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Cisco Networking Academy

SPENGERGASSE *

ausbildung mit zukunft
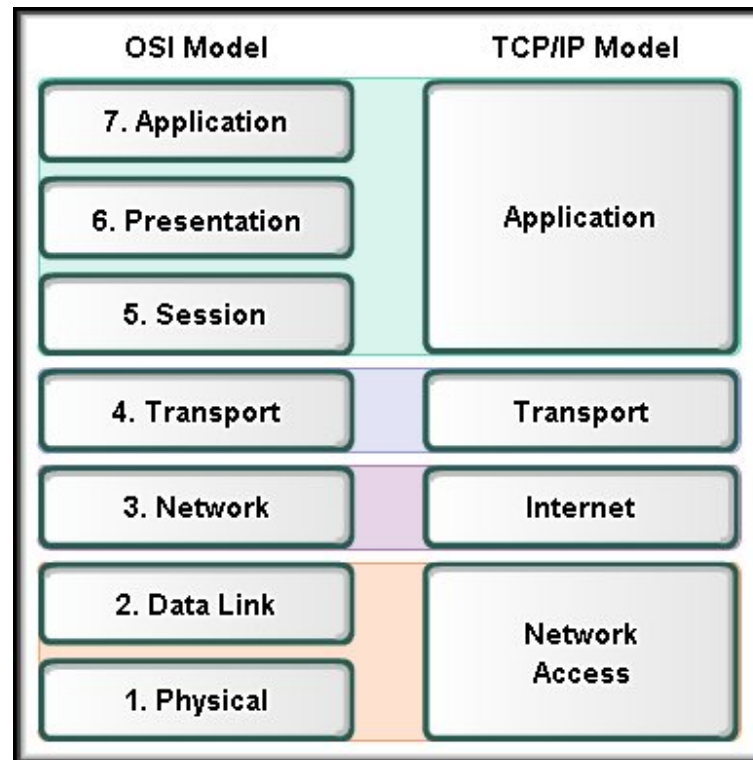
CCNA Exploration
Network Fundamentals

Chapter 3
Application Layer
Functionality and Protocols

Application Layer Functionality and Protocols

Applications: The Interface Between the Networks

OSI Model	TCP/IP Model
7. Application	Application
6. Presentation	
5. Session	
4. Transport	Transport
3. Network	Internet
2. Data Link	Network Access
1. Physical	

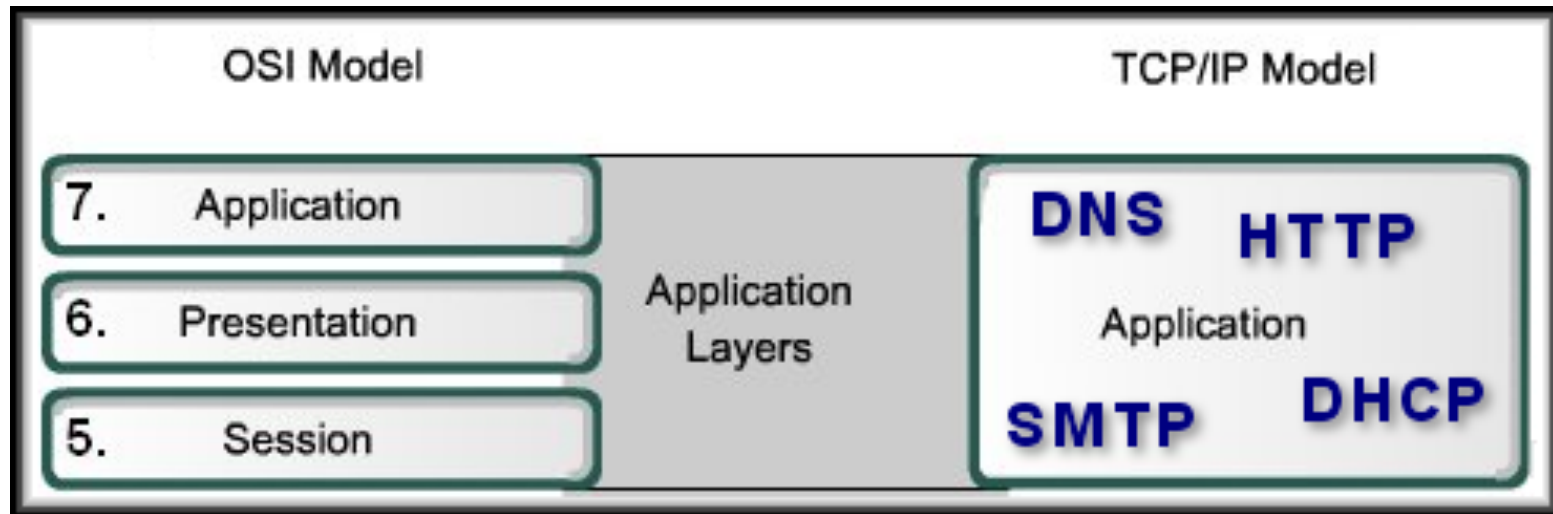# Application Layer – OSI and TCP/IP Models

<u>Two important concepts</u>:

- Application Layer:
  - The first step for getting data on to the network.

