Course Name: A Level (2nd Sem)   Subject: DCN

Topic: Error Detection and Correction   Date: 20-04-20

Types of Errors:

Error in data transmission is a condition when the receiver's information does not matches with the sender's information. Whenever bits flow from one point to another, they are subject to unpredictable changes because of interference. This interference can change the shape of the signal. In a single-bit error, a 0 is changed to a 1 or a 1 to a 0. In a burst error, multiple bits are changed.

Single-Bit Error:

The term single-bit error means that only 1 bit of a given data unit (such as a byte, character, or packet) is changed from 1 to 0 or from 0 to 1. Single-bit errors are the least likely type of error in serial data transmission.
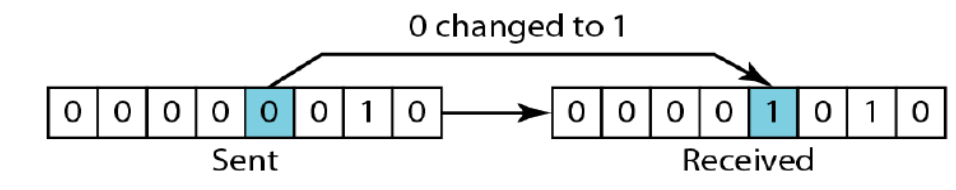
Burst Error:

The term burst error means that 2 or more bits in the data unit have changed from 1 to 0 or from 0 to 1. Figure shows the effect of a burst error on a data unit. In this case, 0100010001000011 was sent, but 0101110101100011 was received. A burst error does not necessarily mean that the errors occur in consecutive bits. The length of the burst is measured from the first corrupted bit to the last corrupted bit. Some bits in between may not have been corrupted.
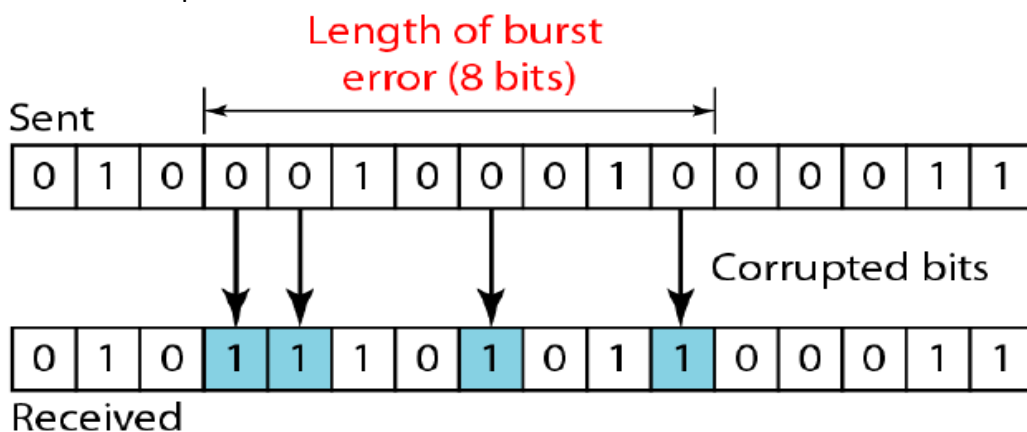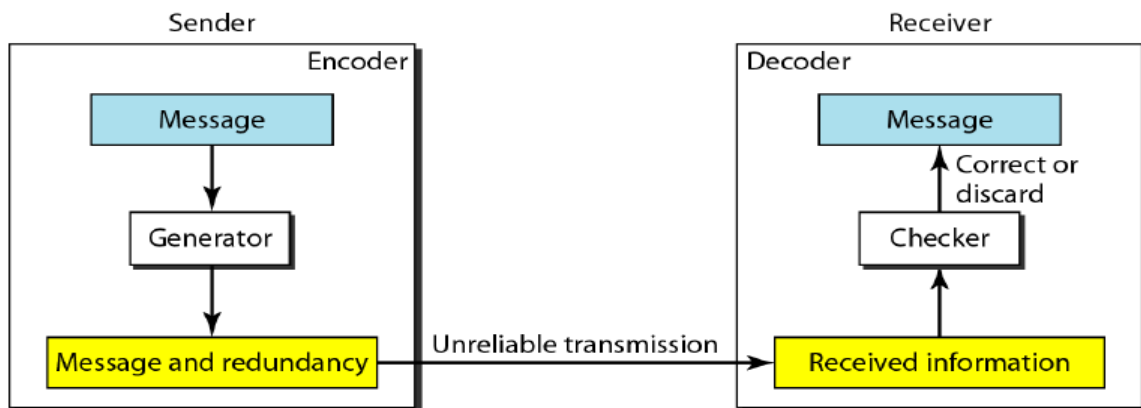
Error Detection and Correction:

In error detection, we are looking only to see if any error has occurred or not. But in error correction, we need to know the exact number of bits that are corrupted and their location in the message. The number of the errors and the size of the message are important factors.

Redundancy: The central concept in detecting or correcting errors is **redundancy**. To be able to detect or correct errors, we need to send some extra bits with our data. These redundant bits are added by the sender and removed by the receiver. Their presence allows the receiver to detect or correct corrupted bits.

Coding: Redundancy is achieved through coding schemes. The sender adds redundant bits through a process that creates a relationship between the redundant bits and the actual data bits. The receiver checks the relationships between the two sets of bits to detect or correct the errors. Figure shows the general idea of coding.

Error Detection Techniques:

Some popular techniques for error detection are:

1. **Simple Parity check**
2. **Two-dimensional Parity check**
3. **Checksum**
4. **Cyclic redundancy check**

Exercises:

A. **What do you understand by error in data transmission? How does a single-bit error differ from a burst error?**
B. **Discuss the concept of redundancy in error detection and correction.**