several terminals to make efficient use of a common data communication.
- It combines input lines whose total bandwidth is greater than that of the output line.
- It might be used to handle data in blocks of packets.

PROTOCOLS

Definition

Protocols is 'an agreed set of operational procedures governing the format of data being transferred, and the signals initiating, controlling and terminating the transfer.

- Data transmitted down a public or private telephone wire may possibly have the problem of distortion or loss of the message.

Hence, computer must be able to

- (a) detect whether there are **ERRORS** in data transmission. e.g. loss of data or data arriving out of sequence different from the sequence in which it was transmitted.
 - (b) Take step to **RECOVER** the loss data, even, if this is simply to notify the computer or terminal operator to telephone the sender of the message that the whole data package will have to be re-transmitted.
- A mechanism used to detect and usually then to correct errors is known as a communications protocol.
 - One set of protocol developed by international standard organisation (ISO). It is know as open system international (OSI)

Protocol was divided into seven functions in a seven layer reference model.

- **THE PHYSICAL LAYER** – deals with electromechanical and other matters. Ensures data bits get to the medium and physical connection is made.
- **DATALINK-** ensures that communication link are set up (e.g. error detection, transmission space) If a packet contains an error (e.g. of format) it will not be sent.
- **NETWORK LAYER** – ensures that individual messages are switched and routed properly through the network by establishing maintaining and terminating connections.
- **TRANSPORT LAYER** – ensures that the previous three layers are used properly so that messages are clearly arrive in the right order.
- **SESSION LAYER** – deals with users opening and closing communications between two computers (open, close, read, write e.t.c.).

- THE PRESENTATION LAYER- provides standard formats for the interpretation of data, enable different terminals and computer equipment to communicate as well as provide the services a particular application needs.
- THE APPLICATION LAYER – deals with interconnection of user programs and applications.

This is only a model and not universally adopted rather at indicate the type of protocol needed.

Factors covered by protocol include the following:-

- Model of transmission; synchronous or asynchronous
- Speed of transmission
- Full or half duplex transmission
- Format of the data
- Error detection and correction procedures.

COMMUNICATION IN THE OFFICE (RECENT DEVELOPMENT)

1990's has been referred to as 'telecom revolution' in the same way as the 1980's were regarded as the 'Computer revolution'.

Modern telephone systems offer many sophisticated functions. Telephone may have a small display that shows the user the name and number of the person who is ringing them.

Other features include:

- a) Hand free operations via a speaker
- b) Different ringing tone for internal or external calls.
- c) Different tones for different users.
- d) Speed dialing-frequently used numbers can be stored in memory and dialed by pressing just one or two keys.
- e) Call diversion, for times when you will not be at your desk.
- f) Call banning, preventing certain numbers from being dialed, or preventing International calls.
- g) Conference calls allowing more than two people to listen to and take part in a conversation.

MOBILE COMMUNICATION

-Radio Networks for portable telephone communications, also known as “Cellular phones”.

Digital networks are being installed and these are better able to support data transmission than the analog network, with higher transmission speeds and less likelihood of data corruption.

- This means that a person salesperson out on the road, say, can send or receive a fax or e-mail simply by plugging a lap-top PC into a mobile phone is already on the market.
- It is now possible to do any kind of ‘office’ activity outside on the move although limitation.

TELEX (TELEgram EXchange)

- A service that enables users to transmit and receive printed messages over a telephone line.
- Users have to be telex subscribers, with their own telex equipment and code number, in order to send or receive messages.
- However, data transmission speed is very slow compared with other methods of telecommunication, and only a restricted set of characters can be used in messages.
- Telex is still used, but fax and E-mail are likely to replace it entirely, in time.

FAX (or FACIMILE TRANSMISSION)

Fax involves the transmission by data link of exact duplicating copies of documents. The original is fed into the fax machine, which ‘reads’ it and convert it into electronic form so it can be transmitted over the telephone. It is printed by the recipient’s fax machine.

- The latest fax machine can also be used as scanners to scan data into a PC, as printers for PC output and as photocopiers.

ELECTRONIC MAIL (E- MAIL)

The term E-mail is used to describe various systems of sending data or message electronically via a telephone or data network and a central computer, without the need to post letters or place a pigeon-holes or dispatch documents by couriers.

Advantages of E-mail

- a. **SPEED** – E-mail is faster than post or fax. It is a time-saver when communicating with people overseas.

- b. ECONOMY – E-mail is reckoned to be 20 times cheaper than fax.
- c. EFFICIENCY – A message is prepared once but can be sent to thousands of employees at the touch of a button.
- d. SECURITY – Access can be restricted by the use of passwords.
- e. Documents can be retrieved from word-processing and graphics packages.
- f. Electronic delivery and read receipts can be requested.
- g. E-mail can be used to send documents and reports as well as short memos, for instance by ‘attaching’ a file.

Information is ‘posted’ by the sender to a central computer which allocates disk storage as a ‘Mail box’ for each user. The information is subsequently ‘collected’ by the receiver from the mail box. Hence,

- a. Senders of information thus have documentary evidence that they have given a piece of information to the recipient and that the recipient has picked up the message.
- b. Receivers are not disturbed by the information when it is sent, but collect it later at their conveniences.

E-mail systems may serve one department or the whole organisation. It is also possible to connect an e-mail system to outside organisation.

VOICE MAIL (V-MAIL)

V-mail systems enables the caller’s message to be recorded at the recipients voice mail box (similar to a mail box in an E-mail system)

The main advantage is that it only requires a telephone to be used. No typing or keying in is necessary. It is basically a spoken Memo.

- Voice mail can be used:
 - a. To contact sales representatives in the field.
 - b. To leave messages in departments in different time tones.
 - c. In organisations where employees might be working away at a clients premises.

VOICE MESSAGING

- This is a kind of switchboard answer phone that takes the place of a human receptionist

Or at least relieves the receptionist of the burden of dealing with common straight forward calls.

- Such system work well if callers frequently have similar needs and these can be accurately anticipated.
- They can be frustrating for callers with non-standard enquiries.
- Badly set-up systems can result in the caller bounced about from one recorded message to another and never getting through to the person they want to deal with.

VIDEO CONFERENCING

-The use of computer and communication technology to conduct meetings in which participants, perhaps in different parts of the world, are linked up via computer and a video system.

- More expensive systems feature a separate room with several video screens, which show the images of those participating in a meeting.
- Even if the technology used is expensive, it is far cheaper when compared to the cost of management times and air fares of business travel.

ELECTRONIC FUND TRANSFER

- A system whereby a computer user can use his computer system to transfer funds. Since business keep most of their cash in bank accounts, electronic funds transfer must involve the banks themselves is known as SWIFT (Society for Worldwide Interbank Financial Telecommunications)