



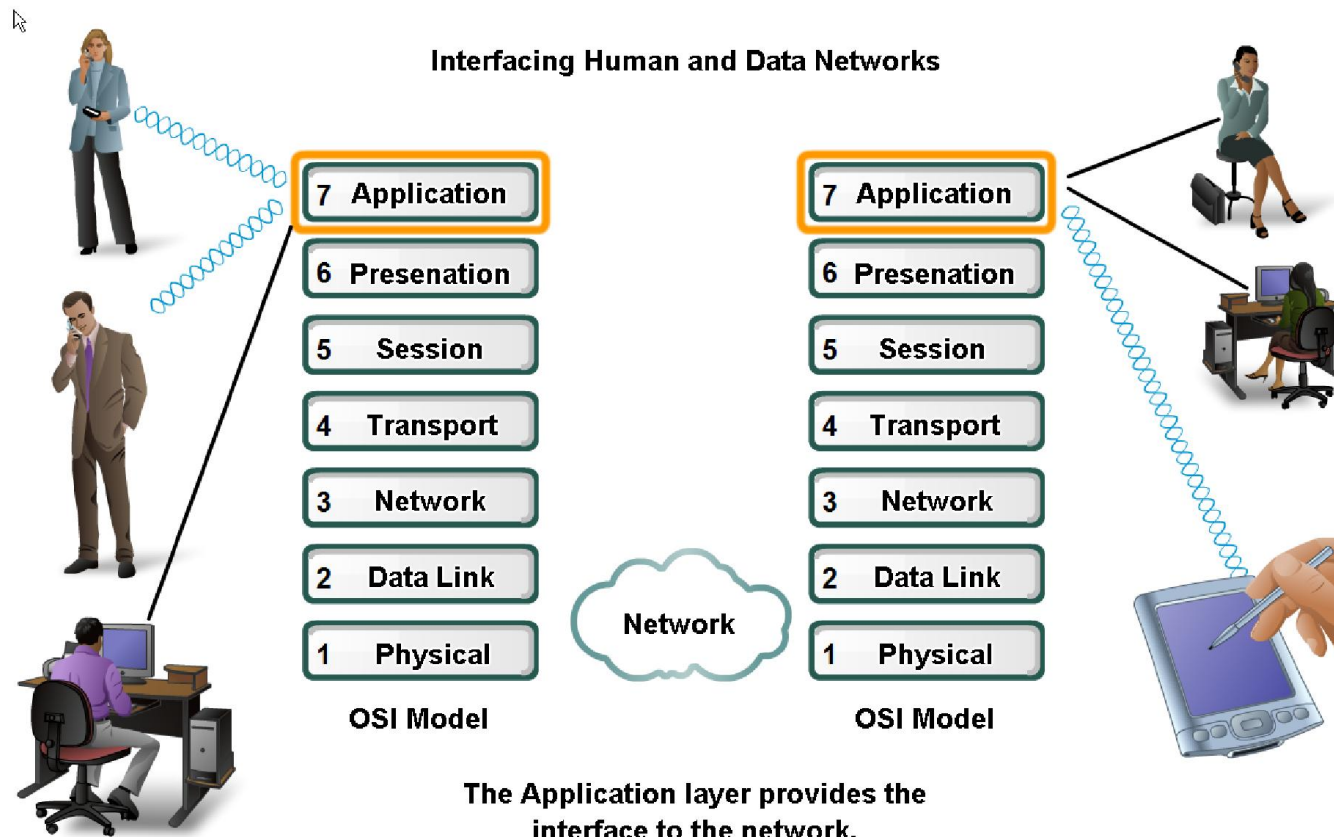
Application Layer Functionality and Protocols



