UNIT – III

Extend a short note on Cyclic Redundancy Check

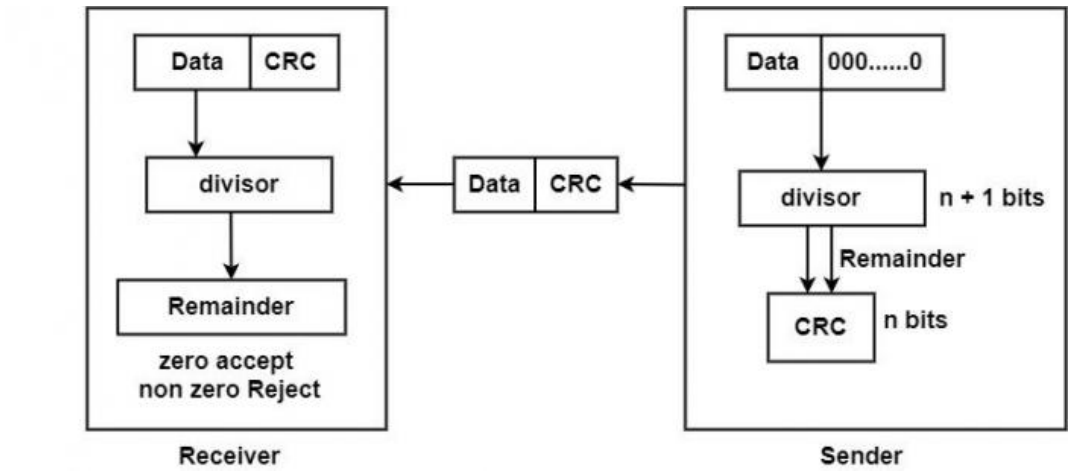
The Cyclic Redundancy Checks (CRC) is the most powerful method for Error-Detection and Correction. It is given as a kbit message and the transmitter creates an (n – k) bit sequence called frame check sequence. The out coming frame, including n bits, is precisely divisible by some fixed number. Modulo 2 Arithmetic is used in this binary addition with no carries, just like the XOR operation.

Redundancy means **duplicacy.** The redundancy bits used by CRC are changed by splitting the data unit by a fixed divisor. The remainder is CRC.

Qualities of CRC

- It should have accurately one less bit than the divisor.
- Joining it to the end of the data unit should create the resulting bit sequence precisely divisible by the divisor.

CRC generator and checker



Apply a short note on Polynomials

A polynomial code is a linear code having a set of valid code words that comprises of polynomials divisible by a shorter fixed polynomial is known as generator polynomial.

They are used for error detection and correction during the transmission of data as well as storage of data.

Types of Polynomial Codes

The types of polynomial codes are:

- Cyclic Redundancy Code
- Bose–Chaudhuri–Hocquenghem (BCH) Codes
- Reed–Solomon Codes

Representation of Bit Strings with Polynomials

The code words, which are essentially bit strings, are represented by polynomials whose coefficients are either 0 or 1. A k – bit word is represented by a polynomial ranging from x^0 to x^{k-1}. The order of this polynomial is the power of the highest coefficient, i.e. $(k-1)$.

For example, an 8 – bit word 11001101 is represented by the following polynomial of order 7:

$1x^7+ 1x^6+ 0x^5+ 0x^4+1x^3+ 1x^2+ 0x^1+1x^0 = x^7+x^6+ x^3+ x^2+1$

Create a short note on Delta Modulation

What is Delta Modulation?

The type of modulation, where the sampling rate is much higher and in which the stepsize after quantization is of smaller value **Δ**, such a modulation is termed as **delta modulation**.

