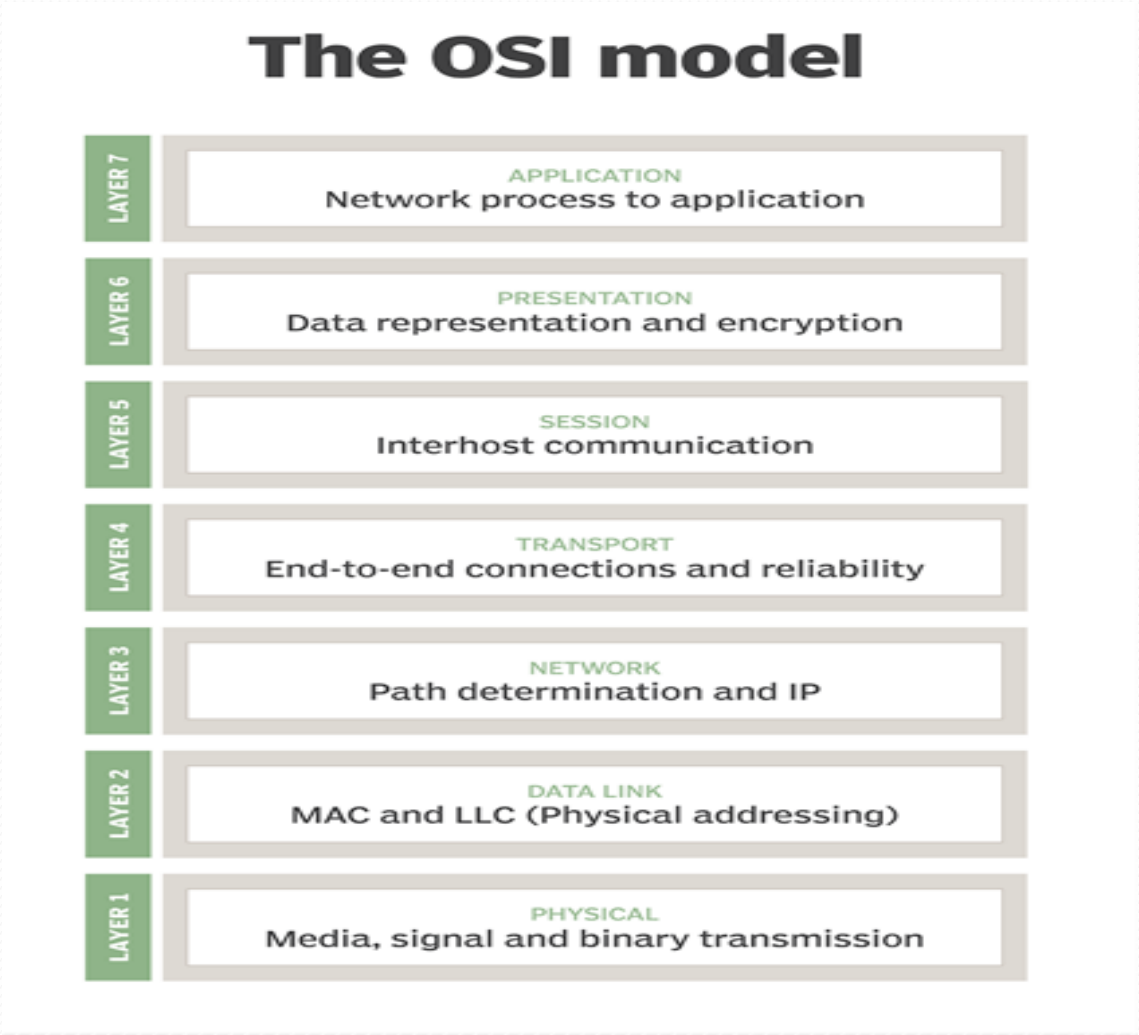
OSI Reference Model

- OSI- Opens System Interconnections.
- It was proposed by ISO (International Organization for Standards) in 1984 after the TCP/IP model.
- Stats developing in late 1970s.
- Approved by 1984.
- The term “Open” in Open System Interconnections denotes “to communicate with any 2 systems” .
- There are 7 layers in OSI Reference model.
- It is also called OSI layered architecture / OSI Protocol architecture.
- The process of breaking up the functions or tasks of networking into layers reduces complexity.
- Each layer provides a service to the layer above it in the protocol specification.
- Each layer communicates with the same layer’s software or hardware on other computers.