- Application Software:
  - The programs used to communicate over the network.

For example:

- When displaying a web page:
  - The Application Layer uses the HTTP Protocol.
 - The Application Software is your browser.

Application Layer – OSI and TCP/IP Models

OSI Model		TCP/IP Model
7. Application		**DNS** **HTTP**
6. Presentation	Application Layers	Application
5. Session		**SMTP** **DHCP**

Functionality of the TCP/IP Application Layer protocols fit roughly into the top three layers of the OSI Model.

– Most TCP/IP application layer protocols were developed before PCs, GUIs and multimedia objects.

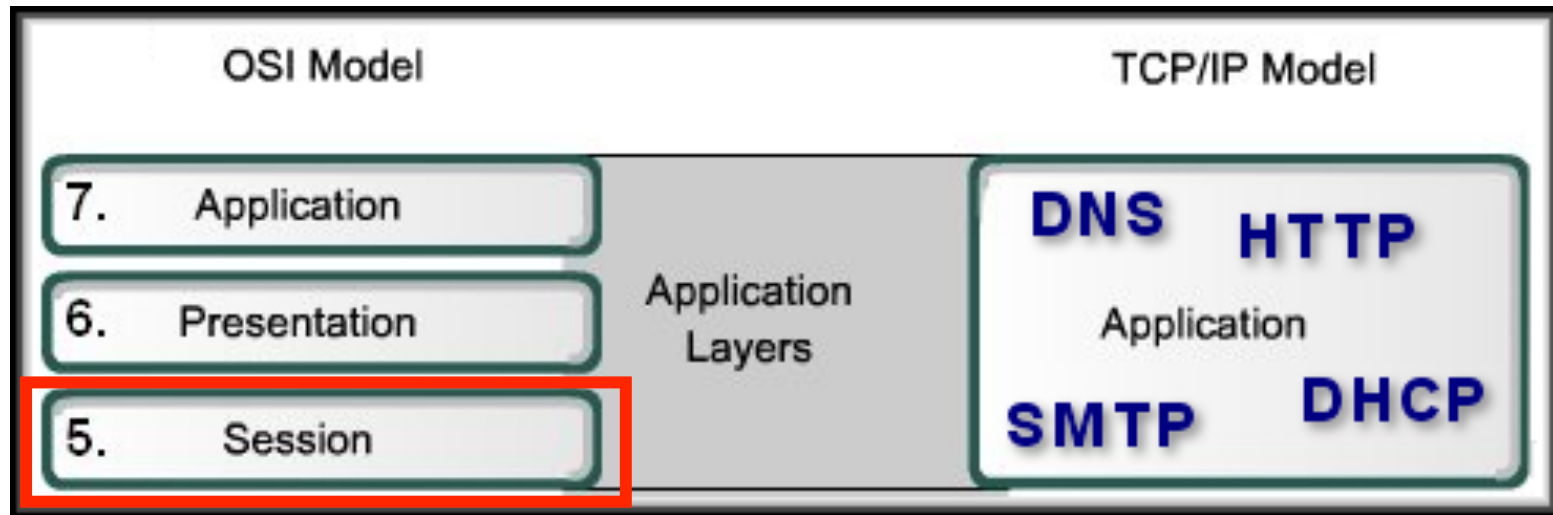– They implement very little of the Presentation and Session layer functionality.