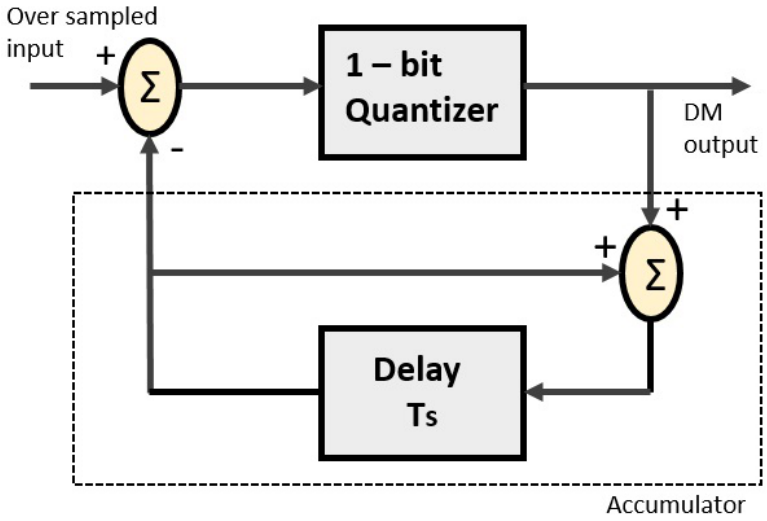
Features of Delta Modulation

- An over-sampled input is taken to make full use of a signal correlation.
- The quantization design is simple.
- The input sequence is much higher than Nyquist rate.
- The quality is moderate.
- The design of the modulator and the demodulator is simple.
- The stair-case approximation of output waveform.
- The step-size is very small, i.e., **Δ** (delta).
- The bit rate can be decided by the user.
- It requires simpler implementation.

Delta Modulation is a simplified form of DPCM technique, also viewed as 1-bit DPCM scheme. As the sampling interval is reduced, the signal correlation will be higher.

Delta Modulator

The **Delta Modulator** comprises of a 1-bit quantizer and a delay circuit along with two summer circuits. Following is the block diagram of a delta modulator.



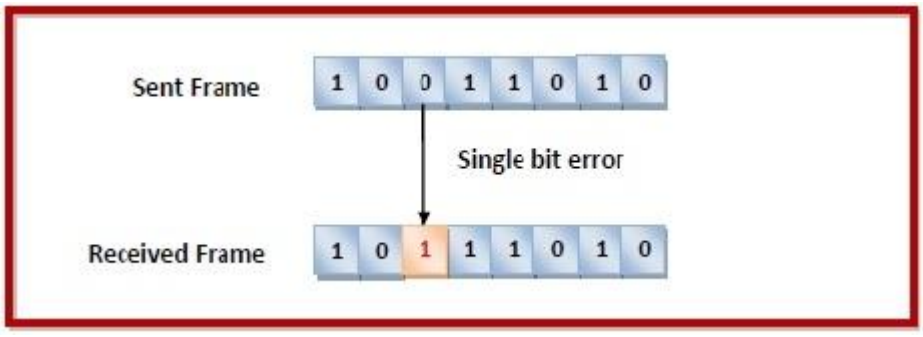
A stair-case approximated waveform will be the output of the delta modulator with the step-size as delta (**Δ**). The output quality of the waveform is moderate.

Categorize the types of errors

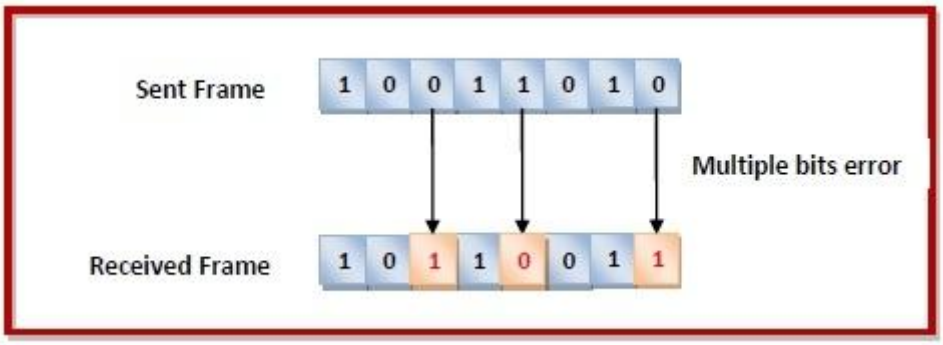
Types of Errors

Errors can be of three types, namely single bit errors, multiple bit errors, and burst errors.

