Module 7: Software Layers (Session Layer, Presentation Layer and Application Layer)

Introduction to Networks v7.0 (ITN)

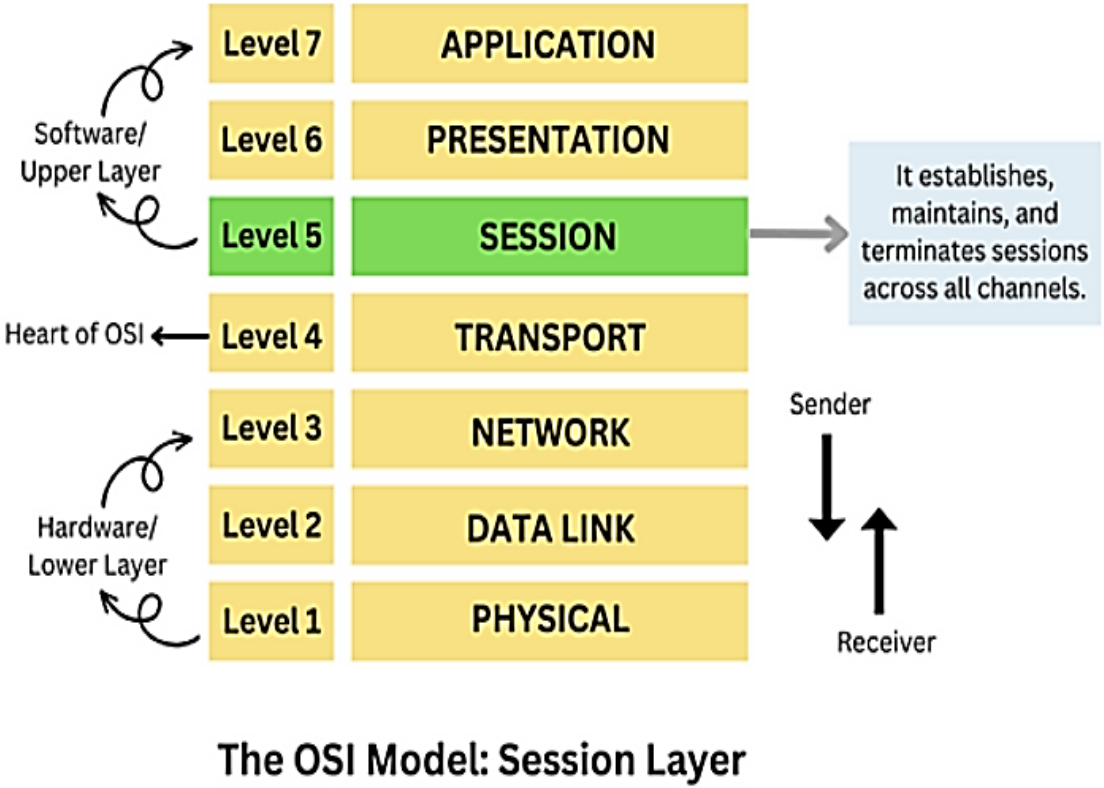
7.1: Session Layer

Session Layer

- Session layer helps in **setting up** and **managing connections**, enabling the sending and receiving of data, followed by termination of connections (or sessions)
- The session layer allows two systems to enter into a dialog. It allows the communication between two processes to take place in either **half-duplex** or **full-duplex** mode.
- Session layer **establishes**, **maintains**, and **synchronizes** the interaction between communicating systems.
- **Protocols** of this layer: RTCP, PPTP, PAP, ADSP, RPC, ISNS, SDP,…

API & NetBIOS

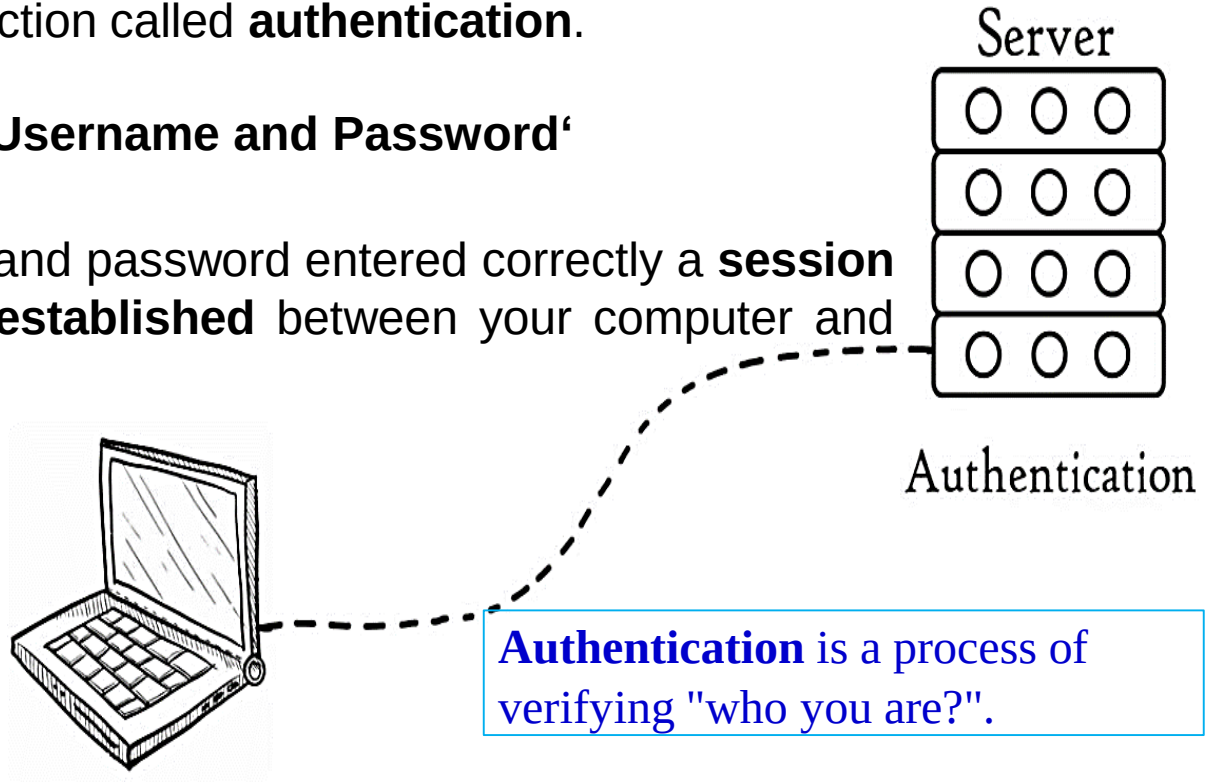
- Session Layer uses **API**s (Application Programming Interfaces)
- **NetBIOS**-Network Basic Input Output System is an example of APIs, which allows applications on different computers to communicate with each other.



