Differentiate between

1. Analog signals and digital signals

Feature	Analog Signal	Digital Signal
Definition	A continuous signal that varies in amplitude and frequency	A discrete signal that represents binary data
Representation	Represented by sine waves	Represented by binary digits (0's and 1's)
Accuracy	Less accurate	More accurate
Noise	Suffers from noise interference	Resistant to noise interference
Bandwidth	More bandwidth required for transmission	Less bandwidth required for transmission
Storage	Cannot be stored without losing quality	Can be stored and reproduced without losing quality
Examples	Sound waves, analog phone lines, old TV transmissions	Digital phone lines, CDs, DVDs, digital TV transmissions

2. LAN vs MAN vs WAN

Feature	LAN	MAN	WAN
Speed	Very high	High	Low to high
Congestion	Low	Moderate to high	Moderate to high
Maintenance	Easy	Moderate to difficult	Difficult
Area Coverage	Small	Medium	Large

3. Unguided transmission and guided transmission

Parameters	Unguided Transmission	Guided Transmission
Physical medium	**Not Required**	**Required**
Signal attenuation	**Not an issue**	**Experiences It**
Interference	**Less**	**More**
Distance	**Longer**	**Shorter**
Security	**Less**	**More**

4. UTP vs STP

Parameters	UTP	STP
Noise	**Comparatively weaker at reducing noise**	**STP cables are better at reducing noise**
Ease of Handling	**UTP cables are generally easier to handle and install**	**STP cables are Difficult to install**
Cost:	**UTP cables are generally less expensive than STP**	**STP cables are generally more expensive than UTP**
Speed and Attenuation:	**Lower Attenuation and Higher Transmission Speed**	**Higher Attenuation and lower Transmission speed**

5. Fiber Optic vs Copper Wire

Sr. No.	Basis	Fiber Optic Cable	Copper Wire
1.	Data Carrier	It carries data in the form of light.	It carries data in the form of electric signals.
2.	Bandwidth	It offers higher bandwidth.	It offers lower bandwidth.
3.	Structure	It is thin, lighter in weight, and smaller in size.	It is heavier and thicker.
4.	Environment	It can be laid in different environments because it is more resistant to corrosive materials.	It cannot be laid in a different environment because it is more prone to corrosive materials.
5.	Attenuation	Attenuation is very low.	Attenuation is high.
6.	Interface	As this data travel in the form of light, they are not affected by the electrical and magnetic interfaces.	As in this data travel in the form of electric signals, they are affected by the electrical and magnetic interfaces.
7.	Security	They provide security against the wiretappers, because there is no leakage of light and are difficult to tap.	They do not provide security against the wiretappers, because there is leakage of signals, and are easy to tap.
8.	Cross-talk problem	There is no such kind of problem.	These are prevalent this problem.

6. Token passing and CSMA/ CD

Token Passing	**CSMA/CD**
Nodes Grant permission for transmitting the data	Each node listens to network before transmitting data in order to avoid collisions

In Token Passing, the nodes are organized in a logical ring topology, and the token circulates around the ring.	In CSMA/CD, the nodes are connected to a shared communication medium, such as a coaxial cable or a hub.
A node can only transmit data when it holds the token.	In CSMA/CD, a node listens to the network before transmitting data.
Token Passing is a deterministic protocol	CSMA/CD is a probabilistic protocol
Token Passing is more suitable for networks with a low to moderate number of nodes	CSMA/CD is more suitable for networks with a higher number of nodes
Token Passing has a high overhead,	CSMA/CD has a lower overhead
Token Passing is more secure than CSMA/CD,	CSMA/CD is less secure than Token Passing,

7. Hub vs Switch

Factor	**Hub**	**Switch**
Layer	Physical layer (Layer 1)	Data link layer (Layer 2)
Ports	Fewer number of ports, typically 4-8	More number of ports, typically 8-48
Device type	Passive device	Active device
Speed	Slower speeds due to collisions and broadcast nature	Faster speeds due to switching and dedicated connections

8. Ring Topology vs Bus topology

Feature	**Ring Topology**	**Bus Topology**
Transmission	Unidirectional	Bidirectional
Network Length	Limited by the number of nodes	Limited by the signal strength
Network Access	Token passing	CSMA/CD
Failure	One node failure may affect the whole network	Any device can be removed without affecting the rest
Collision	No collision	Collision may occur

Network Cost	Expensive	Inexpensive
Installation	Complex	Easy
Scalability	Difficult	Easy
Performance	Good with few nodes	Good with moderate number of nodes