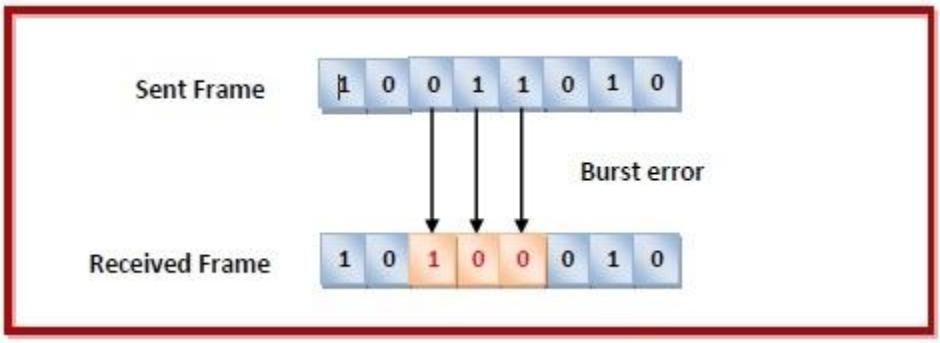
- **Single bit error** – In the received frame, only one bit has been corrupted, i.e. either changed from 0 to 1 or from 1 to 0.



- **Multiple bits error** – In the received frame, more than one bits are corrupted.



- **Burst error** – In the received frame, more than one consecutive bits are corrupted.



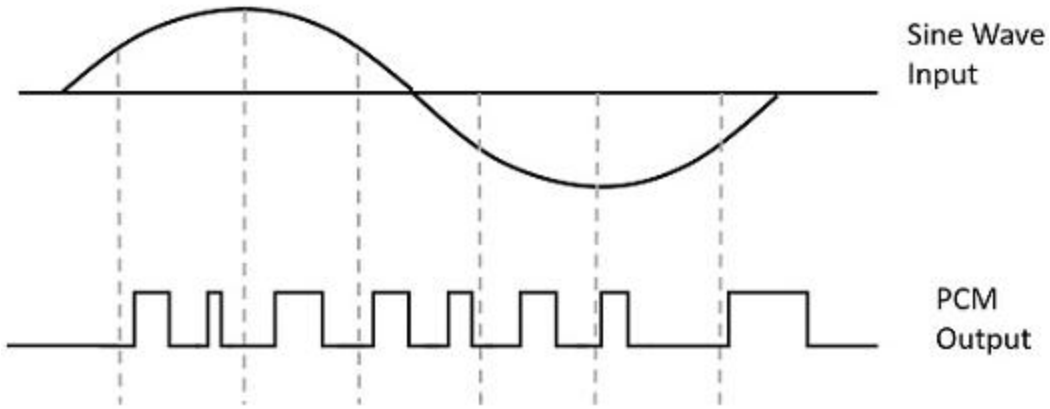
Construct the Pulse Code Modulation

Modulation is the process of varying one or more parameters of a carrier signal in accordance with the instantaneous values of the message signal.

The message signal is the signal which is being transmitted for communication and the carrier signal is a high frequency signal which has no data, but is used for long distance transmission.

There are many modulation techniques, which are classified according to the type of modulation employed. Of them all, the digital modulation technique used is **Pulse Code Modulation** PCM

A signal is pulse code modulated to convert its analog information into a binary sequence, i.e., **1s** and **0s**. The output of a PCM will resemble a binary sequence. The following figure shows an example of PCM output with respect to instantaneous values of a given sine wave.



Instead of a pulse train, PCM produces a series of numbers or digits, and hence this process is called as **digital**. Each one of these digits, though in binary code, represent the approximate amplitude of the signal sample at that instant.

In Pulse Code Modulation, the message signal is represented by a sequence of coded pulses. This message signal is achieved by representing the signal in discrete form in both time and amplitude.

List out the difference between Full duplex and Half duplex

S. No.	Parameters	Simplex	Half Duplex	Full Duplex
1.	**The direction of communication**	Simplex mode is a uni-directional communication.	Half Duplex mode is a two-way directional communication but one at a time.	Full Duplex mode is a two-way directional communication simultaneously.
2.	**Sender and Receiver**	In simplex mode, Sender can send the	In Half Duplex mode, Sender can send the	In Full Duplex mode, Sender can send the