The OSI Model: Session Layer

Authentication

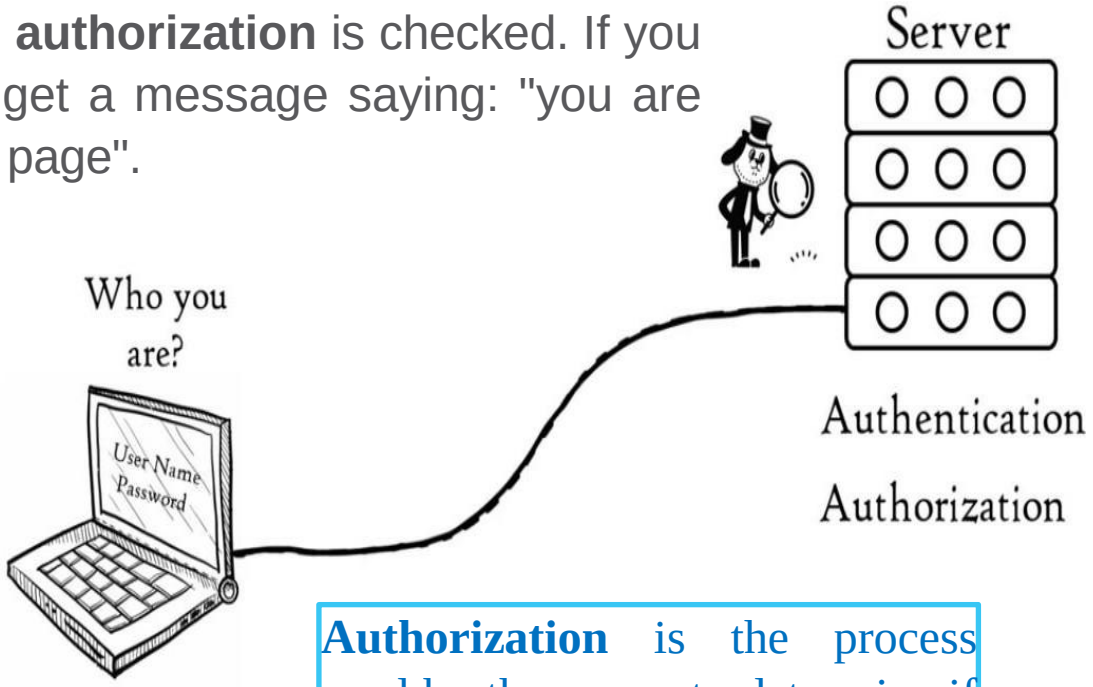
- Before a session or a connection is established with a server, server performs a function called **authentication**.
- For this server uses **'Username and Password‘**
- Once the user name and password entered correctly a **session or a connection is established** between your computer and the server.



Authentication is a process of verifying "who you are?".

Authorization

- After authenticating the user, **authorization** is checked. If you are not authorized, you will get a message saying: "you are not authorized to access this page".

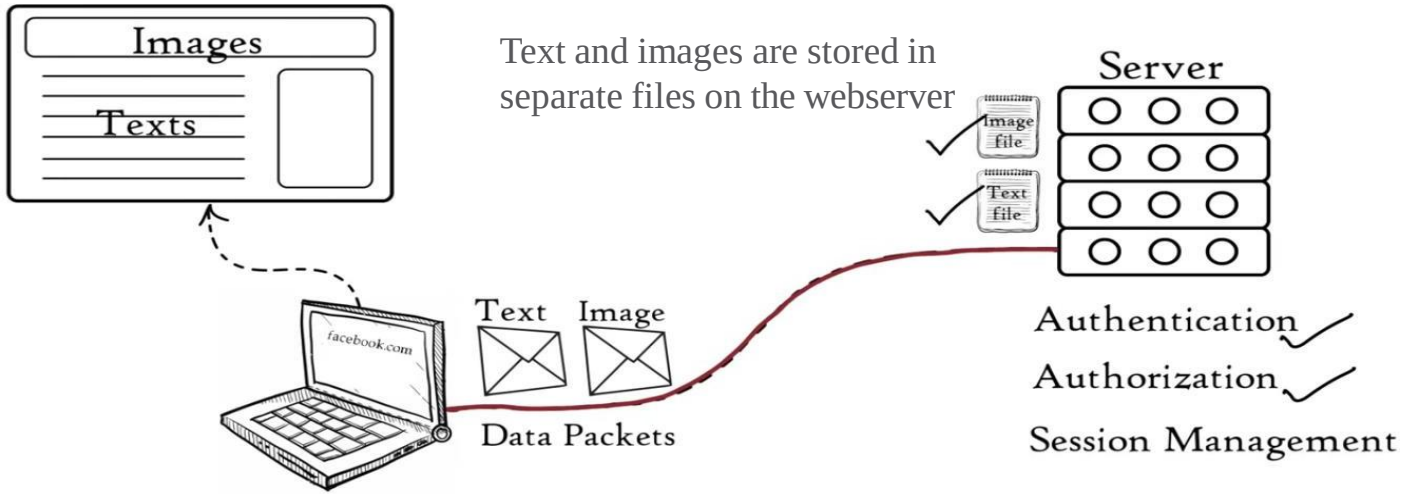


Authorization is the process used by the server to determine if you have **a permission to access a file**.