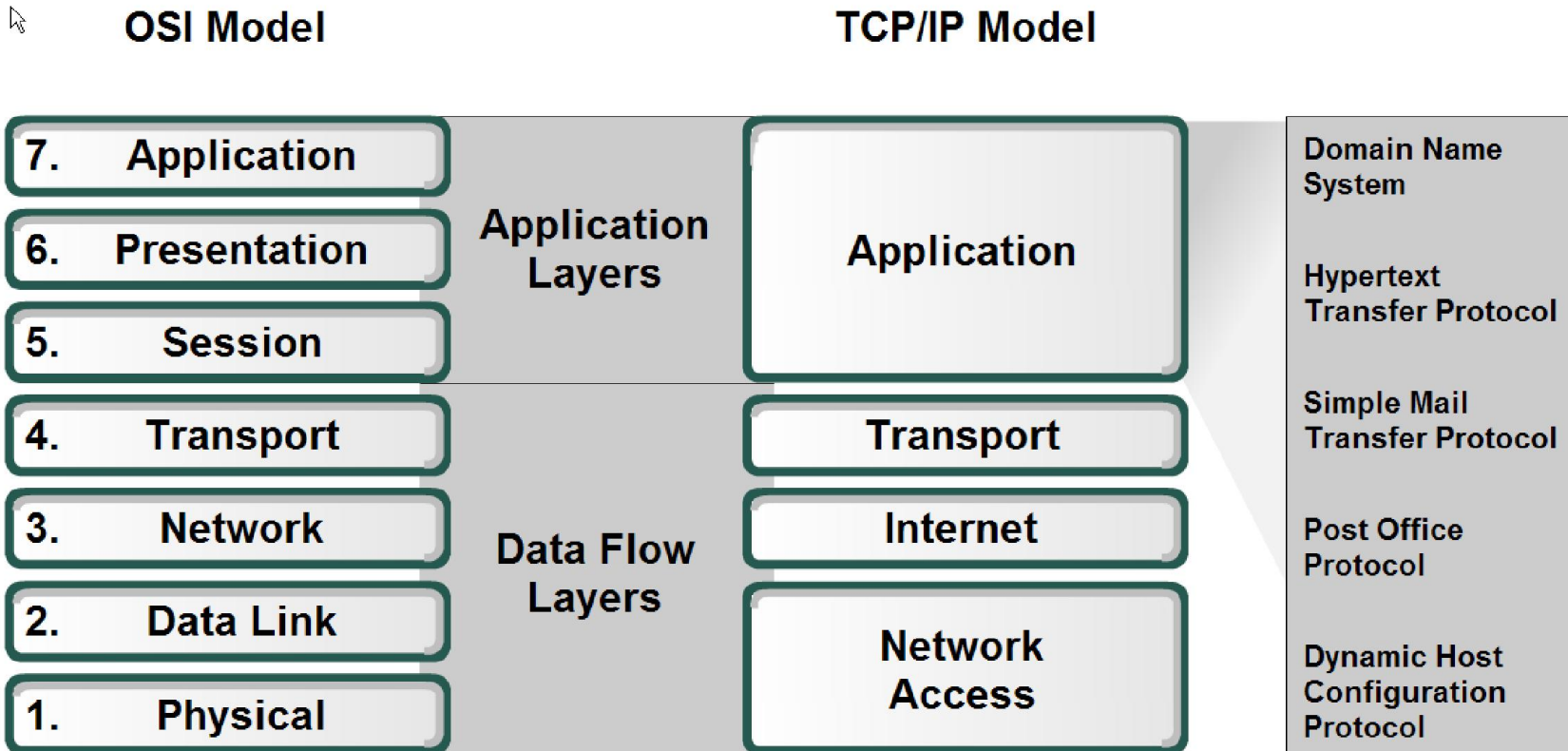
Network Fundamentals – Chapter 3
Sandra Coleman – CCNA, CCAI

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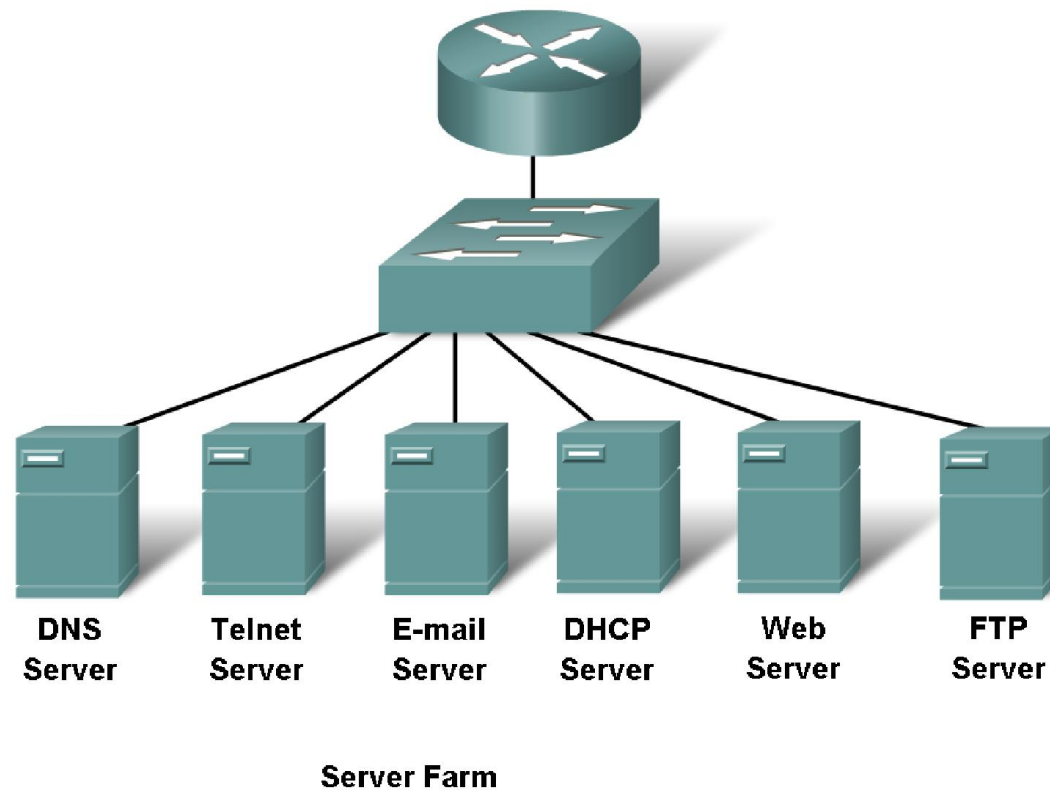
Applications Layer – allows user to interface with the network!



