# Error Detection and Correction

- **Types of Errors**
- **Detection**
- **Correction**

Basic concepts

★ Networks must be able to transfer data from one device to another with complete accuracy.

★ Data can be corrupted during transmission.

★ For reliable communication, errors must be detected and corrected.

★ **Error detection and correction** are implemented either at the **data link layer** or the **transport layer** of the OSI model.

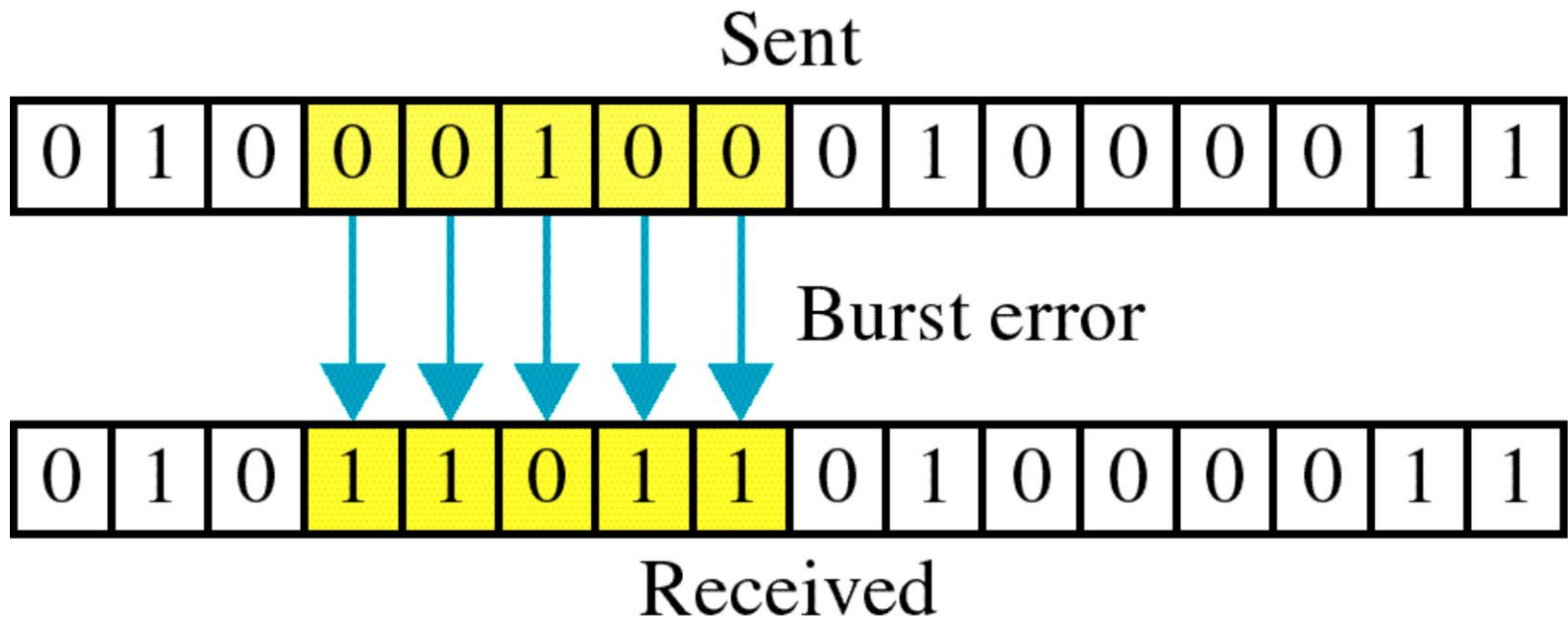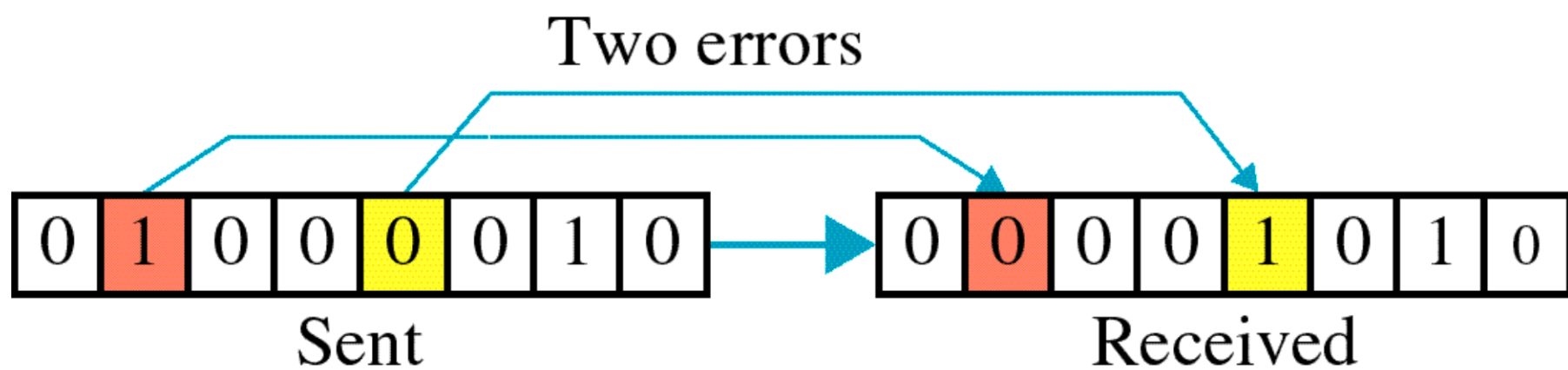# Types of Errors
