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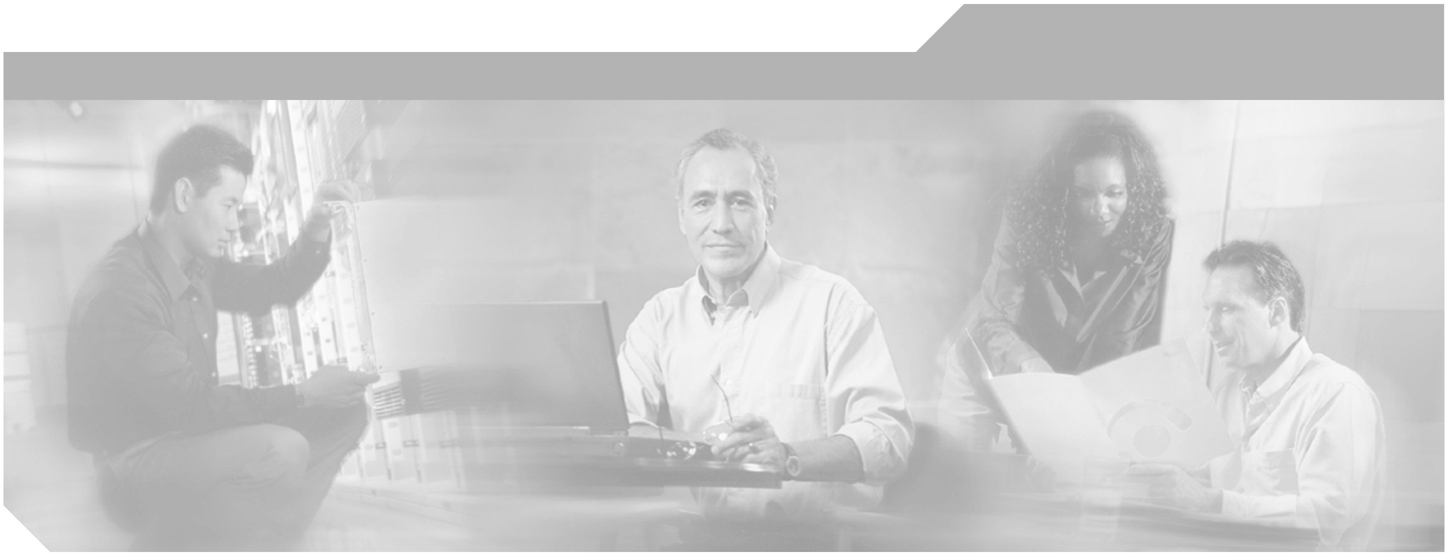

Cisco Aironet 802.11a/b/g Wireless LAN Client Adapters (CB21AG and PI21AG) Installation and Configuration Guide

Corporate Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
http://www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 526-4100

Customer Order Number:
Text Part Number: OL-4211-01

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Cisco Aironet 802.11a/b/g Wireless LAN Client Adapters (CB21AG and PI21AG) Installation and Configuration Guide

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Preface

The preface provides an overview of the *Cisco Aironet 802.11a/b/g Wireless LAN Client Adapters (CB21AG and PI21AG) Installation and Configuration Guide*, references related publications, and explains how to obtain other documentation and technical assistance, if necessary.

The following topics are covered in this section:

Audience

This publication is for the person responsible for installing, configuring, and maintaining a Cisco Aironet IEEE 802.11a/b/g Wireless LAN Client Adapter (CB21AG or PI21AG) on a computer running the Microsoft Windows 2000 or XP operating system. This person should be familiar with computing devices and with network terms and concepts.

Note Windows 2000 and XP are the only supported operating systems.

Purpose

This publication describes the Cisco Aironet CB21AG and PI21AG client adapters and explains how to install, configure, and troubleshoot them.

Caution This manual pertains specifically to Cisco Aironet CB21AG and PI21AG client adapters, whose software is incompatible with that of other Cisco Aironet client adapters. Refer to the *Cisco Aironet 340, 350, and CB20A Wireless LAN Client Adapters Installation and Configuration Guide for Windows* if you are installing or using 340, 350, or CB20A cards.

Organization

This publication contains the following chapters:

- Chapter 1, “Product Overview,” describes the client adapters and their hardware and software components and illustrates two common network configurations.
- Chapter 2, “Preparing for Installation,” provides information that you need to know before installing a client adapter, such as safety information and system requirements.
- Chapter 3, “Installing the Client Adapter,” provides instructions for installing the client adapter.
- Chapter 4, “Using the Profile Manager,” explains how to use the ADU profile manager feature to create and manage profiles for your client adapter.
- Chapter 5, “Configuring the Client Adapter,” explains how to change the configuration parameters for a specific profile.
- Chapter 6, “Using EAP Authentication,” explains the sequence of events that occurs and the actions you must take when a profile that is set for EAP authentication is selected for use.
- Chapter 7, “Performing Diagnostics,” explains how to use ADU to perform user-level diagnostics.
- Chapter 8, “Using the Aironet System Tray Utility (ASTU),” explains how to use the Aironet System Tray Utility (ASTU) to access status information about your client adapter and perform basic tasks.
- Chapter 9, “Routine Procedures,” provides procedures for common tasks related to the client adapters, such as uninstalling client adapter software and restarting an adapter.
- Chapter 10, “Troubleshooting,” provides information for diagnosing and correcting common problems that may be encountered when installing or operating a client adapter.

- Appendix A, “Technical Specifications,” lists the physical, radio, power, and regulatory specifications for the client adapters.
- Appendix B, “Translated Safety Warnings,” provides translations of client adapter safety warnings in nine languages.
- Appendix C, “Declarations of Conformity and Regulatory Information,” provides declarations of conformity and regulatory information for the client adapters.
- Appendix D, “Channels, Power Levels, and Antenna Gains,” lists the IEEE 802.11a, b, and g channels supported by the world's regulatory domains as well as the maximum power levels and antenna gains allowed per domain.
- Appendix E, “Configuring the Client Adapter through Windows XP,” explains how to configure and use your client adapter with Windows XP.

Conventions

This publication uses the following conventions to convey instructions and information:

- Commands and keywords are in **boldface**.
- Variables are in *italics*.
- Configuration parameters are capitalized.
- Notes, cautions, and warnings use the following conventions and symbols:

Note Means *reader take note*. Notes contain helpful suggestions or references to materials not contained in this manual.

Caution Means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.

Warning **This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. (To see translations of the warnings that appear in this publication, refer to the appendix “Translated Safety Warnings.”)**

Waarschuwing **Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico’s en dient u op de hoogte te zijn van standaard maatregelen om ongelukken te voorkomen. (Voor vertalingen van de waarschuwingen die in deze publicatie verschijnen, kunt u het aanhangsel “Translated Safety Warnings” (Vertalingen van veiligheidsvoorschriften) raadplegen.)**

Varoitus **Tämä varoitusmerkki merkitsee vaaraa. Olet tilanteessa, joka voi johtaa ruumiinvammaan. Ennen kuin työskentelet minkään laitteiston parissa, ota selvää sähkökytkentöihin liittyvistä vaaroista ja tavanomaisista onnettomuuksien ehkäisykeinoista. (Tässä julkaisussa esiintyvien varoitusten käännökset löydät liitteestä "Translated Safety Warnings" (käännetyt turvallisuutta koskevat varoitukset).)**

Attention **Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant entraîner des blessures. Avant d'accéder à cet équipement, soyez conscient des dangers posés par les circuits électriques et familiarisez-vous avec les procédures courantes de prévention des accidents. Pour obtenir les traductions des mises en garde figurant dans cette publication, veuillez consulter l'annexe intitulée « Translated Safety Warnings » (Traduction des avis de sécurité).**

Warnung **Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu einer Körperverletzung führen könnte. Bevor Sie mit der Arbeit an irgendeinem Gerät beginnen, seien Sie sich der mit elektrischen Stromkreisen verbundenen Gefahren und der Standardpraktiken zur Vermeidung von Unfällen bewußt. (Übersetzungen der in dieser Veröffentlichung enthaltenen Warnhinweise finden Sie im Anhang mit dem Titel "Translated Safety Warnings" (Übersetzung der Warnhinweise).)**

Avvertenza **Questo simbolo di avvertenza indica un pericolo. Si è in una situazione che può causare infortuni. Prima di lavorare su qualsiasi apparecchiatura, occorre conoscere i pericoli relativi ai circuiti elettrici ed essere al corrente delle pratiche standard per la prevenzione di incidenti. La traduzione delle avvertenze riportate in questa pubblicazione si trova nell'appendice, "Translated Safety Warnings" (Traduzione delle avvertenze di sicurezza).**

Advarsel **Dette varselsymbolet betyr fare. Du befinner deg i en situasjon som kan føre til personskade. Før du utfører arbeid på utstyr, må du være oppmerksom på de faremomentene som elektriske kretser innebærer, samt gjøre deg kjent med vanlig praksis når det gjelder å unngå ulykker. (Hvis du vil se oversettelser av de advarslene som finnes i denne publikasjonen, kan du se i vedlegget "Translated Safety Warnings" [Oversatte sikkerhetsadvarsler].)**

Aviso **Este símbolo de aviso indica perigo. Encontra-se numa situação que lhe poderá causar danos fisicos. Antes de começar a trabalhar com qualquer equipamento, familiarize-se com os perigos relacionados com circuitos eléctricos, e com quaisquer práticas comuns que possam prevenir possíveis acidentes. (Para ver as traduções dos avisos que constam desta publicação, consulte o apêndice "Translated Safety Warnings" - "Traduções dos Avisos de Segurança").**

¡Advertencia! **Este símbolo de aviso significa peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considerar los riesgos que entraña la corriente eléctrica y familiarizarse con los procedimientos estándar de prevención de accidentes. (Para ver traducciones de las advertencias que aparecen en esta publicación, consultar el apéndice titulado "Translated Safety Warnings.")**

Varning! **Denna varningssymbol signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till vanligt förfarande för att förebygga skador. (Se förklaringar av de varningar som förekommer i denna publikation i appendix "Translated Safety Warnings" [Översatta säkerhetsvarningar].)**

Related Publications

For more information about Cisco Aironet CB21AG and PI21AG Wireless LAN Client Adapters for Windows, refer to the following publication:

- *Release Notes for Cisco Aironet 802.11a/b/g Wireless LAN Client Adapters (CB21AG and PI21AG)*

For more information about related Cisco Aironet products, refer to the publications for your infrastructure device. You can access Cisco Aironet technical documentation at this URL:

http://www.cisco.com/en/US/products/hw/wireless/index.html

Obtaining Documentation

Cisco provides several ways to obtain documentation, technical assistance, and other technical resources. These sections explain how to obtain technical information from Cisco Systems.

Cisco.com

You can access the most current Cisco documentation on the World Wide Web at this URL:

http://www.cisco.com/univercd/home/home.htm

You can access the Cisco website at this URL:

http://www.cisco.com

International Cisco websites can be accessed from this URL:

http://www.cisco.com/public/countries_languages.shtml

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Registered Cisco.com users can order a single Documentation CD-ROM (product number DOC-CONDOCCD=) through the Cisco Ordering tool:

http://www.cisco.com/en/US/partner/ordering/ordering_place_order_ordering_tool_launch.html

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Cisco TAC Website

The Cisco TAC website (http://www.cisco.com/tac) provides online documents and tools for troubleshooting and resolving technical issues with Cisco products and technologies. The Cisco TAC website is available 24 hours a day, 365 days a year.

Accessing all the tools on the Cisco TAC website requires a Cisco.com user ID and password. If you have a valid service contract but do not have a login ID or password, register at this URL:

http://tools.cisco.com/RPF/register/register.do

Opening a TAC Case

The online TAC Case Open Tool (http://www.cisco.com/tac/caseopen) is the fastest way to open P3 and P4 cases. (Your network is minimally impaired or you require product information). After you describe your situation, the TAC Case Open Tool automatically recommends resources for an immediate solution. If your issue is not resolved using these recommendations, your case will be assigned to a Cisco TAC engineer.

For P1 or P2 cases (your production network is down or severely degraded) or if you do not have Internet access, contact Cisco TAC by telephone. Cisco TAC engineers are assigned immediately to P1 and P2 cases to help keep your business operations running smoothly.

To open a case by telephone, use one of the following numbers:

Asia-Pacific: +61 2 8446 7411 (Australia: 1 800 805 227)
EMEA: +32 2 704 55 55
USA: 1 800 553-2447

For a complete listing of Cisco TAC contacts, go to this URL:

http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml

TAC Case Priority Definitions

To ensure that all cases are reported in a standard format, Cisco has established case priority definitions.

Priority 1 (P1)—Your network is “down” or there is a critical impact to your business operations. You and Cisco will commit all necessary resources around the clock to resolve the situation.

Priority 2 (P2)—Operation of an existing network is severely degraded, or significant aspects of your business operation are negatively affected by inadequate performance of Cisco products. You and Cisco will commit full-time resources during normal business hours to resolve the situation.

Priority 3 (P3)—Operational performance of your network is impaired, but most business operations remain functional. You and Cisco will commit resources during normal business hours to restore service to satisfactory levels.

Priority 4 (P4)—You require information or assistance with Cisco product capabilities, installation, or configuration. There is little or no effect on your business operations.

Obtaining Additional Publications and Information

Information about Cisco products, technologies, and network solutions is available from various online and printed sources.

- The *Cisco Product Catalog* describes the networking products offered by Cisco Systems, as well as ordering and customer support services. Access the *Cisco Product Catalog* at this URL:

  http://www.cisco.com/en/US/products/products_catalog_links_launch.html

- Cisco Press publishes a wide range of networking publications. Cisco suggests these titles for new and experienced users: Internetworking Terms and Acronyms Dictionary, Internetworking Technology Handbook, Internetworking Troubleshooting Guide, and the Internetworking Design Guide. For current Cisco Press titles and other information, go to Cisco Press online at this URL:

  http://www.ciscopress.com

- Packet magazine is the Cisco quarterly publication that provides the latest networking trends, technology breakthroughs, and Cisco products and solutions to help industry professionals get the most from their networking investment. Included are networking deployment and troubleshooting tips, configuration examples, customer case studies, tutorials and training, certification information, and links to numerous in-depth online resources. You can access Packet magazine at this URL:

  http://www.cisco.com/go/packet

- iQ Magazine is the Cisco bimonthly publication that delivers the latest information about Internet business strategies for executives. You can access iQ Magazine at this URL:

  http://www.cisco.com/go/iqmagazine

- Internet Protocol Journal is a quarterly journal published by Cisco Systems for engineering professionals involved in designing, developing, and operating public and private internets and intranets. You can access the Internet Protocol Journal at this URL:

  http://www.cisco.com/en/US/about/ac123/ac147/about_cisco_the_internet_protocol_journal.html

- Training—Cisco offers world-class networking training. Current offerings in network training are listed at this URL:

  http://www.cisco.com/en/US/learning/index.html

CHAPTER 1

Product Overview

This chapter describes the Cisco Aironet CB21AG and PI21AG client adapters and illustrates their role in a wireless network.

The following topics are covered in this chapter:

- Introduction to the Client Adapters, page 1-2
- Hardware Components, page 1-3
- Software Components, page 1-4
- Network Configurations Using Client Adapters, page 1-5

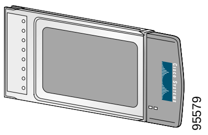
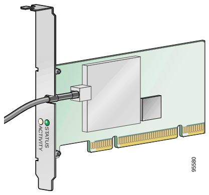
Introduction to the Client Adapters

The Cisco Aironet IEEE 802.11a/b/g Wireless LAN Client Adapters (CB21AG and PI21AG) 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 client adapters are fully compatible when used in devices supporting “plug-and-play” (PnP) technology.

The primary function of the client adapters is to transfer data packets transparently through the wireless infrastructure by communicating with access points that are connected to a wired LAN. The adapters operate similarly to a standard network product except that the cable is replaced with a radio connection and an access point is required to make the connection to the wire. No special wireless networking functions are required, and all existing applications that operate over a network can operate using the adapters.

This document covers the two client adapters described in Table 1-1.

Table 1-1 Client Adapter Types

Client Adapter	Model Number	Description	Illustration
PC-Cardbus card	AIR-CB21AG	An IEEE 802.11a/b/g-compliant 2.4- and 5-GHz 54-Mbps client adapter card radio module with a Cardbus interface that can be inserted into any device equipped with an *external* 32-bit Cardbus slot. Host devices can include laptops and notebook computers.	
PCI card	AIR-PI21AG	An IEEE 802.11a/b/g-compliant 2.4- and 5-GHz 54-Mbps client adapter card radio module that can be inserted into any device equipped with an empty PCI expansion slot, such as a desktop personal computer.	

Terminology

The following terms are used throughout this document:

- **client adapter**—Refers to both types of adapters.
- **PC-Cardbus card** or **PCI card**—Refers to a specific adapter.
- **workstation** (or **station**)—Refers to a computing device with an installed client adapter.
- **infrastructure device**—Refers to a device that connects client adapters to a wired LAN, such as an access point, bridge, or base station. Throughout this document, *access point* is used to represent infrastructure devices in general.

Hardware Components

The client adapters have three major hardware components: a radio, a radio antenna, and two LEDs.

Radio

The client adapters contain a dual-band radio that is both IEEE 802.11a and 802.11b/g compliant. The radio uses both direct-sequence spread spectrum (DSSS) technology and orthogonal frequency division multiplexing (OFDM) technology for client applications in the 2.4-GHz Industrial Scientific Medical (ISM) frequency band and OFDM technology in the 5-GHz Unlicensed National Information Infrastructure (UNII) frequency bands. It can transmit data at up to 100 milliwatts (mW) in the 2.4-GHz band or up to 40 mW in the 5-GHz band over a half-duplex radio channel operating at up to 54 Mbps.

The client adapters operate with other IEEE 802.11a or 802.11b/g-compliant client devices in ad hoc mode or with Cisco Aironet 340, 350, 1100, and 1200 Series Access Points and other IEEE 802.11a or 802.11b/g-compliant infrastructure devices in infrastructure mode. They are approved for indoor and outdoor use in the 2.4-GHz band and for indoor use only in the 5-GHz band except in the United States, which allows for outdoor use on channels 52 through 64.

Radio Antenna

The type of antenna used depends on your client adapter:

- PC-Cardbus cards have an integrated, permanently attached dual-band 2.4/5-GHz 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 housed within the section of the card that hangs out of the PC card slot when the card is installed.
- PCI cards have a 1-dBi dual-band 2.4/5-GHz antenna that is permanently attached by cable. A base is provided with the antenna to enable it to be mounted to a wall or to sit upright on a desk or other horizontal surface.

LEDs

The client adapters have two LEDs that glow or blink to indicate the status of the adapter or to convey error messages. Refer to Chapter 10 for an interpretation of the LED codes.

Software Components

The client adapters have two major software components: a driver and client utilities. These components are installed together by running a single executable Install Wizard file that is available from Cisco.com. This file can be run on Windows 2000 or XP and can be used only with CB21AG and PI21AG client adapters.

Note Chapter 3 provides instructions on using the Install Wizard to install these software components.

Driver

The driver provides an interface between a computer's operating system and the client adapter, thereby enabling the operating system and the applications it runs to communicate with the adapter. The driver must be installed before the adapter can be used.

Client Utilities

Two client utilities are available for use with the client adapters: Aironet Desktop Utility (ADU) and Aironet System Tray Utility (ASTU). These utilities are optional applications that interact with the client adapter's radio to adjust settings and display information.

ADU enables you to create configuration profiles for your client adapter and perform user-level diagnostics. Because ADU performs a variety of functions, it is documented by function throughout this manual.

ASTU, which is accessible from an icon in the Windows system tray, provides a small subset of the features available through ADU. Specifically, it enables you to access status information about your client adapter and perform basic tasks. Chapter 8 provides detailed information and instructions on using ASTU.

Note If your computer is running Windows XP, you can configure your client adapter through the Windows operating system instead of through ADU. Refer to Appendix E for information. However, ADU is recommended for configuring the client adapter.

Network Configurations Using Client Adapters

Client adapters can be used in a variety of network configurations. In some configurations, access points provide connections to your network or act as repeaters to increase wireless communication range. The maximum communication range is based on how you configure your wireless network.

This section describes and illustrates the two most common network configurations:

- Ad hoc wireless local area network (LAN)
- Wireless infrastructure with workstations accessing a wired LAN

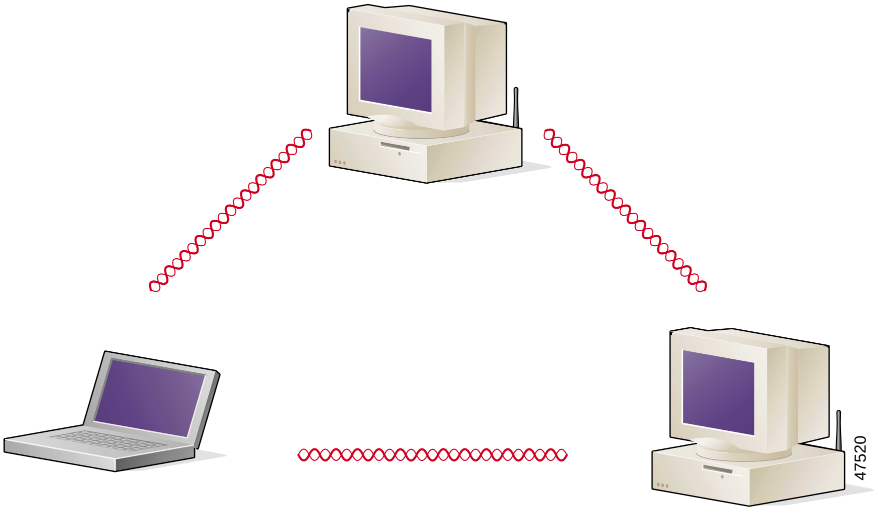
For examples of more complex network configurations involving client adapters and access points, refer to the documentation for your access point.

Note Refer to Chapter 5 for information on setting the client adapter's network type.

Ad Hoc Wireless LAN

An ad hoc (or *peer-to-peer*) wireless LAN (see Figure 1-1) is the simplest wireless LAN configuration. In a wireless LAN using an ad hoc network configuration, all devices equipped with a client adapter can be linked together and communicate directly with each other. The use of an infrastructure device, such as an access point, is not required.

Figure 1-1 Ad Hoc Wireless LAN

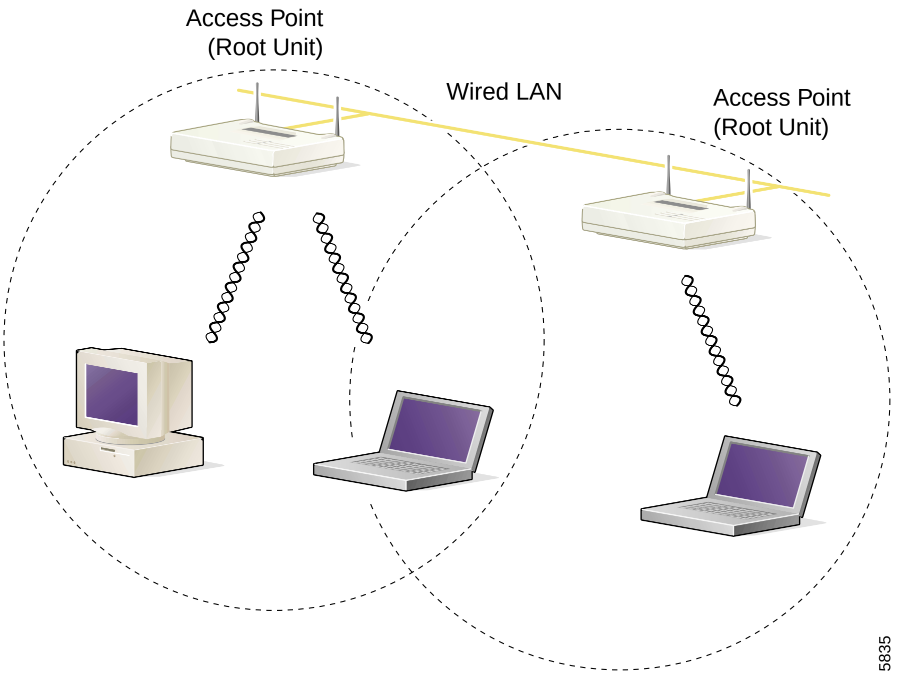


Wireless Infrastructure with Workstations Accessing a Wired LAN

A microcellular network can be created by placing two or more access points on a LAN. Figure 1-2 shows a microcellular network with workstations accessing a wired LAN through several access points.

This configuration is useful with portable or mobile stations because it allows them to be directly connected to the wired network even while moving from one microcell domain to another. This process is transparent, and the connection to the file server or host is maintained without disruption. The mobile station stays connected to an access point as long as it can. However, once the transfer of data packets needs to be retried or beacons are missed, the station automatically searches for and associates to another access point. This process is referred to as *seamless roaming*.

Figure 1-2 Wireless Infrastructure with Workstations Accessing a Wired LAN



CHAPTER 2

Preparing for Installation

This chapter provides information that you need to know before installing a client adapter.

The following topics are covered in this chapter:

Safety information

Follow the guidelines in this section to ensure proper operation and safe use of the client adapter.

FCC Safety Compliance Statement

The FCC, with its action in ET Docket 96-8, has adopted a safety standard for human exposure to RF electromagnetic energy emitted by FCC-certified equipment. When used with approved Cisco Aironet antennas, Cisco Aironet products meet the uncontrolled environmental limits found in OET-65 and ANSI C95.1, 1991. Proper operation of this radio device according to the instructions in this publication will result in user exposure substantially below the FCC recommended limits.

Safety Guidelines

- Do not touch or move the antenna while the unit is transmitting or receiving.
- Do not hold any component containing a radio such that the antenna is very close to or touching any exposed parts of the body, especially the face or eyes, while transmitting.
- Do not operate the radio or attempt to transmit data unless the antenna is connected; otherwise, the radio may be damaged.
- High-gain, wall-mount, or mast-mount antennas are designed to be professionally installed and should be located at a minimum distance of 12 inches (30 cm) or more from the body of all persons. Please contact your professional installer, VAR, or antenna manufacturer for proper installation requirements.
- Use in specific environments:
  - The use of wireless devices in hazardous locations is limited to the constraints posed by the safety directors of such environments.
  - The use of wireless devices on airplanes is governed by the Federal Aviation Administration (FAA).
  - The use of wireless devices in hospitals is restricted to the limits set forth by each hospital.

Warnings

Observe the following warnings when operating the client adapter:

Warning **Do not operate your wireless network device near unshielded blasting caps or in an explosive environment unless the device has been modified to be especially qualified for such use.**

Warning **In order to comply with FCC radio frequency (RF) exposure limits, dipole antennas should be located at a minimum of 7.9 inches (20 cm) or more from the body of all persons.**

Warning **This device has been tested and complies with FCC RF Exposure (SAR) limits in typical laptop computer configurations and this device can be used in desktop or laptop computers with side mounted PC Card slots that can provide at least 0.394 in (1 cm) separation distance from the antenna to the body of the user or a nearby person. Thin laptop computers may need special attention to maintain antenna spacing while operating. This device cannot be used with handheld PDAs (personal digital assistants). Use in other configurations may not ensure compliance with FCC RF exposure guidelines. This device and its antenna must not be co-located or operated in conjunction with any other antenna or transmitter.**

Translated versions of these safety warnings are provided in Appendix B.

Unpacking the Client Adapter

Follow these steps to unpack the client adapter:

Step 1 Open the shipping container and carefully remove the contents.

Step 2 Return all packing materials to the shipping container and save it.

Step 3 Ensure that all items listed in the "Package Contents" section below are included in the shipment. Check each item for damage.

Note If any item is damaged or missing, notify your authorized Cisco sales representative.

Package Contents

Each client adapter is shipped with the following items:

- 1-dBi antenna permanently attached by cable, antenna base, low-profile bracket, two mounting screws, and two plastic wall anchors (PCI cards only)
- *Quick Start Guide: Cisco Aironet 802.11a/b/g Wireless LAN Client Adapters (CB21AG and PI21AG)*
- Cisco Aironet 802.11a/b/g Wireless Adapters (CB21AG and PI21AG) CD
- Cisco product registration card

System Requirements

In addition to the items shipped with the client adapter, you also need the following items in order to install and use the adapter:

- One of the following computing devices running Windows 2000 or XP:
  - Laptop, notebook, or portable or handheld device equipped with a 32-bit Cardbus slot
  - Desktop personal computer equipped with an empty PCI expansion slot

Note Cisco recommends a 300-MHz processor or greater.

- Service Pack 1 for Windows XP (recommended)
- 20 MB of free hard disk space (minimum)
- 128 MB of RAM or greater (recommended)
- The appropriate tools for removing your computer's cover and expansion slot dust cover and for mounting the antenna base (for PCI cards)
- The following information from your system administrator:
  - The logical name for your workstation (also referred to as *client name*)
  - The protocols necessary to bind to the client adapter
  - The case-sensitive service set identifier (SSID) for your RF network
  - If your computer is not connected to a DHCP server, the IP address, subnet mask, and default gateway address of your computer
  - The wired equivalent privacy (WEP) keys of the access points with which your client adapter will communicate, if your wireless network uses static WEP for security
  - The username and password for your network account

Site Requirements

This section discusses the site requirements for both infrastructure and client devices.

For Infrastructure Devices

Because of differences in component configuration, placement, and physical environment, every network application is a unique installation. Therefore, before you install any wireless infrastructure devices (such as access points, bridges, and base stations, which connect your client adapters to a wired LAN), a site survey must be performed to determine the optimum placement of these devices to maximize range, coverage, and network performance.

Note Infrastructure devices are installed and initially configured prior to client devices.

For Client Devices

Because the client adapter is a radio device, it is susceptible to RF obstructions and common sources of interference that can reduce throughput and range. Follow these guidelines to ensure the best possible performance:

- Install the client adapter in an area where large steel structures such as shelving units, bookcases, and filing cabinets will not obstruct radio signals to and from the client adapter.
- Install the client adapter away from microwave ovens. Microwave ovens operate on the same frequency as the client adapter and can cause signal interference.

CHAPTER 3

Installing the Client Adapter

This chapter provides instructions for installing the client adapter.

The following topics are covered in this chapter:

- Inserting a Client Adapter, page 3-2
- Installing the Client Adapter Software, page 3-8
- Verifying Installation, page 3-18

Inserting a Client Adapter

This section provides instructions for inserting a PC-Cardbus card or PCI card into your computer.

Caution These procedures and the physical connections they describe apply generally to conventional Cardbus slots and PCI expansion slots. In cases of custom or nonconventional equipment, be alert to possible differences in Cardbus slot and PCI expansion slot configurations.

Inserting a PC-Cardbus Card

Step 1 Before you begin, examine the card. One end has a dual-row, 68-pin connector. The card is keyed so it can be inserted only one way into the Cardbus slot.

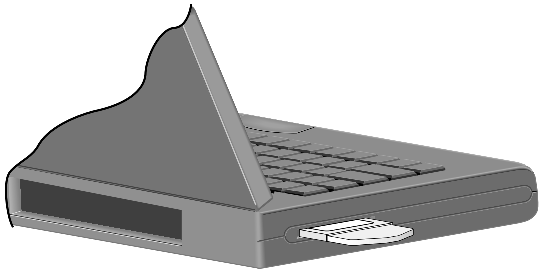
Note The Cardbus slot is on the left or right side of the computer, depending on the model.

Step 2 Turn on your computer and let the operating system boot up completely.

Step 3 Hold the card with the Cisco logo facing up and insert it into the Cardbus slot, applying just enough pressure to make sure it is fully seated (see Figure 3-1).

Caution Do not force the card into your computer's Cardbus slot. Forcing it will damage both the card and the slot. If the card does not insert easily, remove the card and reinsert it.

Figure 3-1 Inserting a PC-Cardbus Card into a Computer



Note The profiles for PC-Cardbus cards are tied to the slot in which the card is inserted. Therefore, you must always insert your PC-Cardbus card into the same slot or create profiles for both slots.

Step 4 When the Found New Hardware Wizard screen appears, click **Cancel**.

Step 5 Go to the "Installing the Client Adapter Software" section on page 3-8.

Inserting a PCI Card

You must perform the following procedures in the order listed below to insert a PCI card:

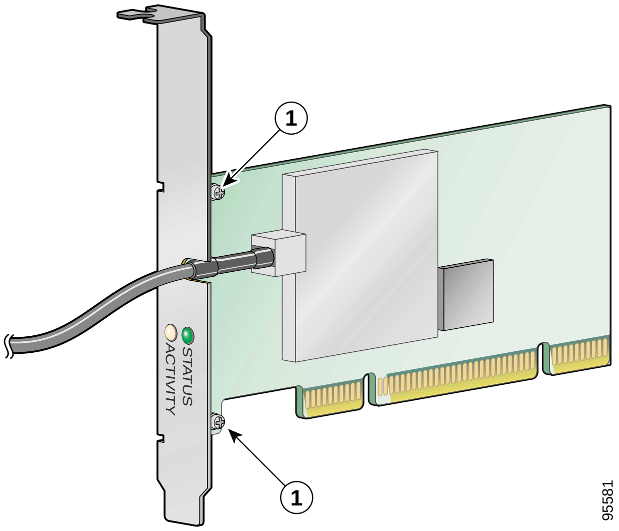
- Change the bracket (if required), see below
- Insert the card, page 3-4
- Assemble the antenna, page 3-5
- Mount the antenna, page 3-6

Changing the Bracket

The PCI card is shipped with a full-profile bracket attached. If the PC into which you are inserting the PCI card requires the card to use a low-profile bracket, follow the steps below to change brackets.

Step 1 Unscrew the two screws that attach the bracket to the card. See Figure 3-2.

Figure 3-2 Changing the PCI Card Bracket



1	Bracket screws

Step 2 Slide the bracket away from the card; then tilt the bracket to free the antenna cable.

⚠ **Caution** Do not pull on the antenna cable or detach it from the PCI card. The antenna is meant to be permanently attached to the card.

Step 3 Hold the low-profile bracket to the card so that the LEDs slip through their corresponding holes on the bracket.

Step 4 Insert the screws that you removed in Step 1 into the holes on the populated side of the card near the bracket (see Figure 3-2) and tighten.

Inserting the Card

Follow the steps below to insert a PCI card into your PC.

Step 1 Turn off the PC and all its components.

Step 2 Remove the computer cover.

Note On most Pentium PCs, PCI expansion slots are white. Refer to your PC documentation for slot identification.

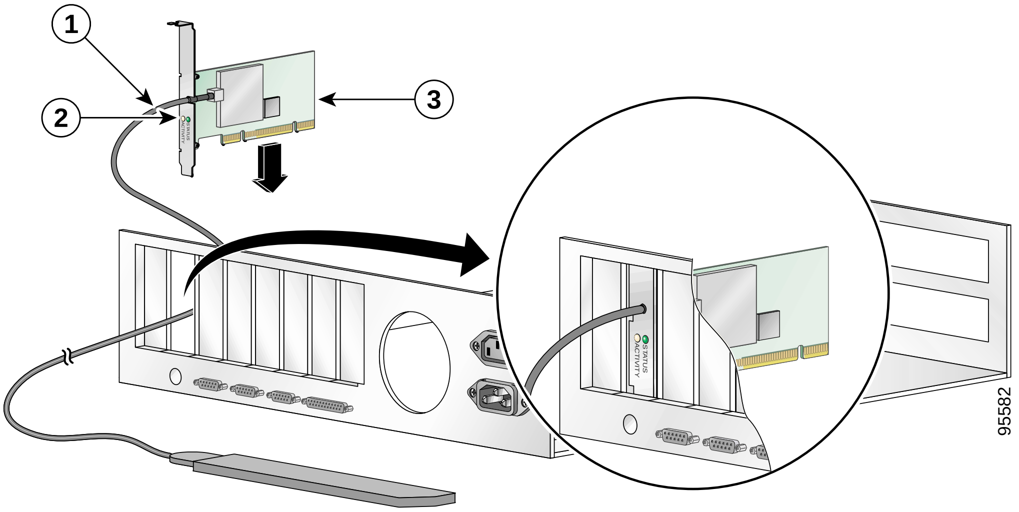
Step 3 Remove the screw from the top of the CPU back panel above an empty PCI expansion slot. This screw holds the metal bracket on the back panel.

Caution Static electricity can damage your PCI card. Before removing the card from the anti-static packaging, discharge static by touching a metal part of a grounded PC.

Step 4 Locate an empty PCI expansion slot inside your computer.

Step 5 Slip your card's antenna through the opening near the empty expansion slot so that it is located outside of the computer. See Figure 3-3.

Figure 3-3 Inserting a PCI Card into a PC



1	Antenna cable
2	LEDs
3	Card edge connector

Step 6 Tilt the card to allow the LEDs to slip through the opening in the CPU back panel. See the enlarged view in Figure 3-3.

Step 7 Press the card into the empty slot until its connector is firmly seated.

Caution Do not force the card into the expansion slot as this could damage both the card and the slot. If the card does not insert easily, remove it and reinsert it.

Step 8 Reinstall the screw on the CPU back panel and replace the computer cover.

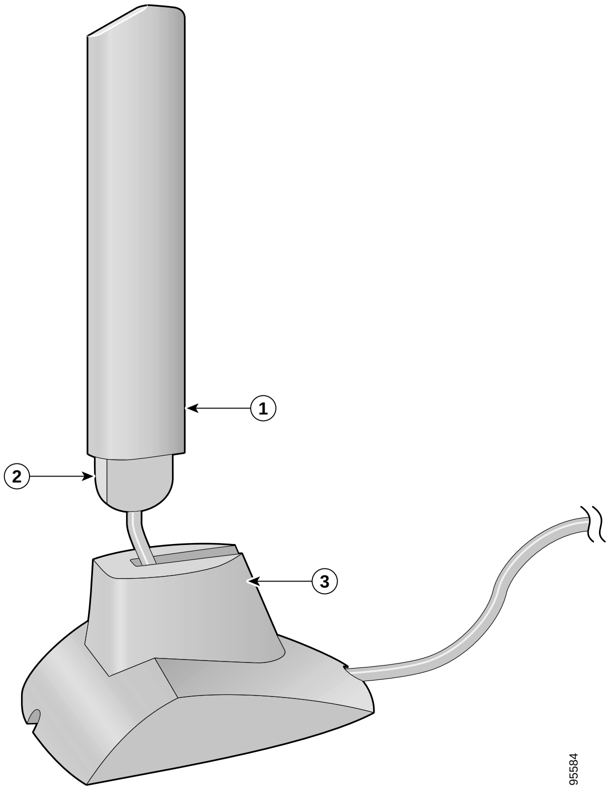
Assembling the Antenna

Follow the steps below to assemble the PCI card's antenna.

Step 1 Slide the antenna through the opening in the bottom of the antenna base.

Step 2 Position the antenna so its notches are facing the Cisco label on the front of the base. See Figure 3-4.

Figure 3-4 Inserting the Antenna into Its Base



1	Antenna
2	Notch
3	Antenna base

Step 3 Press the antenna cable into the receptacle on the top of the base as shown in Figure 3-4.

Step 4 Press the antenna straight down into the receptacle until it clicks into place.

Mounting the Antenna

Because the PCI card is a radio device, it is susceptible to RF obstructions and common sources of interference that can reduce throughput and range. Follow these guidelines to ensure the best possible performance:

- Install the PCI card's antenna in an area where large steel structures such as shelving units, bookcases, and filing cabinets will not obstruct radio signals being transmitted or received.
- Install the antenna away from microwave ovens and 2.4-GHz cordless phones. These products can cause signal interference because they operate in the same frequency range as the PCI card when used in 2.4-GHz mode.

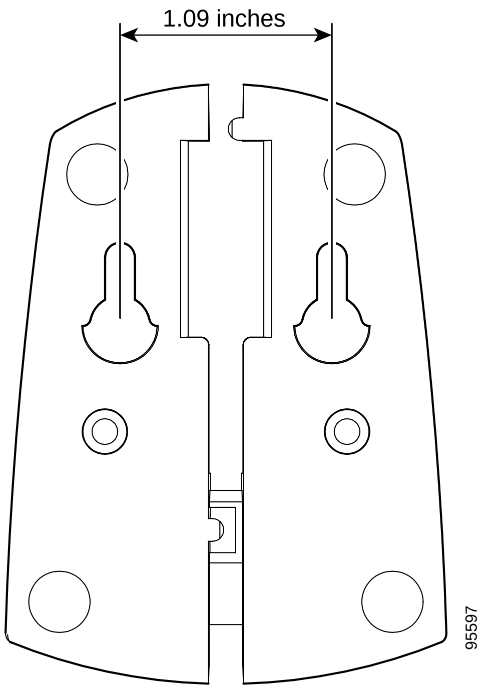
Follow the steps below to position the PCI card's antenna on a flat horizontal surface or to mount it to a wall.

Step 1 Perform one of the following:

- If you want to use the antenna on a flat horizontal surface, position the antenna so it is pointing straight up. Then go to Step 7.
- If you want to mount the antenna to a wall, go to Step 2.

Step 2 Drill two holes in the wall that are 1.09 inches apart. Figure 3-5 shows the distance between the mounting holes on the bottom of the antenna base.

Figure 3-5 Bottom of Antenna Base

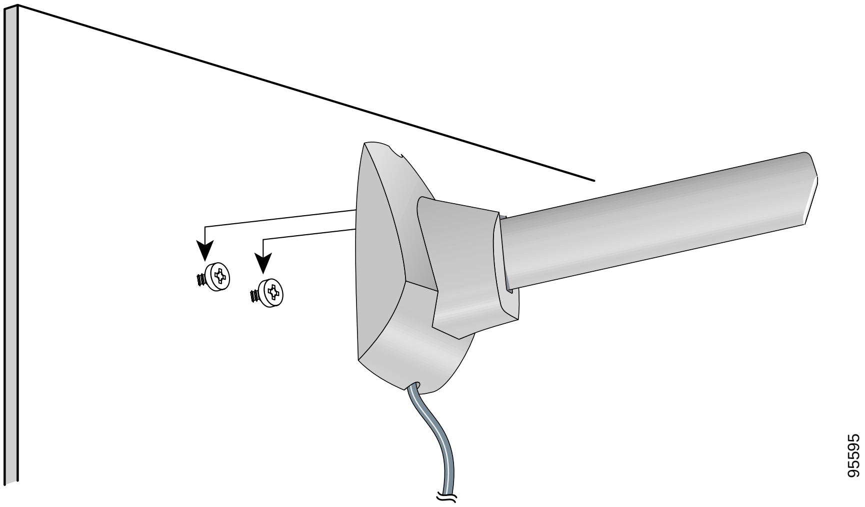


Step 3 Tap the two supplied wall anchors into the holes.

Step 4 Drive the two supplied screws into the wall anchors, leaving a small gap between the screw head and the anchor.

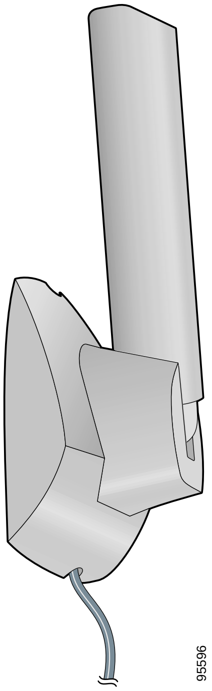
Step 5 Position the mounting holes on the bottom of the antenna base over the screws (see Figure 3-6) and pull down to lock in place.

Figure 3-6 Mounting the Antenna



Step 6 The antenna rotates 90 degrees from its base. For optimal reception, position the antenna so it is pointing straight up (see Figure 3-7).

Figure 3-7 Rotating the Antenna



Step 7 Boot up your PC.

Step 8 When the Found New Hardware Wizard screen appears, click **Cancel**.

Step 9 Go to the "Installing the Client Adapter Software" section below.

Installing the Client Adapter Software

This section enables you to install Cisco Aironet CB21AG or PI21AG client adapter drivers and utilities from a single executable file named Win-Client-802.11a-b-g-Ins-Wizard-v*x*.exe, where *x* represents the version number. Follow the steps below to install these client adapter software components on a computer running Windows 2000 or XP.

Caution Cisco Aironet CB21AG and PI21AG client adapter software is incompatible with other Cisco Aironet client adapter software. Remove or disable any installed Cisco Aironet client adapters before you install or use a CB21AG or PI21AG adapter and do not open the Aironet Client Utility (ACU). Refer to the "Disabling a Cisco Aironet Client Adapter" section on page 10-7 for instructions on disabling a client adapter.

Caution Do not eject your client adapter at any time during the installation process, including during the reboot.

Note This procedure is meant to be used the first time the Cisco Aironet CB21AG or PI21AG client adapter software is installed on your computer. If this software is already installed on your computer, follow the instructions in Chapter 9 to upgrade or uninstall the client adapter software.

Note Only one client adapter can be installed and used at a time. The software does not support the use of multiple cards.

Step 1 Use your computer's web browser to access the following URL:

http://www.cisco.com/public/sw-center/sw-wireless.shtml

Step 2 Select **Option #2: Aironet Wireless Software Display Tables**.

> **Note** You can download software from the Software Selector tool instead of the display tables. To do so, select **Option #1: Aironet Wireless Software Selector**, follow the instructions on the screen, and go to Step 6.

Step 3 Select **Cisco Aironet Wireless LAN Client Adapters**.

Step 4 Under Aironet Client Adapter Installation Wizard (For Windows), select **802.11a/b/g (CB21AG, PI21AG)**.

Step 5 Select the Install Wizard file with the greatest version number.

Step 6 Read and accept the terms and conditions of the Software License Agreement.