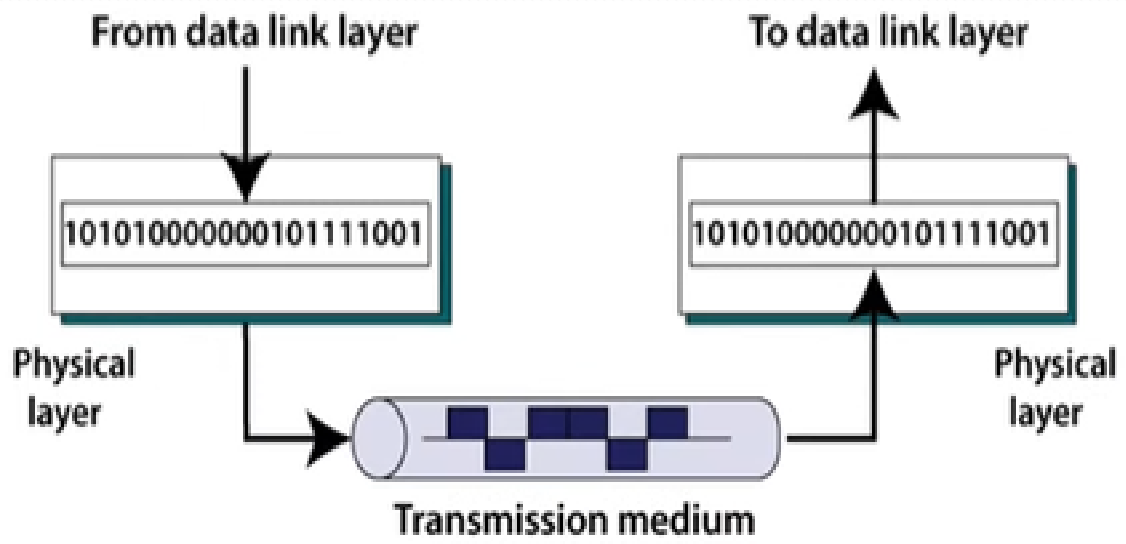
Layers of OSI Reference Model



Physical Layer

- In the OSI model, the physical layer is the lowest layer, and it deals with the actual physical transmission of data over a physical medium, such as copper wires, optical fibres, or wireless radio waves.
- It defines the hardware characteristics and electrical/optical specifications of the transmission medium.
- Examples of devices at the OSI physical layer include Hub, Repeater, Modem, Cables.
- It deals with the mechanical and electrical specifications of the interface and transmission medium.

Physical Layer

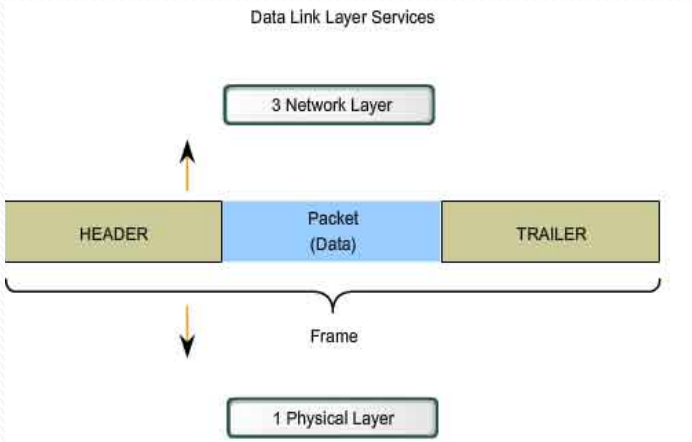


Data Link Layer

- It receives the data from network layer and creates frames, and add physical address to these frames.
- The data unit in the data link layer is called Ethernet frame.
- The DLL is divided into two sub layers.
  - MAC(Media Access Control).
  - LLC(Logical Link Control).
- The MAC sub-layer is responsible for data encapsulation and accessing media.
- **Encapsulation:**
- In encapsulation IP packet receives from network layers are added with header and trailer.

Data Link Layer

- **Header:**
  - Contains MAC address of sender and Receiver.
- **Trailer:**
  - 4 bytes of error checking data used to detect error in received Ethernet frame.



- **Access Method :**
- CSMA/CD
- **LLC(Logical Link Control).**
  - It offers flow control and error control.