Session management

- Session layer keeps a track of which data packet belongs to which file, either text file or image file, to be downloaded.

- Session layer tracks where the received data packet go, in this case it goes to browser

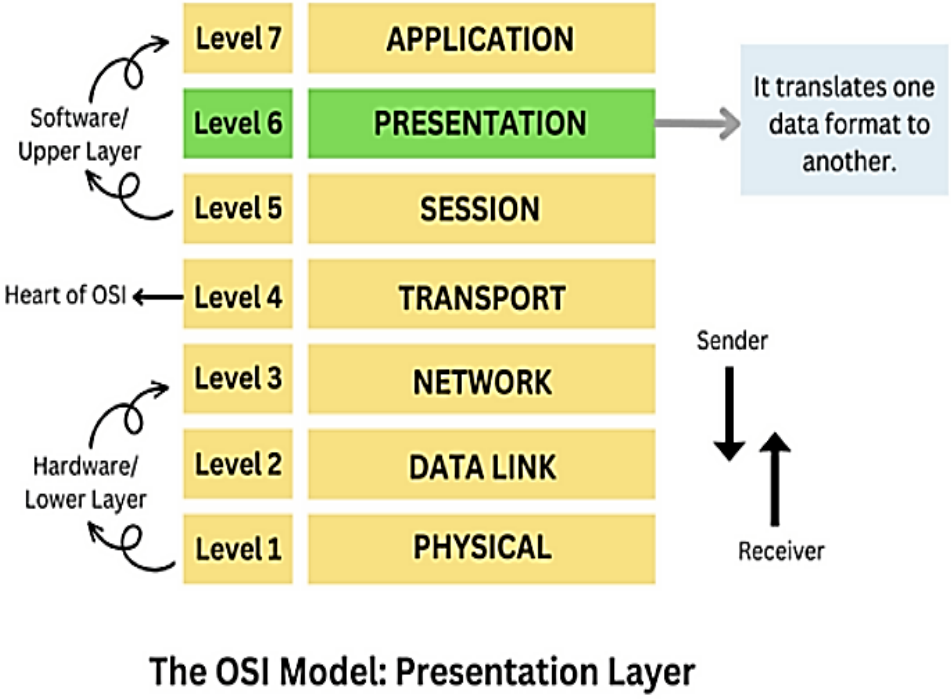


That means, session layer helps in **session management.**

7.2: Presentation Layer

Presentation Layer

- The data received from the **Application Layer** is in the form of **characters and numbers**.
- **Presentation layer** converts these characters and numbers to machine **understandable binary format**
- **Presentation layer** is concerned with the **syntax** and **semantics** of the information exchanged between two systems.
- **Protocols** of this layer: ICA, NDR, AFP, NCP, PAD, XDR, LPP, SSL, ...

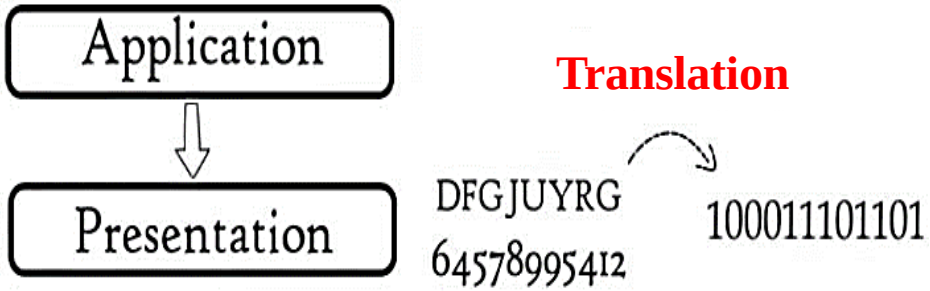


The OSI Model: Presentation Layer

Translation

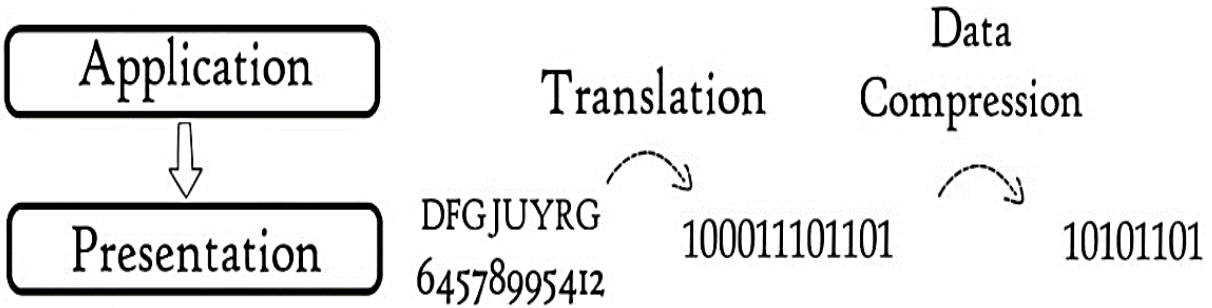
- The presentation layer at the sender changes the information from its sender-dependent format into a common format.

- The presentation layer at the receiving machine changes the common format into its receiver-dependent format.



Data Compression

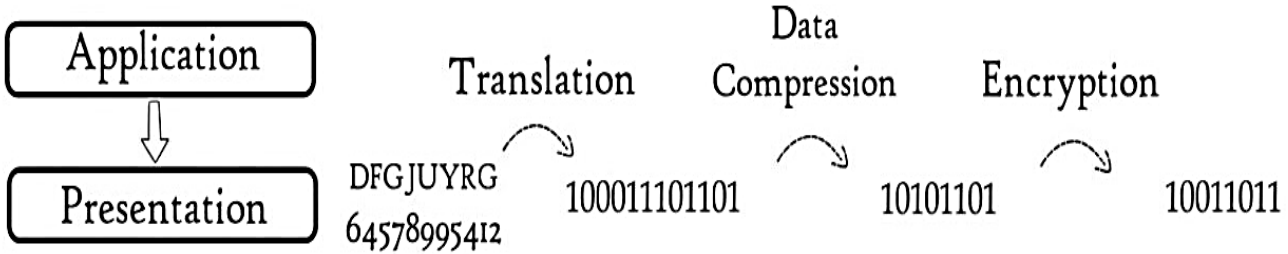
- Before data is transmitted, **presentation layer** reduces the number of bits that are used to represent the original data, this **bit reduction** process is call **Data Compression**



Data compression reduces the amount of bit used to store the original file as the size of file is reduced, it can be received at the destination in a very less time.

