



**Certified Wireless Network Administrator (CWNA)
PW0-106**

Chapter 10
WLAN Architecture



Chapter 10 Overview

- Wireless LAN client devices
- WLAN architecture
- Specialty WLAN infrastructure

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SYBEX **WILEY**

Wireless LAN Client Devices

Radio Card Formats (form factors)

- External Wi-Fi radios
 - PCMCIA adapter (PC Card)
 - ExpressCard
 - Secure Digital (SD)
 - CompactFlash (CF)
 - USB

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PCMCIA adapter/PC card



The image displays three different form factors of PCMCIA wireless LAN adapters. On the left is a full-sized PC card with a black and silver finish. In the center is a mini-PCIe card, also in black and silver. On the right is a USB dongle, which is a small black plastic device with a USB connector on one end and a metal antenna on the other.

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ExpressCard radio



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USB NIC



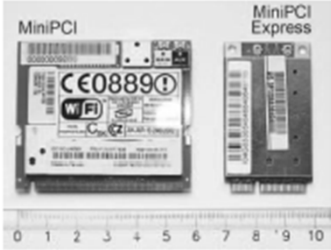
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SYBEX **WILEY**

Wireless LAN Client Devices

Radio Card Formats (form factors)

- Internal Wi-Fi Radios
 - Mini PCI
 - Mini PCI Express
 - Half Mini PCI Express



The image shows two radio cards. The one on the left is a Mini PCI card, and the one on the right is a Mini PCI Express card. They are placed above a ruler marked from 0 to 10 centimeters for scale.


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Wireless LAN Client Devices

Mobile Internet Devices (Use embedded NICS)

- Barcode scanner
- VoWiFi phones
- Gaming devices
- Stereo systems
- Video cameras
- Washing machines
- Refrigerators
- Autos




The image shows a handheld mobile internet device on the right and a Broadcom BCM4317 wireless LAN chip on the left.

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Wearables and the Internet of Things

- Theory of Internet of Things is that in the future, the bulk of the data generated on the Internet might be created by sensors, monitors, and machines



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Chipsets

- Group of integrated circuits designed to work together
- Determines the features supported by the device
- Chipset manufacturers incorporate newer 802.11 technologies as they develop
- Many proprietary technologies turn up in the individual chipsets

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Client Utilities

- Software interface between the radio NIC and you
- Three major types
 - Integrated operating system client utilities
 - Vendor specific client utilities
 - Third-party client utilities

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Integrated OS client utilities for Windows 8.1



The screenshot shows the Windows 8.1 Network settings panel. At the top, it says "Networks" and "View Connection Settings". Below that, "Airplane mode" is set to "Off" with a toggle switch. "Wi-Fi" is set to "On" with a toggle switch. Underneath, there are four network profiles listed with their respective signal strength icons: "MACDADDY Connected", "MACDADDY_EXT", "DIRECT-K1M2070 Series", and "JB".

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Wi-Fi diagnostic tool for Mac OS 10.8

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SYBEX **WILEY**

Integrated OS client utility for iOS 7.0

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SYBEX **WILEY**

Enterprise-class client utility

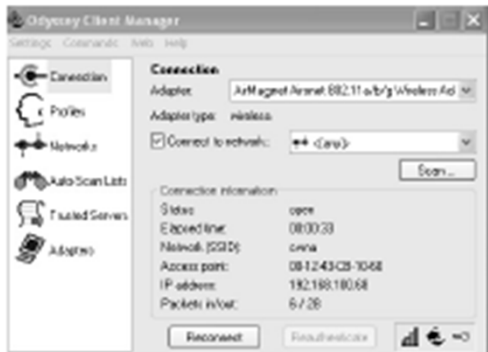


The screenshot shows the Intel PROSet/Wireless utility window. At the top, it says "You are connected to GoodLuck." Below this, network details are listed: Network Name: GoodLuck, Speed: 54.0 Mbps, Signal Quality: Excellent, and IP Address: 192.168.1.111. A "Details..." button is next to the IP address. Under "Wireless Network(s)", the GoodLuck network is shown as "Connected" with a signal strength indicator and a lock icon. Below this, there are buttons for "Disconnect", "Properties...", and "Refresh". At the bottom, there is a "Profiles..." button and a "Help? Close" button.