Application Layer – Provides the interface between the applications on either end of the network.



Protocols and networks



Protocols

- 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

Application layer software

- 2 types

Applications – Provide the human (user) interface. Relies on lower layers to complete the communication process.

Services – establish an interface to the network where protocols provide the rules and formats that govern how data is treated..

How data requests occur & are filled

- Client/server model

Advantages:

- Centralized administration

- Security is easier to enforce

- Application layer services and protocols
- Peer-to-peer networking and applications

Client/Server Model

- **Client –**

- device requesting information (initiates the data exchange)

- Can also UPLOAD data to the servers

- **Server – device responding to the request**

- How does it handle multiple request from multiple users and keep everything in order?

- Relies on support from the lower layer functions to distinguish between services and conversations.

- Server relies on a service called a server daemon – runs in the background and ‘listens’ for requests for that service. It can then exchange messages as appropriate & send requested data.

- **Examples:**

- E-mail Client on an employee computer issues a request to the e-mail server for any unread e-mail. The server responds by sending the e-mail to the client.

- Conversations can originate with either party.

Peer-to-Peer (P2P) Network Model

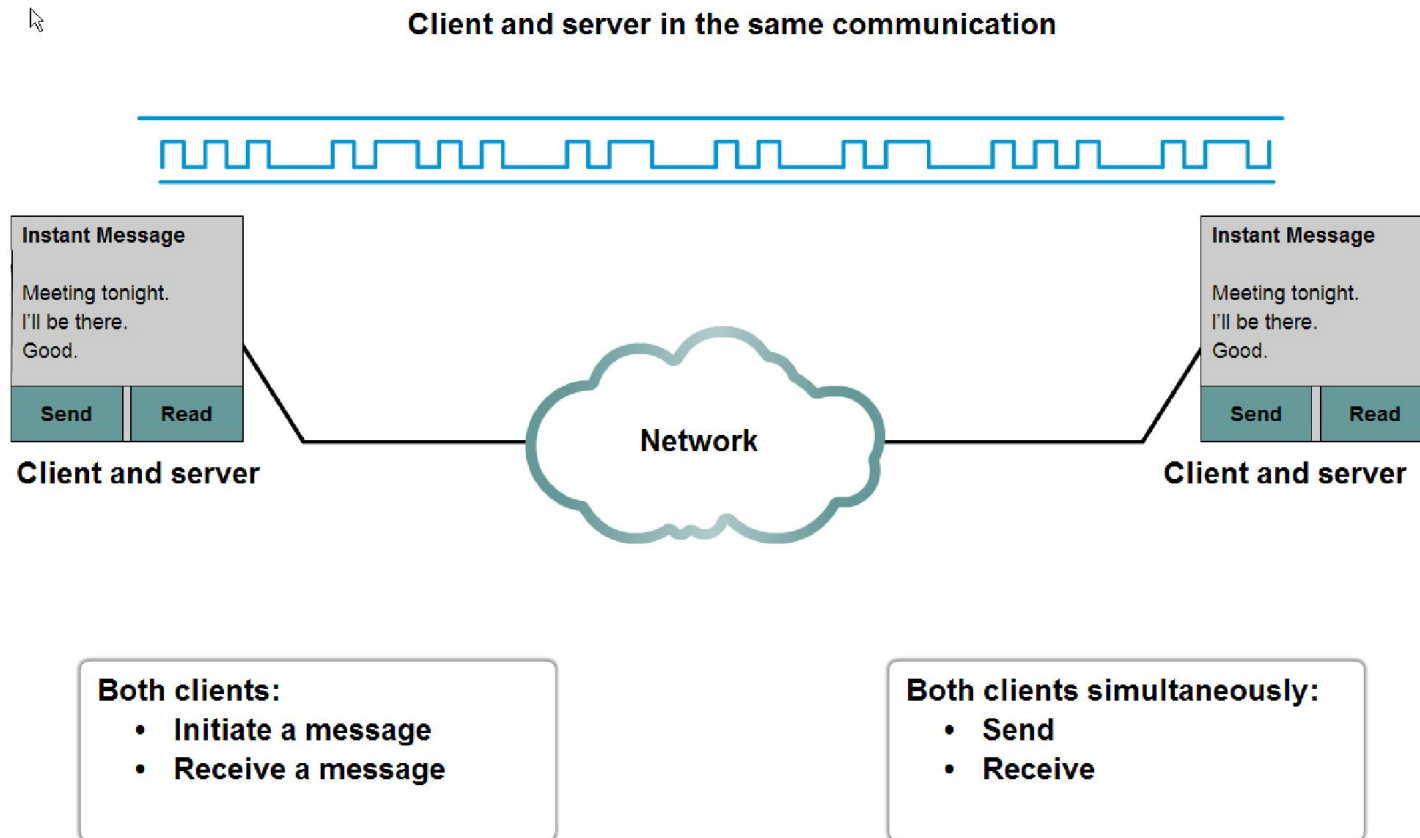
- Two or more computers are connected and are able to share resources **without having a dedicated server**
- Every end device can function as a client or server on a 'per request' basis
- Resources are **decentralized** (information can be located anywhere)
- Difficult to enforce security and policies
- User accounts and access rights have to be set individually on each peer device