Encryption

- To maintain the integrity of data, before transmission, data is **encrypted**.
- Encryption enhances the security of sensitive data.

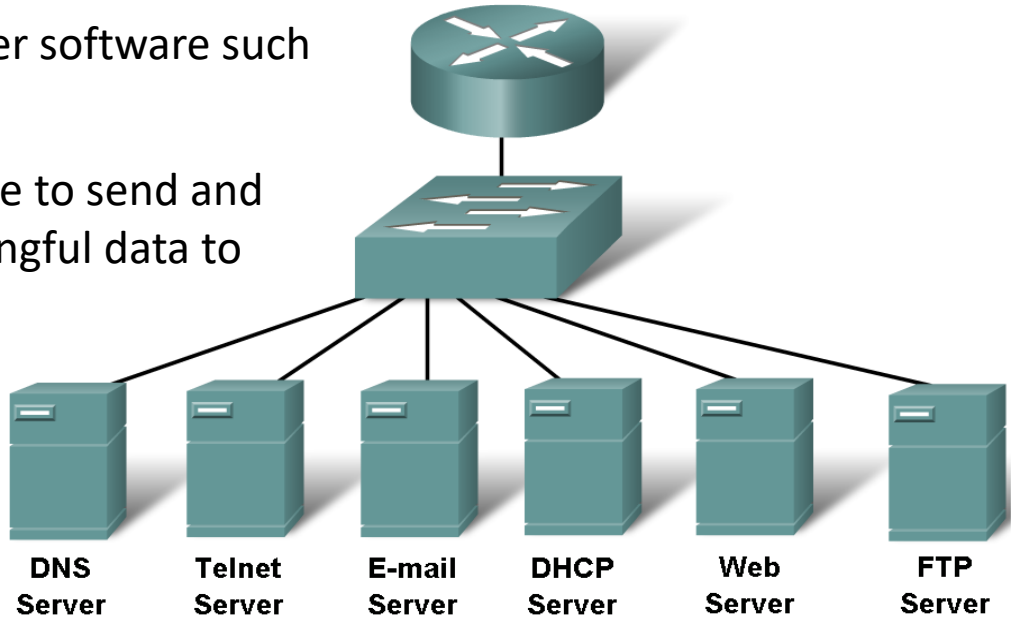


- **SSL** (**Secure Sockets Layer**) protocol is the standard security technology for establishing an encrypted link between a web server and a browser.
- This link ensures that all data passed between the web server and browsers remain private and integral.

7.3: Application Layer

Protocols

- The application layer is used by end-user software such as web browsers and email clients.
- It provides protocols that allow software to send and receive information and present meaningful data to users.
- A few examples of application layer protocols are the Hypertext Transfer Protocol (HTTP), File Transfer Protocol (FTP), Post Office Protocol (POP), Simple Mail Transfer Protocol (SMTP), and Domain Name System (DNS).



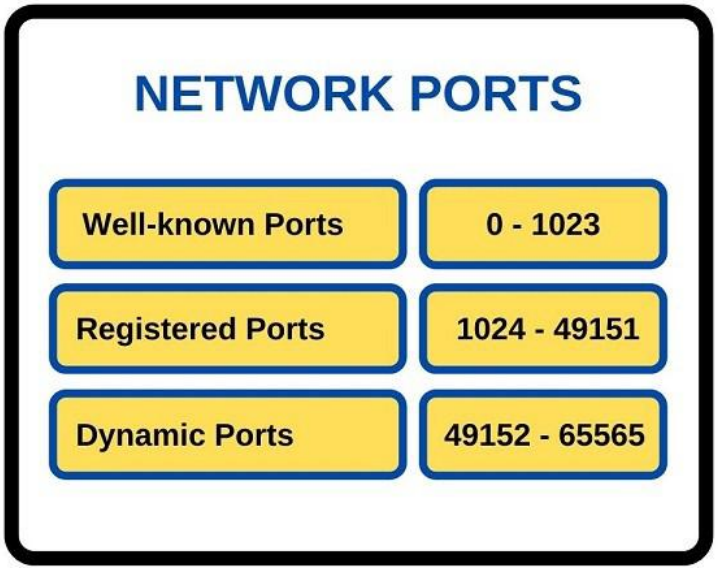
Protocols

Protocols	Description
DNS	Matches domain names with IP addresses
HTTP	Used to transfer data between clients/servers using a web browser
SMTP & POP3	used to send email messages from clients to servers over the internet
FTP	allows the download/upload of files between a client/server
Telnet	allows users to login to a host from a remote location and take control as if they were sitting at the machine (virtual connection)
DHCP	assigns IP addresses, subnet masks, default gateways, DNS servers, etc. To users as they login the network

Port numbers

Port numbers are reserved for common or popular services and applications such as web browsers, email clients, and remote access clients.

- Defined **well-known ports** for common server applications enables clients to easily identify the associated service required.
- **Registered ports** are assigned by IANA to a requesting entity to use with specific processes or applications.
- **Dynamic ports** used by the client's OS to assign port numbers dynamically when a connection to a service is initiated.



Port Number Groups (Cont.)