9. Router and repeater

Features	**Router**	**Repeater**
Functionality	Routes data packets between networks based on IP addresses	Regenerates weak signals in a network to extend the range
Network topology	Can be used in any network topology	Typically used in point-to-point or star network topologies
Range	Can cover long distances between networks	Limited to the range of the original signal
Performance	Can prioritize and manage network traffic for optimal performance	Can introduce latency and delay in network traffic
Security	Provides advanced security features such as firewalls and VPNs	Does not provide any security features
Cost	Tends to be more expensive than repeaters	Relatively less expensive than routers
Complexity	Can be complex to set up and configure	Easy to set up and use

10. OSI vs TCP/IP

OSI reference model	TCP/IP network model
1) It has 7 layers	1) It has 4 layers
2) Transport layer guarantees delivery of packets	2) Transport layer does not guarantees delivery of packets

3) Horizontal approach	3) Vertical approach
4) Separate presentation layer	4) No session layer, characteristics are provided by transport layer
5) Separate session layer	5) No presentation layer, characteristics are provided by application layer
6) Network layer provides both connectionless and connection oriented services	6) Network layer provides only connection less services
7) It defines the services, interfaces and protocols very clearly and makes a clear distinction between them	7) It does not clearly distinguishes between service interface and protocols
8) The protocol are better hidden and can be easily replaced as the technology changes	8) It is not easy to replace the protocols
9) OSI truly is a general model	9) TCP/IP cannot be used for any other application
10) It has a problem of protocol filtering into a model	10) The model does not fit any protocol stack

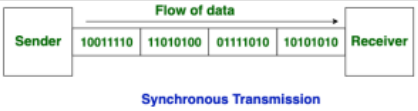
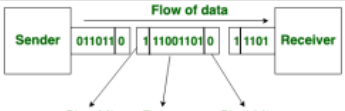
11. FDM and TDM

Frequency Division Multiplexing	**Time division Multiplexing**
FDM divides the channel into two or more frequency ranges that do not overlap	TDM divides and allocates certain time periods to each channel in an alternating manner
Frequency is shared	Times scale is shared
Used with Analog signals	Used with both Digital signals and analog signals
Interference is high	Interference is Low or negligible
Utilization is Ineffective	Efficiently used

12. LRC and CRC

	LRC (Longitudinal Redundancy Check)	CRC (Cyclic Redundancy Check)
Type of technique	Parity-based technique	Mathematical-based technique
Calculation	Adds up all bits in a data packet and checks if total is odd or even	Generates a checksum based on a mathematical calculation performed on the entire data packet
Error detection	Detects errors where an odd number of bits are flipped	Detects errors where multiple bits are flipped
Complexity	Simple	More complex than LRC
Data packet size	Suitable for smaller data packets	Suitable for larger data packets
Efficiency	Less efficient in detecting errors compared to LRC	More efficient in detecting errors compared to LRC

13.Synchronous and Asynchronous communication

Synchronous communication	Asynchronous communication
In Synchronous Transmission, data is sent in form of blocks or frames.	In Asynchronous Transmission, data is sent in form of byte or character.
Sender and Receiver use the same clock signal	Does not need clock signal between the sender and the receiver
It is more efficient and more reliable than asynchronous transmission to transfer the large amount of data.	In this transmission start bits and stop bits are added with data.
 Synchronous Transmission	 Asynchronous Transmission
Synchronous transmission is fast.	Asynchronous transmission is slow.
In Synchronous transmission, time interval of transmission is constant.	In asynchronous transmission, time interval of transmission is not constant, it is random.

14. IPv4 vs IPv6

IPV4	IPv6
Source and destination addresses are 32 bits (4 bytes) in length.	Source and destination addresses are 128Bits (16 bytes) in length.
No. addresses are limited to number of bits (32 bits)	Larger addressing area
Uses broadcast addresses to send traffic to all nodes on a subnet.	There are no IPv6 broadcast addresses. Instead, multicast scoped addresses aroused
Fragmentation is supported at Originating hosts and intermediate routers.	Fragmentation is not supported at routers. It is only supported at the originating host
IP header includes a checksum	IP header does not include a checksum.
IP header includes options	All optional data is moved to IPv6extension headers
IPv4 has classful addressing scheme, includes classes like A,B,C,D and E.	Classless addressing scheme.
Uses decimal dotted notation	Uses hexadecimal notation