P2P Applications

- Running applications in **hybrid** mode allows for a centralized directory of files even though the files themselves may be on multiple machines
- Unlike P2P networks, a device can act as both the client and server within the same communication
- Each device must provide a user interface and run a background service.
- Can be used on P2P networks, client/server networks and across the internet.

P2P Applications Example

Peer-to-Peer Applications
Client and server in the same communication



Common Port Numbers

- TCP

 - FTP – 20-21

 - Telnet – 23

 - SMTP – 25

 - DNS – 53 (Both TCP & UDP)

 - HTTP – 80

- UDP

 - DHCP – 67 & 68

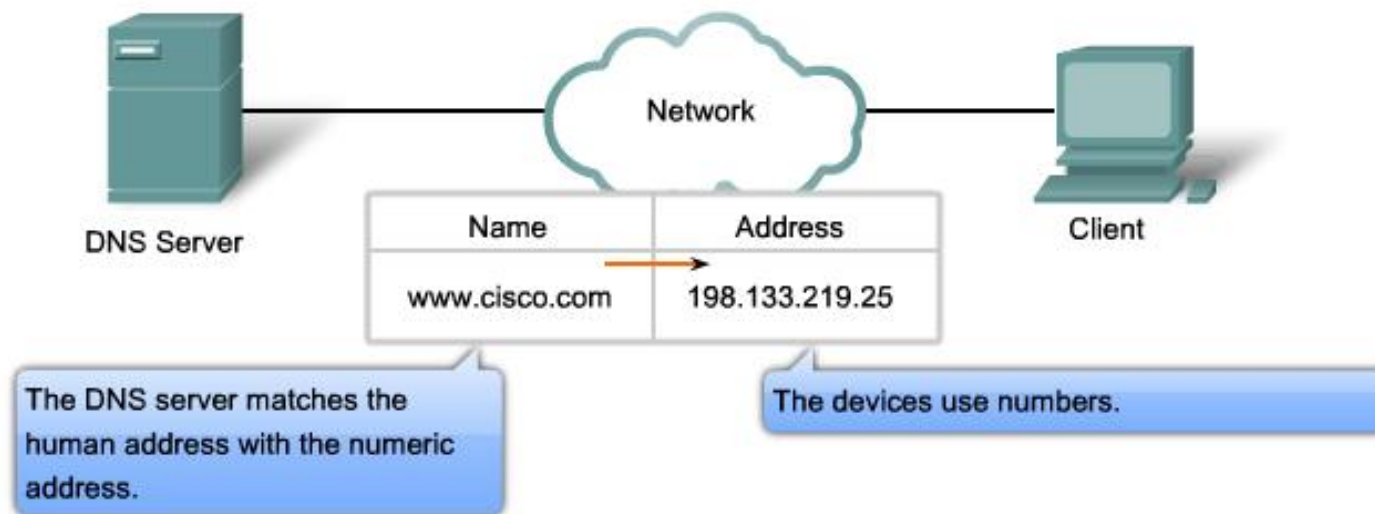
 - POP – 110

DNS Services

- DNS resolver – supports name resolution for other network applications and services that need it.
- Devices are usually given 1 or more DNS Server addresses they can use for name resolution.
- Uses different types of **resource records** to actually resolve the name/IP address issues

