Overview

The Cisco Aironet 1500 Series Outdoor Mesh Access Point (hereafter called the *access point*) is a wireless device designed for wireless client access, point-to-point bridging, point-to-multipoint bridging, and point-to-multipoint mesh wireless connectivity. The access point is a standalone unit that can be mounted on a streetlight pole or on a building wall or overhang.access point

The access point is available in two models: LAP1510 (supports 2.4-GHz and 5-GHz radios) and LAP1505 (supports a 2.4-GHz radio).The access point provides client access and supports 6 to 54 Mbps data rates without the need for a license. The LAP1510 model dedicates the 5-GHz radio for backhaul operations to reach a wired network and uses the 2.4-GHz radio for wireless clients. The LAP1505 model uses the 2.4-GHz radio for both backhaul and wireless clients.

The access point can also operate as a relay node for other access points not directly connected to a wired network. Intelligent wireless routing is provided by the patent-pending Adaptive Wireless Path Protocol (AWPP). This enables each access point to identify its neighbors and intelligently choose the optimal path to the wired network by calculating the cost of each path in terms of signal strength and the number of hops required to get to a controller.

The access point is configured, monitored, and operated through a Cisco wireless LAN controller (hereafter called a *controller*) as described in the *Cisco Wireless LAN Controller Configuration Guide.* The *Deployment Guide: Cisco Mesh Networking Solution* describes how to plan and initially configure the Cisco Mesh network, which supports wireless point-to-point, point-to-multipoint, and mesh deployments. The controllers use a browser-based management system, a command-line interface (CLI), or the Cisco Wireless Control System (WCS) network management system to manage the controller and the associated access points. The access point is compliant with Wi-Fi Protected Access (WPA2) and employs hardware-based Advanced Encryption Standard (AES) encryption between wireless nodes to provide end-to-end security.

This chapter provides information on the following topics:

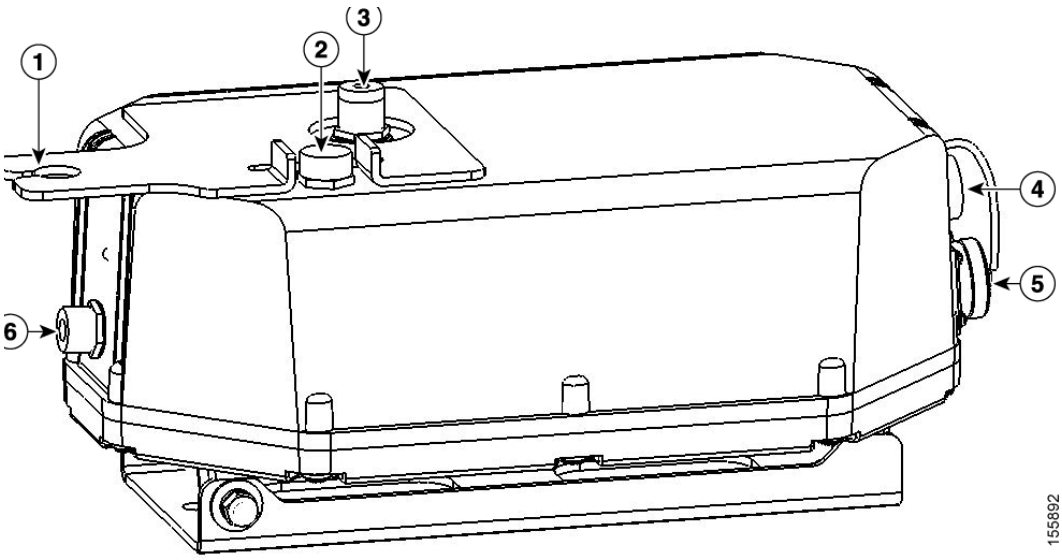
Hardware Features

Some of the access point hardware features are listed below:

