Wireless Devices, Deployment and Vertical Markets

COMP3049 Intermediate Wireless Technologies

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CWNA Exam Objectives

- Identify the purpose of the following infrastructure devices and explain how to install, configure and manage them:
  - Access Points
  - Bridges
  - Workgroup Bridges

CWNA Exam Objectives

- Identify the purpose of the following wireless LAN client devices and explain how to install, configure and manage them:
  - PCMCIA Cards (PC Cards)
  - Serial and Ethernet Converters
  - USB Devices
  - PCI/ISA Devices

CWNA Exam Objectives

- Identify the purpose of the following wireless LAN gateway devices and explain how to install, configure and manage them:
  - Residential Gateways
  - Enterprise Gateways

Introduction

- This lecture will cover:
  - The most common types of wireless hardware available today
  - Definition and role of the hardware on the network
  - Common options that might be included with the hardware
  - How to install and configure the hardware

Access Points

- The second most common wireless LAN device that an administrator works with
- Provides clients with a point of access into a network
- A *half-duplex* device with "intelligence" equivalent to that of a sophisticated Ethernet switch

Access Points

Cisco WRVS4400N

Small Business Router

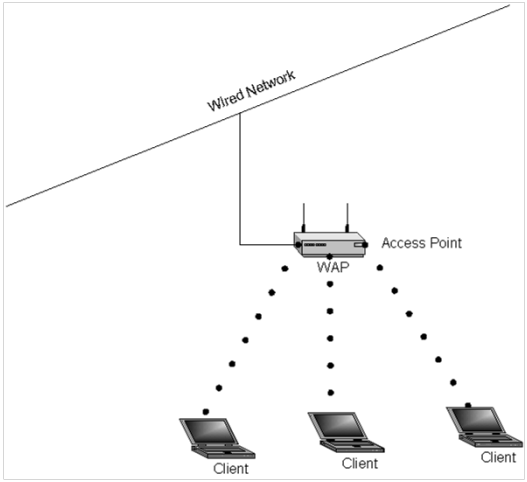
Cisco AP1250

Motorola 7131
Tri-Radio

Motorola 650

Thin AP

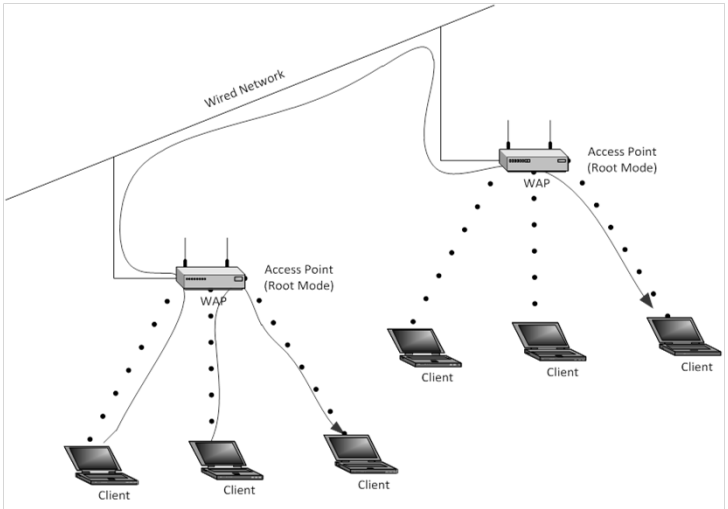
Access Point Installed on a Network



Access Point Modes

- Root Mode
  - Used when the AP is connected to a wired network (backbone) through its wired (usually) Ethernet interface
  - AP's "talk" to each other over the wires to coordinate roaming functionality such as re-association
  - Wireless clients can communicate with other clients through the AP with which they are associated