Application Layer – OSI and TCP/IP Models
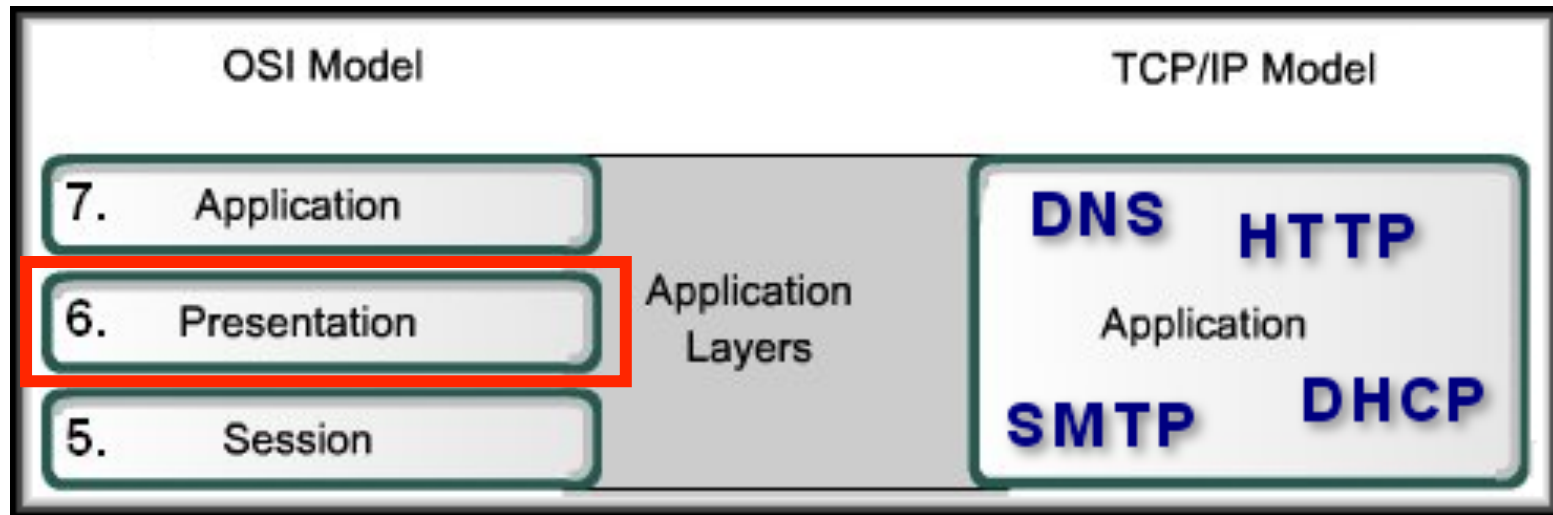
Presentation Layer Functionality:
- Coding and conversion of application layer data.
- Compression.
  - Coding and compression formats: GIF, JPG, TIF
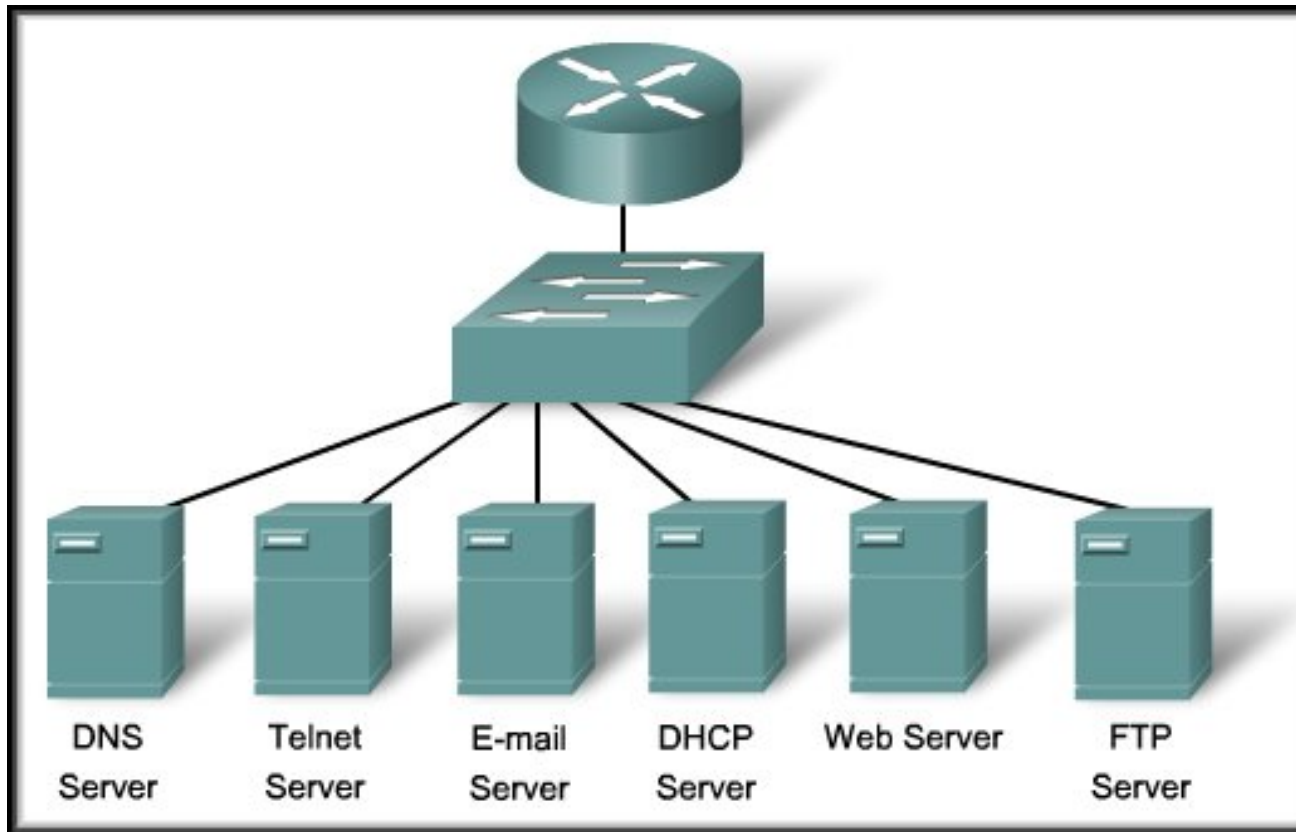- Encryption.

Application Layer – OSI and TCP/IP Models

Session Layer Functionality:

- – Create and maintain dialogs between source and destination applications.
- – Handles the exchange of information to initiate dialogs, keep them active and restart sessions.
- – Incorporated by most applications (e.g. Web Browser).