Network Layer

- The transport layer passes the TCP segments or UDP datagram to the network layers.
- Then NL accept the transport layer segments and add logical addressing and form a packet.
- Responsible for moving packets from source to destination.
- Also provides internetworking.
- Also determine best path for packet delivery.
- It offers
  - Logical addressing
  - Routing
  - Path determination

Transport Layer

- Transport layer ensure end to end error free reliable delivery of data.
- It uses TCP and UDP protocols.
- When the message reaches the transport layers, one transport layer protocols TCP or UDP is selected.
- Normally, OSI transport layer is connection oriented . i.e. TCP is selected.

TCP

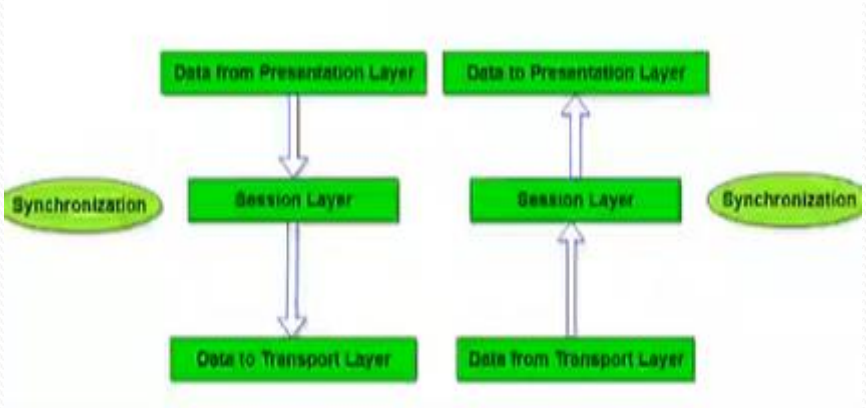
- Supports segmentation
- Connection oriented
- Reliable
- TCP segment

UDP

- Does not support segmentation
- Connection less
- Unreliable
- UDP datagram

Session Layer

- Creates communication channel and controlling ports and session.
- It establishes, maintains, and ends a session.
- It is also responsible for dialog control and Co-ordinates communication between the system.
- Session layer enables two systems to enter into a dialog/Communication.
  - Session management.
  - Authentication.
  - Authorization.
  - Synchronization



Presentation Layer

- Presentation Layer is responsible for to Translate, Compress, Encrypt and Decrypt data.
- The data is in the form of character or numbers.
- Ex: Character code translation from ASCII to EBCDIC
  - ASCII →EBCDIC
- Before data is transmitted ,presentation layer reduces the number of bits that are use for represent original data. This bit reduction process is called compression.
- It helps to encrypt data for security purpose i.e. it enhance security.

Application Layer

- Application layer allows access to network resources.
- In the application layer, an application, such as an internet browser, gets the data and a user can then interact with it.
- Highest level of OSI layers.
- Application-layer helps to identify communication partners, determining resource availability, and synchronizing communication.
- It allows users to log on to a remote host.
- This layer provides various e-mail services.
- This is also called closet layer from user.

Protocols used in OSI reference Model

Layer	Name	Protocols
Layer 7	Application	SMTP, HTTP, FTP, POP3, SNMP, DNS etc.
Layer 6	Presentation	MPEG, ASCH, SSL, TLS.
Layer 5	Session	NetBIOS, SAP
Layer 4	Transport	TCP, UDP
Layer 3	Network	IPV4, IPV6, ICMP, IPSEC, ARP, MPLS.
Layer 2	Data Link	RAPA, PPP, Frame Relay, ATM, etc.
Layer 1	Physical	RS232, 100BaseTX, ISDN.

TCP/IP Model and its Comparison with OSI

Brief History of TCP/IP Model

- TCP/IP protocol suite was developed before the OSI model.
- TCP/IP is a set of protocols developed to allow co-operating computers to share resources across a network.
- In 1969 the Defense Advanced research projects Agency (DARPA) funded a research and development project to create an experimental packet switching network. This network is called ARPANET.
- n 1975 the ARPANET was converted from an experimental network to an operational network, and the responsibility for administering the network was given to the Defense Communication Agency (DCA).