DSN Services and Protocol

Resolving DNS Addresses



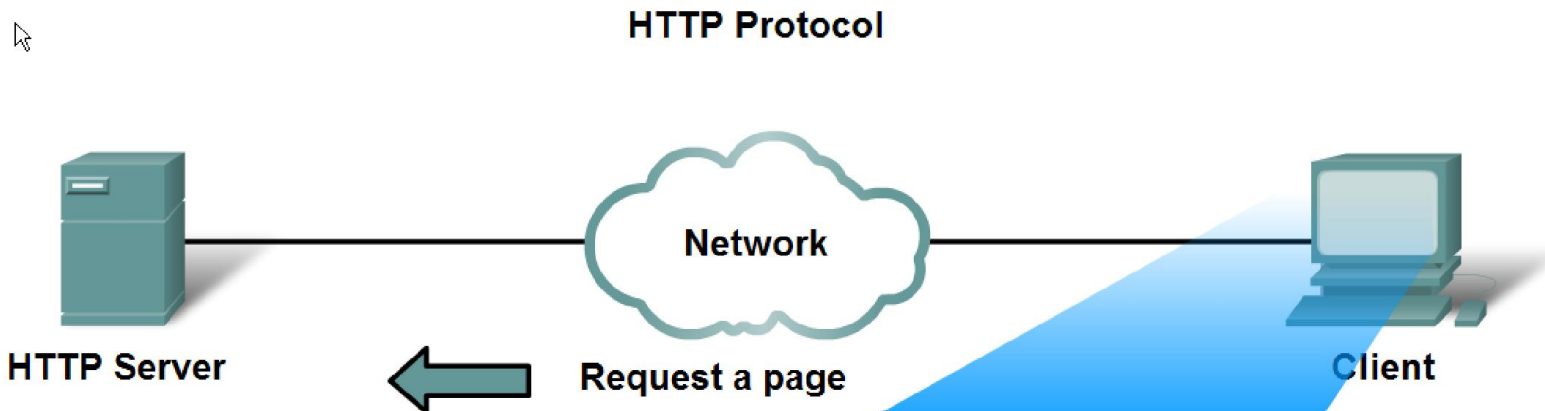
DNS Servers resolve names to IP addresses. It would be difficult to remember the IP address of every website we like to visit, but we can remember names.

THANK YOU DNS SERVER!

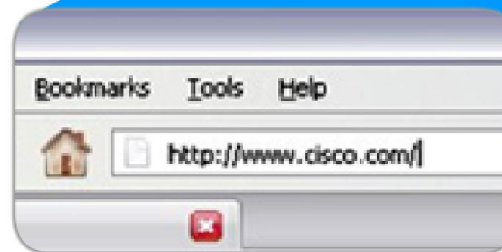
WWW Service and HTTP

- Steps:
 - 1) URL is typed in the address bar.
 - 2) Browser checks with DNS server to convert it to an IP address
 - 3) Connects to the server requested
 - 4) Using **HTTP** or **HTTPS** protocol requirements, the browser sends a GET request to the server to ask for the desired html document (usually index.html)
 - 5) The server sends the HTML code for the web page to the browser.
 - 6) The browser interprets the HTML code and formats the page to fit the browser window.
 - 7) See the next slide for an example.

WWW Service and HTTP



HTTP/HTTPS
are some of the
MOST used
application
protocols!



