Overview

This chapter describes the Cisco Aironet Wireless LAN Client Adapter, also referred to as an *adapter* or *client adapter*, and illustrates its role in a wireless network.

These topics are covered in this section:

Introduction to the Wireless LAN Adapters

The Cisco Aironet Wireless LAN Client Adapters, also referred to as *adapters*, are radio modules that provide transparent, wireless, data communications between fixed, portable, or mobile devices and other wireless devices or a wired network infrastructure. The adapters are fully compatible when used in devices supporting Plug-and-Play (PnP) technology. Host devices can be any device equipped with a PC Card Type II or Type III slot. These devices include:

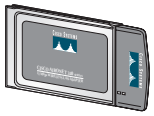
- Desktop systems
- Portable laptops
- Notebook computers
- Personal digital assistants
- Pen based computers
- Other data collection devices

The primary function of the adapters is to transfer data packets transparently through the wireless infrastructure. The adapters operate similarly to a standard network product except that the cable is replaced with a radio connection. No special wireless networking functions are required, and all existing applications that operate over a network can operate using the adapters.

The PC Card can also be built into peripheral devices such as printers to provide them with a transparent wireless connection to a wired network.

This document covers three types of adapters:

- PC card client adapter (also referred to as a *PC card*)—A PCMCIA card radio module that can be inserted into any device equipped with an *external* Type II or Type III PC card slot. Host devices can include laptops, notebook computers, personal digital assistants, and hand-held or portable devices.

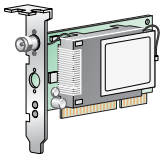


47519

- LM card client adapter (also referred to as an *LM card*)—A PCMCIA card radio module that can be inserted into any device equipped with an *internal* Type II or Type III PC card slot. Host devices usually include hand-held or portable devices.

47893

- PCI client adapter—A client adapter card radio module that can be inserted into any device equipped with an empty PCI expansion slot, such as a desktop computer.



65189

Refer to the "Radio Antenna" section on page 1-4 for antenna differences between these adapters.

Terminology

Throughout this document, these terms are used:

- client adapter—Refers to all three types of adapters
- PC card, LM card, or PCI client adapter—Refers only to a specific adapter
- workstation (or **station)**—Refers to a computing device with an installed client adapter
- End Node—A client node that is located at the end of the Network Tree.
- Infrastructure—The wireless infrastructure is the communications system that combines access points, mobile nodes, and fixed nodes. Access points within the infrastructure can be either root units, which are physically wired to the LAN backbone, or can act as wireless repeaters. Other RF enabled devices serve as fixed nodes or mobile client nodes.
- Parent/Child Node—Refers to the relationships between nodes in the wireless infrastructure. The complete set of relationships is sometimes described as a network tree. For example, the access point (at the top of the tree) would be the parent of the end nodes. Conversely, the end nodes would be the children of the access point.
- Power Saving Protocol (PSP) and Non-Power Saving Protocol—The Power Saving Protocol allows computers (usually portable computers) to power up only part of the time to conserve energy. If a client node is using the Power Saving Protocol to communicate with the network, the access point must be aware of this mode and implement additional features such as message store and forward. If the client node is powered from an AC line, do not use PSP.
- Repeater—A repeater is an access point that extends the radio range of the infrastructure. A repeater is not physically attached to the wired LAN, but communicates through radio to another access point, which is either a root unit or another repeater.
- Root Unit—The root unit is an access point that is located at the top, or starting point, of a wireless infrastructure. A root unit provides the physical connection to the wired LAN and contains configuration information in its association table that covers all nodes that access the wired network (backbone). All access points directly attached to the wired LAN backbone are root units.

Parts of the Client Adapter

The client adapter is composed of three major parts: a radio, a radio antenna, and two LEDs.

Radio

The client adapter contains a direct-sequence spread spectrum (DSSS) radio that operates in the 2.4-GHz license-free Industrial Scientific Medical (ISM) band. The radio transmits data over a half-duplex radio channel operating at up to 11 Mbps.