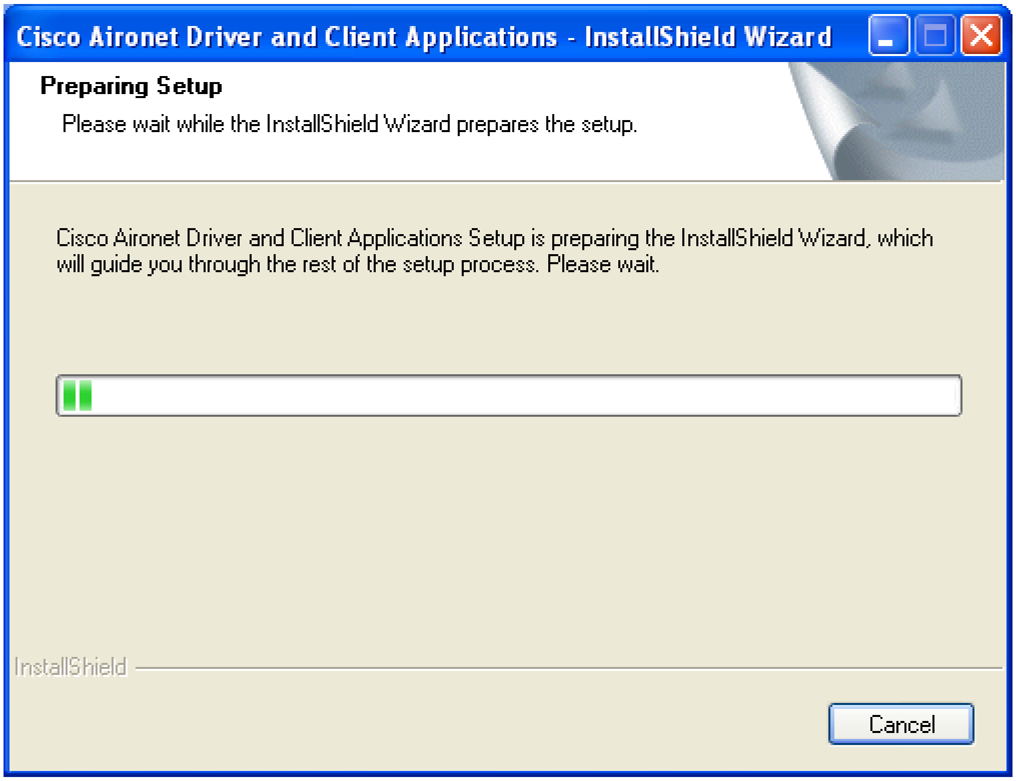
Step 7 Select the file again to download it.

Step 8 Save the file to your computer's hard drive.

Step 9 Use Windows Explorer to find the file.

Step 10 Double-click the file. The "Starting InstallShield Wizard" message appears followed by the Preparing Setup screen (see Figure 3-8) and the Cisco Aironet Installation Program screen (see Figure 3-9).

Figure 3-8 Preparing Setup Screen



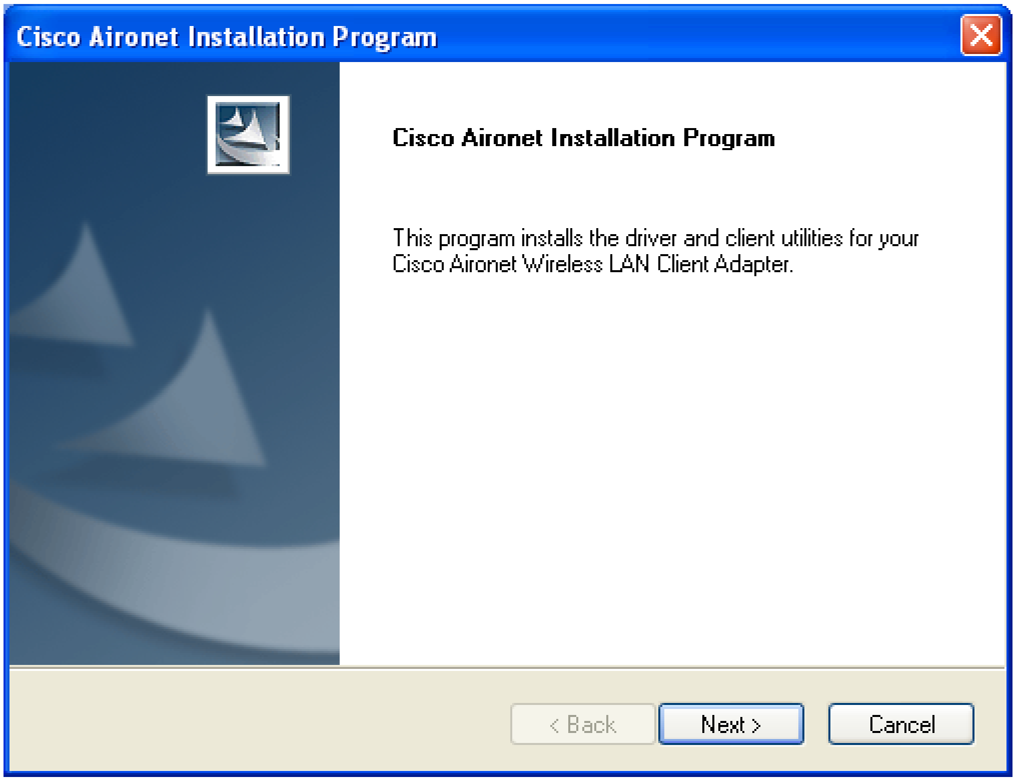
Cisco Aironet Driver and Client Applications - InstallShield Wizard

Preparing Setup

Please wait while the InstallShield Wizard prepares the setup.

Cisco Aironet Driver and Client Applications Setup is preparing the InstallShield Wizard, which will guide you through the rest of the setup process. Please wait.

Figure 3-9 Cisco Aironet Installation Program Screen

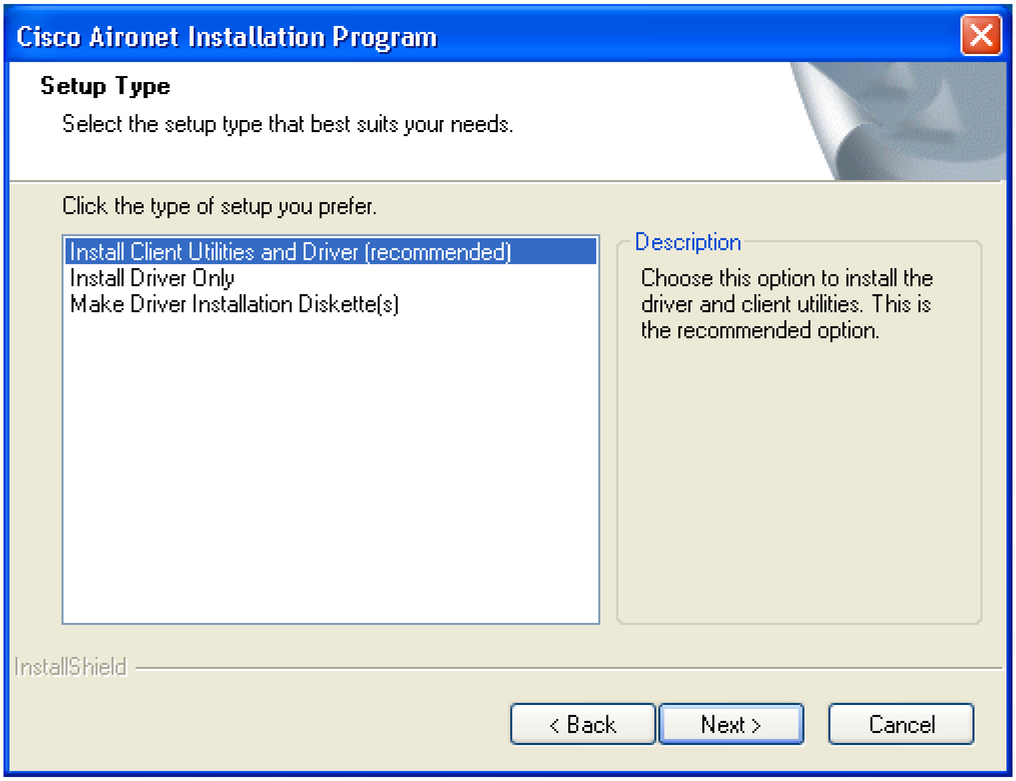


Cisco Aironet Installation Program

This program installs the driver and client utilities for your Cisco Aironet Wireless LAN Client Adapter.

Step 11 Click **Next**. The Setup Type screen appears (see Figure 3-10).

Figure 3-10 Setup Type Screen



Cisco Aironet Installation Program

Setup Type

Select the setup type that best suits your needs.

Click the type of setup you prefer.

- Install Client Utilities and Driver (recommended)
- Install Driver Only
- Make Driver Installation Diskette(s)

Description

Choose this option to install the driver and client utilities. This is the recommended option.

Step 12 Select one of the following options:

Note To ensure compatibility among software components, Cisco recommends that you install the client utilities and driver.

- **Install Client Utilities and Driver (recommended)**—Installs the client adapter driver and client utilities.
- **Install Driver Only**—Installs only the client adapter driver. If you select this option, go to Step 24.
- **Make Driver Installation Diskette(s)**—Enables you to create driver installation diskettes.

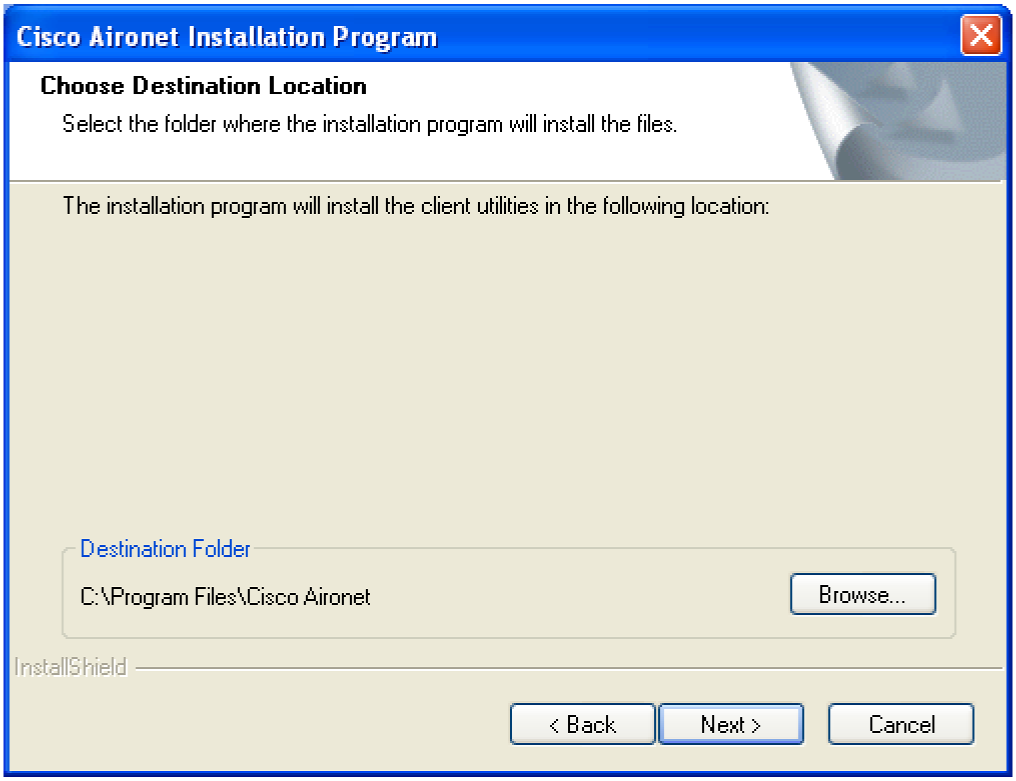
Step 13 Click **Next**.

Step 14 If a message appears indicating that you are required to restart your computer at the end of the installation process, click **Yes**.

Note If you click **No**, you are asked to confirm your decision. If you proceed, the installation process terminates.

The Choose Destination Location screen appears (see Figure 3-11).

Figure 3-11 Choose Destination Location Screen



Cisco Aironet Installation Program

Choose Destination Location

Select the folder where the installation program will install the files.

The installation program will install the client utilities in the following location:

Destination Folder

C:\Program Files\Cisco Aironet

Step 15 Perform one of the following:

- If you selected the first option in Step 12, click **Next** to install the client utility files in the C:\Program Files\Cisco Aironet directory.

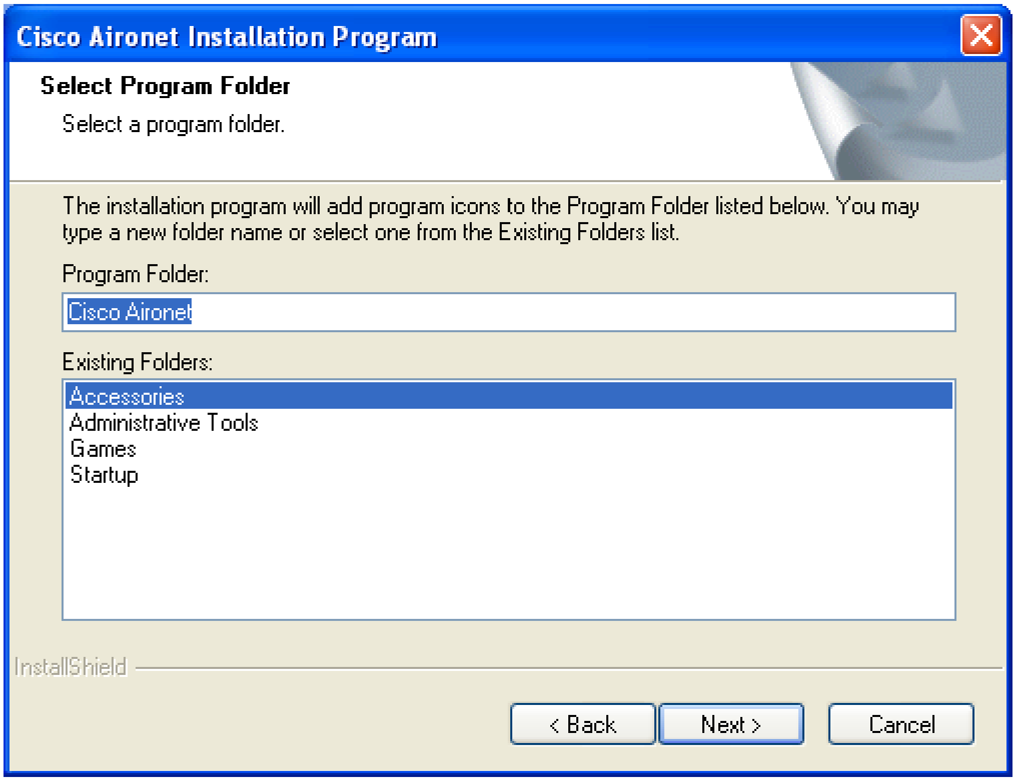
Note If you want to install the client utilities in a different directory, click **Browse**, select a different directory, click **OK**, and click **Next**.

- If you selected the Make Driver Installation Diskette(s) option in Step 12, insert a floppy disk into your computer and click **Next** to copy the driver to the diskette. Go to Step 24.

Note If you want to copy the driver to a different drive or directory, click **Browse**, select a new location, click **OK**, and click **Next**.

Step 16 The Select Program Folder screen appears (see Figure 3-12).

Figure 3-12 Select Program Folder Screen



Cisco Aironet Installation Program

Select Program Folder

Select a program folder.

The installation program will add program icons to the Program Folder listed below. You may type a new folder name or select one from the Existing Folders list.

Program Folder:

Cisco Aironet

Existing Folders:

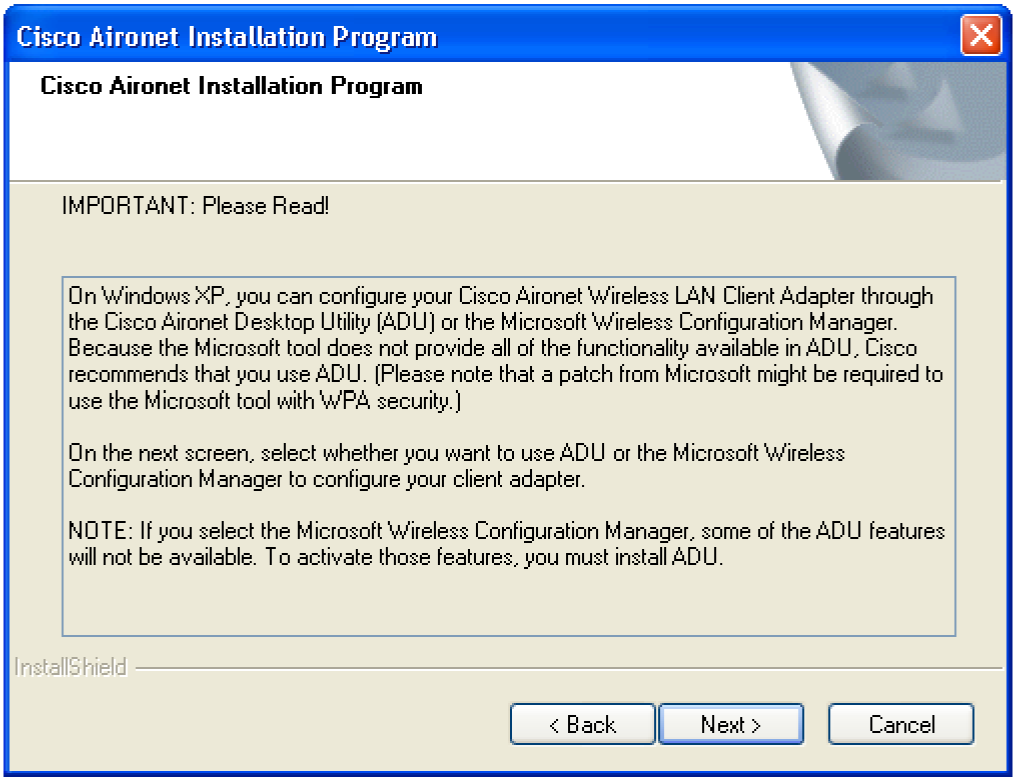
- Accessories
- Administrative Tools
- Games
- Startup

Step 17 Click **Next** to add program icons to the Cisco Aironet program folder.

Note If you want to specify a different program folder, select a folder from the Existing Folders list or type a new folder name in the Program Folder field and click **Next**.

Step 18 If your computer is running Windows 2000, go to Step 24. If your computer is running Windows XP, the IMPORTANT: Please Read! screen appears (see Figure 3-13).

Figure 3-13 IMPORTANT: Please Read! Screen



Cisco Aironet Installation Program
Cisco Aironet Installation Program
InstallShield
< Back
Next >
Cancel

IMPORTANT: Please Read!

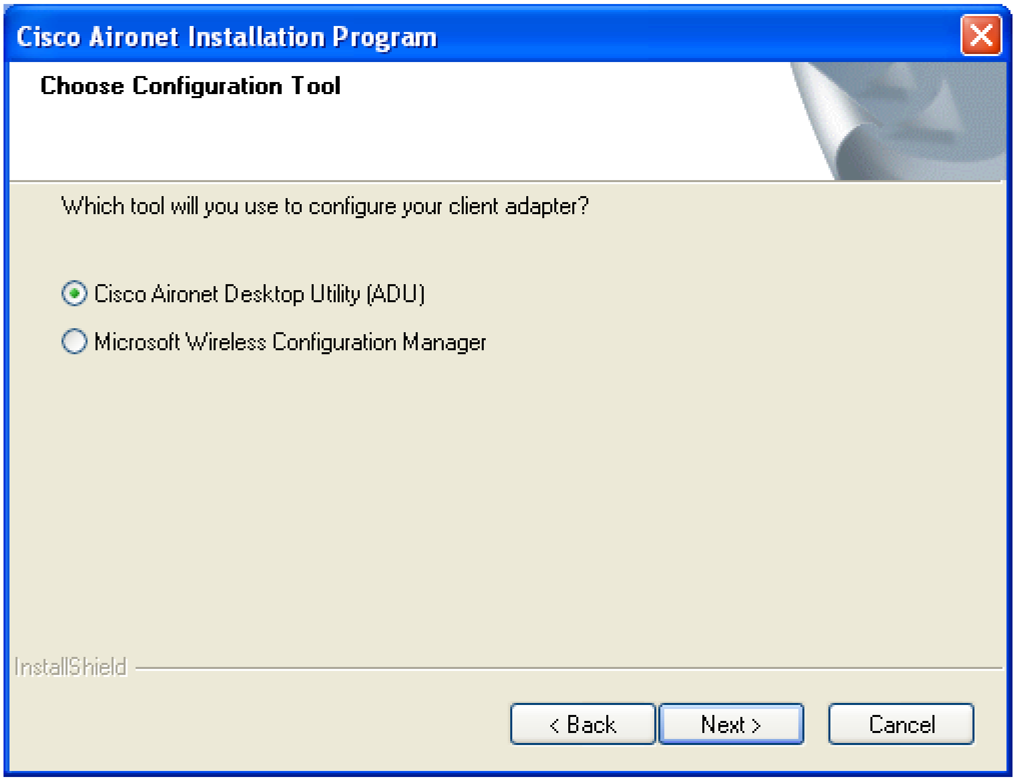
On Windows XP, you can configure your Cisco Aironet Wireless LAN Client Adapter through the Cisco Aironet Desktop Utility (ADU) or the Microsoft Wireless Configuration Manager. Because the Microsoft tool does not provide all of the functionality available in ADU, Cisco recommends that you use ADU. (Please note that a patch from Microsoft might be required to use the Microsoft tool with WPA security.)

On the next screen, select whether you want to use ADU or the Microsoft Wireless Configuration Manager to configure your client adapter.

NOTE: If you select the Microsoft Wireless Configuration Manager, some of the ADU features will not be available. To activate those features, you must install ADU.

Step 19 Read the information displayed and click **Next**. The Choose Configuration Tool screen appears (see Figure 3-14).

Figure 3-14 Choose Configuration Tool Screen


Cisco Aironet Installation Program

Choose Configuration Tool

Which tool will you use to configure your client adapter?

● Cisco Aironet Desktop Utility (ADU)

○ Microsoft Wireless Configuration Manager

Step 20 Select one of the following options:

- **Cisco Aironet Desktop Utility (ADU)**—Enables you to configure your client adapter using ADU.
- **Microsoft Wireless Configuration Manager**—Enables you to configure your client adapter using the Microsoft Wireless Configuration Manager in Windows XP.

To help you with your decision, Table 3-1 compares the Windows XP and ADU client adapter features.

Table 3-1 Comparison of Windows XP and ADU Client Adapter Features

Feature	Windows XP	ADU
Configuration parameters	Limited	Extensive
Capabilities		
Create profiles	No	Yes
Turn radio on or off	No	Yes
Security		
Static WEP	Yes	Yes
LEAP authentication with dynamic WEP	No	Yes
EAP-TLS or PEAP authentication	Yes	Yes

Table 3-1 Comparison of Windows XP and ADU Client Adapter Features (continued)

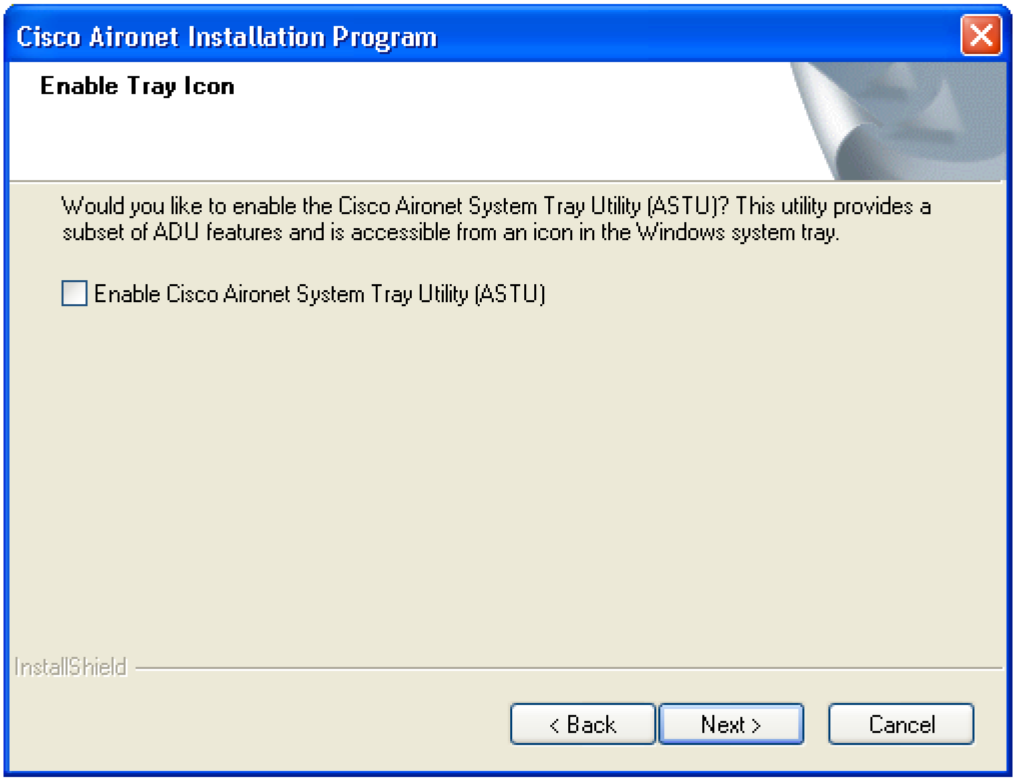
Feature	Windows XP	ADU
Diagnostics		
Status screen	Limited	Extensive
Statistics screen (transmit & receive)	No	Yes

Note If you select Cisco Aironet Desktop Utility (ADU), the Microsoft Wireless Configuration Manager is disabled. If you ever manually enable it, you are prompted to disable it whenever ADU is activated.

Step 21 Click **Next**.

Step 22 If you selected Cisco Aironet Desktop Utility (ADU) in Step 20, go to Step 24. If you selected Microsoft Wireless Configuration Manager, the Enable Tray Icon screen appears (see Figure 3-15).

Figure 3-15 Enable Tray Icon Screen



Cisco Aironet Installation Program

Enable Tray Icon

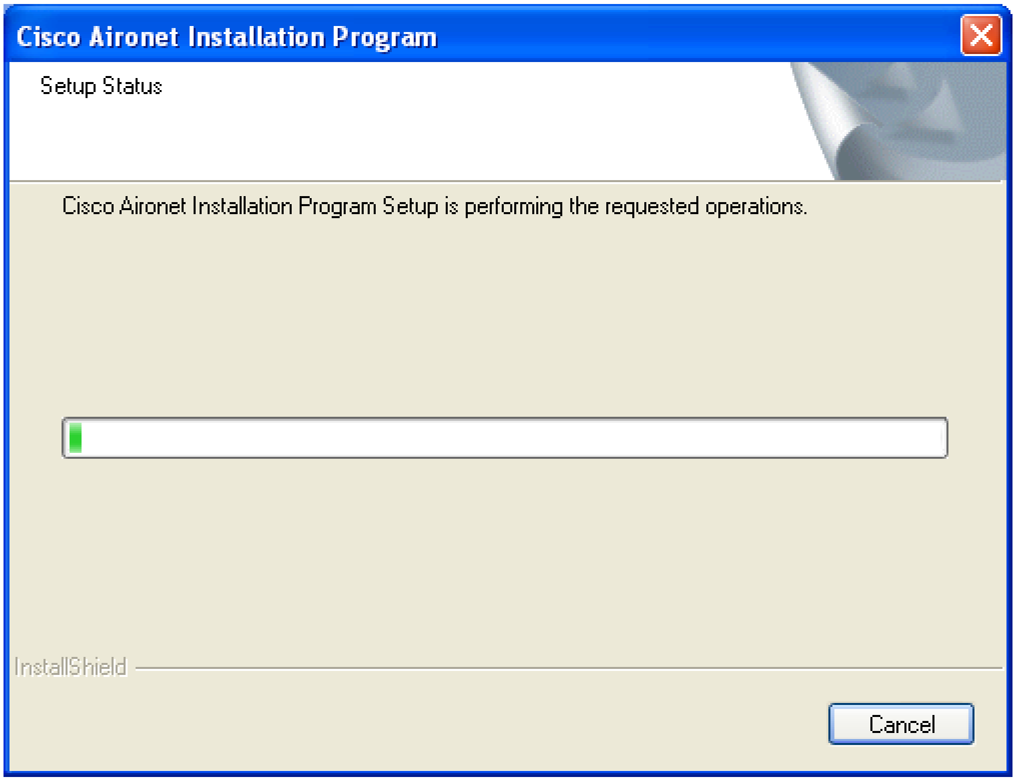
Would you like to enable the Cisco Aironet System Tray Utility (ASTU)? This utility provides a subset of ADU features and is accessible from an icon in the Windows system tray.

□ Enable Cisco Aironet System Tray Utility (ASTU)

Step 23 Check the **Enable Cisco Aironet System Tray Utility (ASTU)** check box if you want to be able to use ASTU even though you have chosen to configure your client adapter through Windows instead of ADU.

Step 24 When prompted to insert your client adapter, click **OK**. The Setup Status screen appears (see Figure 3-16).

Figure 3-16 Setup Status Screen



Cisco Aironet Installation Program

Setup Status

Cisco Aironet Installation Program Setup is performing the requested operations.

The installation process begins, and you are notified as each software component is installed.

Note This process may take several minutes.

Step 25 When a message appears indicating that your computer needs to be rebooted, click **OK** and allow your computer to restart.

Note This process may take several minutes.

Step 26 After your computer reboots, the Windows Found New Hardware Wizard appears. Click **Next**, allow the wizard to install the software for the client adapter, and click **Finish**.

Step 27 If your computer is not connected to a DHCP server and you plan to use TCP/IP, follow the steps below for your operating system.

- **Windows 2000**—Double-click **My Computer**, **Control Panel**, and **Network and Dial-up Connections**. Right-click **Local Area Connection *x*** (where *x* represents the number of the connection). Click **Properties**. In the Components Checked Are Used by This Connection field, select **Internet Protocol (TCP/IP)** and click **Properties**. Click **Use the following IP address** and enter the IP address, subnet mask, and default gateway address of your computer (which can be obtained from your system administrator). Click **OK** twice.
- **Windows XP**—Double-click **My Computer**, **Control Panel**, and **Network Connections**. Right-click **Wireless Network Connection *x*** (where *x* represents the number of the connection). Click **Properties**. In the This Connection Uses the Following Items field, select **Internet Protocol (TCP/IP)** and click **Properties**. Select **Use the following IP address** and enter the IP address, subnet mask, and default gateway address of your computer (which can be obtained from your system administrator). Click **OK** twice.

Step 28 If you are prompted to restart your computer, click **Yes**.

Step 29 Go to the "Verifying Installation" section below to determine if the installation was successful.

Verifying Installation

To verify that you have properly installed the client adapter software, check the client adapter's LEDs. If the installation was successful, the client adapter's green LED blinks.

Note If your installation was unsuccessful or you experienced problems during or after installation, refer to Chapter 10 for troubleshooting information.

Now that your client adapter is properly installed, it is ready to be configured.

- If you are planning to configure your client adapter through ADU, go to Chapter 4 to create configuration profiles.
- If you are planning to configure your client adapter through Windows XP's Wireless Configuration Manager, go to Appendix E.

CHAPTER 4

Using the Profile Manager

This chapter explains how to use ADU's profile manager feature to create and manage profiles for your client adapter.

The following topics are covered in this chapter:

- Overview of Profile Manager, page 4-2
- Opening Profile Manager, page 4-2
- Creating a New Profile, page 4-4
- Including a Profile in Auto Profile Selection, page 4-7
- Selecting the Active Profile, page 4-8
- Modifying a Profile, page 4-9
- Importing and Exporting Profiles, page 4-10

Overview of Profile Manager

ADU's profile manager feature allows you to create and manage up to 16 *profiles* (or saved configurations) for your client adapter. These profiles enable you to use your client adapter in different locations, each of which requires different configuration settings. For example, you may want to set up profiles for using your client adapter at the office, at home, and in public areas such as airports. Once the profiles are created, you can easily switch between them without having to reconfigure your client adapter each time you enter a new location.

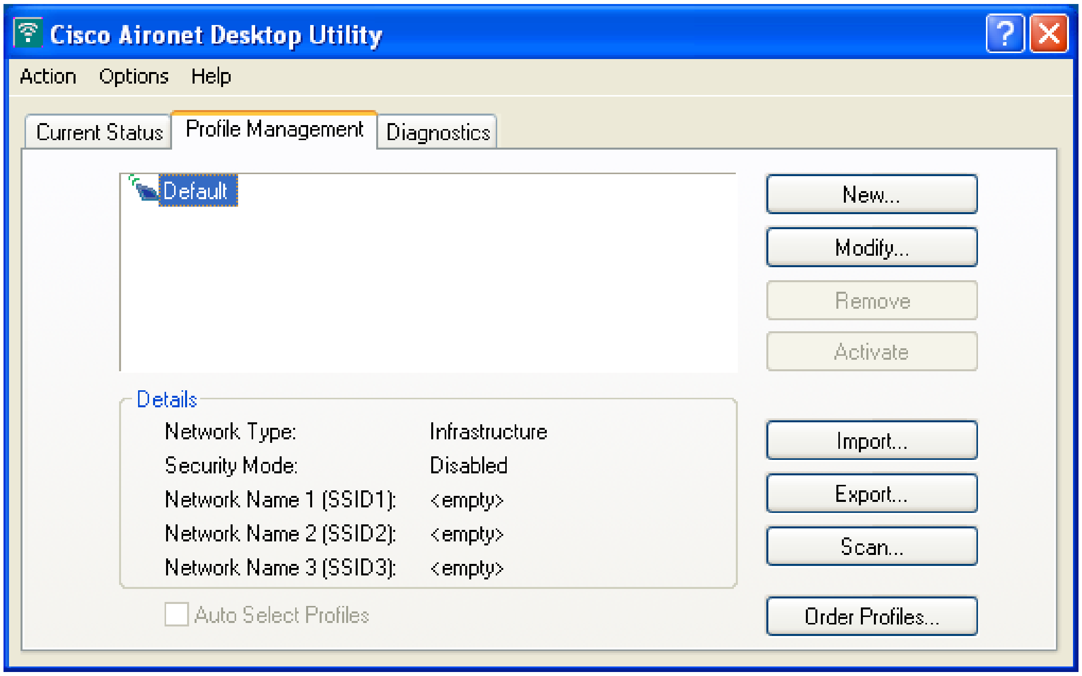
Profiles are stored in the registry and are lost if you uninstall the client adapter's software. To prevent your profiles from becoming lost, Cisco recommends that you back up your profiles using the profile manager's import/export feature. See the "Importing and Exporting Profiles" section on page 4-10 for details.

Opening Profile Manager

Step 1 To open ADU's profile manager, double-click the **Aironet Desktop Utility** icon on your desktop.

Step 2 Click the **Profile Management** tab. The Cisco Aironet Desktop Utility (Profile Management) screen appears (see Figure 4-1).

Figure 4-1 Cisco Aironet Desktop Utility (Profile Management) Screen



Network Type: Infrastructure
Security Mode: Disabled
Network Name 1 (SSID1): <empty>
Network Name 2 (SSID2): <empty>
Network Name 3 (SSID3): <empty>

Note The profile manager feature provides you with a default profile that is configured to use default values. This profile is named *Default* and appears in the profiles list on the Cisco Aironet Desktop Utility (Profile Management) screen. You can use this profile as is or modify it by following the instructions in the "Modifying a Profile" section on page 4-9.

Table 4-1 provides a description of the status fields on the Cisco Aironet Desktop Utility (Profile Management) screen.

Table 4-1 Description of Status Fields on Profile Management Screen

Field	Description
Network Type	The type of network that is configured for the selected profile. **Value:** Infrastructure or Ad Hoc **Note** Refer to the Network Type parameter in Table 5-3 for instructions on setting the network type.
Security Mode	The type of security that is configured for the selected profile. **Value:** Disabled, Pre-Shared Keys (Static WEP), Pre-Shared Keys, LEAP, EAP-TLS, PEAP (EAP-GTC), or PEAP (EAP-MSCHAP V2)
Network Name 1 (SSID1)	The service set identifier (SSID) is the wireless network that is configured for the selected profile. **Note** Refer to the SSID1 parameter in Table 5-2 for instructions on setting SSID1.
Network Name 2 (SSID2)	An optional SSID that is configured for the selected profile. It identifies a second distinct network and enables the client adapter to roam to that network without having to be reconfigured. **Note** Refer to the SSID2 parameter in Table 5-2 for instructions on setting SSID2.
Network Name 3 (SSID3)	An optional SSID that is configured for the selected profile. It identifies a third distinct network and enables the client adapter to roam to that network without having to be reconfigured. **Note** Refer to the SSID3 parameter in Table 5-2 for instructions on setting SSID3.

Profile manager allows you to perform the following tasks related to the management of profiles:

- Create a new profile, page 4-4
- Include a profile in auto profile selection, page 4-7
- Select the active profile, page 4-8
- Edit a profile, page 4-9
- Delete a profile, page 4-9
- Import a profile, page 4-10
- Export a profile, page 4-11

Follow the instructions on the page indicated for the task you want to perform.

Note If your system administrator used an administrative tool to deactivate certain parameters, these parameters are grayed out and cannot be selected.

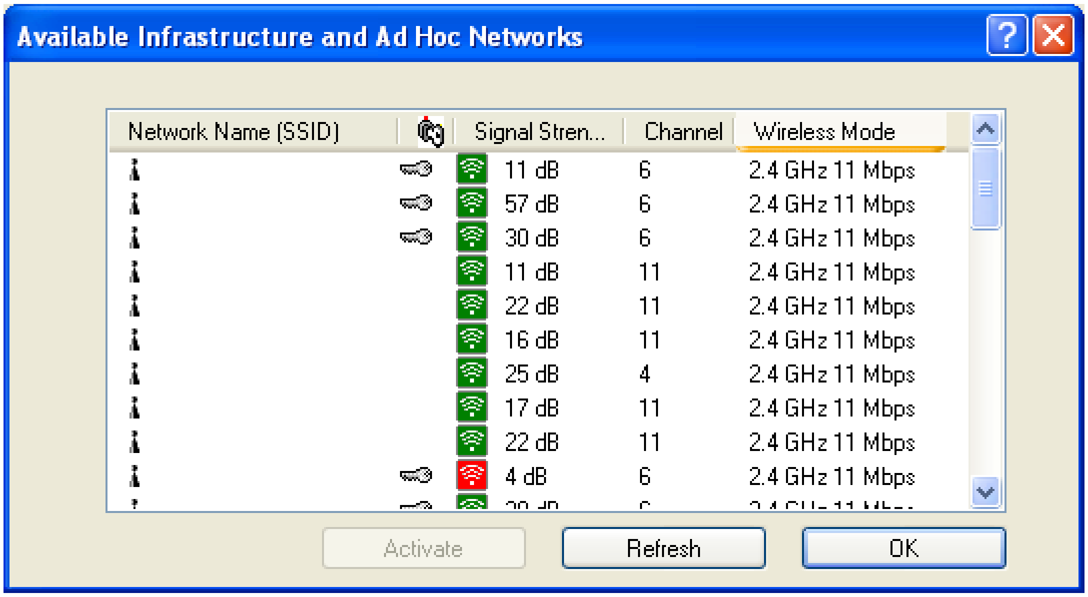
Creating a New Profile

Follow the steps below to create a new profile.

Step 1 Perform one of the following:

- If you want to create a new profile from scratch, click **New** on the Cisco Aironet Desktop Utility (Profile Management) screen. Then go to Step 4.
- If you want to find an available network and create a profile based on it, click **Scan** on the Cisco Aironet Desktop Utility (Profile Management) screen. The Available Infrastructure and Ad Hoc Networks screen appears (see Figure 4-2).

Figure 4-2 Available Infrastructure and Ad Hoc Networks Screen



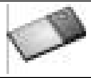
Network Name (SSID)		Signal Stren...	Channel	Wireless Mode
	🔑	🟩 11 dB	6	2.4 GHz 11 Mbps
	🔑	🟩 57 dB	6	2.4 GHz 11 Mbps
	🔑	🟩 30 dB	6	2.4 GHz 11 Mbps
		🟩 11 dB	11	2.4 GHz 11 Mbps
		🟩 22 dB	11	2.4 GHz 11 Mbps
		🟩 16 dB	11	2.4 GHz 11 Mbps
		🟩 25 dB	4	2.4 GHz 11 Mbps
		🟩 17 dB	11	2.4 GHz 11 Mbps
		🟩 22 dB	11	2.4 GHz 11 Mbps
	🔑	🟥 4 dB	6	2.4 GHz 11 Mbps

This screen displays a list of all available networks.

Note The Allow Broadcast SSID to Associate option on the access point must be enabled for the SSID to appear in the list of available networks.

Table 4-2 provides a description of the fields on the Available Infrastructure and Ad Hoc Networks screen.

Table 4-2 Description of Available Infrastructure and Ad Hoc Networks Screen

<table>
<tr><th>Field</th><th>Description</th></tr>
<tr><td>Network Name (SSID)</td><td>The service set identifier (SSID) indicates the name of an available wireless network. The icons to the left of the SSIDs provide information on network type and link status.
<table>
<tr><th>Icon</th><th>Description</th></tr>
<tr><td> </td><td>An available infrastructure network.</td></tr>
<tr><td> </td><td>The infrastructure network to which your client adapter is currently associated.</td></tr>
<tr><td></td><td>An available ad hoc network.</td></tr>
<tr><td> </td><td>The ad hoc network to which your client adapter is currently associated.</td></tr>
</table></td></tr>
<tr><td>Key icon 🔑</td><td>SSIDs that are designated with a key icon are being advertised as secure networks.</td></tr>
<tr><td>Signal Strength</td><td>The signal strength for all received packets. The higher the value, the stronger the signal.
Note The color of this parameter's icon provides a visual interpretation of signal strength: Excellent or Good (green), Fair (yellow), Poor (red).
Note The signal strength is displayed either in decibels (dB) or as a percentage (%), depending on the value selected for the Signal Strength Display Units parameter on the Display Settings screen. See the "Setting Parameters that Affect ADU Diagnostic Tools" section on page 7-2 for more information.</td></tr>
<tr><td>Channel</td><td>The channel that the access point is using for communications.</td></tr>
<tr><td>Wireless Mode</td><td>The frequency and rate at which the access point is configured to transmit and receive packets.</td></tr>
</table>

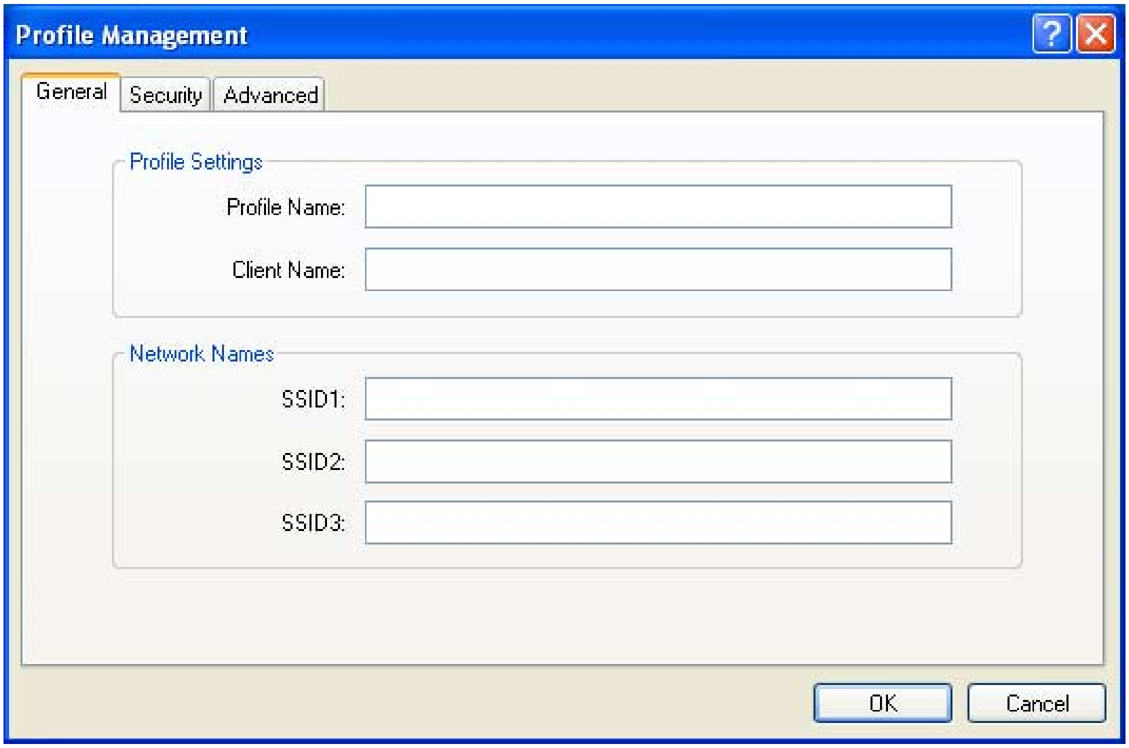
The information on the Available Infrastructure and Ad Hoc Networks screen is updated at the rate specified by the Refresh Interval parameter on the Display Settings screen. See the "Setting Parameters that Affect ADU Diagnostic Tools" section on page 7-2 for more information. You can also click the **Refresh** button to update the list of available networks.

Step 2 Scroll down to see the full list of available networks.

Step 3 Click on the SSID of the network to which you want your client adapter to associate and click **Activate**.

Step 4 When the Profile Management (General) screen appears (see Figure 4-3), enter a name for your new profile (such as *Office*, *Home*, etc.) in the Profile Name field.

Figure 4-3 Profile Management (General) Screen



Step 5 Perform one of the following:

- If you want this profile to use the default values, click **OK**. The profile is added to the profiles list on the Cisco Aironet Desktop Utility (Profile Management) screen.

  Note If you are creating a profile after scanning for an available network, the SSID of the network appears in the SSID1 field.

- If you want to change any of the configuration parameter settings, follow the instructions in Chapter 5. The profile is added to the profiles list on the Cisco Aironet Desktop Utility (Profile Management) screen.

Note The profiles for PC-Cardbus cards are tied to the slot in which the card is inserted. Therefore, you must always insert your PC-Cardbus card into the same slot, create profiles for both slots, or export the profiles from one slot and import them for the other slot.

Including a Profile in Auto Profile Selection

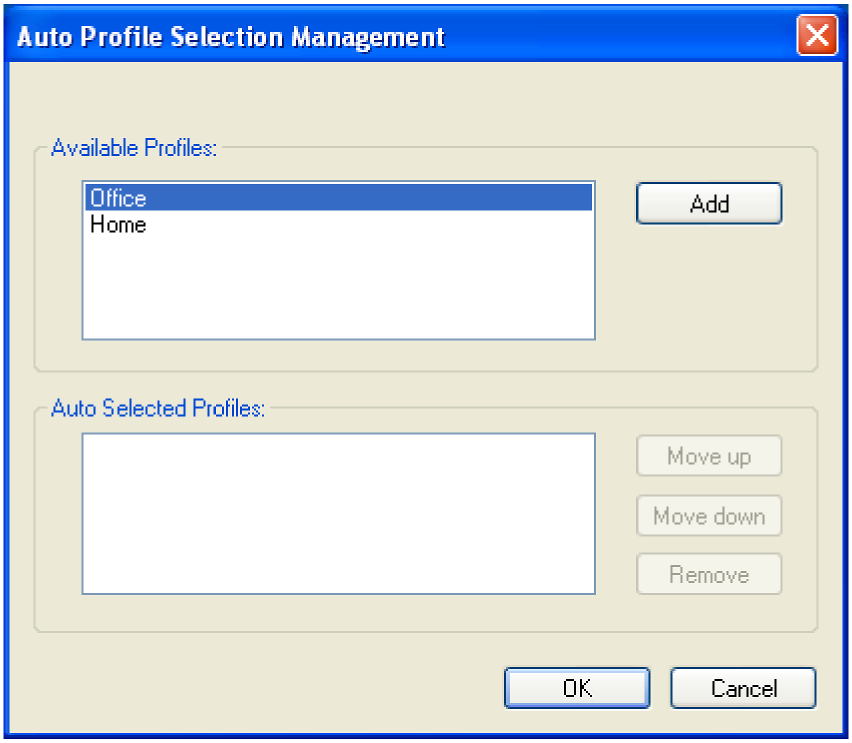
After you have created profiles for your client adapter, you can choose to include them in the profile manager's auto profile selection feature. Then when auto profile selection is enabled, the client adapter automatically selects a profile from the list of profiles that were included in auto profile selection and uses it to establish a connection to the network.

