

Computer Networks (CSC105)

Data Communication

Module 3: Transmission Modes, Switching: Circuit Switching, Message Switching, Packet Switching

Transmission Modes

3 ways of transmitting data – Simplex, Half-duplex, Full-duplex

- Simplex
 - Data is transmitted in one direction only – from Sender to Receiver; unidirectional communication.
 - Entire capacity of the channel is used to send data in one direction only.
 - eg. Radio station sends signals to its listeners but does not receive any signal back from the listeners.
- Half-duplex
 - Data can travel in both directions, but not simultaneously; i.e. when Station A is transmitting, Station B cannot transmit but can only receive data. Station B can transmit only when Station A is not transmitting.
 - Channel capacity is used entirely by the station which is transmitting at that time.
 - eg. In a Walkie-talkie, only one person is allowed to talk at a time.
- Full-duplex
 - Both stations can transmit and receive simultaneously; bi-directional communication.
 - Signals going in one direction share the capacity of the link with signals going in the other direction.
 - This can be achieved by having two physically separate transmission paths; one for sending and one for receiving or
 - The capacity of the channel can be divided between signals travelling in both directions.
 - eg. A telephone network - two people can communicate by a telephone line, wherein both can talk and listen at the same time.

Switching

A network comprises of a set of connected devices. Whenever we have a large network, we have the problem of how to connect various devices to make one-to-one communication possible. Considering the various topologies that we have learnt and applying those methods is highly impractical and not feasible for large networks. A better solution is switching.

Switched network comprises of interlinked nodes called switches, which are capable of creating temporary connections between two or more devices linked to the switch.

Traditionally, we have three methods of switching: Circuit, Message and Packet Switching.

Message switching has phased out in general communications but still has networking applications.

Circuit Switching

Circuit switching takes place in three phases:

- Setup phase, wherein a dedicated path (connection) is established between the Sender and the Receiver.
- All the data is transmitted along this dedicated path.
- After the Sender has finished sending all the data, the connection is torn down.

In this type of switching technique, the resources are reserved during the setup phase and they remain dedicated for the entire duration of data transfer. Hence, no congestion can occur after setup.

Message Switching

No physical path is established in advance. As and when there is data to be transmitted, the sender will forward it to the first switching office. Each block of data will be received in its entirety, checked for errors and then re-transmitted to the next switching office till it reaches its destination. A network using this technique is called a Store-and-Forward Network.

In message switching, there is no limit on the block size. So there have to be disks large enough to buffer long blocks of data. Also a single block can tie up a line for minutes, making it useless for interactive traffic.

Packet Switching

To overcome the problems of message switching, packet switching was invented. In this method, there is an upper limit on the block size and therefore the message is broken down into smaller sized packets. These packets are buffered in the main memory instead of on a disk. No user can monopolize the transmission line for a very long time making it advantageous for interactive traffic. Also the first packet of a multi-packet message can be forwarded before the second one has fully arrived. This reduces delay and improves throughput.