Component 4: Introduction to
Information and Computer Science

Unit 7: Networks & Networking
(Part 4 of 5)

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 networking logical model concepts.

Wireless Communications

- Wireless devices communicate without cabling.
- Signals sent via:
  - Infrared light – laptop to laptop
  - Microwave – requires clear line of sight
  - Radio frequency - most common method
- Governed by IEEE 802.11 standard.
- Seems to be available everywhere!

Wireless – The Good, The Bad, & The Ugly

- Good:
  - No cables needed to connect devices to network.
  - Cleaner work environment without cables.
  - Devices can be easily moved about.
  - Easy for users to connect.
- Bad:
  - Can be slower than wired networks.
  - Limited signal range.
- Ugly:
  - Security issues.

How Does Wireless Function

- Home wireless communication is done by radio frequency.
  - Radio frequencies are mapped to channel numbers.
  - In North America, channels are 1-13 for 802.11 a/b/g
- Need the following for typical home setup:
  - Computers need wireless NICs
    – Facilitates connection to a wireless router.
  - Network needs a wireless router
    – Also known as a wireless access point (WAP).
  - Wireless router needs to connect to a wired device
    – To get Internet access, wireless router needs wired connection to the ISP device (cable modem router).

Wireless Network Setup

- WAP:
  - SSID – name for wireless network.
  - Change WAP default password since globally known.
  - IP address and subnet mask.
  - Configure WPA2 and record the code/phrase created.
  - Cable WAP so it somehow connects to ISP device.
- Each wireless client:
  - SSID configured same as WAP.
  - IP address and subnet mask in same range as WAP.
  - Configure WPA2 using code/phrase from WAP.

Wireless Network Setup (cont'd)

- Standards are backwards compatible
  - 802.11g NICs work in 802.11 a/b device-controlled WLANs.
- Wireless RF channels
  - WAPs and clients must use same channel.
  - Different channels cannot communicate.
  - Channel numbers correspond to an RF range.
  - Channels 1, 6, and 11 RF do not overlap. Use one of these!
    - Channel 5 uses the RF range of 2.421–2.443 GHz.
    - Channel 6 uses the RF range of 2.426–2.448 GHz.

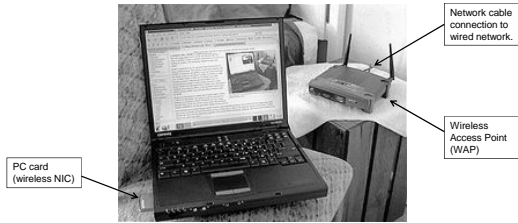## Wireless Components Example

- The notebook is connected to the wireless access point using a PC card.

Network cable connection to wired network.

Wireless Access Point (WAP)

PC card (wireless NIC)

Network Hardware

- Common components are:
  - Networked devices
  - NIC (wired and wireless)
  - Switch
  - Router
  - ISP device
  - Server
  - Surge protector
  - Uninterruptable Power System (UPS)

Network Hardware - Networked devices

- Computers / Laptops with:
  - Network-enabled operating system (OS).
  - NIC to connect to switch/router.
  - Cabling for wired network.

Network Hardware - NICs

- Required for network communication
  - Hardware uses OS services to communicate on network.
- Wired – requires cabling, jacks, switch/router.
- Wireless – requires WAP and some wired device to communicate with wired devices.

Vintage 10 Mbps Ethernet NIC for wired network.

54 Mbps Wireless LAN PCI Card (802.11g).

Network Hardware – Switch

- Very important network component.
- Devices plug into switch to communicate with each other.
- Switch plugs into ISP device to provide Internet access.

Image shows a 5-port Atlantis Ethernet switch.

If this switch connects to an ISP device, with five ports it could also accommodate a printer and three other devices.

One of the devices could be a WAP, which would allow wired and wireless clients to communicate with each other.

Network Hardware - Router

- Network boundary defined by IP address and subnet mask numbers.
- Router connects different IP networks so they can communicate with each other.
- Routers can be wired or wireless.
- ISP devices are routers.

Image shows a Cisco Linksys WRT54GL wireless router typically found in a SOHO (small office, home office) network.

The blue Ethernet cable extending out of its rear, to the right, connects this device to the wired network.
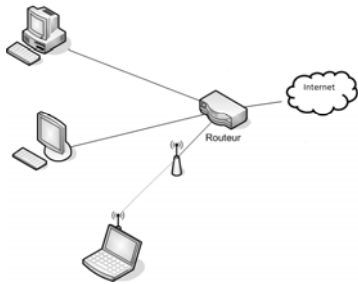

Routed Network Example

Network Hardware – ISP Device

- Connects SOHO and Office networks to Internet.
- Can lease from ISP with Internet service.
  - Sometimes available for purchase too.
- Usually has one Internet port to connect to a wall port.
- Usually has one switch port to connect one device using Ethernet cable.
  - Can use that port to connect to a switch, which can connect to other devices or other switches to extend network.
  - All devices then share the one Internet connection.

ISP Device Examples

Network Hardware - Server

- Computer with specialized OS installed.
  - Windows Server 2008
  - Ubuntu Server
  - Novell Open Enterprise Server
- Creates 'gated community' of devices and users.
  - Server maintains database of objects, restricts access to authorized devices/users, and manages them.
- Can provide various functions:

✓ Domain controller	✓ DHCP server	✓ Certificate server
✓ Print server	✓ DNS server	
	✓ File server	✓ NAP server

Network Hardware – Surge Protector

- Protects devices from spikes in power usually originating with the power company.
  - Some power strips are also surge protectors – need to carefully read product information to differentiate.
- Devices need to be plugged in to gain protection.
- Power surge can destroy a devices circuitry.
- Protection measured in Joules.
  - Joules define how much electricity the surge protector can absorb without failure.
  - Should consult electrician to protect hardware.

Network Hardware - UPS

- Uninterruptible power supply (UPS) provides emergency power to attached devices when power fails.
- Short battery power time (5-30 min.) depending on attached devices.
  - Computer and monitor – portable unit okay.
  - Whole building – need large (site) solution.
- Never plug laser printer into UPS.
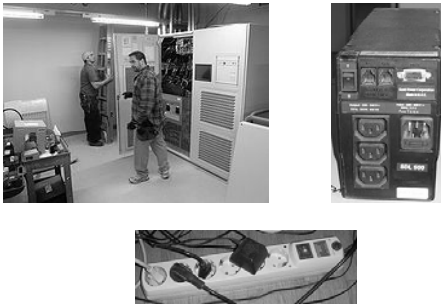 - Due to power requirements, will instantly drain available UPS battery power.

Surge Protector & UPS Examples