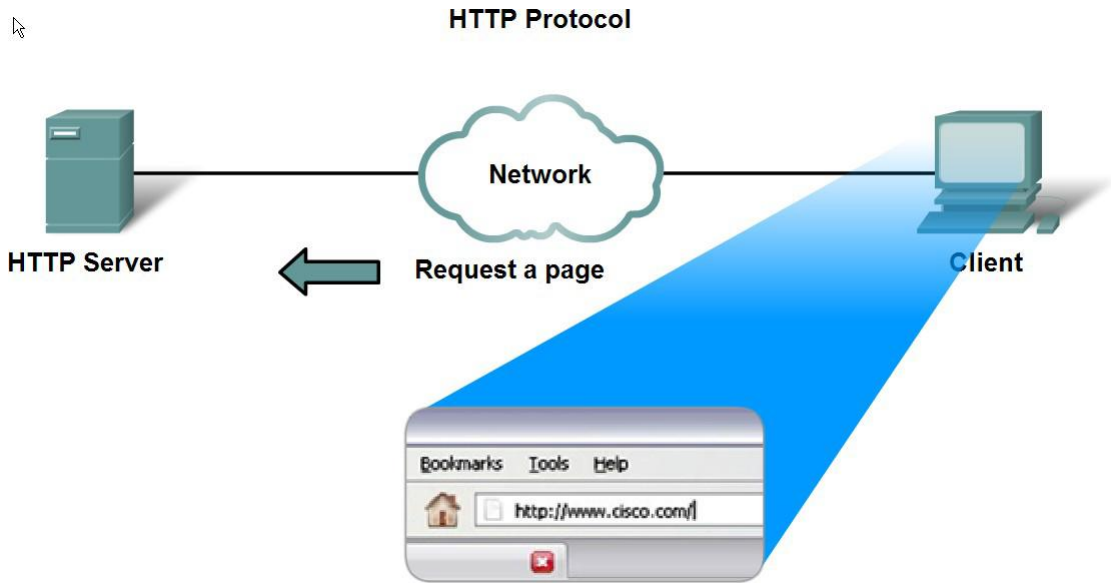
Well-Known Port Numbers

Port Number	Protocol	Application
20	TCP	File Transfer Protocol (FTP) - Data
21	TCP	File Transfer Protocol (FTP) - Control
22	TCP	Secure Shell (SSH)
23	TCP	Telnet
25	TCP	Simple Mail Transfer Protocol (SMTP)
53	UDP, TCP	Domain Name Service (DNS)
67	UDP	Dynamic Host Configuration Protocol (DHCP) - Server
68	UDP	Dynamic Host Configuration Protocol (DHCP) - Client
69	UDP	Trivial File Transfer Protocol (TFTP)
80	TCP	Hypertext Transfer Protocol (HTTP)
110	TCP	Post Office Protocol version 3 (POP3)
143	TCP	Internet Message Access Protocol (IMAP)
161	UDP	Simple Network Management Protocol (SNMP)
443	TCP	Hypertext Transfer Protocol Secure (HTTPS)

HTTP Protocol

Q: What is HTTP Protocol?

Ans: HTTP is an abbreviation of Hypertext Transfer Protocol used mainly to access data on the World Wide Web. HTTP use TCP connection and port 80.



- A client that wants to access a Web page needs the **file name and the address.**
- The uniform resource locator (URL) is a standard locator for specifying any kind of information on the Internet, The URL defines four things:

HTTP vs. HTTPS Protocol

Q: Compare between HTTP & HTTPS.

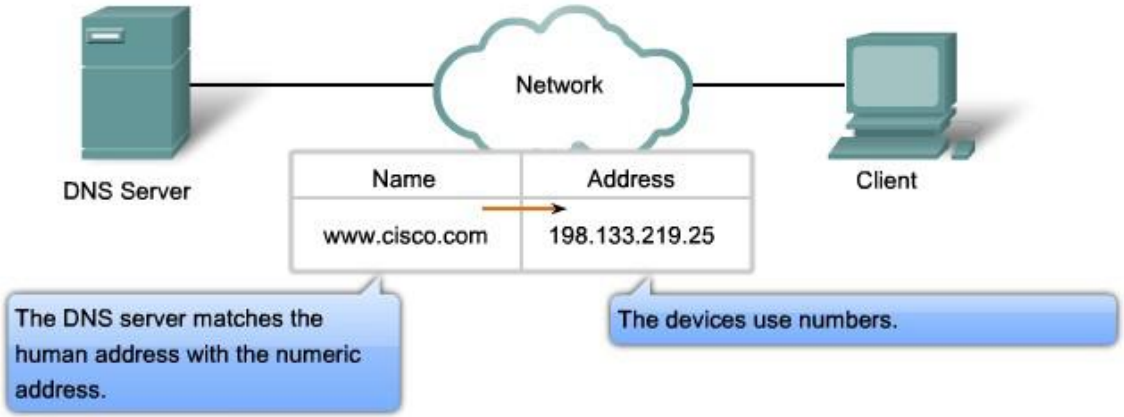
HTTP	HTTPS
1. URL begins with "http://"	**1.** URL begins with "https://"
2. unsecured	**2.** secured
3. uses port 80 for communication	**3.** uses port 443 for communication.
4. operates at Application Layer	**4.** operates at Transport and application Layer.
5. No encryption	**5.** uses encryption
6. No certificates required	**6.** certificates required

DNS Protocol

Q: What is DNS Protocol?

- Domain Name System (DNS) is a protocol that allows us to use human readable names to communicate over networks, rather than having to manage and memorize IP addresses.

- These names must be unique because the addresses are unique.