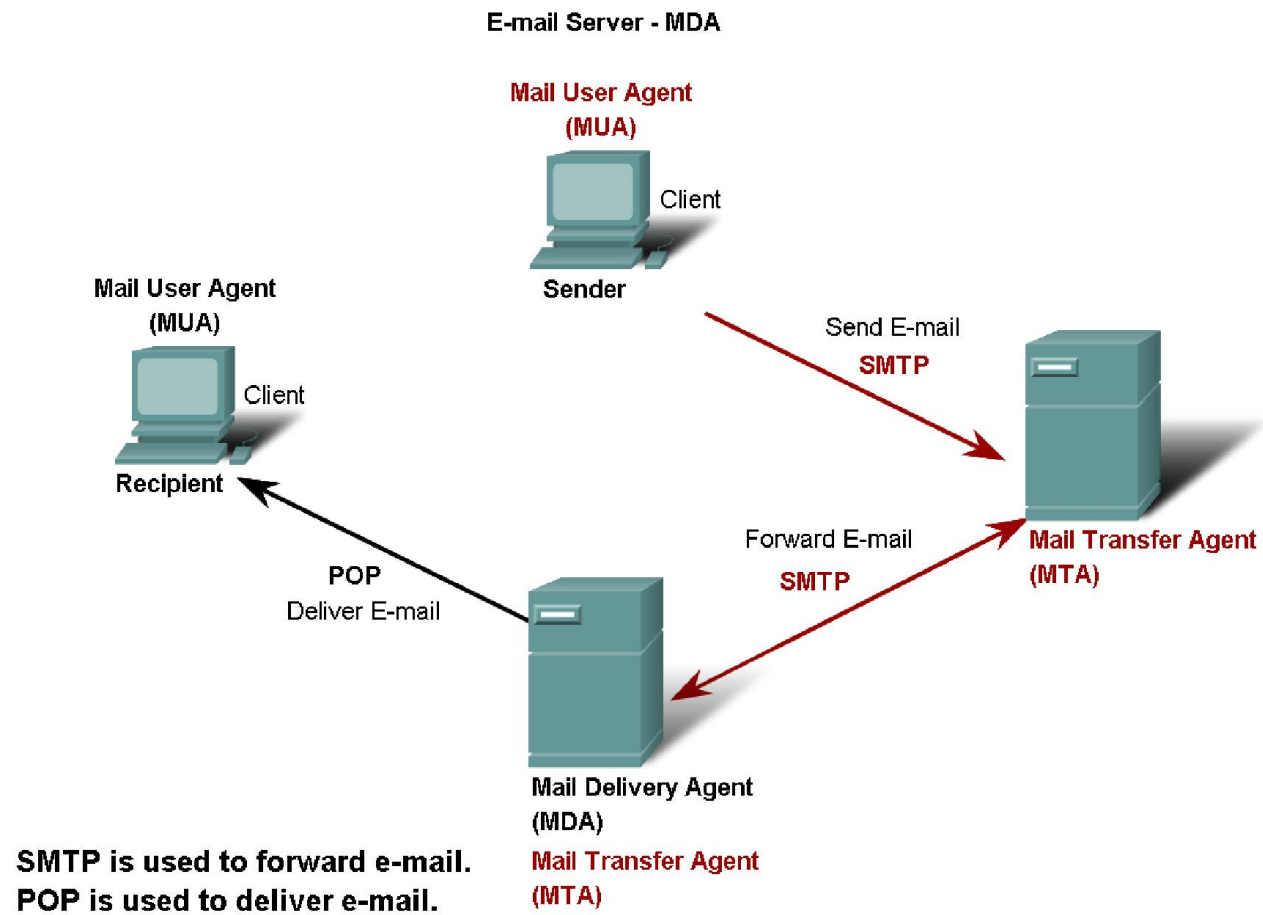
E-mail services and SMTP/POP protocols

- 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)
 - SMTP – handles outbound messages from clients

E-mail services and SMTP/POP protocols

- What do servers require?
 - 1) **Must be running SMTP!**
 - 2) Also operates
 - 1) **Mail Transfer Agent (MTA) – used to forward email**
 - 1) **Receives email from the clients MUA**
 - 2) **Uses SMTP to route email between SERVERS!**
 - 3) **Passes email to the MDA for final delivery**
 - 2) **Mail Delivery Agent (MDA) – receives messages from MUA or from the MTA on another server**
 - 3) **For two e-mail servers to talk – MUST run SMTP and MTA in order to transfer mail between the 2 servers!**
 - 4) **Some clients run Lotus Notes, Groupwise, or MS Exchange. They have their own proprietary protocol for handling e-mail.**

E-mail services and SMTP/POP protocols



FTP

- Commonly used application layer protocol
- Allows for the transfer of files between clients/servers.
- Requires 2 connections to the server
 - 1) Commands – uses TCP port 21
 - 2) Actual data – uses TCP port 20

