Configuring the Client Adapter

This chapter explains how to set the configuration parameters for a specific profile.

The following topics are covered in this chapter:

- Overview, page 5-2
- Setting System Parameters, page 5-3
- Setting RF Network Parameters, page 5-7
- Setting Advanced Infrastructure Parameters, page 5-14
- Setting Advanced Ad Hoc Parameters, page 5-18
- Setting Network Security Parameters, page 5-21
- Enabling Wi-Fi Multimedia, page 5-62

Overview

When you choose to create a new profile or edit an existing profile on the Profile Manager screen, the Properties screens appear with the name of your profile in parentheses. 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 Properties screens, wait until you are finished with all of the screens before clicking OK. When you click OK, you are returned to the Profile Manager screen.

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

- **System Parameters**—Prepares the client adapter for use in a wireless network
- **RF Network**—Controls how the client adapter transmits and receives data
- **Advanced (Infrastructure)**—Controls how the client adapter operates within an infrastructure network
- **Advanced (Ad Hoc)**—Controls how the client adapter operates within an ad hoc (peer-to-peer) network
- **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 the instructions for setting each Properties screen's parameters.

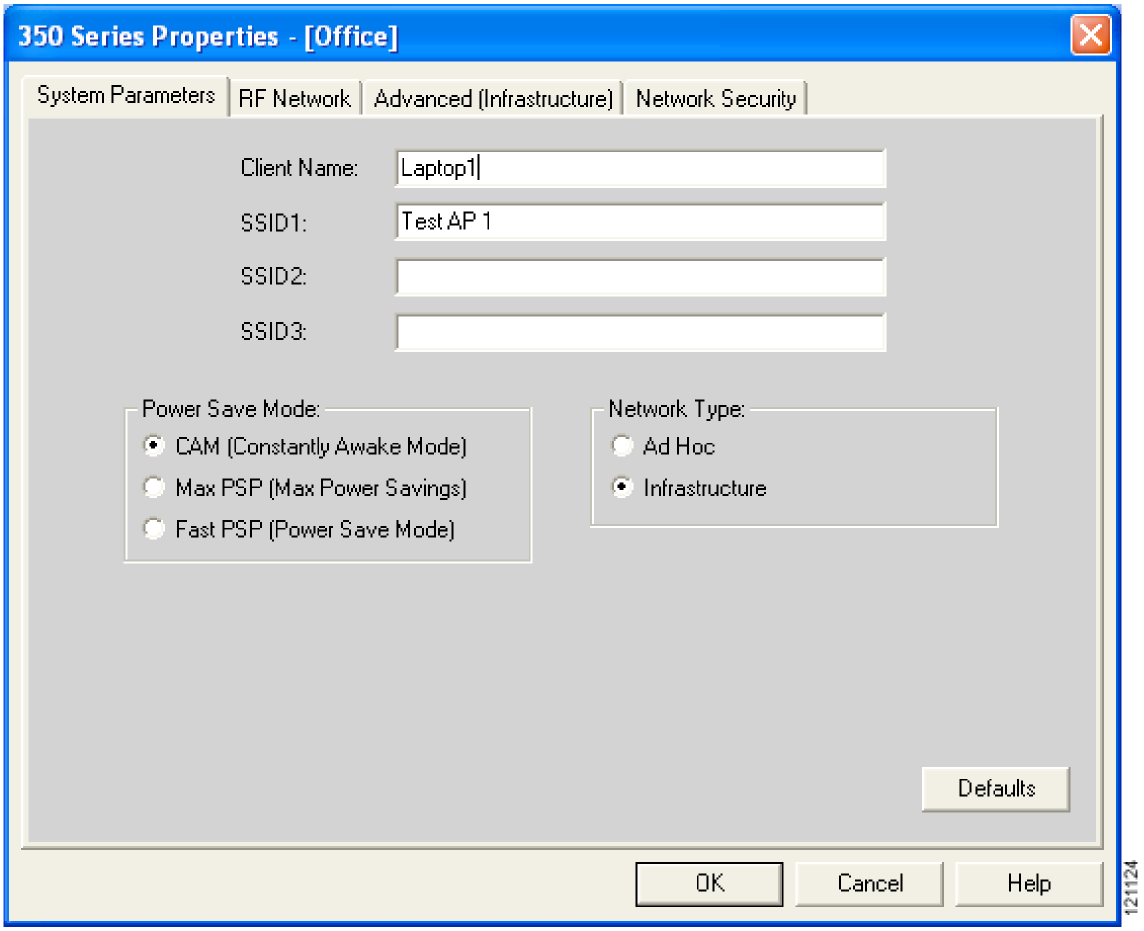
Table 5-1 Locating Configuration Instructions

Parameter Category	Page Number
System	page 5-3
RF network	page 5-7
Advanced infrastructure	page 5-14
Advanced ad hoc	page 5-18
Network security	page 5-21

Setting System Parameters

The System Parameters 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 create and save a new profile or click Edit on the Profile Manager screen.

Figure 5-1 System Parameters Screen



350 Series Properties - [Office]

Client Name: Laptop1

SSID1: Test AP 1

SSID2:

SSID3:

Power Save Mode:
- ● CAM (Constantly Awake Mode)
- ○ Max PSP (Max Power Savings)
- ○ Fast PSP (Power Save Mode)

Network Type:
- ○ Ad Hoc
- ● Infrastructure

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

Table 5-2 System Parameters

Parameter	Description
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. **Range:** You can key in up to 16 ASCII characters **Default:** A blank field **Note** Each computer on the network should have a unique client name.
SSID1	The service set identifier (SSID) identifies the specific wireless network that you want 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 (see the AP Radio Hardware page in the access point management system). 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 you to roam to that network without having to reconfigure your client adapter. **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.
SSID3	An optional SSID that identifies a third distinct network and enables you to roam to that network without having to reconfigure your client adapter. **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.

Table 5-2 System Parameters (continued)

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>Power Save Mode</td><td>Sets your client adapter to its optimum power consumption setting.
<b>Options:</b> CAM, Max PSP, or Fast PSP
<b>Default:</b> CAM (Constantly Awake Mode)
<table>
<tr><th>Power Save Mode</th><th>Description</th></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>Max PSP (Max Power Savings)</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).
<b>Note</b> When you set Max PSP mode and close ACU, the following message appears the next time you open ACU: “Maximum Power Save Mode will be temporarily disabled while you are running this application.” While ACU is open, Fast PSP mode is active. When you close ACU, the card returns to Max PSP mode.</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>
</table>
</td></tr>
</table>

Table 5-2 System Parameters (continued)