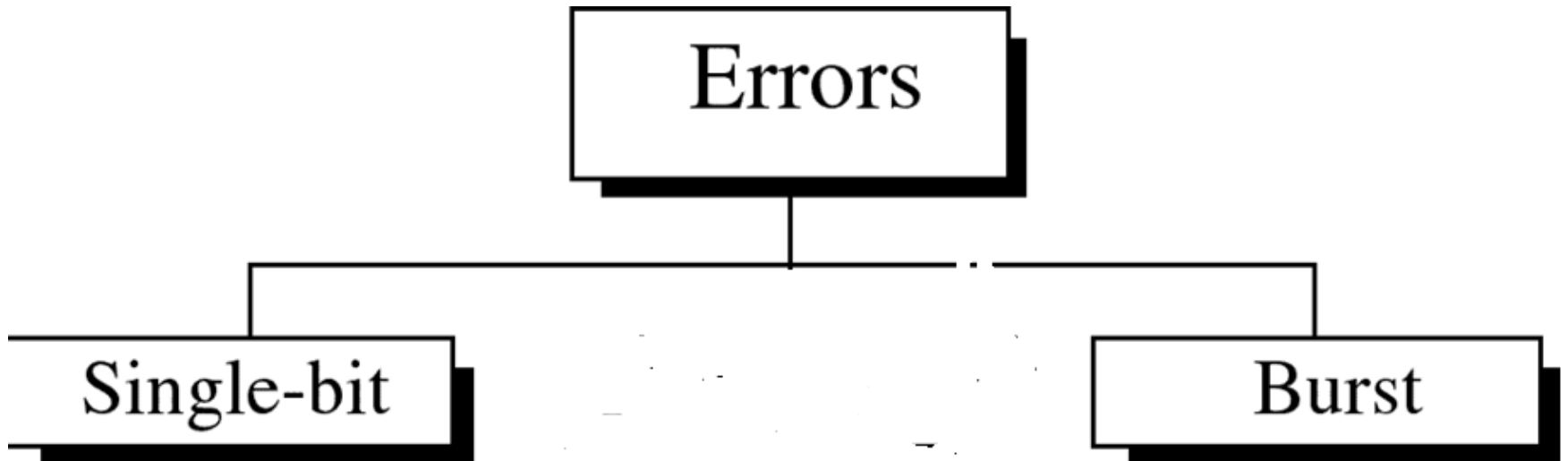
Single-bit error
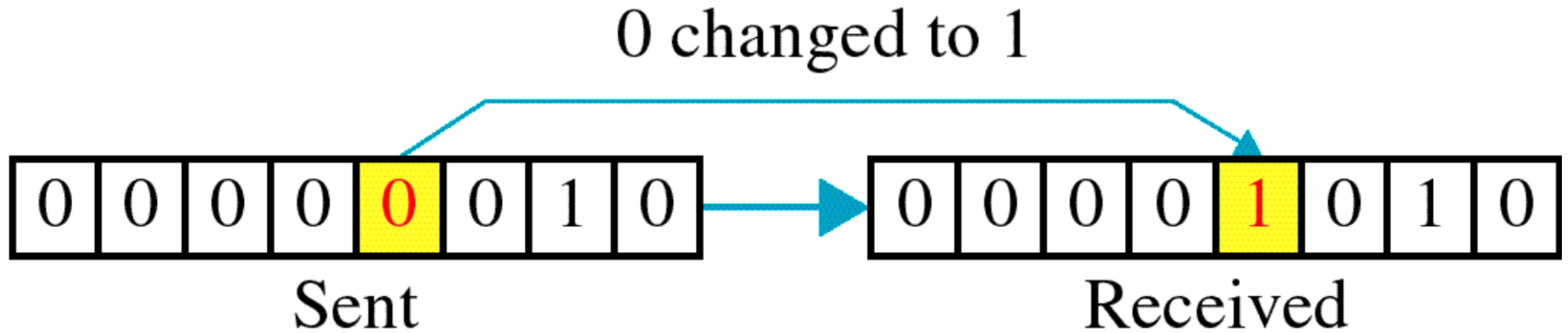
Single bit errors are the **least likely** type of errors in serial data transmission because the noise must have a very short duration which is very rare. However this kind of errors can happen in parallel transmission.

Example:

★ If data is sent at 1Mbps then each bit lasts only 1/1,000,000 sec. or 1 μs.

★ For a single-bit error to occur, the noise must have a duration of only 1 μs, which is very rare.