DSSS technology causes radio signals to be transmitted over a wide frequency range, using multiple frequencies simultaneously. The benefit of this technology is its ability to protect the data transmission from interference. For example, if a particular frequency encounters noise, interference, or both, enough redundancy is built into the signal on other frequencies that the client adapter usually is successful in its transmission.

Radio Antenna

The type of antenna used depends on your client adapter:

- PC cards have an integrated, permanently attached diversity antenna. The benefit of the diversity antenna system is improved coverage. The system works by allowing the card to switch and sample between its two antenna ports in order to select the optimum port for receiving data packets. As a result, the card has a better chance of maintaining the radio frequency (RF) connection in areas of interference. The antenna is located within the section of the card that protrudes from the PC card slot when the card is installed.
- LM cards are shipped without an antenna; however, an antenna can be connected through the card's external connector. If a snap-on antenna is used, it should be operated in diversity mode. Otherwise, the antenna mode used should correspond to the antenna port to which the antenna is connected.
- PCI client adapters are shipped with a 2-dBi dipole antenna that attaches to the adapter's antenna connector. However, other types of antennas can be used. PCI adapters can be operated only through the antenna port located on the right side of the radio module (not to be confused with the antenna connector on the card carrier).

Note External antennas used in combination with a power setting resulting in a radiated power level above 100 mW equivalent isotropic radiated power (EIRP) are not allowed for use within the European community and other countries that have adopted the European R&TTE directive. CEPT recommendation Rec 70.03, or both. For more details on legal combinations of power levels and antennas in those countries, contact Cisco Corporate Compliance.

LEDs

The adapter has two LEDs that glow or blink to show the status of the adapter or to convey error messages. See "Interpreting the Indicator LEDs" section on page 5-2 for an interpretation of the LED codes.

Radio Ranges

Because of differences in component configuration, placement, and physical environment, every network application is a unique installation. Before installing the system, you should perform a site survey in order to determine the optimum utilization of networking components and to maximize range, coverage, and network performance.

Here are some operating and environmental conditions that you need to consider:

- Data Rates—Sensitivity and range are inversely proportional to data bit rates. The maximum radio range is achieved at the lowest workable data rate. There is a decrease in receiver threshold sensitivity as the radio data rate increases.
- Antenna Type and Placement—Proper antenna configuration is a critical factor in maximizing radio range. As a general guide, range increases in proportion to antenna height.

Note For a detailed explanation of antenna types and configurations along with guidelines on selecting antennas for specific environments, see the *Aironet Antenna Guide* on Cisco's. web site:

http://www.cisco.com/univercd/cc/td/doc/product/wireless/air_legc/antennas/index.htm

- **Physical Environments**—Clear or open areas provide better radio range than closed or filled areas. Also, the less cluttered the work environment, the greater the range.
- **Obstructions**—Avoid locating the computing device and antenna in a location where there is a metal barrier between the sending and receiving antennas.
- **Building Materials**—Radio penetration is greatly influenced by the building material used in construction. For example, drywall construction allows greater range than concrete blocks. Metal or steel construction is a barrier to radio signals.

Link Test

The link test tool is used to determine RF coverage. The test results help the installer eliminate low RF signal level area that can result in loss of connection.

Note External antennas used in combination with a power setting resulting in a radiated power level above 100 mW equivalent isotropic radiated power (EIRP) are not allowed for use within the European community and other countries that have adopted the European R&TTE directive or the CEPT recommendation Rec 70.03 or both. For more details on legal combinations of power levels and antennas in those countries, contact Cisco Corporate Compliance.

Data Transparency and Protocols

The Cisco Aironet Wireless LAN Adapter transports data packets transparently as they move through the wireless infrastructure. The PC Card operates similarly to a standard network product except that the wire is replaced with a radio connection. No special wireless networking functions are required. All existing applications, which operate over a network, operate using the Cisco Aironet Wireless LAN Adapter.

Protocols Supported

The Cisco Aironet Wireless LAN Client Adapter can be used in a variety of infrastructure configurations. Cisco Aironet access points provide connections to Ethernet Networks. When using the Cisco Aironet standard device drivers, the PC Card is fully compliant with the protocols and wired networks listed in Table 1-1

.