Follow the steps below to include any of your profiles in auto profile selection and to establish the order in which the profiles will be selected for use.

Step 1 Open ADU and click the **Profile Management** tab.

Step 2 Click **Order Profiles**. The Auto Profile Selection Management screen appears (see Figure 4-4).

Figure 4-4 Auto Profile Selection Management Screen



Step 3 All the profiles that you created are listed in the Available Profiles box. Highlight each one that you want to include in auto profile selection and click the **Add** button. The profiles appear in the Auto Selected Profiles box.

The following rules apply to auto profile selection:

- You must include at least two profiles in the Auto Selected Profiles box.
- The profiles must specify an SSID; otherwise, they do not appear in the Available Profiles box.
- Profiles cannot specify multiple SSIDs; otherwise, they do not appear in the Available Profiles box.

- Each profile that is included in auto profile selection must have a unique SSID. For example, if Profile A and Profile B both have "ABCD" as their SSID, only Profile A or Profile B (whichever one was created first) appears in the Available Profiles box and can be included in auto profile selection.

Note If you ever want to remove a profile from auto profile selection, highlight the profile in the Auto Selected Profiles box and click **Remove**. The profile is removed from the Auto Selected Profiles box.

Step 4 The first profile in the Auto Selected Profiles box has the highest priority while the last profile has the lowest priority. To change the order (and priority) of your auto-selectable profiles, highlight the profile that you want to move and click **Move up** or **Move down** to move the profile up or down, respectively.

Step 5 Click **OK**.

When auto profile selection is enabled (see the "Selecting the Active Profile" section below for instructions), the client adapter scans for an available network. The profile with the highest priority and the same SSID as one of the found networks is the one that is used to connect to the network. If the connection fails, the client adapter tries the next highest priority profile that matches the SSID and so on.

Selecting the Active Profile

Follow the steps below to specify the profile that the client adapter is to use.

Note You can use ASTU instead of ADU's Profile Manager to select the active profile. Refer to Chapter 8 for instructions.

Step 1 Open ADU and click the **Profile Management** tab. The Cisco Aironet Desktop Utility (Profile Management) screen appears (see Figure 4-1).

Step 2 Perform one of the following:

- Select one profile for the client adapter to use by clicking on that profile in the profiles list.

  If the client adapter cannot associate to an access point or loses association while using the selected profile, the adapter does not attempt to associate using another profile. To associate, you must select a different profile or activate auto profile selection.

- Enable auto profile selection by checking the **Auto Select Profiles** check box.

  This option causes the client adapter's driver to automatically select a profile from the list of profiles that were set up to be included in auto profile selection.

  If the client adapter loses association for more than 10 seconds (or for more than the time specified by the LEAP authentication timeout value on the LEAP Settings screen if LEAP is enabled), the driver switches automatically to another profile that is included in auto profile selection. The adapter will not switch profiles as long as it remains associated or reassociates within 10 seconds (or within the time specified by the LEAP authentication timeout value). To force the client adapter to associate to a different access point, you must uncheck the **Auto Select Profiles** check box and select a new profile from the profiles list.

Note This option is available only if two or more profiles are included in auto profile selection.

Note Login scripts are not reliable if you use auto profile selection with LEAP. If you LEAP authenticate and achieve full network connectivity before or at the same time as you log into the computer, the login scripts will run. However, if you LEAP authenticate and achieve full network connectivity after you log into the computer, the login scripts will not run.

- Click **Scan**. The Available Infrastructure and Ad Hoc Networks screen appears (see Figure 4-2). Double-click the SSID of a network that is used by one of your profiles and click **OK**. Go to Step 4.

Step 3 Click **Activate** to save your selection.

Step 4 The client adapter starts using a profile based on the option selected above. The active profile is designated by the following icon in the profiles list:

Modifying a Profile

This section provides instructions for modifying an existing profile. Follow the steps in the corresponding section below to edit or delete a profile.

Editing a Profile

Step 1 Open ADU and click the **Profile Management** tab. The Cisco Aironet Desktop Utility (Profile Management) screen appears (see Figure 4-1).

Step 2 In the profiles list, highlight the profile that you want to edit.

Step 3 Click **Modify**.

Step 4 Follow the instructions in Chapter 5 to change any of the configuration parameters for this profile.

Deleting a Profile

Step 1 Open ADU and click the **Profile Management** tab. The Cisco Aironet Desktop Utility (Profile Management) screen appears (see Figure 4-1).

Step 2 In the profiles list, highlight the profile that you want to delete.

Step 3 Click **Remove**. The profile is deleted.

Importing and Exporting Profiles

This section provides instructions for importing and exporting profiles. You may want to use the import/export feature for the following reasons:

- To back up profiles before uninstalling client adapter software
- To export profiles for a PC-Cardbus card in one Cardbus slot and export them for use with a second Cardbus slot
- To set up your computer with a profile from another computer
- To export one of your profiles and use it to set up additional computers

Follow the steps in the corresponding section below to import or export profiles.

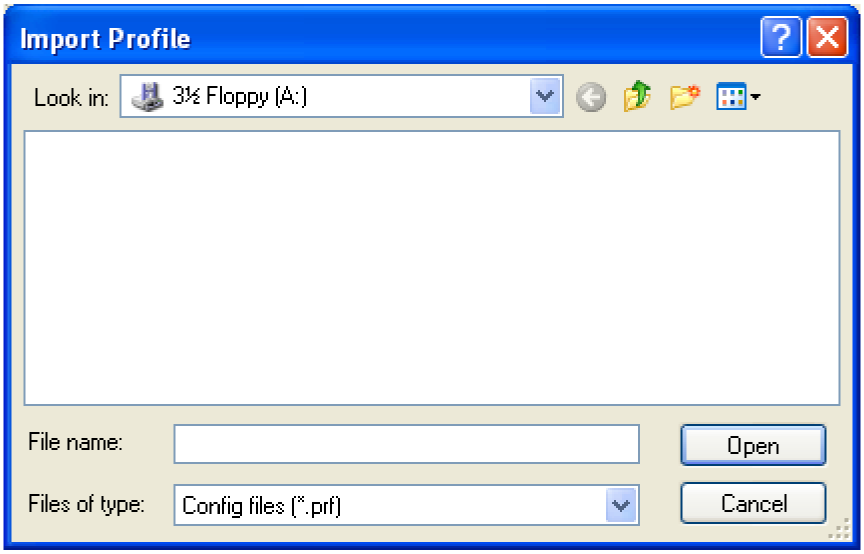
Importing a Profile

Step 1 If the profile that you want to import is on a floppy disk, insert the disk into your computer's floppy drive.

Step 2 Open ADU and click the **Profile Management** tab. The Cisco Aironet Desktop Utility (Profile Management) screen appears (see Figure 4-1).

Step 3 Click **Import**. The Import Profile screen appears (see Figure 4-5).

Figure 4-5 Import Profile Screen


Import Profile

Look in: 3½ Floppy (A:)

File name:

Files of type: Config files (*.prf)

Step 4 In the Look in drop-down box, find the directory where the profile is located.

Step 5 Select the profile that you want to import so it appears in the File name box at the bottom of the screen.

Step 6 Click **Open**. The imported profile appears in the profiles list on the Cisco Aironet Desktop Utility (Profile Management) screen.

Exporting a Profile

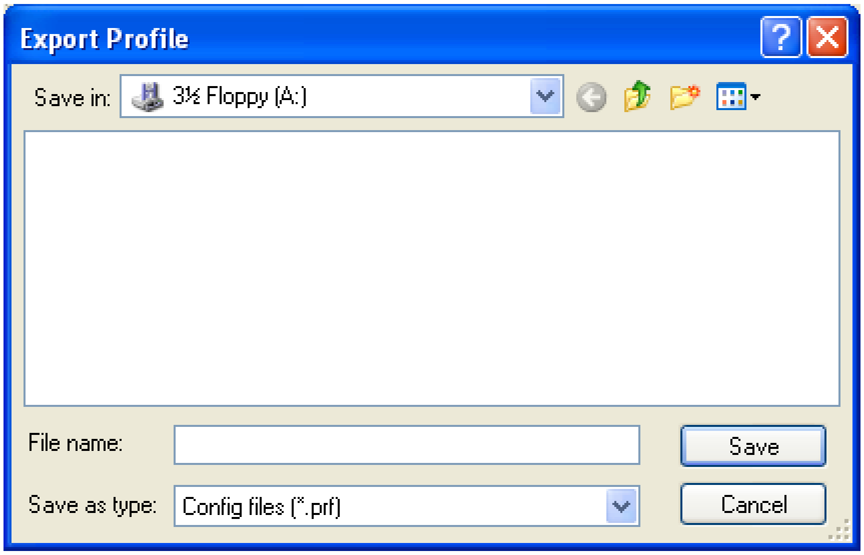
Step 1 Insert a blank floppy disk into your computer's floppy drive, if you wish to export a profile to a floppy disk.

Step 2 Open ADU and click the **Profile Management** tab. The Cisco Aironet Desktop Utility (Profile Management) screen appears (see Figure 4-1).

Step 3 In the profiles list, select the profile that you want to export.

Step 4 Click **Export**. The Export Profile screen appears (see Figure 4-6).

Figure 4-6 Export Profile Screen



The profile name appears in the File name box.

Step 5 Select a directory (for example, your computer's floppy disk drive or a location on the network) from the Save in drop-down box.

Note The default location is the Profiles folder in the directory where ADU is installed (for example, C:\Program Files\Cisco Aironet\Profiles).

Step 6 Click **Save**. The profile is exported to the specified location.

Step 7 Follow the instructions in the "Importing a Profile" section to import the profile on another computer.

CHAPTER 5

Configuring the Client Adapter

This chapter explains how to change the configuration parameters for a specific profile. The following topics are covered in this chapter:

Overview

When you choose to create a new profile or modify an existing profile on the Cisco Aironet Desktop Utility (Profile Management) screen, the Profile Management screens appear. These screens enable you to set the configuration parameters for that profile.

Note If you do not change any of the configuration parameters, the default values are used.

Note If you are planning to set parameters on more than one of the Profile Management screens, wait until you are finished with all of the screens before clicking **OK**. When you click **OK**, you are returned to the Cisco Aironet Desktop Utility (Profile Management) screen.

Each of the Profile Management screens (listed below) contains parameters that affect a specific aspect of the client adapter:

- **General**—Prepares the client adapter for use in a wireless network
- **Advanced**—Controls how the client adapter operates within an infrastructure or ad hoc network
- **Security**—Controls how a client adapter associates to an access point, authenticates to the wireless network, and encrypts and decrypts data

Table 5-1 enables you to quickly locate instructions for setting each Profile Management screen's parameters.

Table 5-1 Locating Configuration Instructions

Parameter Category	Page Number
General	page 5-3
Advanced	page 5-5
Security	page 5-10

Setting General Parameters

The Profile Management (General) screen (see Figure 5-1) enables you to set parameters that prepare the client adapter for use in a wireless network. This screen appears after you click **New** or **Modify** on the Cisco Aironet Desktop Utility (Profile Management) screen.

Figure 5-1 Profile Management (General) Screen

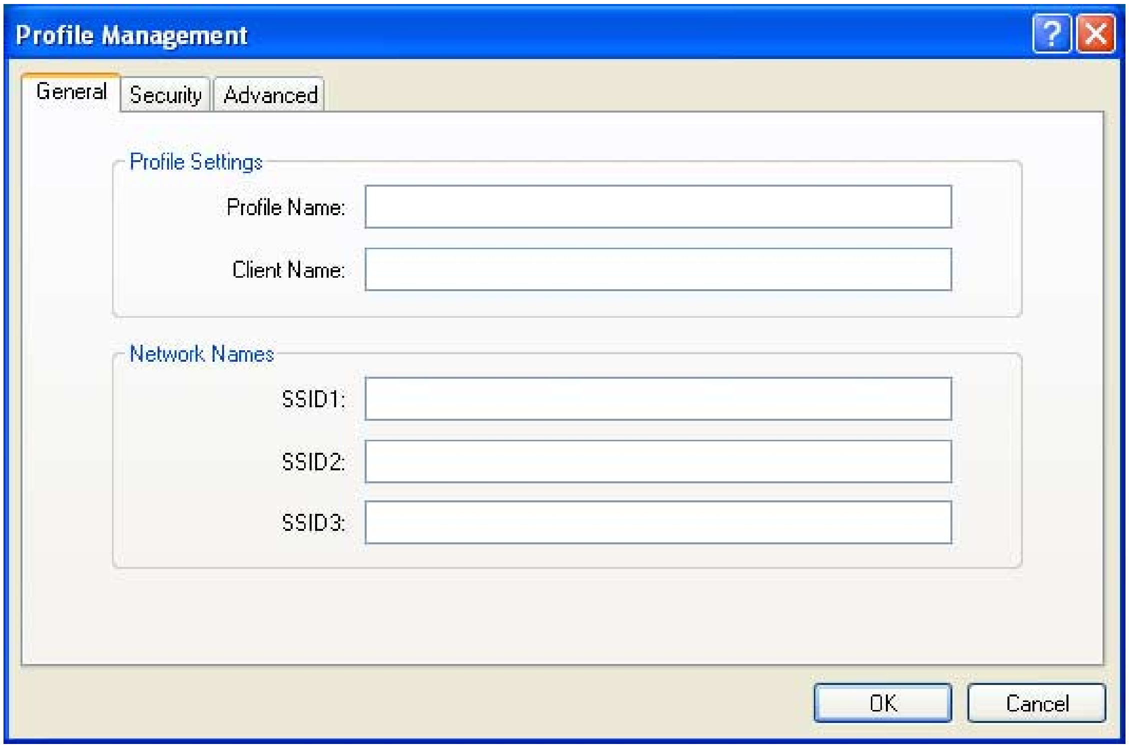


Table 5-2 lists and describes the client adapter's general parameters. Follow the instructions in the table to change any parameters.

Table 5-2 Profile Management General Parameters

Parameter	Description
Profile Name	The name assigned to the configuration profile. **Range:** You can key in up to 32 ASCII characters
Client Name	A logical name for your workstation. It allows an administrator to determine which devices are connected to the access point without having to memorize every MAC address. This name is included in the access point's list of connected devices. The client name is filled in automatically but can be changed. **Range:** You can key in up to 16 ASCII characters **Default:** The name of your computer **Note** Each computer on the network should have a unique client name.

Table 5-2 Profile Management General Parameters (continued)

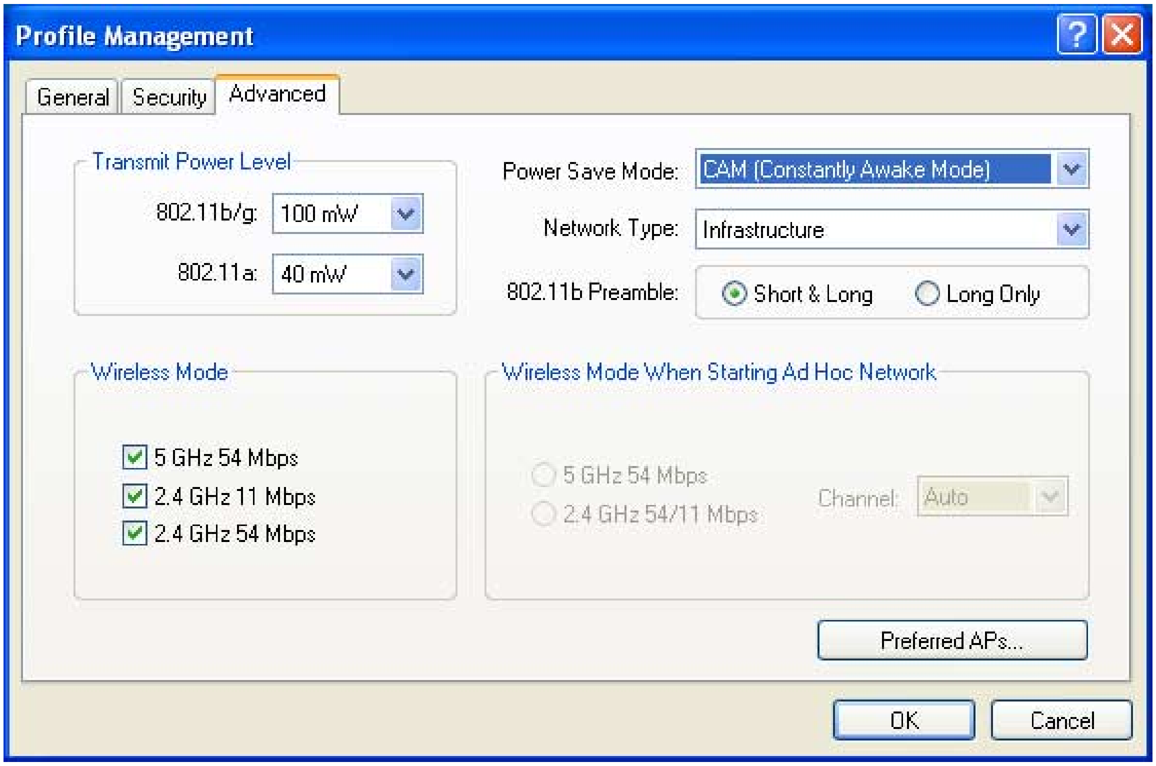
Parameter	Description
SSID1	The service set identifier (SSID) identifies the specific wireless network that you want the client adapter to access. **Range:** You can key in up to 32 ASCII characters (case sensitive) **Default:** A blank field **Note** If you leave this parameter blank, your client adapter can associate to any access point on the network that is configured to allow broadcast SSIDs. If the access point with which the client adapter is to communicate is not configured to allow broadcast SSIDs, the value of this parameter must match the SSID of the access point. Otherwise, the client adapter is unable to access the network.
SSID2	An optional SSID that identifies a second distinct network and enables the client adapter to roam to that network without having to be reconfigured. **Range:** You can key in up to 32 ASCII characters (case sensitive) **Default:** A blank field **Note** If a profile specifies more than one SSID, it cannot be included in auto profile selection. **Note** This field is unavailable for any profiles that are included in auto profile selection or configured for use in an ad hoc network.
SSID3	An optional SSID that identifies a third distinct network and enables the client adapter to roam to that network without having to be reconfigured. **Range:** You can key in up to 32 ASCII characters (case sensitive) **Default:** A blank field **Note** If a profile specifies more than one SSID, it cannot be included in auto profile selection. **Note** This field is unavailable for any profiles that are included in auto profile selection or configured for use in an ad hoc network.

Go to the next section to set additional parameters or click **OK** to save your changes and return to the Cisco Aironet Desktop Utility (Profile Management) screen.

Setting Advanced Parameters

The Profile Management (Advanced) screen (see Figure 5-2) enables you to set parameters that control how the client adapter operates within an infrastructure or ad hoc network. To access this screen, select the **Advanced** tab from any Profile Management screen.

Figure 5-2 Profile Management (Advanced) Screen



Transmit Power Level

802.11b/g: 100 mW

802.11a: 40 mW

Power Save Mode: CAM (Constantly Awake Mode)

Network Type: Infrastructure

802.11b Preamble: ● Short & Long ○ Long Only

Wireless Mode

☑ 5 GHz 54 Mbps
☑ 2.4 GHz 11 Mbps
☑ 2.4 GHz 54 Mbps

Wireless Mode When Starting Ad Hoc Network

○ 5 GHz 54 Mbps
○ 2.4 GHz 54/11 Mbps

Channel: Auto

Table 5-3 lists and describes the client adapter's advanced parameters. Follow the instructions in the table to change any parameters.

Table 5-3 Profile Management Advanced Parameters

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>Transmit Power Level</td><td>Defines the power level at which your client adapter transmits. This value must not be higher than that allowed by your country’s regulatory agency (FCC in the U.S., DOC in Canada, ETSI in Europe, MKK in Japan, etc.).
<b>Options:</b> Dependent on the radio band used and the power table programmed into the client adapter; see the table below
<b>Default:</b> The maximum power level programmed into the client adapter and allowed by your country’s regulatory agency
<table>
<tr><th>Radio Band</th><th>Transmit Power Level</th></tr>
<tr><td>802.11b/g</td><td>10, 20, 32, 50, 63, or 100 mW</td></tr>
<tr><td>802.11a</td><td>10, 13, 20, 25, or 40 mW</td></tr>
</table>
<b>Note</b> Reducing the transmit power level conserves battery power but decreases radio range.</td></tr>
</table>

Table 5-3 Profile Management Advanced Parameters (continued)

<table>
<tr><th>Parameter</th><th colspan="2">Description</th></tr>
<tr><td rowspan="6">Power Save Mode</td><td colspan="2">Sets your client adapter to its optimum power consumption setting.
Options: CAM (Constantly Awake Mode), Fast PSP (Power Save Mode), or Max PSP (Max Power Saving)
Default: CAM (Constantly Awake Mode)</td></tr>
<tr><td>**Power Save Mode**</td><td>**Description**</td></tr>
<tr><td>CAM (Constantly Awake Mode)</td><td>Keeps the client adapter powered up continuously so there is little lag in message response time.
Consumes the most power but offers the highest throughput. Is recommended for desktop computers and devices that use AC power.</td></tr>
<tr><td>Fast PSP (Power Save Mode)</td><td>Switches between PSP mode and CAM mode, depending on network traffic. This mode switches to CAM when retrieving a large number of packets and switches back to PSP after the packets have been retrieved.
Is recommended when power consumption is a concern but you need greater throughput than that allowed by Max PSP.</td></tr>
<tr><td>Max PSP (Max Power Saving)</td><td>Causes the access point to buffer incoming messages for the client adapter, which wakes up periodically and polls the access point to see if any buffered messages are waiting for it. The adapter can request each message and then go back to sleep.
Conserves the most power but offers the lowest throughput. Is recommended for devices for which power consumption is the ultimate concern (such as small battery-powered devices).</td></tr>
<tr><td colspan="2">**Note** If you select Ad Hoc for Network Type, CAM mode is used automatically.</td></tr>
</table>

Table 5-3 Profile Management Advanced Parameters (continued)

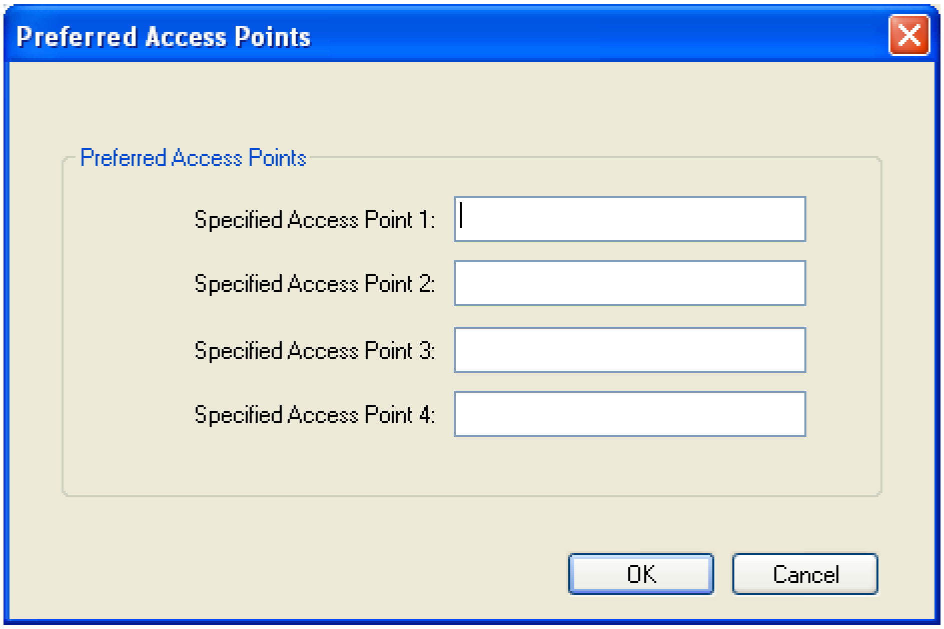
<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>Network Type</td><td>Specifies the type of network in which your client adapter is installed.
<b>Options:</b>Infrastructure or Ad Hoc
<b>Default:</b> Infrastructure
<table>
<tr><th>Network Type</th><th>Description</th></tr>
<tr><td>Ad Hoc</td><td>Often referred to as <i>peer to peer</i>. Indicates that your wireless network consists of a few wireless devices that are not connected to a wired Ethernet network through an access point. For example, an ad hoc network could be set up between computers in a conference room so users can share information in a meeting.</td></tr>
<tr><td>Infrastructure</td><td>Indicates that your wireless network is connected to a wired Ethernet network through an access point.</td></tr>
</table></td></tr>
<tr><td>802.11b Preamble</td><td>Determines whether your client adapter will use both short and long radio headers or only long radio headers. The adapter can use short radio headers only if the access point is also configured to support them and is using them. If any clients associated to an access point are using long headers, then <i>all</i> clients in that cell must also use long headers, even if both this client and the access point have short radio headers enabled.
Short radio headers improve throughput performance; long radio headers ensure compatibility with clients and access points that do not support short radio headers.
<b>Options:</b>Short &amp; Long or Long Only
<b>Default:</b> Short &amp; Long</td></tr>
<tr><td>Wireless Mode</td><td>Specifies the frequency and rate at which your client adapter will transmit or receive packets to or from access points.
<b>Options:</b>5 GHz 54 Mbps, 2.4 GHz 11 Mbps, and 2.4 GHz 54 Mbps
<b>Default:</b> All options selected
<b>Note</b> When more than one option is selected, the client adapter attempts to use the wireless modes in this order: 2.4 GHz 54 Mbps, 5 GHz 54 Mbps, 2.4 GHz 11 Mbps.
<b>Note</b> If you select 2.4 GHz 54 Mbps, the client attempts to associate to access points containing an 802.11b or 802.11g radio. If you select 2.4 GHz 11 Mbps, the client attempts to associate only to access points containing an 802.11b radio.
<b>Note</b> Your client adapter’s wireless mode must match that of the access points with which it is to communicate. Otherwise, your client adapter may not be able to associate to them.</td></tr>
</table>

Table 5-3 Profile Management Advanced Parameters (continued)

Parameter	Description
Wireless Mode When Starting Ad Hoc Network	Specifies the frequency and rate at which your client adapter will transmit or receive packets to or from other clients (in ad hoc mode). **Options:**5 GHz 54 Mbps or 2.4 GHz 54/11 Mbps **Default:** 5 GHz 54 Mbps **Note** Your client adapter's wireless mode must match that of the other clients with which it is to communicate. Otherwise, your client adapter may not be able to associate to them. **Note** The client scans the band(s) specified by the Wireless Mode parameter before creating a new ad hoc cell based on the band specified by the Wireless Mode When Starting Ad Hoc Network parameter.
Channel	Specifies the channel that your client adapter will use for communications in a 2.4-GHz ad hoc network. The available channels conform to the IEEE 802.11 Standard for your regulatory domain. The channel of the client adapter must be set to match the channel used by the other clients in the wireless network. If the client adapter does not find any other ad hoc clients, this parameter specifies the channel with which the adapter will start its cell. **Range:** Dependent on regulatory domain **Example:** 1 to 11 (2412 to 2462 MHz) in North America **Default:** Auto (the client automatically determines the channel on which to start communications) **Note** This parameter is available only when 2.4 GHz 54/11 Mbps is selected for the Wireless Mode When Starting Ad Hoc Network parameter. When 5 GHz 54 Mbps is selected, the Channel parameter is set to Auto automatically. **Note** Refer to Appendix D for a list of channel identifiers, channel center frequencies, and regulatory domains for each channel.

If your client adapter is being configured for use in an infrastructure network and you want to specify up to four access points to which the client adapter should attempt to associate, click **Preferred APs**. The Preferred Access Points screen appears (see Figure 5-3).

Figure 5-3 Preferred Access Points Screen


Preferred Access Points
Preferred Access Points
Specified Access Point 1:
Specified Access Point 2:
Specified Access Point 3:
Specified Access Point 4:
OK
Cancel

Leave the Specified Access Point fields blank or enter the MAC addresses of up to four preferred access points to which the client adapter can associate; then click **OK**. If the specified access points are not found or the client adapter roams out of range, the adapter may associate to another access point.

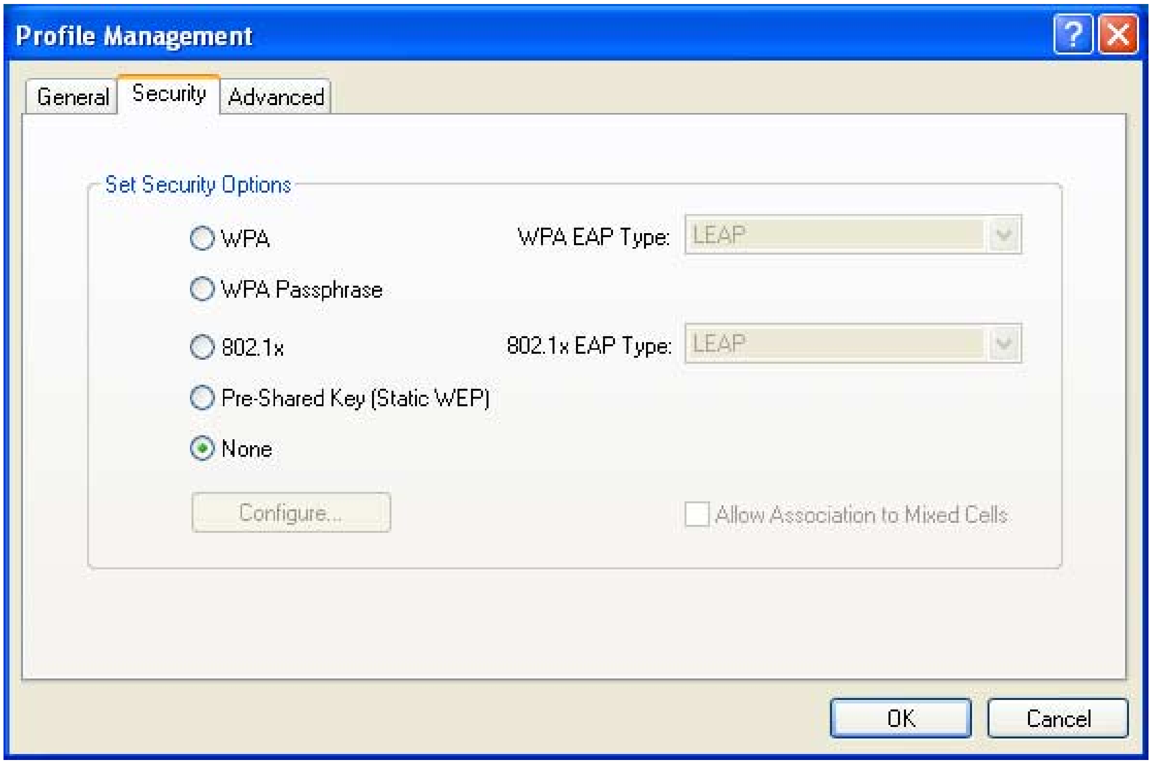
Note This parameter should be used only for access points that are in repeater mode. For normal operation, leave these fields blank because specifying an access point slows down the roaming process.

Go to the next section to set additional parameters or click **OK** to save your changes and return to the Cisco Aironet Desktop Utility (Profile Management) screen.

Setting Security Parameters

The Profile Management (Security) screen (see Figure 5-4) enables you to set parameters that control how the client adapter associates to an access point, authenticates to the wireless network, and encrypts and decrypts data. To access this screen, select the **Security** tab from any Profile Management screen.

Figure 5-4 Profile Management (Security) Screen



Profile Management

General | Security | Advanced

Set Security Options

○ WPA WPA EAP Type: LEAP

○ WPA Passphrase

○ 802.1x 802.1x EAP Type: LEAP

○ Pre-Shared Key (Static WEP)

● None

Configure... □ Allow Association to Mixed Cells

OK Cancel

This screen is different from the other Profile Management screens in that it includes many security features, each of which involves a number of steps. In addition, the security features themselves are complex and need to be understood before they are implemented. Therefore, this section provides an overview of the security features as well as procedures for using them.

However, before you determine the appropriate security settings for your client adapter, you must decide how to set the **Allow Association to Mixed Cells** parameter, which appears at the bottom of the Profile Management (Security) screen and is not associated to any of the security features. See the "Setting the Allow Association to Mixed Cells Parameter" section below.

Setting the Allow Association to Mixed Cells Parameter

The Allow Association to Mixed Cells parameter indicates whether the client adapter can associate to an access point that allows both WEP and non-WEP associations. Follow the steps below to set this parameter.

Step 1 Perform one of the following:

- Check the **Allow Association to Mixed Cells** check box if the access point to which the client adapter is to associate has WEP set to Optional and WEP is enabled on the client adapter. Otherwise, the client is unable to establish a connection with the access point.
- Uncheck the **Allow Association to Mixed Cells** check box if the access point to which the client adapter is to associate does not have WEP set to Optional. This is the default setting.

Note For security reasons, Cisco recommends that WEP-enabled and WEP-disabled clients not be allowed in the same cell because broadcast packets are sent unencrypted, even to clients running WEP.

Step 2 Perform one of the following:

- If you do not want to change any other parameters on the Profile Management (Security) screen, click **OK** to save your changes and return to the Cisco Aironet Desktop Utility (Profile Management) screen.
- If you want to change some of the other parameters on the Profile Management (Security) screen, go to the next section.

Overview of Security Features

You can protect your data as it is transmitted through your wireless network by encrypting it through the use of wired equivalent privacy (WEP) encryption keys. With WEP encryption, the transmitting device encrypts each packet with a WEP key, and the receiving device uses that same key to decrypt each packet.

The WEP keys used to encrypt and decrypt transmitted data can be statically associated with your adapter or dynamically created as part of the EAP authentication process. The information in the "Static WEP Keys" and "EAP (with Dynamic WEP Keys)" sections below can help you to decide which type of WEP keys you want to use. Dynamic WEP keys with EAP offer a higher degree of security than static WEP keys.

WEP keys, whether static or dynamic, are either 40 or 128 bits in length. 128-bit WEP keys offer a greater level of security than 40-bit WEP keys.

Note Refer to the "Additional WEP Key Security Features" section on page 5-16 for information on three security features that can make your WEP keys even more secure.

Static WEP Keys

Each device (or profile) within your wireless network can be assigned up to four static WEP keys. If a device receives a packet that is not encrypted with the appropriate key (as the WEP keys of all devices that are to communicate with each other must match), the device discards the packet and never delivers it to the intended receiver.

Static WEP keys are write-only and temporary; therefore, they cannot be read back from the client adapter, and they are lost when power to the adapter is removed or the Windows device is rebooted. Although the keys are temporary, you do not need to re-enter them each time the client adapter is inserted or the Windows device is rebooted. This is because the keys are stored (in an encrypted format for security reasons) in the registry of the Windows device. When the driver loads and reads the client adapter's registry parameters, it also finds the static WEP keys, unencrypts them, and stores them in volatile memory on the adapter.

The Define Pre-Shared Keys screen enables you to view the WEP key settings for a particular profile and then to assign new WEP keys or overwrite existing WEP keys as well as to enable or disable static WEP. Refer to the "Using Static WEP" section on page 5-20 for instructions.

EAP (with Dynamic WEP Keys)

The standard for wireless LAN security, as defined by the Institute of Electrical and Electronics Engineers (IEEE), is called *802.1X for 802.11*, or simply *802.1X*. An access point that supports 802.1X and its protocol, Extensible Authentication Protocol (EAP), acts as the interface between a wireless client and an authentication server, such as a Remote Authentication Dial-In User Service (RADIUS) server, to which the access point communicates over the wired network.

Four 802.1X authentication types can be selected in ADU for use with Windows 2000 or XP:

- **EAP-Cisco Wireless** (or **LEAP**)—LEAP is enabled or disabled for a specific profile through ADU. ADU offers a variety of LEAP configuration options, including how and when a username and password are entered to begin the authentication process.

  The username and password are used by the client adapter to perform mutual authentication with the RADIUS server through the access point. The username and password are stored in the client adapter's volatile memory; therefore, they are temporary and need to be re-entered whenever power is removed from the adapter, typically due to the client adapter being ejected or the system powering down.

  RADIUS servers that support LEAP include Cisco Secure ACS version 2.6 or greater, Cisco Access Registrar version 1.7 or greater, Funk Software's Steel-Belted RADIUS version 3.0 or greater, and Meetinghouse Data Communications' AEGIS version 1.1 or greater.

- **EAP-TLS**—This authentication type uses a dynamic session-based WEP key, which is derived from the client adapter and RADIUS server, to encrypt data.

  RADIUS servers that support EAP-TLS include Cisco Secure ACS version 3.0 or greater and Cisco Access Registrar version 1.8 or greater.

  Note EAP-TLS requires the use of a certificate. Refer to Microsoft's documentation for information on downloading and installing the certificate.

- **PEAP (EAP-MSCHAP V2)**—This PEAP authentication type supports only a Windows username and password. It is based on EAP-TLS authentication but uses a password instead of a client certificate for authentication. PEAP (EAP-MSCHAP V2) uses a dynamic session-based WEP key, which is derived from the client adapter and RADIUS server, to encrypt data.

  RADIUS servers that support PEAP (EAP-MSCHAP V2) authentication include Cisco Secure ACS version 3.2 or greater.

- **PEAP (EAP-GTC)**—This PEAP authentication type is designed to support One-Time Password (OTP) and Windows NT or 2000 domain user databases over a wireless LAN. It is based on EAP-TLS authentication but uses a password or PIN instead of a client certificate for authentication. PEAP (EAP-GTC) uses a dynamic session-based WEP key, which is derived from the client adapter and RADIUS server, to encrypt data. If your network uses an OTP user database, PEAP (EAP-GTC) requires you to enter a software token PIN to start the EAP authentication process and gain access to the network. If your network uses a Windows NT or 2000 domain user database, PEAP (EAP-GTC) requires you to enter your username, password, and domain name in order to start the authentication process.

  RADIUS servers that support PEAP (EAP-GTC) authentication include Cisco Secure ACS version 3.1 or greater.

When you enable Network-EAP or Require EAP on your access point and configure your client adapter for LEAP, EAP-TLS, or PEAP, authentication to the network occurs in the following sequence:

1. The client associates to an access point and begins the authentication process.

   Note The client does not gain full access to the network until authentication between the client and the RADIUS server is successful.

2. Communicating through the access point, the client and RADIUS server complete the authentication process, with the password (LEAP and PEAP) or certificate (EAP-TLS) being the shared secret for authentication. The password or internal key is never transmitted during the process.
3. If authentication is successful, the client and RADIUS server derive a dynamic, session-based WEP key that is unique to the client.
4. The RADIUS server transmits the key to the access point using a secure channel on the wired LAN.
5. For the length of a session, or time period, the access point and the client use this key to encrypt or decrypt all unicast packets (and broadcast packets if the access point is set up to do so) that travel between them.

Refer to the "Enabling LEAP" section on page 5-23 for instructions on enabling LEAP or to the "Enabling EAP-TLS or PEAP" section on page 5-26 for instructions on enabling EAP-TLS or PEAP.

Note Refer to the IEEE 802.11 Standard for more information on 802.1X authentication and to the following URL for additional information on RADIUS servers:
http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/12cgcr/secur_c/scprt2/scrad.htm

Wi-Fi Protected Access (WPA)

Wi-Fi Protected Access (WPA) is a standards-based, interoperable security enhancement that strongly increases the level of data protection and access control for existing and future wireless LAN systems. It is derived from and is forward-compatible with the upcoming IEEE 802.11i standard. WPA leverages Temporal Key Integrity Protocol (TKIP) for data protection and 802.1X for authenticated key management.

WPA supports two mutually exclusive key management types: WPA and WPA passphrase (or WPA Pre-shared Key). Using WPA key management, clients and the authentication server authenticate to each other using an EAP authentication method, and the client and server generate a pairwise master key (PMK). Using WPA, the server generates the PMK dynamically and passes it to the access point. Using WPA passphrase, however, you configure a passphrase (or pre-shared key) on both the client and the access point, and that passphrase is used as the PMK.

Refer to the "Using a WPA Passphrase" section on page 5-22 for instructions on using a WPA passphrase, the "Enabling LEAP" section on page 5-35 for instructions on enabling LEAP with WPA, or the "Enabling Host-Based EAP" section on page 5-39 for instructions on enabling EAP-TLS, PEAP (EAP-GTC), or PEAP (EAP-MSCHAP V2) with WPA.

Note WPA must also be enabled on the access point. Access points must use IOS release 12.2(11)JA or greater to enable WPA. Refer to the documentation for your access point for instructions on enabling this feature.

Fast Roaming (CCKM)

Some applications that run on a client device may require fast roaming between access points. Voice applications, for example, require seamless roaming to prevent delays and gaps in conversation. Fast roaming is enabled automatically for LEAP-enabled clients using WPA but must be enabled on the access point.

During normal operation, LEAP-enabled clients mutually authenticate with a new access point by performing a complete LEAP authentication, including communication with the main RADIUS server. However, when you configure your wireless LAN for fast roaming, LEAP-enabled clients securely roam from one access point to another without the need to reauthenticate with the RADIUS server. Using Cisco Centralized Key Management (CCKM), an access point that is configured for wireless domain services (WDS) uses a fast rekeying technique that enables client devices to roam from one access point to another in under 150 milliseconds (ms). Fast roaming ensures that there is no perceptible delay in time-sensitive applications such as wireless Voice over IP (VoIP), enterprise resource planning (ERP), or Citrix-based solutions.

Note Access points must use IOS release 12.2(11)JA or greater to enable fast roaming. Refer to the documentation for your access point for instructions on enabling this feature.

Reporting Access Points that Fail LEAP Authentication

The CB21AG and PI21AG client adapters automatically support a new feature that is designed to detect access points that fail LEAP authentication. This feature is supported by the following access point firmware versions:

- 12.00T or greater (340, 350, and 1200 series access points)
- 12.2(4)JA or greater (1100 series access points)

An access point running one of these firmware versions records a message in the system log when the client discovers and reports another access point in the wireless network that has failed LEAP authentication.

The process takes place as follows:

1. A client with a LEAP profile attempts to associate to access point A.
2. Access point A does not handle LEAP authentication successfully, perhaps because the access point does not understand LEAP or cannot communicate to a trusted LEAP authentication server.
3. The client records the MAC address for access point A and the reason why the association failed.
4. The client associates successfully to access point B.
5. The client sends the MAC address of access point A and the reason code for the failure to access point B.
6. Access point B logs the failure in the system log.

Note This feature does not need to be enabled on the client adapter or access point; it is supported automatically by both devices. However, the access points must use these firmware versions or greater.

Additional WEP Key Security Features

The three security features discussed in this section (MIC, TKIP, and broadcast key rotation) are designed to prevent sophisticated attacks on your wireless network's WEP keys. These features do not need to be enabled on the client adapter; they are supported automatically in the client adapter software. However, they must be enabled on the access point.

Note Access point firmware version 11.10T or greater is required to enable these security features. Refer to the software configuration guide for your access point for instructions on enabling these security features.

Message Integrity Check (MIC)

MIC prevents bit-flip attacks on encrypted packets. During a bit-flip attack, an intruder intercepts an encrypted message, alters it slightly, and retransmits it, and the receiver accepts the retransmitted message as legitimate. The MIC adds a few bytes to each packet to make the packets tamper-proof.

The Advanced Status screen indicates if MIC is being used, and the Advanced Statistics screen provides MIC statistics.

Temporal Key Integrity Protocol (TKIP)

This feature, also referred to as *WEP key hashing*, defends against an attack on WEP in which the intruder uses the initialization vector (IV) in encrypted packets to calculate the WEP key. TKIP removes the predictability that an intruder relies on to determine the WEP key by exploiting IVs. It protects both unicast and broadcast WEP keys.

Broadcast Key Rotation

EAP authentication provides dynamic unicast WEP keys for client devices but uses static broadcast, or multicast, keys. When you enable broadcast WEP key rotation, the access point provides a dynamic broadcast WEP key and changes it at the interval you select. When you enable this feature, only wireless client devices using LEAP, EAP-TLS, or PEAP authentication can associate to the access point. Client devices using static WEP (with open or shared key authentication) cannot associate.

Synchronizing Security Features

In order to use any of the security features discussed in this section, both your client adapter and the access point to which it will associate must be set appropriately. Table 5-4 indicates the client and access point settings required for each security feature. This chapter provides specific instructions for enabling the security features on your client adapter. Refer to the documentation for your access point for instructions on enabling any of these features on the access point.