Application Layer – OSI and TCP/IP Models

Application Layer – Services, Ports

DNS (Domain Name System)
    Resolves Internet names (URLs) to IP Addresses, port 53

Telnet, SSH (Terminal emulation, Secure shell)
    access to servers and network devices, port 23, 22

SMTP (Simple Mail Transfer Protocol)
    Transfer of mail messages and attachments (outgoing), port 25

POP3, POP3S (Post Office Protocol)
    Transfer of mail messages and attachments (incoming), port 110, 995

IMAP
    Internet Message Access Protocol, port 143

DHCP (Dynamic Host Configuration Protocol)
    Assigns IP Addresses (IP, subnetmask) and other parameters (DNS, Gateway, …) to hosts,
    port 67, 68

HTTP(s) (Hypertext Transfer Protocol)
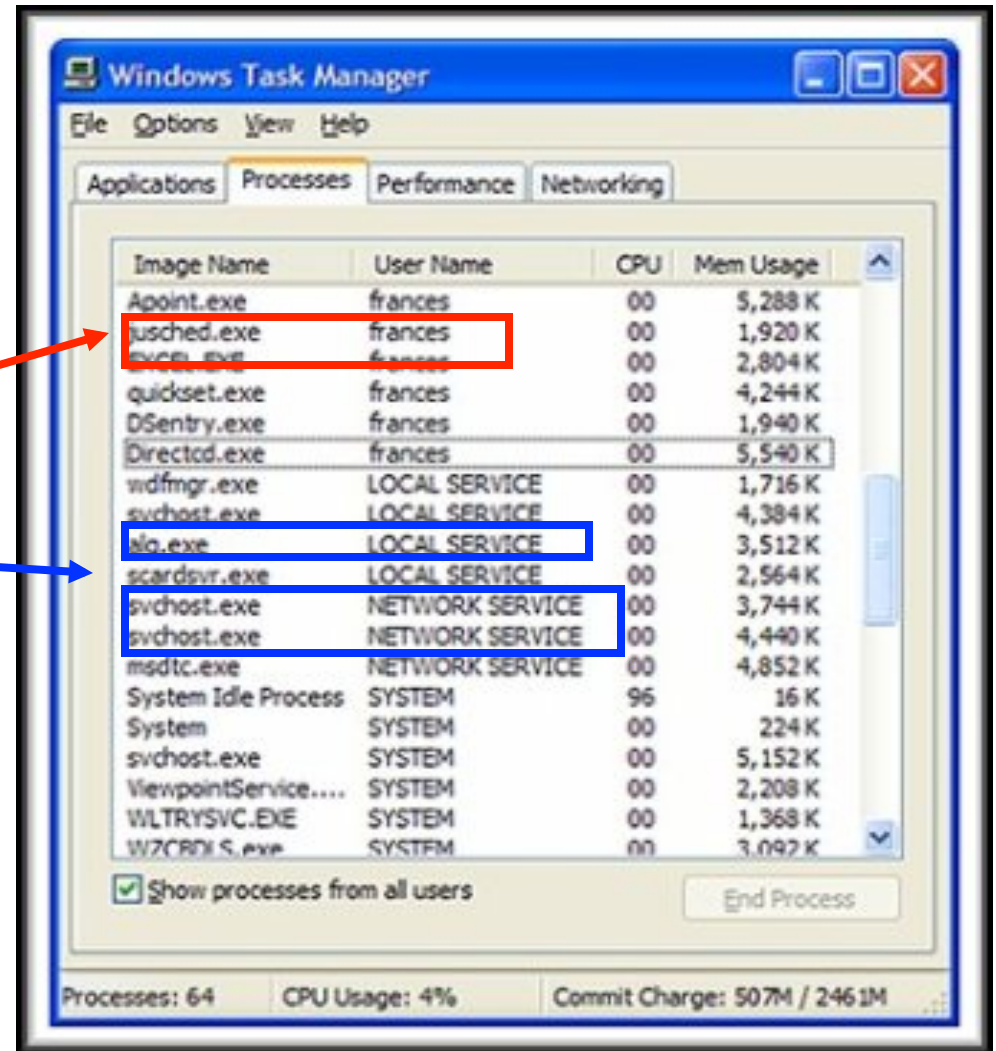   Transfer files that make up web pages, port 80, 443

