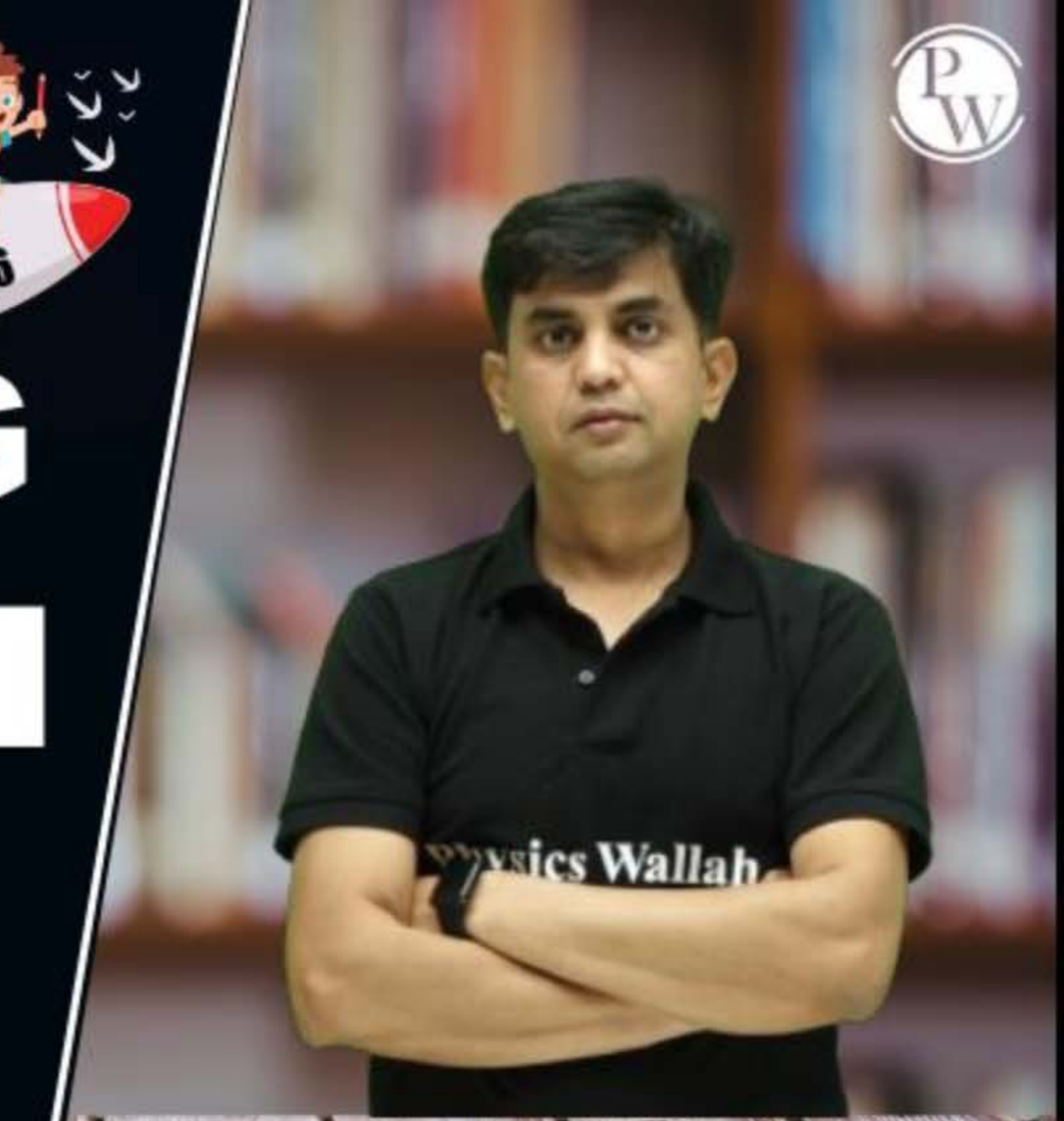
CS & IT ENGINEERING

Computer Network

Error Control

Lecture No. - 01



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Recap of Previous Lecture

Topic Data Link Layer

Topic Physical Layer

Topic Circuit Switching

Topics to be Covered

- Topic: Packet Switching
- Topic: Error Control
- Topic: One-bit parity

Topic : Packet Switching

→ Message is divided into smaller size packets
[Packets may be same or different size]

→ Example : Internet is a packet-switched network

* store-and-Forward

DARPA → Packet-switch Network
[TCP/IP Model]

OSI → Datagram Network
[OSI Model]

Topic : Packet Switching

Advantage :-

→ Store and Forward [Datagram Network]
[No any established circuit required between sender and receiver]

→ Efficent utilization of network resources
[Lead to better utilization of bandwidth resource]