Table 5-4 Client and Access Point Security Settings

Security Feature	Client Setting	Access Point Setting
Static WEP with open authentication	Select Pre-Shared Key (Static WEP) and create a WEP key	Set up and enable WEP and enable Open Authentication for the SSID
Static WEP with shared key authentication	Select Pre-Shared Key (Static WEP) and create a WEP key	Set up and enable WEP and enable Shared Key Authentication for the SSID
WPA Passphrase (or WPA Pre-shared Key)	Select WPA Passphrase and enter the passphrase	Select a cipher suite, enable Open Authentication and WPA for the SSID, and enter a WPA Pre-Shared Key
LEAP authentication	Select 802.1x and LEAP; then set LEAP settings	Set up and enable WEP and enable Network-EAP for the SSID
LEAP authentication with WPA	Select WPA and LEAP; then set LEAP settings	Select a cipher suite that includes TKIP, set up and enable WEP, and enable Network-EAP and WPA for the SSID **Note** To allow both WPA and non-WPA clients to use the SSID, enable optional WPA.
EAP-TLS authentication		
If using ACU to configure card	Select 802.1x and EAP-TLS; then set EAP-TLS settings	Set up and enable WEP and enable Open Authentication for the SSID and specify the use of EAP
If using Windows XP to configure card	Select Enable network access control using IEEE 802.1X and Smart Card or other Certificate as the EAP Type	Set up and enable WEP and enable Open Authentication for the SSID and specify the use of EAP

Table 5-4 Client and Access Point Security Settings (continued)

Security Feature	Client Setting	Access Point Setting
EAP-TLS authentication with WPA		
If using ACU to configure card	Select WPA and EAP-TLS; then set EAP-TLS settings	Select a cipher suite that includes TKIP; set up and enable WEP; and enable WPA and Open Authentication for the SSID and specify the use of EAP **Note** To allow both WPA and non-WPA clients to use the SSID, enable optional WPA.
If using Windows XP to configure card	Enable WPA and select Enable network access control using IEEE 802.1X and Smart Card or other Certificate as the EAP Type	Select a cipher suite that includes TKIP; set up and enable WEP; and enable WPA and Open Authentication for the SSID and specify the use of EAP **Note** To allow both WPA and non-WPA clients to use the SSID, enable optional WPA.
PEAP authentication		
If using ACU to configure card	Select 802.1x and PEAP (EAP-GTC) or PEAP (EAP-MSCHAP V2); then set PEAP settings	Set up and enable WEP and enable Open Authentication for the SSID and specify the use of EAP
If using Windows XP to configure card	Select Enable network access control using IEEE 802.1X and PEAP as the EAP Type	Set up and enable WEP and enable Open Authentication for the SSID and specify the use of EAP

Table 5-4 Client and Access Point Security Settings (continued)

Security Feature	Client Setting	Access Point Setting
PEAP authentication with WPA		
If using ACU to configure card	Select WPA and PEAP (EAP-GTC) or PEAP (EAP-MSCHAP V2); then set PEAP settings	Select a cipher suite that includes TKIP; set up and enable WEP; and enable WPA and Open Authentication for the SSID and specify the use of EAP **Note** To allow both WPA and non-WPA clients to use the SSID, enable optional WPA.
If using Windows XP to configure card	Enable WPA and select Enable network access control using IEEE 802.1X and PEAP as the EAP Type	Select a cipher suite that includes TKIP; set up and enable WEP; and enable WPA and Open Authentication for the SSID and specify the use of EAP **Note** To allow both WPA and non-WPA clients to use the SSID, enable optional WPA.
Fast roaming (CCKM)	Enable LEAP and WPA	Use firmware version 12.2(11)JA or greater, select a cipher suite that is compatible with CCKM, and enable Network-EAP and CCKM for the SSID **Note** To allow both 802.1X clients and non-802.1X clients to use the SSID, enable optional CCKM.
Reporting access points that fail LEAP authentication	No settings required; automatically enabled	No settings required; automatically enabled in the following firmware versions: 12.00T or greater (340, 350, and 1200 series access points) or IOS release 12.2(4)JA or greater (1100 series access points)
MIC	No settings required; automatically enabled	Set up and enable WEP with full encryption, set MIC to MMH or select Enable MIC check box, and set Use Aironet Extensions to Yes
TKIP	No settings required; automatically enabled	Set up and enable WEP, set TKIP to Cisco or select Enable Per Packet Keying check box, and set Use Aironet Extensions to Yes
Broadcast key rotation	Enable LEAP, EAP-TLS, or PEAP	Set up and enable WEP and set Broadcast WEP Key Rotation Interval to any value other than zero (0)

Using Static WEP

This section provides instructions for entering new static WEP keys or overwriting existing static WEP keys.

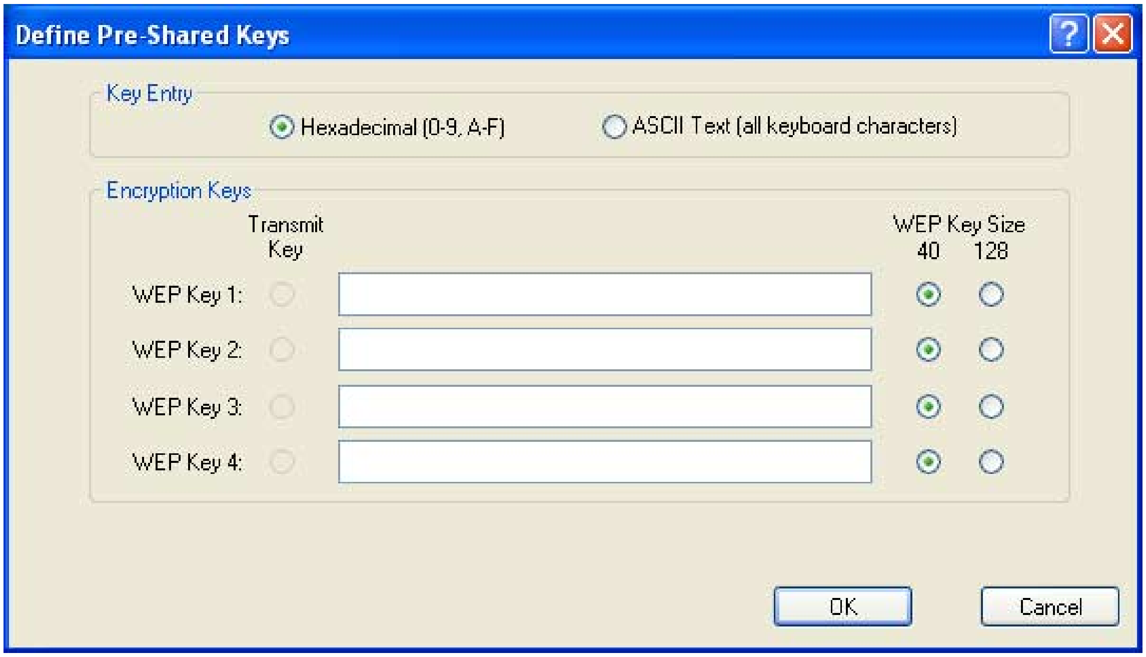
Entering a New Static WEP Key

Follow the steps below to enter a new static WEP key for this profile.

Step 1 Select **Pre-Shared Key (Static WEP)** on the Profile Management (Security) screen.

Step 2 Click **Configure**. The Define Pre-Shared Keys screen appears (see Figure 5-5).

Figure 5-5 Define Pre-Shared Keys Screen



Define Pre-Shared Keys

Key Entry

● Hexadecimal (0-9, A-F) ○ ASCII Text (all keyboard characters)

Encryption Keys

	Transmit Key		WEP Key Size 40	128
WEP Key 1:	○		●	○
WEP Key 2:	○		●	○
WEP Key 3:	○		●	○
WEP Key 4:	○		●	○

Step 3 Select one of the following WEP key entry methods:

- **Hexadecimal (0-9, A-F)**—Specifies that the WEP key will be entered in hexadecimal characters, which include 0-9, A-F, and a-f.
- **ASCII Text (all keyboard characters)**—Specifies that the WEP key will be entered in ASCII text, which includes alpha characters, numbers, and punctuation marks.

Note ASCII text WEP keys are not supported on the Cisco Aironet 1200 Series Access Points, so you must select the Hexadecimal (0-9, A-F) option if you are planning to use your client adapter with these access points.

Step 4 For the static WEP key that you are entering (1, 2, 3, or 4), select a WEP key size of 40 or 128 on the right side of the screen. 128-bit client adapters can use 40- or 128-bit keys, but 40-bit adapters can use only 40-bit keys. If 128 bit is not supported by the client adapter, this option is unavailable.

Step 5 Obtain the static WEP key from your system administrator and enter it in the blank field for the key you are creating. Follow the guidelines below to enter a new static WEP key:

- WEP keys must contain the following number of characters:
  - 10 hexadecimal characters or 5 ASCII text characters for 40-bit keys

    Example: 5A5A313859 (hexadecimal) or ZZ18Y (ASCII)
  - 26 hexadecimal characters or 13 ASCII text characters for 128-bit keys

    Example: 5A583135333554595549333534 (hexadecimal) or ZX1535TYUI354 (ASCII)

  Note You must enter hexadecimal characters for 5-GHz client adapters if these adapters will be used with Cisco Aironet 1200 Series Access Points.

- Your client adapter's WEP key must match the WEP key used by the access point (in infrastructure mode) or clients (in ad hoc mode) with which you are planning to communicate.
- When setting more than one WEP key, the keys must be assigned to the same WEP key numbers for all devices. For example, WEP key 2 must be WEP key number 2 on all devices. When multiple WEP keys are set, they must be in the same order on all devices.

  Note After you enter a WEP key, you can write over it, but you cannot edit or delete it.

Step 6 Click the **Transmit Key** button to the left of the key you want to use to transmit packets. Only one WEP key can be selected as the transmit key.

Step 7 Click **OK** to save your changes and return to the Profile Management (Security) screen.

Step 8 Click **OK** to return to the Cisco Aironet Desktop Utility (Profile Management) screen.

Overwriting an Existing Static WEP Key

Follow the steps below to overwrite an existing static WEP key.

Note You can overwrite existing WEP keys, but you cannot edit or delete them.

Step 1 Select **Pre-Shared Key (Static WEP)** on the Profile Management (Security) screen.

Step 2 Click **Configure**. The Define Pre-Shared Keys screen appears (see Figure 5-5).

Step 3 Look at the current WEP key settings in the middle of the screen. All existing static WEP keys are displayed as asterisks for security reasons.

Step 4 Decide which existing static WEP key you want to overwrite.

Step 5 Click within the field for that key and delete the asterisks.

Step 6 Enter a new key, following the guidelines outlined in Step 5 of the "Entering a New Static WEP Key" section on page 5-20.

Step 7 Make sure the **Transmit Key** button to the left of your key is selected, if you want this key to be used to transmit packets.

Step 8 Click **OK** to save your changes and return to the Profile Management (Security) screen.

Step 9 Click **OK** to return to the Cisco Aironet Desktop Utility (Profile Management) screen.

Disabling Static WEP

If you ever need to disable static WEP for a particular profile, select **None** on the Profile Management (Security) screen and click **OK**.

Note Selecting any of the other security options on the Profile Management (Security) screen disables static WEP automatically.

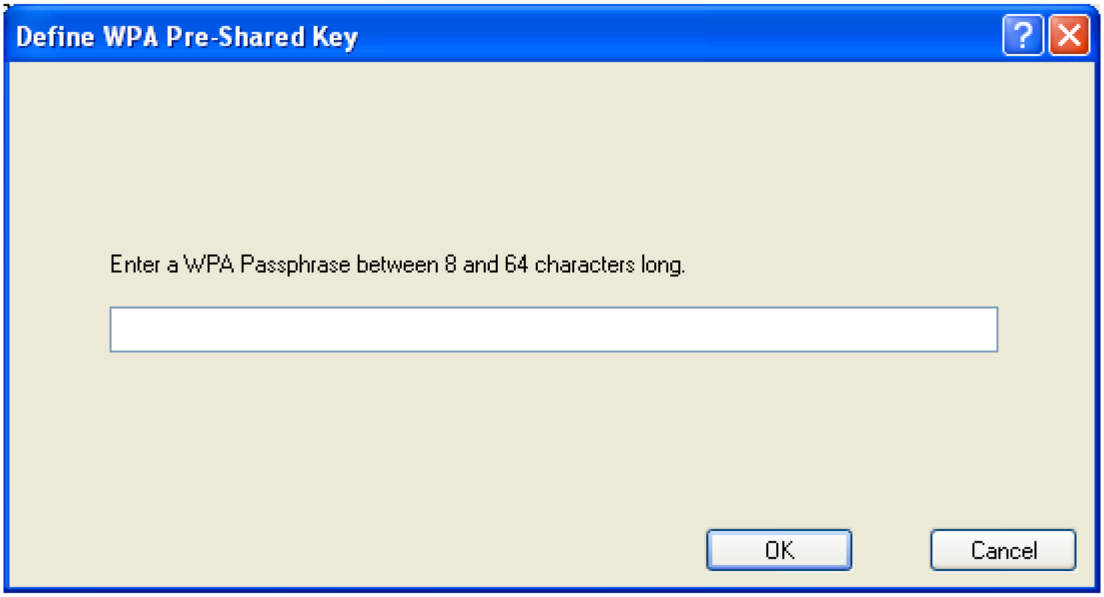
Using a WPA Passphrase

Follow the steps below to enter a WPA passphrase (also known as a *WPA pre-shared key*) for this profile.

Step 1 Select **WPA Passphrase** on the Profile Management (Security) screen.

Step 2 Click **Configure**. The Define WPA Pre-Shared Key screen appears (see Figure 5-6).

Figure 5-6 Define WPA Pre-Shared Key Screen



Define WPA Pre-Shared Key

Enter a WPA Passphrase between 8 and 64 characters long.

Step 3 Obtain the WPA passphrase for the access point (in an infrastructure network) or other clients (in an ad hoc network) from your system administrator and enter it in the WPA Passphrase field. Follow the guidelines below to enter a WPA passphrase:

- WPA passphrases must contain 8 to 63 ASCII text characters or 64 hexadecimal characters.
- Your client adapter's WPA passphrase must match the passphrase used by the access point (in infrastructure mode) or clients (in ad hoc mode) with which you are planning to communicate.

Step 4 Click **OK** to save your changes and return to the Profile Management (Security) screen.

Step 5 Click **OK** to return to the Cisco Aironet Desktop Utility (Profile Management) screen.

Enabling LEAP

Before you can enable LEAP authentication, your network devices must meet the following requirements:

- Client adapters must support WEP and use the drivers and utilities included in the Install Wizard file.
- Access points to which your client adapter may attempt to authenticate must use the following firmware versions or greater: 11.23T (340 and 350 series access points), 11.54T (1200 series access points), or IOS release 12.2(4)JA (1100 series access points).

  Note To use WPA, access points must use IOS release 12.2(11)JA or greater. To use the Reporting Access Points That Fail LEAP Authentication and Fast Roaming features, access points must use the firmware versions listed on page 5-17.

- All necessary infrastructure devices (for example, access points, servers, etc.) must be properly configured for LEAP authentication.

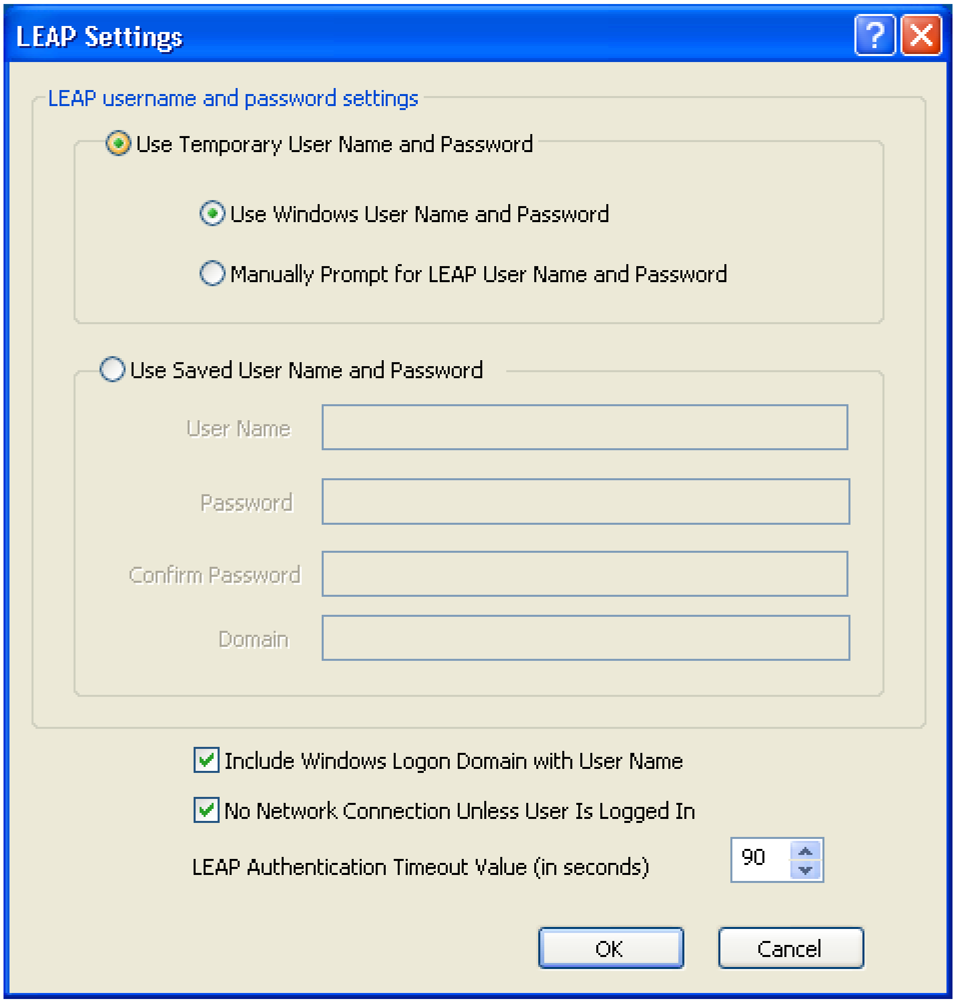
Follow the steps below to enable LEAP authentication for this profile.

Step 1 Perform one of the following:

- If you want to enable LEAP without WPA, select **802.1x** under Set Security Options and **LEAP** in the 802.1x EAP Type drop-down box.
- If you want to enable LEAP with WPA, select **WPA** under Set Security Options and **LEAP** in the WPA EAP Type drop-down box.

Step 2 Click **Configure**. The LEAP Settings screen appears (see Figure 5-7).

Figure 5-7 LEAP Settings Screen



LEAP Settings

LEAP username and password settings

● Use Temporary User Name and Password

● Use Windows User Name and Password

○ Manually Prompt for LEAP User Name and Password

○ Use Saved User Name and Password

User Name

Password

Confirm Password

Domain

☑ Include Windows Logon Domain with User Name

☑ No Network Connection Unless User Is Logged In

LEAP Authentication Timeout Value (in seconds) 90

Step 3 Select one of the following LEAP username and password setting options:

- **Use Temporary User Name and Password**—Requires you to enter the LEAP username and password each time the computer reboots in order to authenticate and gain access to the network.
- **Use Saved User Name and Password**—Does not require you to enter a LEAP username and password each time the computer reboots. Authentication occurs automatically as needed using a saved username and password (which are registered with the RADIUS server).

Step 4 Perform one of the following:

- If you selected Use Temporary User Name and Password in Step 3, select one of the following options:
  - **Use Windows User Name and Password**—Causes your Windows username and password to also serve as your LEAP username and password, giving you only one set of credentials to remember. After you log in, the LEAP authentication process begins automatically. This is the default setting.
  - **Manually Prompt for LEAP User Name and Password**—Requires you to manually invoke the LEAP authentication process as needed using the Manual LEAP Login option in the Action drop-down menu or in ASTU. You are not prompted to enter a LEAP username and password during the Windows login. This option might be used to support a software token one-time password system or other systems that require additional software that is not available at login.
- If you selected Use Saved User Name and Password in Step 3, follow the steps below:

  a. Enter a username and password in the appropriate fields.

  Note Usernames and passwords are limited to 32 ASCII characters each. However, if a domain name is entered in the Domain field, the sum of the username and domain name is limited to 31 ASCII characters.

  b. Re-enter the password in the Confirm Password field.

  c. If you wish to specify a domain name that will be passed to the RADIUS server along with your username, enter it in the Domain field.

Step 5 If you work in an environment with multiple domains and, therefore, want your Windows login domain to be passed to the RADIUS server along with your username, check the **Include Windows Logon Domain with User Name** check box. The default setting is checked.

Note This check box is available only if you selected to use a temporary username and password.

Step 6 If you want to force the client adapter to disassociate after you log off so that another user cannot gain access to the wireless network using your credentials, check the **No Network Connection Unless User Is Logged In** check box. The default setting is checked.

Step 7 In the LEAP Authentication Timeout Value field, select the amount of time (in seconds) before a LEAP authentication is considered to be failed and an error message appears.

Range: 30 to 500 seconds

Default: 90 seconds

Step 8 Click **OK** to save your changes and return to the Profile Management (Security) screen.

Step 9 Click **OK** to return to the Cisco Aironet Desktop Utility (Profile Management) screen.

Step 10 Follow the steps below if you want to take advantage of the fast roaming feature:

a. Perform one of the following steps, depending on your computer's operating system:

– If your computer is running Windows 2000, double-click **My Computer**, **Control Panel**, and **Network and Dial-up Connections**. Right-click **Local Area Connection**. Click **Properties**. The Local Area Connection Properties screen appears.

– If your computer is running Windows XP, double-click **My Computer**, **Control Panel**, and **Network Connections**. Right-click **Wireless Network Connection**. Click **Properties**. The Wireless Network Connection Properties screen appears. Select the **Wireless Networks** tab. Make sure the **Use Windows to configure my wireless network settings** check box is checked. Select the SSID of the profile you are creating from the list of available networks and click **Configure**. If your profile's SSID is not listed, click **Add**, enter your profile's SSID in the Network name (SSID) field.

b. Click the **Authentication** tab.

c. Uncheck the **Enable network access control using IEEE 802.1X** or **Enable IEEE 802.1x authentication for this network** check box.

d. Click **OK** to save your settings.

e. If you are using Windows XP, uncheck the **Use Windows to configure my wireless network settings** check box on the Wireless Networks screen and click **OK**.

Step 11 Refer to Chapter 6 for instructions on authenticating using LEAP.

Enabling EAP-TLS or PEAP

Before you can enable EAP-TLS or PEAP authentication, your network devices must meet the following requirements:

- Client adapters must support WEP and use the drivers and utilities included in the Install Wizard file.
- Access points to which your client adapter may attempt to authenticate must use the following firmware versions or greater: 12.00T (340, 350, and 1200 series access points) or IOS release 12.2(4)JA (1100 series access points).

Note To use WPA, access points must use IOS release 12.2(11)JA or greater.

- All necessary infrastructure devices (for example, access points, servers, gateways, user databases, etc.) must be properly configured for the authentication type you plan to enable on the client.

Follow the instructions in one of the sections below to enable EAP-TLS or PEAP authentication for this profile:

- Enabling EAP-TLS, page 5-27
- Enabling PEAP (EAP-MSCHAP V2), page 5-28
- Enabling PEAP (EAP-GTC), page 5-29

Enabling EAP-TLS

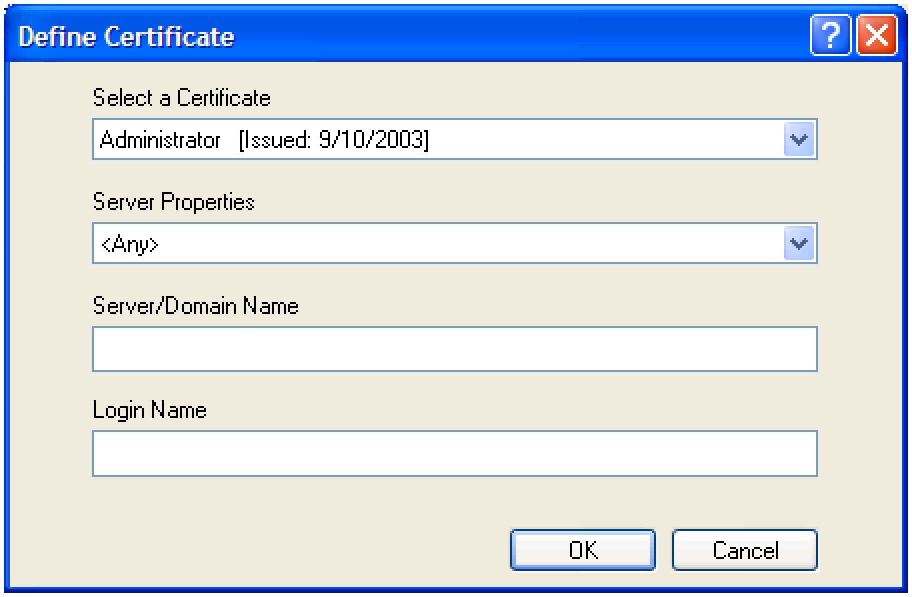
Follow the steps below to enable EAP-TLS authentication for this profile.

Step 1 Perform one of the following:

- If you want to enable EAP-TLS without WPA, select **802.1x** under Set Security Options and **EAP-TLS** in the 802.1x EAP Type drop-down box.
- If you want to enable EAP-TLS with WPA, select **WPA** under Set Security Options and **EAP-TLS** in the WPA EAP Type drop-down box.

Step 2 Click **Configure**. The Define Certificate screen appears (see Figure 5-8).

Figure 5-8 Define Certificate Screen



Define Certificate

Select a Certificate: Administrator [Issued: 9/10/2003]

Server Properties: <Any>

Server/Domain Name:

Login Name:

Step 3 Select your server certificate in the Select a Certificate drop-down list.

Step 4 Select the certificate authority from which the server certificate was downloaded in the Server Properties drop-down list.

Step 5 Enter the domain name and username that will be used for authentication, if they are not retrieved automatically from the certificate.

Step 6 Click **OK** twice to save your changes and return to the Cisco Aironet Desktop Utility (Profile Management) screen. The configuration is complete.

Step 7 Refer to Chapter 6 for instructions on authenticating using EAP-TLS.

Enabling PEAP (EAP-MSCHAP V2)

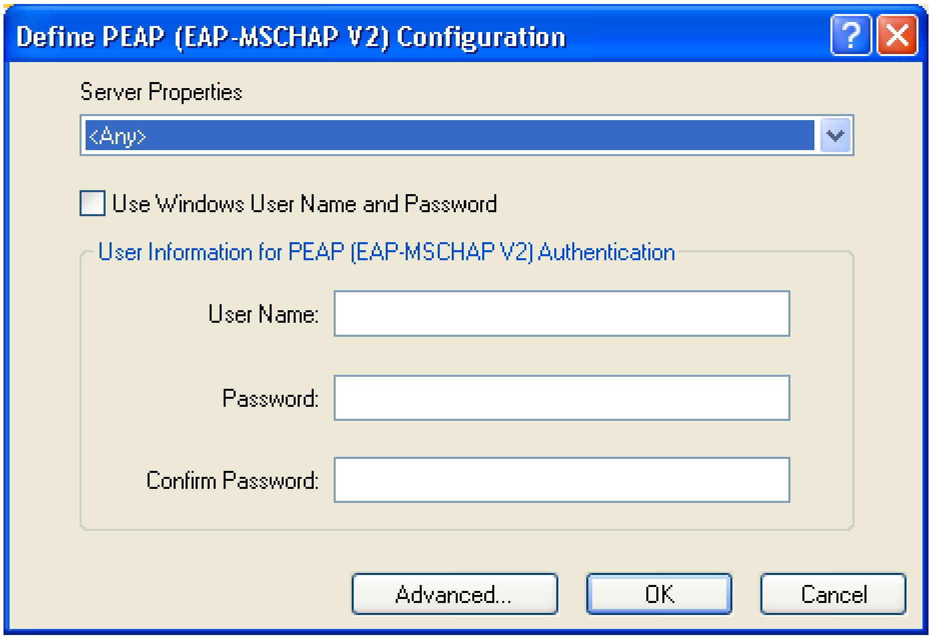
Follow the steps below to enable PEAP (EAP-MSCHAP V2) for this profile.

Step 1 Perform one of the following:

- If you want to enable PEAP (EAP-MSCHAP V2) without WPA, select **802.1x** under Set Security Options and **PEAP (EAP-MSCHAP V2)** in the 802.1x EAP Type drop-down box.
- If you want to enable PEAP (EAP-MSCHAP V2) with WPA, select **WPA** under Set Security Options and **PEAP (EAP-MSCHAP V2)** in the WPA EAP Type drop-down box.

Step 2 Click **Configure**. The Define PEAP (EAP-MSCHAP V2) Configuration screen appears (see Figure 5-9).

Figure 5-9 Define PEAP (EAP-MSCHAP V2) Configuration Screen



Define PEAP (EAP-MSCHAP V2) Configuration

Server Properties

<Any>

□ Use Windows User Name and Password

User Information for PEAP (EAP-MSCHAP V2) Authentication

User Name:

Password:

Confirm Password:

Step 3 Select the certificate authority from which the server certificate was downloaded in the Server Properties drop-down list.

Step 4 Perform one of the following:

- If you want your Windows username and password to also serve as your PEAP username and password, check the **Use Windows User Name and Password** check box.

  This option gives you only one set of credentials to remember. After you log in, the PEAP authentication process begins automatically.

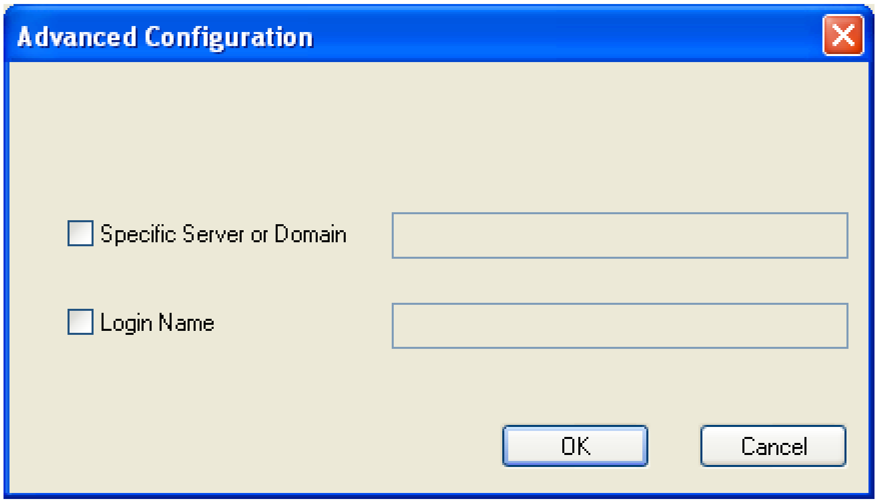
- If you want to enter a separate PEAP username and password (which are registered with the RADIUS server) in addition to your regular Windows login in order to start the PEAP authentication process, follow the steps below:

  a. Enter your PEAP (EAP-MSCHAP V2) authentication username and password in the corresponding fields.

  b. Re-enter your password in the Confirm Password field.

Step 5 Click **Advanced**. The Advanced Configuration screen appears (see Figure 5-10).

Figure 5-10 Advanced Configuration Screen



Step 6 If you want to specify the server or domain that will be used for authentication, check the **Specific Server or Domain** check box and enter the server or domain name in the corresponding edit box.

Step 7 If you want to specify the username that will be used for authentication, check the **Login Name** check box and enter the username in the Login Name edit box.

Step 8 Click **OK** three times to save your changes and return to the Cisco Aironet Desktop Utility (Profile Management) screen. The configuration is complete.

Step 9 Refer to Chapter 6 for instructions on authenticating using PEAP.

Enabling PEAP (EAP-GTC)

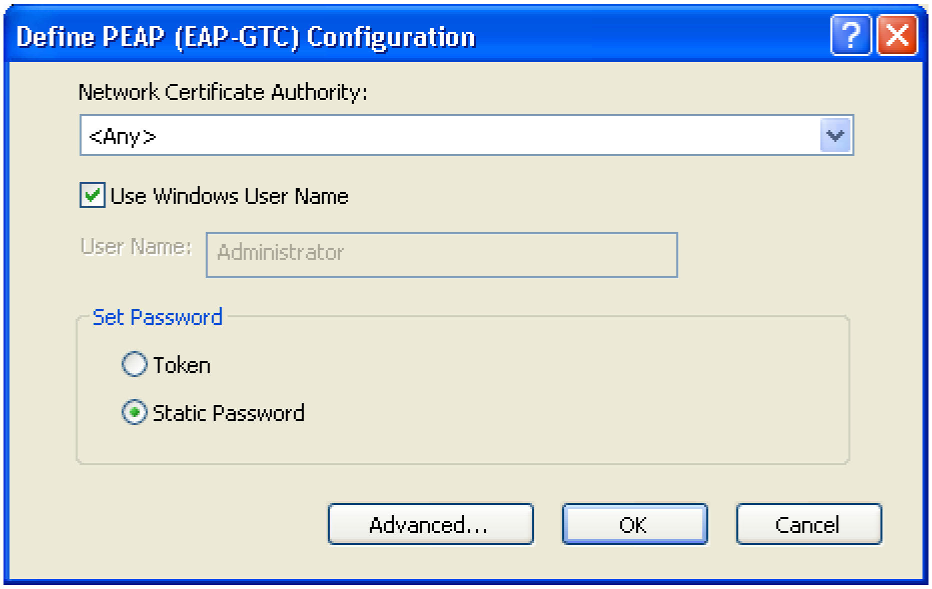
Follow the steps below to enable PEAP (EAP-GTC) for this profile.

Step 1 Perform one of the following:

- If you want to enable PEAP (EAP-GTC) without WPA, select **802.1x** under Set Security Options and **PEAP (EAP-GTC)** in the 802.1x EAP Type drop-down box.
- If you want to enable PEAP (EAP-GTC) with WPA, select **WPA** under Set Security Options and **PEAP (EAP-GTC)** in the WPA EAP Type drop-down box.

Step 2 Click **Configure**. The Define PEAP (EAP-GTC) Configuration screen appears (see Figure 5-11).

Figure 5-11 Define PEAP (EAP-GTC) Configuration Screen



Define PEAP (EAP-GTC) Configuration

Network Certificate Authority: <Any>

☑ Use Windows User Name

User Name: Administrator

Set Password

○ Token

● Static Password

Step 3 Select the certificate authority from which the server certificate was downloaded in the Network Certificate Authority drop-down list.

Step 4 Perform one of the following:

- If you want your Windows username to also serve as your PEAP username, check the **Use Windows User Name** check box.

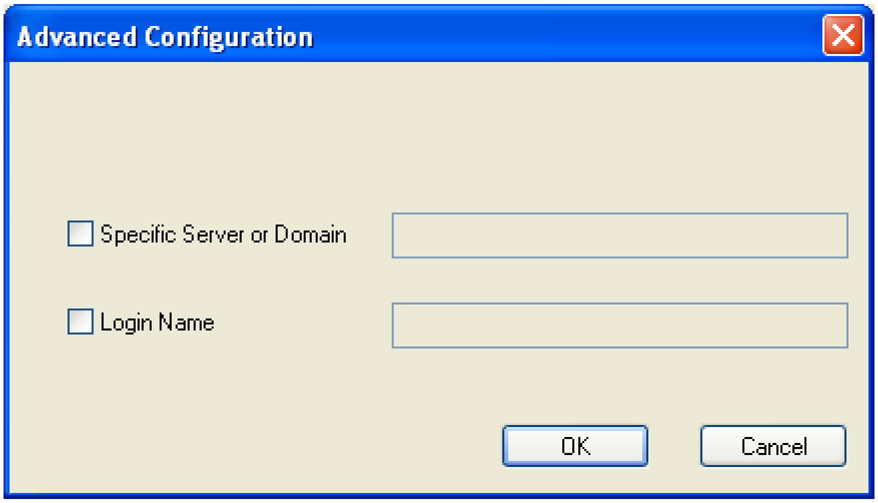
  This option gives you only one username to remember. After you log in, the PEAP authentication process begins automatically.

- If you want to enter a separate PEAP username (which is registered with the RADIUS server) in addition to your regular Windows username in order to start the PEAP authentication process, enter your PEAP username in the User Name field.

Step 5 Select either **Token** or **Static Password**, depending on your user database.

Step 6 Click **Advanced**. The Advanced Configuration screen appears (see Figure 5-12).

Figure 5-12 Advanced Configuration Screen



□ Specific Server or Domain

□ Login Name

Step 7 If you want to specify the server or domain that will be used for authentication, check the **Specific Server or Domain** check box and enter the server or domain name in the corresponding edit box.

Step 8 If you want to specify the username that will be used for authentication, check the **Login Name** check box and enter the username in the Login Name edit box.

Step 9 Click **OK** three times to save your settings. The configuration is complete.

Step 10 Refer to Chapter 6 for instructions on authenticating using PEAP.

Disabling EAP

If you ever need to disable EAP authentication (LEAP, EAP-TLS, or PEAP) for a particular profile, select **None** on the Profile Management (Security) screen and click **OK**.

Note Selecting **Pre-Shared Key (Static WEP)** or **WPA Passphrase** on the Profile Management (Security) screen disables EAP automatically.

CHAPTER 6

Using EAP Authentication

This chapter explains the sequence of events that occurs and the actions you must take when a profile that is set for EAP authentication is selected for use.

The following topics are covered in this chapter:

Overview

This chapter explains the sequence of events that occurs as soon as you or ADU's auto profile selection feature selects a profile that uses EAP authentication as well as after you eject and reinsert the client adapter, reboot the computer, log on while this profile is selected, or are informed that your username and password have expired. The chapter contains five sections based on the profile's authentication type and its username and password settings:

- LEAP with the Windows username and password, page 6-3
- LEAP with a manually prompted login, page 6-5
- LEAP with a saved username and password, page 6-8
- EAP-TLS, page 6-9
- PEAP, page 6-10

Also provided are an overview of LEAP authentication (below) and instructions for restarting the authentication process when necessary (page 6-12).

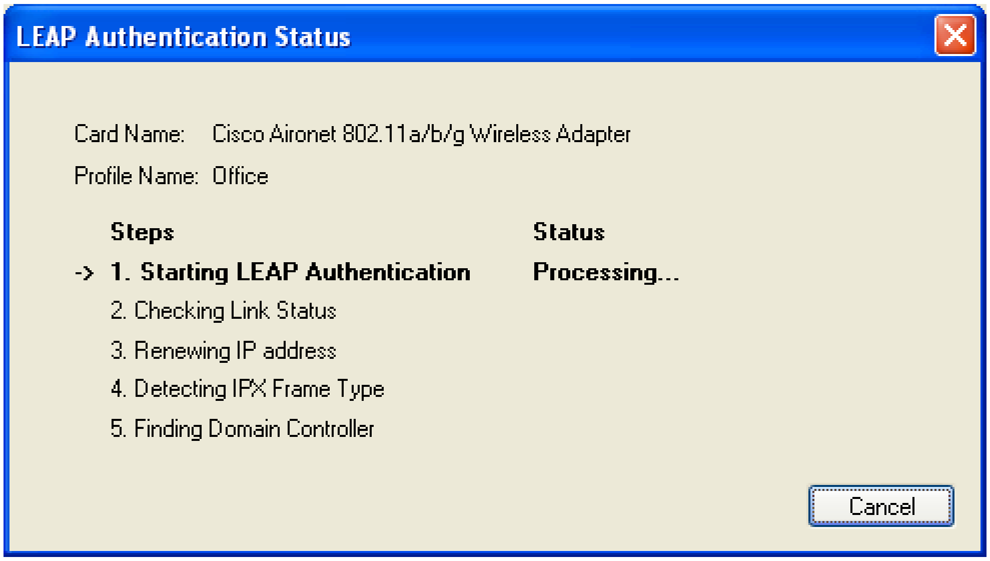
Follow the instructions for your profile's authentication type and credential settings to successfully authenticate.

Note If any error messages appear during authentication, refer to Chapter 10 for explanations and recommended actions.

Using LEAP

When LEAP authentication begins, the LEAP Authentication Status screen appears (see Figure 6-1).

Figure 6-1 LEAP Authentication Status Screen



LEAP Authentication Status

Card Name: Cisco Aironet 802.11a/b/g Wireless Adapter
Profile Name: Office

	Steps	Status
->	**1. Starting LEAP Authentication**	**Processing...**
	2. Checking Link Status	
	3. Renewing IP address	
	4. Detecting IPX Frame Type	
	5. Finding Domain Controller	

This screen provides information about the status of LEAP authentication. Table 6-1 lists and explains the stages of LEAP authentication. As each stage is completed, a status message (such as *Success)* appears in the Status field. If any error messages appear, refer to the "Error Messages" section on page 10-11 for an explanation and the recommended action to take.

Table 6-1 Stages of LEAP Authentication

Stage	**Explanation**
Starting LEAP Authentication	The client adapter associates to an access point, and the LEAP authentication process begins.
Checking Link Status	The client adapter is LEAP authenticated, and the network connection is verified.
Renewing IP Address	If DHCP is enabled, the IP address is released and renewed.
Detecting IPX Frame Type	The IPX frame type is reset if AutoDetect is enabled.
Finding Domain Controller	If you are logging into a domain and the active profile specifies that the domain name be included, an attempt is made to find the domain controller to make sure subsequent access to the domain is successful.

Using LEAP with the Windows Username and Password

After Profile Selection or Card Insertion

After you (or auto profile selection) select a profile that uses LEAP authentication and specifies that your Windows username and password also serve as your LEAP username and password or you eject and reinsert the client adapter while this profile is selected, the following events occur:

1. The LEAP Authentication Status screen appears.
2. If your client adapter authenticates, the screen shows that each stage was successful and then disappears. ASTU now shows *Authenticated*, and the Server Based Authentication field on the ADU Current Status screen shows *LEAP*.

   If the authentication attempt fails, an error message appears after the LEAP timeout period has expired. Refer to the "Error Messages" section on page 10-11 for the necessary action to take.

After a Reboot or Logon

After your computer reboots or you log on, follow the steps below to LEAP authenticate.

Step 1 When the Windows login screen appears, enter your Windows username and password and click **OK**. The domain name is optional.

Note If your computer has Novell Client 32 software installed, a separate LEAP login screen appears before the Novell login screen. If this occurs, enter your Windows and Novell username and password in the login screens and click **OK**.

The LEAP Authentication Status screen appears.

Step 2 If your client adapter authenticates, the screen shows that each stage was successful and then disappears. ASTU now shows *Authenticated*, and the Server Based Authentication field on the ADU Current Status screen shows *LEAP*.

If the authentication attempt fails, an error message appears after the LEAP timeout period has expired. Refer to the "Error Messages" section on page 10-11 for the necessary action to take.

Step 3 Windows continues to log you onto the system.

After Your LEAP Credentials Expire

If the LEAP credentials (username and password) for your current profile expire or become invalid, follow the steps below to reauthenticate.

Note If you change your Windows password using the standard Windows Change Password function, the client updates the LEAP password automatically and maintains its connection to the access point if the current profile uses the Windows username and password.

Step 1 Click **OK** when the following message appears: "The user name and password entered are no longer valid and have failed the LEAP authentication process. Please enter a new user name and password."

Step 2 When the Windows login screen appears, enter your new username and password and click **OK**. The client adapter should authenticate using your new credentials.

Note If you click Cancel rather than OK on the Windows login screen, the following message appears: "The profile will be disabled until you select the Reauthenticate option, Windows restarts, or the card is ejected and reinserted. Are you sure?" If you click No, the Windows login screen reappears and allows you to enter your new credentials. If you click Yes, the current profile is disabled until you select Reauthenticate from ASTU or the Action drop-down menu in ADU, reboot your computer, or eject and reinsert the card.

Using LEAP with a Manually Prompted Login

After Profile Selection

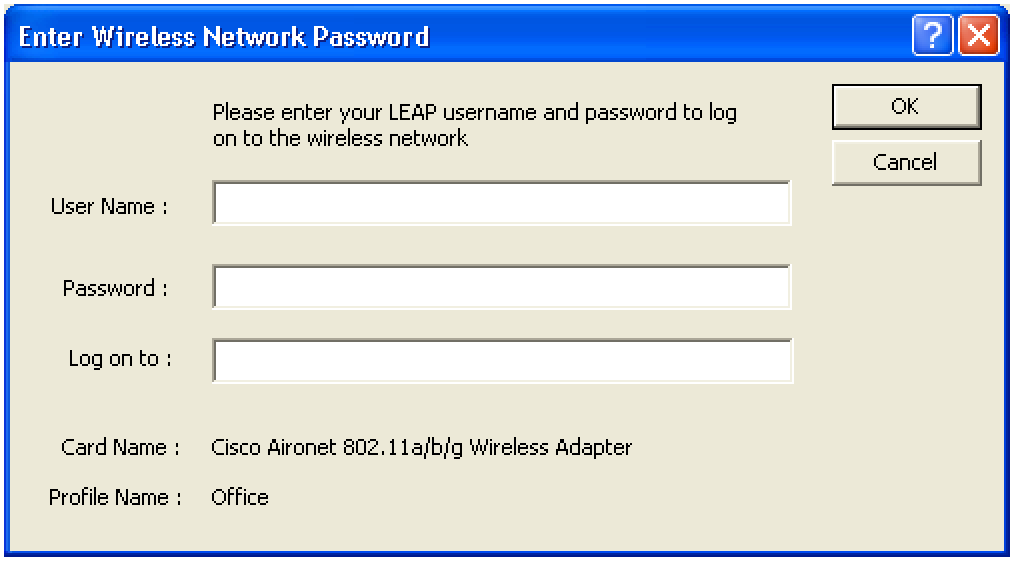
After you (or auto profile selection) select a profile that uses LEAP authentication but specifies that the process be manually invoked, follow the steps below to LEAP authenticate.

Note This procedure is applicable the first time a manual LEAP profile is selected. After you follow the steps below to enter your LEAP credentials, you can switch profiles without having to re-enter your credentials until you reboot your computer, eject and reinsert your client adapter, or change the profile in any way (including its priority in auto profile selection).

Step 1 Perform one of the following:

- If you activate a manual LEAP profile, the LEAP login screen appears (see Figure 6-2).

Figure 6-2 LEAP Login Screen


Enter Wireless Network Password

Please enter your LEAP username and password to log on to the wireless network

User Name :

Password :

Log on to :

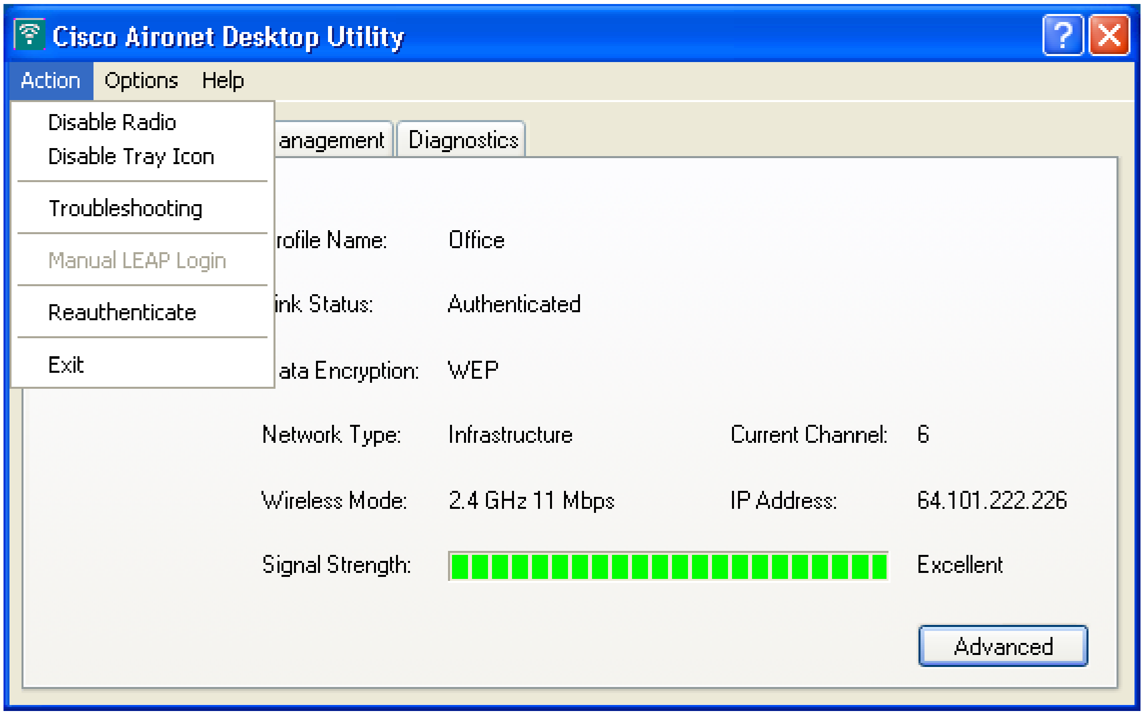
Card Name : Cisco Aironet 802.11a/b/g Wireless Adapter

Profile Name : Office

Enter your LEAP username and password and click **OK**. The domain name is optional.

