



Error Detection in Computer Networks

Questions & Answers

1. Explain what is meant by an error in data communication

- Error is a condition when the receiver's information does not match the sender's information. During transmission, digital signals suffer from noise that can introduce errors in the binary bits traveling from sender to receiver. That means a 0 bit may change to 1 or a 1 bit may change to 0.

Single-Bit Error

Burst Error

2. Explain single bit error and burst error using an appropriate diagram

- Single-bit error:
- A single-bit error occurs when only one bit of a data unit is altered during transmission. It can happen due to noise or interference on the communication channel. To illustrate this, consider a scenario where a binary data unit is being transmitted

Original Data: 1 0 1 0 1 0 1 0

| |

Received Data: 1 0 1 0 1 1 1 0

- Burst error:
- A burst error refers to a series of consecutive bit errors that occur within a short period of time. It can be caused by issues such as signal attenuation, synchronization problems, or interference from external sources.

Original Data: 1 0 1 0 1 0 1 0

| | | |

Received Data: 1 1 1 1 0 0 1 0

3. What is Noise in data communication?

- Noise refers to any external and unwanted information that interferes with a transmission signal. Noise can diminish transmission strength and disturb overall communication efficiency. In communications, noise can be created by radio waves, power lines, lightning and bad connections.

4. What are The reasons for occur Errors?

- Noise and Interference:

External sources of noise, such as electromagnetic radiation, atmospheric conditions, or radio frequency interference (RFI), can introduce errors by distorting or corrupting the transmitted signal. Interference can be particularly problematic in wireless communication systems.

- Channel Distortions:

Communication channels, both wired and wireless, can introduce errors due to factors like attenuation (signal loss over distance), signal reflections, multipath propagation (arrival of multiple copies of a signal due to reflections), fading (variation in signal strength), or crosstalk (unwanted coupling between channels). These distortions can cause errors in the received signal.

- Hardware or Equipment Malfunctions:

Errors can occur if there are faults or malfunctions in the hardware components involved in data transmission and reception. This can include issues with network cards, cables, connectors, routers, switches, or other networking equipment

- Software or Firmware Issues:

Errors can also be caused by bugs, glitches, or software/firmware malfunctions in the devices or systems involved in data communication. This can include issues with operating systems, device drivers, networking protocols, or applications handling the data.

- Timing and Synchronization Problems:

Errors can arise if there are timing discrepancies or synchronization issues between the sender and receiver. For example, if the clocks of the transmitting and receiving devices are not synchronized properly, it can lead to errors in data transmission.

- Human Error:

Mistakes made by humans, such as incorrect data entry, configuration errors, or improper handling of equipment, can introduce errors in data communication.

- Environmental Factors:

Environmental conditions, such as extreme temperatures, humidity, electromagnetic interference (EMI) from nearby electronic devices, or physical obstructions, can impact the quality of data transmission and introduce errors.

5. Explain odd parity and even parity.

- Odd Parity:

In odd parity, an additional parity bit is added to the data in such a way that the total number of 1s (including the parity bit) in the data is always odd

Original Data: 1101

During the transmission, if any bit (including the parity bit) is changed due to noise or error, the parity check can detect the discrepancy by examining the total number of 1s. If the received data has an even number of 1s, it means an error has occurred.

- Even Parity:

In even parity, similar to odd parity, an additional parity bit is added to the data. However, in even parity, the total number of 1s (including the parity bit) is always made even. The parity bit is chosen so that the total number of 1s becomes even.

Original Data: 1100

During transmission, the receiver can perform a parity check by counting the number of 1s (including the parity bit). If the received data has an odd number of 1s, it indicates an error.

- By using either odd parity or even parity, errors due to single-bit flips can be detected. However, they cannot correct the errors; they can only indicate whether an error has occurred.

6. . A data transmission system uses an even parity error detection scheme. The

transmitter transmits the following bit stream:

01011100

Due to noise in the transmission channel, the following bit stream was received by

the receiver:

01011000

(i) Identify which bit(s) is(are) in error.

- The 6th bit in the transmitted data is 1, but it has been changed to 0 in the received data. This indicates an error in the 6th bit position.

(ii) Will this error be detected by the receiver? Explain.

- Yes, the receiver will detect the error based on the mismatch between the received data's parity (odd) and the expected even parity. The receiver can then request retransmission of the data or take appropriate measures to handle the detected error.

(iii) If detected, can this error be corrected by the receiver? Explain.

- No, the parity error detection scheme used in this scenario cannot correct the detected error. It can only indicate whether an error has occurred.

Reference

- <https://www.geeksforgeeks.org/>