FTP(S) ((Secure) File Transfer Protocol)
    Interactive file transfer between systems, port control:21,data:21 and 3713, data:989,990
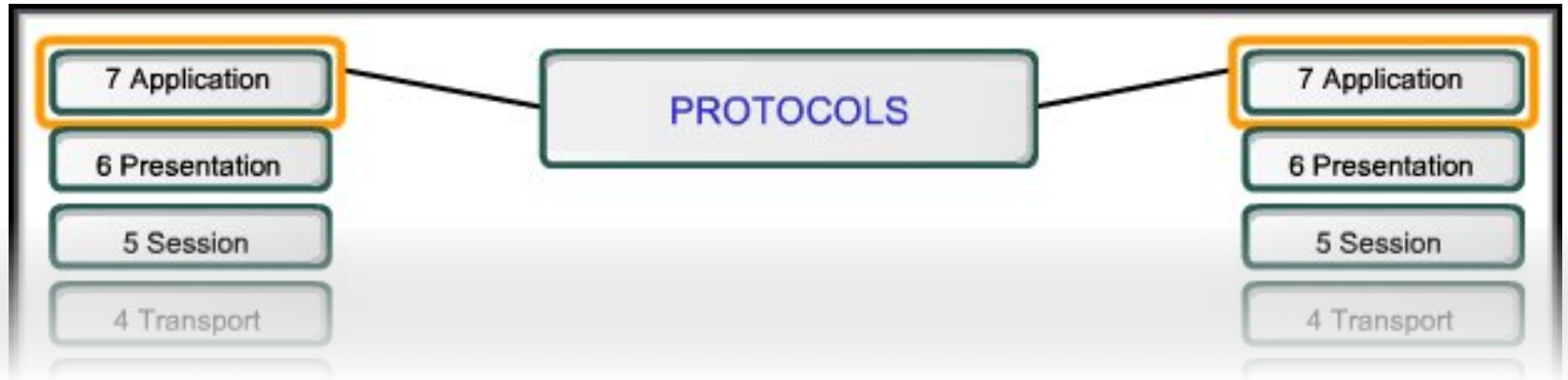
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Application Layer Software

Within the Application layer, there are two forms of software programs or processes that provide access to the network:

– Applications
– Services

Application Layer Software

- Application layer protocols are used by both the source and destination devices during a communication session.
- The application layer protocols implemented on the source and destination host must match

Application Layer Software

The Application Layer uses protocols that are implemented within applications and services

- **Applications** provide people a way to create messages.
- Application layer **services** establish an interface to the network.
- **Protocols** provide the rules and formats that govern how data is treated.

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Application Layer Software

- Application layer protocols are used by both the **source and destination** devices during a communication session.

- The application layer protocols implemented on the source and destination host **must match**.

Application Layer Software

| IP Header	TCP Header	HTTP Header	Data

- Applications and services can use multiple protocols.
  - Encapsulate the protocol.
  - Be encapsulated by a protocol.
  - Invoke other protocols.

- For example, using a web browser (HTTP) may invoke:
  - DNS, ARP, ICMP
  - May use TCP, UDP, Ethernet, PPP (Much More Later)
  - Definitely uses IP

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Application Layer Functionality and Protocols

Making Provisions for Applications and Services

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Application Layer Functionality and Protocols