- If auto profile selection selects a manual LEAP profile, you must select the **Manual LEAP Login** option from ASTU or the Action drop-down menu (see Figure 6-3).

Figure 6-3 Action Drop-Down Menu



rofile Name: Office

ink Status: Authenticated

ata Encryption: WEP

Network Type: Infrastructure

Current Channel: 6

Wireless Mode: 2.4 GHz 11 Mbps

IP Address: 64.101.222.226

Signal Strength: Excellent

When the LEAP login screen appears (see Figure 6-2), enter your LEAP username and password and click **OK**. The domain name is optional.

Step 2 The LEAP Authentication Status screen appears. If your client adapter authenticates, the screen shows that each stage was successful and then disappears. ASTU now shows *Authenticated*, and the Server Based Authentication field on the ADU Current Status screen shows *LEAP*.

If the authentication attempt fails, an error message appears after the LEAP timeout period has expired. Refer to the "Error Messages" section on page 10-11 for the necessary action to take.

After a Reboot, Logon, or Card Insertion

After your computer reboots, you log on, or you eject and reinsert the client adapter, the adapter does not automatically attempt to authenticate. You must manually invoke the authentication process. To do so, follow the steps below.

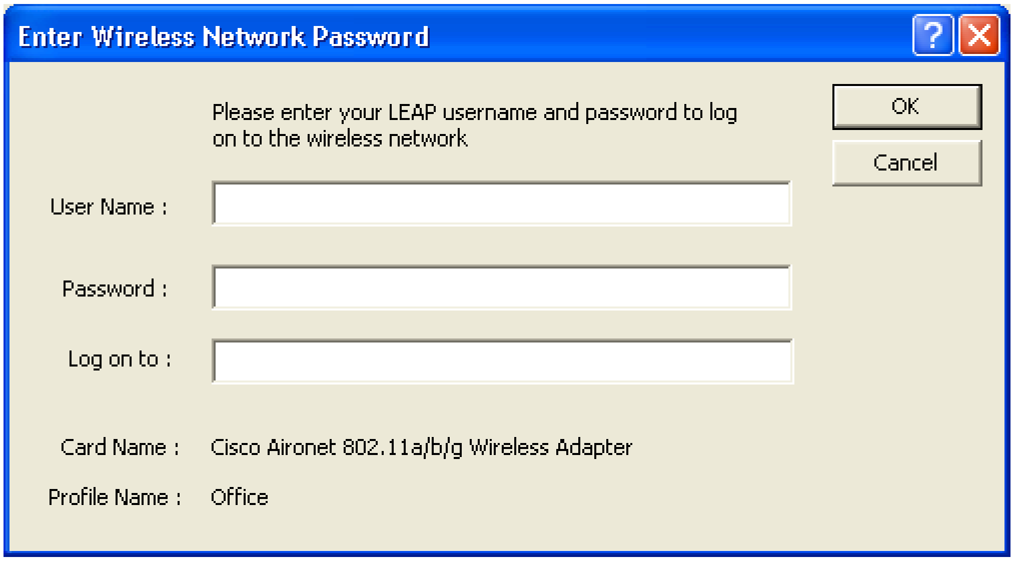
Step 1 If you rebooted your computer or logged on, complete your standard Windows login.

Step 2 Open ASTU or ADU.

Step 3 Select the **Manual LEAP Login** option.

Step 4 When the LEAP login screen appears (see Figure 6-4), enter your LEAP username and password and click **OK**. The domain name is optional.

Figure 6-4 LEAP Login Screen



Please enter your LEAP username and password to log on to the wireless network

Card Name : Cisco Aironet 802.11a/b/g Wireless Adapter

Profile Name : Office

The LEAP Authentication Status screen appears.

Step 5 If your client adapter authenticates, the screen shows that each stage was successful and then disappears. ASTU now shows *Authenticated*, and the Server Based Authentication field on the ADU Current Status screen shows *LEAP*.

If the authentication attempt fails, an error message appears after the LEAP timeout period has expired. Refer to the "Error Messages" section on page 10-11 for the necessary action to take.

After Your LEAP Credentials Expire

If the LEAP credentials (username and password) for your current profile expire or become invalid, follow the steps below to reauthenticate.

Step 1 Click **OK** when the following message appears: "The user name and password entered are no longer valid and have failed the LEAP authentication process. Please enter a new user name and password."

Step 2 When the LEAP login screen appears, enter your new username and password and click **OK**. The client adapter should authenticate using your new credentials.

Note If you click Cancel rather than OK on the LEAP login screen, the following message appears: "The profile will be disabled until you select the Reauthenticate option, Windows restarts, or the card is ejected and reinserted. Are you sure?" If you click No, the LEAP login screen reappears and allows you to enter your new credentials. If you click Yes, the current profile is disabled until you select Reauthenticate from ASTU or the Action drop-down menu in ADU, reboot your computer, or eject and reinsert the card.

Using LEAP with a Saved Username and Password

After Profile Selection or Card Insertion

After you (or auto profile selection) select a profile that uses LEAP authentication with a saved LEAP username and password or you eject and reinsert the client adapter while this profile is selected, the following events occur:

1. The LEAP Authentication Status screen appears.
2. If your client adapter authenticates, the screen shows that each stage was successful and then disappears. ASTU now shows *Authenticated*, and the Server Based Authentication field on the ADU Current Status screen shows *LEAP*.

   If the authentication attempt fails, an error message appears after the LEAP timeout period has expired. Refer to the "Error Messages" section on page 10-11 for the necessary action to take.

After a Reboot or Logon

After your computer reboots or you log on, the following events occur:

1. After you enter your Windows username and password, the LEAP authentication process begins automatically using your saved LEAP username and password.

   Note If you unchecked the **No Network Connection Unless User Is Logged In** check box on the LEAP Settings screen, the LEAP authentication process begins before the Windows login screen appears.

2. If your client adapter authenticates, the screen shows that each stage was successful and then disappears. ASTU now shows *Authenticated*, and the Server Based Authentication field on the ADU Current Status screen shows *LEAP*.

   If the authentication attempt fails, an error message appears after the LEAP timeout period has expired. Refer to the "Error Messages" section on page 10-11 for the necessary action to take.

3. Windows continues to log you onto the system.

After Your LEAP Credentials Expire

If the LEAP credentials (username and password) for your current profile expire or become invalid, follow the steps below to reauthenticate.

Step 1 Click **OK** when the following message appears: "The saved user name and password entered for this profile are no longer valid and have failed the LEAP authentication process. Please enter a new user name and password. Remember to change them permanently in the profile using the ADU Profile Manager."

Step 2 When the LEAP login screen appears, enter your new username and password and click **OK**. The client adapter should authenticate using your new credentials.

Note If you click Cancel rather than OK on the LEAP login screen, the following message appears: "The profile will be disabled until you select the Reauthenticate option, Windows restarts, or the card is ejected and reinserted. Are you sure?" If you click No, the LEAP login screen reappears and allows you to enter your new credentials. If you click Yes, the current profile is disabled until you select Reauthenticate from ASTU or the Action drop-down menu in ADU, reboot your computer, or eject and reinsert the card.

Step 3 Edit the profile in ADU by changing the saved username and password on the LEAP Settings screen.

Step 4 Click **OK** twice to save the changes to your profile.

Using EAP-TLS

After Profile Selection or Card Insertion

After you (or auto profile selection) select a profile that uses EAP-TLS authentication or you eject and reinsert the client adapter while this profile is selected, follow the steps below to EAP authenticate.

Step 1 If your computer is running Windows XP and a pop-up message appears above the Windows system tray informing you that you need to accept a certificate to begin the EAP authentication process, click the message and follow the instructions provided to accept the certificate.

Note You should not have to accept a certificate for future authentication attempts. After you accept one, the same certificate is used subsequently.

Step 2 If a message appears indicating the root certification authority for the server's certificate, and it is the correct certification authority, click **OK** to accept the connection. Otherwise, click **Cancel**.

Step 3 If a message appears indicating the server to which your client adapter is connected, and it is the correct server to connect to, click **OK** to accept the connection. Otherwise, click **Cancel**.

Step 4 The client adapter should now EAP authenticate. If the authentication was successful, ASTU shows *Authenticated*, and the Server Based Authentication field on the ADU Current Status screen shows *EAP-TLS*.

If the authentication attempt fails, an error message appears. Refer to the "Error Messages" section on page 10-11 for the necessary action to take.

After a Reboot or Logon

After your computer reboots or you log on using your Windows username and password, the EAP authentication process begins automatically and the client adapter should EAP authenticate.

If the authentication was successful, ASTU shows *Authenticated*, and the Server Based Authentication field on the ADU Current Status screen shows *EAP-TLS*.

If the authentication attempt fails, an error message appears. Refer to the "Error Messages" section on page 10-11 for the necessary action to take.

Using PEAP

After Profile Selection, Card Insertion, Reboot, or Logon

After you (or auto profile selection) select a profile that uses PEAP authentication, follow the steps in one of the sections below, depending on your user database, to EAP authenticate.

Note These instructions are applicable after profile selection, card ejection and re-insertion, reboot, or logon.

Windows NT or 2000 Domain Databases Only

Step 1 If your computer is running Windows XP, a pop-up message appears above the Windows system tray informing you that you need to select a certificate or other credentials to access the network. Click this message.

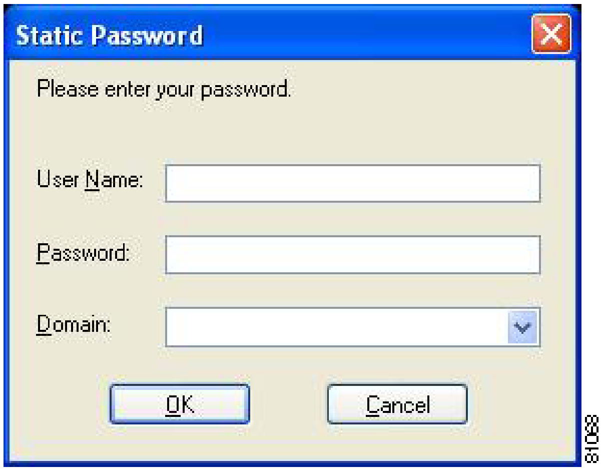
Step 2 If a message appears indicating the root certification authority for the server's certificate and it is the correct certification authority, click **OK** to accept the connection. Otherwise, click **Cancel**.

Step 3 If a message appears indicating the server to which your client adapter is connected and it is the correct server to connect to, click **OK** to accept the connection. Otherwise, click **Cancel**.

Step 4 Perform one of the following:

- If your computer is running Windows 2000, the Static Password screen appears (see Figure 6-5).
- If your computer is running Windows XP, a pop-up message appears above the Windows system tray prompting you to process your logon information for your wireless network. Click this message. The Static Password screen appears (see Figure 6-5).

Figure 6-5 Static Password Screen



Static Password

Please enter your password.

User Name:

Password:

Domain:

Step 5 Enter your PEAP authentication username and password (which are registered with the RADIUS server).

Step 6 If applicable, select your domain name from the drop-down list or type it in.

Step 7 Click **OK**. The PEAP Authentication Status screen appears.

If your client adapter authenticates, the screen shows that each stage was successful and then disappears. ASTU now shows *Authenticated*, and the Server Based Authentication field on the ADU Current Status screen shows *PEAP*.

If the authentication attempt fails, an error message appears. Refer to the "Error Messages" section on page 10-11 for the necessary action to take.

Step 8 If you also have a locally cached Windows password, you must change it manually in Windows to synchronize your passwords. To do so, press **Ctrl**-**Alt**-**Delete**, select **Change Password**, and enter your old password once and your new password twice.

OTP Databases Only

Step 1 If your computer is running Windows XP, a pop-up message appears above the Windows system tray informing you that you need to select a certificate or other credentials to access the network. Click this message.

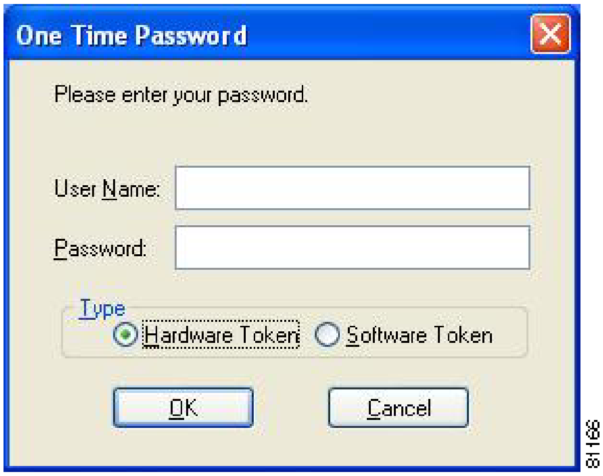
Step 2 If a message appears indicating the root certification authority for the server's certificate and it is the correct certification authority, click **OK** to accept the connection. Otherwise, click **Cancel**.

Step 3 If a message appears indicating the server to which your client adapter is connected and it is the correct server to connect to, click **OK** to accept the connection. Otherwise, click **Cancel**.

Step 4 Perform one of the following:

- If your computer is running Windows 2000, the One Time Password screen appears (see Figure 6-6).
- If your computer is running Windows XP, a pop-up message appears above the Windows system tray prompting you to process your logon information for your wireless network. Click this message. The One Time Password screen appears (see Figure 6-6).

Figure 6-6 One Time Password Screen


One Time Password

Please enter your password.

User Name:

Password:

Type

● Hardware Token ○ Software Token

Step 5 Enter your PEAP authentication username in the User Name field.

Step 6 Select either the **Hardware Token** or **Software Token** option. If you select the Software Token option, the Password field on the One Time Password screen changes to the PIN field.

Note The Hardware Token and Software Token options are available only if you selected both of them on the Generic Token Card Properties screen during configuration. Otherwise, only the option you selected will be available.

Step 7 Enter either your hardware token password or your software token PIN.

Step 8 Click **OK**. The PEAP Authentication Status screen appears.

If your client adapter authenticates, the screen shows that each stage was successful and then disappears. ASTU now shows *Authenticated*, and the Server Based Authentication field on the ADU Current Status screen shows *PEAP*.

If the authentication attempt fails, an error message appears. Refer to the "Error Messages" section on page 10-11 for the necessary action to take.

Restarting the Authentication Process

If your client adapter was unable to authenticate using the specified username and password and you have exhausted the retry limit (for example, LEAP tries only once to prevent you from being locked out of the system), the current profile is disabled until you change the username or password, reboot your computer, or eject and re-insert the client adapter. To force your client adapter to try to reauthenticate using the username and password of the current profile, select **Reauthenticate** from ASTU or the Action drop-down menu in ADU.

Performing Diagnostics

This chapter explains how to use ADU to perform user-level diagnostics.

The following topics are covered in this chapter:

- Overview of ADU Diagnostic Tools, page 7-2
- Setting Parameters that Affect ADU Diagnostic Tools, page 7-2
- Viewing the Current Status of Your Client Adapter, page 7-4
- Viewing Statistics for Your Client Adapter, page 7-10

Overview of ADU Diagnostic Tools

In addition to enabling you to configure your client adapter for use in various types of networks, ADU provides tools that enable you to assess the performance of the client adapter and other devices on the wireless network. ADU diagnostic tools perform the following functions:

- Display your client adapter's current status and configured settings
- Display statistics pertaining to your client adapter's transmission and reception of data

Table 7-1 enables you to quickly locate instructions for using ADU diagnostic tools.

Table 7-1 Locating Diagnostic Instructions

Diagnostic Tool	Page Number
Status	page 7-4
Statistics	page 7-10

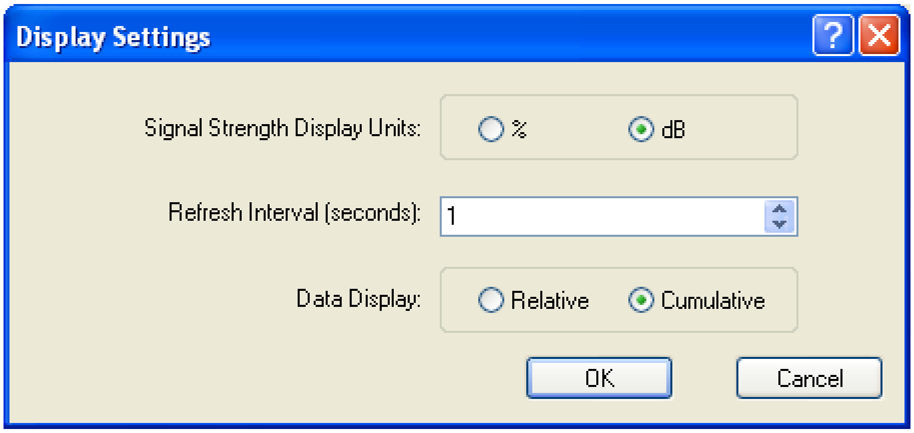
Setting Parameters that Affect ADU Diagnostic Tools

Several parameters affect the operation of ADU diagnostic tools. Follow the steps below to set these parameters.

Step 1 Open ADU.

Step 2 Select **Display Settings** from the Options drop-down menu. The Display Settings screen appears (see Figure 7-1).

Figure 7-1 Display Settings Screen



Display Settings

Signal Strength Display Units: ○ % ● dB

Refresh Interval (seconds): 1

Data Display: ○ Relative ● Cumulative

Step 3 Table 7-2 lists and describes the parameters that affect the operation of ADU diagnostic tools. Follow the instructions in the table to change any parameters.

Table 7-2 Parameters Affecting ADU Diagnostic Tools

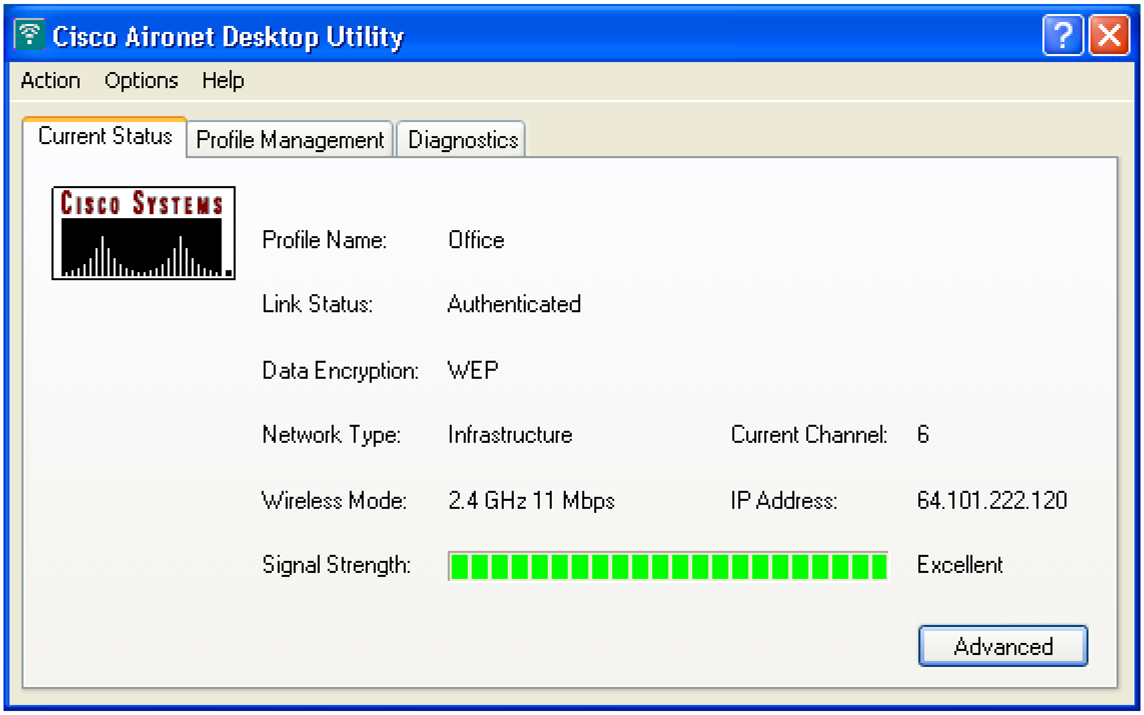
<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>Signal Strength Display Units</td><td>Specifies the units used to display signal strength on the status screens.
Default: dB
<table><tr><th>Units</th><th>Description</th></tr><tr><td>%</td><td>Displays the signal strength as a percentage.</td></tr><tr><td>dB</td><td>Displays the signal strength in decibels.</td></tr></table></td></tr>
<tr><td>Refresh Interval</td><td>Specifies how often the status and statistics screens and the ASTU icon are updated.
Range: 1 to 5 seconds between updates (in 1-second increments)
Default: 5 seconds between updates</td></tr>
<tr><td>Data Display</td><td>Specifies whether the data that is displayed on the statistics screens continue to increment until the driver is reloaded or only until an update occurs (every 1 to 5 seconds).
Options: Relative or Cumulative
Default: Cumulative
<table><tr><th>Data Display</th><th>Description</th></tr><tr><td>Relative</td><td>Displays statistical data collected since the last update, as specified by the Refresh Interval (1 to 5 seconds).</td></tr><tr><td>Cumulative</td><td>Displays statistical data collected since the driver was loaded, upon card insertion or reboot.</td></tr></table></td></tr>
</table>

Step 4 Click **OK** to save your changes.

Viewing the Current Status of Your Client Adapter

ADU enables you to view the current status of your client adapter as well as many of the settings that have been configured for the adapter. To view your client adapter's status and settings, open ADU. The Current Status screen appears (see Figure 7-2).

Figure 7-2 Current Status Screen



Profile Name: Office

Link Status: Authenticated

Data Encryption: WEP

Network Type: Infrastructure

Current Channel: 6

Wireless Mode: 2.4 GHz 11 Mbps

IP Address: 64.101.222.120

Signal Strength: Excellent

Table 7-3 interprets each element of the Current Status screen.

Table 7-3 Basic Client Adapter Status

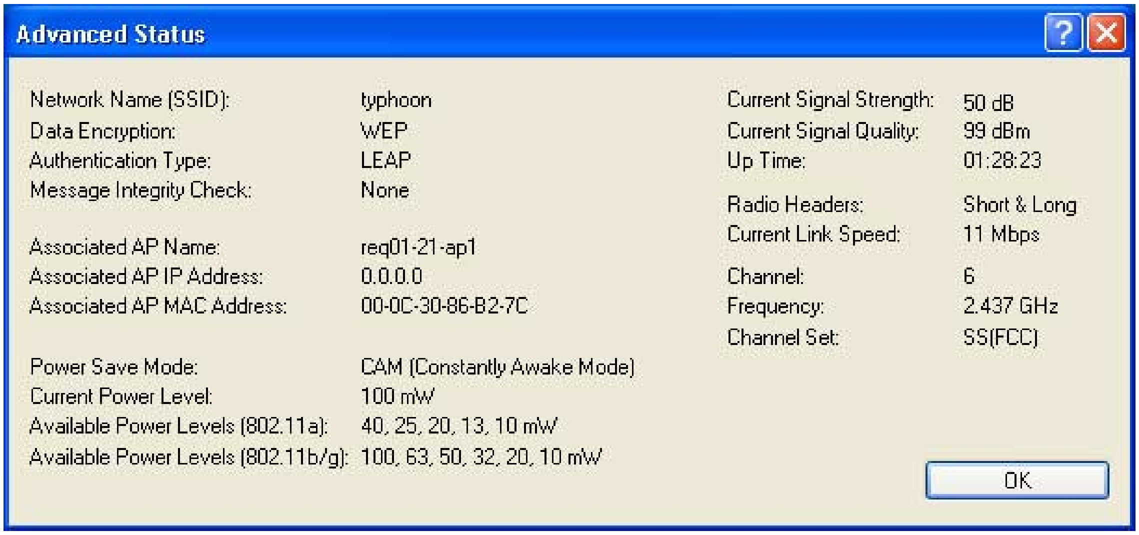
<table>
<tr><th>Status</th><th colspan="2">Description</th></tr>
<tr><td>Profile Name</td><td colspan="2">The network configuration (or profile) your client adapter is currently using.</td></tr>
<tr><td rowspan="8">Link Status</td><td colspan="2">The operational mode of your client adapter.
Value: Not Associated, Associated, Authenticating, Authenticated, Authentication Failed, Authentication Failed Retrying</td></tr>
<tr><td>**Link Status**</td><td>**Description**</td></tr>
<tr><td>Not Associated</td><td>The client adapter has not established a connection to an access point.</td></tr>
<tr><td>Associated</td><td>The client adapter has established a connection to an access point.</td></tr>
<tr><td>Authenticating</td><td>The client adapter is associated to an access point, and the EAP authentication process has begun but not yet succeeded.</td></tr>
<tr><td>Authenticated</td><td>The client adapter is associated to an access point, and the user is EAP authenticated.</td></tr>
<tr><td>Authentication Failed</td><td>The client adapter is associated to an access point, but the user has failed to EAP authenticate.</td></tr>
<tr><td>Authentication Failed Retrying</td><td>The client adapter is associated to an access point, the user has failed to EAP authenticate, but another authentication attempt is being made.</td></tr>
<tr><td>Data Encryption</td><td colspan="2">The data encryption type that was negotiated with the access point upon association.
Value: None, WEP, CKIP, or TKIP</td></tr>
<tr><td>Network Type</td><td colspan="2">The type of network in which your client adapter is being used.
Value: Infrastructure or Ad Hoc
Note Refer to the Network Type parameter in Table 5-3 for information on setting the network type.</td></tr>
<tr><td>Current Channel</td><td colspan="2">The channel that your client adapter is currently using for communications. This field displays “Scanning” while the client adapter searches for a channel.
Value: Dependent on radio band and regulatory domain
Note Refer to the Channel parameter in Table 5-3 for information on selecting the channel for your client adapter.</td></tr>
</table>

Table 7-3 Basic Client Adapter Status (continued)

Status	Description
Wireless Mode	The frequency and rate at which your client adapter is transmitting or receiving packets to or from access points **Value:** 5 GHz 54 Mbps, 2.4 GHz 11 Mbps, or 2.4 GHz 54 Mbps **Note** Refer to the Wireless Mode parameter in Table 5-3 for information on selecting the wireless mode for your client adapter.
IP Address	The IP address of your client adapter.
Signal Strength	The signal strength for all received packets. The color of this parameter's progress bar provides a visual interpretation of signal strength. **Value:** Excellent (green), Good (green), Fair (orange), Poor (yellow), or No Link

Click **Advanced** if you want to view more detailed status information for your client adapter. The Advanced Status screen appears (see Figure 7-3).

Figure 7-3 Advanced Status Screen



Advanced Status

Network Name (SSID): typhoon
Data Encryption: WEP
Authentication Type: LEAP
Message Integrity Check: None

Associated AP Name: req01-21-ap1
Associated AP IP Address: 0.0.0.0
Associated AP MAC Address: 00-0C-30-86-B2-7C

Power Save Mode: CAM (Constantly Awake Mode)
Current Power Level: 100 mW
Available Power Levels (802.11a): 40, 25, 20, 13, 10 mW
Available Power Levels (802.11b/g): 100, 63, 50, 32, 20, 10 mW

Current Signal Strength: 50 dB
Current Signal Quality: 99 dBm
Up Time: 01:28:23

Radio Headers: Short & Long
Current Link Speed: 11 Mbps

Channel: 6
Frequency: 2.437 GHz
Channel Set: SS(FCC)

Table 7-4 interprets each element of the Advanced Status screen.

Table 7-4 Advanced Client Adapter Status

Status	Description
Network Name (SSID)	The name of the network to which your client adapter is currently associated. **Note** Refer to the SSID1 parameter in Table 5-2 for information on setting the client adapter's SSID.
Data Encryption	The data encryption type that was negotiated with the access point upon association. **Value:** None, WEP, CKIP, or TKIP
Authentication Type	The EAP authentication type that your client adapter is currently using. **Value:** TBD **Note** Refer to the "Setting Security Parameters" section on page 5-10 for information on setting the authentication type.
Associated AP Name	The name of the access point to which your client adapter is associated. It is shown only if the client adapter is in infrastructure mode, the access point was configured with a name, and Aironet Extensions are enabled (on access points running Cisco IOS release 12.2(4)JA or greater).
Associated AP IP Address	The IP address of the access point to which your client adapter is associated. It is shown only if the client adapter is in infrastructure mode, the access point was configured with an IP address, and Aironet Extensions are enabled (on access points running Cisco IOS release 12.2(4)JA or greater). **Note** If Aironet Extensions are disabled, the IP address of the associated access point is shown as 0.0.0.0.
Associated AP MAC Address	The MAC address of the access point to which your client adapter is associated. It is shown only if the client adapter is in infrastructure mode. **Note** This field displays the MAC address of the access point's Ethernet port (for access points that do not run Cisco IOS) or the MAC address of the access point's radio (for access points that run Cisco IOS). The MAC address of the Ethernet port on access points that run Cisco IOS is printed on a label on the back of the device.
Power Save Mode	The client adapter's current power consumption setting. **Value:** CAM (Constantly Awake Mode), Max PSP (Max Power Saving), or Fast PSP (Power Save Mode) **Note** Refer to the Power Save Mode parameter in Table 5-3 for information on setting the client adapter's power save mode.

Table 7-4 Advanced Client Adapter Status (continued)

Status	Description
Current Power Level	The power level at which your client adapter is currently transmitting. The maximum level is dependent upon the radio band used and your country's regulatory agency. **Value:** 10, 20, 32, 50, 63, or 100 mW (802.11b/g band); 10, 13, 20, 25, or 40 mW (802.11a band) **Note** Refer to the Transmit Power Level parameter in Table 5-3 for information on setting the client adapter's power level.
Available Power Levels	The power levels at which your client adapter is capable of transmitting. The maximum level is dependent upon the radio band used and your country's regulatory agency. **Value:** 10, 20, 32, 50, 63, or 100 mW (802.11b/g band); 10, 13, 20, 25, or 40 mW (802.11a band) **Note** Refer to the Transmit Power Level parameter in Table 5-3 for information on the client adapter's available power levels.
Current Signal Strength	The signal strength for all received packets. The higher the value, the stronger the signal. **Range:** 0 to 100%
Current Signal Quality	The signal quality for all received packets. The higher the value, the clearer the signal. **Range:** 0 to 100% **Note** This setting appears only if you selected signal strength to be displayed as a percentage. See the Signal Strength Display Units parameter in Table 7-2 for information.
Up Time	The amount of time (in hours:minutes:seconds) since the client adapter was last reset. If the adapter has been running for more than 24 hours, the time is displayed in days, hours:minutes:seconds.
802.11b Preamble	Indicates whether your client adapter is using only long radio headers or short and long radio headers. **Value:** Short & Long or Long Only **Note** This field contains a value only when the client adapter is operated in 2.4-GHz 11-Mbps or 2.4-GHz 54-Mbps mode. **Note** Refer to the 802.11b Preamble parameter in Table 5-3 for information on using radio headers.

Table 7-4 Advanced Client Adapter Status (continued)

<table>
<tr><th>Status</th><th>Description</th></tr>
<tr><td>Message Integrity Check</td><td>Indicates whether your client adapter is using message integrity check (MIC) to protect packets sent to and received from the access point.
MIC prevents bit-flip attacks on encrypted packets. During a bit-flip attack, an intruder intercepts an encrypted message, alters it slightly, and retransmits it, and the receiver accepts the retransmitted message as legitimate.
<b>Note</b> MIC is supported automatically by the client adapter’s driver, but it must be enabled on the access point.
<b>Value:</b> None, MMH, or Michael
<table>
<tr><th>Message Integrity Check</th><th>Description</th></tr>
<tr><td>None</td><td>MIC is disabled.</td></tr>
<tr><td>MMH</td><td>MIC is enabled and is being used with CKIP.</td></tr>
<tr><td>Michael</td><td>MIC is enabled and is being used with WPA and TKIP.</td></tr>
</table></td></tr>
<tr><td>Current Link Speed</td><td>The rate at which your client adapter is currently transmitting data packets.
<b>Value:</b> 1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48, or 54 Mbps</td></tr>
<tr><td>Channel</td><td>The channel that your client adapter is currently using for communications. This field displays “Scanning” while the client adapter searches for a channel.
<b>Value:</b> Dependent on radio band and regulatory domain
<b>Note</b> Refer to the Channel parameter in Table 5-3 for information on selecting the channel for your client adapter.
<b>Note</b> Refer to Appendix D for a list of channel identifiers, channel center frequencies, and regulatory domains for each channel.</td></tr>
<tr><td>Frequency</td><td>The radio frequency that your client adapter is currently using for communications. This field displays “Scanning” while the client adapter searches for a frequency.
<b>Value:</b> Dependent on radio band and regulatory domain
<b>Note</b> Refer to the Wireless Mode parameter in Table 5-3 for information on selecting the frequency for your client adapter.</td></tr>
<tr><td>Channel Set</td><td>The regulatory domain for which your client adapter is currently configured. This value is not user selectable.
<b>Value:</b> Americas, AMEA, Japan, or Rest of World</td></tr>
</table>

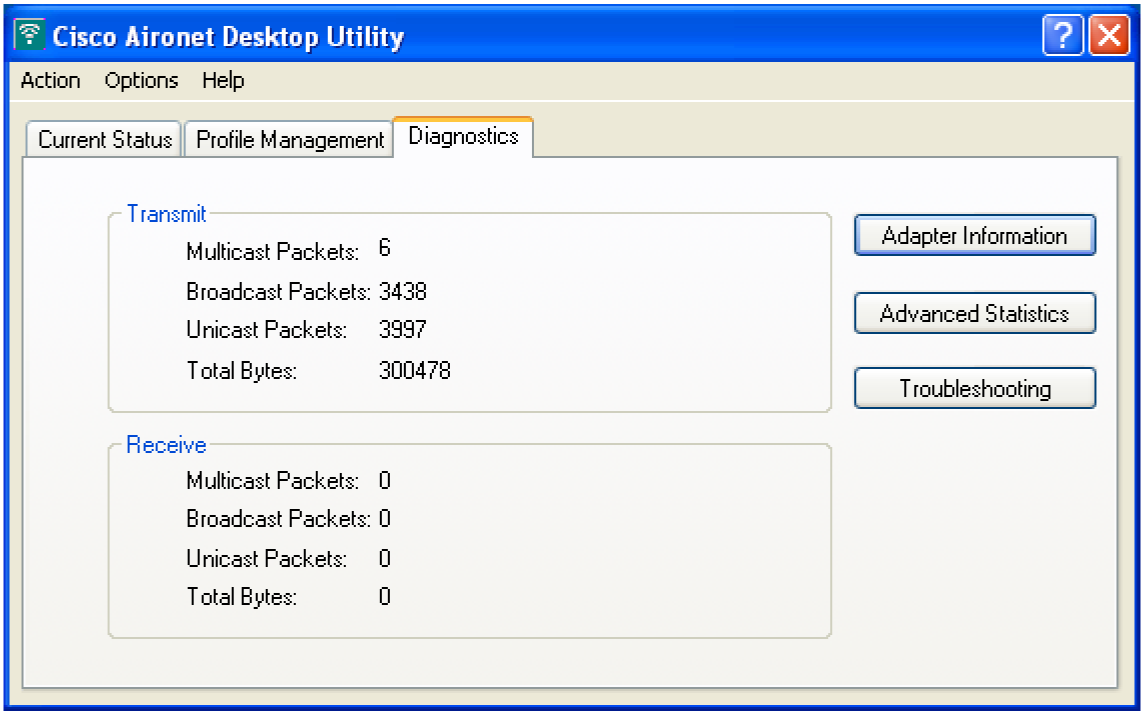
Click **OK** to close the Advanced Status screen.

Viewing Statistics for Your Client Adapter

ADU enables you to view statistics that indicate how data is being received and transmitted by your client adapter.

To view your client adapter's statistics, open ADU; then click the **Diagnostics** tab. The Cisco Aironet Desktop Utility (Diagnostics) screen appears (see Figure 7-4).

Figure 7-4 Cisco Aironet Desktop Utility (Diagnostics) Screen



Transmit

Multicast Packets: 6
Broadcast Packets: 3438
Unicast Packets: 3997
Total Bytes: 300478

Receive

Multicast Packets: 0
Broadcast Packets: 0
Unicast Packets: 0
Total Bytes: 0

This screen displays basic transmit and receive statistics for your client adapter. The statistics are calculated on a relative or cumulative basis as specified by the Data Display parameter and are continually updated at the rate specified by the Refresh Interval parameter. Instructions for changing the Data Display and Refresh Interval settings are provided in Table 7-2.

Table 7-5 describes each statistic that is displayed for your client adapter.

Table 7-5 Basic Client Adapter Statistics

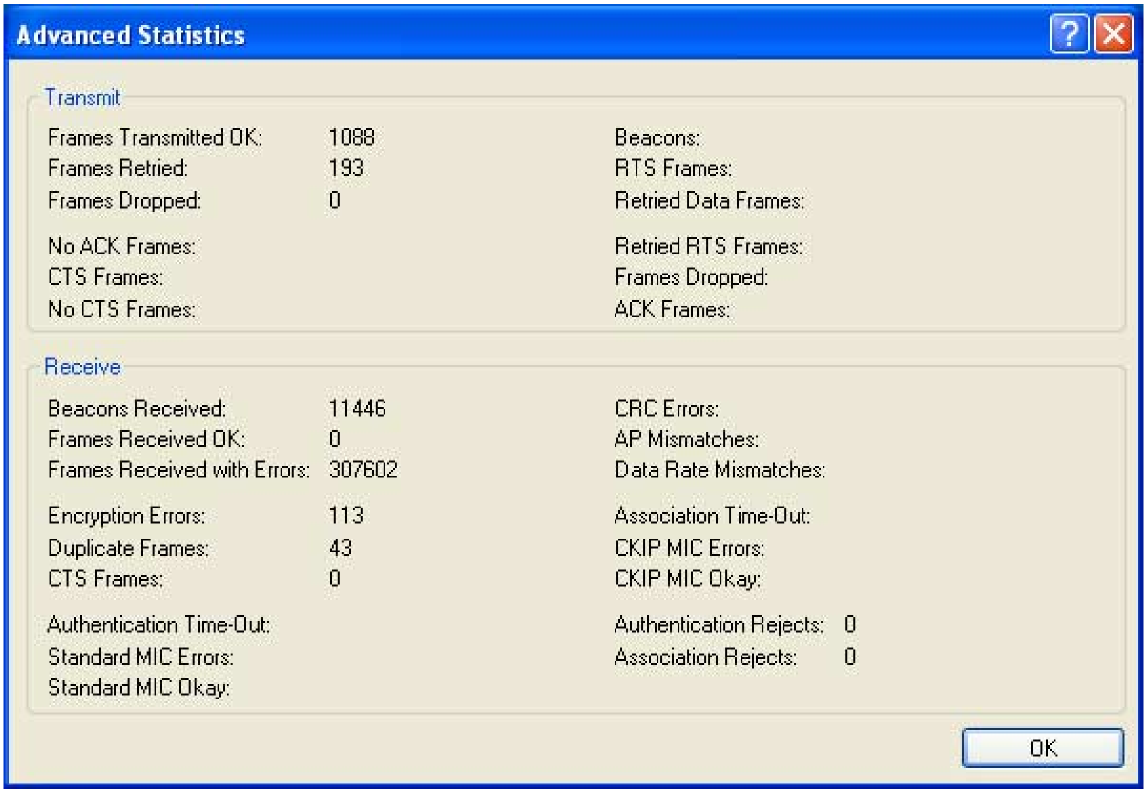
Statistic	Description
Transmit Statistics	
Multicast Packets	The number of multicast packets that were transmitted successfully.
Broadcast Packets	The number of broadcast packets that were transmitted successfully.
Unicast Packets	The number of unicast packets that were transmitted successfully.
Total Bytes	The number of bytes of data that were transmitted successfully.

Table 7-5 Basic Client Adapter Statistics (continued)

Statistic	Description
Receive Statistics	
Multicast Packets	The number of multicast packets that were received successfully.
Broadcast Packets	The number of broadcast packets that were received successfully.
Unicast Packets	The number of unicast packets that were received successfully.
Total Bytes	The number of bytes of data that were received successfully.

Click **Advanced Statistics** if you want to view additional statistics for your client adapter. The Advanced Statistics screen appears (see Figure 7-5).

Figure 7-5 Advanced Statistics Screen



Transmit

Frames Transmitted OK: 1088
Frames Retried: 193
Frames Dropped: 0

No ACK Frames:
CTS Frames:
No CTS Frames:

Beacons:
RTS Frames:
Retried Data Frames:

Retried RTS Frames:
Frames Dropped:
ACK Frames:

Receive

Beacons Received: 11446
Frames Received OK: 0
Frames Received with Errors: 307602

Encryption Errors: 113
Duplicate Frames: 43
CTS Frames: 0

Authentication Time-Out:
Standard MIC Errors:
Standard MIC Okay:

CRC Errors:
AP Mismatches:
Data Rate Mismatches:

Association Time-Out:
CKIP MIC Errors:
CKIP MIC Okay:

Authentication Rejects: 0
Association Rejects: 0

Table 7-6 interprets each element of the Advanced Statistics screen.

Table 7-6 Advanced Client Adapter Statistics

Status	Description
Transmit Statistics	
Frames Transmitted OK	The number of frames that were transmitted successfully.
Frames Retried	The number of frames that were retried.
Frames Dropped	The number of frames that were dropped due to errors or collisions.
No ACK Frames	The number of transmitted frames that did not have their corresponding Ack frame received successfully.
CTS Frames	The number of clear-to-send (CTS) frames that were transmitted in response to a successfully received RTS frame.
No CTS Frames	The number of frames for which no CTS frame was received in response to an RTS frame.
Beacons	The number of beacon frames that were transmitted successfully (in ad hoc mode only).
RTS Frames	The number of request-to-send (RTS) frames that were transmitted successfully.
Retried Data Frames	The number of normal data frames that were retransmitted.
Retried RTS Frames	The number of request-to-send (RTS) frames that were retransmitted.
Frames Dropped	The number of frames that failed to be transmitted successfully after exhausting the maximum number of retries.
ACK Frames	The number of transmitted frames that had their corresponding Ack frame received successfully.
Receive Statistics	
Beacons Received	The number of beacon frames that were received successfully.
Frames Received OK	The number of all frames that were received successfully.
Frames Received with Errors	The number of frames that were received with an invalid checksum.
Encryption Errors	The number of frames that were received with encryption errors.
Duplicate Frames	The number of duplicate frames that were received successfully.
CTS Frames	The number of clear-to-send (CTS) frames that were received in response to an RTS frame.
Authentication Time-Out	The number of times the client adapter tried to authenticate to an access point but was unable to because the access point did not respond fast enough (timed out).
Standard MIC Errors	The number of frames that were discarded due to an incorrect message integrity check (MIC) value.
Standard MIC Okay	The number of frames that were received with the correct message integrity check (MIC) value.
CRC Errors	The number of cyclic redundancy check (CRC) errors detected in the data portion of the frame.

Table 7-6 Advanced Client Adapter Statistics (continued)

Status	Description
AP Mismatches	The number of times the client adapter tried to associate to an access point but was unable to because the access point was not the adapter's specified access point. **Note** Refer to the Specified Access Point 1- 4 parameter on page 5-10 for information on specifying access points.
Data Rate Mismatches	The number of times the client adapter tried to associate to an access point but was unable to because the adapter's data rate was not supported by the access point. **Note** Refer to the Wireless Mode parameter in Table 5-3 for information on supported data rates.
Association Time-Out	The number of times the client adapter tried to associate to an access point but was unable to because the access point did not respond fast enough (timed out).
CKIP MIC Errors	The number of frames that were discarded due to an incorrect message integrity check (MIC) value when CKIP was being used. **Note** This field is displayed only if MIC is enabled on the access point.
CKIP MIC Okay	The number of frames that were received with the correct message integrity check (MIC) value when CKIP was being used. **Note** This field is displayed only if MIC is enabled on the access point.
Authentication Rejects	The number of times the client adapter tried to authenticate to an access point but was rejected.
Association Rejects	The number of times the client adapter tried to associate to an access point but was rejected.

Click **OK** to close the Advanced Statistics screen.

CHAPTER 8

Using the Aironet System Tray Utility (ASTU)

This chapter explains how to use the Aironet System Tray Utility (ASTU) to access status information about your client adapter and perform basic tasks.

The following topics are covered in this chapter:

Overview of ASTU

ASTU is an optional application that provides a small subset of the features available through ADU. Specifically, it enables you to access status information about your client adapter and perform basic tasks. ASTU is accessible from an icon in the Windows system tray, making it easily accessible and convenient to use. The ASTU icon appears only if a client adapter is installed in your computer.

ASTU provides information and options in the following ways:

- In the appearance of the icon itself
- Through a tool tip window that appears when you hover the cursor over the icon
- Through a pop-up menu that appears when you right-click the icon

The ASTU Icon

The appearance of the ASTU icon indicates the connection status of your client adapter. ASTU reads the client adapter status and updates every 1 to 5 seconds, depending on the value entered for the Refresh Interval on the Display Settings screen. Table 8-1 interprets the different appearances of the ASTU icon.

Note Windows 2000 and XP may display their own wireless network connection status icon in the system tray. Cisco recommends that you turn off the Windows icon and use the ASTU icon to monitor your wireless connection.

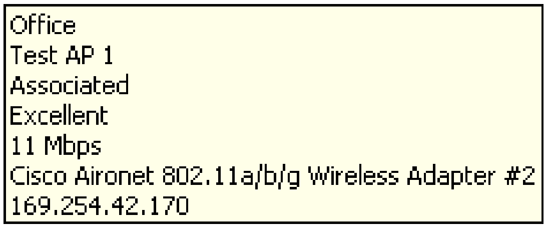
Table 8-1 Interpreting the ASTU Icon

Icon	Description
⬜	The client adapter's radio is turned off.
⬛	The client adapter is not associated to an access point.
▨	The client adapter is associated to an access point, but the user is not authenticated.
🟩	The client adapter is associated to an access point, and the link quality is excellent or good.
🟨	The client adapter is associated to an access point, and the link quality is fair.
🟥	The client adapter is associated to an access point, and the link quality is poor.

Tool Tip Window

When you hover the cursor over the ASTU icon, the Tool Tip window appears (see Figure 8-1).

Figure 8-1 Tool Tip Window



Office
Test AP 1
Associated
Excellent
11 Mbps
Cisco Aironet 802.11a/b/g Wireless Adapter #2
169.254.42.170

This window provides information on the current status of your client adapter. Table 8-2 lists and describes each element of the Tool Tip window.