S. No.	Parameters	Simplex	Half Duplex	Full Duplex
		data but that sender can't receive the data.	data and also can receive the data but one at a time.	data and also can receive the data simultaneously.
3.	**Channel usage**	Usage of one channel for the transmission of data.	Usage of one channel for the transmission of data.	Usage of two channels for the transmission of data.
4.	**Performance**	The simplex mode provides less performance than half duplex and full duplex.	The Half Duplex mode provides less performance than full duplex.	Full Duplex provides better performance than simplex and half duplex mode.
5.	**Bandwidth Utilization**	Simplex utilizes the maximum of a single bandwidth.	The Half-Duplex involves lesser utilization of single bandwidth at the time of transmission.	The Full-Duplex doubles the utilization of transmission bandwidth.
6.	**Suitable for**	It is suitable for those transmissions when there is	It is suitable for those transmissions when there is	It is suitable for those transmissions when there is

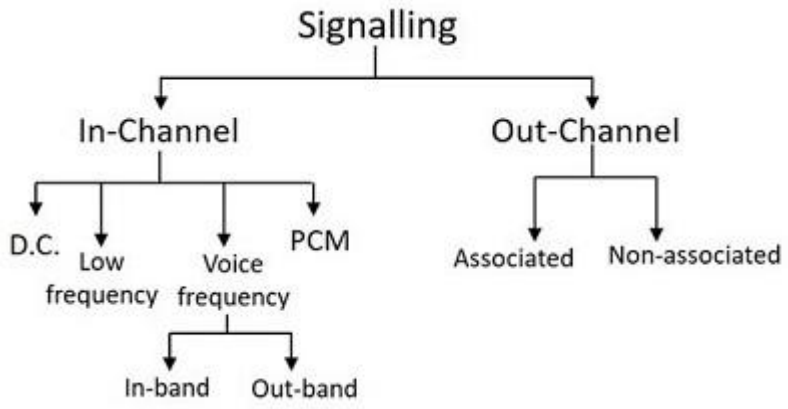
S. No.	Parameters	Simplex	Half Duplex	Full Duplex
		requirement of full bandwidth for delivering data.	requirement of sending data in both directions, but not at the same time.	requirement of sending and receiving data simultaneously in both directions.
7.	**Examples**	Example of simplex mode are: Keyboard and monitor.	Example of half duplex mode is: Walkie-Talkies.	Example of full duplex mode is: Telephone.

UNIT- IV

Identify the Control Signaling

the signaling techniques are categorized into two, the In-channel signaling and the Common channel signaling. However, these are further divided into few types depending upon the frequencies and frequency techniques used.

The division is as shown in the following figure –



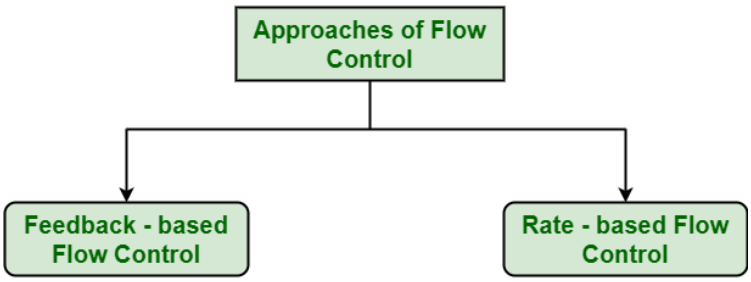
In-channel Signaling

This type of signaling is used to carry voice or data and pass control signals related to a call or connection. There are different types of In-channel Signaling, as seen in the above figure. The D.C. signaling is simple, cheap and reliable even for unamplified audio circuits. However, for amplified audio circuits, low frequency A.C. signaling may be adopted.

The Voice Frequency signaling is used when FDM (Frequency Division Multiplexing) transmission systems are used, because low frequency signaling and D.C. signaling cannot be provided. This Voice Frequency signaling may be **In-band** or **Out-band**.

Demonstrate the Generic Flow Control

Flow control is design issue at Data Link Layer. It is a technique that generally observes the proper flow of data from sender to receiver. It is very essential because it is possible for sender to transmit data or information at very fast rate and hence receiver can receive this information and process it.