- Dual simultaneous 2.4- and 5-GHz radio operation (see the "Single or Dual Radio Operation" section on page 1-3)
- External antennas (see the "External Antennas" section on page 1-3)
- Multiple power sources (see the "Multiple Power Sources" section on page 1-4)
- Ethernet port see the "Ethernet Port" section on page 1-5)
- Metal enclosure supports outdoor installations (see the "Metal Enclosure" section on page 1-6
  - Industrial temperature rating
- Optional pole mount kit (see the "Optional Hardware" section on page 1-6)
- Optional streetlight power tap adapter (see the "Optional Hardware" section on page 1-6)
- Optional 150 ft (45.72 m) Ethernet outdoor cable (see the "Optional Hardware" section on page 1-6)

Figure 1-1 shows the access point connectors.

Figure 1-1 Access Point Connectors



1	5.8-GHz antenna bracket (LAP1510 model only)	**4**	Ethernet (PoE) connector (MS3112P14-12P)
2	Vent (do not remove)	**5**	AC power connector (MS3112P14-5P)
3	2.4-GHz Type N antenna connector	**6**	5.8-GHz Type N antenna connector (LAP1510 model only)

Connectors

The access point supports four connectors (see Figure 1-1):

- Ethernet (PoE) connector—12 pin circular Mil spec (MS3112P14-12P)
- AC power connector—5 pin circular Mil spec (MS3112P14-5P)
- 2.4-GHz Type N antenna connector
- 5-GHz Type N antenna connector (LAP1510 model only)

Single or Dual Radio Operation

The access point is available in two models: LAP1510 (supports 2.4-GHz and 5-GHz radios) and LAP1505 (supports only a 2.4-GHz radio). The radios use external antennas (see "External Antennas").

The LAP1510 model supports simultaneous dual-radio operation using a 2.4-GHz 802.11b/g radio and a 5-GHz 802.11a radio.The 5-GHz radio incorporates an Unlicensed National Information Infrastructure (UNII) radio transceiver operating in the UNII 5-GHz frequency bands. The 5-GHz radio on the access point is used for backhaul operations to the controller. The 5-GHz radio can also operate in the 4.9-GHz Public Safety band in the United States.

Note The 4.9-GHz band requires a license and may be used only by qualified Public Safety operators as defined in section 90.20 of the FCC rules.

The LAP1505 model supports both mesh backhaul operation and wireless clients using the 2.4-GHz radio.

External Antennas

The access point is equipped with an N-type radio frequency (RF) connector on the large flat side of the unit for an external 2.4-GHz antenna. The LAP1510 model also has an N-type RF connector on the end of the unit for an external 5-GHz antenna (see Figure 1-1). When using the optional Cisco external omnidirectional antennas, the 2.4-GHz antenna connects directly to the access point, and the 5-GHz antenna connects to the access point using the antenna's included coax cable.

The Cisco omnidirectional external antennas use vertical polarization.

The access point can also be equipped with specific third-party external antennas (see Table 1-1 and Table 1-2), subject to local regulatory requirements. When you are installing third-party antennas, they must be installed with all waterproofing steps recommended by the third-party manufacturer.

Note When you mount the access point in an indoor environment, you must also mount the antennas in an indoor environment.

Warning **Only trained and qualified personnel should be allowed to install, replace, or service this equipment.** Statement 1030

Table 1-1 and Table 1-2 lists the supported external antennas for the access point.

Table 1-1 External 5-GHz Antennas[1]

Part Number	Model	Gain (dBi)
AIR-ANT5175V-N	4.9 GHz Compact omnidirectional[2]	6.5
	5 GHz Compact omnidirectional	7.5
AIR-ANT58G10SSA-N	5 GHz Sector	9.5
Cushcraft S49014WP (third party)	5 GHz Patch	14
Cushcraft S54717P (third party)	5 GHz Patch	17

1. Not supported on the LAP1505 model.
2. The use of the 4.9-GHz band requires a license and may be used only by qualified Public Safety operators as defined in section 90.20 of the FCC rules.