Table 1-1 Protocols Supported

Drivers	Operating Systems
ODI	MS-DOS-based driver for Novell NetWare

Table 1-1 Protocols Supported

Drivers	Operating Systems
NDIS2	MS-DOS, Windows 3.xx
Packet	MS-DOS, Windows 3.xx

Security Features

The Cisco Aironet Wireless LAN Client Adapter employs Direct Sequence Spread Spectrum Technology, previously developed for military *anti-jamming* and *low probability of intercept* radio systems.

The access point must be set to the same SSID as all other devices on the wireless infrastructure. Units with a different SSID cannot directly communicate with each other.

System Configurations

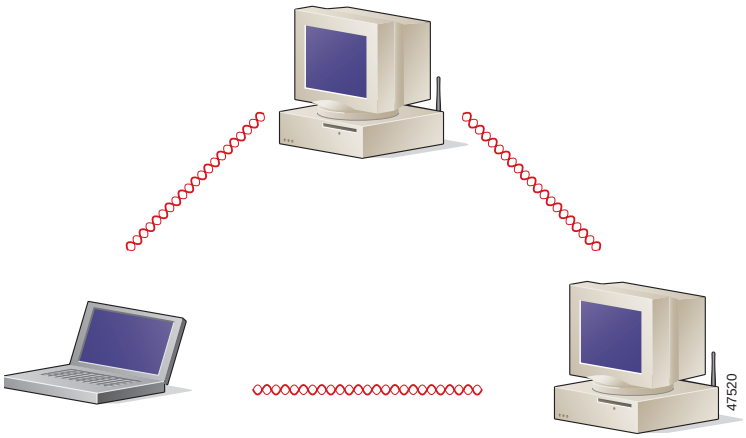
The Cisco Aironet Wireless LAN Client Adapter can be used in a variety of network system configurations. Access points provide connections to your Ethernet networks or act as repeaters increasing wireless communication range. The maximum communication range is based on how you configure your wireless infrastructure.

Examples of some common system configurations are shown on the pages that follow, along with a description of each.

Ad Hoc Wireless LAN

An ad hoc wireless LAN (Figure 1-1) is the simplest wireless LAN configuration. In a wireless LAN, using an ad hoc network operating system (such as Windows for Workgroups), all devices equipped with the PC Card can be linked together and communicate directly with each other

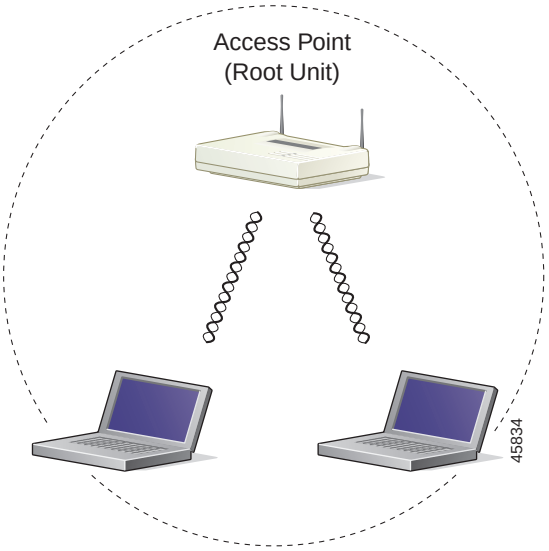
Figure 1-1 Ad Hoc Wireless LAN



Wireless Infrastructure

In a wireless infrastructure (Figure 1-2), an access point is used as a stand alone root unit. The root unit is not attached to any wired LAN (such as an Ethernet LAN), but functions as a hub linking all stations together. This configuration is similar to the ad hoc network, except that the access point serves as the focal point for communications. This increases the effective communication range over the ad hoc LAN because both stations are not required to be in direct communication range of each other.