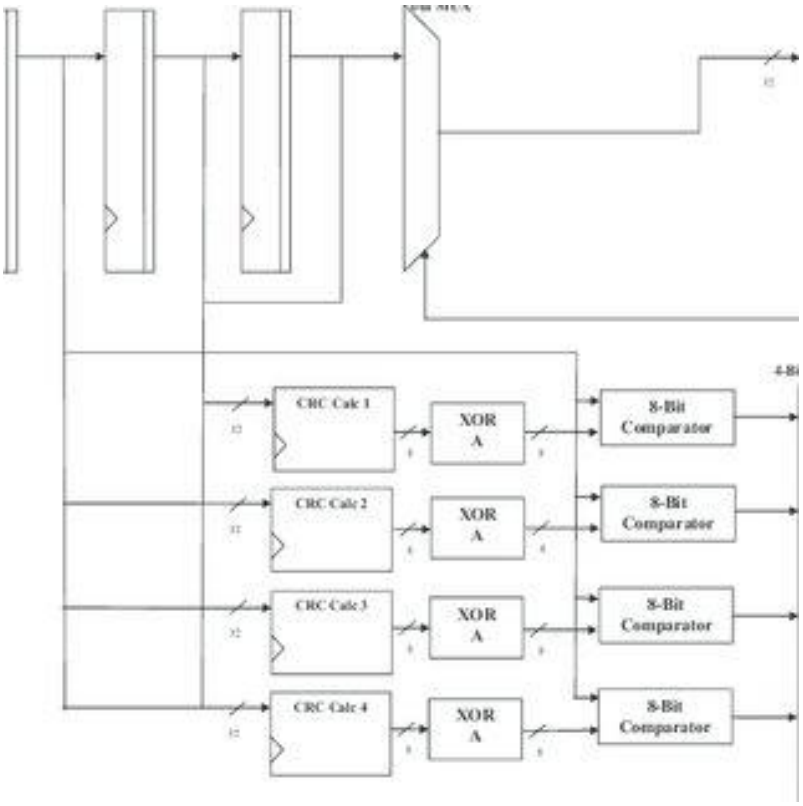


Approaches to Flow Control : Flow Control is classified into two categories:

- **Feedback – based Flow Control :** In this control technique, sender simply transmits data or information or frame to receiver, then receiver transmits data back to sender and also allows sender to transmit more amount of data or tell sender about how receiver is processing or doing. This simply means that sender transmits data or frames after it has received acknowledgements from user.
- **Rate – based Flow Control :** In this control technique, usually when sender sends or transfer data at faster speed to receiver and receiver is not being able to receive data at the speed, then mechanism known as built-in mechanism in protocol will just limit or restricts overall rate at which data or information is being transferred or transmitted by sender without any feedback or acknowledgement from receiver.

Techniques of Flow Control in Data Link Layer : There are basically two types of techniques being developed to control the flow of data

Sketch a Cell Delineation State Diagram



Examine the Constant Bit Rate

For constant bit rate coding, a rate control algorithm is needed in an FB coding scheme to regulate the bitstream generated by the two image regions and to achieve an overall target bit rate. A content-based rate control strategy that not only takes the buffer fullness but also the content classification into account is typically required. The strategy can be classified into two general types, namely, independent and joint.

In an independent rate control strategy, the bit rate of each region is pre-assigned and two separate rate control algorithms are performed independent of each other. The output bit rate, R, is the sum of the individual bit rates for the foreground region, R_{fg} , and background region, R_{bg},

Solve the explicit Congestion Signaling

Explicit Signaling

• In this method, the congested nodes explicitly send a signal to the source or destination to inform about the congestion.

• Explicit signaling is different from the choke packet method. In choke packed method, a separate packet is used for this purpose whereas in explicit signaling method, the signal is included in the packets that carry data .

• Explicit signaling can occur in either the forward direction or the backward direction .

• In backward signaling, a bit is set in a packet moving in the direction opposite to the congestion. This bit warns the source about the congestion and informs the source to slow down.

• In forward signaling, a bit is set in a packet moving in the direction of congestion. This bit warns the destination about the congestion. The receiver in this case uses policies such as slowing down the acknowledgements to remove the congestion.

Characteristics the backward explicit congestion notification

In this method of congestion control, congested router or node sends a special type of packet called choke packet to the source to inform it about the congestion.

• Here, congested node does not inform its upstream node about the congestion as in backpressure method.

• In choke packet method, congested node sends a warning directly to the source station *i.e.* the intermediate nodes through which the packet has traveled are not warned.