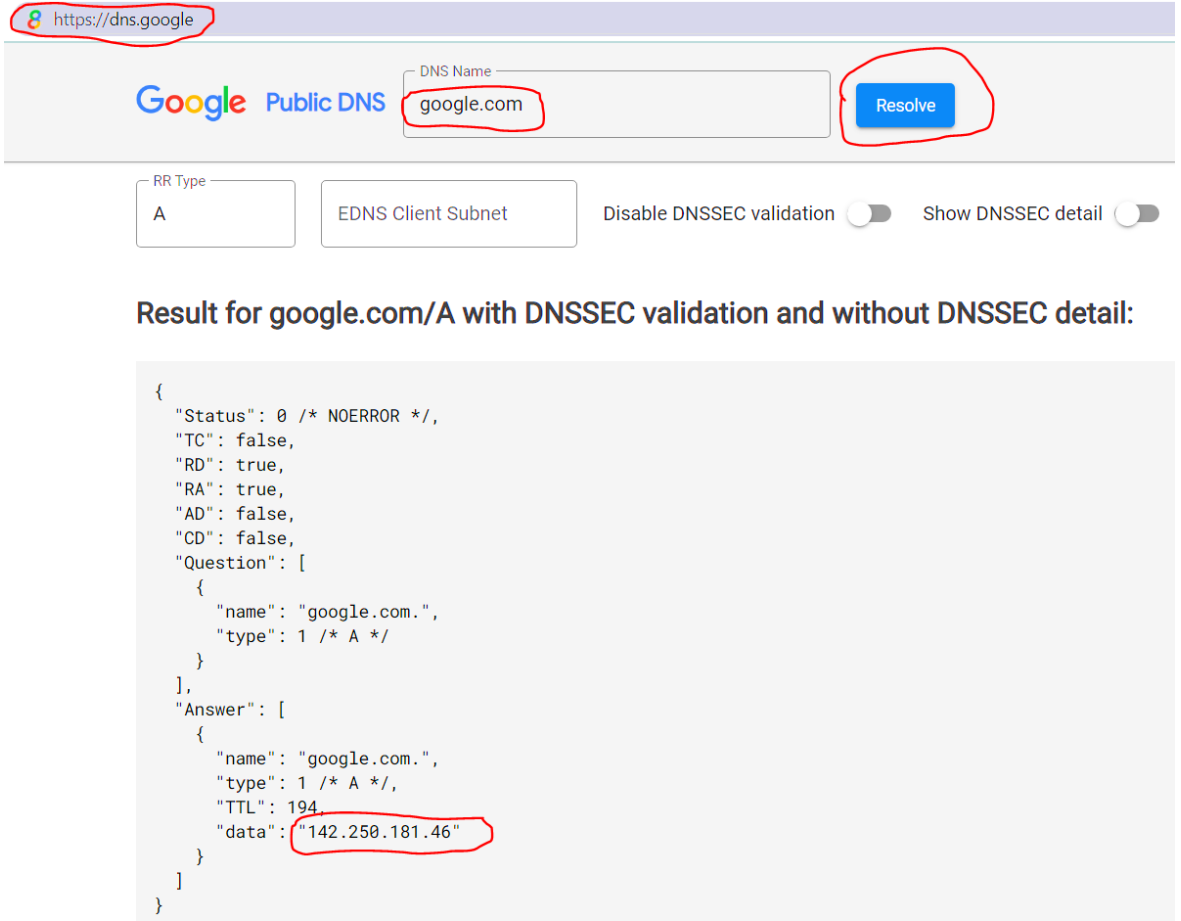
DNS Protocol

Q: How can I query the DNS IP for any site?

1. In google type: “https://dns.google” to open the DNS browser.

2. Type the site you want to know.

3. Copy and paste the number mentioned in the DNS program to open the site.



E-mail Protocols

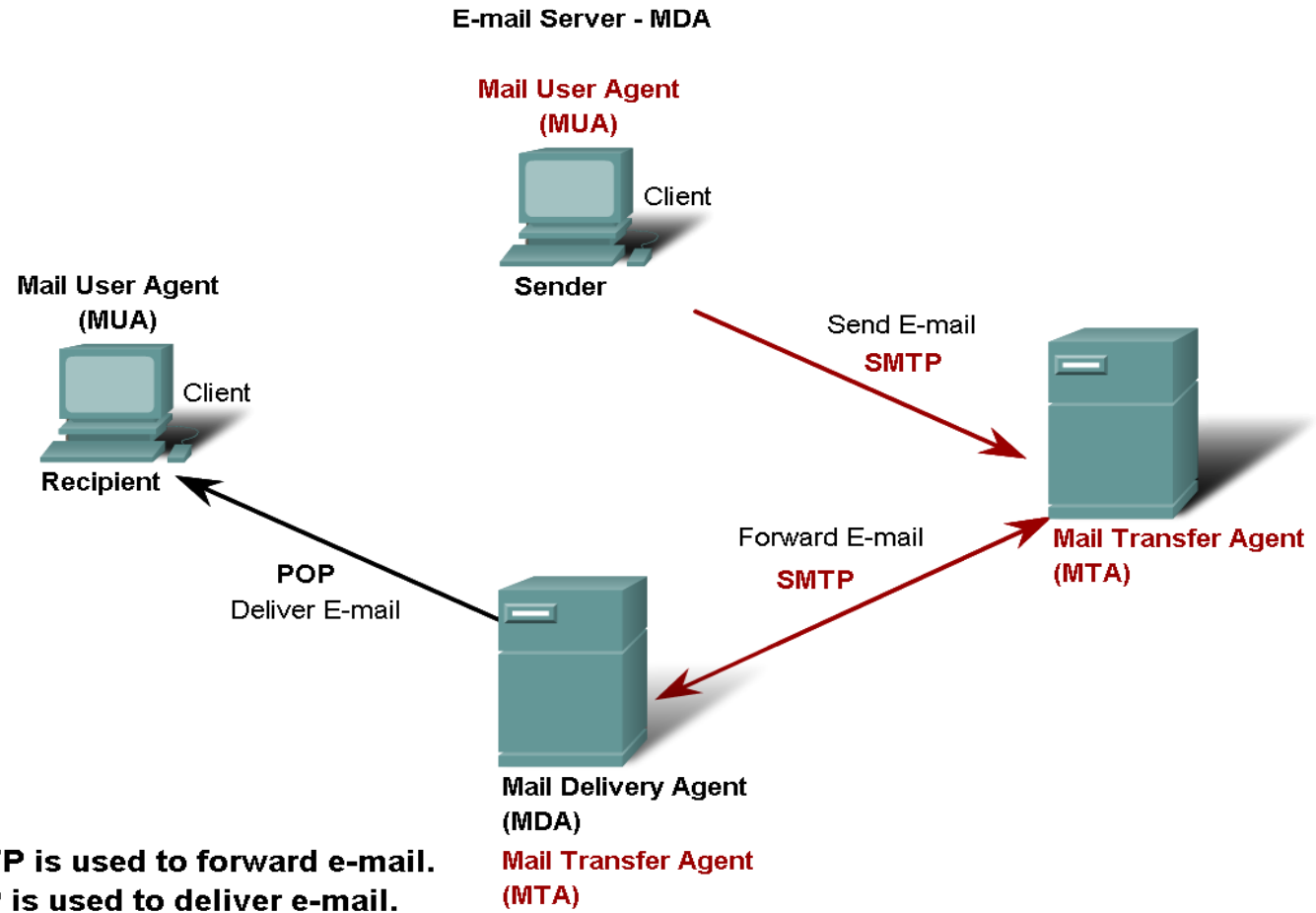
E-mail Protocols (SMTP/POP/IMAP)