Table 8-2 Tool Tip Window Elements

Status Element	Description
Active profile	The network configuration (or profile) that your client adapter is currently using.
SSID	The name of the network to which your client adapter is currently associated. **Note** Refer to the SSID1 parameter in Table 5-2 for information on setting the client adapter's SSID.

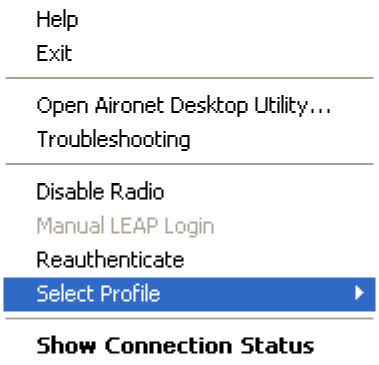
Table 8-2 Tool Tip Window Elements (continued)

<table>
<tr><th>Status Element</th><th>Description</th></tr>
<tr><td>Connection status</td><td>The operational mode of your client adapter.
<b>Value:</b> Not Associated, Associated, Authenticating, Authenticated, Authentication Failed, Authentication Failed Retrying
<table>
<tr><th>Connection Status</th><th>Description</th></tr>
<tr><td>Not Associated</td><td>The client adapter has not established a connection to an access point.</td></tr>
<tr><td>Associated</td><td>The client adapter has established a connection to an access point.</td></tr>
<tr><td>Authenticating</td><td>The client adapter is associated to an access point, and the EAP authentication process has begun but not yet succeeded.</td></tr>
<tr><td>Authenticated</td><td>The client adapter is associated to an access point, and the user is EAP authenticated.</td></tr>
<tr><td>Authentication Failed</td><td>The client adapter is associated to an access point, but the user has failed to EAP authenticate.</td></tr>
<tr><td>Authentication Failed Retrying</td><td>The client adapter is associated to an access point, the user has failed to EAP authenticate, but another authentication attempt is being made.</td></tr>
</table>
</td></tr>
<tr><td>Link quality</td><td>The client adapter's ability to communicate with the access point, which is determined by the combined result of the adapter's signal strength and signal quality.
<b>Value:</b> Excellent, Good, Fair, Poor, or No Link</td></tr>
<tr><td>Link speed</td><td>The rate at which your client adapter is currently transmitting data packets.
<b>Value:</b> 1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48, or 54 Mbps</td></tr>
<tr><td>Client adapter type</td><td>A description of your client adapter.</td></tr>
<tr><td>Client adapter IP address</td><td>The IP address of your client adapter.</td></tr>
</table>

Pop-Up Menu

When you right-click the ASTU icon, the ASTU pop-up menu appears (see Figure 8-2).

Figure 8-2 ASTU Pop-Up Menu



The following sections describe each ASTU pop-up menu option.

Note If your system administrator used an administrative tool to deactivate certain ASTU menu options, these options do not appear in the menu and therefore cannot be selected.

Help

This option enables you to access the online help.

Exit

This option closes ADU and ASTU.

Note To reactivate ADU, double-click the **Aironet Desktop Utility** icon on your computer desktop. To reactivate ASTU, select the **Enable Tray Icon** option from ADU’s Action drop-down menu.

Open Aironet Desktop Utility

This option activates ADU. It is available only if ADU was installed.

Note You can also activate ADU by double-clicking the ASTU icon.

Troubleshooting

This option activates the troubleshooting utility, which enables you to identify and resolve configuration and association problems with your client adapter. Refer to the "Using the Troubleshooting Utility" section on page 10-3 for detailed instructions on using this utility.

Preferences

When you select this option, the Aironet System Tray Utility Preferences screen appears (see Figure 8-3).

Figure 8-3 Aironet System Tray Utility Preferences Screen

This screen enables you to determine when ASTU runs and to select the options that appear on the ASTU pop-up menu. Follow the steps below to make your selections.

Step 1 If you want ASTU to run automatically when Windows starts, make sure the **Run the program automatically when Windows starts** check box is checked. Otherwise, uncheck this check box.

Note If you do not select this option and later want to run ASTU, you must use Windows Explorer to find the path where the ASTU software is installed. (The default location is C:\Program Files\Cisco Systems\Aironet Client Monitor.) Then double-click **ACUMon.exe**.

Step 2 In the Menu Options portion of the screen, make sure the check boxes of all the options that you want to appear in the ASTU pop-up menu are checked. Any options that are not checked will not be included in the menu.

Note The Preferences option cannot be deselected. It always appears in the ASTU pop-up menu.

Step 3 Click **OK** to save your changes.

Enable/Disable Radio

This option enables you to turn the client adapter's radio on or off. Turning the radio off prevents the adapter from transmitting RF energy. You might want to turn off the client adapter's radio in the following situations:

- You are not transmitting data and want to conserve battery power.
- You are using a laptop on an airplane and want to prevent the adapter's transmissions from potentially interfering with the operation of certain devices.

When the radio is on, it periodically sends out probes even if it is not associated to an access point, as required by the 802.11 specification. Therefore, it is important to turn it off around devices that are susceptible to RF interference.

Note Your client adapter is not associated while the radio is off.

Note If your client adapter's radio is turned off before your computer enters standby or hibernate mode or before you reboot the computer, the radio remains off when the computer resumes. You must turn the radio back on to resume operation.

If the radio is on, select **Disable Radio** to turn off the radio.

If the radio is off, select **Enable Radio** to turn on the radio.

Manual LEAP Login

TBD

Reauthenticate

This option enables you to force your client adapter to try to reauthenticate using the username and password of the current profile.

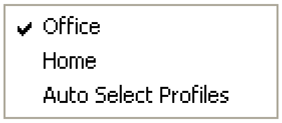
If your client adapter was unable to authenticate using the specified username and password and you have exhausted the retry limit (for example, LEAP tries only once to prevent you from being locked out of the system), the current profile is disabled until you change the username or password, reboot your computer, eject and reinsert the client adapter, or select the Reauthenticate option.

Select Profile

This option enables you to select the active profile for your client adapter.

When you select Select Profile from the ASTU pop-up menu, a profiles submenu appears (see Figure 8-4).

Figure 8-4 Profiles Submenu


✓ Office
Home
Auto Select Profiles

From this menu, you can choose between the following options:

- **Auto Select Profiles**—Causes the client adapter's driver to automatically select a profile from the list of profiles that were set up in ACU to be included in auto profile selection.

  If the client adapter loses association for more than 10 seconds (or for more than the time specified by the LEAP authentication timeout value on the LEAP Settings screen if LEAP is enabled), the driver switches automatically to another profile that is included in auto profile selection. The adapter will not switch profiles as long as it remains associated or reassociates within 10 seconds (or within the time specified by the LEAP authentication timeout value). To force the client adapter to associate to a different access point, you must select a new profile.

  Note This option is available only if two or more profiles are included in auto profile selection.

  Note Login scripts are not reliable if you use auto profile selection with LEAP. If you LEAP authenticate and achieve full network connectivity before or at the same time as you log into the computer, the login scripts will run. However, if you LEAP authenticate and achieve full network connectivity after you log into the computer, the login scripts will not run.

- **A specific profile**—When you select a profile from the list of available profiles, the client adapter attempts to establish a connection to an access point using the parameters that were configured for that profile.

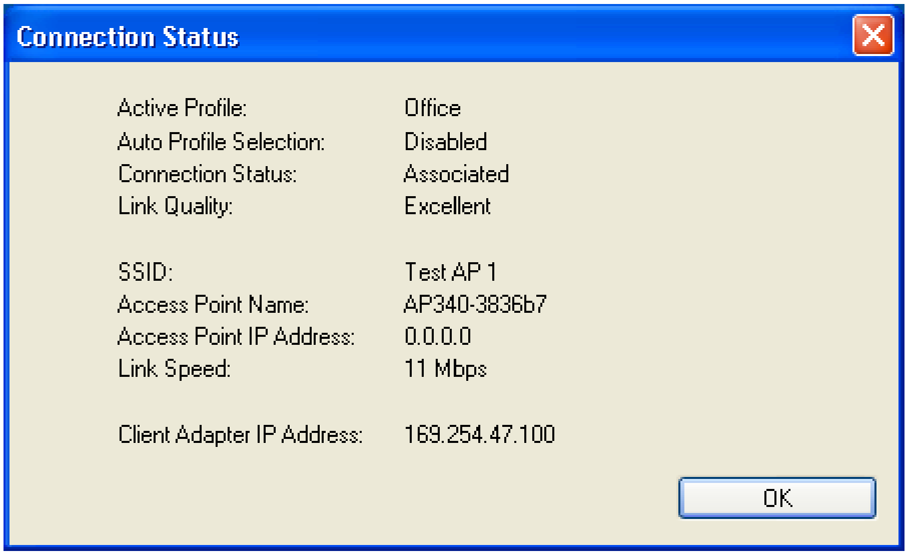
  If the client adapter cannot associate to the access point or loses association while using the selected profile, the adapter does not attempt to associate using another profile. To associate, you must select a different profile or select Auto Select Profiles.

Simply click the desired profile to select it. A check mark appears beside the profile, and the client adapter attempts to establish a connection using the selected profile.

Show Connection Status

When you select this option, the Connection Status screen appears (see Figure 8-5).

Figure 8-5 Connection Status Screen



Active Profile: Office
Auto Profile Selection: Disabled
Connection Status: Associated
Link Quality: Excellent

SSID: Test AP 1
Access Point Name: AP340-3836b7
Access Point IP Address: 0.0.0.0
Link Speed: 11 Mbps

Client Adapter IP Address: 169.254.47.100

This screen provides information on the current status of your client adapter. Table 8-3 interprets each element of the Connection Status screen.

Note You can also access the Connection Status screen by double-clicking the ASTU icon.

Table 8-3 Connection Status Screen Elements

Status Element	Description
Active Profile	The network configuration (or profile) that your client adapter is currently using.
Auto Profile Selection	Indicates whether your client adapter is using auto profile selection. **Value:** Enabled or Disabled

Table 8-3 Connection Status Screen Elements (continued)

<table>
<tr><th>Status Element</th><th>Description</th></tr>
<tr><td>Connection Status</td><td>The operational mode of your client adapter.
<b>Value:</b> Not Associated, Associated, Authenticating, Authenticated, Authentication Failed, Authentication Failed Retrying
<table>
<tr><th>Connection Status</th><th>Description</th></tr>
<tr><td>Not Associated</td><td>The client adapter has not established a connection to an access point.</td></tr>
<tr><td>Associated</td><td>The client adapter has established a connection to an access point.</td></tr>
<tr><td>Authenticating</td><td>The client adapter is associated to an access point, and the EAP authentication process has begun but not yet succeeded.</td></tr>
<tr><td>Authenticated</td><td>The client adapter is associated to an access point, and the user is EAP authenticated.</td></tr>
<tr><td>Authentication Failed</td><td>The client adapter is associated to an access point, but the user has failed to EAP authenticate.</td></tr>
<tr><td>Authentication Failed Retrying</td><td>The client adapter is associated to an access point, the user has failed to EAP authenticate, but another authentication attempt is being made.</td></tr>
</table></td></tr>
<tr><td>Link Quality</td><td>The client adapter’s ability to communicate with the access point, which is determined by the combined result of the adapter’s signal strength and signal quality.
<b>Value:</b> Excellent, Good, Fair, or Poor</td></tr>
<tr><td>SSID</td><td>The name of the network to which your client adapter is currently associated.
<b>Note</b> Refer to the SSID1 parameter in Table 5-2 for information on setting the client adapter’s SSID.</td></tr>
<tr><td>Access Point Name</td><td>The name of the access point to which your client adapter is associated. It is shown only if the client adapter is in infrastructure mode, the access point was configured with a name, and Aironet Extensions are enabled (on access points running Cisco IOS release 12.2(4)JA or greater).</td></tr>
<tr><td>Access Point IP Address</td><td>The IP address of the access point to which your client adapter is associated. It is shown only if the client adapter is in infrastructure mode, the access point was configured with an IP address, and Aironet Extensions are enabled (on access points running Cisco IOS release 12.2(4)JA or greater).
<b>Note</b> If Aironet Extensions are disabled, the IP address of the associated access point is shown as 0.0.0.0.</td></tr>
</table>

Table 8-3 Connection Status Screen Elements (continued)

Status Element	Description
Link Speed	The rate at which your client adapter is currently transmitting data packets. **Value:** 1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48, or 54 Mbps
Client Adapter IP Address	The IP address of your client adapter.

CHAPTER 9

Routine Procedures

This chapter provides procedures for common tasks related to the client adapter.

The following topics are covered in this chapter:

Removing a Client Adapter

Follow the instructions in this section to remove a PC-Cardbus card or PCI card from a computing device, when necessary.

Caution These procedures and the physical connections they describe apply generally to conventional Cardbus slots and PCI expansion slots. In cases of custom or nonconventional equipment, be alert to possible differences in Cardbus slot and PCI expansion slot configurations.

Removing a PC-Cardbus Card

To remove a PC-Cardbus card after it is successfully installed and configured (such as when your laptop is to be transported), completely shut down your computer and pull the card directly out of the Cardbus slot. When the card is reinserted and the computer is rebooted, your connection to the network should be re-established.

Note If you need to remove your PC-Cardbus card but do not want to shut down your computer, double-click the **Unplug or Eject Hardware** icon in the Windows system tray, select the Cisco Aironet client adapter you want to remove under Hardware devices, click **Stop**, and click **OK** twice. Then pull the card directly out of the card slot.

Removing a PCI Card

Because PCI client adapters are installed inside desktop computers, which are not designed for portable use, you should have little reason to remove the adapter. However, instructions are provided below in case you ever need to remove your PCI card.

Step 1 Completely shut down your computer.

Step 2 Remove the computer cover.

Step 3 Remove the screw from the top of the CPU back panel above the PCI expansion slot that holds your client adapter.

Step 4 Pull up firmly on the client adapter to release it from the slot and carefully tilt the adapter to slip its antenna through the opening near the slot.

Step 5 Reinstall the screw on the CPU back panel and replace the computer cover.

Client Adapter Software Procedures

This section provides instructions for the following procedures:

- Upgrading the client adapter software, page 9-3
- Uninstalling the client adapter software, page 9-6
- Finding the driver version, page 9-7
- ADU procedures, page 9-7
- ACM procedures, page 9-10

Upgrading the Client Adapter Software

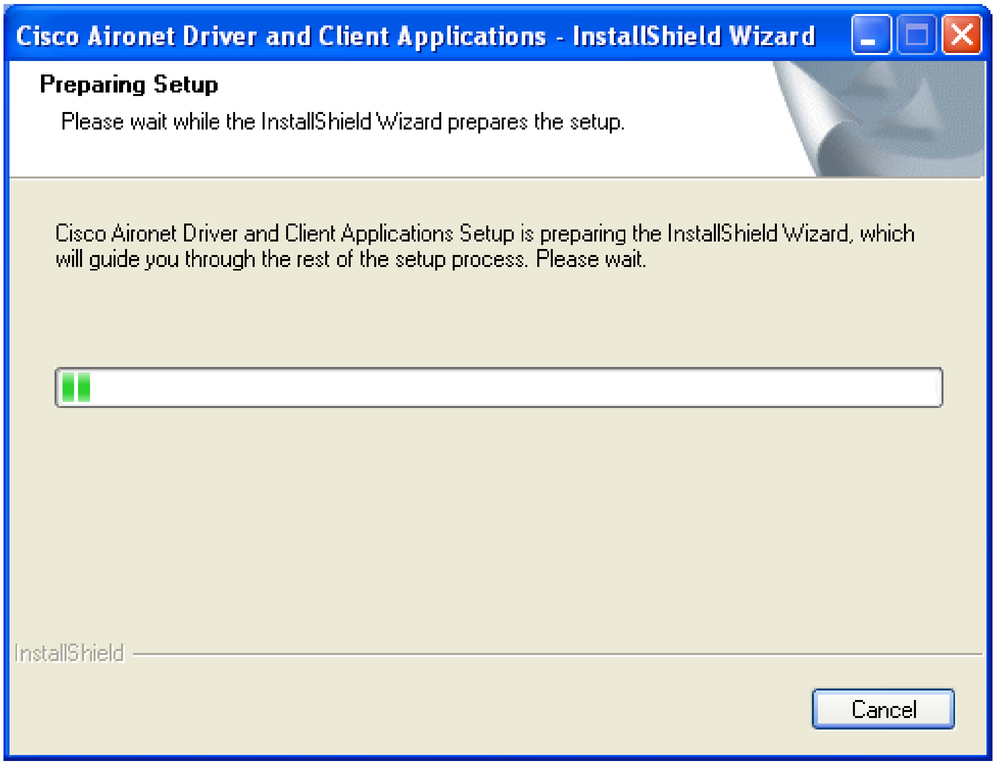
Follow the steps below to upgrade your Cisco Aironet CB21AG or PI21AG client adapter software to a more recent version using the settings that were selected during the last installation.

Note If you want to upgrade your client adapter software using new settings, uninstall the previous installation (see the instructions on page 9-6); then install the new software (see the instructions on page 3-8).

Step 1 Use Windows Explorer to find the Install Wizard file.

Step 2 Double-click the file. The "Starting InstallShield Wizard" message appears followed by the Preparing Setup screen (see Figure 9-1) and the Previous Installation Detected screen (see Figure 9-2).

Figure 9-1 Preparing Setup Screen



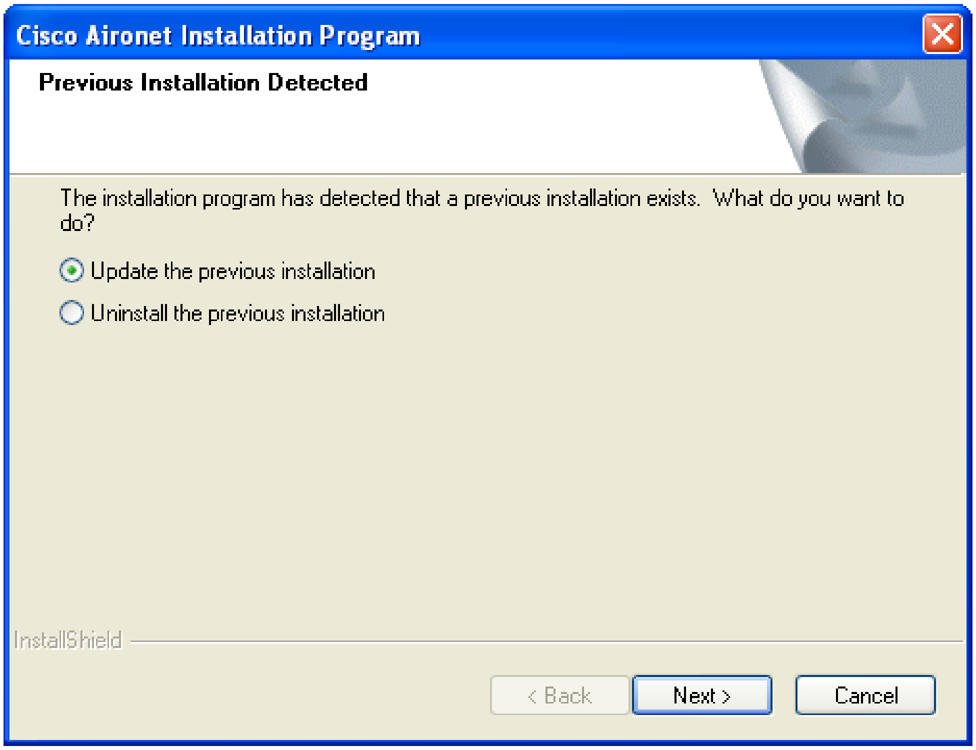
Cisco Aironet Driver and Client Applications - InstallShield Wizard

Preparing Setup

Please wait while the InstallShield Wizard prepares the setup.

Cisco Aironet Driver and Client Applications Setup is preparing the InstallShield Wizard, which will guide you through the rest of the setup process. Please wait.

Figure 9-2 Previous Installation Detected



Cisco Aironet Installation Program

Previous Installation Detected

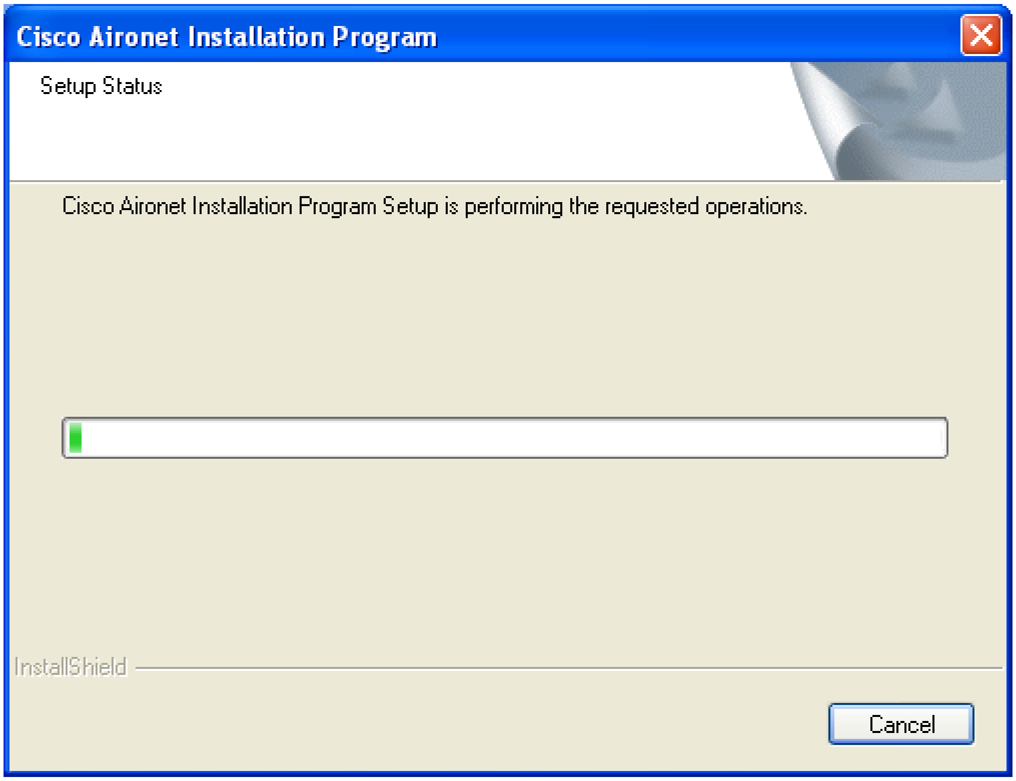
The installation program has detected that a previous installation exists. What do you want to do?

● Update the previous installation

○ Uninstall the previous installation

Step 3 Select **Update the previous installation** and click **Next**. The Setup Status screen appears (see Figure 9-3).

Figure 9-3 Setup Status Screen



Cisco Aironet Installation Program

Setup Status

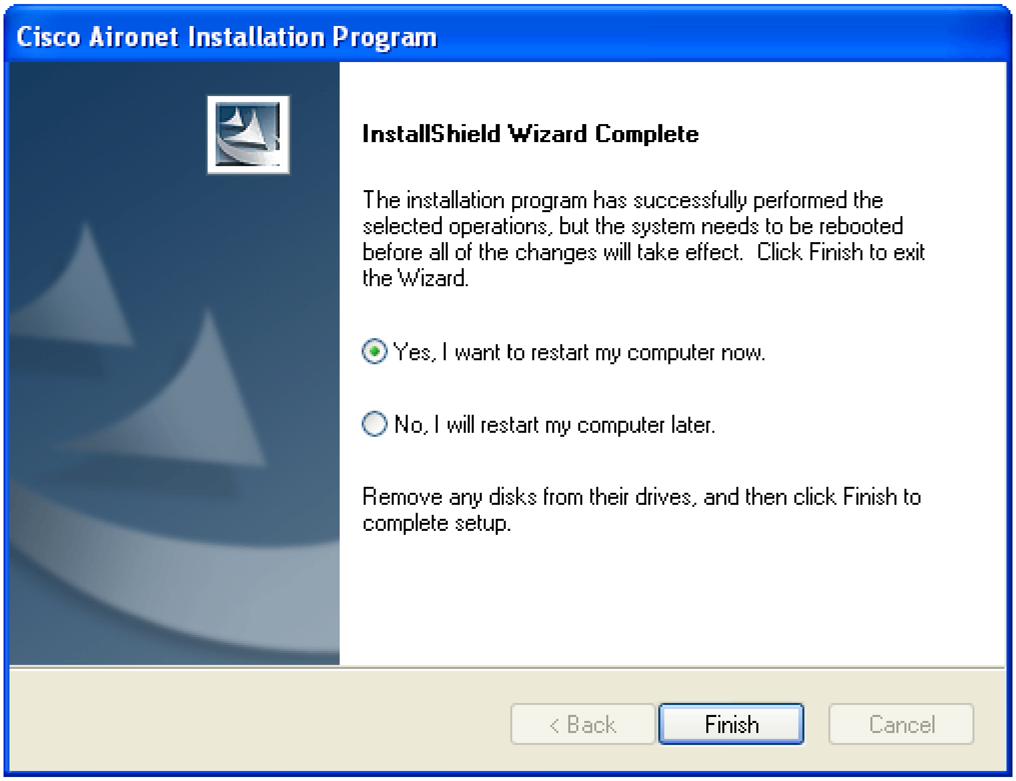
Cisco Aironet Installation Program Setup is performing the requested operations.

The upgrade process begins, and you are notified as each software component is reinstalled.

Note This process may take several minutes.

Step 4 When the InstallShield Wizard Complete screen appears (see Figure 9-4), select **Yes, I want to restart my computer now** and click **Finish**.

Figure 9-4 InstallShield Wizard Complete Screen



Cisco Aironet Installation Program

InstallShield Wizard Complete

The installation program has successfully performed the selected operations, but the system needs to be rebooted before all of the changes will take effect. Click Finish to exit the Wizard.

● Yes, I want to restart my computer now.

○ No, I will restart my computer later.

Remove any disks from their drives, and then click Finish to complete setup.

The client adapter has been upgraded.

Uninstalling the Client Adapter Software

This section provides instructions for uninstalling the software for your Cisco Aironet CB21AG or PI21AG client adapter. This procedure is necessary if you want to remove installed client adapter software from your computer or downgrade to previous versions.

Note If you want to downgrade to earlier versions of client adapter software, follow the steps below to uninstall the current software. Then install the older software.

Note When you uninstall the client adapter software, any existing profiles are removed. If you want to save your profiles for later use, follow the instructions in Chapter 4 to export your profiles before uninstalling the software.

Step 1 Perform one of the following:

- If you want to remove the client adapter from your computer, shut down your computer, remove the client adapter, and reboot your computer.
- If you want to leave your client adapter inserted in your computer, go to Step 2.

Step 2 Use Windows Explorer to find the Install Wizard file.

Step 3 Double-click the file. The "Starting InstallShield Wizard" message appears followed by the Preparing Setup screen (see Figure 9-1) and the Previous Installation Detected screen (see Figure 9-2).

Step 4 Select **Uninstall the previous installation** and click **Next**.

Step 5 When prompted to confirm your decision, click **OK**. The process to uninstall the files begins.

Note This process may take several minutes.

Step 6 When prompted to uninstall the device driver, click **Yes**.

Step 7 When the InstallShield Wizard Complete screen appears (see Figure 9-4), select **Yes, I want to restart my computer now** and click **Finish**.

Step 8 If you did not remove the client adapter from your computer, the Found New Hardware Wizard screen appears after your computer reboots. Click **Cancel**.

The client adapter software and its program folder have been uninstalled.

Note This procedure does not remove the Install Wizard file. If you want to remove it from your computer, find the file using Windows Explorer and delete it.

ADU Procedures

This section provides instructions for the following procedures:

- Opening ADU, page 9-7
- Exiting ADU, page 9-8
- Finding the version of ADU, page 9-8
- Viewing client adapter information, page 9-9
- Accessing online help, page 9-10

Opening ADU

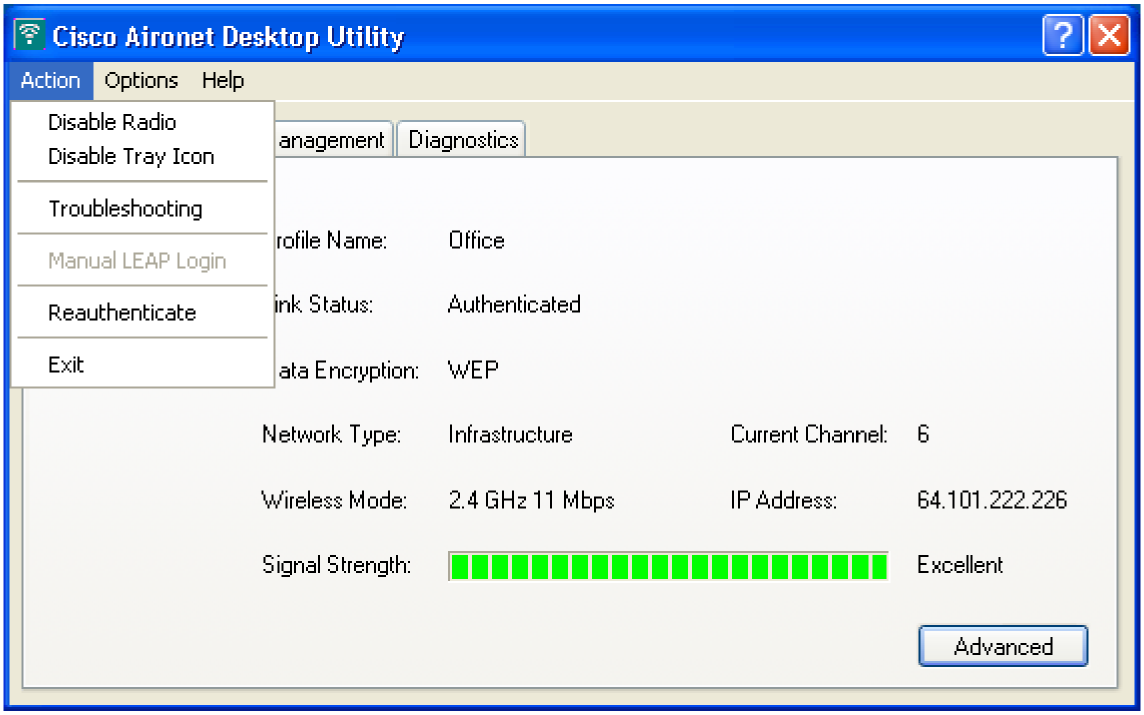
To open ADU, perform one of the following:

- Double-click the **Aironet Desktop Utility** icon on your desktop.
- Select **Aironet Desktop Utility (ADU)** from the folder in the Windows Start Menu that you chose during installation (the default location is **Start** > **Program Files** > **Cisco Aironet** > **Aironet Desktop Utility**).
- Right-click the ASTU icon in the Windows system tray and select **Open Aironet Desktop Utility**.

Exiting ADU

To exit ADU, select **Exit** from the Action drop-down menu (see Figure 9-5).

Figure 9-5 Action Drop-Down Menu



rofile Name: Office

ink Status: Authenticated

ata Encryption: WEP

Network Type: Infrastructure

Current Channel: 6

Wireless Mode: 2.4 GHz 11 Mbps

IP Address: 64.101.222.226

Signal Strength: Excellent

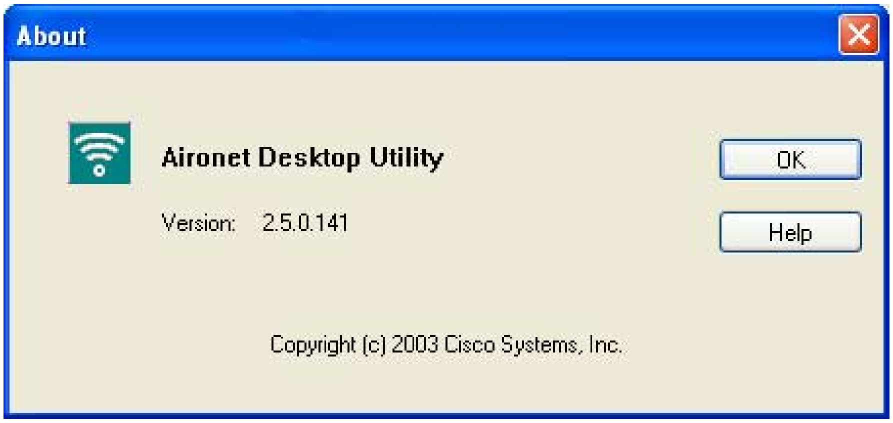
Finding the Version of ADU

Follow the instructions in this section to find the version of ADU that is currently installed.

Step 1 Open ADU.

Step 2 Select the **About Aironet Desktop Utility** option from the Help drop-down menu. The About screen appears (see Figure 9-6).

Figure 9-6 About Screen



Aironet Desktop Utility

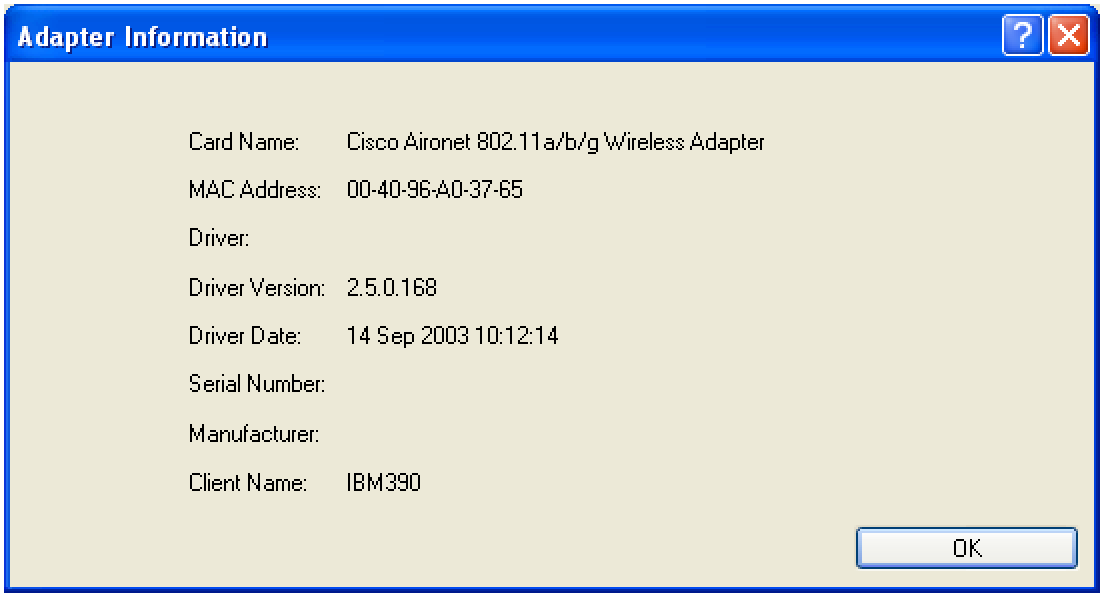
Version: 2.5.0.141

Copyright (c) 2003 Cisco Systems, Inc.

Viewing Client Adapter Information

To view information about your client adapter, open ADU. Then click the **Diagnostics** tab and **Adapter Information**. The Adapter Information screen appears (see Figure 9-7).

Figure 9-7 Adapter Information Screen



Card Name: Cisco Aironet 802.11a/b/g Wireless Adapter
MAC Address: 00-40-96-A0-37-65
Driver:
Driver Version: 2.5.0.168
Driver Date: 14 Sep 2003 10:12:14
Serial Number:
Manufacturer:
Client Name: IBM390

Table 9-1 interprets each element of the Adapter Information screen.

Table 9-1 Adapter Information

Status	Description
Card Name	A description of your client adapter.
MAC Address	The MAC address assigned to your client adapter at the factory.
Driver	The filename and location of your client adapter's driver.
Driver Version	The version of the NDIS device driver that is currently installed on your computer.
Driver Date	The date that your client adapter's driver was created.
Serial Number	The serial number of your client adapter. **Note** The serial number appears only if the number has been programmed into your card.
Manufacturer	The manufacturer of your client adapter.
Client Name	The name your client adapter uses when it associates to an access point. **Note** Refer to the Client Name parameter in Table 5-2 for information on setting the client name.

Click **OK** to close the Adapter Information screen.

Accessing Online Help

To access ADU's online help, open ADU. Then select the **Aironet Desktop Utility Help** option from the Help drop-down menu.

ASTU Procedures

Refer to Chapter 8 for instructions on using ASTU.

Turning Your Client Adapter's Radio On or Off

Your client adapter's radio can be turned on or off. Turning the radio off prevents the adapter from transmitting RF energy. You might want to turn off the client adapter's radio in the following situations:

- You are not transmitting data and want to conserve battery power.
- You are using a laptop on an airplane and want to prevent the adapter's transmissions from potentially interfering with the operation of certain devices.

When the radio is on, it periodically sends out probes even if it is not associated to an access point, as required by the 802.11 specification. Therefore, it is important to turn it off around devices that are susceptible to RF interference.

Note Your client adapter is not associated while its radio is off.

Note If your client adapter's radio is turned off before your computer enters standby or hibernate mode or before you reboot the computer, the radio remains off when the computer resumes. You must turn the radio back on to resume operation.

You can use ADU or ASTU to turn the client adapter's radio on or off. Follow the instructions below to use ADU or refer to the "Enable/Disable Radio" section on page 8-7 to use ASTU.

If your client adapter's radio is on, open ADU and select **Disable Radio** from the Action drop-down menu (see Figure 9-5) to turn off the radio.

If your client adapter's radio is off, open ADU and select **Enable Radio** from the Action drop-down menu (see Figure 9-5) to turn on the radio.

CHAPTER 10

Troubleshooting

This chapter provides information for diagnosing and correcting common problems that may be encountered when installing or operating the client adapter.

The following topics are covered in this chapter:

Accessing the Latest Troubleshooting Information

This chapter provides basic troubleshooting tips for your client adapter. For more up-to-date and complex troubleshooting information, refer to the TAC web site. To access this site, go to Cisco.com, click **Technical Support** > **Hardware Support** > **Wireless Devices**. Then select your product and **Troubleshooting** to find information on the problem you are experiencing.

Interpreting the Indicator LEDs

The client adapter shows messages and error conditions through its two LEDs:

- **Link Integrity/Power LED (green**)—This LED lights when the client adapter is receiving power and blinks slowly when the adapter is linked with the network.
- **Link Activity LED (amber)**—This LED blinks quickly when the client adapter is receiving or transmitting data and blinks in a repeating pattern to indicate an error condition.

Table 10-1 interprets the LED operating messages.

Table 10-1 LED Operating Messages

Green LED	Amber LED	Condition
Off	Off	Client adapter is not receiving power.
Blinking slowly	Off	Client adapter is in power save mode.
On	Off	Client adapter has awakened from power save mode.
Alternating blink:		Client adapter is scanning for a network.
On	Off	
Off	On	
Blinking slowly	Blinking slowly	Client adapter is associated to an access point.
Blinking quickly	Blinking quickly	Client adapter is transmitting or receiving data while associated to an access point.

Troubleshooting the Client Adapter

This section provides troubleshooting tips should you encounter problems with your client adapter. Use Table 10-2 to quickly locate specific troubleshooting information.

Table 10-2 Locating Troubleshooting Information

Troubleshooting Information	Page Number
Using the troubleshooting utility	10-3
Disabling the Microsoft Wireless Configuration Manager	10-7
Client adapter recognition problems	10-7
Resolving resource conflicts	10-8
Problems associating to an access point	10-9
Problems authenticating to an access point	10-10
Problems connecting to the network	10-10
Prioritizing network connections	10-10
Parameters missing from Profile Manager screen	10-10
Windows Wireless Network Connection icon shows unavailable connection (Windows XP only)	10-11

Using the Troubleshooting Utility

The troubleshooting utility enables you to identify and resolve configuration and association problems with your client adapter. It is meant to be used only when the client adapter is in infrastructure mode as it assesses the connection between the adapter and an access point.

Follow the instructions in one of the subsections below to use the utility to diagnosis your client adapter's operation, save a detailed report to a text file, or access online help.

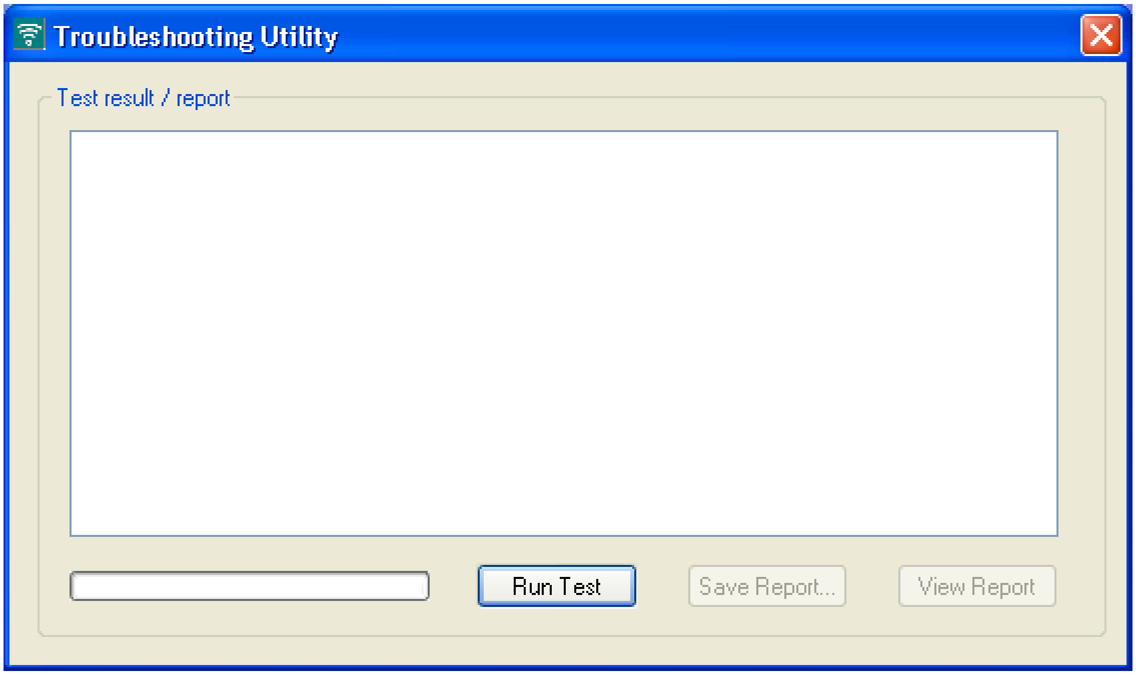
Diagnosing Your Client Adapter's Operation

Step 1 Perform one of the following to activate the troubleshooting utility:

- Open ADU; select **Troubleshooting** from the Action drop-down menu.
- Open ADU; click the **Diagnostics** tab and **Troubleshooting**.
- Right-click the ASTU icon; select **Troubleshooting** from the pop-up menu.

The Troubleshooting Utility screen appears (see Figure 10-1).

Figure 10-1 Troubleshooting Utility Screen

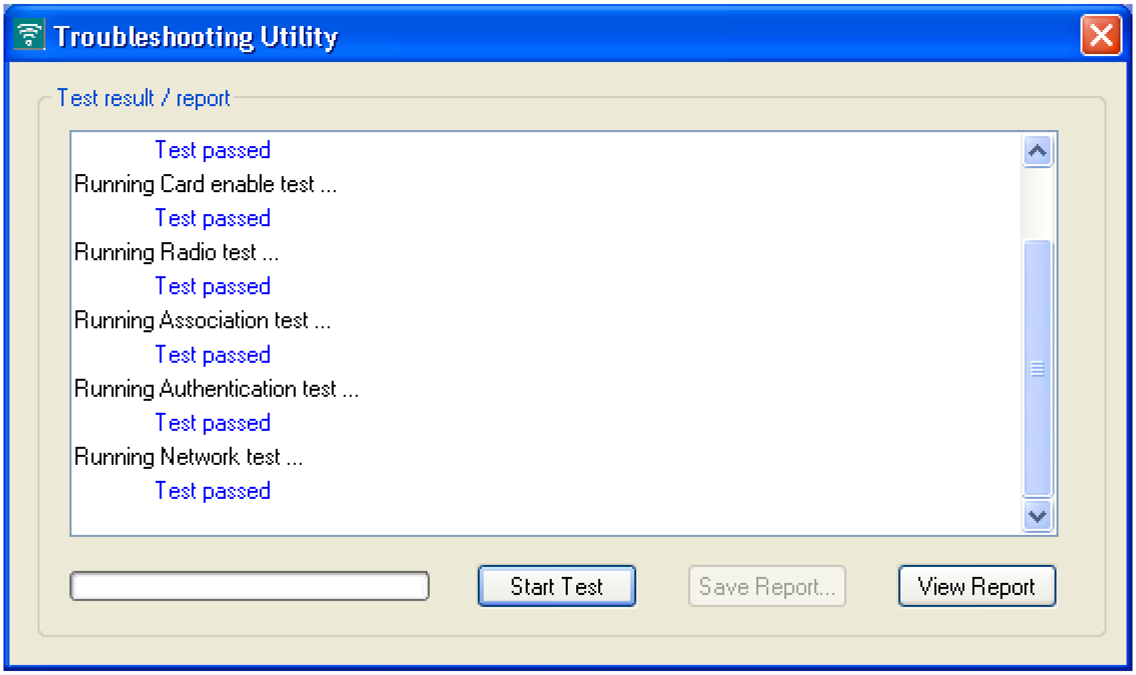


Step 2 Click **Run Test**. The utility performs the following series of seven tests to check the operation of your client adapter and to pinpoint specific problems if they exist:

1. Driver installation test
2. Card insertion test
3. Card enable test
4. Radio test
5. Association test
6. Authentication test
7. Network test

The utility runs and then displays the results for each test (see Figure 10-2).

Figure 10-2 Troubleshooting Utility Screen (with Test Results)



```
        Test passed
Running Card enable test ...
        Test passed
Running Radio test ...
        Test passed
Running Association test ...
        Test passed
Running Authentication test ...
        Test passed
Running Network test ...
        Test passed
```

One of the following status messages appears for each test:

- **Test passed**—The test completed successfully.
- **Test bypassed**—The test was skipped because it was not required for the active profile.
- **Test failed**—The test failed. Follow the instructions in Step 3 to obtain more details.

Note You can click **Stop Test** at any time to stop the testing process, or you can click **Start Test** once the testing process has stopped to run the test again.

Step 3 To view more detailed information, click **View Report**. A report appears that provides more detailed results for your client adapter.

Note The report contains valuable information that, if necessary, could be used by TAC to analyze any problems. Follow the instructions in the next section if you want to save the report to a text file.