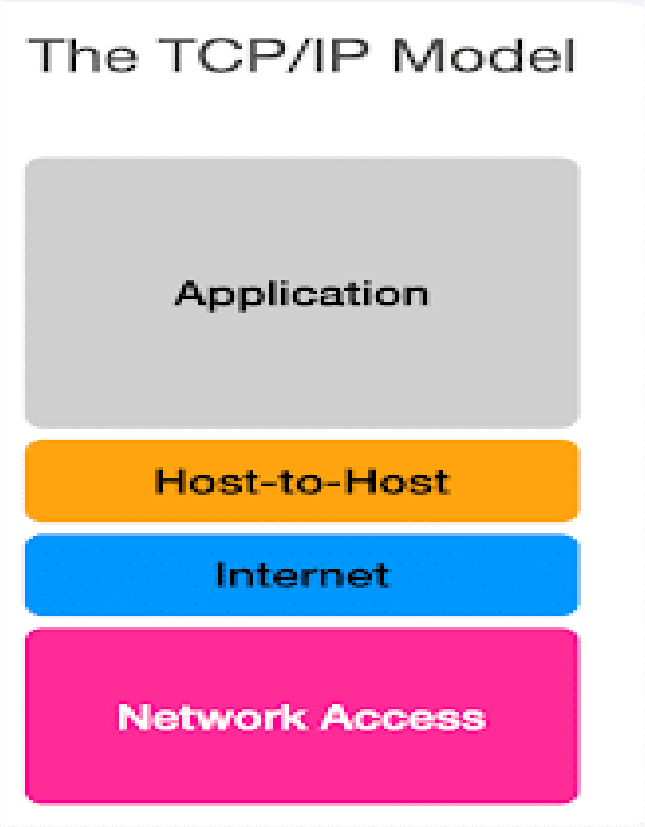
Cont.

- The TCP/IP protocols were adopted as Military Standards (MIL STD) in 1983, and all hosts connected to the network were required to convert to the new protocols.
- DARPA funded to implement TCP/IP in Berkely Unix.
- In 1983, the old ARPANET was divided into MILNET and smaller ARPANET. The Internet was used to refer to the entire network; MILNET and ARPANET.

TCP/IP Model

- The TCP/IP model is a widely used networking model that consists of four layers: Application, Transport, Internet, and Link(Network Access Layer).
- TCP/IP is a set of protocols developed to allow cooperating computers to share resources across a network.
- It serves as the foundation for the modern internet and is responsible for the end-to-end communication of data packets across networks.
- The TCP/IP model combines the OSI model's physical and data link layers into a single "Link Layer" due to its focus on real-world networking.
- Key protocols within the TCP/IP model include TCP (Transmission Control Protocol) and IP (Internet Protocol), which enable reliable communication and routing of data packets.
- It is a more flexible and adaptable model compared to OSI, making it well-suited for the dynamic and evolving nature of the internet.

TCP/IP Model


The TCP/IP Model
Application
Host-to-Host
Internet
Network Access

TCP/IP Model

Layers

- Application Layer
- Transport Layer
- Internet Layer
- Network Access Layer/Link layer

