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Assignment On Physical Layer

Modem

Modem stands for Modulator/Demodulator. The modem is defined as a **networking device** that is used to connect devices connected in the network to the **internet**. The main function of a modem is to convert the **analog signals (**The signals remain in a continuous state in both values and time**)** that come from telephone wire into a **digital form**. The modem can perform both the task of **modulation (**The process by which data is converted into electrical/digital signals for transferring that signal over a medium is called modulation**)** and **demodulation (**The process of extracting data from the transmitted signal is called demodulation**)** simultaneously. The various forms of modulation are designed due to the characteristics most commonly amplitude, frequency, and phase.

Types of Modulation

- **Amplitude Modulation:** It is a type of modulation in which only the **amplitude** of the carrier signal is varied to represent the data being added to the signals whereas the phase and the frequency of the signal are kept unchanged**.**
- **Frequency Modulation:** It is a type of modulation in which only the **frequency** of the carrier signal is varied to represent the frequency of the data whereas the phase and the amplitude of the signals are kept unchanged.
- **Phase Modulation:** It is a type of modulation in which the **phase** of the carrier signal is varied to represent the data being added to the signal. Different information values are represented by different phases. For example: '1' may be represented by 0° while '0' by 180°.

What is the Needed of Modulation?

- **Wireless Communication:** Modulation provides a wireless connection to transmit the signals to a longer distance.
- **Size of Antenna:** As we know that the size of the antenna is inversely proportional to the frequency of the radiated signal and antenna size must be 1/10th of the wavelength.

Advantages of Modulation

- It reduces the size of the antenna.
- It reduces the cost of wires.
- It prohibits the mixing of signals.
- It increases the range of communication.

Disadvantages of Modulation

- The cost of the equipment is higher.
- The receiver and the transmitter are very complicated.
- For better communication, the antennas for the FM system must be kept closed.

RS232 interfacing sequences

RS232 is an Interface and the protocol between **DTE** (data terminal equipment) and **DCE** (data communication equipment) using serial binary data exchange. Here C is used for the current version. *Universal Asynchronous Data Receiver & Transmitter (UART)*, attached in a motherboard, used in connection with RS232 for transmitting data to any serial device like modem or printer from its DTE

interface.

Handshaking

Before the actual data transfer, signals are transmitted from DTE to DCE in order to make connections by a process known as handshaking. Following is the sequence of signal handshaking:

- Initially, the computer activates RTS signal to modem when a data is transferred from computer to modem.
- Modem in turn activates the DCD and then the CTS gets activated.
- Computer then sends data on TXD. After the data transmission is completed, the computer deactivates the RTS which causes the modem to deactivate CTS.

Application

- It is used in establishing communication between the computer and embedded systems.
- Due to its lower costs, It plays a vital role in CNC machines and servo controllers
- Some microcontroller boards and PLC machines use RS232C.

Limitations

- It cannot be used for chip to chip or chip to sensor device communication
- It degrades the performance of the system in the presence of noise and requires shorter cables due to having common grounds between DTE and DCE

- The cost of system increases as RS232C interface needs separate transceiver chips.

Line coding and it's technique

Data as well as **signals** that represents data can either be digital or analog. **Line coding** is the process of converting **digital data to digital signals**. By this technique we converts a sequence of bits to a digital signal. At the sender side digital data are encoded into a digital signal and at the receiver side the digital data are recreated by decoding the digital signal.

Unipolar scheme – In this scheme, all the signal levels are either above or below the axis. (**Non return to zero (NRZ) –** It is unipolar line coding scheme in which positive voltage defines bit 1 and the zero voltage defines bit 0. Signal does not return to zero at the middle of the bit thus it is called NRZ)

Advantages: Simple receiver circuit, Low DC component, Low cost

Disadvantages: Poor noise immunity, Limited dynamic range

Polar schemes – In polar schemes, the voltages are on the both sides of the axis. (**NRZ-L and NRZ-I –** These are somewhat similar to unipolar NRZ scheme but here we use two levels of amplitude (voltages). For **NRZ-L(NRZ-Level)**)

Advantages: High noise immunity, Error resistance

Disadvantages: Complex receiver circuit, Limited data rate

Bipolar schemes – In this scheme there are three voltage levels positive, negative, and zero. The voltage level for one data element is at zero, while the voltage level for the other element alternates between positive and negative.

Advantages: High data rate, Differential signal

Disadvantages: Complex receiver circuit, Limited dynamic range

Reference: Tutorialspoint, Hashstudioz, *Computer Networks* by Andrew S.