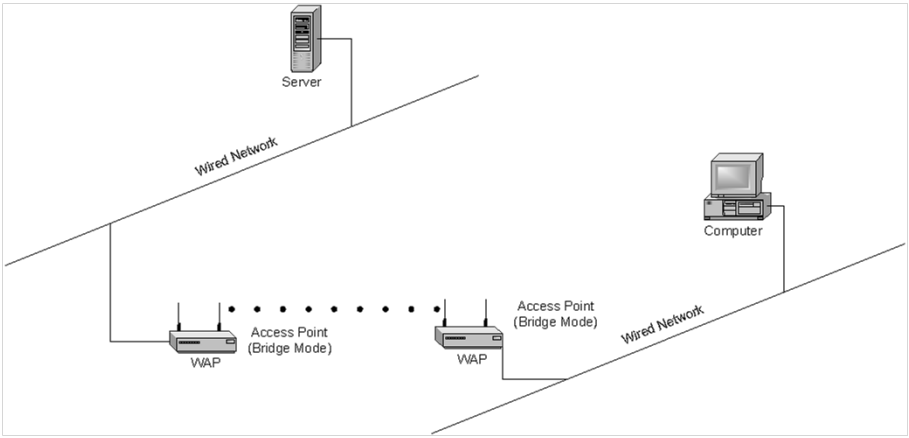
Root Mode



Access Point Modes

- Bridge Mode
  - AP's work exactly like wireless bridges (discussed later)
  - Few AP's on the market have bridge functionality
  - Clients do not associate to bridges
  - Bridges are used to link two or more wired segments together

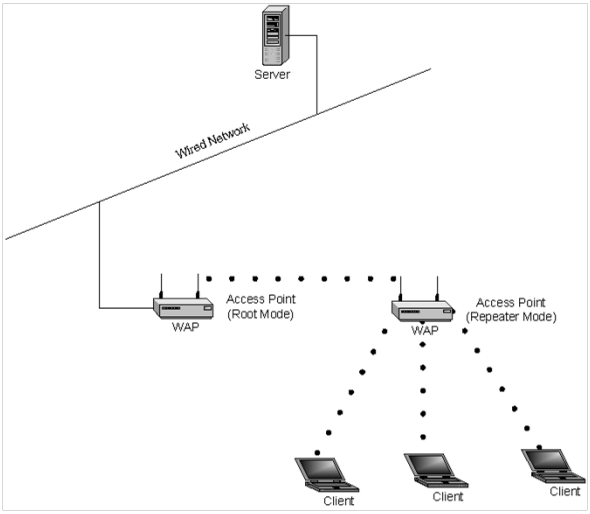
Bridge Mode



Access Point Modes

- Repeater Mode
  - AP's can provide a wireless upstream link to a wired network
  - One AP is configured in root mode and the other in repeater mode
  - The AP in repeater mode connects to clients as an AP and to another AP configured in root mode as a client
  - Not recommended unless absolutely necessary
    - Lower throughput and high latency

Repeater Mode



Common Options

- An AP is considered a portal
  - Allows client connectivity from an 802.11 to an 802.3 or 802.5 network
- Fixed or detachable antennas
- Advanced filtering
- Removable (modular) radio cards
- Variable Output Power
- Various types of wired connectivity

Common Options

- Detachable antennas
  - Ability to attach a different antenna to the AP
- Diversity antennas
  - AP picks the antenna which has the best reception (due to multipath)
- Advanced Filtering
  - MAC filtering
    - Filters devices not listed in the AP's MAC list
  - Protocol filtering
    - Lets administrator decide which protocols should be used across the wireless link

Common Options

- Removable (Modular) Radio
  - Use a single AP as both AP and Bridge if two card slots available
  - Use each radio card as an independent AP
    - Connect twice as many clients
- Variable Output Power
  - Allows administrator to control the area of coverage
    - Control sizing of cells without using attenuators or amplifiers

Common Options

- Various types of wired connectivity
  - Connect AP to Ethernet 10/100BaseT or to fiber backbone (100 BaseFX)
  - More flexibility in locating AP's

Configuration and Management

- The methods vary by manufacturer
  - Console, telnet, Web based, custom software
  - Default configuration and IP address
    - With hardware reset
  - Higher cost usually = more features
  - Most expensive have native VPN and Radius
  - Features may vary even with AP's from the same manufacturer
    - Example: MAC filters that can be used to explicitly deny or allow a client PC to connect

Configuration and Management

- Selecting the right AP is important
  - 100Mbps, or 1Gbps connection to the wired network?
  - PoE or not?
- Know your environment; look for products that fit; read the specifications in detail
- Spend time *now* learning about products available on the market

Configuration and Management

- Basic list of features
  - Small Office, Home Office
    - MAC filters
    - WEP (64 or 128-bit minimum)
    - USB or console configuration interface
    - Built-in Web Server configuration interface
    - Simple custom configuration application