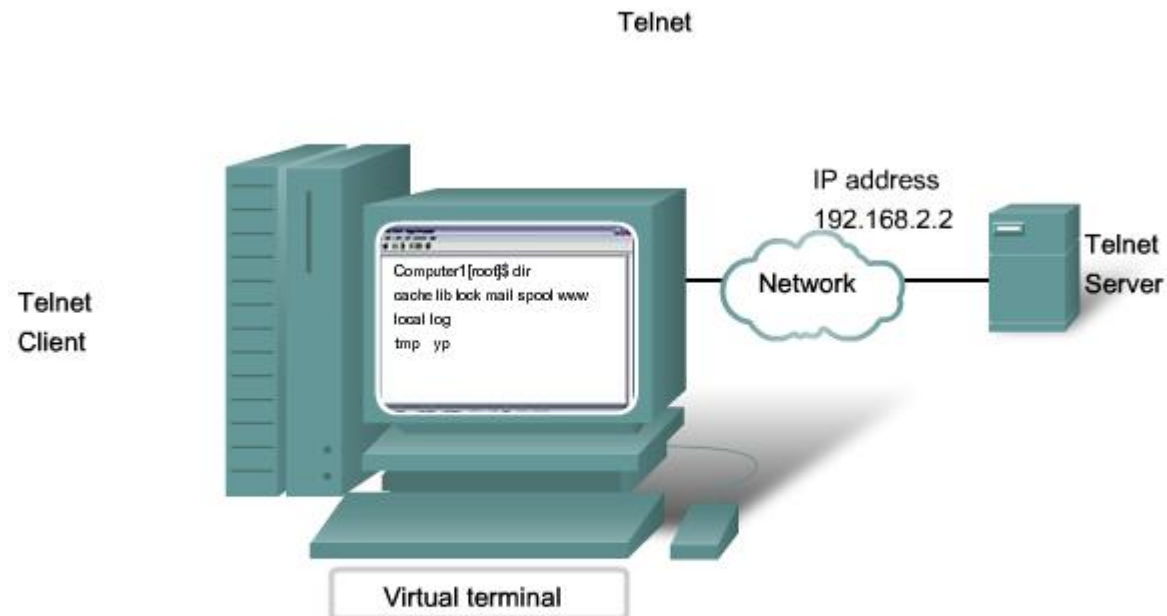
DHCP

- Dynamic Host Configuration Protocol – enables devices to obtain IP addresses, subnet masks, gateways, DNS server information, etc. from a DHCP server.
- An IP address that is not being used is assigned from a range of available addresses
- Not permanently assigned – only leased for a specific period of time (usually 24 hours – 7 days)
- If the host logs off or the power is lost, the IP address they were using is returned to the pool to be re-assigned to another host when needed.
- This is how you are able to use Wi-Fi at various places in the world!
- Don't use DHCP for devices such as servers, printers, routers, switches, etc. These should be statically assigned.
- This will be covered in greater detail in CCNA 4.

Telnet

- Developed in the early 1970's – among the oldest of the application layer protocols and services in the TCP/IP protocol suite.
- Allows users to emulate text-based terminal devices over the network using software.
- A connection is known as a 'virtual terminal (vty)' session.
- Can be run from the command prompt on a PC.
- You can use the device as if you were sitting there with all the rights and priorities that your username will offer you.
- **Disadvantages: Doesn't support encryption like SSH. All data is transferred as plain text. It can be easily intercepted and understood.**
- If security is a concern, you should use Secure Shell (SSH) protocol. Provides for remote logins with stronger authentication than telnet.
- Network Professionals should always use SSH whenever possible.

Telnet



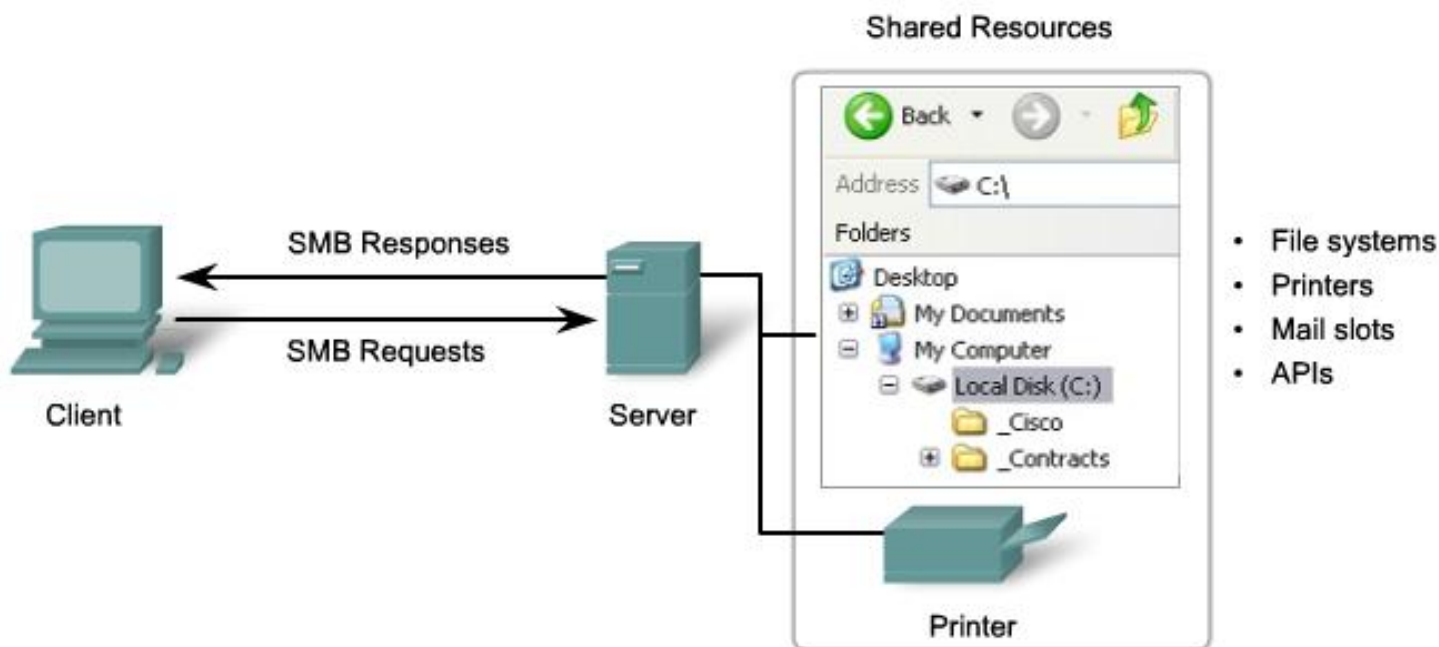
Telnet provides a way to use a computer, connected via the network, to access a network device as if the keyboard and monitor were directly connected to the device.