Table 1-2 External 2.4-GHz Antennas

Part Number	Model	Gain (dBi)
AIR-ANT-2455V-N	2.4 GHz Compact Omnidirectional	5.5
Cushcraft S2406BP (third party)	2.4 GHz Omnidirectional	8

Multiple Power Sources

The access point can be powered by one of these power sources:

- 48 VDC inline power-over-Ethernet (PoE)
- AC power

Inline PoE is provided by a shielded Ethernet cable using the Cisco Aironet Power Injector (AIR-PWRINJ1500=), hereafter called the *power injector*.

Caution To provide inline PoE, you must use the power injector (AIR- PWRINJ1500=) specified for the access point. Other power injectors, PoE switches, and 802.3af power sources may not provide adequate power, which may cause the access point to malfunction and cause over-current conditions at the power source. You must ensure that the switch port connected to the access point has PoE turned off.

Caution The power injector (AIR- PWRINJ1500=) has been evaluated for installation in an indoor environment only.

Caution When the access point is installed outdoors or in a wet or damp location, the AC branch circuit that is powering the access point should be provided with ground fault protection (GFCI), as required by Article 210 of the National Electrical Code (NEC).

Note The maximum Ethernet cable length is 128 ft. (38 m) from the switch to the power injector and 200 ft. (61 m) from the power injector to the access point.

AC power is provided from an AC power source (100 to 240 VAC at 50/60 Hz):

- AC power cord options:
  - 15-ft (4.6-m) power cord (AIR-CORD1500-15NA=) for use in the US and Canada.
  - 40-ft (12.2-m) power cord (AIR-CORD1500-40NA=) for light pole installations in the US and Canada.
  - 40-ft (12.2-m) power cord (AIR-CORD1500-40UE=) for use outside the US and Canada. One end of the power cord is terminated with an access point AC power connector and the other end is unterminated.
  - 4-ft (1.2-m) streetlight power tap adapter (AIR-PWR-ST-LT-TAP=) for light pole installations in the US and Canada.

Note For important safety instructions for AC power cords, refer to the *AC Power Cords for Cisco Aironet 1500 Series Outdoor Mesh Access Points* document that shipped with your AC power cords.

Ethernet Port

The access point's Ethernet port uses a Mil-spec 12 pin connector, linking the access point to your 10BASE-T or 100BASE-T Ethernet LAN through the optional power injector. The shielded Ethernet cables are used to send and receive Ethernet data and to optionally supply inline 48-VDC power from the power injector.

The Ethernet MAC address is printed on the label on the side of the access point (refer to the "Finding the Product Serial Number" section on page xvii).

Tip The access point senses the Ethernet and power signals and automatically switches internal circuitry to match the cable connections.

Caution To provide inline PoE, you must use the power injector (AIR- PWRINJ1500=) specified for the access point. Other power injectors, PoE switches, and 802.3af power sources may not provide adequate power, which may cause the access point to malfunction and cause over-current conditions at the power source.

Metal Enclosure

The access point uses a metal enclosure that can accommodate both indoor or outdoor operating environments and an industrial temperature operating range of –40°C (–40°F) to +55°C (+131°F). The access point complies with NEMA Type 4X and IP66 requirements from IEC60529.

The access point is shipped with a mounting plate attached to the unit.

Note When the access point is mounted indoors, the antennas must also be mounted indoors.

Optional Hardware

Some of the access point hardware options are listed below:

- Pole mount kit (AIR-ACCPMK1500=)-—provides hardware for mounting the access point to the top of a metal pole, such as a streetlight pole.
- Streetlight power tap adapter (AIR-PWR-ST-LT-TAP=)—connects to the light control connector on a streetlight pole and provides AC power to the access point.
- Outdoor rated Ethernet cable (AIR-ETH1500-150=)—used to supply Ethernet and optional DC power to the access point.
- Power injector (AIR-PWRINJ1500=)—provides power-over-Ethernet (PoE) to the access point.
- AC power cord (for additional information, refer to the "Multiple Power Sources" section on page 1-4).