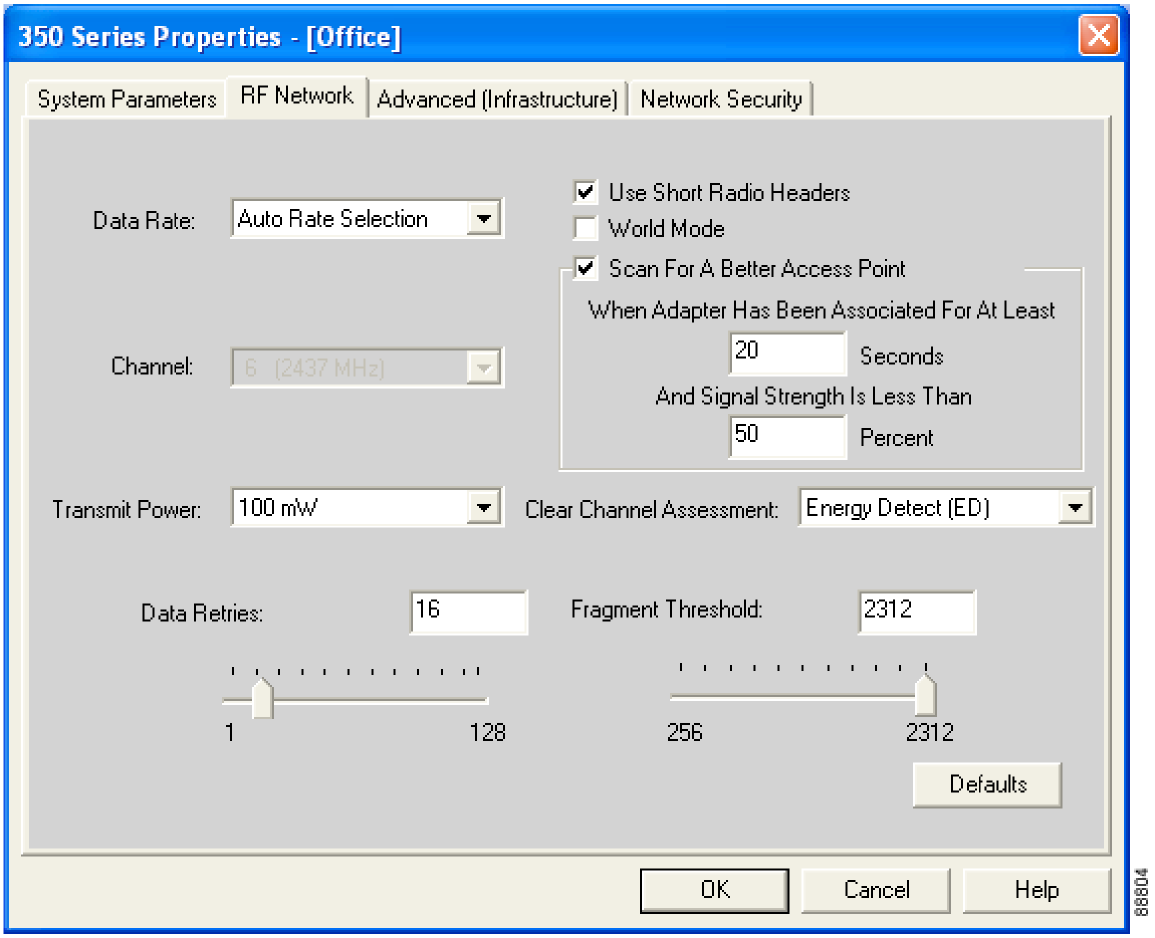
<table>
<tr><th>Parameter</th><th colspan="2">Description</th></tr>
<tr><td rowspan="4">Network Type</td><td colspan="2">Specifies the type of network in which your client adapter is installed.
Options: Ad Hoc or Infrastructure
Default: Infrastructure</td></tr>
<tr><td>**Network Type**</td><td>**Description**</td></tr>
<tr><td>Ad Hoc</td><td>Often referred to as *peer to peer.* 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 can 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>

Go to the next section to set additional parameters or click **OK** to return to the Profile Manager screen. On the Profile Manager screen, click **OK** or **Apply** to save your changes.

Setting RF Network Parameters

The RF Network screen (see Figure 5-2) enables you to set parameters that control how and when the client adapter transmits and receives data. To access this screen, choose the **RF Network** tab from the Properties screens.

Figure 5-2 RF Network Screen



Data Rate: Auto Rate Selection

Channel: 6 (2437 MHz)

☑ Use Short Radio Headers

☐ World Mode

☑ Scan For A Better Access Point

When Adapter Has Been Associated For At Least 20 Seconds

And Signal Strength Is Less Than 50 Percent

Transmit Power: 100 mW

Clear Channel Assessment: Energy Detect (ED)

Data Retries: 16 (1 – 128)

Fragment Threshold: 2312 (256 – 2312)

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

Table 5-3 RF Network Parameters

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>Data Rate</td><td>Specifies the rate at which your client adapter should transmit or receive packets to or from access points (in infrastructure mode) or other clients (in ad hoc mode).

Auto Rate Selection is recommended for infrastructure mode; setting a specific data rate is recommended for ad hoc mode.

<b>Options:</b> Auto Rate Selection, 1 Mbps Only, 2 Mbps Only, 5.5 Mbps Only, or 11 Mbps Only (2.4-GHz client adapters);
Auto Rate Selection, 6 Mbps Only, 9 Mbps Only, 12 Mbps Only, 18 Mbps Only, 24 Mbps Only, 36 Mbps Only, 48 Mbps Only, or 54 Mbps Only (5-GHz client adapters)

<b>Default:</b> Auto Rate Selection
<table>
<tr><th colspan="2">Data Rate</th><th rowspan="2">Description</th></tr>
<tr><th>2.4-GHz Client Adapters</th><th>5-GHz Client Adapters</th></tr>
<tr><td>Auto Rate Selection</td><td>Auto Rate Selection</td><td>Uses the 11-Mbps (for 2.4-GHz client adapters) or 54-Mbps (for 5-GHz client adapters) data rate when possible but drops to lower rates when necessary.</td></tr>
<tr><td>1 Mbps Only</td><td>6 Mbps Only</td><td>Offers the greatest range but the lowest throughput.</td></tr>
<tr><td>2 Mbps Only and 5.5 Mbps Only</td><td>9 Mbps Only to 48 Mbps Only</td><td>Progressively offers less range but greater throughput than the 1 Mbps Only (for 2.4-GHz client adapters) or 6 Mbps Only (for 5-GHz client adapters) option.</td></tr>
<tr><td>11 Mbps Only</td><td>54 Mbps Only</td><td>Offers the greatest throughput but the lowest range.</td></tr>
</table>
<b>Note</b> Your client adapter's data rate must be set to Auto Rate Selection or must match the data rate of the access point (in infrastructure mode) or the other clients (in ad hoc mode) with which it is to communicate. Otherwise, your client adapter may not be able to associate to them.</td></tr>
</table>

Table 5-3 RF Network Parameters (continued)

Parameter	Description
Use Short Radio Headers	Checking this check box sets your client adapter to use short radio headers. However, 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 *all* 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. **Default:** Checked **Note** This parameter is available only for 2.4-GHz client adapters. **Note** This parameter is referred to as *Preambles* on the access point screens.
World Mode	Checking this check box enables the client adapter to adopt the maximum transmit power level and the frequency range of the access point to which it is associated, provided the access point is also configured for world mode. This parameter is available only in infrastructure mode and is designed for users who travel between countries and want their client adapters to associate to access points in different regulatory domains. **Default:** Unchecked **Note** This parameter is available only for 2.4-GHz client adapters. **Note** When World Mode is enabled, the client adapter is limited to the maximum transmit power level allowed by the country of operation's regulatory agency.
Scan For A Better Access Point	Checking this check box causes the client to look for a better access point if the signal strength of its associated access point is less than the specified value after the specified time and to switch associations if it finds one. **Example:** If the default values of 20 seconds and 50% are used, the client begins monitoring the strength of the signal received from its associated access point 20 seconds after becoming associated. The monitoring continues once per second. If the client detects a signal strength reading below 50%, it scans for a better access point. **Range:** 5 to 255 seconds; 0 to 75% signal strength **Defaults:** Checked, 20 seconds, 50% signal strength **Note** The ability to specify the time and signal strength is available in ACU version 6.1 or later, which is included in Install Wizard version 1.1 or later.

Table 5-3 RF Network Parameters (continued)

Parameter	Description
Channel	Specifies the frequency that your client adapter will use as the channel for communications. These channels conform to the IEEE 802.11 Standard for your regulatory domain. • In infrastructure mode, this parameter is set automatically and cannot be changed. The client adapter listens to the entire spectrum, selects the best access point to associate to, and uses the same frequency as that access point. • In ad hoc mode, 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 adapters, this parameter specifies the channel with which the adapter will start its cell. **Range:** Dependent on client adapter radio and regulatory domain **Example for 2.4-GHz client adapters:** 1 to 11 (2412 to 2462 MHz) in North America **Example for 5-GHz client adapters:** 36, 40, 44, 48, 52, 56, 60, and 64 (5180, 5200, 5220, 5240, 5260, 5280, 5300, and 5320 MHz) in North America **Default:** Dependent on client adapter radio and regulatory domain **Example for 2.4-GHz client adapters:** 6 (2437 MHz) in North America **Example for 5-GHz client adapters:** 36 (5180 MHz) in North America **Note** Refer to Appendix D for a list of channel identifiers, channel center frequencies, and regulatory domains for each channel.