File Sharing Services and SMB protocol

- Server Message Block
- SMB has become a mainstay of Microsoft networking, even more so since the introduction of Windows 2000 software.
- **Allows servers to share their resources with clients**
- Linux and Unix also share with Microsoft networks using a version of SMB called SAMBA.
- Apple also supports sharing resources using an SMB protocol
- What can SMB do?
 - Start, authenticate, and terminate sessions
 - Control file and printer access
 - Allow applications to send/receive messages to/from another device

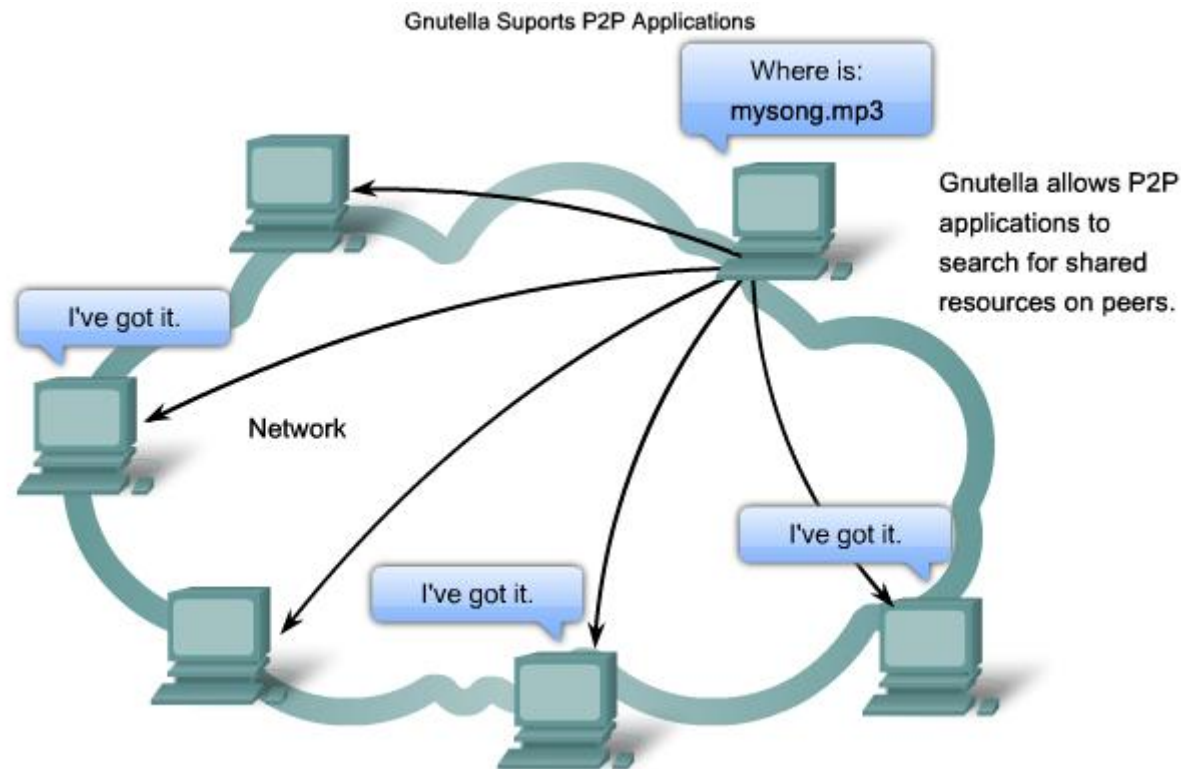
File sharing services and SMB

File Sharing Using the SMB Protocol



SMB is a client-server, request-response protocol. Servers can make their resources available to clients on the network.

Gnutella protocol



People can make files on their hard disks available to other users to download.

Relies heavily on HTTP services.

Client applications that use Gnutella are BearShare, LimeWire, Morpheus, WinMX, Gnucleus, etc.

All finished!

Study Guide due on Test day

1. Matching – pg. 64
2. Matching – pg. 65
3. Multiple Choice – pg. 65
4. Matching – pg. 66
5. Multiple Choice – pg. 67-68

Labs – NONE!

Packet Tracer Activities: - NOW!

Skills Integration Challenge – pg. 87 in your lab book

Test for Ch. 3 & 4 next class meeting.