- When accessing information on a device, the data may not be physically stored on that device.
- If that is the case, a request must be made to the device where the data resides.
-
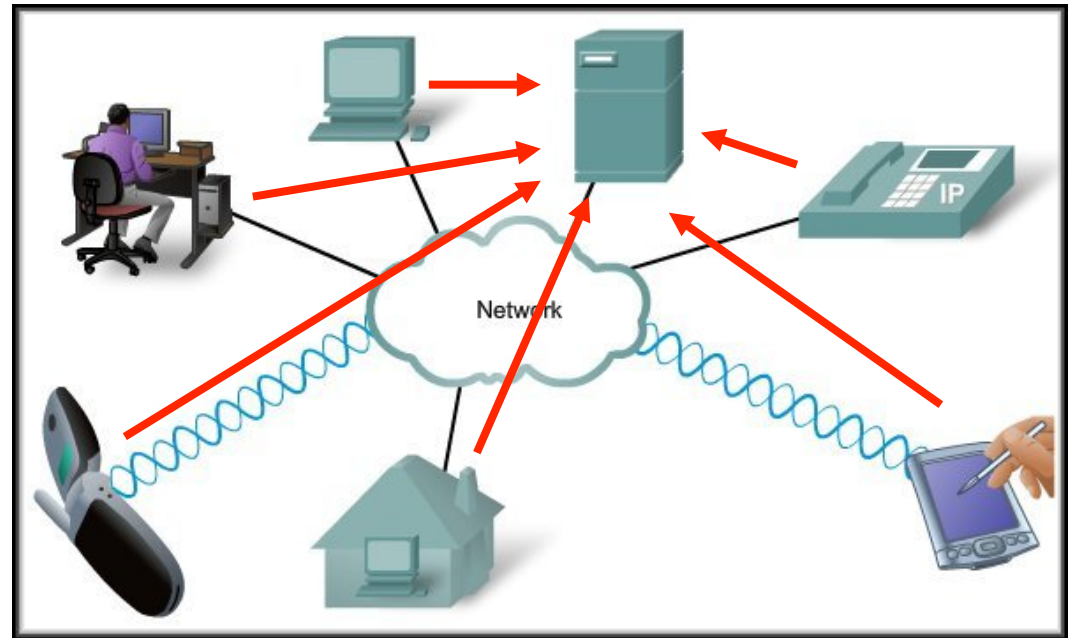
  Three methods:
  - Client/Server Model
  - Application Layer Services and Protocols
  - Peer-to-Peer (P2P) Networking and Applications
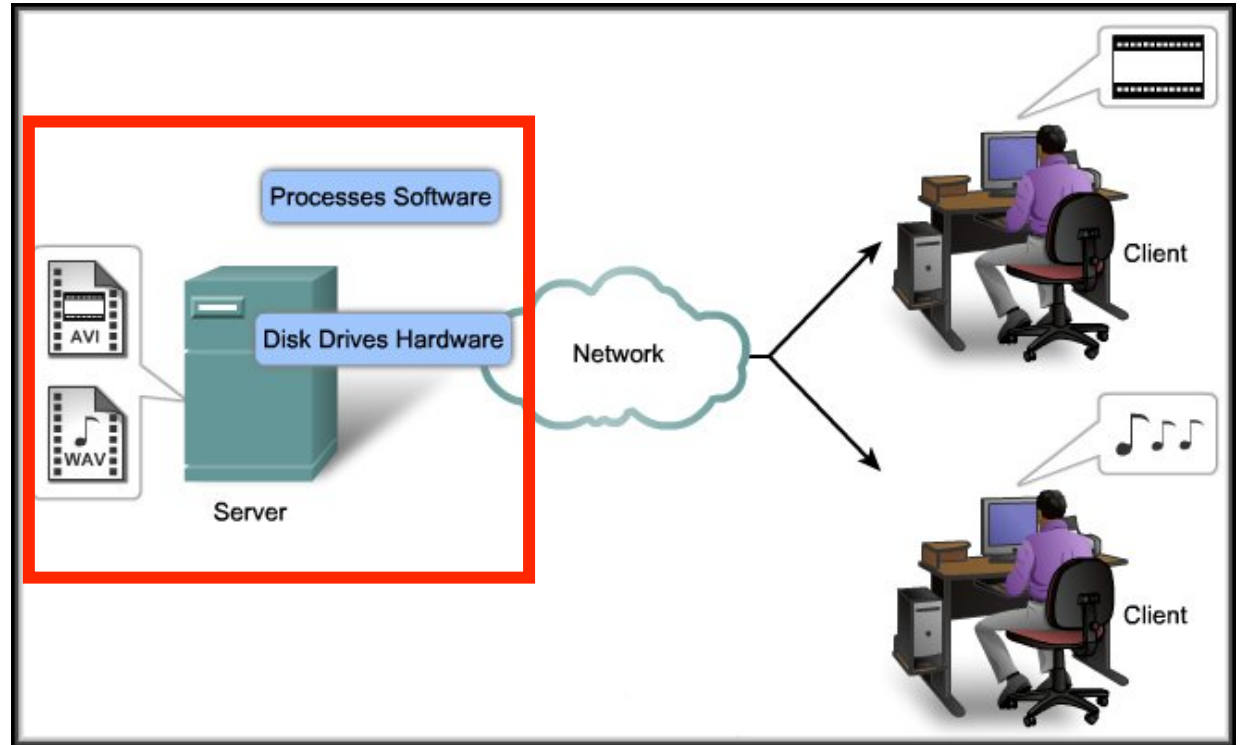

Network

IP

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Client/Server Model
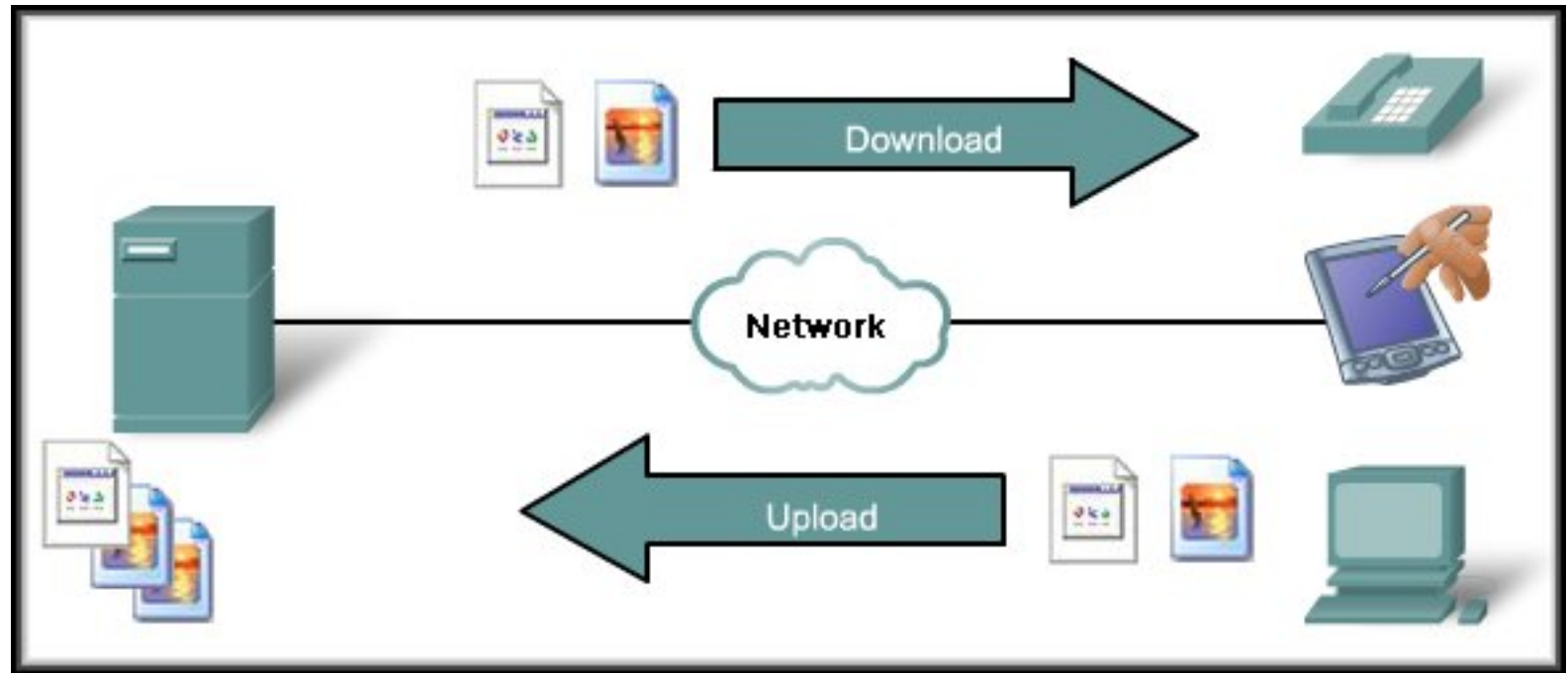
The biggest advantage of the client/server model is the centralization of resources. (User Names and Passwords, Files, Databases)

