MOBILE COMPUTING

(DEEPTHI R - 20PW08)

Slide 44: A signal is any observable change in a quantity over space or time. Signals are used to represent the data physically. Any of the parameters of a signal, such as the signal amplitude, frequency, phase, and shape represent the value of the data.
Signals are broadly categorized as analog and digital. Analog signals vary continuously over time and have continuous values whereas, digital signals represent data as a sequence of discrete amplitude values and take discrete values over the time domain.
A periodic signal is one that repeats the sequence of values exactly after a fixed length of time, known as the period. The common parameters of a periodic signal are period(T), frequency, F = 1/T, amplitude A, and phase shift Φ. Frequency is an expression of how frequently a periodic signal repeats itself at a given amplitude. The amplitude of a periodic variable is a measure of its change in a single period.

Slide 45: Based on the distance between the sender and receiver of the signal, the signal can either be transmitted, detected, or interfered with.
Transmission range: In this range, a receiver receives the signals with an error rate low enough to be able to communicate and can also act as the sender to establish a new connection.
Detection range: In this range, the transmitted power is large enough to be differentiated from background noise. However, the error rate is too high to establish a connection in this range.
Interference range: The sender may interfere with another transmission by adding background noise. A receiver will not be able to detect the signals under this range.(Refer to Figure 1 on Page 2)

Slide 46: Signals propagate rectilinearly in free space. Receiving power declines proportionally to $1/d^2$ in a vacuum where 'd' is the distance between the sender and the receiver.
In addition to the distance, the receiving power is attenuated by the following factors:
Shadowing/blocking - Large objects create their shadow which may penetrate or block the signal,
Reflection - this effect occurs if the object is large compared to the wavelength of the transmitted signal,
Refraction - this effect occurs because the velocity depends on the density of the medium through which it travels,
Scattering - if the obstacle size is much less than the wavelength of the transmitted signal, it can be scattered, and
Diffraction - this effect means that the radio waves will be deflected at an edge and propagated in different directions.
(Refer to Figure 2 on Page 2)

Slide 47: Signal can take different paths between sender and receiver due to reflection, scattering and diffraction. The signal is dispersed over time called the run time dispersion. This is due to division of signal into weaker pulses, interference with "neighbor" symbols (Inter Symbol Interference (ISI)), reduction of effective bandwidth.
(Refer to Figure 3 on Page 2)

Slide 48: Effects of mobility: As the channel characteristics vary over time and space, the signal paths change, the delays and phases of different signal parts change. In turn, the distance between the sender and receiver also change.
Fading occurs when there are significant variations in received signal amplitude and phase over time or space. There are two types of fading, long term and short term. Long term fading has a slower variation in mean signal strength and is produced by movement over much longer distances. Short term fading describes the constant amplitude fluctuations in the received signal and is caused by multipath reflection of transmitted signal by local scatters like buildings.In short term fading, there are quick changes in the power received.

Slide 49: Generally, radio waves can exhibit three fundamental propagation behaviors depending on their frequency.Ground wave (for < 2 MHz), Sky wave (for 2 – 30 MHz), and Line of sight propagation (> 30 MHz).
Ground wave: This propagation is suitable for the broadcast at low frequencies. Waves with low frequencies follow the earth's surface and can propagate over long distances.
Sky wave: In this propagation, the signal reception is by the reflection of the waves from the 'Ionosphere'.
Line-of-Sight (LOS) wave: LOS propagation is also known as space wave propagation. These waves use LOS propagation because the wavelength of space waves is too short for reflection from the ionosphere.
(Refer to Figure 4 on Page 2)

Slide 50: Modulation is the process of converting data into radio waves by adding information to an electronic or optical carrier signal.

The two types of modulation are analog and digital. In digital modulation, digital data is translated into an analog signal (baseband). ASK, FSK and PSK are different methods. After digitally modulating, there are visible differences in spectral efficiency, power efficiency, robustness. In analog modulation, the center frequency of baseband signal is shifted up to the radio carrier.