Table 5-3 RF Network Parameters (continued)

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>Transmit Power</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 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>Possible Power Levels</th><th>Client Adapter Type</th></tr>
<tr><td>100 mW, 50 mW, 30 mW, 20 mW, 5 mW, or 1 mW</td><td>350 series client adapters</td></tr>
<tr><td>20 mW, 10 mW, or 5 mW</td><td>PC-Cardbus card</td></tr>
</table>
<b>Note</b> Reducing the transmit power level conserves battery power but decreases radio range.
<b>Note</b> When World Mode is enabled, the client adapter is limited to the maximum transmit power level allowed by the country of operation’s regulatory agency.
<b>Note</b> If you are using an older version of a 350 series client adapter, your power level options may be different than those listed here.</td></tr>
</table>

Table 5-3 RF Network Parameters (continued)

<table>
<tr><th>Parameter</th><th colspan="2">Description</th></tr>
<tr><td rowspan="7">Clear Channel Assessment</td><td colspan="2">Specifies the method that determines whether the channel on which your client adapter will operate is clear prior to the transmission of data.
<b>Options:</b> Firmware Default (<i>XXX</i>), Carrier/Correlation (Car/Cor), Energy Detect (ED), or ED or Car/Cor
<b>Default:</b> Firmware Default (<i>XXX</i>)</td></tr>
<tr><td><b>Method</b></td><td><b>Description</b></td></tr>
<tr><td>Firmware Default (<i>XXX</i>)</td><td>The Clear Channel Assessment (CCA) mechanism will report that the channel is busy based on the default value of the client adapter’s firmware. The firmware’s CCA default value is shown in parentheses.
<b>Note</b> The CCA default value for PCM, LMC, and PCI card firmware is Car/Cor; the default value for mini PCI card firmware is ED.</td></tr>
<tr><td>Carrier/Correlation (Car/Cor)</td><td>The CCA mechanism will report that the channel is busy upon detection of a direct-sequence spread spectrum (DSSS) signal. This signal may be above or below the ED threshold.</td></tr>
<tr><td>Energy Detect (ED)</td><td>The CCA mechanism will report that the channel is busy upon detection of any energy above the ED threshold.</td></tr>
<tr><td>ED or Car/Cor</td><td>The CCA mechanism will report that the channel is busy upon detection of a DSSS signal or any energy above the ED threshold.</td></tr>
<tr><td colspan="2"><b>Note</b> This parameter is available only for 2.4-GHz client adapters.</td></tr>
</table>

Table 5-3 RF Network Parameters (continued)

Parameter	Description
Data Retries	Defines the number of times a packet is resent if the initial transmission is unsuccessful. **Range:** 1 to 128 **Default:** 16 (2.4-GHz client adapters) or 32 (5-GHz client adapters) **Note** If your network protocol performs its own retries, set this to a smaller value than the default. This way notification of a “bad” packet is sent up the protocol stack quickly so the application can retransmit the packet if necessary.
Fragment Threshold	Defines the threshold above which an RF data packet is split up or fragmented. If one of those fragmented packets experiences interference during transmission, only that specific packet would need to be resent. Throughput is generally lower for fragmented packets because the fixed packet overhead consumes a higher portion of the RF bandwidth. **Range:** 256 to 2312 **Default:** 2312

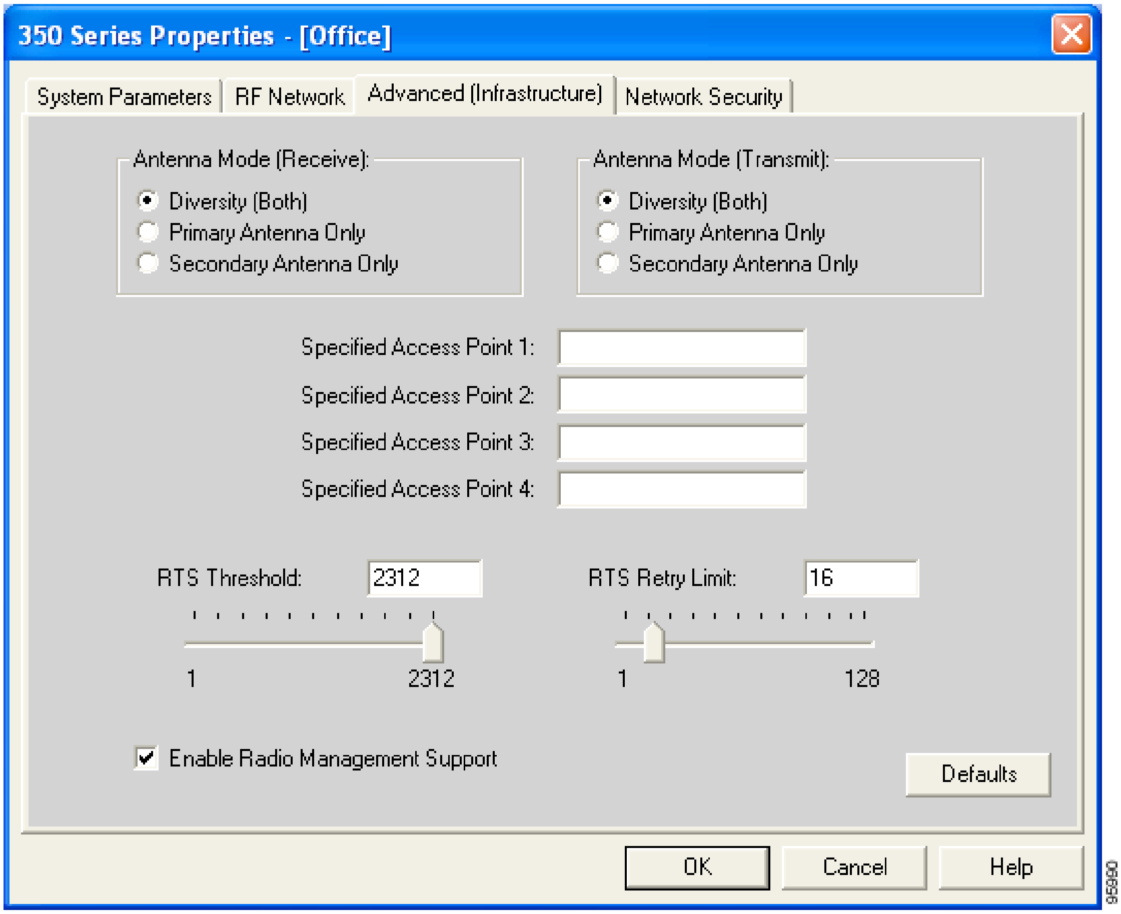
Go to the next section to set additional parameters or click **OK** to return to the Profile Manager screen. On the Profile Manager screen, click **OK** or **Apply** to save your changes.

Setting Advanced Infrastructure Parameters

Note You can set advanced infrastructure parameters only if your client adapter has been set to operate in an infrastructure network. See the Network Type parameter in Table 5-2.

The Advanced (Infrastructure) screen (see Figure 5-3) enables you to set parameters that control how the client adapter operates within an infrastructure network. To access this screen, choose the **Advanced (Infrastructure)** tab from the Properties screens.

Figure 5-3 Advanced (Infrastructure) Screen



Antenna Mode (Receive):
● Diversity (Both)
○ Primary Antenna Only
○ Secondary Antenna Only

Antenna Mode (Transmit):
● Diversity (Both)
○ Primary Antenna Only
○ Secondary Antenna Only

Specified Access Point 1:
Specified Access Point 2:
Specified Access Point 3:
Specified Access Point 4:

RTS Threshold: 2312 (1 – 2312)

RTS Retry Limit: 16 (1 – 128)

☑ Enable Radio Management Support

Table 5-4 lists and describes the client adapter's advanced infrastructure parameters. Follow the instructions in the table to change any parameters.