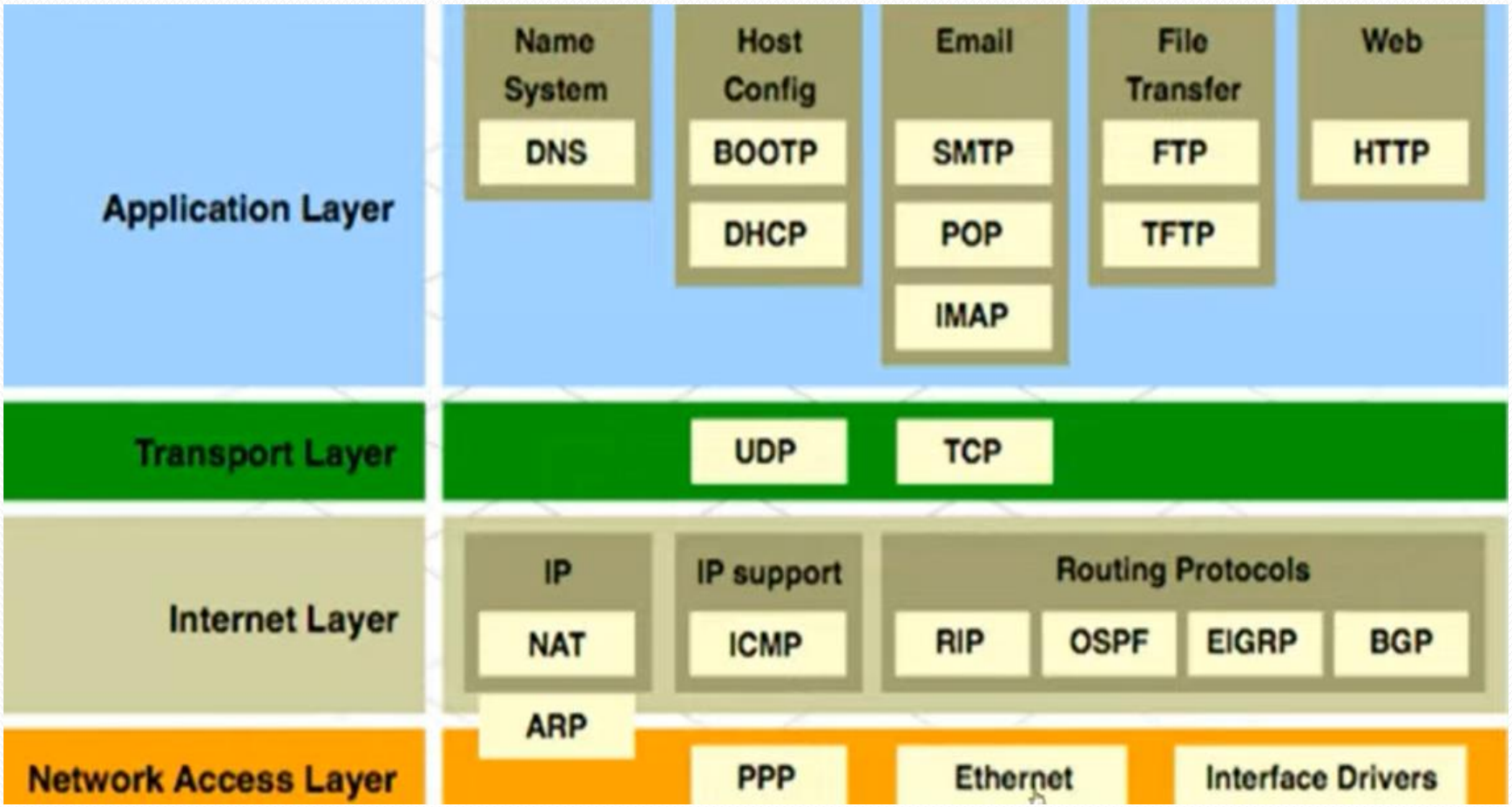
PDUs

- Application message
- TCP segment/UDP datagram
- IP packet
- Ethernet Frame

TCP/IP Model

- **Application Layer:**
  - This layer is responsible for providing network services directly to end-users or applications. It includes protocols like HTTP (for web browsing), SMTP (for email), FTP (for file transfer), and more. Application layer protocols facilitate communication between software applications running on different devices.
- **Transport Layer:**
  - The transport layer is responsible for end-to-end communication and data flow control between devices on different networks. It includes two main protocols: Transmission Control Protocol (TCP) and User Datagram Protocol (UDP). TCP provides reliable, connection-oriented communication, while UDP offers connectionless, unreliable communication.
- **Internet Layer:**
  - This layer handles logical addressing, routing, and forwarding of data packets across different networks. The primary protocol at this layer is the Internet Protocol (IP), which enables the routing of packets from the source to the destination based on IP addresses.
- **Link Layer:/Network Access Layer**
  - The link layer, sometimes called the network interface or data link layer, deals with the physical connection between devices on the same local network segment. It includes hardware-specific protocols and technologies, such as Ethernet, Wi-Fi, and others. This layer is responsible for addressing and error detection at the local network level.