Burst error

Sent

| 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |

Burst error

| 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |

Received

The term **burst error** means that two or more bits in the data unit have changed from 1 to 0 or from 0 to 1.

Burst errors 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.

★ **Burst error is most likely to happen in serial transmission** since the duration of noise is normally longer than the duration of a bit.

★ The number of bits affected depends on the data rate and duration of noise.

Example:

➔ If data is sent at rate = 1Kbps then a noise of 1/100 sec can affect 10 bits.(1/100*1000)

➔ If same data is sent at rate = 1Mbps then a noise of 1/100 sec can affect 10,000 bits.(1/100*10^6)
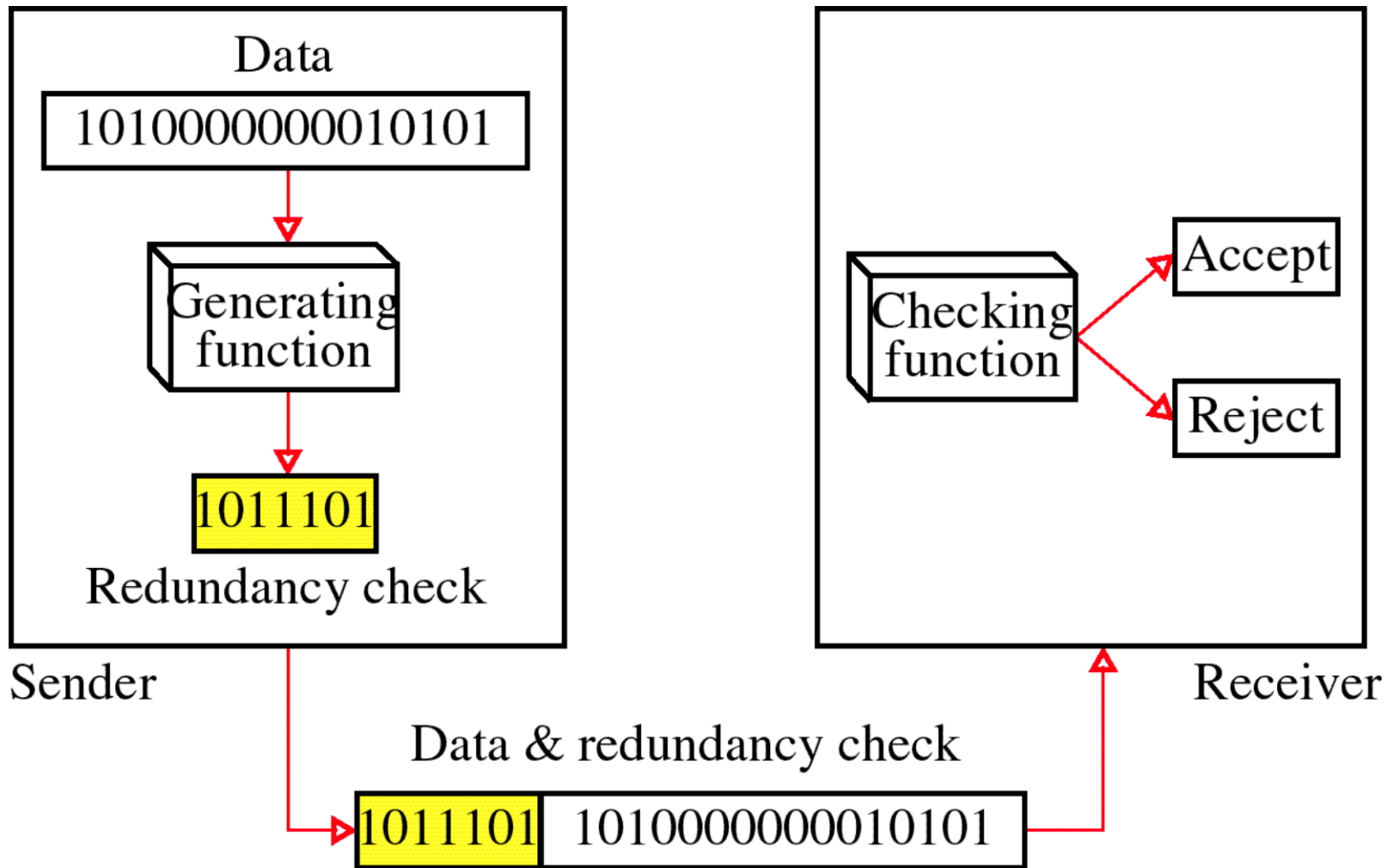
Error detection

Error detection means to decide whether the received data is correct or not without having a copy of the original message.

Error detection **uses the concept of redundancy**, **which means** adding extra bits for detecting errors at the destination.

Redundancy

- The main concept in detecting or correcting errors is redundancy

- The redundancy means- (sending some extra bits)

- We need to send some extra bits with our data to detect and correct errors

- These redundancy bits are added by the sender and removed by the receiver

Redundancy

Error Detection Methods

```
                    Detection methods
                           |
        _____
       |                    |                   |
  Parity Check             CRC             Checksum
       |
       V
   ____|____
  |         |
Even Parity  Odd Parity
```