Table 5-4 Advanced (Infrastructure) Parameters

Parameter	Description
Antenna Mode (Receive)	Specifies the antenna that your client adapter uses to receive data. • PC card—The PC card's integrated, permanently attached antenna operates best when used in diversity mode. Diversity mode allows the card to use the better signal from its two antenna ports. **Options:** Diversity (Both), Primary Antenna Only, Secondary Antenna Only **Default:** Diversity (Both) • LM card—The LM card is shipped without an antenna; however, an antenna can be connected through the card's external connector. If a snap-on antenna is used, diversity mode is recommended. Otherwise, choose the mode that corresponds to the antenna port to which the antenna is connected. **Options:** Diversity (Both), Primary Antenna Only, Secondary Antenna Only **Default:** Diversity (Both) • PCI card—The PCI card must use the Primary Antenna Only option. **Default:** Primary Antenna Only • Mini PCI card—The mini PCI card, which can be used with one or two antennas, operates best in diversity mode. Diversity mode allows the card to use the better signal from its two antenna connectors. **Options:** Diversity (Both), Primary Antenna Only, Secondary Antenna Only **Default:** Diversity (Both) **Note** This parameter is available only for 2.4-GHz client adapters. **Note** The Primary Antenna Only and Secondary Antenna Only options were formerly named Right Antenna Only and Left Antenna Only, respectively.
Antenna Mode (Transmit)	Specifies the antenna that your client adapter uses to transmit data. See the Antenna Mode (Receive) parameter above for information on the options available for your client adapter. **Note** This parameter is available only for 2.4-GHz client adapters.

Table 5-4 Advanced (Infrastructure) Parameters (continued)

Parameter	Description
Specified Access Point 1- 4	Specifies the MAC addresses of up to four preferred access points with which the client adapter can associate. If the specified access points are not found or the client adapter roams out of range, the adapter may associate to another access point. You can enter the MAC addresses of the access points in the edit boxes or choose not to specify access points by leaving the boxes blank. **Default:** Blank fields **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.
RTS Threshold	Specifies the size of the data packet that the low-level RF protocol issues to a request-to-send (RTS) packet. Setting this parameter to a small value causes RTS packets to be sent more often. When this occurs, more of the available bandwidth is consumed and the throughput of other network packets is reduced, but the system is able to recover faster from interference or collisions, which may be caused from a high multipath environment characterized by obstructions or metallic surfaces. **Range:** 0 to 2312 **Default:** 2312 **Note** Refer to the IEEE 802.11 Standard for more information on the RTS/CTS mechanism.
RTS Retry Limit	Specifies the number of times the client adapter resends a request-to-send (RTS) packet if it does not receive a clear-to-send (CTS) packet from the previously sent RTS packet. Setting this parameter to a large value decreases the available bandwidth whenever interference is encountered but makes the system more immune to interference and collisions, which may be caused from a high multipath environment characterized by obstructions or metallic surfaces. **Range:** 1 to 128 **Default:** 16 (2.4-GHz client adapters) or 32 (5-GHz client adapters) **Note** Refer to the IEEE 802.11 Standard for more information on the RTS/CTS mechanism.

Table 5-4 Advanced (Infrastructure) Parameters (continued)

Parameter	Description
Enable Radio Management Support	Checking this check box enables the access point to which the client adapter is associated to control the use of radio management (RM), provided RM is enabled on the access point. RM is a system-wide feature that involves multiple infrastructure nodes. The RM feature on the access point acts on radio measurement requests from other network devices to instruct the access point and its associated clients to perform required radio measurements and then report them. **Default:** Checked **Note** This parameter is available in Install Wizard version 1.2 or later for 350 series cards and Install Wizard version 1.3 or later for CB20A cards. **Note** Access points must use Cisco IOS Release 12.2(13)JA or later to enable RM. Refer to the documentation for your access point for instructions on enabling this feature.

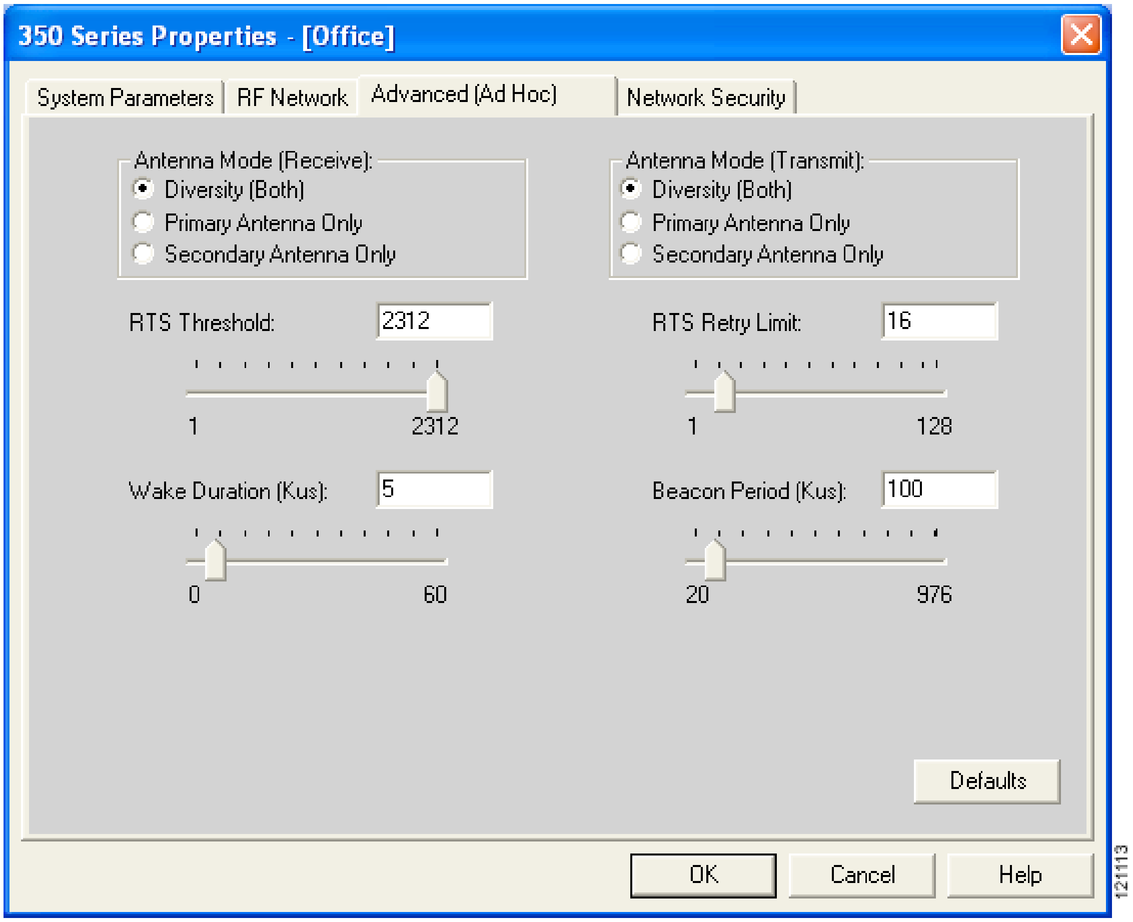
Go to the next section to set additional parameters or click **OK** to return to the Profile Manager screen. On the Profile Manager screen, click **OK** or **Apply** to save your changes.

Setting Advanced Ad Hoc Parameters

Note You can set advanced ad hoc parameters only if your client adapter has been set to operate in an ad hoc network. See the Network Type parameter in Table 5-2.