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Third-party client utility



The screenshot shows the Orinoco Client Manager utility window. On the left is a navigation pane with icons for Connection, Profiles, Networks, Auto Scan Lists, Trusted Servers, and Admin. The main pane is titled "Connection" and shows the following settings: Adapter: AirMagnet Aranal 68211 a/b/g Wireless Ad NI, Adapter type: wireless, and a "Connect to network:" dropdown menu with "cna" selected. A "Scan..." button is next to the dropdown. Below this, "Connection information" is displayed: SSID: cna, ESSID/line: 08:00:23, Network (SSID): cna, Access point: 08-12-43-C5-7D-68, IP address: 192.168.180.68, and Packets in/Out: 6/728. At the bottom are "Reconnect" and "Disconnect" buttons, along with signal strength and power icons.



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Management, Control, and Data Planes

- Management plane - defined by administrative network management, administration, and monitoring
- Control plane - consists of control or signaling information and is often defined as network intelligence or protocols
- Data plane, - also known as the user plane, is the location in a network where user traffic is actually forwarded
- Where these three logical planes of operation function is different depending on the type of WLAN architecture

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802.11 Management plane

Functions

- WLAN Configuration
- WLAN Monitoring and Reporting
- WLAN Firmware Management

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802.11 Control plane

Functions

- Dynamic RF
- Roaming Mechanisms
- Client Load Balancing
- Mesh Protocols

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802.11 Data plane

Functions

- Where user data is forwarded
- Devices that usually participate in the data plane are the AP and a WLAN controller
- Each vendor has a unique method and recommendations for handling data forwarding.

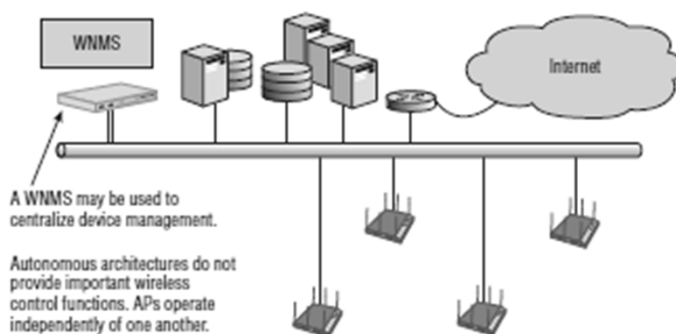
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WLAN Architecture

Three primary WLAN architectures

- Autonomous WLAN architecture
- Centralized WLAN architecture
- Distributed WLAN architecture

Autonomous WLAN Architecture



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NMS diagnostic utilities

The screenshot shows a web-based interface for network management. On the left, there is a list of devices with columns for 'Modify', 'update..', 'Status..', and 'Device Inventory..'. The 'Status..' column shows various device names and IP addresses. A dropdown menu is open over the 'Device Inventory..' column, listing various diagnostic utilities such as 'Device Monitoring', 'Client Information', 'L2 Neighbor Information', 'Diagnose', 'Ping', 'Show Log', 'Show Version', 'Show Running Config', 'Show IP Routes', 'Show MAC Routes', 'Show ARP Cache', 'Show Routing Table', 'Show DNSP Neighbors', 'Show DNSP Cache', 'Show DNSP Client Allocation', 'Alarms', 'Show ABBP Tunnel', 'Show GIG Tunnel', 'Show IKE Event', 'Show IKE SA', 'Show IPsec SA', 'Show IPsec Tunnel', 'Show CPU', 'Show Memory', 'Show Multicast Monitoring', 'Client Monitor', 'VLAN Probe', and 'Reverse Sniffer'.

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Wireless Network Management System

- Moves the management plane out of the autonomous access points
- Provides a central point of management to configure and maintain thousands of autonomous access points

The screenshot shows the Aerohive management interface. The top navigation bar includes 'Home', 'Monitor', 'Topology', 'Configuration', 'Tools', and 'Teacherview'. The 'Monitor' section is active, showing a list of 'Active Clients'. The table below has columns for 'Health', 'MAC Address', 'IP Address', 'VLAN', 'User Profile Attribute', 'Host Name', and 'User Name'. The table contains several rows of client data.