Servers

- Servers are repositories of information

- Processes on the server control the delivery of information to the client

- The information is usually shared with multiple clients.
  - Web Server
  - FTP Server
  - Database Server

Servers

The server runs a service, or **process**, sometimes called a server **daemon**

Daemons (like other services):
- Typically run in the background.
- Are not under an end user's direct control.
- Are described as "listening" for a request from a client.
- Programmed to respond whenever the server receives a request for the service provided by the daemon.

When a daemon "hears" a request from a client:
- It exchanges appropriate messages with the client.
- Sends the requested data in the proper format.

Peer-to-Peer (P2P) Networking
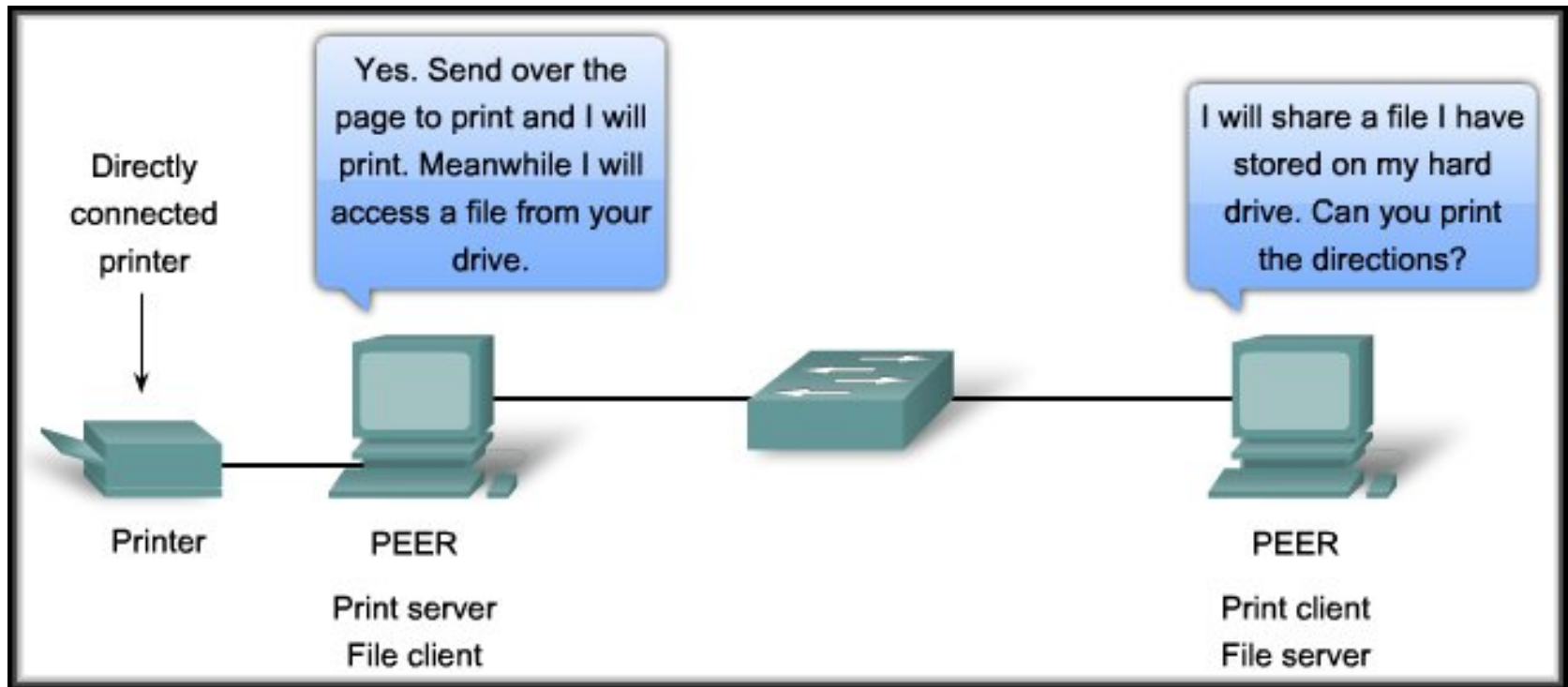
- Two or more computers are connected via a network and can share resources (such as printers and files) without having a dedicated server.