The Advanced (Ad Hoc) screen (see Figure 5-4) enables you to set parameters that control how the client adapter operates within an ad hoc network. To access this screen, choose the **Advanced (Ad Hoc)** tab from the Properties screens.

Figure 5-4 Advanced (Ad Hoc) Screen



350 Series Properties - [Office]

Antenna Mode (Receive):
● Diversity (Both)
○ Primary Antenna Only
○ Secondary Antenna Only

Antenna Mode (Transmit):
● Diversity (Both)
○ Primary Antenna Only
○ Secondary Antenna Only

RTS Threshold: 2312

RTS Retry Limit: 16

Wake Duration (Kus): 5

Beacon Period (Kus): 100

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

Table 5-5 Advanced (Ad Hoc) Parameters

Parameter	Description
Antenna Mode (Receive)	Specifies the antenna that your client adapter uses to receive data. • PC card—The PC card's integrated, permanently attached antenna operates best when used in diversity mode. Diversity mode allows the card to use the better signal from its two antenna ports. **Options:** Diversity (Both), Primary Antenna Only, Secondary Antenna Only **Default:** Diversity (Both) • LM card—The LM card is shipped without an antenna; however, an antenna can be connected through the card's external connector. If a snap-on antenna is used, diversity mode is recommended. Otherwise, choose the mode that corresponds to the antenna port to which the antenna is connected. **Options:** Diversity (Both), Primary Antenna Only, Secondary Antenna Only **Default:** Diversity (Both) • PCI card—The PCI card must use the Primary Antenna Only option. **Default:** Primary Antenna Only • Mini PCI card—The mini PCI card, which can be used with one or two antennas, operates best in diversity mode. Diversity mode allows the card to use the better signal from its two antenna connectors. **Options:** Diversity (Both), Primary Antenna Only, Secondary Antenna Only **Default:** Diversity (Both) **Note** This parameter is available only for 2.4-GHz client adapters. **Note** The Primary Antenna Only and Secondary Antenna Only options were formerly named Right Antenna Only and Left Antenna Only, respectively.
Antenna Mode (Transmit)	Specifies the antenna that your client adapter uses to transmit data. See the Antenna Mode (Receive) parameter above for information on the options available for your client adapter. **Note** This parameter is available only for 2.4-GHz client adapters.

Table 5-5 Advanced (Ad Hoc) Parameters (continued)

Parameter	Description
RTS Threshold	Specifies the size of the data packet that the low-level RF protocol issues to a request-to-send (RTS) packet. Setting this parameter to a small value causes RTS packets to be sent more often. When this occurs, more of the available bandwidth is consumed and the throughput of other network packets is reduced, but the system is able to recover faster from interference or collisions, which may be caused from a high multipath environment characterized by obstructions or metallic surfaces. **Range:** 0 to 2312 **Default:** 2312 **Note** Refer to the IEEE 802.11 Standard for more information on the RTS/CTS mechanism.
RTS Retry Limit	Specifies the number of times the client adapter resends a request-to-send (RTS) packet if it does not receive a clear-to-send (CTS) packet from the previously sent RTS packet. Setting this parameter to a large value decreases the available bandwidth whenever interference is encountered but makes the system more immune to interference and collisions, which may be caused from a high multipath environment characterized by obstructions or metallic surfaces. **Range:** 1 to 128 **Default:** 16 (2.4-GHz client adapters) or 32 (5-GHz client adapters) **Note** Refer to the IEEE 802.11 Standard for more information on the RTS/CTS mechanism.
Wake Duration (Kμs)	Specifies the amount of time following a beacon that the client adapter stays awake to receive announcement traffic indication message (ATIM) packets, which are sent to the adapter to keep it awake until the next beacon. Refer to the Power Save Mode parameter in Table 5-2. **Range:** 0 Kμs (in CAM mode); 5 to 60 Kμs (in Max PSP or Fast PSP mode) **Default:** 5 Kμs **Note** If your client adapter is set to CAM mode, you must set the wake duration to 0 Kμs. If your client adapter is set to Max PSP or Fast PSP mode, you must set the wake duration to a minimum of 5 Kμs. **Note** Kμs is a unit of measurement in software terms. K = 1024, μ = 10^{-6}, and s = seconds, so Kμs = .001024 seconds, 1.024 milliseconds, or 1024 microseconds.

Table 5-5 Advanced (Ad Hoc) Parameters (continued)

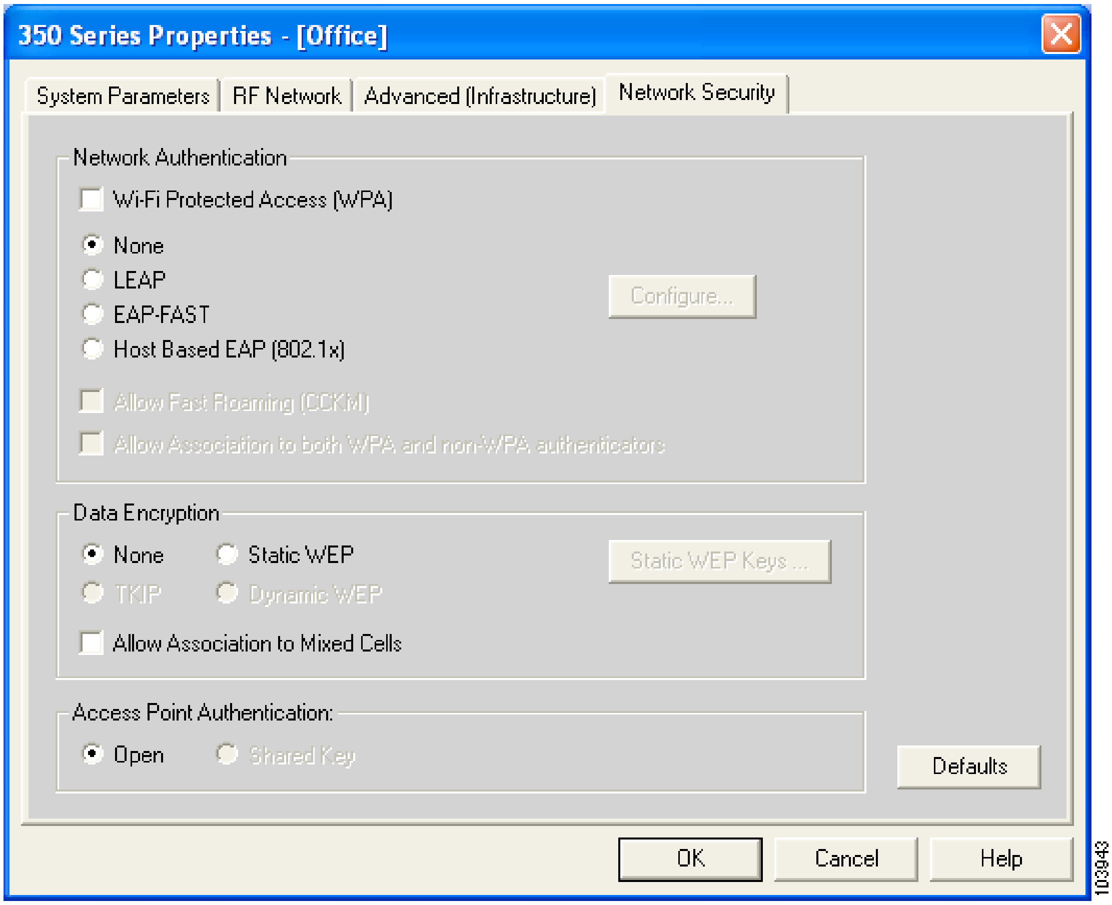
Parameter	Description
Beacon Period (Kµs)	Specifies the duration between beacon packets, which are used to help clients find each other in ad hoc mode. **Range:** 20 to 976 Kµs **Default:** 100 Kµs

Go to the next section to set additional parameters or click **OK** to return to the Profile Manager screen. On the Profile Manager screen, click **OK** or **Apply** to save your changes.