Health	MAC Address	IP Address	VLAN	User Profile Attribute	Host Name	User Name
	001E3B130501	10.7.198.100	106	106	TRAINING-PC8	
	001E3B130505	10.7.198.100	106	106	TRAINING-PC9	
	001E3B130500	10.7.193.101	109	103	TRAINING-PC3	
	001E3B1305A1	10.7.192.101	107	107	TRAINING-PC7	
	001E3B130506	10.7.111.101	111	111	TRAINING-PC11	
	001E3B1305A0	10.7.198.101	109	109	TRAINING-PC8	
	001E3B1305A3	10.7.118.101	110	110	TRAINING-PC10	
	001E3B1305A8	10.7.112.100	112	112	TRAINING-PC12	

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Cloud Networking

- Two most common cloud networking models
 - Cloud-Enabled Networking
 - Cloud-Based Networking

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Centralized WLAN Architecture

- Management Plane - Access points are configured and managed from the WLAN controller
- Control Plane - Dynamic RF, load balancing and other mechanisms exist in the WLAN controller.
- Data Plane - The WLAN controller exists as a data distribution point for user traffic. Access points tunnel all user traffic to a central controller.





WLAN Controller

Features

- AP Management
- 802.11 Traffic Tunneling
- AP Group Profiles
- WLAN Profiles
- Virtual BSSIDs
- User Management
- Layer 2 Security Support
- Layer 3 and 7 VPN Concentrators

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WLAN Controller

Features

- Captive Portal
- Automatic Failover and Load Balancing
- Internal Wireless Intrusion Detection Systems
- Dynamic RF Spectrum Management
- Bandwidth Management
- Firewall Capabilities
- Power over Ethernet (PoE)
- Management Interfaces

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WLAN Controller

Centralized WLAN architecture

The WLAN controller is a central point of data aggregation for all managed APs and offloads certain network functions from the AP.

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WLAN Controller

IP tunneling core layer

WLAN controller

Core

IP encapsulation tunnel

Access

Distribution

Network resources

Lightweight access points

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WLAN Controller

Virtual
WLANs,
virtual
BSSIDs, and
VLANs

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Controller Data Forwarding Models

Centralized Data Forwarding

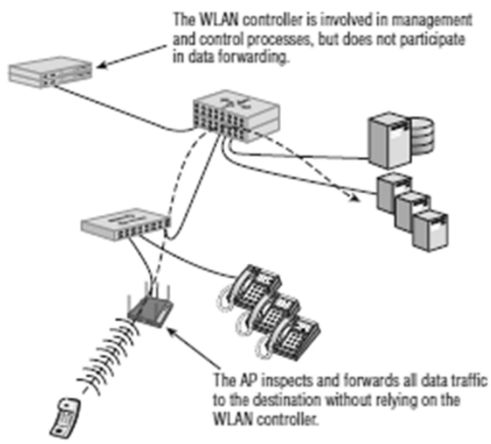
Centralized Data
Forwarding

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Controller Data Forwarding Models

Distributed Data Forwarding



The WLAN controller is involved in management and control processes, but does not participate in data forwarding.

The AP inspects and forwards all data traffic to the destination without relying on the WLAN controller.