Network Configuration Examples

The access point is a wireless device designed for wireless client access and point-to-point bridging, point-to-multipoint bridging, and point-to-multipoint mesh wireless connectivity. The access point provides 5-GHz backhaul capability to link with another access point to reach a wired network connection or to provide repeater operations for other access points.

The access point plays two primary radio roles: a root access point (hereafter called a *RAP*) or a non-root access point (hereafter called a *MAP*). When the access point has a wired Ethernet connection to the controller (through a switch), the radio role is called a RAP. A RAP is a parent node to any bridging or mesh network. A controller can support one or more RAPs, each one parenting the same or different wireless networks. There can be more than one RAP for the same mesh network for redundancy. RAPs also support wireless clients on the band not being used for the backhaul interface.

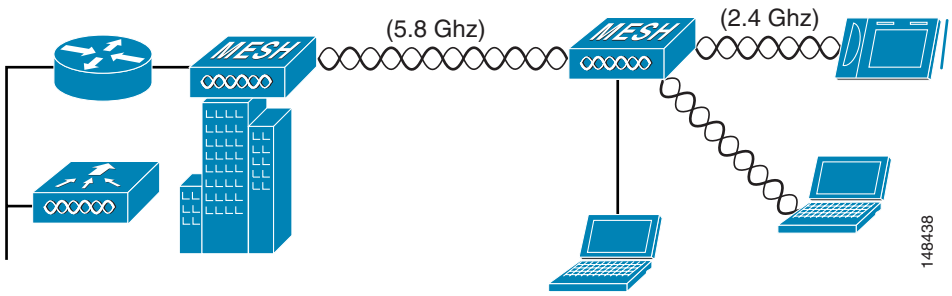
When the access point does not have a wired Ethernet connection to the controller (through a switch), the radio role is called a MAP. The MAPs have a wireless connection (through the backhaul interface) to other MAPs and finally to a RAP with an Ethernet connection through a switch to the controller. MAPs may also have a wired Ethernet connection to a local LAN and serve as a bridge endpoint for that LAN (using a point-to-point or point-to-multipoint bridge connection). MAPs also support wireless clients on the band not used for the backhaul interface.

Wireless Backhaul

The access point supports wireless backhaul capability using the 5-GHz radio to bridge to another access point to reach a wired network connection to a controller (see Figure 1-2). The access point connected to the wired network is considered a RAP in this configuration. The remote access point is considered a MAP and transfers wireless client traffic to the RAP for transfer to the wired network. Lightweight access point protocol (LWAPP) control traffic is also transferred over this bridged link.

Note The LAP 1505 model uses the 2.4-GHz radio for backhaul and wireless client operations.

Figure 1-2 Access Point Backhaul Example



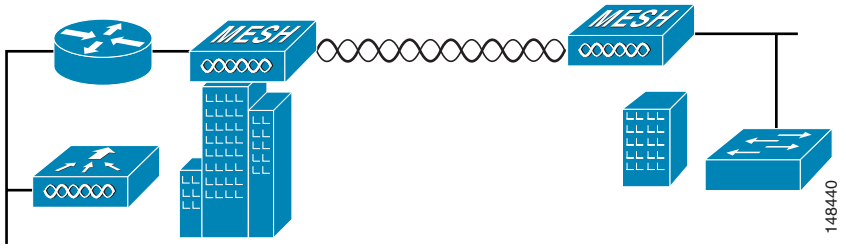
Point-to-Point Bridging

The access points can be used to extend a remote network by using the 5-GHz backhaul radio to bridge the two network segments as shown in Figure 1-3. To support Ethernet bridging, you must enable bridging on the controller for each access point.

Note The LAP 1505 model uses the 2.4-GHz radio for bridging operations.

Wireless client access is supported; however, if bridging between tall buildings, the 2.4-Ghz wireless coverage area may be limited and possibly not suitable for direct wireless client access.