Smaller antennas, Frequency Division Multiplexing and medium characteristics are few factors that motivate to go for modulation. The basic schemes of modulation are based on amplitude, phase and frequency.

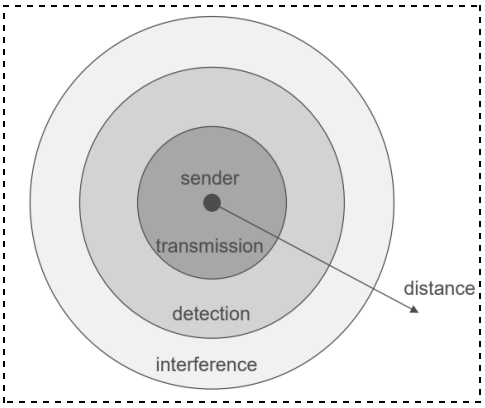

Figure 1

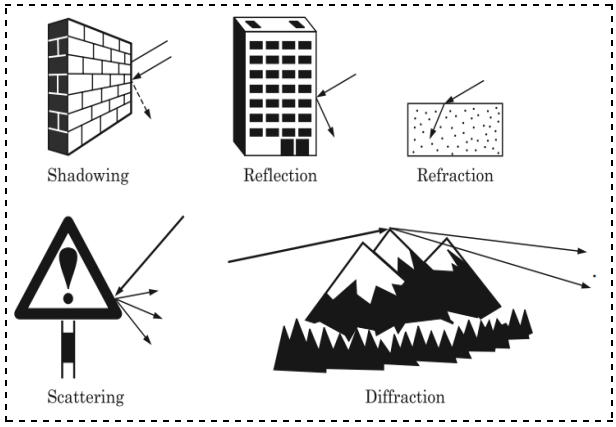

Figure 2

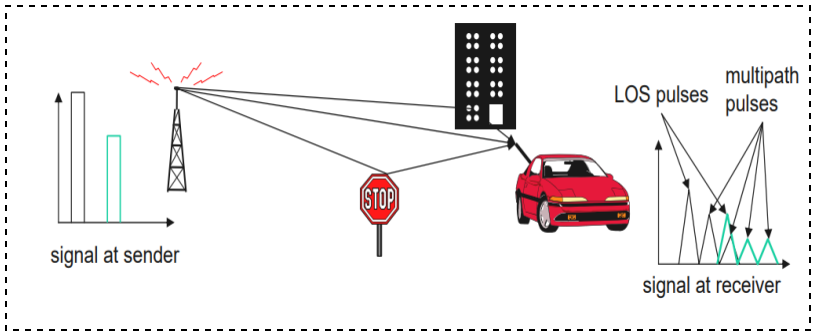

Figure 3

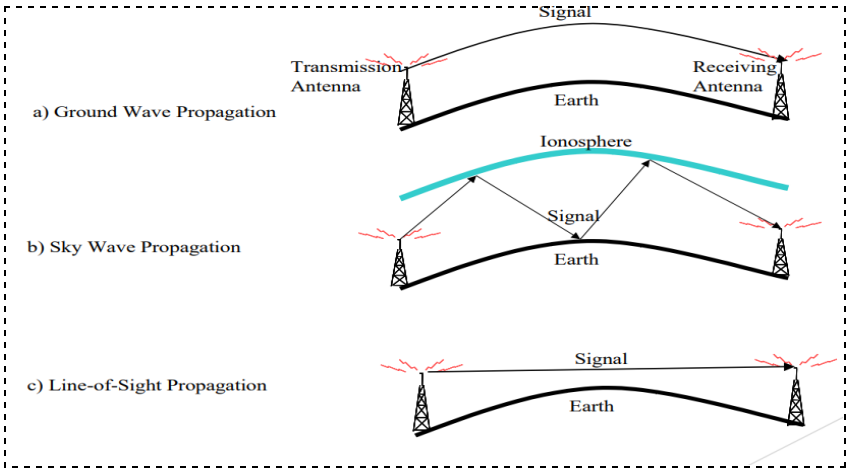

Figure 4