

Component 4: Introduction to Information and Computer Science

Unit 7: Networks & Networking Lecture 1

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Unit Objectives

- Understand the history of networks and their evolution.
- List and describe the various types of network communications.
- List and describe the various forms of network addressing, including DNS.
- List and define the different types of networks.
- Describe different network topologies.
- List and describe different network standards and protocols.
- Describe wireless communication.
- List and describe network hardware.
- Explain logical networking model concepts.

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What is a Network?

- According to Wikipedia, a network is:
 - "...a collection of computers and devices connected by communications channels that facilitates communications among users and allows users to share resources with other users."
- In English please...
 - A network is made up of computers, printers, other devices, and some sort of media (cabling, wireless) that allows all of these devices to communicate with each other.

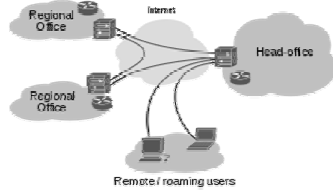
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Modern Network Example

- A site-to-site network with support for remote users.



http://en.wikipedia.org/wiki/File:Virtual_Private_Network_overview.svg

Why Networks?

- Share hardware –
 - Printer, scanner, data storage devices.
- Share software –
 - Software installed on a server to reduce cost.
- Share files –
 - Images, spreadsheets, documents.
- Communicate –
 - E-mail, network phones, live chat, instant messaging.

Networks Decrease Cost

- Printed documentation moved to a Web server.
 - No longer need to update physically. Can update Web page and notify users of changes.
- E-mail done electronically and replaces paper documents.
- Easier to keep device software current.
 - No need to physically visit each device to manage it or upgrade software.

Networks Serve Customers

- Documentation can be posted online in Web pages and kept current by changing one document.
- Customers can chat or e-mail with customer service reps.
- Customer service reps have access to a common network database containing solutions to common customer requests or issues.

Networks Serve Customers (cont'd)

- Hospitals can store all patient data in one common network database, improving quality of care.
- Medical staff and patients can access electronic medical records stored in a network database.

How Devices Connect to a Network

- Wired or wireless connections.
- Network may be connected to the Internet.
 - An Internet connection requires the use of an ISP.
 - An intranet connection does not connect a device to the Internet.
 - However, it may connect various offices together, regardless of their location (Chicago to Portland) and not provide Internet access.

Wired vs. Wireless Networks

- **Wired connections:**
 - Require NIC, copper cables, switch, router.
 - Home routers also contain switch ports.
- **Wireless connections:**
 - Require wireless NIC, WAP, switch, router.
 - Most routers contain a few switch ports.
- **Fiber connections:**
 - Require fiber NIC, fiber optic cables, switch, router.
 - Most routers and switches do NOT contain fiber ports and they can be costly to purchase.

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It's All About Speed

- Networks measure speed using the terms bandwidth and throughput.
 - Bandwidth is the highest number of bits that can be sent at any one time.
 - Throughput is the amount of bandwidth you can use for actual network communications.
- **Example:**
 - Bandwidth on your cabled network is 100 Mbps.
 - Because of physical limitations and other required network traffic, throughput is usually approx. 70 Mbps.

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It's All About Speed (cont'd)

- Speed is influenced by the network media:
 - Copper wire speed is commonly 100/1,000 Mbps.
 - Wireless speed is commonly 54 Mbps.
 - The 'Draft N' standard offers approx. 200 Mbps speed!
 - Fiber optic cable offers the same speeds as copper wiring but can travel longer distances.

Left: LC/PC connectors. Right: SC/PC connectors. All four connectors have white caps covering the ferrules.



Copper wiring with RJ-45 jack at end.



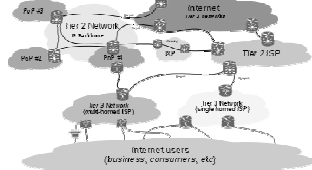
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Service Providers and You

- Internet Access Providers connect users to the Internet.
 - ✓ Access to the Internet revolves around the use of ISPs.
 - ✓ ISPs are organized as local, regional, and national providers.



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Connecting to the Internet

- Devices commonly connect to the Internet via dialup, broadband, Wi-Fi, satellite, and 3G.
 - ✓ Dialup – copper phone lines to connect to an ISP's modem. Limited to a speed of 56 Kbps.
 - The slowest connection type!
 - ✓ Broadband – higher quality copper phone lines, coaxial cable, or fiber optic connection type.
 - Faster than dialup and in the approximate range of 768 Kbps and higher.

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Connecting to the Internet (cont'd)

- Wi-Fi – wireless (radio frequency) connection type.
 - ✓ Wi-Fi refers to the IEEE 802.11 standard governing wireless technologies.
 - ✓ Typically used to connect laptops to WAPs. The WAP is connected to the wired network to gain access to the Internet.
 - ✓ Also used extensively by hotels and airports.
 - ✓ Wireless speeds range from 1 Mbps to 200+ Mbps, depending on a variety of factors.

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Connecting to the Internet (cont'd)

- Satellite – Connection to a ground satellite dish (antennae) and the satellite relays signals to a satellite orbiting the earth. Then the orbiting satellite relays the signal to another ground satellite dish.
 - ✓ Can be somewhat slow because of the time it takes to make a round trip. The loss of speed is known as "latency."
- 3G – The 3rd Generation of standards governing mobile telecommunications.
 - ✓ Speed ranges from 2 Mbps – 5 Mbps, depending on plan and location.

Leasing an IP Address

- ISPs lease IP addresses to subscribers.
 - ✓ Your private (home or business) network usually utilizes private IP addressing.
 - ✓ The ISP typically leases your location one public IP address.
 - ✓ The ISPs equipment is provided with a public IP address to connect to the ISPs public network.
 - ✓ The ISPs equipment is also provided with a private IP address to connect to your private network.

Leasing a Dynamic IP Address

- The ISPs equipment is able to translate addressing between the private and public networks.
- ISPs generally provide you with an IP address that may change from day to day.
 - ✓ This is a typical leased, dynamic IP address and is included in the monthly fee.

Leasing a Static IP Address

- ISPs can also lease an IP address for the duration of the contract.
 - ✓ The static IP address will not change.
- Most Web sites use static IP addresses so that their domain name will be reliably mapped to one IP address.
- ISPs charge more each month for static IP address. The charge ranges from \$5 to \$100, depending on provider.