Setting Network Security Parameters

The Network Security screen (see Figure 5-5) 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, choose the **Network Security** tab from the Properties screens.

Figure 5-5 Network Security Screen



350 Series Properties - [Office]

System Parameters | RF Network | Advanced (Infrastructure) | Network Security

Network Authentication

□ Wi-Fi Protected Access (WPA)

● None
○ LEAP
○ EAP-FAST
○ Host Based EAP (802.1x)

Configure...

□ Allow Fast Roaming (CCKM)
□ Allow Association to both WPA and non-WPA authenticators

Data Encryption

● None ○ Static WEP
○ TKIP ○ Dynamic WEP

Static WEP Keys ...

□ Allow Association to Mixed Cells

Access Point Authentication:

● Open ○ Shared Key

Defaults

OK Cancel Help

This screen is different from the other Properties screens in that it presents several 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 Network 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 these steps to set this parameter.

Note This parameter is unavailable if the Wi-Fi Protected Access (WPA) check box is checked.

Step 1 Perform one of the following:

- Check the **Allow Association to Mixed Cells** check box if the access point with 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 with 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 Network Security screen, click **OK** to return to the Profile Manager screen; then click **OK** or **Apply** to save your changes
- If you want to change some of the other parameters on the Network 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 5-29 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 Network Security screen enables you to view the current WEP key settings for the client adapter 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 5-35 for instructions.

EAP (with Dynamic WEP Keys)

The new 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.

Three 802.1X authentication types can be selected in ACU for use with Windows operating systems:

- **EAP-Cisco Wireless** (or **LEAP**)—This authentication type is available for 350 series and CB20A cards on Windows 2000 and XP. Support for LEAP is provided not in the Windows operating system but in your client adapter's firmware and the Cisco software that supports it. RADIUS servers that support LEAP include Cisco Secure ACS version 2.6 and later, Cisco Access Registrar version 1.7 and later, and Funk Software's Steel-Belted RADIUS version 3.0 and later.

LEAP is enabled or disabled for a specific profile through ACU, provided the LEAP security module was selected during installation. After LEAP is enabled, a variety of configuration options are available, 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 need to be re-entered each time the client adapter is inserted or the Windows device is rebooted, unless you configure your adapter to use saved LEAP credentials.

Note If the LEAP security module was not selected during installation, the LEAP option is unavailable in ACU. If you want to be able to enable and disable LEAP, you must run the installation program again and choose **LEAP**.

- **EAP-FAST—**This authentication type (Flexible Authentication via Secure Tunneling) is available for 350 series and CB20A cards on computers running Windows 2000 or XP. EAP-FAST uses a three-phased tunneled authentication process to provide advanced 802.1X EAP mutual authentication.
  - Phase 0 enables the client to dynamically provision a protected access credentials (PAC) when necessary. During this phase, a PAC is generated securely between the user and the network.
  - Phase 1 uses the PAC to establish a mutually authenticated and secure tunnel between the client and the RADIUS server. RADIUS servers that support EAP-FAST include Cisco Secure ACS version 3.2.3 and later.
  - Phase 2 performs client authentication in the established tunnel.

  EAP-FAST is enabled or disabled for a specific profile through ACU, provided the EAP-FAST security module was selected during installation. After EAP-FAST is enabled, a variety of configuration options are available, including how and when a username and password are entered to begin the authentication process and whether automatic or manual PAC provisioning is used.

  The client adapter uses the username, password, and PAC to perform mutual authentication with the RADIUS server through the access point. The username and password need to be re-entered each time the client adapter is inserted or the Windows device is rebooted, unless you configure your adapter to use saved EAP-FAST credentials.

  PACs are created by Cisco Secure ACS and are identified by an ID. The user obtains his or her own copy of the PAC from the server, and the ID links the PAC to the profile created in ACU. When manual PAC provisioning is enabled, the PAC file is manually copied from the server and imported onto the client device. The following rules govern PAC storage:
  - In most cases PACs are provisioned and stored separately for each Windows logon user. These per-user PACs are not viewable by other users.
  - If a profile is configured to use manual provisioning, each user must manually provision his or her own PAC for that profile.
  - PAC files can be added or replaced using the import feature, but they cannot be removed or exported.
  - For profiles configured with saved EAP-FAST usernames and passwords, the PACs are not stored per user but in a global PAC area shared by all users. Global PACs are also enabled when the No Network Connection Unless User Is Logged In check box is unchecked. These global PACs can be imported and used by all users.

> **Note** PACs are also stored globally on computers that use the Novell Network login prompt or any other third-party login application that does not share its credentials with the EAP-FAST supplicant.

EAP-FAST authentication is designed to support the following user databases over a wireless LAN:

- Cisco Secure ACS internal user database
- Cisco Secure ACS ODBC user database
- Windows NT/2000/2003 domain user database
- LDAP user database

LDAP user databases (such as NDS) support only manual PAC provisioning while the other three user databases support both automatic and manual PAC provisioning.

> **Note** If the EAP-FAST security module was not selected during installation, the EAP-FAST option is unavailable in ACU. If you want to be able to enable and disable EAP-FAST, you must run the installation program again and choose **EAP-FAST**. EAP-FAST is supported in Install Wizard version 1.3 and later.

- **Host Based EAP**—Choosing this option enables you to use any 802.1X authentication type for which your operating system has support. For example, if your operating system uses the Microsoft 802.1X supplicant, it provides native support for EAP-TLS authentication and general support for PEAP and EAP-SIM authentication.

> **Note** To use EAP-TLS, PEAP, or EAP-SIM authentication, you must install the Microsoft 802.1X supplicant, ACU, and the PEAP or EAP-SIM supplicant; configure your client adapter using ACU; enable the authentication type in Windows; and enable Network-EAP on the access point.

- **EAP-TLS**—EAP-TLS is enabled or disabled through the operating system and uses a dynamic session-based WEP key, which is derived from the client adapter and RADIUS server, to encrypt data. Once enabled, a few configuration parameters must be set within the operating system.

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

> **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**)—PEAP authentication is designed to support One-Time Password (OTP), Windows NT or 2000 domain, and LDAP 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 is enabled or disabled through the operating system and 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 requires you to enter either a hardware token password or 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 or an LDAP user database (such as NDS), PEAP requires you to enter your username, password, and domain name in order to start the authentication process.

RADIUS servers that support PEAP authentication include Cisco Secure ACS version 3.1 or later and Cisco Access Registrar version 3.5 or later.

Note Windows XP Service Pack 1 and the Microsoft 802.1X supplicant for Windows 2000 include Microsoft's PEAP supplicant, which supports a Windows username and password only and does not interoperate with Cisco's PEAP supplicant. To use Cisco's PEAP supplicant, install the Install Wizard file after Windows XP Service Pack 1 or the Microsoft 802.1X supplicant for Windows 2000. Otherwise, Cisco's PEAP supplicant is overwritten by Microsoft's PEAP supplicant.

– **EAP-SIM**—EAP-SIM authentication is designed for use in public wireless LANs and requires clients equipped with PCSC-compliant smartcard readers. The EAP-SIM supplicant included in the Install Wizard file supports only Gemplus SIM+ cards; however, an updated supplicant is available that supports standard GSM-SIM cards as well as more recent versions of the EAP-SIM protocol. The new supplicant is available for download from Cisco.com at the following URL:

  http://www.cisco.com/cgi-bin/tablebuild.pl/access-registrar-encrypted

  Please note that the above requirements are necessary but not sufficient to successfully perform EAP-SIM authentication. Typically, you are also required to enter into a service contract with a WLAN service provider, who must support EAP-SIM authentication in its network. Also, while your PCSC smartcard reader may be able to read standard GSM-SIM cards or chips, EAP-SIM authentication usually requires your GSM cell phone account to be provisioned for WLAN service by your service provider.