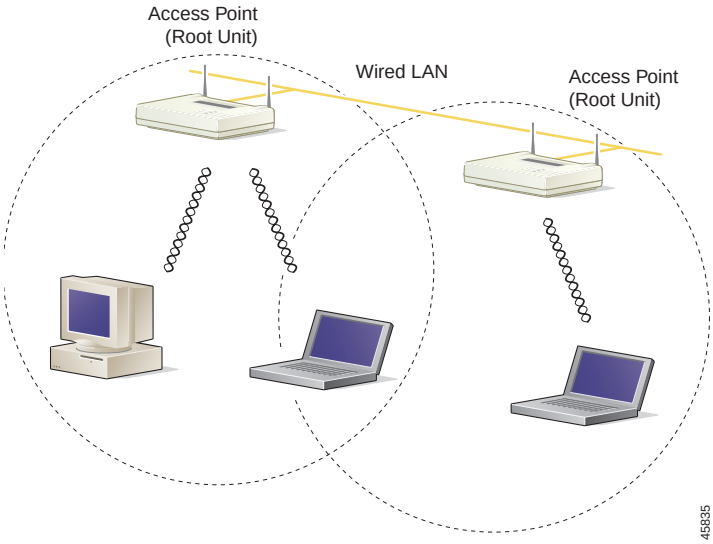
Figure 1-2 Wireless Infrastructure



Wireless Infrastructure with Workstations Accessing a Wired LAN

A micro-cellular network can be created by placing two or more access points on a LAN (Figure 1-3). The roaming protocols allow remote workstations to move from one microcell domain to another. The process is seamless and transparent. The connection to the file server or host is maintained without disruption. This configuration is useful with portable or mobile stations, allowing them to be directly connected to the wired network even while moving about (roaming). When an infrastructure is configured by using multiple access points and repeaters, a mobile station is automatically associated and re-associated to the access point which provides the best performance. This is referred to as seamless roaming.

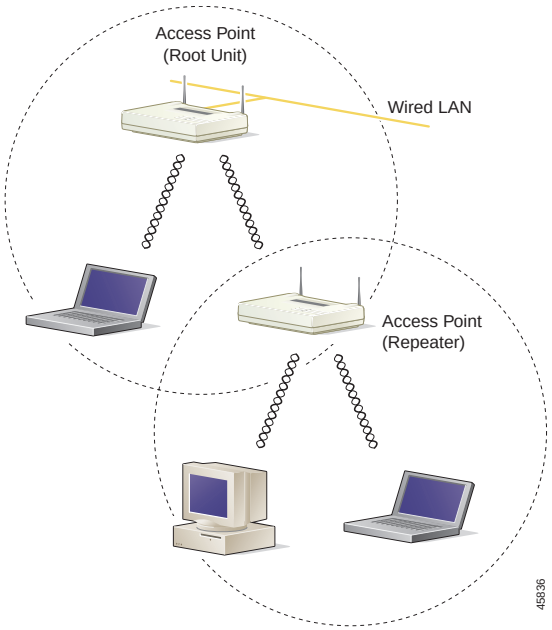
Figure 1-3 Wireless Infrastructure with Workstations Accessing a Wired LAN



Extended Infrastructure Using Repeaters

An access point can be configured as a stand-alone repeater to extend the range of your infrastructure, or to overcome an RF blocking obstacle (Figure 1-4). The repeater forwards traffic between the Cisco Aironet Wireless LAN Client Adapter equipped workstations and devices and the wired LAN by sending packets to either another repeater or to another access point attached to the wired LAN. The data is sent through whichever route provides the greatest performance for the client. Multiple repeater hops can be supported in the path to the wired LAN.