Figure 1-3 Access Point Point-to-Point Bridging Example

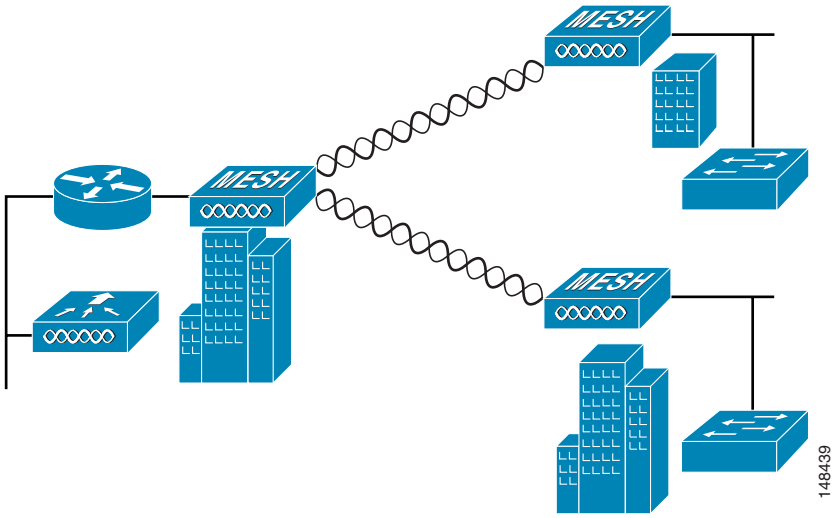


Point-to-Multipoint Bridging

The access points can be used as a RAP to connect multiple remote MAPs with their associated wired networks (see Figure 1-4). By default this capability is turned-off for all access points. To support Ethernet bridging, you must enable bridging on the controller for each access point.

Wireless client access can be provided over the bridging link; however, if bridging between tall buildings, the 2.4-Ghz wireless coverage area may be limited and possibly not suitable for direct wireless client access.

Figure 1-4 Access Point Point to Multipoint Bridging Example



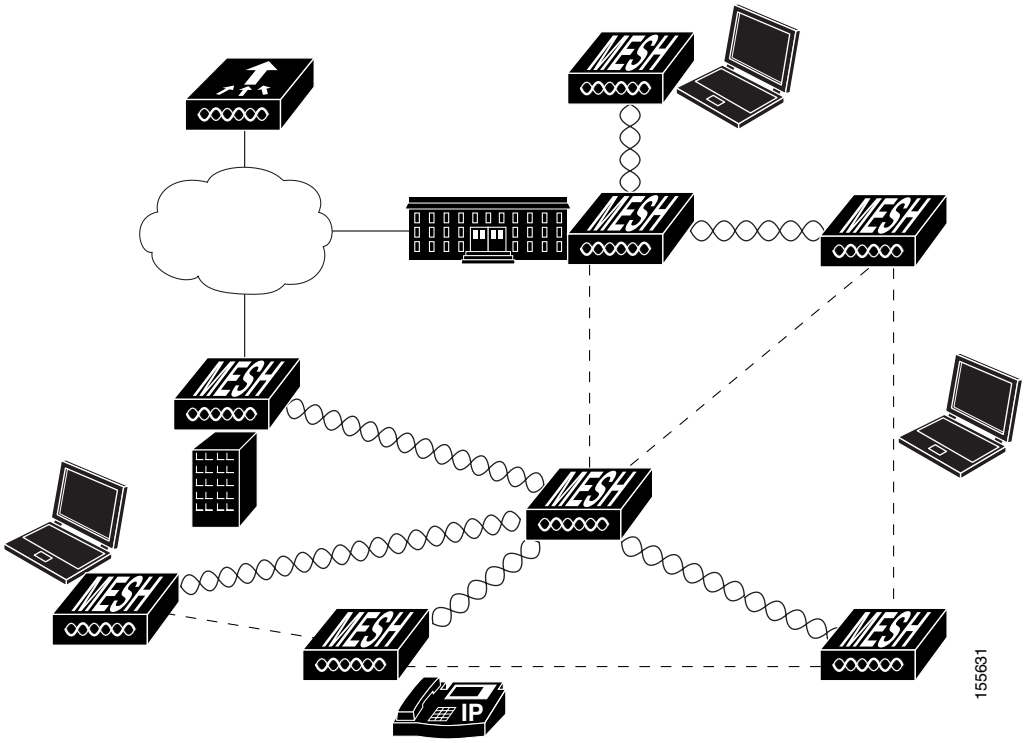
Mesh Network

The access points are typically deployed in a mesh network configuration. In a typical mesh deployment, one or more RAPs have a wired network connection through a switch to a controller. Other remote MAPs without wired network connections use the backhaul feature to optimally link to a RAP that is connected to the wired network. In the mesh network, the links between the access points are referred to as the *backhaul links*.