  EAP-SIM is enabled or disabled through the operating system and uses a dynamic session-based WEP key, which is derived from the client adapter and RADIUS server, to encrypt data. EAP-SIM requires you to enter a user verification code, or *PIN*, for communication with the SIM card. You can choose to have the PIN stored in your computer or to be prompted to enter it after a reboot or prior to every authentication attempt.

  RADIUS servers that support EAP-SIM include Cisco Access Registrar version 3.0 or later.

Note Because EAP-TLS, PEAP, and EAP-SIM authentication are enabled in the operating system and not in ACU, you cannot switch between these authentication types simply by switching profiles in ACU. You can create a profile in ACU that uses host-based EAP, but you must enable the specific authentication type in Windows (provided Windows uses the Microsoft 802.1X supplicant). In addition, Windows can be set for only one authentication type at a time; therefore, if you have more than one profile in ACU that uses host-based EAP and you want to use another authentication type, you must change authentication types in Windows after switching profiles in ACU.

When you enable Network-EAP or EAP on your access point and configure your client adapter for LEAP, EAP-FAST, EAP-TLS, PEAP, or EAP-SIM, 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), password and PAC (EAP-FAST), certificate (EAP-TLS), or internal key stored on the SIM card and in the service provider's Authentication Center (EAP-SIM) being the shared secret for authentication. The password, PAC, 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 one of these sections for instructions on enabling EAP authentication:

- Enabling LEAP, page 5-38
- Enabling EAP-FAST, page 5-42
- Enabling Host-Based EAP, page 5-49

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 greatly 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) and Michael message integrity check (MIC) for data protection and 802.1X for authenticated key management.

WPA supports two mutually exclusive key management types: WPA and WPA-Pre-shared key (WPA-PSK). 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). The server generates the PMK dynamically and passes it to the access point. Using WPA-PSK key management, however, you configure a pre-shared key on both the client and the access point, and that pre-shared key is used as the PMK.

Only 350 series and CB20A cards that are installed on computers running Windows 2000 or XP and running LEAP, EAP-FAST, or host-based EAP authentication can be used with WPA. Support for WPA is available in the software components included in Install Wizard version 1.2 or later. However, if you want to use host-based EAP authentication with WPA, you must install additional software with WPA support. The following WPA software is recommended for use with Cisco Aironet client adapters:

- Funk Odyssey Client supplicant version 2.2 (for Windows 2000)
- Windows XP Service Pack 1 and Microsoft support patch 815485 (for Windows XP)

Note Meetinghouse AEGIS Client supplicant version 2.1 or later is also supported for use with Windows 2000 and XP; however, it was not tested with this client adapter software release.

The software components included in Install Wizard version 1.3 or later automatically support WPA migration mode. *WPA migration mode* is an access point setting that enables both WPA and non-WPA clients to associate to the access point using the same SSID.

Refer to one of these sections for instructions on enabling EAP authentication with WPA:

- Enabling LEAP, page 5-38
- Enabling EAP-FAST, page 5-42
- Enabling Host-Based EAP, page 5-49

Note WPA must also be enabled on the access point. Access points must use Cisco IOS Release 12.2(11)JA or later 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. Support for fast roaming is available for LEAP-enabled clients in Install Wizard version 1.1 or later and EAP-FAST-enabled clients in Install Wizard version 1.3 or later.

During normal operation, LEAP- or EAP-FAST-enabled clients mutually authenticate with a new access point by performing a complete LEAP or EAP-FAST authentication, including communication with the main RADIUS server. However, when you configure your wireless LAN for fast roaming, LEAP- or EAP-FAST-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.

This feature is enabled on the client adapter in two ways, depending on the software installed:

- If you are using ACU version 6.2 and client adapter firmware version 5.30.17 (which is included in Install Wizard version 1.2) or later, you need to enable fast roaming in ACU. Refer to Step 10 in the "Enabling LEAP" section or Step 12 in the "Enabling EAP-FAST" section for details.
- If you are using client adapter firmware version 5.20.17 (which is included in Install Wizard version 1.1), fast roaming is supported automatically.

Regardless of how fast roaming is enabled on the client adapter, it must also be enabled on the access point.

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

Note If the Microsoft 802.1X supplicant is installed on your computer, you must disable one or two Windows parameters in order for this feature to operate correctly. Refer to Step 13 in the "Enabling LEAP" section or Step 15 in the "Enabling EAP-FAST" section for details.

Reporting Access Points that Fail LEAP or EAP-FAST Authentication

The following client adapter and access point firmware versions support a feature that is designed to detect access points that fail LEAP or EAP-FAST authentication:

- Client adapter firmware version 5.02.20 or later (for LEAP)
- Client adapter firmware version 5.40.10 or later (for EAP-FAST)
- 12.00T or later (340, 350, and 1200 series access points)
- Cisco IOS Release 12.2(4)JA or later (1100 series access points)

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

The process takes place as follows:

1. A client with a LEAP or EAP-FAST profile attempts to associate to access point A.
2. Access point A does not handle LEAP or EAP-FAST authentication successfully, perhaps because the access point does not understand LEAP or EAP-FAST or cannot communicate to a trusted LEAP or EAP-FAST 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 in the firmware of both devices. However, both the client and access point must use these firmware versions or later.

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 firmware and driver versions included in the Install Wizard file. However, they must be enabled on the access point.

Note Access point firmware version 11.10T or later is required to enable these security features. Refer to the documentation 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 Status screen indicates if MIC is being used, and the Statistics screen provides MIC statistics.

Note If you enable MIC on the access point, your client adapter's driver must support these features; otherwise, the client cannot associate.

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.

Note If you enable TKIP on the access point, your client adapter's firmware must support these features; otherwise, the client cannot associate.

Note TKIP is automatically enabled whenever WPA is enabled, and it is disabled whenever WPA is disabled.

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 choose. When you enable this feature, only wireless client devices using LEAP, EAP-FAST, EAP-TLS, PEAP, or EAP-SIM 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 5-6 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 5-6 Client and Access Point Security Settings

Security Feature	Client Setting	Access Point Setting
Static WEP with open authentication	Disable Network Authentication, enable Static WEP and Open Authentication and create a WEP key	Set up and enable WEP and enable Open Authentication for the SSID
Static WEP with shared key authentication	Disable Network Authentication, enable Static WEP and Shared Key Authentication and create a WEP key	Set up and enable WEP and enable Shared Key Authentication for the SSID
LEAP authentication	Enable LEAP	Set up and enable WEP and enable Network-EAP for the SSID
LEAP authentication with WPA	Enable LEAP and Wi-Fi Protected Access (WPA) **Note** To allow the client to associate to both WPA and non-WPA access points, enable Allow Association to both WPA and non-WPA authenticators.	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-FAST authentication	Enable EAP-FAST and enable automatic provisioning or import a PAC file	Set up and enable WEP and enable Network-EAP for the SSID
EAP-FAST authentication with WPA	Enable EAP-FAST and Wi-Fi Protected Access (WPA) and enable automatic provisioning or import a PAC file **Note** To allow the client to associate to both WPA and non-WPA access points, enable Allow Association to both WPA and non-WPA authenticators.	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.