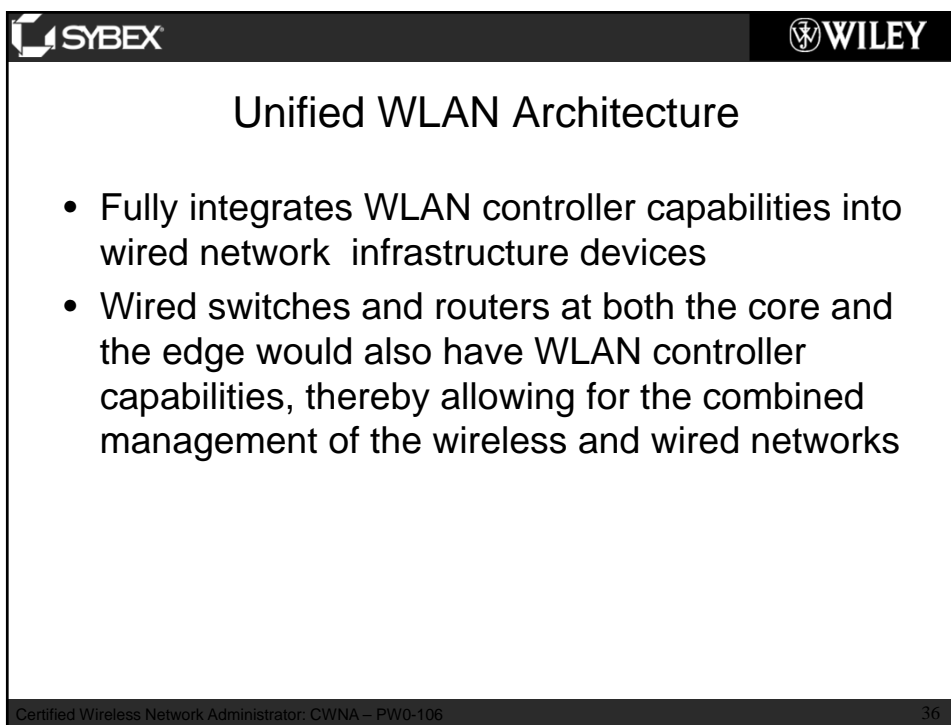
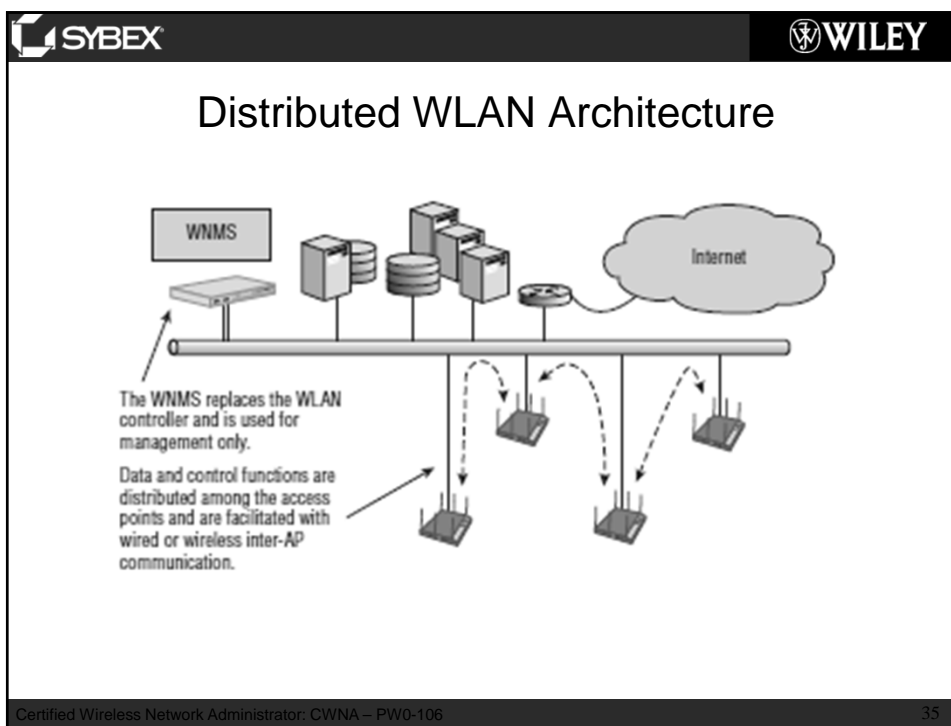
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Remote Office WLAN Controller

- Has much less processing power than a core WLAN controller and is also less expensive
- Typically communicate with a central WLAN controller across a WAN link
- Through a VPN tunnel, the central controller will download the network configuration settings to the remote WLAN controller, which will then control and manage the local APs.