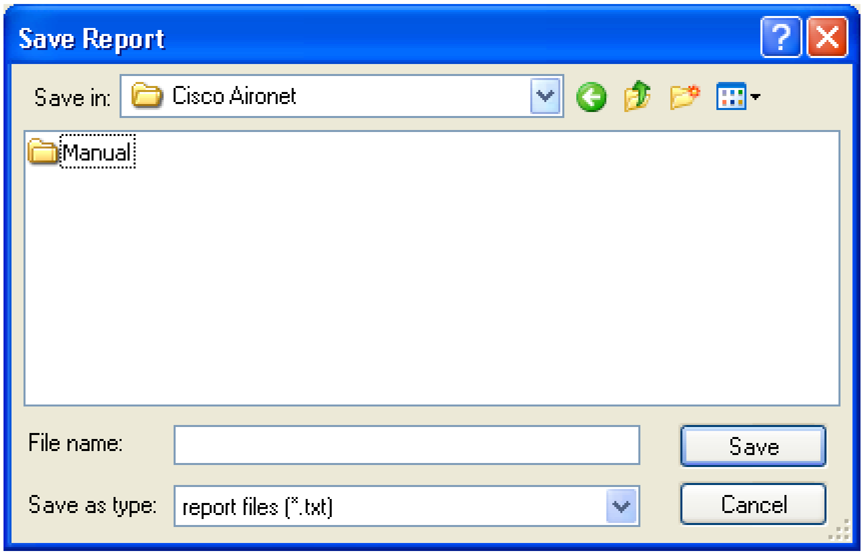
Step 4 If a problem is discovered, the report provides some possible repair suggestions. Follow the repair instructions carefully and run the troubleshooting utility again.

Saving the Detailed Report to a Text File

Follow the steps below to save the detailed troubleshooting report to your computer's hard drive.

Step 1 Click **Save Report**. The Save Report screen appears (see Figure 10-3).

Figure 10-3 Save Report Screen



Save Report

Save in: Cisco Aironet

Manual

File name:

Save as type: report files (*.txt)

Step 2 Enter a name for the detailed report in the File name field. The report is saved as a *.txt file.

Step 3 Use the Save in box at the top of the screen to specify the location on your computer's hard drive where the file will be saved.

Note The default location is the Logs folder in the directory where ADU is installed (for example, C:\Program Files\Cisco Aironet\Logs).

Step 4 Click **Save**. The file is saved as a text file in the location specified.

Disabling a Cisco Aironet Client Adapter

Cisco Aironet CB21AG and PI21AG client adapter software is incompatible with other Cisco Aironet client adapter software. Therefore, Cisco recommends that you remove or disable any other Cisco Aironet adapters before installing or using a CB21AG or PI21AG card.

Follow the steps below to disable a client adapter.

Step 1 Double-click **My Computer**, **Control Panel**, and **System**.

Step 2 Select the **Hardware** tab.

Step 3 Click **Device Manager**.

Step 4 Double-click **Network adapters**.

Step 5 Right-click the client adapter that you want to disable.

Step 6 Select **Disable**. The client adapter is disabled.

Disabling the Microsoft Wireless Configuration Manager (Windows XP Only)

If any conflicts arise between ADU and the Microsoft Wireless Configuration Manager on a computer running Windows XP, follow the steps below to disable the Microsoft configuration manager.

Step 1 Double-click **My Computer**, **Control Panel**, and **Network Connections**.

Step 2 Right-click **Wireless Network Connection** and click **Properties**.

Step 3 Select the **Wireless Networks** tab and uncheck the **Use Windows to configure my wireless network settings** check box.

Step 4 Select the **Authentication** tab.

Note In Service Pack 1 for Windows XP, the Authentication tab has moved from its previous location. To access it, click the **Wireless Networks** tab, select the network that you are configuring in the Preferred network list, and click **Properties**.

Step 5 Uncheck the **Enable network access control using IEEE 802.1X** check box.

Client Adapter Recognition Problems

If your client adapter is not being recognized by your computer's PCMCIA adapter, check your computer's BIOS and make sure that the PC card controller mode is set to PCIC compatible.

Note A computer's BIOS varies depending on the manufacturer. For support on BIOS-related issues, consult your computer's manufacturer.

Resolving Resource Conflicts

If you encounter problems while installing your client adapter on a computer running a Windows operating system, you may need to specify a different interrupt request (IRQ) or I/O range for the adapter.

The default IRQ for the client adapter is IRQ 10, which may not work for all systems. Follow the steps for your specific operating system to obtain an available IRQ.

During installation the adapter's driver installation script scans for an unused I/O range. The installation can fail if the I/O range found by the driver installation script is occupied by another device but not reported by Windows. An I/O range might not be reported if a device is physically present in the system but not enabled under Windows. Follow the steps for your specific operating system to obtain an available I/O range.

Resolving Resource Conflicts in Windows 2000

Step 1 Double-click **My Computer**, **Control Panel**, and **System**.

Step 2 Click the **Hardware** tab and **Device Manager**.

Step 3 Double-click **Network Adapters** and the Cisco Systems Wireless LAN Adapter.

Step 4 In the General screen, the Device Status field indicates if a resource problem exists. If a problem is indicated, click the **Resources** tab.

Step 5 Uncheck the **Use automatic settings** check box.

Step 6 Under Resource Settings or Resource Type, click **Input/Output Range**.

Step 7 Look in the Conflicting Device list at the bottom of the screen. If it indicates that the range is being used by another device, click the **Change Setting** button.

Step 8 Scroll through the ranges in the Value dialog box and select one that does not conflict with another device. The Conflict Information window at the bottom of the screen indicates if the range is already being used.

Step 9 Click **OK**.

Step 10 Under Resource Settings or Resource Type, click **Interrupt Request**.

Step 11 Look in the Conflicting Device list at the bottom of the screen. If it indicates that the IRQ is being used by another device, click the **Change Setting** button.

Step 12 Scroll through the IRQs in the Value dialog box and select one that does not conflict with another device. The Conflict Information window at the bottom of the screen indicates if the IRQ is already being used.

Step 13 Click **OK**.

Step 14 Reboot your computer.

Resolving Resource Conflicts in Windows XP

Note These instructions assume you are using Windows XP's classic view, not its category view.

Step 1 Double-click **My Computer**, **Control Panel**, and **System**.

Step 2 Click the **Hardware** tab and **Device Manager**.

Step 3 Under Network Adapters, double-click the Cisco Systems Wireless LAN Adapter.

Step 4 In the General screen, the Device Status field indicates if a resource problem exists. If a problem is indicated, click the **Resources** tab.

Step 5 Uncheck the **Use automatic settings** check box.

Step 6 Under Resource Settings, click **I/O Range**.

Step 7 Look in the Conflicting Device list at the bottom of the screen. If it indicates that the range is being used by another device, click the **Change Setting** button.

Step 8 Scroll through the ranges in the Value dialog box and select one that does not conflict with another device. The Conflict Information window at the bottom of the screen indicates if the range is already being used.

Step 9 Click **OK**.

Step 10 Under Resource Settings, click **IRQ**.

Step 11 Look in the Conflicting Device list at the bottom of the screen. If it indicates that the IRQ is being used by another device, click the **Change Setting** button.

Step 12 Scroll through the IRQs in the Value dialog box and select one that does not conflict with another device. The Conflict Information window at the bottom of the screen indicates if the IRQ is already being used.

Step 13 Click **OK**.

Step 14 Reboot your computer.

Problems Associating to an Access Point

Follow the instructions below if your client adapter fails to associate to an access point.

- If possible, move your workstation a few feet closer to an access point and try again.
- Make sure that the client adapter is securely inserted in your computer's client adapter slot.
- If you are using a PCI card, make sure that the antenna is securely attached.
- Make sure that the access point is turned on and operating.
- Check that all parameters are set properly for both the client adapter and the access point. These include the SSID, EAP authentication, WEP activation, network type, channel, etc.
- Follow the instructions in the previous section to resolve any resource conflicts.
- If the client adapter still fails to establish contact, refer to the "Obtaining Technical Assistance" section in the Preface for technical support information.

Problems Authenticating to an Access Point

If your client adapter is a 40-bit card and LEAP or EAP is enabled, the adapter can associate but not authenticate to access points using 128-bit encryption. To authenticate to an access point using 128-bit encryption, you have two options:

- Purchase a 128-bit client adapter. This is the most secure option.
- Disable static WEP for the client adapter and configure the adapter and the access point to associate to mixed cells. This option presents a security risk because your data is not encrypted as it is sent over the RF network.

Problems Connecting to the Network

After you have installed the appropriate firmware, driver, client utilities, and security modules, contact your IS department if you have a problem connecting to the network. Proxy server, network protocols, and further authentication information might be needed to connect to the network.

Prioritizing Network Connections

If your computer has more than one network adapter is enabled (such as a Cisco Aironet client adapter and an Ethernet card), you can select which one to use by assigning a priority to your network connections.

Follow the steps below to prioritize your network connections.

Step 1 Right-click the **My Network Places** icon on your desktop.

Step 2 Click **Properties**.

Step 3 Select the **Advanced** menu option at the top of the screen.

Step 4 Select **Advanced Settings**. Your network connections are listed in the Connections box on the Adapters and Bindings tab.

Step 5 Use the arrows beside the Connections box to move the network connection that you want to use to the top.

Step 6 Click **OK**.

Parameters Missing from Profile Manager Screen

If some parameters are unavailable on the Profile Manager screen, your system administrator may have used an administrative tool to deactivate these parameters. In this case, these parameters cannot be selected.

Windows Wireless Network Connection Icon Shows Unavailable Connection (Windows XP Only)

If your computer is running Windows XP and you configured your client adapter using ADU, the Windows Wireless Network Connection icon in the Windows system tray may be marked with a red *X* and show an unavailable connection even though a wireless connection exists. This is caused by a conflict between ADU and Windows XP's wireless network settings. Simply ignore the Windows icon and use the ASTU icon to check the status of your client adapter's wireless connection.

Error Messages

This section provides a list of error messages that may appear during the installation, configuration, or use of your client adapter. The messages are listed in alphabetical order within each section, and an explanation as well as a recommended user action are provided for each message.

To Be Added

APPENDIX A

Technical Specifications

This appendix provides technical specifications for the Cisco Aironet CB21AG and PI21AG Wireless LAN Client Adapters.

The following topics are covered in this appendix:

- Physical Specifications, page A-2
- Radio Specifications, page A-2
- Power Specifications, page A-5
- Safety and Regulatory Compliance Specifications, page A-6

Table A-1 lists the technical specifications for the Cisco Aironet CB21AG and PI21AG Wireless LAN Client Adapters.

Table A-1 Technical Specifications for Cisco Aironet CB21AG and PI21AG Wireless LAN Client Adapters

Physical Specifications	
Size	
PC-Cardbus card	4.5 in. L x 2.1 in. W x 0.2 in. H (11.3 cm L x 5.4 cm W x 0.5 cm H)
PCI card	
Standard PCI card	4.7 in. L x 0.7 in. W x 4.8 in. H (12 cm L x 1.8 cm W x 12.1 cm H)
Low-profile PCI card	4.7 in. L x 0.7 in. W x 3.1 in. H (12 cm L x 1.8 cm W x 7.9 cm H)
Weight	
PC-Cardbus card	1.55 oz (44 g)
PCI card	
Standard PCI card with antenna	3.6 oz (103 g)
Standard PCI card without antenna	1.9 oz (55 g)
Low-profile PCI card with antenna	3.5 oz (98 g)
Low-profile PCI card without antenna	1.7 oz (49 g)
Enclosure	
PC-Cardbus card	Type II Cardbus
PCI card	Standard or low-profile Type II PCI
Connector	
PC-Cardbus card	68-pin Cardbus
PCI card	62-pin PCI
Status indicators	Green and amber LEDs; see Chapter 10
Operating temperature	32°F to 158°F (0°C to 70°C)
Storage temperature	32°F to 185°F (0°C to 85°C)
Humidity (non-operational)	90% relative humidity
ESD	15 kV (human body model)
Radio Specifications	
Type	
802.11a	Orthogonal frequency division multiplexing (OFDM)
802.11b/g	Direct-sequence spread spectrum (DSSS) and orthogonal frequency division multiplexing (OFDM)

Table A-1 Technical Specifications for Cisco Aironet CB21AG and PI21AG Wireless LAN Client Adapters (continued)

Power output **Note** Refer to Appendix D for limitations on radiated power (EIRP) levels in the European community and other countries.	
802.11a	40 mW (16 dBm) 25 mW (14 dBm) 20 mW (13 dBm) 13 mW (11 dBm) 10 mW (10 dBm)
802.11b/g	100 mW (20 dBm) 63 mW (18 dBm) 50 mW (17 dBm) 32 mW (15 dBm) 20 mW (13 dBm) 10 mW (10 dBm)
Operating frequency	
802.11a	5.15 to 5.25 GHz in the UNII 1 band* 5.25 to 5.35 GHz in the UNII 2 band* 5.470 to 5.725 GHz in the European band 5.725 to 5.825 GHz in the UNII 3 band* *Depending on the regulatory domain in which the client adapter is used
802.11b/g	2.400 to 2.497 GHz (depending on the regulatory domain in which the client adapter is used)
Usable channels	
802.11a	5150 to 5350 MHz and 5725 to 5825 MHz
802.11b/g	2412 to 2484 MHz in 5-MHz increments
Interference rejection	
802.11a/g	16 dBc @ 6 Mbps adjacent channel rejection 15 dBc @ 9 Mbps adjacent channel rejection 13 dBc @ 12 Mbps adjacent channel rejection 11 dBc @ 18 Mbps adjacent channel rejection 8 dBc @ 24 Mbps adjacent channel rejection 4 dBc @ 36 Mbps adjacent channel rejection 0 dBc @ 48 Mbps adjacent channel rejection –1 dBc @ 54 Mbps adjacent channel rejection
802.11b	35 dBc adjacent channel rejection
Data rates	1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48, and 54 Mbps
Modulation	Differential binary phase shift keying (DBPSK) - 1 Mbps Differential quaternary phase shift keying (DQPSK) - 2 Mbps Complementary code keying (CCK) - 5.5 and 11 Mbps Binary phase shift keying (BPSK) - 6 and 9 Mbps Quaternary phase shift keying (QPSK) - 12 and 18 Mbps 16-quadrate amplitude modulation (16-QAM) - 24 and 36 Mbps 64-quadrate amplitude modulation (64-QAM) - 48 and 54 Mbps

Table A-1 Technical Specifications for Cisco Aironet CB21AG and PI21AG Wireless LAN Client Adapters (continued)

Receiver sensitivity	
802.11a	**5150 to 5250 MHz** –87 dBm @ 6, 9, 12, and 18 Mbps –82 dBm @ 24 Mbps –79 dBm @ 36 Mbps –74 dBm @ 48 Mbps –72 dBm @ 54 Mbps **5250 to 5350 MHz** –89 dBm @ 6, 9, and 12 Mbps –85 dBm @ 18 Mbps –82 dBm @ 24 Mbps –79 dBm @ 36 Mbps –74 dBm @ 48 Mbps –72 dBm @ 54 Mbps **5470 to 5725 MHz** –87 dBm @ 6, 9, 12, and 18 Mbps –82 dBm @ 24 Mbps –79 dBm @ 36 Mbps –74 dBm @ 48 Mbps –72 dBm @ 54 Mbps **5725 to 5805 MHz** –84 dBm @ 6, 9, and 12 Mbps –83 dBm @ 18 Mbps –82 dBm @ 24 Mbps –79 dBm @ 36 Mbps –72 dBm @ 48 Mbps –65 dBm @ 54 Mbps
802.11b/g	–94 dBm @ 1 Mbps –93 dBm @ 2 Mbps –92 dBm @ 5.5 Mbps –90 dBm @ 11 Mbps –86 dBm @ 6, 9, 12, and 18 Mbps –84 dBm @ 24 Mbps –80 dBm @ 36 Mbps –75 dBm @ 48 Mbps –71 dBm @ 54 Mbps

Table A-1 Technical Specifications for Cisco Aironet CB21AG and PI21AG Wireless LAN Client Adapters (continued)

Receiver delay spread (multipath)	
802.11a/g	400 ns @ 6 Mbps 250 ns @ 9 and 12 Mbps 220 ns @ 18 Mbps 160 ns @ 24 Mbps 100 ns @ 36 Mbps 90 ns @ 48 Mbps 70 ns @ 54 Mbps
802.11b	350 ns @ 1 Mbps 300 ns @ 2 Mbps 200 ns @ 5.5 Mbps 130 ns @ 11 Mbps
Range	**Outdoor** 2000 ft (610 m) @ 1 Mbps 700 ft (213 m) @ 11 Mbps 300 ft (91 m) @ 54 Mbps **Indoor** 300 ft (91 m) @ 1 Mbps 150 ft (46 m) @ 11 Mbps 80 ft (24 m) @ 54 Mbps The above range numbers assume that the client adapter is being used with a Cisco Aironet 1200 Series Access Point with a 2.2-dBi antenna. Different range characteristics are likely when using the client adapter with a non-Cisco access point or a Cisco Aironet 1200 Series Access Point with a different antenna.
Antennas	
PC-Cardbus card	Integrated dual-band 2.4/5-GHz diversity antenna
PCI card	1-dBi dual-band 2.4/5-GHz antenna, permanently attached by cable
Power Specifications	
Operational voltage	3.3 V (± 0.3 V)
Receive current steady state	350 mA maximum
Transmit current steady state	650 mA maximum
Sleep mode steady state	270 mA maximum

Table A-1 Technical Specifications for Cisco Aironet CB21AG and PI21AG Wireless LAN Client Adapters (continued)

Safety and Regulatory Compliance Specifications	
Safety	Designed to meet: • UL 1950 Third Ed. • CSA 22.2 No. 950-95 • IEC 60950 Second Ed., including Amendments 1-4 with all national deviations • EN 60950 Second Ed., including Amendments 1-4
EMI and susceptibility	FCC Part 15.107 & 15.109 Class B ICES-003 Class B (Canada) VCCI (Japan) EN 301.489-1 and EN-301.489-17 (Europe)
Radio approvals	FCC Part 15.247 FCC Part 15.401-15.407 Canada RSS-210 Japan Telec 33 and 66 Europe EN-300.328, EN-301.893 ARIB STD-T71 (Japan) AS 4268.2 (Australia) AS/NZS 3548 (Australia and New Zealand)
RF exposure	FCC Bulletin OET-65C Industry Canada RSS-102

APPENDIX B

Translated Safety Warnings

This appendix provides translations of the safety warnings that appear in this publication.

The following topics are covered in this appendix:

- Explosive Device Proximity Warning, page B-2
- Dipole Antenna Installation Warning, page B-3
- Warning for Laptop Users, page B-4

Explosive Device Proximity Warning

Warning **Do not operate your wireless network device near unshielded blasting caps or in an explosive environment unless the device has been modified to be especially qualified for such use.**

Waarschuwing **Gebruik dit draadloos netwerkapparaat alleen in de buurt van onbeschermde ontstekers of in een omgeving met explosieven indien het apparaat speciaal is aangepast om aan de eisen voor een dergelijk gebruik te voldoen.**

Varoitus **Älä käytä johdotonta verkkolaitetta suojaamattomien räjäytysnallien läheisyydessä tai räjäytysalueella, jos laitetta ei ole erityisesti muunnettu sopivaksi sellaiseen käyttöön.oen.**

Attention **Ne jamais utiliser un équipement de réseau sans fil à proximité d'un détonateur non blindé ou dans un lieu présentant des risques d'explosion, sauf si l'équipement a été modifié à cet effet.**

Warnung **Benutzen Sie Ihr drahtloses Netzwerkgerät nicht in der Nähe ungeschützter Sprengkapseln oder anderer explosiver Stoffe, es sei denn, Ihr Gerät wurde eigens für diesen Gebrauch modifiziert und bestimmt.**

Avvertenza **Non utilizzare la periferica di rete senza fili in prossimità di un detonatore non protetto o di esplosivi a meno che la periferica non sia stata modificata a tale proposito.**

Advarsel **Ikke bruk den trådløse nettverksenheten nært inntil uisolerte fenghetter eller i et eksplosivt miljø med mindre enheten er modifisert slik at den tåler slik bruk.**

Aviso **Não opere o dispositivo de rede sem fios perto de cápsulas explosivas não protegidas ou num ambiente explosivo, a não ser que o dispositivo tenha sido modificado para se qualificar especialmente para essa utilização.**

¡Advertencia! **No utilizar un aparato de la red sin cable cerca de un detonador que no esté protegido ni tampoco en un entorno explosivo a menos que el aparato haya sido modificado con ese fin.**

Varning! **Använd inte den trådlösa nätverksenheten i närheten av oskyddade tändhattar eller i en explosiv miljö om inte enheten modifierats för att kunna användas i sådana sammanhang.**

Dipole Antenna Installation Warning

Warning

In order to comply with FCC radio frequency (RF) exposure limits, dipole antennas should be located at a minimum of 7.9 inches (20 cm) or more from the body of all persons.

Waarschuwing

Om te voldoen aan de FCC radiofrequentie (RF) blootstellingslimieten dienen dipoolantennes zich minstens 20 cm of meer van de lichamen van alle personen bevinden.

Varoitus

FCC:n antamien radiotaajuuksille altistumista koskevien rajoitusten mukaan dipoliantennien on sijaittava vähintään 20 cm:n päässä kaikista henkilöistä.

Attention

Pour se conformer aux limites d’exposition à la fréquence radio préconisées par la FCC (Federal Communications Commission), les antennes dipôles doivent se situer à un minimum de 20 cm de toute personne.

Warnung

Um die in den FCC-Richtlinien festgelegten Expositionshöchstgrenzen für Radiofrequenzen (RF) nicht zu überschreiten, sollten Dipolantennen mindestens 20 cm (7,9 Zoll) vom Körper aller Person entfernt aufgestellt werden.

Avvertenza

Per conformarsi ai limiti FCC di esposizione a radiofrequenza (RF), le antenne a dipolo devono stare ad una distanza minima di 20 cm dal corpo di ogni persona.

Advarsel

I henhold til eksponeringsgrensene for radiofrekvenser (RF), skal dipole antenner befinne seg på en avstand av minst 20 cm eller mer fra mennesker.

Aviso

Para estar de acordo com as normas FCC de limites de exposição para freqüência de rádio (RF), as antenas dipolo devem estar distantes no mínimo 20 cm (7,9 pol) do corpo de qualquer pessoa.

¡Advertencia!

Para cumplir con los límites de exposición de radio frecuencia (RF) de la Comisión Federal de Comunicaciones (FCC) es preciso ubicar las antenas dipolo a un mínimo de 20 cm (7,9 pulgadas) o más del cuerpo de las personas.

Varning!

För att följa FCC-exponeringsgränserna för radiofrekvens (RF), bör dipolsantenner placeras på minst 20 cm avstånd från alla människor.

Warning for Laptop Users

Warning **This device has been tested and complies with FCC RF Exposure (SAR) limits in typical laptop computer configurations and this device can be used in desktop or laptop computers with side mounted PC Card slots that can provide at least 0.394 in (1 cm) separation distance from the antenna to the body of the user or a nearby person. Thin laptop computers may need special attention to maintain antenna spacing while operating. This device cannot be used with handheld PDAs (personal digital assistants). Use in other configurations may not ensure compliance with FCC RF exposure guidelines. This device and its antenna must not be co-located or operated in conjunction with any other antenna or transmitter.**

Translations to be added

APPENDIX C

Declarations of Conformity and Regulatory Information

This appendix provides declarations of conformity and regulatory information for the Cisco Aironet CB21AG and PI21AG Wireless LAN Client Adapters.

The following topics are covered in this appendix:

Manufacturer's Federal Communication Commission Declaration of Conformity Statement

Tested To Comply
With FCC Standards

FOR HOME OR OFFICE USE

Models: AIR-CB21AG-A-K9, AIR-PI21AG-A-K9

FCC Certification Number: LDK102050 (CB21AG)
LDK102051 (PI21AG)

Manufacturer: Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA

This device complies with Part 15 rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits of a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and radiates radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference. However, there is no guarantee that interference will not occur. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician.

Caution The Part 15 radio device operates on a non-interference basis with other devices operating at this frequency when using integrated antennas. Any changes or modification to the product not expressly approved by Cisco could void the user's authority to operate this device.

Caution Within the 5.15-to-5.25-GHz band, UNII devices are restricted to indoor operations to reduce any potential for harmful interference to co-channel Mobile Satellite Systems (MSS) operations.

Department of Communications – Canada

Canadian Compliance Statement

This Class B Digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numerique de la classe B respecte les exigences du Reglement sur le material broilleur du Canada.

This device complies with Class B Limits of Industry Canada. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

Cisco Aironet CB21AG and PI21AG Wireless LAN Client Adapters are certified to the requirements of RSS-210 for 2.4-GHz and 5-GHz devices. The use of these devices in a system operating either partially or completely outdoors may require the user to obtain a license for the system according to the Canadian regulations. For further information, contact your local Industry Canada office.

European Community, Switzerland, Norway, Iceland, and Liechtenstein

Declaration of Conformity with Regard to the R&TTE Directive 1999/5/EC

English:	This equipment is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.
Deutsch:	Dieses Gerät entspricht den grundlegenden Anforderungen und den weiteren entsprecheneden Vorgaben der Richtlinie 1999/5/EU.
Dansk:	Dette udstyr er i overensstemmelse med de væsentlige krav og andre relevante bestemmelser i Directiv 1999/5/EF.
Español:	Este equipo cumple con los requisitos esenciales asi como con otras disposiciones de la Directive 1999/5/EC.
Έλληνας:	Αυτός ο εξοπλισμός συμμορφώνεται με τις ουσιώδεις απαιτήσεις και τις λοιπές διατάξεις της Οδηγίας 1999/5/EK.
Français:	Cet appareil est conforme aux exigencies essentialles et aux autres dispositions pertinantes de la Directive 1999/5/EC.
Íslenska:	Þessi búnaður samrýmist lögboðnum kröfum og öðrum ákvæðum tilskipunar 1999/5/ESB.
Italiano:	Questo apparato é conforme ai requisiti essenziali ed agli altri principi sanciti dalla Direttiva 1999/5/EC.

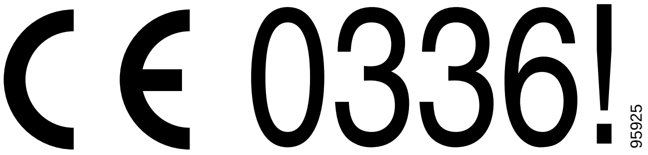
Nederlands:	Deze apparatuur voldoet aan de belangrijkste eisen en andere voorzieningen van richtlijn 1999/5/EC.
Norsk:	Dette utstyret er i samsvar med de grunnleggende krav og andre relevante bestemmelser i EU-directiv 1999/5/EC.
Português:	Este equipamento satisfaz os requisitos essenciais e outras provisões da Directiva 1999/5/EC.
Suomalainen:	Tämä laite täyttää direktiivin 1999/5/EY oleelliset vaatimukset ja on siinä asetettujen muidenkin ehtojen mukainen.
Svenska:	Denna utrustning är i överensstämmelse med de väsentliga kraven och andra relevanta bestämmelser i Direktiv 1999/5/EC.

The Declaration of Conformity related to this product can be found at the following URL: http://www.ciscofax.com.

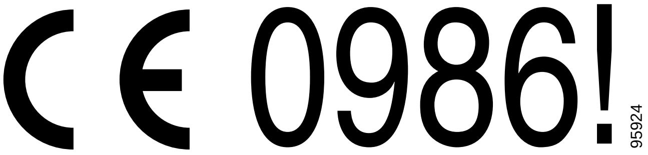
The following standards were applied:

- Radio: EN 300.328-1, EN 300.328-2 (2.4-GHz operation);
  EN 301.893 (5-GHz operation)
- EMC: EN 301.489-1, EN 301.489-17
- Safety: EN 60950

The following CE mark is affixed to the Cisco Aironet CB21AG Wireless LAN Client Adapter:



The following CE mark is affixed to the Cisco Aironet PI21AG Wireless LAN Client Adapter:



Note This equipment is intended to be used in all EU and EFTA countries. Outdoor use may be restricted to certain frequencies and/or may require a license for operation. For more details, contact your customer service representative.

Declaration of Conformity for RF Exposure

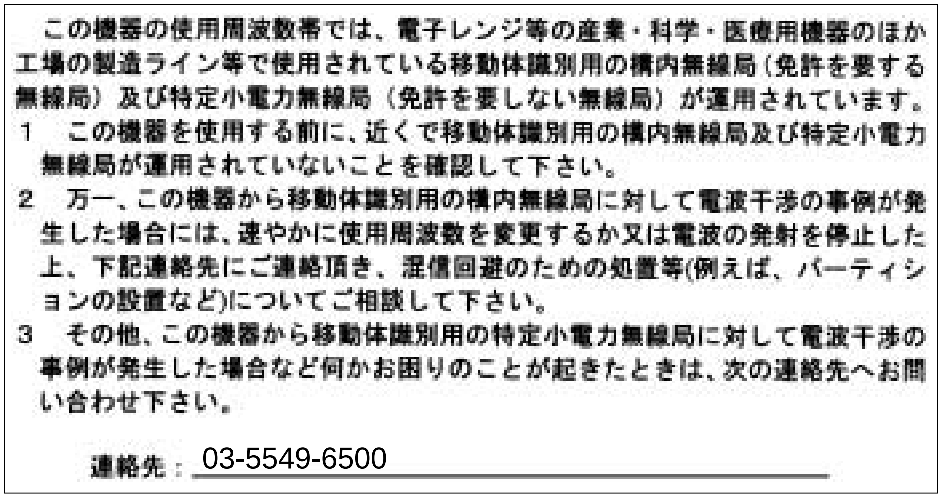
The radio module has been evaluated under FCC Bulletin OET 65C and found compliant to the requirements as set forth in CFR 47 Sections 2.1091, 2.1093, and 15.247 (b) (4) addressing RF Exposure from radio frequency devices.

Guidelines for Operating Cisco Aironet Wireless LAN Client Adapters in Japan

This section provides guidelines for avoiding interference when operating Cisco Aironet Wireless LAN Client Adapters in Japan. These guidelines are provided in both Japanese and English.

Note The use of 5-GHz devices is limited to indoor use in Japan.

Japanese Translation



　この機器の使用周波数帯では、電子レンジ等の産業・科学・医療用機器のほか工場の製造ライン等で使用されている移動体識別用の構内無線局（免許を要する無線局）及び特定小電力無線局（免許を要しない無線局）が運用されています。

1　この機器を使用する前に、近くで移動体識別用の構内無線局及び特定小電力無線局が運用されていないことを確認して下さい。

2　万一、この機器から移動体識別用の構内無線局に対して電波干渉の事例が発生した場合には、速やかに使用周波数を変更するか又は電波の発射を停止した上、下記連絡先にご連絡頂き、混信回避のための処置等(例えば、パーティションの設置など)についてご相談して下さい。

3　その他、この機器から移動体識別用の特定小電力無線局に対して電波干渉の事例が発生した場合など何かお困りのことが起きたときは、次の連絡先へお問い合わせ下さい。

連絡先：03-5549-6500

43768

English Translation

This equipment operates in the same frequency bandwidth as industrial, scientific, and medical devices such as microwave ovens and mobile object identification (RF-ID) systems (licensed premises radio stations and unlicensed specified low-power radio stations) used in factory production lines.

1. Before using this equipment, make sure that no premises radio stations or specified low-power radio stations of RF-ID are used in the vicinity.
2. If this equipment causes RF interference to a premises radio station of RF-ID, promptly change the frequency or stop using the device; contact the number below and ask for recommendations on avoiding radio interference, such as setting partitions.
3. If this equipment causes RF interference to a specified low-power radio station of RF-ID, contact the number below.

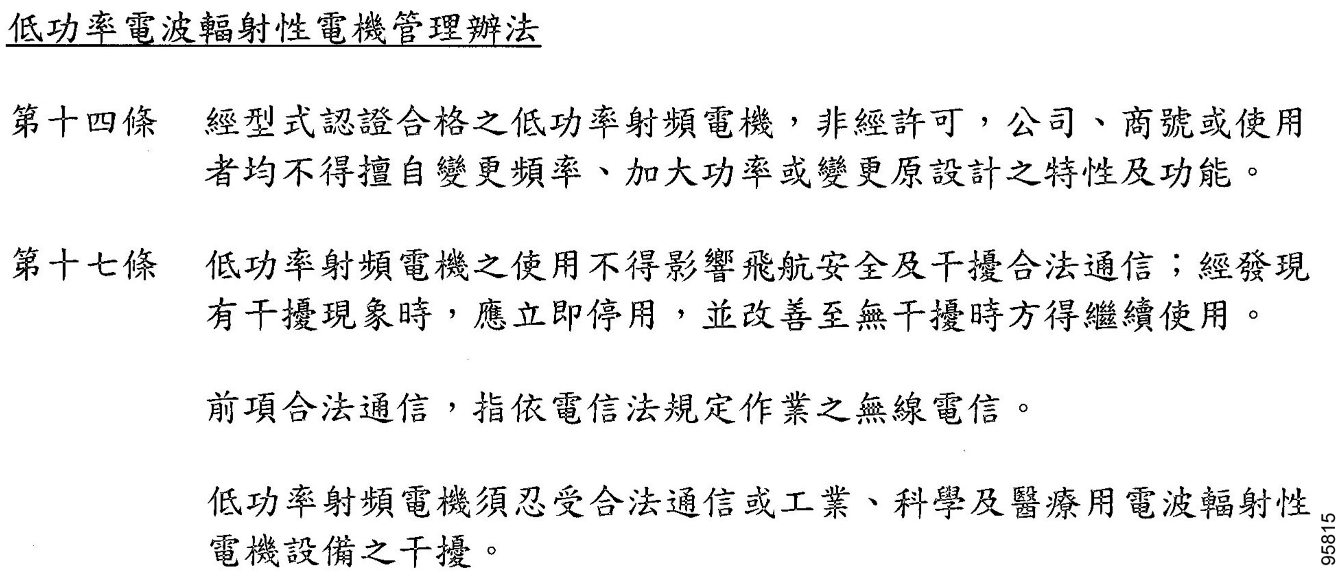
Contact Number: 03-5549-6500

Administrative Rules for Cisco Aironet Wireless LAN Client Adapters in Taiwan

This section provides administrative rules for operating Cisco Aironet Wireless LAN Client Adapters in Taiwan. The rules are provided in both Chinese and English.

2.4- and 5-GHz Client Adapters

Chinese Translation



低功率電波輻射性電機管理辦法

第十四條　經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

第十七條　低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。

前項合法通信，指依電信法規定作業之無線電信。

低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

English Translation

Administrative Rules for Low-power Radio-Frequency Devices

Article 14

For those low-power radio-frequency devices that have already received a type-approval, companies, business units or users should not change its frequencies, increase its power or change its original features and functions.

Article 17

The operation of the low-power radio-frequency devices is subject to the conditions that no harmful interference is caused to aviation safety and authorized radio station; and if interference is caused, the user must stop operating the device immediately and can't re-operate it until the harmful interference is clear.

The authorized radio station means a radio-communication service operating in accordance with COMMUNICATION ACT.

The operation of the low-power radio-frequency devices is subject to the interference caused by the operation of an authorized radio station, by another intentional or unintentional radiator, by industrial, scientific and medical (ISM) equipment, or by an incidental radiator.

5-GHz Client Adapters

Chinese Translation

本設備限於室內使用

English Translation

This equipment is limited for indoor use.

APPENDIX D

Channels, Power Levels, and Antenna Gains

This appendix lists the IEEE 802.11a, b, and g channels supported by the world's regulatory domains as well as the maximum power levels and antenna gains allowed per data rate.

The following topics are covered in this appendix:

- Channels, page D-2
- Maximum Power Levels and Antenna Gains, page D-4

Channels

IEEE 802.11a

The channel identifiers, channel center frequencies, and regulatory domains of each IEEE 802.11a 20-MHz-wide channel are shown in Table D-1.

Table D-1 Channels for IEEE 802.11a

Channel Identifier	Frequency (in MHz)	Regulatory Domains			
		Americas (-A)	EMEA (-E)	Japan (-J)	Rest of World (-W)
34	5170	–	–	X	–
36	5180	X	X	–	X
38	5190	–	–	X	–
40	5200	X	X	–	X
42	5210	–	–	X	–
44	5220	X	X	–	X
46	5230	–	–	X	–
48	5240	X	X	–	X
52	5260	X	X	–	X
56	5280	X	X	–	X
60	5300	X	X	–	X
64	5320	X	X	–	X
100	5500	–	X	–	–
104	5520	–	X	–	–
108	5540	–	X	–	–
112	5560	–	X	–	–
116	5580	–	X	–	–
120	5600	–	X	–	–
124	5620	–	X	–	–
128	5640	–	X	–	–
132	5660	–	X	–	–
136	5680	–	X	–	–
140	5700	–	X	–	–
149	5745	X	–	–	X
153	5765	X	–	–	X
157	5785	X	–	–	X
161	5805	X	–	–	X

Note All channel sets are restricted to indoor usage except the Americas (-A), which allows for indoor and outdoor use on channels 52 through 161 in the United States.

IEEE 802.11b/g

The channel identifiers, channel center frequencies, and regulatory domains of each IEEE 802.11b/g 22-MHz-wide channel are shown in Table D-2.

Table D-2 Channels for IEEE 802.11b/g

Channel Identifier	Frequency (in MHz)	Regulatory Domains			
		Americas (-A)	EMEA (-E)	Japan (-J)	Rest of World (-W)
1	2412	X	X	X	X
2	2417	X	X	X	X
3	2422	X	X	X	X
4	2427	X	X	X	X
5	2432	X	X	X	X
6	2437	X	X	X	X
7	2442	X	X	X	X
8	2447	X	X	X	X
9	2452	X	X	X	X
10	2457	X	X	X	X
11	2462	X	X	X	X
12	2467	–	X	X	X
13	2472	–	X	X	X
14	2484	–	–	X	–

Note Mexico is included in the Americas regulatory domain; however, channels 1 through 8 are for indoor use only while channels 9 through 11 can be used indoors and outdoors. Users are responsible for ensuring that the channel set configuration is in compliance with the regulatory standards of Mexico.

Note In Japan, channel 14 is not supported for 802.11g mode.

Maximum Power Levels and Antenna Gains

IEEE 802.11a

An improper combination of power level and antenna gain can result in equivalent isotropic radiated power (EIRP) above the amount allowed per regulatory domain. Table D-3 indicates the maximum power levels and antenna gains allowed for each data rate in the IEEE 802.11a regulatory domains.

Table D-3 Maximum Power Levels Per Antenna Gain for IEEE 802.11a

Data Rate	Maximum Power Level (mW) for PC-Cardbus Card with 0-dBi Antenna Gain	Maximum Power Level (mW) for PCI Card with 1-dBi Antenna Gain
6 Mbps	40	31.6
9 Mbps	40	31.6
12 Mbps	40	31.6
18 Mbps	40	31.6
24 Mbps	40	31.6
36 Mbps	25.1	25.1
48 Mbps	20	20
54 Mbps	20	20

IEEE 802.11b

An improper combination of power level and antenna gain can result in equivalent isotropic radiated power (EIRP) above the amount allowed per regulatory domain. Table D-5 indicates the maximum power levels and antenna gains allowed for each data rate in the IEEE 802.11b regulatory domains.

Table D-4 Maximum Power Levels Per Antenna Gain for IEEE 802.11b

Data Rate	Maximum Power Level (mW) for PC-Cardbus Card with 0-dBi Antenna Gain	Maximum Power Level (mW) for PCI Card with 1-dBi Antenna Gain
1 Mbps	100	79
2 Mbps	100	79
5.5 Mbps	100	79
11 Mbps	100	79

IEEE 802.11g

An improper combination of power level and antenna gain can result in equivalent isotropic radiated power (EIRP) above the amount allowed per regulatory domain. Table D-5 indicates the maximum power levels and antenna gains allowed for each data rate in the IEEE 802.11g regulatory domains.

Table D-5 Maximum Power Levels Per Antenna Gain for IEEE 802.11g

Data Rate	Maximum Power Level (mW) for PC-Cardbus Card with 0-dBi Antenna Gain	Maximum Power Level (mW) for PCI Card with 1-dBi Antenna Gain
6 Mbps	45	35.8
9 Mbps	45	35.8
12 Mbps	45	35.8
18 Mbps	45	35.8
24 Mbps	45	35.8
36 Mbps	40	40
48 Mbps	31.6	31.6
54 Mbps	20	20

APPENDIX E

Configuring the Client Adapter through Windows XP

This appendix explains how to configure and use the client adapter with Windows XP.

The following topics are covered in this appendix:

Overview

This appendix provides instructions for minimally configuring the client adapter through Windows XP (instead of through ADU) as well as for enabling one of the security options that are available for use with this operating system. The "Overview of Security Features" section below describes each of these options so that you can make an informed decision before you begin the configuration process.

In addition, this appendix also provides basic information on using Windows XP to specify the networks to which the client adapter associates and to view the current status of your client adapter.

Note If you require more information about configuring or using your client adapter with Windows XP, refer to Microsoft's documentation for Windows XP.

Overview of Security Features

When you use your client adapter with Windows XP, you can protect your data as it is transmitted through your wireless network by encrypting it through the use of wired equivalent privacy (WEP) encryption keys. With WEP encryption, the transmitting device encrypts each packet with a WEP key, and the receiving device uses that same key to decrypt each packet.

The WEP keys used to encrypt and decrypt transmitted data can be statically associated with your adapter or dynamically created as part of the EAP authentication process. The information in the "Static WEP Keys" and "EAP (with Dynamic WEP Keys)" sections below can help you to decide which type of WEP keys you want to use. Dynamic WEP keys with EAP offer a higher degree of security than static WEP keys.

WEP keys, whether static or dynamic, are either 40 or 128 bits in length. 128-bit WEP keys offer a greater level of security than 40-bit WEP keys.

Static WEP Keys

Each device within your wireless network can be assigned up to four static WEP keys. If a device receives a packet that is not encrypted with the appropriate key (as the WEP keys of all devices that are to communicate with each other must match), the device discards the packet and never delivers it to the intended receiver.

Static WEP keys are write-only and temporary; therefore, they cannot be read back from the client adapter, and they are lost when power to the adapter is removed or the Windows device is rebooted. Although the keys are temporary, you do not need to re-enter them each time the client adapter is inserted or the Windows device is rebooted. This is because the keys are stored (in an encrypted format for security reasons) in the registry of the Windows device. When the driver loads and reads the client adapter's registry parameters, it also finds the static WEP keys, unencrypts them, and stores them in volatile memory on the adapter.

EAP (with Dynamic WEP Keys)

The standard for wireless LAN security, as defined by the Institute of Electrical and Electronics Engineers (IEEE), is called *802.1X for 802.11*, or simply *802.1X*. An access point that supports 802.1X and its protocol, Extensible Authentication Protocol (EAP), acts as the interface between a wireless client and an authentication server, such as a Remote Authentication Dial-In User Service (RADIUS) server, to which the access point communicates over the wired network.

Two 802.1X authentication types are available when configuring your client adapter through Windows XP:

- **EAP-TLS**—This authentication type uses a dynamic session-based WEP key, which is derived from the client adapter and RADIUS server, to encrypt data.

  RADIUS servers that support EAP-TLS include Cisco Secure ACS version 3.0 or greater and Cisco Access Registrar version 1.8 or greater.

  Note EAP-TLS requires the use of a certificate. Refer to Microsoft's documentation for information on downloading and installing the certificate.

- **Protected EAP** (or **PEAP**)—One of the following PEAP authentication types are available, depending on the software that is installed on your computer:
  - **PEAP (EAP-MSCHAP V2)**—This PEAP authentication type is available if Cisco's PEAP security module (which is included in the Install Wizard file for Cisco Aironet 340, 350, and CB20A client adapters) was not previously installed on your computer or was installed prior to Service Pack 1 for Windows XP.

    PEAP (EAP-MSCHAP V2) authentication supports only a Windows username and password. It is based on EAP-TLS authentication but uses a password instead of a client certificate for authentication. PEAP (EAP-MSCHAP V2) uses a dynamic session-based WEP key, which is derived from the client adapter and RADIUS server, to encrypt data.

    RADIUS servers that support PEAP (EAP-MSCHAP V2) authentication include Cisco Secure ACS version 3.2 or greater.
  - **PEAP (EAP-GTC)**—This PEAP authentication type is available only if Cisco's PEAP security module (which is included in the Install Wizard file for Cisco Aironet 340, 350, and CB20A client adapters) was previously installed on your computer and installed after Service Pack 1 for Windows XP.

    PEAP (EAP-GTC) authentication is designed to support One-Time Password (OTP) and Windows NT or 2000 domain user databases over a wireless LAN. It is based on EAP-TLS authentication but uses a password or PIN instead of a client certificate for authentication. PEAP (EAP-GTC) uses a dynamic session-based WEP key, which is derived from the client adapter and RADIUS server, to encrypt data. If your network uses an OTP user database, PEAP (EAP-GTC) requires you to enter a software token PIN to start the EAP authentication process and gain access to the network. If your network uses a Windows NT or 2000 domain user database, PEAP (EAP-GTC) requires you to enter your username, password, and domain name in order to start the authentication process.

    RADIUS servers that support PEAP (EAP-GTC) authentication include Cisco Secure ACS version 3.1 or greater.

When you enable Require EAP on your access point and configure your client adapter for EAP-TLS or PEAP using Windows XP, authentication to the network occurs in the following sequence:

1. The client adapter associates to an access point and begins the authentication process.

   Note The client does not gain full access to the network until authentication between the client and the RADIUS server is successful.

2. Communicating through the access point, the client and RADIUS server complete the authentication process, with the password (PEAP) or certificate (EAP-TLS) being the shared secret for authentication. The password or internal key is never transmitted during the process.
3. If authentication is successful, the client and RADIUS server derive a dynamic, session-based WEP key that is unique to the client.
4. The RADIUS server transmits the key to the access point using a secure channel on the wired LAN.
5. For the length of a session, or time period, the access point and the client use this key to encrypt or decrypt all unicast packets (and broadcast packets if the access point is set up to do so) that travel between them.

Note Refer to the IEEE 802.11 Standard for more information on 802.1X authentication and to the following URL for additional information on RADIUS servers:
http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/12cgcr/secur_c/scprt2/scrad.htm

Wi-Fi Protected Access (WPA)

Wi-Fi Protected Access (WPA) is a standards-based, interoperable security enhancement that strongly increases the level of data protection and access control for existing and future wireless LAN systems. It is derived from and is forward-compatible with the upcoming IEEE 802.11i standard. WPA leverages Temporal Key Integrity Protocol (TKIP) for data protection and 802.1X for authenticated key management.

WPA supports two mutually exclusive key management types: WPA and WPA passphrase (or WPA Pre-shared Key). Using WPA key management, clients and the authentication server authenticate to each other using an EAP authentication method, and the client and server generate a pairwise master key (PMK). Using WPA, the server generates the PMK dynamically and passes it to the access point. Using WPA passphrase, however, you configure a passphrase (or pre-shared key) on both the client and the access point, and that passphrase is used as the PMK.