Figure 1-4 Extended Infrastructure Using Repeaters



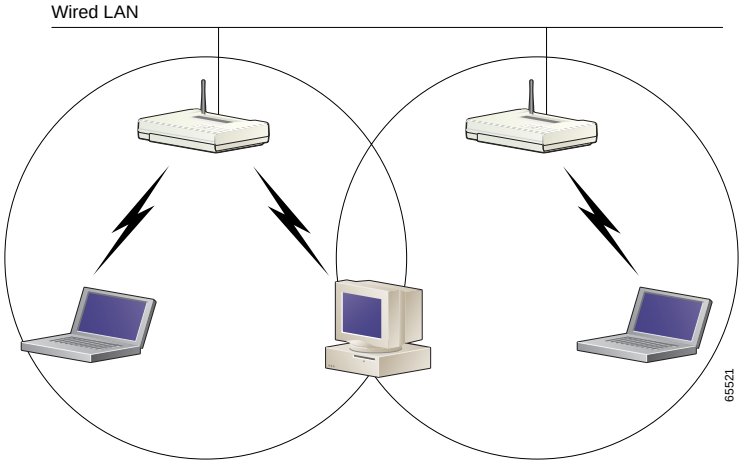
Coverage Options

The system architecture options of the wireless station and access points provide for a variety of coverage alternatives and flexibility. The system can be designed to provide a wide coverage area with minimal overlap (Figure 1-5) or coverage with heavy overlap (Figure 1-6). The latter improves system performance and protection against downtime in the event of a component failure.

Minimal Overlap Coverage

By arranging the access points so that the overlap in coverage area is minimized, a large area can be covered with minimal system cost (Figure 1-5). The total bandwidth available to each mobile station depends on the amount of data each mobile station needs to transfer and the number of stations located in each cell. Seamless roaming is supported as a mobile station moves in and out of range of each access point, thereby maintaining a constant connection to the wired LAN. Each access point (and adapter) must be configured with the same SSID to provide the roaming capability.

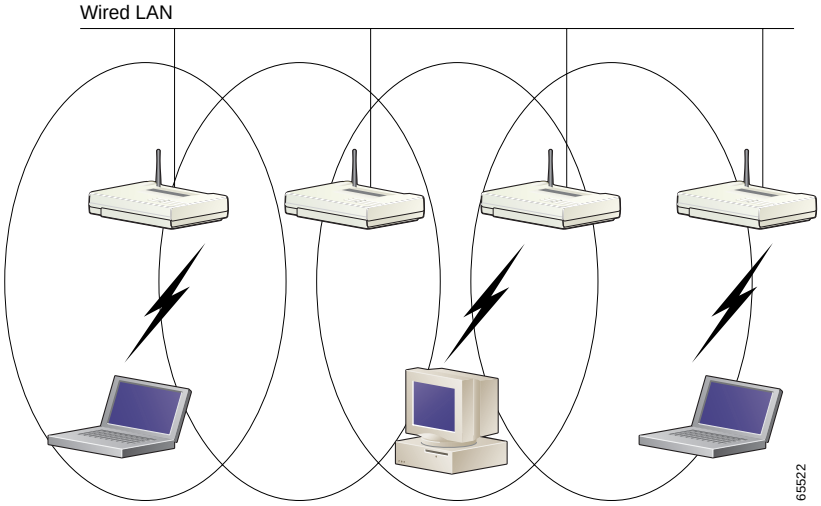
Figure 1-5 Minimal Overlap Coverage Option



Heavy Overlap Coverage

By arranging the access points so that the overlap in coverage area is nearly maximized, a large number of mobile stations can be supported in the same wireless infrastructure (Figure 1-6). However, units in overlapping coverage areas on the same frequency will detect adjacent cell traffic and delay transmissions that would cause collisions. This reduces the aggregate radio system throughput. Heavy cell overlap is not recommended for maximum system throughput. Due to the redundancy in coverage overlap, system access is not lost if an access point fails. If the access point fails, the station automatically roams to an operational access point. With this system architecture, all access points and PC Card units must be configured with the same SSID.

Figure 1-6 Heavy Overlap Coverage Option



Multiple Overlapping Systems Coverage

Multiple systems can operate in the same vicinity (Figure 1-7). The architecture provides multiple channels, which can exist in the same area with virtually no interference to each other. In this mode, each system must be configured with different SSIDs and different channels, which prevent clients from roaming to access points of a different wireless system.

Figure 1-7 Multiple Overlapping Systems Coverage Option