Configuration and Management

- Basic list of features (cont'd.)
  - Enterprise class AP's
    - Advanced custom configuration application
    - Advanced Web based configuration
    - Telnet access
    - SNMP management capabilities
    - 802.1x/EAP security
    - VPN client and server
    - Routing Static/Dynamic
    - Repeater functionality
    - Bridging functionality
    - Mounting options

Configuration and Management

- Corporations look for two things:
  - Easily add network access in areas that do not have wired access (no cables)
  - Provide easy mobility for users with laptops
- Cost reductions
  - Cable installations (can cost up to $200 per jack in NA)
  - Time required to troubleshoot cabling problems

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Configuration and Management

- Mounting
  - Use zip ties or factory provided mounting plate
  - Do not cover lights (LEDs on AP)
  - Mount so that lights can be seen from the ground
  - Label AP's in a way that is readable from the floor
  - Mount to a column, pole or to a 2x4
  - Allow for ventilation
  - Think about how to provide electrical power to the AP's

Configuration and Management

- Client utility used for configuring adapters
  - Windows Zero Configuration (WZC)
    - Most widely used
    - Fewer security options
    - Easier support
    - Opportunistic PMK caching (white paper on CD)
  - Manufacturer provided
  - Third party ($$)

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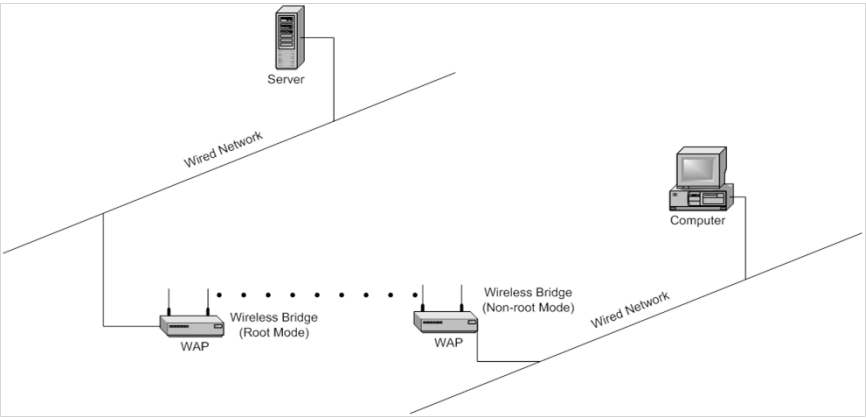
Wireless Bridges

- Provide connectivity between two wired segments (or buildings)
- Used in point-to-point or multipoint configurations
- Half-duplex devices for Layer 2 connectivity only

Wireless Bridging of two LANs



Wireless Bridges

- Operate in one of four modes
  - Root mode
  - Non-root mode
  - Access Point mode (workgroup bridge)
    - Limited clients (usually 8)
  - Repeater mode

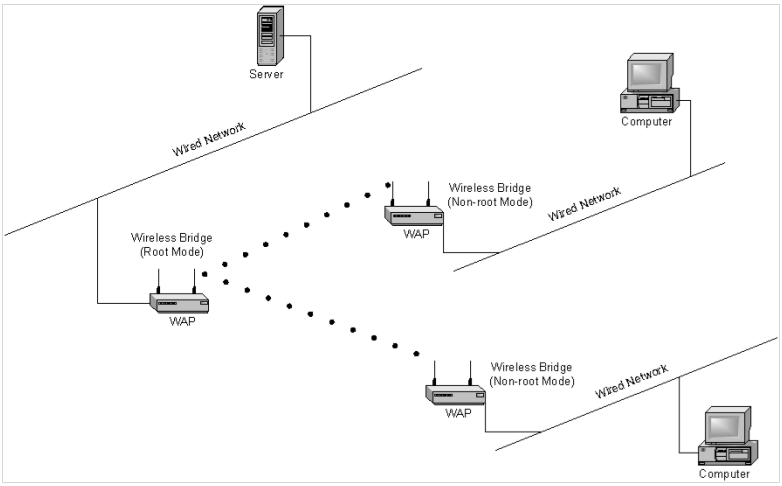
Wireless Bridges

- Root mode
  - One bridge in a group (point-to-multipoint) must be setup in root mode
  - In root mode the bridge can only communicate with clients and other non-root bridges, *it cannot associate with another root mode bridge*

Wireless Bridges

- Non-root mode
  - Associate with wireless bridges that are in root mode
  - Some support wireless client connectivity
  - When using Spanning Tree Protocol all non-root bridges must have connectivity to the root bridge

