



LECTURE NOTES-Computer Network

BCA-IVth Semester

Lecture 1

MULTIPLEXING



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Frequency-division multiplexing:

(FDM) The simultaneous transmission of multiple separate signals through a shared medium (such as a wire, **optical fibre**, or light beam) by modulating, at the transmitter, the separate signals into separable frequency bands, and adding those results linearly either before transmission or within the medium. While thus combined, all the signals may be amplified, conducted, translated in frequency and routed toward a destination as a single signal, resulting in economies which are the motivation for multiplexing. Apparatus at the receiver separates the multiplexed signals by means of frequency passing or rejecting filters, and demodulates the results individually, each in the manner appropriate for the modulation scheme used for that band or group.

Bands are joined to form groups, and groups may then be joined into larger groups; this process may be considered recursively, but such technique is common only in large and sophisticated systems and is not a necessary part of FDM.

Neither the transmitters nor the receivers need be close to each other; ordinary radio, television, and cable service are examples of FDM. It was once the mainstay of the long distance telephone system. The more recently developed time division multiplexing in its several forms lends itself to the handling of digital data, but the low cost and high quality of available FDM equipment, especially that intended for television signals, make it a reasonable choice for many purposes.

Frequency-division multiplexing (FDM) is a technique that divides the available bandwidth of a channel into sub-channels, each of which is assigned to one device. Frequency-division multiplexing is directly applicable to analogue sources and essentially involves forming a composite signal by 'stacking' several information channels side-by-side in frequency. This composite frequency-multiplexed signal is then used to modulate a carrier in some conventional manner. Recovery of the individual messages after reception and initial demodulation is accomplished by bandpass filtering and frequency selection of the channels.

Time division multiplexing :

Time division multiplexing (TDM) is a technique that shares a transmission channel between users by dividing transmission time by allotting to each device a time slot during which it can send or receive data. Time division multiplexing involves interleaving in time the narrow pulses of pulse-code

modulation (PCM) or delta modulation (DM) to form one composite digital signal for transmission. De-multiplexing of the time-multiplexed pulse streams at the receiver is accomplished by gating appropriate pulses into individual channel filters.

Definition:

(TDM) A type of multiplexing where two or more channels of information are transmitted over the same link by allocating a different time interval ("slot" or "slice") for the transmission of each channel. I.e. the channels take turns to use the link. Some kind of periodic synchronising signal or distinguishing identifier is usually required so that the receiver can tell which channel is which. TDM becomes inefficient when traffic is intermittent because the time slot is still allocated even when the channel has no data to transmit. Statistical time division multiplexing was developed to overcome this problem.

Wavelength division multiplexing:

Wavelength division multiplexing (WDM) is the sharing of an optical fibre channel by providing multiple channels, each of which modulates a laser of different wavelength. A modern form of frequency-division multiplexing (FDM).

WDM Multiplexing several Optical Carrier signals on a single optical fibre by using different wavelengths (colours) of laser light to carry different signals.

The device that joins the signals together is known as a multiplexor, and the one that splits them apart is a demultiplexor. With the right type of fibre you can have a device that does both and that ought to be called a "mudem" but isn't.

The first WDM systems combined two signals and appeared around 1985. Modern systems can handle up to 128 signals and can expand a basic 9.6 Gbps fibre system to a capacity of over 1000 Gbps. Note that this term applies to an optical carrier (which is typically described by its wavelength), whereas frequency division multiplexing typically applies to a radio carrier (which is more often described by frequency). However, since wavelength and frequency are inversely proportional, and since radio and light are both forms of electromagnetic radiation, the distinction is somewhat arbitrary.

WDM systems are popular with telecommunications companies because they allow them to expand the capacity of their fibre networks without digging up

the road again. All they have to do is to upgrade the (de)multiplexors at each end. However these systems are expensive and complicated to run. There is currently no standard, which makes it awkward to integrate with older but more standard SONET systems.

CODE DIVISION MULTIPLE ACCESS

CDMA (Or "spread spectrum") A form of multiplexing where the transmitter encodes the signal using a pseudo-random sequence which the receiver also knows and can use to decode the received signal. Each different random sequence corresponds to a different communication channel.

Motorola uses CDMA for digital cellular phones. Qualcomm pioneered the introduction of CDMA into wireless telephone services.