Intelligent wireless routing is provided by the patent-pending Adaptive Wireless Path protocol (AWPP). This enables each MAP to identify its neighbors and intelligently choose the optimal path to the RAP with the wired network connection by calculating the cost of each path in terms of signal strength and the number of hops required to get to a controller.

Figure 1-5 illustrates a typical mesh configuration using MAPs and RAPs.

Figure 1-5 Typical Mesh Configuration Using Access Points



Layer 2 and Layer 3 Network Operation

The access points support Layer 2 or Layer 3 network operation. In Layer 2 configurations, the access point and the controller are on the same subnet and communicate with encapsulated Ethernet frames using MAC addresses rather than IP addresses. Layer 2 configurations are typically not scalable into larger networks. Additionally, Layer 2 operation is supported only by the Cisco 4400 series controllers.

Access points and controllers in Layer 3 configurations use IP addresses and UDP packets, which can be routed through large networks. Layer 3 operation is scalable and recommended by Cisco.

Figure 1-6 illustrates a typical Layer-3 wireless network configuration containing access points and a controller.

Figure 1-6 Typical Layer 3 Access Point Network Configuration Example

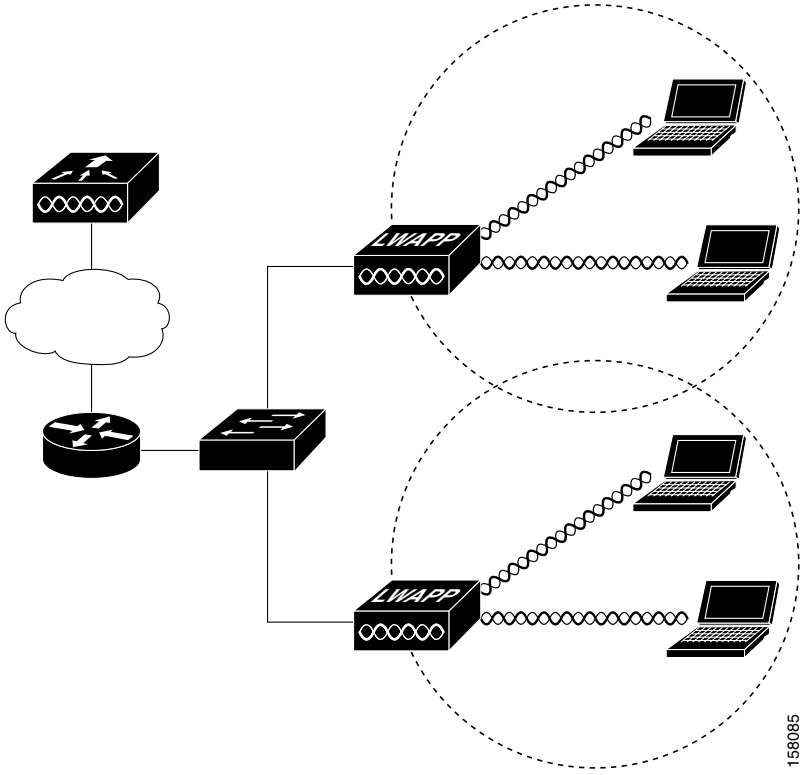


Figure 1-7 illustrates a typical Layer 2 network configuration. In a Layer 2 configuration, the controller and the access points are on the same subnet.

Figure 1-7 Typical Layer 2 Access Point Network Configuration Example