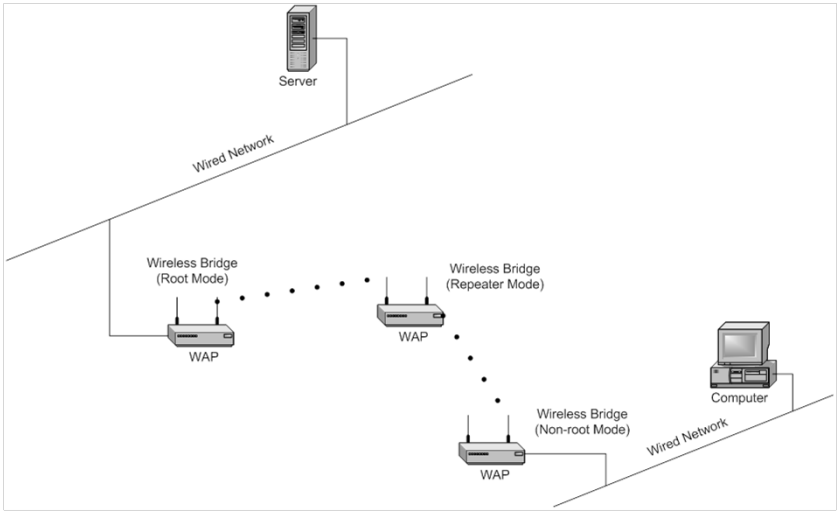
Wireless Bridges



Wireless Bridges

- Access Point Mode
  - Some manufacturers allow a bridge to be configured so that it can be used as an AP
- Repeater mode
  - A bridge that is placed between two AP's to extend the range of the wireless segment
  - Reduced throughput is a concern
    - Half duplex operation

Wireless Bridges



Wireless Bridges – Common Options

- Fixed or detachable antennas
  - Some wireless bridges, designed to be installed outdoors come in a NEMA weatherproof enclosure
- Advanced filtering capabilities
  - Most have protocol filtering to allow or disallow specific packets based on Layer 3, Layer 4 ports or even Layer 7 application
  - Administrator can prevent users from running bandwidth intensive applications based on port, application or protocol

Wireless Bridges – Common Options

- Removable, modular radio cards
  - Similar to AP's
- Variable output power
  - Allows creation of viable long-distance links
- Various types of wired connectivity
  - Always try to configure for full-duplex wired connection
  - Distance to nearest wiring closed is also important

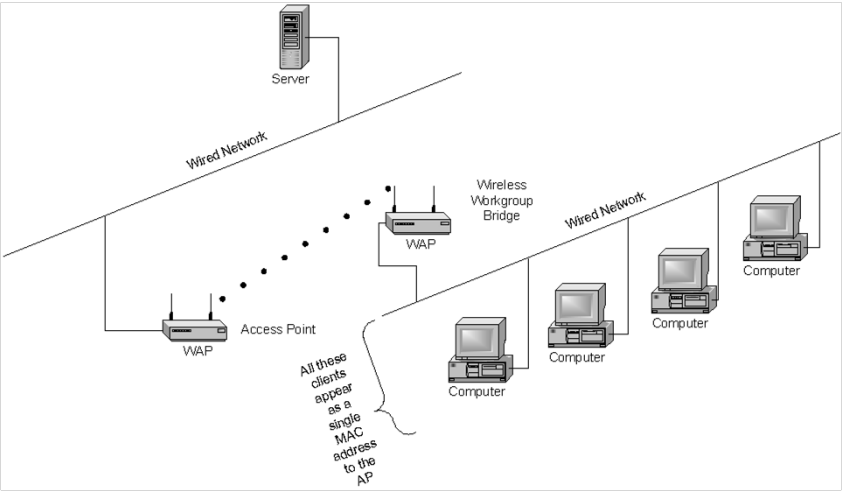
Wireless Bridges – Common Options

- Configuration and Management
  - Similar to AP's
  - PoE when necessary to install outdoors
  - Frequent throughput checks are vital when using bridges
  - Connection methods for configuration especially critical for outdoor installations

Wireless Workgroup Bridges

- Similar but not the same as Wireless Bridges
- Client device capable of combining multiple wired LAN client devices into one collective wireless LAN client
- Workgroup bridge appears as a single client device
- MAC addresses of individual clients behind WGB will not be seen on the AP
- Useful for connecting mobile classrooms and remote campus buildings with a small no. of users

Wireless Workgroup Bridges



Wireless Workgroup Bridges

- Common Options
  - Same or very similar to wireless bridges

Wireless ISP

- Last-mile data delivery
  - Farms
  - Cottages
  - Any area not serviced by CATV or DSL
    - DSL limit of approx. 4 Km.