- End devices (peers) can function as either a server or client depending upon the required service

Peer-to-Peer (P2P) Networking
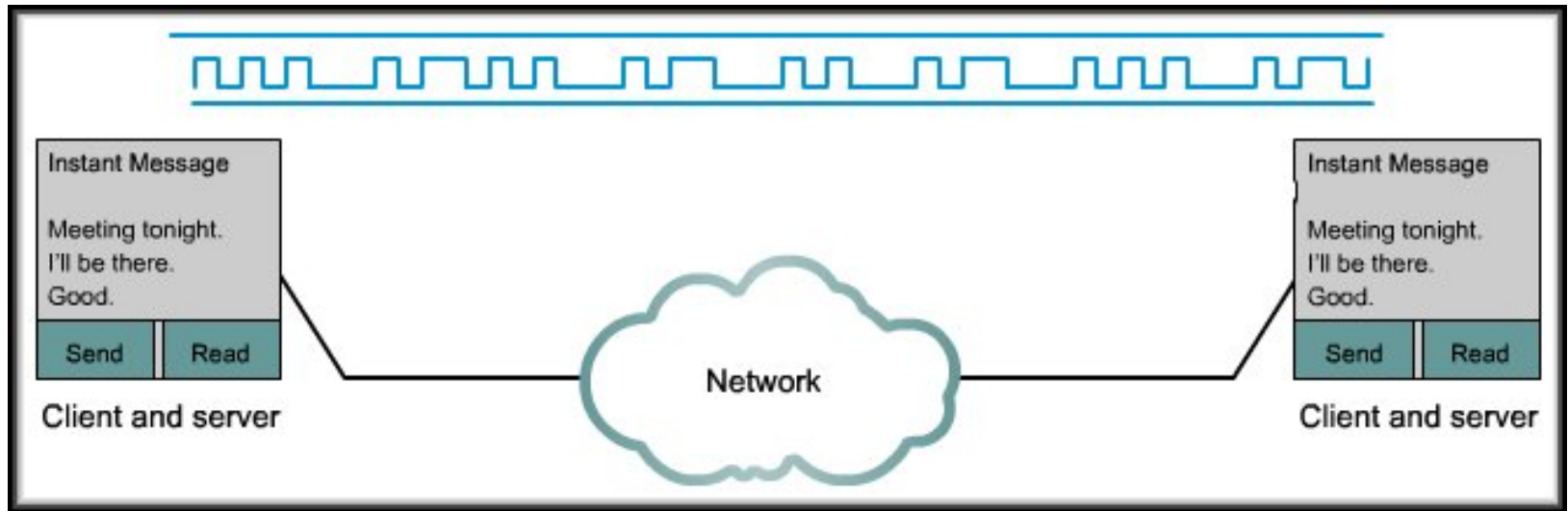
One big disadvantage of P2P networking is that it decentralizes the services on a multiuser network.

Maintaining security and access policies on a P2P network is definitely a challenge. All Policies and User Names and Passwords must be maintained on each peer device.

Application Layer Functionality and Protocols

Application Layer Protocols and Services Examples

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Introduction

| IP Header | TCP Header | HTTP Header | Data |

Commonly used protocols:

- The OSI Model Transport Layer uses an addressing scheme called a port number
- Port numbers identify applications and Application Layer services that are the source and destination of data
- Server programs generally use predefined port numbers that are commonly known by clients
- We will be referring to these port numbers as we look at some of the Application Layer applications and services

Commonly Used Protocols

IP Header	TCP Header	HTTP Header	Data

Application / Service	Acronym	Port
Domain Name System	DNS	53
Hypertext Transfer Protocol	HTTP	80
Simple Mail Transfer Protocol	SMTP	25
Post Office Protocol	POP3	110
Telnet	Telnet	23
Dynamic Host Configuration Protocol	DHCP	67
File Transfer Protocol	FTP	20, 21

Protocol examples

$\Longrightarrow$ DNS.pdf

$\Longrightarrow$ DHCP.pdf

$\Longrightarrow$ HTTP.pdf