A host supplicant with WPA support is required to use WPA. Windows XP Service Pack 1 and Microsoft supplicant Q815485 are recommended for use with CB21AG and PI21AG client adapters. Service Pack 1 and the Q815485 supplicant can be downloaded from the following URLs:

- Service Pack 1:
  http://www.microsoft.com/WindowsXP/pro/downloads/servicepacks/sp1/default.asp
- Q815485 supplicant:
  http://www.microsoft.com/downloads/details.aspx?FamilyID=009d8425-ce2b-47a4-abec-274845dc9e91&DisplayLang=en

Note WPA must also be enabled on the access point. Access points must use IOS release 12.2(11)JA or greater to enable WPA. Refer to the documentation for your access point for instructions on enabling this feature.

Configuring the Client Adapter

Follow the steps below to configure your client adapter using Windows XP.

Note These instructions assume you are using the following:
- Windows XP Service Pack 1 and the Microsoft Q815485 supplicant
- Windows XP's classic view rather than its category view

If you do not use Service Pack 1 and the Q815485 supplicant, the screens you see will look different than those shown in this section and will not support PEAP and WPA.

Step 1 Make sure the client adapter's driver has been installed and the client adapter is inserted in the Windows XP device.

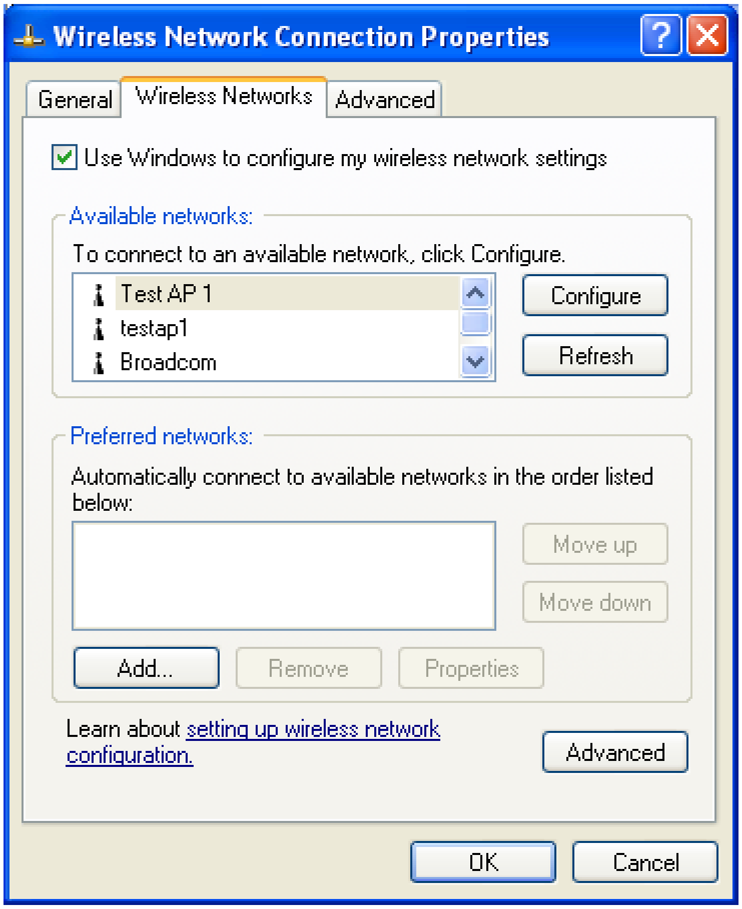
Step 2 Double-click **My Computer**, **Control Panel**, and **Network Connections**.

Step 3 Right-click **Wireless Network Connection**.

Step 4 Click **Properties**. The Wireless Network Connection Properties screen appears.

Step 5 Select the **Wireless Networks** tab. The following screen appears (see Figure E-1).

Figure E-1 Wireless Network Connection Properties Screen (Wireless Networks Tab)



Wireless Network Connection Properties

☑ Use Windows to configure my wireless network settings

Available networks:

To connect to an available network, click Configure.

Test AP 1
testap1
Broadcom

Preferred networks:

Automatically connect to available networks in the order listed below:

Learn about setting up wireless network configuration.

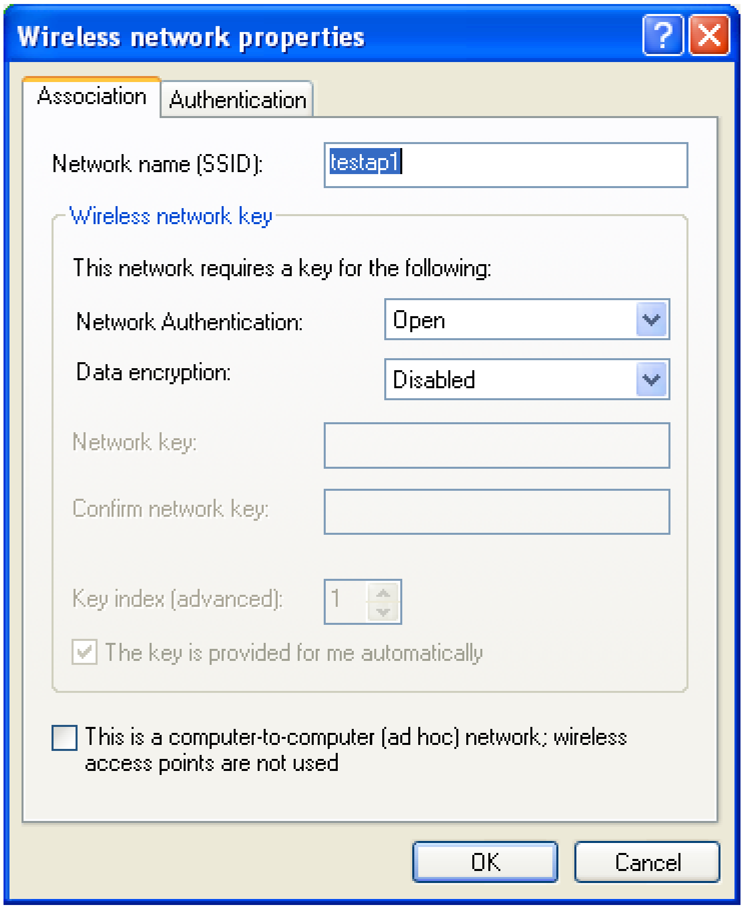
Step 6 Make sure that the **Use Windows to configure my wireless network settings** check box is checked.

Step 7 Select the SSID of the access point to which you want the client adapter to associate from the list of available networks and click **Configure**. If the SSID of the access point you want to use is not listed or you are planning to operate the client adapter in an *ad hoc network* (a computer-to-computer network without access points), click **Add**.

Note The Allow Broadcast SSID to Associate option on the access point must be enabled for the SSID to appear in the list of available networks.

The Wireless Network Properties screen appears (see Figure E-2).

Figure E-2 Wireless Network Properties Screen (Association Tab)



Network name (SSID): testap1

Wireless network key

This network requires a key for the following:

Network Authentication: Open

Data encryption: Disabled

Network key:

Confirm network key:

Key index (advanced): 1

☑ The key is provided for me automatically

☐ This is a computer-to-computer (ad hoc) network; wireless access points are not used

Step 8 Perform one of the following:

- If you selected an SSID from the list of available networks, make sure the SSID appears in the Network name (SSID) field.
- If you clicked Add, enter the case-sensitive SSID of the access point or the ad hoc network to which you want the client adapter to associate in the Network name (SSID) field.

Step 9 Check the **This is a computer-to-computer (ad hoc mode) network; wireless access points are not used** check box at the bottom of the screen if you are planning to operate the client adapter in an ad hoc network.

Step 10 Select one of the following options from the Network Authentication drop-down list:

- **Open**—Enables your client adapter, regardless of its WEP settings, to authenticate and attempt to communicate with an access point. This option is recommended if you want to use static WEP or EAP authentication without WPA.
- **Shared**—Enables your client adapter to communicate only with access points that have the same WEP key. Cisco recommends that shared key authentication not be used because it presents a security risk.

Note EAP-TLS does not work with shared key authentication because shared key authentication requires the use of a WEP key, and a WEP key is not set for EAP-TLS until after the completion of EAP authentication.

- **WPA**—Enables WPA, which enables your client adapter to associate to access points using WPA.
- **WPA-PSK**—Enables WPA Pre-shared key (WPA-PSK), which enables your client adapter to associate to access points using WPA-PSK.
- **WPA-None**—Enables WPA for your client adapter when the client is set for ad hoc mode.

Note Refer to the "Wi-Fi Protected Access (WPA)" section on page E-4 for more information on WPA and WPA-PSK.

Step 11 Select one of the following options from the Data encryption drop-down list:

- **Disabled**—Disables data encryption for your client adapter. This option is available only when Open or Shared has been selected for Network Authentication.
- **WEP**—Enables static or dynamic WEP for your client adapter. This option is recommended for use with open authentication.
- **TKIP**—Enables Temporal Key Integrity Protocol (TKIP) for your client adapter. This option is recommended for use with WPA and WPA-PSK.

Step 12 Follow the steps below to enter a static WEP key if you are planning to use static WEP.

Note If you are planning to use EAP-TLS or PEAP authentication, which uses dynamic WEP, go to •.

a. Make sure the **The key is provided for me automaticall**y check box is unchecked.

b. Obtain the WEP key for the access point (in an infrastructure network) or other clients (in an ad hoc network) from your system administrator and enter it in both the Network key and Confirm network key fields. Follow the guidelines below to enter a new static WEP key:

- WEP keys must contain the following number of characters:
  - 10 hexadecimal characters or 5 ASCII text characters for 40-bit keys

    Example: 5A5A313859 (hexadecimal) or ZZ18Y (ASCII)
  - 26 hexadecimal characters or 13 ASCII text characters for 128-bit keys

    Example: 5A583135333554595549333534 (hexadecimal) or ZX1535TYUI354 (ASCII)

Note You must enter hexadecimal characters for 5-GHz client adapters if these adapters will be used with Cisco Aironet 1200 Series Access Points.

- Your client adapter's WEP key must match the WEP key used by the access point (in infrastructure mode) or clients (in ad hoc mode) with which you are planning to communicate.

c. In the Key index (advanced) field, select the number of the WEP key you are creating (**1**, **2**, **3**, or **4**).

Note The WEP key must be assigned to the same number on both the client adapter and the access point (in an infrastructure network) or other clients (in an ad hoc network).

d. Click **OK** to save your settings and to add this SSID to the list of preferred networks (see Figure E-1). The configuration is complete for static WEP. The client adapter automatically attempts to associate to the network(s) in the order in which they are listed.

Step 13 If you enabled WPA-PSK or WPA-None, obtain the pre-shared key for the access point (in an infrastructure network) or other clients (in an ad hoc network) from your system administrator and enter it in both the Network key and Confirm network key fields. Follow the guidelines below to enter a pre-shared key:

- Pre-shared keys must contain 8 to 63 ASCII text characters or 64 hexadecimal characters.

Note You must enter hexadecimal characters for 5-GHz client adapters if these adapters will be used with Cisco Aironet 1200 Series Access Points.

- Your client adapter's pre-shared key must match the pre-shared key used by the access point (in infrastructure mode) or clients (in ad hoc mode) with which you are planning to communicate.

Step 14 Check the **The key is provided for me automaticall**y check box if you are planning to use EAP-TLS or PEAP, which uses dynamic WEP keys.

Note This parameter is not available if you enabled WPA or WPA-PSK.

Step 15 Perform one of the following if you are planning to use EAP authentication:

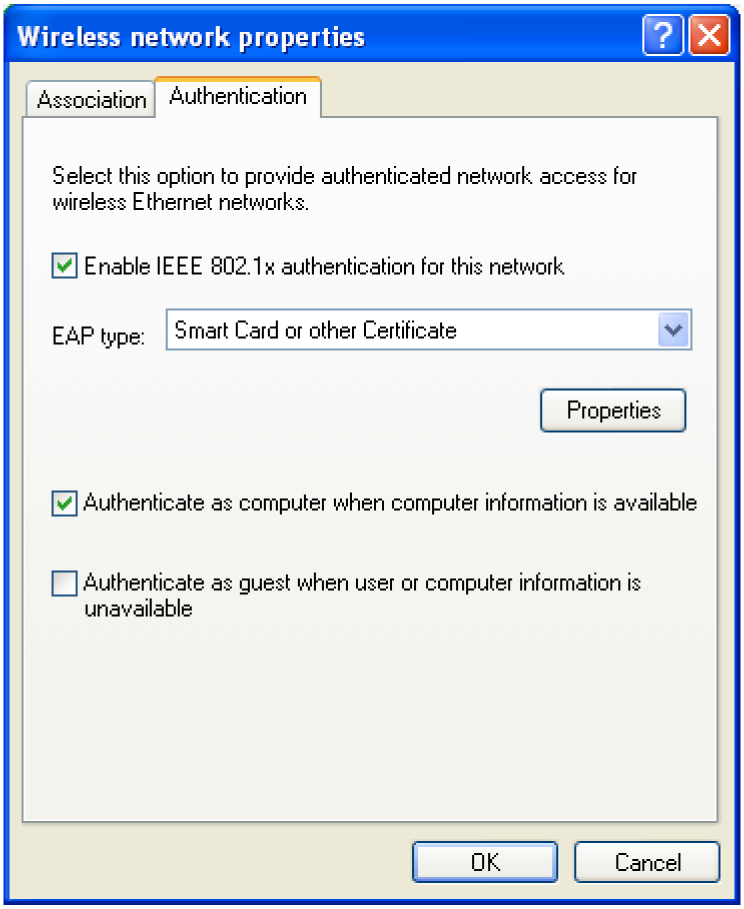
- If you are planning to use EAP-TLS authentication, follow the instructions in the "Enabling EAP-TLS Authentication" section below.
- If you are planning to use PEAP authentication, follow the instructions in the "Enabling PEAP Authentication" section on page E-12.

Enabling EAP-TLS Authentication

Follow the steps below to prepare the client adapter to use EAP-TLS authentication, provided you have completed the initial configuration.

Step 1 Click the **Authentication** tab on the Wireless Network Properties screen. The following screen appears (see Figure E-3).

Figure E-3 Wireless Network Properties Screen (Authentication Tab)



Wireless network properties

Select this option to provide authenticated network access for wireless Ethernet networks.

☑ Enable IEEE 802.1x authentication for this network

EAP type: Smart Card or other Certificate

☑ Authenticate as computer when computer information is available

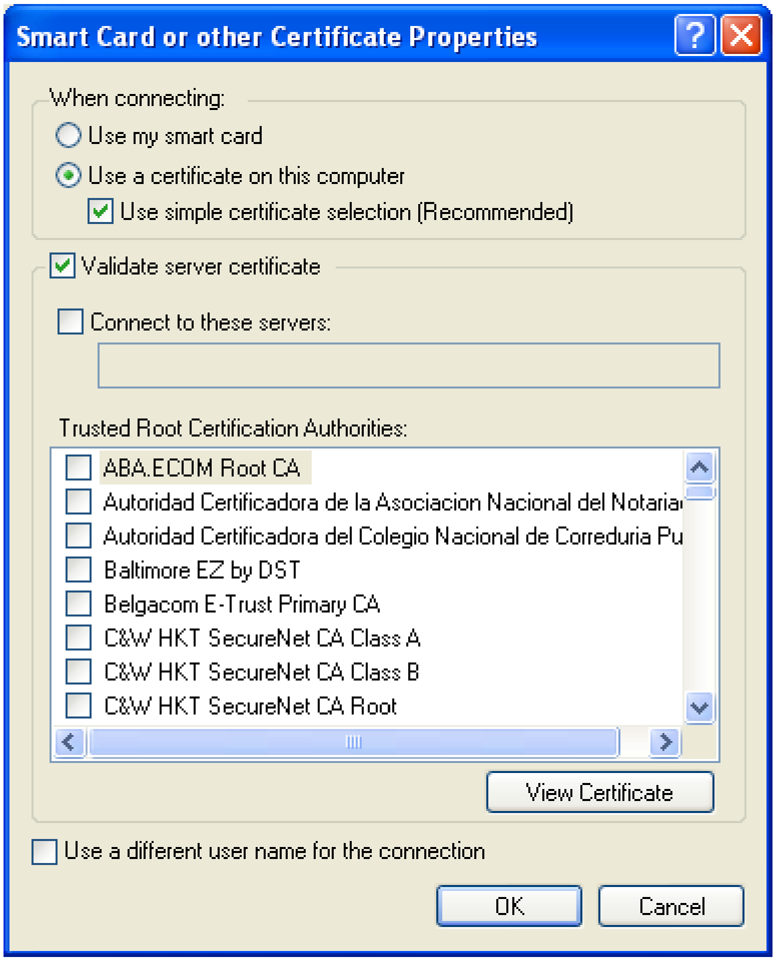
□ Authenticate as guest when user or computer information is unavailable

Step 2 Check the **Enable IEEE 802.1x authentication for this network** check box if you did not enable WPA or WPA-PSK on the Association screen.

Step 3 For EAP type, select **Smart Card or other Certificate**.

Step 4 Click **Properties**. The Smart Card or other Certificate Properties screen appears (see Figure E-4).

Figure E-4   Smart Card or other Certificate Properties Screen



Smart Card or other Certificate Properties

When connecting:

○ Use my smart card

● Use a certificate on this computer

☑ Use simple certificate selection (Recommended)

☑ Validate server certificate

☐ Connect to these servers:

Trusted Root Certification Authorities:

☐ ABA.ECOM Root CA
☐ Autoridad Certificadora de la Asociacion Nacional del Notaria
☐ Autoridad Certificadora del Colegio Nacional de Correduria Pu
☐ Baltimore EZ by DST
☐ Belgacom E-Trust Primary CA
☐ C&W HKT SecureNet CA Class A
☐ C&W HKT SecureNet CA Class B
☐ C&W HKT SecureNet CA Root

☐ Use a different user name for the connection

Step 5 Select the **Use a certificate on this computer** option.

Step 6 Check the **Use simple certificate selection (Recommended)** check box.

Step 7 Check the **Validate server certificate** check box if server certificate validation is required.

Step 8 If you want to specify the name of the server to connect to, check the **Connect to these servers** check box and enter the server name in the field below.

Note If you enter a server name and the client adapter connects to a server that does not match the name you entered, you are prompted to accept or cancel the connection during the authentication process.

Note If you leave this field blank, the server name is not verified, and a connection is established as long as the certificate is valid.

Step 9 In the Trusted Root Certification Authorities field, check the check box beside the name of the certificate authority from which the server certificate was downloaded.

Note If you leave all check boxes unchecked, you are prompted to accept a connection to the root certification authority during the authentication process.

Step 10 Click **OK** three times to save your settings. The configuration is complete.

Step 11 If a pop-up message appears above the system tray informing you that you need to accept a certificate to begin the EAP authentication process, click the message and follow the instructions provided to accept the certificate.

Note You should not be prompted to accept a certificate for future authentication attempts. After you accept one, the same certificate is used subsequently.

Step 12 If a message appears indicating the root certification authority for the server's certificate, and it is the correct certification authority, click **OK** to accept the connection. Otherwise, click **Cancel**.

Step 13 If a message appears indicating the server to which your client adapter is connected, and it is the correct server to connect to, click **OK** to accept the connection. Otherwise, click **Cancel**.

The client adapter should now EAP authenticate.

Note Whenever the computer reboots and you enter your Windows username and password, the EAP authentication process begins automatically and the client adapter should EAP authenticate.

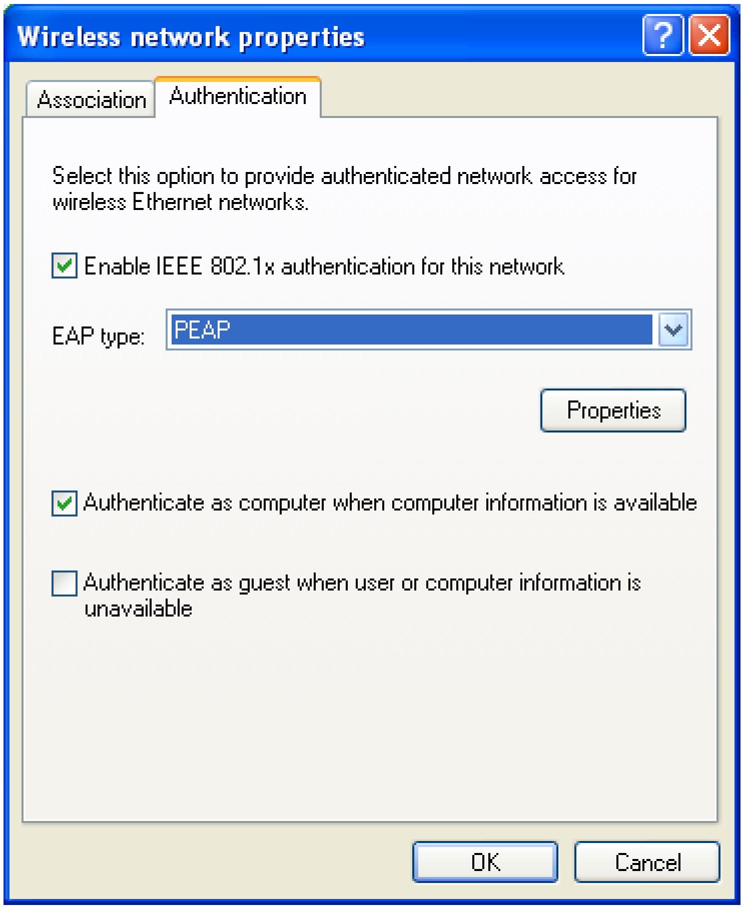
Step 14 To verify authentication, double-click **My Computer**, **Control Panel**, and **Network Connections**. The status appears to the right of your Wireless Network Connection. Click **View** and **Refresh** to obtain the current status. If the client adapter is authenticated, the status reads *Authentication succeeded*.

Enabling PEAP Authentication

Follow the steps below to prepare the client adapter to use PEAP authentication, provided you have completed the initial configuration.

Step 1 Click the **Authentication** tab on the Wireless Network Properties screen. The following screen appears (see Figure E-5).

Figure E-5 Wireless Network Properties Screen (Authentication Tab)



Select this option to provide authenticated network access for wireless Ethernet networks.

☑ Enable IEEE 802.1x authentication for this network

EAP type: PEAP

☑ Authenticate as computer when computer information is available

□ Authenticate as guest when user or computer information is unavailable

Step 2 Check the **Enable IEEE 802.1x authentication for this network** check box if you did not enable WPA or WPA-PSK on the Association screen.

Step 3 For EAP type, select one of the following, depending on the software that is installed on your computer:

- **Protected EAP (PEAP)**—This option appears for PEAP (EAP-MSCHAP V2).
- **PEAP**—This option appears for PEAP (EAP-GTC).

Step 4 Perform one of the following:

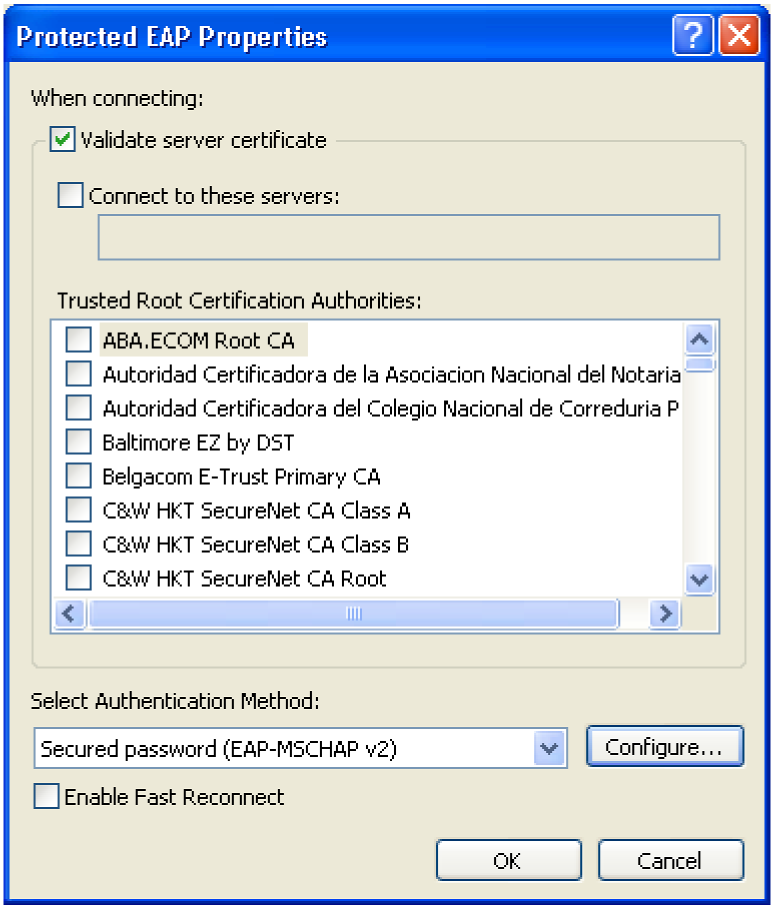
- If you selected Protected EAP (PEAP), follow the instructions in the "Enabling PEAP (EAP-MSCHAP V2)" section below.
- If you selected PEAP, follow the instructions in the "Enabling PEAP (EAP-GTC)" section on page E-15.

Enabling PEAP (EAP-MSCHAP V2)

Follow the steps below to enable PEAP (EAP-MSCHAP V2).

Step 1 Click **Properties**. The Protected EAP Properties screen appears (see Figure E-8).

Figure E-6 Protected EAP Properties Screen



Protected EAP Properties

When connecting:

☑ Validate server certificate

□ Connect to these servers:

Trusted Root Certification Authorities:

□ ABA.ECOM Root CA
□ Autoridad Certificadora de la Asociacion Nacional del Notaria
□ Autoridad Certificadora del Colegio Nacional de Correduria P
□ Baltimore EZ by DST
□ Belgacom E-Trust Primary CA
□ C&W HKT SecureNet CA Class A
□ C&W HKT SecureNet CA Class B
□ C&W HKT SecureNet CA Root

Select Authentication Method:

Secured password (EAP-MSCHAP v2)

□ Enable Fast Reconnect

Step 2 Check the **Validate server certificate** check box if server certificate validation is required (recommended).

Step 3 If you want to specify the name of the server to connect to, check the **Connect to these servers** check box and enter the appropriate server name in the field below.

Note If you enter a server name and the client adapter connects to a server that does not match the name you entered, you are prompted to accept or cancel the connection during the authentication process.

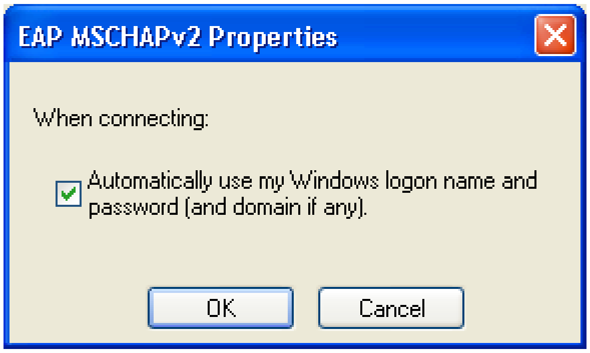
Note If you leave this field blank, the server name is not verified, and a connection is established as long as the certificate is valid.

Step 4 In the Trusted Root Certification Authorities field, select the certificate authority from which the server certificate was downloaded.

Step 5 In the Select Authentication Method drop-down box, select **Secured password (EAP-MSCHAP v2)**.

Step 6 Click **Configure**. The EAP MSCHAPv2 Properties screen appears (see Figure E-7).

Figure E-7 EAP MSCHAPv2 Properties Screen



EAP MSCHAPv2 Properties

When connecting:

☑ Automatically use my Windows logon name and password (and domain if any).

Step 7 Make sure the **Automatically use my Windows logon name and password (and domain if any)** check box is checked.

Step 8 Click **OK** four times to save your settings. The configuration is complete.

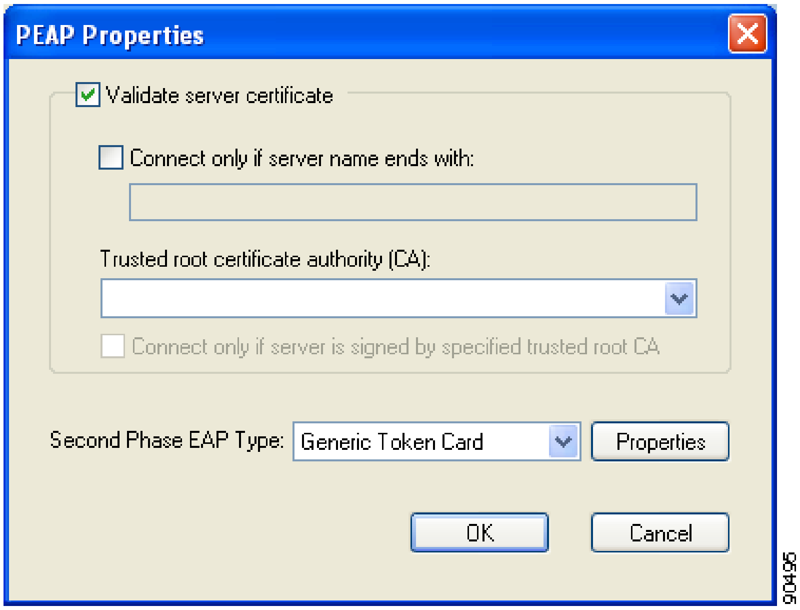
Step 9 Refer to the "Using PEAP" section on page 6-10 for instructions on authenticating using PEAP.

Enabling PEAP (EAP-GTC)

Follow the steps below to enable PEAP (EAP-GTC).

Step 1 Click **Properties**. The PEAP Properties screen appears (see Figure E-8).

Figure E-8 PEAP Properties Screen



PEAP Properties

☑ Validate server certificate

□ Connect only if server name ends with:

Trusted root certificate authority (CA):

□ Connect only if server is signed by specified trusted root CA

Second Phase EAP Type: Generic Token Card

Step 2 Check the **Validate server certificate** check box if server certificate validation is required (recommended).

Step 3 If you want to specify the name of the server to connect to, check the **Connect only if server name ends with** check box and enter the appropriate server name suffix in the field below.

Note If you enter a server name and the client adapter connects to a server that does not match the name you entered, you are prompted to accept or cancel the connection during the authentication process.

Note If you leave this field blank, the server name is not verified, and a connection is established as long as the certificate is valid.

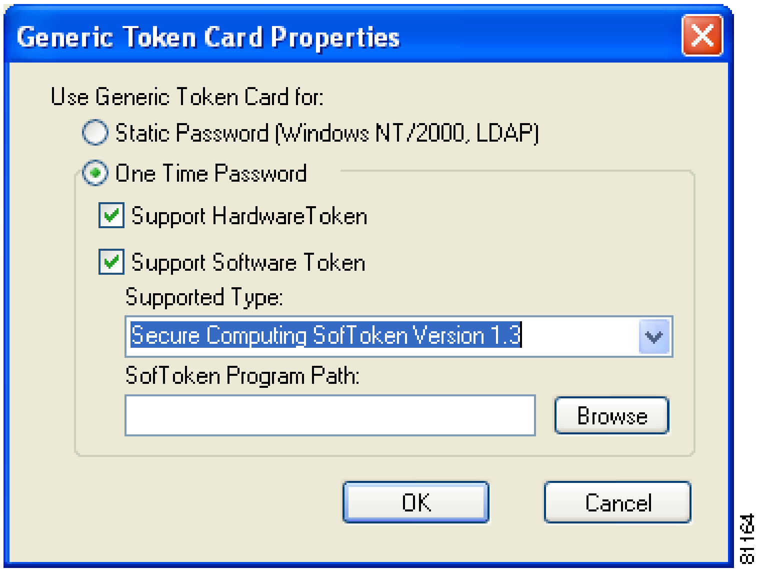
Step 4 Make sure that the name of the certificate authority from which the server certificate was downloaded appears in the Trusted root certificate authority (CA) field. If necessary, click the arrow on the drop-down menu and select the appropriate name.

Note If you leave this field blank, you are prompted to accept a connection to the root certification authority during the authentication process.

Step 5 Check the **Connect only if server is signed by specified trusted root CA** check box if you want to ensure that the certificate server uses the trusted root certificate specified in the field above. This prevents the client from establishing connections to rogue access points.

Step 6 Currently Generic Token Card is the only second phase EAP type available. Click **Properties**. The Generic Token Card Properties screen appears (see Figure E-9).

Figure E-9 Generic Token Card Properties Screen



Generic Token Card Properties

Use Generic Token Card for:

○ Static Password (Windows NT/2000, LDAP)

● One Time Password

☑ Support HardwareToken

☑ Support Software Token

Supported Type:

Secure Computing SofToken Version 1.3

SofToken Program Path:

Step 7 Select either the **Static Password (Windows NT/2000, LDAP)** or the **One Time Password** option, depending on your user database.

Step 8 Perform one of the following:

- If you selected the **Static Password (Windows NT/2000, LDAP)** option in Step 7, go to Step 9.
- If you selected the **One Time Password** option in Step 7, check one or both of the following check boxes to specify the type of tokens that will be supported for one-time passwords:
  - **Support Hardware Token**—A hardware token device obtains the one-time password. You must use your hardware token device to obtain the one-time password and enter the password when prompted for your user credentials.
  - **Support Software Token**—The PEAP supplicant works with a software token program to retrieve the one-time password. You have to enter only the PIN, not the one-time password. If you check this check box, you must also select from the Supported Type drop-down box the software token software that is installed on the client (such as Secure Computing SofToken Version 1.3, Secure Computing SofToken II 2.0, or RSA SecurID Software Token v 2.5), and if Secure Computing SofToken Version 1.3 is selected, you must find the software program path using the Browse button.

Note The SofToken Program Path field is unavailable if a software token program other than Secure Computing SofToken Version 1.3 is selected.

Step 9 Click **OK** four times to save your settings. The configuration is complete.

Step 10 Refer to the "Using PEAP" section on page 6-10 for instructions on authenticating using PEAP.

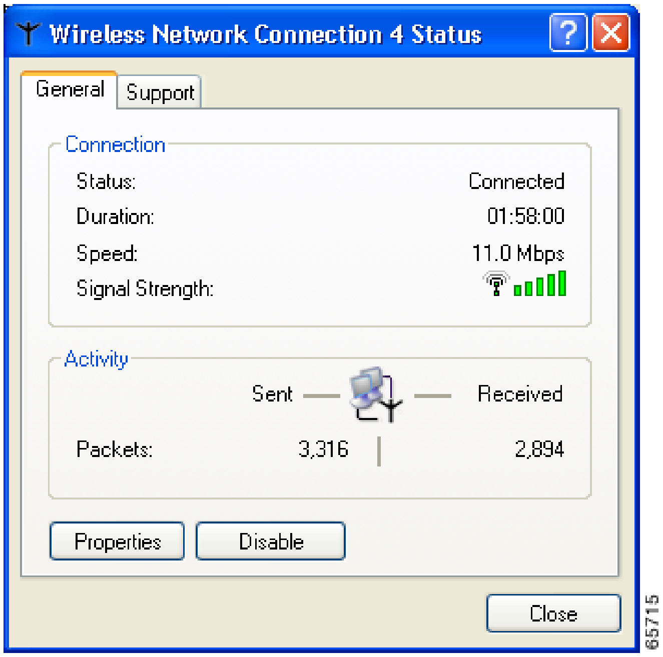
Associating to an Access Point Using Windows XP

Windows XP causes the client adapter's driver to automatically attempt to associate to the first network in the list of preferred networks (see Figure E-1). If the adapter fails to associate or loses association, it automatically switches to the next network in the list of preferred networks.The adapter does not switch networks as long as it remains associated to the access point. To force the client adapter to associate to a different access point, you must select a different network from the list of available networks (and click **Configure** and **OK)**.

Viewing the Current Status of Your Client Adapter

To view the status of your client adapter, click the icon of the two connected computers in the Windows system tray. The Wireless Network Connection Status screen appears (see Figure E-10).

Figure E-10 Wireless Network Connection Status Screen



Status: Connected

Duration: 01:58:00

Speed: 11.0 Mbps

Signal Strength:

Sent — Received

Packets: 3,316 | 2,894

GLOSSARY

16-QAM Quadrate amplitude modulation. A modulation technique used by IEEE 802.11-compliant wireless LANs for transmission at 24 and 36 Mbps.

64-QAM Quadrate amplitude modulation. A modulation technique used by IEEE 802.11-compliant wireless LANs for transmission at 48 and 54 Mbps.

802.1X Also called *802.1X for 802.11*. 802.1X is the new standard for wireless LAN security, as defined by the Institute of Electrical and Electronics Engineers (IEEE). An access point that supports 802.1X and its protocol, Extensible Authentication Protocol (EAP), acts as the interface between a wireless client and an authentication server, such as a Remote Authentication Dial-In User Service (RADIUS) server, to which the access point communicates over the wired network.

802.11 The IEEE standard that specifies carrier sense media access control and physical layer specifications for 1- and 2-megabit-per-second (Mbps) 2.4-GHz wireless LANs.

802.11a The IEEE standard that governs the deployment of 5-GHz OFDM systems. It specifies the implementation of the physical layer for wireless UNII bands (see UNII, UNII 1, and UNII 2) and provides four channels per 100 MHz of bandwidth.

802.11b The IEEE standard that specifies carrier sense media access control and physical layer specifications for 5.5- and 11-Mbps 2.4-GHz wireless LANs.

802.11g The IEEE standard that specifies carrier sense media access control and physical layer specifications for 54-Mbps 2.4-GHz wireless LANs.

A

Access Point A wireless LAN data transceiver that uses radio waves to connect a wired network with wireless stations.

Ad Hoc Network A wireless network composed of stations without access points.

Alphanumeric A set of characters that contains both letters and numbers.

Associated A station is configured properly to allow it to wirelessly communicate with an access point.

B

Bandwidth Specifies the amount of the frequency spectrum that is usable for data transfer. It identifies the maximum data rate that a signal can attain on the medium without encountering significant power loss.

BPSK Binary phase shift keying. A modulation technique used by IEEE 802.11-compliant wireless LANs for transmission at 1 Mbps.

Broadcast key rotation A security feature for use with dynamic WEP keys. If your client adapter uses LEAP, EAP-TLS, or PEAP authentication and you enable this feature, the access point changes the dynamic broadcast WEP key that it provides at the interval you select.

C

CCK Complementary code keying. A modulation technique used by IEEE 802.11b-compliant wireless LANs for transmission at 5.5 and 11 Mbps.

CCKM Cisco Centralized Key Management. Using CCKM, authenticated client devices can roam from one access point to another without any perceptible delay during reassociation. An access point on your network provides wireless domain services (WDS) and creates a cache of security credentials for CCKM-enabled client devices on the subnet. The WDS access point's cache of credentials dramatically reduces the time required for reassociation when a CCKM-enabled client device roams to a new access point.

CKIP Cisco Key Integrity Protocol. Cisco’s WEP key permutation technique based on an early algorithm presented by the IEEE 802.11i security task group.

Client A radio device that uses the services of an access point to communicate wirelessly with other devices on a local area network.

CSMA Carrier sense multiple access. A wireless LAN media access method specified by the IEEE 802.11 specification.

Cyclic Redundancy Check (CRC) A method of checking for errors in a received packet.

D

Data Rates The range of data transmission rates supported by a device. Data rates are measured in megabits per second (Mbps).

dBi A ratio of decibels to an isotropic antenna that is commonly used to measure antenna gain. The greater the dBi value, the higher the gain and the more acute the angle of coverage.

DHCP Dynamic Host Configuration Protocol. A protocol available with many operating systems that automatically issues IP addresses within a specified range to devices on the network. The device retains the assigned address for a specific administrator-defined period.

Dipole A type of low-gain (2.2-dBi) antenna consisting of two (often internal) elements.

DSSS Direct-sequence spread spectrum. A type of spread spectrum radio transmission that spreads its signal continuously over a wide frequency band.

Duplicate Packets Packets that were received twice because an acknowledgement got lost and the sender retransmitted the packet.

E

EAP Extensible Authentication Protocol. EAP is the protocol for the optional IEEE 802.1X wireless LAN security feature. An access point that supports 802.1X and EAP acts as the interface between a wireless client and an authentication server, such as a Remote Authentication Dial-In User Service (RADIUS) server, to which the access point communicates over the wired network.

Ethernet The most widely used wired local area network. Ethernet uses carrier sense multiple access (CSMA) to allow computers to share a network and operates at 10, 100, or 1000 megabits per second (Mbps), depending on the physical layer used.

F

File Server A repository for files so that a local area network can share files, mail, and programs.

Fragmentation Threshold The size at which packets are fragmented and transmitted a piece at a time instead of all at once. The setting must be within the range of 64 to 2312 bytes.

Full Duplex A means of communication whereby each node receives and transmits simultaneously (two-way). See also Half Duplex.

G

Gateway A device that connects two otherwise incompatible networks together.

GHz Gigahertz. One billion cycles per second. A unit of measure for frequency.

H

Half Duplex A means of communication whereby each node receives and transmits in turn (one-way). See also Full Duplex.

Hexadecimal A set of characters consisting of ten numbers and six letters (0-9, A-F, and a-f).

I

IEEE Institute of Electrical and Electronics Engineers. A professional society serving electrical engineers through its publications, conferences, and standards development activities. The body responsible for the Ethernet 802.3 and wireless LAN 802.11 specifications.

Infrastructure The wired Ethernet network.

Infrastructure Device A device (such as an access point, bridge, or base station) that connects client adapters to a wired LAN.

IP Address The Internet Protocol (IP) address of a station.

IP Subnet Mask The number used to identify the IP subnetwork, indicating whether the IP address can be recognized on the LAN or if it must be reached through a gateway.

IPX Internetwork Packet Exchange. The NetWare network layer protocol used for transferring data from servers to workstations.

Isotropic An antenna that radiates its signal 360 degrees both vertically and horizontally in a perfect sphere.

L

LEAP LEAP, or *EAP-Cisco Wireless*, is the 802.1X authentication type that is available for use with operating systems that do not have EAP support. Support for LEAP is provided in the client adapter’s firmware and the Cisco software that supports it, rather than in the operating system. With LEAP, a username and password are used by the client adapter to perform mutual authentication with the RADIUS server through an access point.

M

MAC Address The Media Access Control (MAC) address is a unique serial number assigned to a networking device by the manufacturer.

MIC Message integrity check. MIC prevents bit-flip attacks on encrypted packets. During a bit-flip attack, an intruder intercepts an encrypted message, alters it slightly, and retransmits it, and the receiver accepts the retransmitted message as legitimate. The client adapter’s driver must support MIC functionality, and MIC must be enabled on the access point.

Modulation Any of several techniques for combining user information with a transmitter’s carrier signal.

Multicast Packets Packets transmitted to multiple stations.

Multipath The echoes created as a radio signal bounces off of physical objects.

O

OFDM Orthogonal frequency division multiplexing. A multicarrier modulation method for broadband wireless communications.

Overrun Packets Packets that were discarded because the access point had a temporary overload of packets to handle.

P

Packet A basic message unit for communication across a network. A packet usually includes routing information, data, and sometimes error detection information.

Q

QPSK Quadruple phase shift keying. A modulation technique used by IEEE 802.11-compliant wireless LANs for transmission at 2 Mbps.

R

Radio Channel The frequency at which a radio operates.

Range A linear measure of the distance that a transmitter can send a signal.

Receiver Sensitivity A measurement of the weakest signal a receiver can receive and still correctly translate it into data.

RF Radio frequency. A generic term for radio-based technology.

Roaming A feature of some access points that allows users to move through a facility while maintaining an unbroken connection to the LAN.

RP-TNC A connector type unique to Cisco Aironet radios and antennas. Part 15.203 of the FCC rules covering spread spectrum devices limits the types of antennas that may be used with transmission equipment. In compliance with this rule, Cisco Aironet, like all other wireless LAN providers, equips its radios and antennas with a unique connector to prevent attachment of non-approved antennas to radios.

RTS Threshold The packet size at which an access point issues a request to send (RTS) before sending the packet.

S

Spread Spectrum A radio transmission technology that spreads data over a much wider bandwidth than otherwise required in order to gain benefits such as improved interference tolerance and unlicensed operation.

SSID Service set identifier. A unique identifier that stations must use to be able to communicate with an access point. The SSID can be any alphanumeric entry up to a maximum of 32 characters.

T

TKIP Temporal Key Integrity Protocol. Also referred to as *WEP key hashing*. A security feature that defends against an attack on WEP in which the intruder uses the initialization vector (IV) in encrypted packets to calculate the WEP key. TKIP removes the predictability that an intruder relies on to determine the WEP key by exploiting IVs.

Transmit Power The power level of radio transmission.

U

Unicast Packets Packets transmitted in point-to-point communication.

UNII Unlicensed National Information Infrastructure. An FCC regulatory domain for 5-GHz wireless devices. UNII bands are 100 MHz wide and divided into four channels when using 802.11a OFDM modulation.

UNII 1 A UNII band dedicated to in-building wireless LAN applications. UNII 1 is located at 5.15 to 5.25 GHz and allows for a maximum transmit power of 40 mW (or 16 dBm) with an antenna up to 6 dBi. UNII 1 regulations require a nonremovable, integrated antenna.

UNII 2 A UNII band dedicated to in-building wireless LAN applications. UNII 2 is located at 5.25 to 5.35 GHz and allows for a maximum transmit power of 200 mW (or 23 dBm) with an antenna up to 6 dBi. UNII 2 regulations allow for an auxiliary, user-installable antenna.

UNII 3 A UNII band dedicated to wireless LAN applications. UNII 3 is located at 5.725 to 5.825 GHz and allows for a maximum transmit power of 1 Watt (or 30 dBm) with an antenna up to 6 dBi. UNII 3 regulations allow for an auxiliary, user-installable antenna.

W

WDS Wireless domain services (WDS). An access point providing WDS on your wireless LAN maintains a cache of credentials for CCKM-capable client devices on your wireless LAN. When a CCKM-capable client roams from one access point to another, the WDS access point forwards the client's credentials to the new access point with the multicast key. Only two packets pass between the client and the new access point, greatly shortening the reassociation time.

WEP Wired equivalent privacy. An optional security mechanism defined within the 802.11 standard designed to protect your data as it is transmitted through your wireless network by encrypting it through the use of encryption keys.

Workstation A computing device with an installed client adapter.

WPA Wi-Fi Protected Access. A standards-based, interoperable security enhancement that strongly increases the level of data protection and access control for existing and future wireless LAN systems. It is derived from and will be compatible with the upcoming IEEE 802.11i standard. WPA leverages Temporal Key Integrity Protocol (TKIP) for data protection and 802.1X for authenticated key management.

INDEX

To Be Added