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SOHO and Mobile Offices

- SOHO same as home WLAN
- Mobile office uses small, portable Wireless Gateways
  - Connect via 3G cellular Internet stick

TRENDNet TEW655BR3G

Dlink DIR-412

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WLAN Client Devices

- PCMCIA (PC Cards), Compact Flash and SD cards (Eye-Fi), Express Cards
- Ethernet and serial converters to 802.11
- USB Adapters
- PCI/PCIx
- Mini-PCI Adapters (inside laptops)

WLAN Client Devices

- Desktop
- PDA
- Notebook
- Projector
- Fridge, Washer, Dryer
- Television
- 802.11 is low cost but, where will it end?

WLAN Client Devices

- Antennas on external PC Cards (PCMCIA, etc.) vary greatly
- A few manufacturers make cards with detachable antennas (Cisco and Proxim)
- Some USB Adapters ship with an extension cable and a desk holder for the USB device

Wireless USB Adapters

Engenius

Belkin

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WLAN Client Devices

- Some manufacturers of chipsets for 802.11
  - Atheros
  - Intel
  - Broadcom
- Atheros was the first to mass-produce chipsets for 802.11a using 5GHz UNII band
- CF/SD cards draw very little power but may have range issues

WLAN Client Devices

- Wireless Ethernet and Serial Converters
  - Ethernet converters allow connection of a wireless radio to an Ethernet port on the computer
  - Serial is rarely used and only on slower client devices such as terminals and telemetry equipment
  - In most cases these devices do not include the radio and a PC Card must be purchased separately
  - Ethernet converters allow conversion of large number of wired nodes to wireless

Wireless Ethernet and Serial Converters

Ethernet to 802.11a/b/g or n

B&B Electronics (Industrial)

WLAN Client Devices

- USB Adapters
  - Popular because of the simple installation
  - Some use removable PC Cards others have built-in radio card
  - May only be compatible with a PC Card from the same manufacturer

Linksys USB 802.11g adapter

WLAN Client Devices

- PCI, PCIx Adapters
  - Installed inside a desktop computer
  - Some have a non-removable radio card with an external “rubber-ducky” antenna
  - Some use the antenna on the PC Card
  - Usually only compatible with a PC Card from the same manufacturer because of proprietary drivers

Linksys PCI adapter

WLAN Client Devices

- Configuration and Management
  - Two basic steps
    - Install drivers
    - Install manufacturer's wireless utilities
  - Installation of drivers is no different than for other devices
  - Drivers are not available for all Operating Systems
    - Check before purchasing

WLAN Client Devices

- Manufacturer Utilities
  - Some offer a full suite, others provide the most basic means of connectivity
  - A complete suite might include:
    - Site survey tools
    - Spectrum Analyzer
    - Power and speed monitoring
    - Profile configuration
    - Link status monitor with link test functions

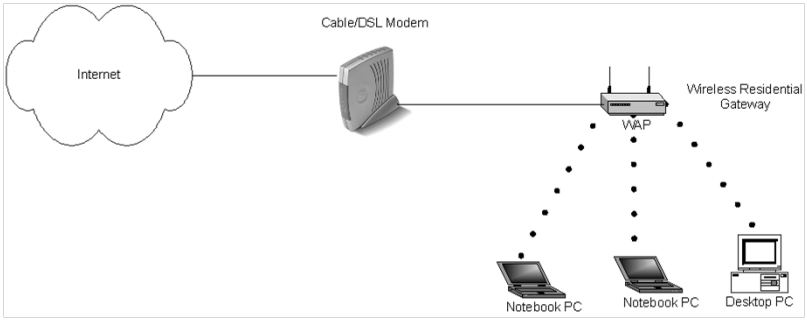
WLAN Client Devices

- Common Functionality of Utilities
  - Infrastructure/Ad Hoc mode
  - SSID (Network Name)
  - Channel
  - WEP Keys
  - Authentication type (open system or shared key)
  - Note: some manufacturers do not provide all this functionality