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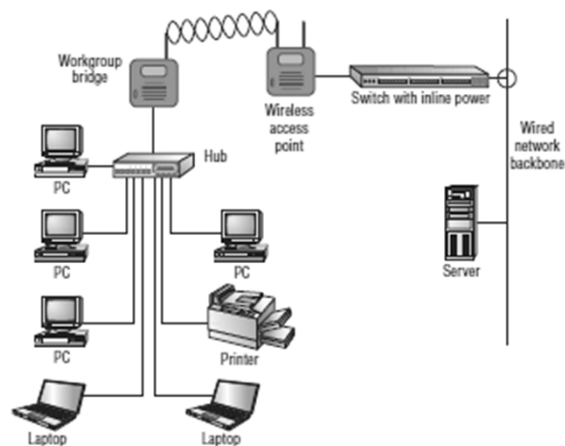


Hybrid Architecture

- Many hybrids of these WLAN architectures exist
- WLAN controller vendors are pushing some of the control plane intelligence back into the access points
- One WLAN controller vendor has a cloud-based controller where much of the control plane intelligence exists in the cloud

Specialty WLAN Infrastructure

Wireless Workgroup Bridge



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Specialty WLAN Infrastructure

Wireless LAN Bridges

The diagram illustrates two configurations of Wireless LAN Bridges. In the first configuration, a single Root bridge is connected to a single Nonroot bridge. In the second configuration, a single Root bridge is connected to three Nonroot bridges, forming a mesh network.

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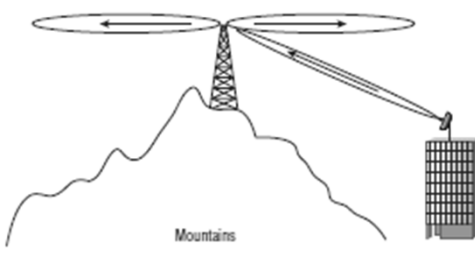
Other vendor configuration modes:

- AP Mode - Converts a bridge into an access point
- WGB Mode - Converts a bridge into a workgroup bridge
- Repeater Mode - Repeats the cell of a root bridge to a nonroot bridge
- Root with Clients - Root bridge that also allows clients to associate
- Nonroot with Clients - Nonroot bridge that also allows clients to associate

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Common bridging challenge



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Enterprise WLAN Routers

- Configurable 802.11 radios
- Multiport Ethernet switch for connecting wired clients
- PoE-enabled Ethernet ports
- Network Address Translation (NAT)
- Port Address Translation (PAT)
- Port forwarding
- Firewall
- VPN client
- DHCP server
- USB support for 3G/4G cellular backhaul

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Wireless LAN Mesh Access Points

Network resources

2.4 GHz channels 1, 6, and 11 used for access coverage

5 GHz channels 48, 56, 64, 153, and 161 used for backhaul

Channel 11

Channel 1

Channel 11

Channel 6

Channel 1

Channel 11

C-channel

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WLAN Array

- Up to 16 access-point radios using sector antennas and an embedded WLAN controller all reside in one device

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Virtual AP System

- Uses multiple access points that all share a single basic service set identifier (BSSID)
- Stations believe they are connected to only a single access point, although they may be roaming across multiple physical APs
- Zero handoff time and many of the latency issues associated with roaming are resolved
- Uses a unique WLAN topology called single-channel architecture (SCA)

Real-Time Location Systems



- Can track the location of any 802.11 radio device as well as active Wi-Fi RFID tags with much greater accuracy



SYBEX **WILEY**

Real-Time Location Systems

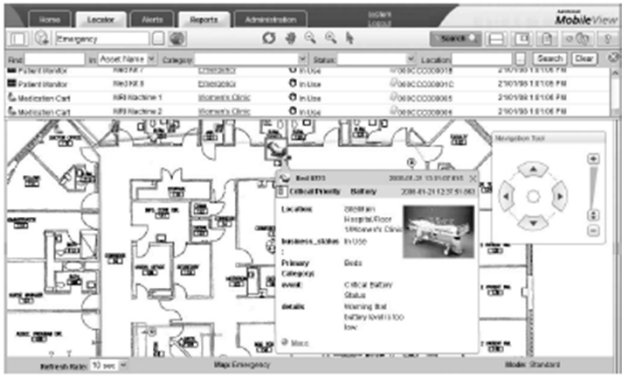
- Can track the location of any 802.11 radio device as well as active Wi-Fi RFID tags with much greater accuracy

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RTLS application




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VoWiFi

Components :

- VoWiFi Telephones
- 802.11 Infrastructure (APs and Controllers)
- PBX
- WMM Support



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SYBEX **WILEY**

Chapter 10 Summary

- Wireless LAN client devices
- WLAN architecture
- Specialty WLAN infrastructure

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