OSI Reference Model

No	Layer			Device	Unit
	General	**OSI**	**DOD**		
7	Upper	Application	Process / Application		
6		Presentation			
5		Session			
4	Middle	Transport	Host to Host	Local Dir	Segment
3		Network	Internet	Router	Packet
2	Lower	Data Link	Network Access	Switch / Bridge	Frame
1		Physical		Hub/Repeater	Bit

Application Layer

- Identifies and establishes the resources availability of the intended communication devices.
- Synchronises Sending and recieving Applications
- Agrees on error control and data integrity of communicating applications.
- Provides system-independent processes or program services to end users.
- User Interface - ***Telnet, SMTP, FTP*** etc.

Presentation Layer

- Negotiates Data Transfer Syntax
- Encoding or Decoding (***ASCII, EBCDIC, PICT, JPEG,TIFF, MPEG, MIDI***).

Session Layer

- Establishing, Managing and Terminating sessions between applications.
- Coordinates communication between Systems.
- Protocols : ***NFS, SQL, X-Window, RPC***

Transport Layer

- Mechanism for multiplexing upper-layer application, establishing session, and building / tearing down virtual circuits.
- Flow Control :
  - Upon recieving the segments, the recipient sends an acknowledgement back to the sender.
  - Any segments not acknowledged are retransmitted.
  - Segments are sequenced back to their proper order upon arrival at their destination.
  - A managable data flow is maintained in order to avoid congestion,overloading and the loss of any data.
- Acknowledgment and windowing
- Hides detail of any network-dependent information from the higher layers by providing transparent data transfer.
- Reliable data transport, error checking and recovery, flow control, multiplexing.

Network Layer

- Routing and Logical Addressing

Data Link Layer

- Putting 1s and 0s into a logical group.
- Two IEEE Sublayers

  LLC (Logical Link Control): Manage Communications

  MAC (Media Access Control): Manages Device Addressing and access to the physical layer.
- Reliable transit of data across the physical network.

Physical Layer

- Bit Synchronisation
- Defines the physical topology
- Build, maintain and break physical connections.

Test your knowledge

1. Bridges work at which layer of OSI reference model?
2. Repeaters work at which layer of the OSI reference model?
3. Routers work at which layer of the OSI reference model?
4. Which layer defines bit synchronisation?
5. Which layer defines the physical topology?
6. Which layer hides details of any network-dependent information from the higher layers by providing transparent data transfer?
7. Which layer is responsible for addressing devices and routing through an internetwork?
8. Which layer is responsible for coordinating communication between systems?
9. Which layer is responsible for determining if sufficient resources for the intended communication exists?
10. Which layer is responsible for flow control, acknowledgment, and windowing?
11. Which layer is responsible for framing?
12. Which layer is responsible for identifying and establishing the availability of the intended communication partner?
13. Which layer is responsible for negotiating data transfer syntax?
14. Which layer is responsible for providing mechanisms for multiplexing upper-layer application, session establishment, and tear-down of virtual circuits?

15. Which layer is responsible for putting 1s and 0s into a logical group?

16. Which layer is responsible for synchronizing sending and receiving applications?

Connection Oriented & Connectionless Network Service

Describe connection-oriented network service and connectionless network service, and identify the key differences between them.

Specification	Connection Oriented	Connectionless
Reliablity	Reliable	Unreliable
Sequencing	Yes	No
Acknowledgment	Yes (Virtual Circuit)	No
Overhead	High	Low
Benefit	Error Checking	Best Effort Delivery
IP	TCP (Port 6)	UDP (Port 17)
Novell	SPX	IPX

TCP : Transmission Control Protocol
UDP : User Datagram Protocol.

Connection Oriented Communications Session between Systems

- The segments delivered are acknowledged back to the sender upon their reception.
- Any segments not acknowledged are retransmitted.
- Segments are sequenced back into their proper order upon arrival at their destination.
- A manageable data flow is maintained in order to avoid congestion, overloading, and the loss of any data.

Describe *data link addresses* and *network-addresses* and identify the key diferences between them

Description	Data Link Address	Network Address
Definition	A unique address that is burned into each NIC by the manufacturer	A virtual address that is also known as a logical address
Length	6 Bytes = 48 bit FF:FF:FF:FF:FF:FF	4 Bytes = 32 bit FF:FF:FF:FF
Scheme	Hirerarchial	Flat
Address	MAC	Network
Protocol	RARP - Known	ARP - Known

Define and explain the 5 conversion steps of data encapsulation

1. User Information is converted into data.
2. The data is converted into segments.
3. The segments are converted into packets or datagrams.
4. The packets or datagrams are converted into Frames.
5. The Frames are then put into bits.