Wireless Residential Gateways

- A device designed to connect *a small number of wireless nodes* to a single device for Layer 2 and 3 connectivity usually to the Internet
- A combination of AP and gateway
- Most include a built-in hub or switch
- WAN port connects to the Internet via:
  - Cable modem
  - xDSL modem
  - Analog modem
  - Satellite modem

Wireless Residential Gateways



Wireless Residential Gateways

- Common Options
  - Point-to-Point over Ethernet protocol
  - Network Address Translation
  - Port Address Translation
  - Ethernet switching
  - Virtual services (DMZ)
  - Print server
  - Fail-over routing (switches to phone modem if Cable/DSL fails)
  - VPN
  - DHCP
  - Configurable Firewall

Wireless Residential Gateways

- Configuration and Management
  - All devices can be configured using a Web browser
  - Some may support console, telnet and USB
  - Management functions include statistics, up-time, dynamic IP addressing, VPN, etc.
  - Usually simple to configure and monitor for the non-technical home or home-office user
  - ISP's usually do not provide technical support

Enterprise Wireless Gateways

- A device that provides authentication and connectivity
- Appropriate for large-scale wireless LANs
  - Rate-limiting, QoS and complex profile management (roaming)
- Needs powerful CPU and high-speed Ethernet interfaces to support many AP's
- Usually SNMP manageable
- Some support 802.11, Bluetooth and other standards simultaneously

Enterprise Wireless Gateways

- Can be configured for hot fail-over (redundant gateways installed in pairs)
- Support of RADIUS, LDAP and other authentication methods, built-in encryption for VPN's, QoS, time-of-day access
- Expensive but usually worth the cost

Aruba 2400 Wireless Switch

Supports up to 48 AP's

www.arubanetworks.com

Enterprise Wireless Gateways

- Configuration and Management
  - May need extensive configuration
  - Allow management and sometimes configuration of multiple AP's
  - Configuration can be backed-up to the network
  - Usually rack-mountable 1U or 2U

Wireless Vertical Markets

- Educational- classroom
- Industrial – warehousing/manufacturing
- Healthcare – Hospitals and Offices
- Municipal networks
- Hotspots
- Transportation (with backhaul)
- First response (ambulance, fire)

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Wireless Vertical Markets

- Fixed/Mobile Convergence
  - Cellular based mobile Wi-Fi
  - Skype, Fring, Truphone over Wi-Fi

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WLAN Vendors

- Aerohive
- Aruba
- Bluesocket
- Colubris
- Extricom
- Meru
- Motorola
- Proxim
- Ruckus
- Siemens
- Trapeze
- Xirrus
- Cisco

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WLAN Vendors

- WLAN Mesh
  - BelAir
  - Firetide
  - Meraki
  - MeshDynamics
  - Strix Systems
  - Tropos
- WLAN Tshoot/Design
  - AirMagnet
  - Berkeley Varitronics
  - CACE
  - Ekahau
  - Fluke Networks
  - Metageek
  - Tamosoft
  - WildPackets
  - Wireshark

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WLAN Vendors

- Management
  - Airwave
  - Wavelink
- Security
  - AirDefense
  - AirTight
  - Fortress Technologies
  - Juniper Networks
- VoWiFi
  - Ascom
  - Polycom
  - Vocera
- Convergence
  - Agito
  - DiVitas Networks

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WLAN Vendors

- RTLS
  - AeroScout
  - Newbury Networks
- SOHO
  - Apple
  - Buffalo Technology
  - Belkin
  - Dlink
  - Linksys
- Netgear
- SMC Networks
- Engenius
- TRENDNet
- Hawking Technology
- TPLink
- And many others…

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See also…

- Link provided in WebCT to page containing a large collection of software and hardware tools
- This link also applies to Chapter 12 (WLAN Troubleshooting)

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WLANs and Health Issues

- U.S. Federal Communications Commission
  - www.fcc.gov/oet/rfsafety/rf-faqs.html
- World Health Organization
  - www.who.int/peh-emf
- Wi-Fi Alliance
  - www.wi-fi.org

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Summary

- The “key” points are:
  - There are many different kinds of wireless devices, not just the ones you can get at Best Buy or Staples
  - A good prospective network technician or wireless administrator needs to broaden his/her understanding of the capabilities and functionality of the many devices available