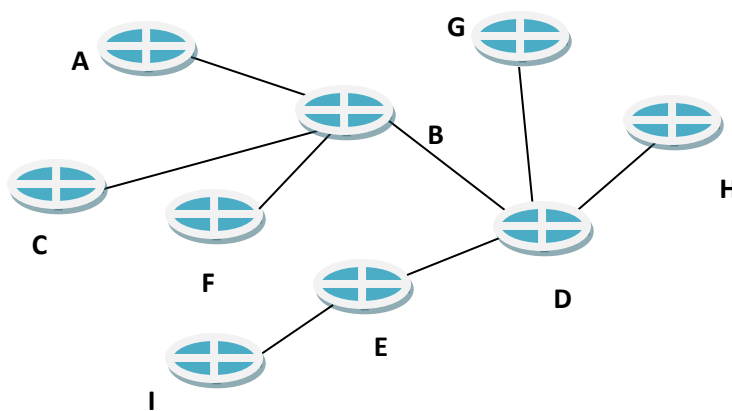


1) The key difference between Pure Aloha and Slotted Aloha:

In Pure Aloha, Data is transmitted at time by nodes. However, data can send whenever node want to. This can lead to collision in case of Multiple Nodes when they are transmitting at same time. Since time is divided into slots in Slotted Aloha, every node can transmit the data at the beginning of time slots only.

Throughput of Slotted Aloha is (0.368) double when  $G=1$  of the throughput of Pure Aloha (0.184). the Slotted Aloha performs better than Pure Aloha in any circumstance and can send more packets than Pure Aloha.

2)



3) Compare to single encryption, double encryption is more secure because to decrypt cipher text from double encryption, one must use two keys. To make more secure, double number of possibilities to decrypt the data using Brute Force Attack.

4) Bit String: 001011010101000011111101001101

Key: 10110

Encryption : Divide the Bit String as the same length as key

SubString	XOR	Key	Cipher
00101	XOR	10110	10011
10101	XOR	10110	00011
01000	XOR	10110	11110
01111	XOR	10110	11001
11010	XOR	10110	01100
01101	XOR	10110	11011
Cipher Text: 100110001111110110010110011011			

Decryption: Divide the received Cipher Text into the substring of length of key.

SubString	XOR	Key	Plain text
10011	XOR	10110	00101
00011	XOR	10110	10101

11110	XOR	10110	01000
11001	XOR	10110	01111
01100	XOR	10110	11010
11011	XOR	10110	01101
Plain Text: 001011010101000011111101001101			

5) Number of Possible keys =  $2^{64}$   
Seconds in 30 Days: 2592000 sec  
Number of keys per-second =  $\frac{\text{Number of Possible keys}}{\text{Seconds in 30 Days}}$   

$$= \frac{2^{64}}{2592000}$$

$$= 7116799411153.3 \text{ keys}$$

- 6)
- Channel Partitioning: Frequency Division Multiple Access (FDM) , Time Division Multiple Access(TDM)
  - Random Access: Pure ALOHA, Slotted ALOHA, CSMA
  - Taking Turns: Token Ring

In Cable Access Network, FDM is used at downstream channel, where broadcasting the data is done CMTS (This is the only station responsible for broadcasting) and for no collision, token rings is used for upstream. TDM is used at upstream. In case of multiple senders, sender assigned the time slots to upload the data who has token (it is allotted from CMTS).

- 7)
- a. In fully-connected topology, every node has direct link between them as every node connected with each other. This direct links gives various advantages:
- Between to nodes, there is no third party. This will provide high security.
  - Due to direct, data transfer speed is high between sender and receiver. This will help us use full-bandwidth of link.
  - No collision.
- b. **Disadvantages:**
- Not highly scalable.
  - Addition of new node is very costly because new node must link with each node of network.
  - Cost of Maintenance is high.
- c. This topology helps us to the issue of Limited host-to-host Capacity and host in any two racks have higher speed between them if they are not connected with same switch.
- For example: Tier-1 nodes = 4**  
**Tier-2 nodes = 4**

With the use of fully connected topology: Between two nodes of Tier 2, it provides 4 distinct path which gives an 40Gbps total capacity.

Without Fully-Connected: to Transmit data from Node A to Node B (Both nodes are of Tier 2), host need to travel higher up the hierarchy. This will result in reduction of the speed than the speed of the network with fully-connected topology.

8) Assume the utilization of Hamming Codes for single-bit error correction.

A) For 11 bits string = 4 parity bits is enough.

$$\text{Total Possible number of errors} = 11 + 4 = 15 < 2^4 = 16$$

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
p1	p2	M1	p3	M2	M3	M4	p4	M5	M6	M7	M8	M9	M10	M11

B) For 19 bits string = 5 parity bits is enough

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
p1	p2	m1	p3	m2	m3	m4	p4	m5	m6	m7	m8	m9	m10	m11	p5	m12	m13	m14	m15	m16	m17	m18	m19

$$\text{Total Possible number of errors} = 19 + 5 = 24 < 2^5 = 32$$

9) Fully Switched Ethernet LANs: Without the collision issues, They provide a superior performance compared to Token Ring LANs.

In fully switched Ethernet, different collision domain is cause due to usage of switches and since there is no collision because each device is connected to a different port.

Furthermore, CSMA/CD is not need since it operates in a full-duplex mode.

Disadvantages:

Token Rings:

- While transmitting, Chance of token lost, and corruption is possible.
- Causes a problem when host lost his token.

Switched Ethernet:

- Collision issues occurs when Switched Ethernet with hubs are used.

References:

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