- E-mail is the most popular network **service.**
- E-mail **client** (when people compose e-mail) is called Mail User Agent (**MUA**)
- MUA **allows** messages to be **sent/retrieved** to and from your mailbox
- Requires several applications and services:

  -**POP or POP3** – deliver email from server to client (incoming messages) post office prot.

  –**SMTP** – handles outbound messages from clients

E-mail Protocols



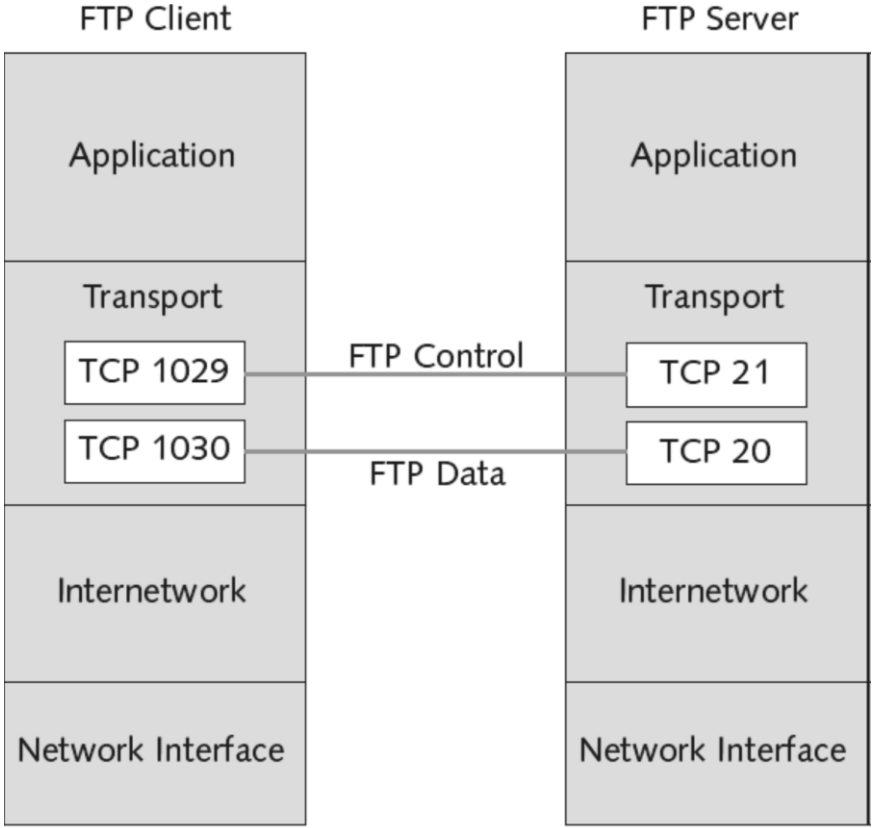
SMTP is used to forward e-mail.
POP is used to deliver e-mail.

FTP Protocol

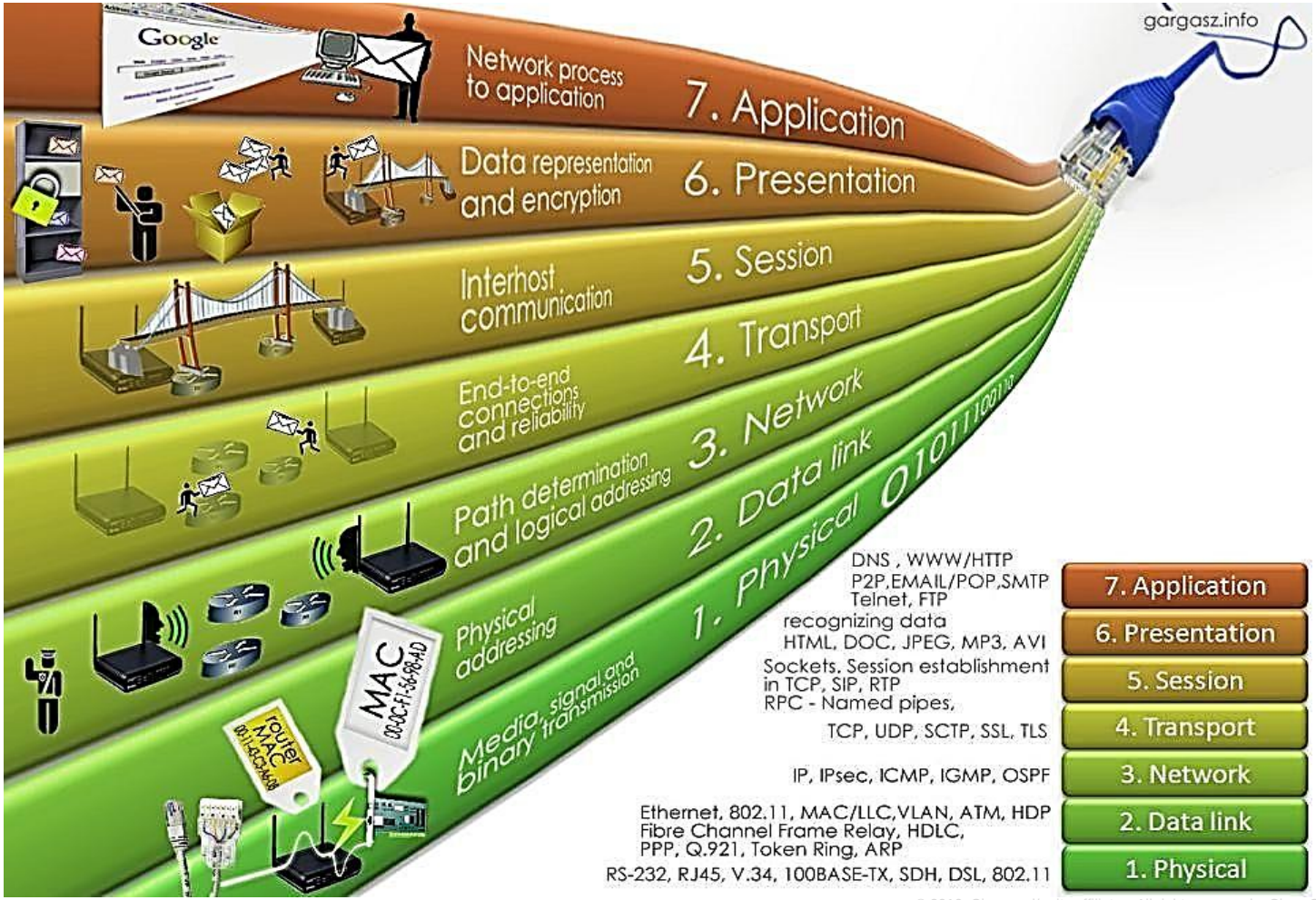
File Transfer Protocol (FTP)