Protocols Used in TCP/IP Model



Parameters	OSI Model	TCP/IP Model
Full Form	OSI stands for Open Systems Interconnection.	TCP/IP stands for Transmission Control Protocol/Internet Protocol.
Layers	It has 7 layers.	It has 4 layers.
Usage	It is low in usage. Generally in Research.	It is mostly used for network design.
Model	It is theoretical/Reference Model.	It is Practical/Implementation Model.
Delivery	Delivery of the package is guaranteed in OSI Model.	Delivery of the package is not guaranteed in TCP/IP Model.
Replacement	Replacement of tools and changes can easily be done in this model.	Replacing the tools is not easy as it is in OSI Model.
Reliability	It is less reliable than TCP/IP Model.	It is more reliable than OSI Model.
Developed By	ISO(International Organization for Standardization)	DoD(Department of Defense)
Model Concept	Based on three concept i.e Service, Interface and protocols.	It didn't explicitly distinguish between service ,interface and protocols.
Layer Separation	OSI model has separate Presentation layer and Session layer.	TCP/IP model does not have separate Presentation layer and Session layer.

Table : OSI vs TCP/IP Model

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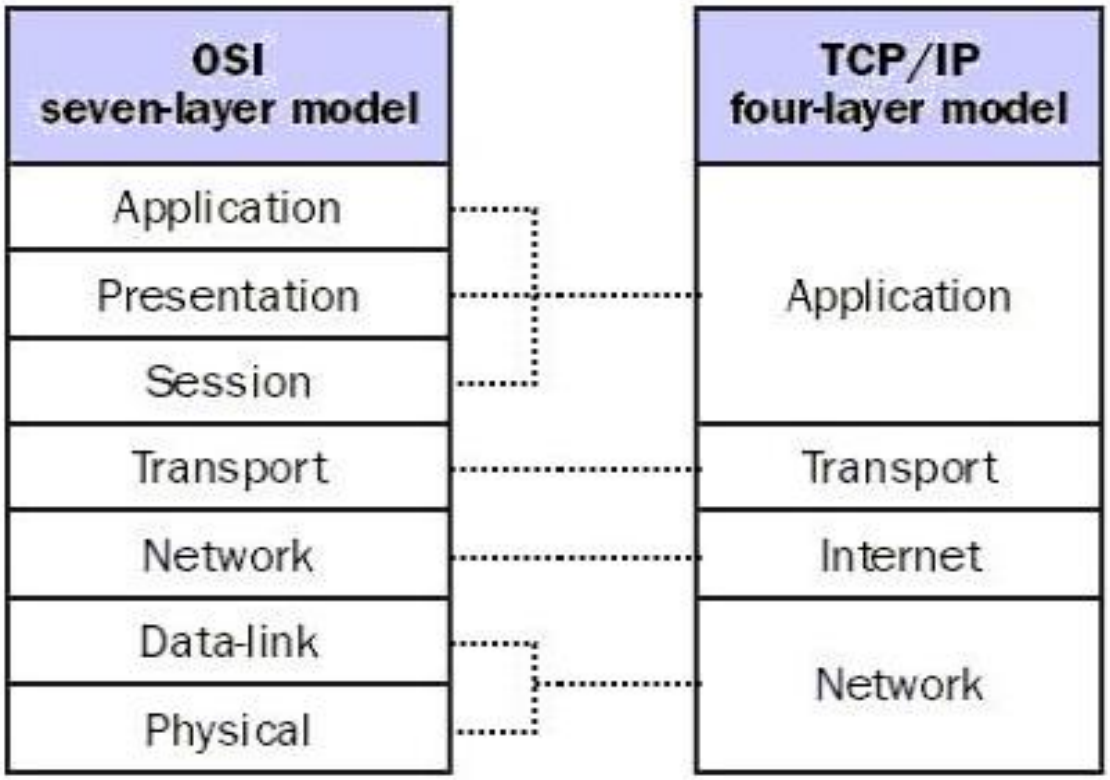

Figure 5: The Internet model mapped to the OSI model

Parameter	Connection-Oriented	Connection-Less
Connection	Prior connection need to be established.	No prior connection is established.
Resource Allocation	Resource need to be allocated.	No prior allocation of resource is required.
Reliability	It ensures reliable transfer of data.	Less reliable.
Congestion	Congestion is not at all possible.	Congestion can occur likely.
Transfer mode	It can be implemented either using Circuit switching or VCs.	It can be implemented using Packet Switching.
Retransmission	It is possible to retransmit the lost data bits.	Not possible
Suitability	It is suitable for long and steady communication.	It is suitable for bursty transmissions.
Signalling	Connection is established through process of signalling.	There is no concept of signalling.
Packet travel	Sequential fashions	Random manner
Delay	More delay	NO delay due to absence of connection established phase.

Table. Connection vs connection less services

Thank you!