Topic : Packet Switching

⇒ Node : Router

Disadvantage :-

→ Congestion may occur during routing

→ Every packet is treated independently at every intermediate router

=> More per packet processing overhead at intermediate router

=> Packets may follow different routing paths

=> Packets may have different end-to-end delay

Topic : Types of services

→ Based on order of delivery of data (or packets) at reciver

→ Types of network services :

1. Connection Oriented Services
   [Order of delivery of data (or packets) is same as transmitter transmitted]
2. Connection Less Services
   [Data (or packets) can be delivered in any order to receiver]

Topic : Types of services

→ Circuit switching provide Connection Oriented and Reliable services

→ Packet switching provide Connection Less and Unreliable services

→ Sometimes packet switching may require reordering of packets at receiver

IP : Connection less and unreliable

→ Best Effort Delivery (No any ACK)

#Q. Which one of the following statements is FALSE? (H.W.) IIT-D

[GATE 2004, 1-Mark]

(A) Packet switching leads to better utilization of bandwidth resources than circuit switching

(B) Packet switching results in less variation in delay than circuit switching

(C) Packet switching requires more per-packet processing than circuit switching

(D) Packet switching can lead to reordering unlike in circuit switching

Topic : Virtual Circuit Switching

→ Need to establish virtual circuit between sender and receiver before transmission

→ Entire routing path of packets is determined before transmission
[Entire routing path is fixed for duration of virtual circuit]

→ Example : Used in technologies like X.25, Frame Relay, and ATM

Topic : Virtual Circuit Switching

Advantage :-

→ Every packets follow each other on predefined path
[Connection Oriented Packet Switching]

Disadvantage :-

→ Congestion may occur during routing

→ Packets may have different end-to-end delay

Topic : Error Control

Receiver	Sender
(Received data) 1 0 1 1 0 0 1 0	(Transmitted data) 1 0 1 1 0 0 1 0

→ if "**Received data**" is not same as "**Transmitted data**"
then "**chance of error**"

Topic : Error

Error : Corrupted data [flipped data bits]

Types of error:

1. **Single bit error**
2. **Burst error**

Error : bits can be erased

Topic : Single bit error

→ Only one bit in the received data has changed.

Transmitted data = 1 0 1 1 0 0 1 0

Received data = 1 0 1 1 1 0 1 0

No. of corrupted bits = 1

Topic : Burst Error

→ Multiple bit error

→ More than one [two or more] bit in the received data have changed.

Transmitted data = 1 0 1 1 0 0 1 0

Received data = 1 1 1 1 0 1 0 0

No. of corrupted bits ≥ 2

No. of corrupted bits = 3

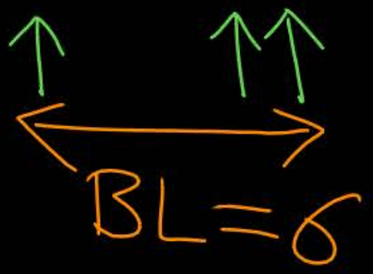
Topic : Burst Error

→ Burst Length =

Length from first corrupted bit to the last corrupted bit [inclusive]

Transmitted data = 1 0 1 1 0 0 1 0

Received data = 1 1 1 1 0 1 0 0



Topic : Burst Error

→ In case of burst error,

total number of corrupted data bits is less than equal to Burst Length

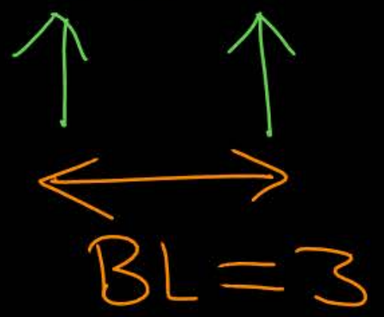
For 2 bit Error

$BL >= 2$

#Q. Consider ASCII character "A" (ASCII value 65) is transmitted by transmitter, but ASCII character "D" (ASCII value 68) is received by receiver. Calculate burst length ?

Transmitted Data = "A" = 65 = 0100001

Received Data = "D" = 68 = 0100100



Ans=3

Topic : Error Control

→ Based on Redundant bits

[Parity bits or extra bits or check bits]

1. **Error detection** only
2. **Error detection and correction**

Topic : Error detection

→ Can only detect error(s)

→ Not able to correct

→ Retransmission of corrupted data

Two error detection technique :

1. Cyclic Redundancy Check (CRC) ⟹ Data Link Layer [Frame] → V.V.Imp.
2. Checksum ⟹ TCP, UDP, IPv4 → Easy

CN-1

Topic : Error detection and correction

→ Can detect as well as correct error(s)

→ Forward error correction (FEC)

Two error detection and correction technique :

1. 2D Parity ⟹ IT-2008
2. Hamming Code ⟹ CS-2021

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* Hamming Distance ⇒ Imp.

2 mins Summary

Topic Packet Switching

Topic Error Control

Topic ~~One bit parity~~

THANK - YOU