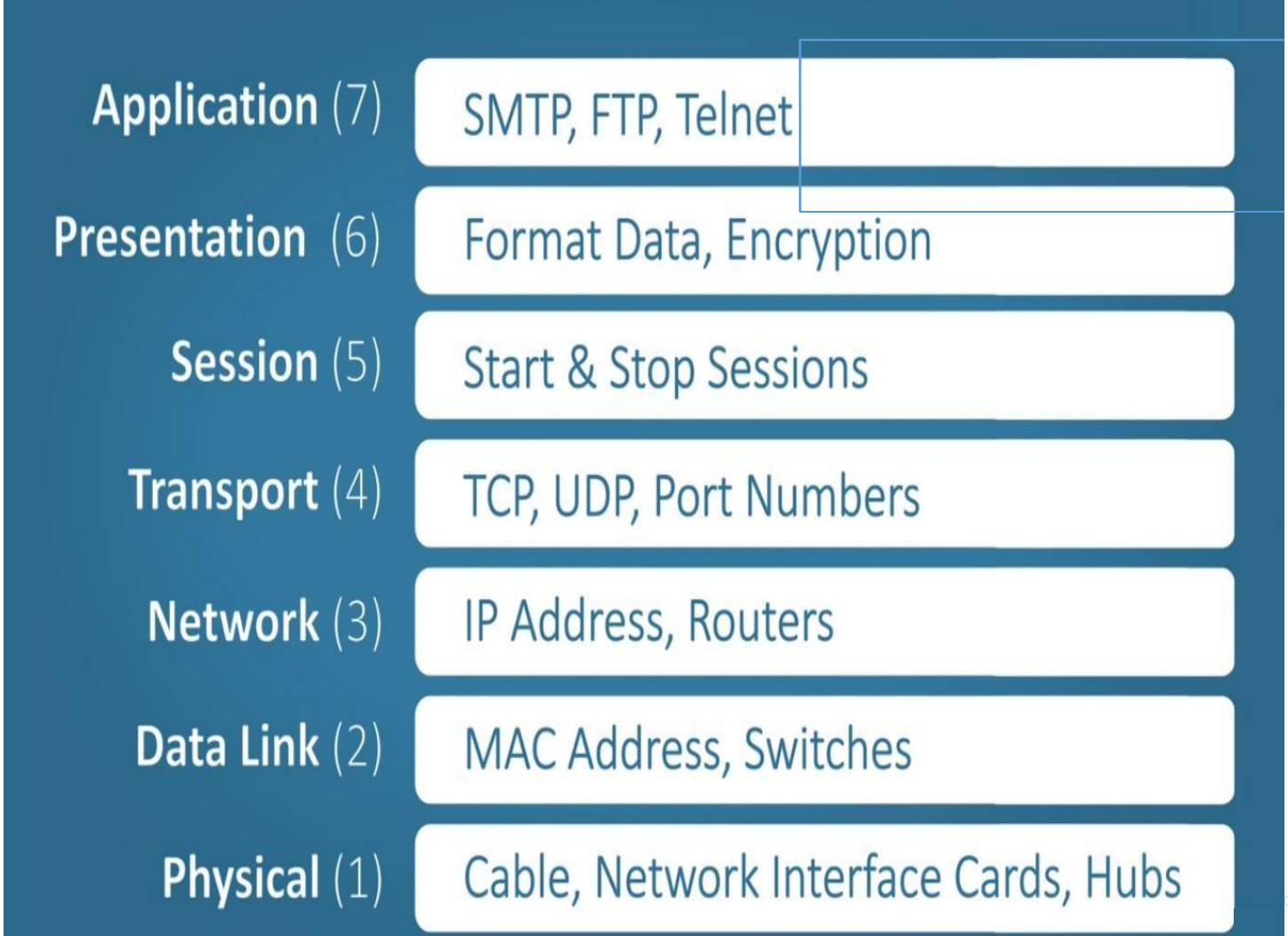
- Commonly used application layer protocol
- Allows for the **transfer of files** between clients/servers.
- Requires 2 connections to the server:

  Commands –uses TCP port 21 **Actual data** –uses TCPport 20



TCP port usage in FTP communications




Application (7)
SMTP, FTP, Telnet
Presentation (6)
Format Data, Encryption
Session (5)
Start & Stop Sessions
Transport (4)
TCP, UDP, Port Numbers
Network (3)
IP Address, Routers
Data Link (2)
MAC Address, Switches
Physical (1)
Cable, Network Interface Cards, Hubs