TCP/IP protocol suite

Application

end-to-end layer
responsible for data transmitted between endpoints of network connection; layer performs its operation *only* at beginning and ending point of network connection

May, in some cases, include encryption & compression services
Supports the network applications
Hypertext Transfer Protocol (HTTP): allow Web browsers & servers to send and receive World Wide Web (WWW) pages
Simple Mail Transfer Protocol (SMTP): allow users to send and receive electronic mail (e-mail)
File Transfer Protocol (FTP): transfer files from one computer system to another (download/upload)
Telnet: allow a remote user to log in to another computer system
Simple Network Management Protocol (SNMP): allow the numerous elements within a computer network to be managed from a single point

Transport

end-to-end layer
responsible for data transmitted between endpoints of network connection; layer performs its operation *only* at beginning and ending point of network connection

Commonly uses TCP to maintain an error-free end-to-end connection by including error control information in case one packet from a sequence of packets does not arrive at final destination & packet sequencing information so that all packets stay in proper order
This layer performs *end-to-end* error control & *end-to-end* flow control: means transport layer is not in use while data packet is hopping from point to point within the network
User Datagram Protocol (UDP) is also found in this layer & is used as an alternative, though less frequently

Network

NOT an end-to-end layer
perform operations at each node (or device) along the network path, not just at the endpoints

Also known or called the Internet layer or IP layer
Used to transfer data within & between networks
Internet Protocol (IP): software that prepares packet of data so it can move from one network to another on the Internet or within a set of corporate networks
As this layer sends packet from node to node, it generates network addressing needed for system to recognize next intended receiver
To pick a path through network, this layer determines routing information & applies it to each packet or group of packets

Network Access

NOT an end-to-end layer
perform operations at each node (or device) along the network path, not just at the endpoints

Gets the data from the user workstation to the Internet
Most of the time, the connection that gets the data from the user workstation to the Internet is a local area network (LAN)
This layer prepares a data packet (called a frame) for transmission from the user workstation to a router sitting between the LAN & the Internet
Frame contains an identifier that signals beginning & end of the frame & also spaces for control information & address information
This layer can incorporate some form of error detection software; if an error occurs during transmission, this layer is responsible for error control, by informing sender of the error
This layer may also perform flow control: ensures that one node does not overwhelm the next node with too much data
Last layer before the data is handed off for transmission across medium (also called the data link layer)

Physical

NOT an end-to-end layer
perform operations at each node (or device) along the network path, not just at the endpoints

Layer in which the actual transmission of data occurs: transmission can be over a physical wire or it can be a radio signal transmitted through the air
To perform this transmission of bits: this layer handles voltage levels, plug & connector dimensions, pin configurations & other electrical & mechanical issues
This layer determines encoding or modulation technique to be used to convert the digital or analog data into digital or analog signals & then transmits the signals

OSI model

Application	Application using the network resides This layer is similar to the functionalities of the Application layer in the TCP/IP protocol suite model End user interacts with the information using this layer via Web browsers (Mozilla Firefox, Microsoft Edge, Microsoft Internet Explorer, Google Chrome, Safari, Opera, etc.) End user interacts with e-mail client, such as Microsoft Outlook, Mozilla Thunderbird, OS X Mail, IncrediMail, Mailbox and iOS Mail, etc. End user interacts with FTP client to download/upload files via FTP protocol
Presentation	Performs a series of miscellaneous functions necessary for presenting data package properly to sender or receiver i.e., this layer may perform ASCII-to-non-ASCII character conversion, encryption & decryption of secure documents & compress data into smaller units Operating systems (i.e., Microsoft Windows, Linux, UNIX, Mac OSX, etc.) reside & operate/function at this layer Device drivers reside at this layer
Session	This layer is responsible for establishing sessions between users (establish a communication connection between two computers or devices, i.e., user's computer with Web server) Supports **token management** (service that controls which user's computer talks during current session by passing software token back & forth) Establishes **synchronization points** (backup points used in case of errors or failures) Please note: many network applications do not include a specific session layer & do not use tokens to manage a conversation; if they do, "token" is inserted by application layer (or possibly the transport layer) instead of session layer; also, if network applications use synchronization points, these points often are inserted by application layer
Transport	This layer ensures that data packet that arrives at the final destination is identical to data packet that left the originating station Performs similar functions as the Transport layer in the TCP/IP protocol suite model This layer performs end-to-end error control & end-to-end flow control: means transport layer is not in use while data packet is hopping from point to point within the network This layer also determines how much data should be sent out to a destination system at one time and vice versus This layer decides how large a block of information should be sent/received, how long a computer should wait before it receives an acknowledgement that the information was successfully sent or received
Network	This layer is responsible for getting data packets from router to router through the network Performs similar functions as the Network layer of the TCP/IP protocol suite model Routers operate on this layer IP Addresses, gateway addresses, subnet mask addresses, DNS addresses are all located at this layer IPv4 & IPv6 reside at this layer
Data Link	This layer is responsible for taking data from the network layer & transforming it into a frame for transmission from the user workstation to a router sitting between the LAN & the Internet Frame contains an identifier that signals beginning & end of the frame & also spaces for control information & address information Performs similar functions as the Network Access layer of the TCP/IP protocol suite model Switches operate on this layer MAC Addresses (hard coded addresses that are built into network interface cards [NIC cards]) & ARP (Address Resolution Protocol) reside at this layer Frame relay, ATM, FDDI & Fibre Channel all reside at this layer
Physical	This layer handles the transmission of bits over a communications channel Performs similar functions as the Physical layer of the TCP/IP protocol suite model This layer includes physical items such as patch panels, patch cables (Ethernet wires), connectors, hubs, repeaters, etc. RS-232 (serial connection), DSL, 10BaseT, 100BaseTX, ISDN & T1 all reside at this layer