Table 5-6 Client and Access Point Security Settings (continued)

Security Feature	Client Setting	Access Point Setting
EAP-TLS authentication		
If using ACU to configure card	Enable Host Based EAP (802.1x) and Dynamic WEP in ACU and select Enable network access control using IEEE 802.1X (or Enable IEEE 802.1x authentication for this network) and Certificates (or Smart Card or other Certificate) as the EAP Type in Windows	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
EAP-TLS authentication with WPA		
If using ACU to configure card	Enable Wi-Fi Protected Access (WPA), Host Based EAP (WPA), and Dynamic WEP in ACU and enable WPA and select Enable network access control using IEEE 802.1X and Certificates (or Smart Card or Other Certificate) as the EAP Type in Windows	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	Enable Host Based EAP (802.1x) and Dynamic WEP in ACU and select Enable network access control using IEEE 802.1X (or Enable IEEE 802.1x authentication for this network) and PEAP as the EAP Type in Windows	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 5-6 Client and Access Point Security Settings (continued)

Security Feature	Client Setting	Access Point Setting
PEAP authentication with WPA		
If using ACU to configure card	Enable Wi-Fi Protected Access (WPA), Host Based EAP (WPA), and Dynamic WEP in ACU and enable WPA and select Enable network access control using IEEE 802.1X and PEAP as the EAP Type in Windows	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.
EAP-SIM authentication		
If using ACU to configure card	Enable Host Based EAP (802.1x) and Dynamic WEP in ACU and select Enable network access control using IEEE 802.1X (or Enable IEEE 802.1x authentication for this network) and SIM Authentication as the EAP Type in Windows	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 SIM Authentication as the EAP Type	Set up and enable WEP and enable Open Authentication for the SSID and specify the use of EAP

Table 5-6 Client and Access Point Security Settings (continued)

Security Feature	Client Setting	Access Point Setting
EAP-SIM authentication with WPA		
If using ACU to configure card	Enable Wi-Fi Protected Access (WPA), Host Based EAP (WPA), and Dynamic WEP in ACU and enable WPA and select Enable network access control using IEEE 802.1X and SIM Authentication as the EAP Type in Windows	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 SIM Authentication 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 or EAP-FAST and select Allow Fast Roaming (CCKM)	Use firmware version 12.2(11)JA or later, 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.
Fast roaming (CCKM) with TKIP	Enable LEAP or EAP-FAST, enable Wi-Fi Protected Access (WPA), and select Allow Fast Roaming (CCKM)	Use firmware version 12.2(11)JA or later, select a cipher suite that includes TKIP, 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 or EAP-FAST authentication	No settings required; automatically enabled in firmware version 5.02.20 or later (for LEAP) or 5.40.10 or later (for EAP-FAST)	No settings required; automatically enabled in the following firmware versions: 12.00T or later (340, 350, and 1200 series access points) or Cisco IOS Release 12.2(4)JA or later (1100 series access points)

Table 5-6 Client and Access Point Security Settings (continued)

Security Feature	Client Setting	Access Point Setting
MIC	No settings required; automatically enabled by the driver included in the Install Wizard file	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 by the firmware included in the Install Wizard file	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-FAST, EAP-TLS, PEAP, or EAP-SIM and use the firmware included in the Install Wizard file	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

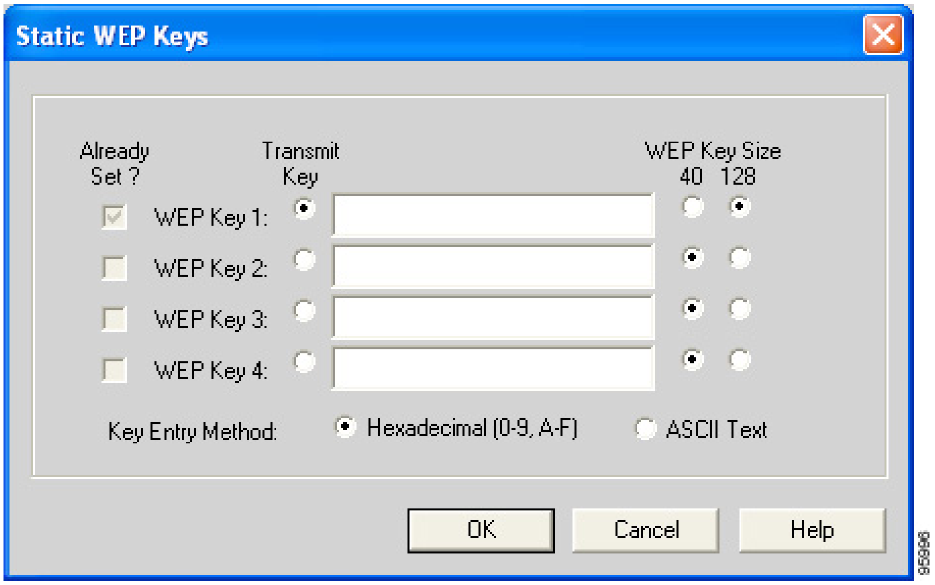
Follow these steps to enter a new static WEP key for this profile.

Step 1 Choose **None** under Network Authentication on the Network Security screen.

Step 2 Choose **Static WEP** under Data Encryption.

Step 3 Click the **Static WEP Keys** button. The Static WEP Keys screen appears (see Figure 5-6).

Figure 5-6 Static WEP Keys Screen



Static WEP Keys

Already Set ?		Transmit Key		WEP Key Size 40	128
☑	WEP Key 1:	●		○	●
□	WEP Key 2:	○		●	○
□	WEP Key 3:	○		●	○
□	WEP Key 4:	○		●	○

Key Entry Method: ● Hexadecimal (0-9, A-F) ○ ASCII Text

Step 4 Choose 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**—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 choose the Hexadecimal (0-9, A-F) option if you are planning to use your client adapter with these access points.

Step 5 For the static WEP key that you are entering (1, 2, 3, or 4), choose 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 6 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 7 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 8 Click **OK** to exit the Static WEP Keys screen and return to the Network Security screen.

Step 9 Choose one of the following access point authentication options, which defines how your client adapter will attempt to authenticate to an access point:

- **Open**—Enables your client adapter, regardless of its WEP settings, to authenticate and attempt to communicate with an access point. Open Authentication is the default setting.
- **Shared Key**—Enables your client adapter to communicate only with access points that have the same WEP key. This option is available only if Use Static WEP Keys is selected.

  In shared key authentication, the access point sends a known unencrypted "challenge packet" to the client adapter, which encrypts the packet and sends it back to the access point. The access point attempts to decrypt the encrypted packet and sends an authentication response packet indicating the success or failure of the decryption back to the client adapter. If the packet is successfully encrypted/decrypted, the user is considered to be authenticated.

  Note Cisco recommends that shared key authentication not be used because it presents a security risk.

Step 10 Click **OK** to return to the Profile Manager screen; then click **OK** or **Apply** to save your changes.

Overwriting an Existing Static WEP Key

Follow these steps to overwrite an existing static WEP key.

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

Step 1 Click the **Static WEP Keys** button on the Network Security screen. The Static WEP Keys screen appears (see Figure 5-6).

Step 2 Look at the current WEP key settings in the middle of the screen. A check mark appears in the Already Set? box for all existing static WEP keys.

Note For security reasons, the codes for existing static WEP keys do not appear on the screen.

Step 3 Decide which existing static WEP key you want to overwrite.

Step 4 Click within the blank field of that key.

Step 5 Enter a new key, following the guidelines outlined in Step 6 of the "Entering a New Static WEP Key" section on page 5-35.

Step 6 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 7 Click **OK** to exit the Static WEP Keys screen and return to the Network Security screen.

Step 8 Click **OK** to return to the Profile Manager screen; then click **OK** or **Apply** to save your changes.

Disabling Static WEP

If you ever need to disable static WEP for a particular profile, choose **None** under Data Encryption on the Network Security screen, click **OK**, and click **OK** or **Apply** on the Profile Manager screen.

Note Choosing **LEAP** or **EAP-FAST** under Network Authentication on the Network Security screen disables static WEP automatically.

Enabling LEAP

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

- Client adapters must support WEP and use the firmware, drivers, utilities, and security modules included in the Install Wizard file.
- To use WPA, 350 series and CB20A client adapters must use the software included in Install Wizard version 1.2 or later on a computer running Windows 2000 or XP.
- Access points to which your client adapter may attempt to authenticate must use the following firmware versions or later: 11.23T (340 and 350 series access points), 11.54T (1200 series access points), or Cisco IOS Release 12.2(4)JA (1100 series access points).

  Note To use WPA or fast roaming (CCKM), access points must use Cisco IOS Release 12.2(11)JA or later. To use the Reporting Access Points That Fail LEAP or EAP-FAST Authentication and Fast Roaming features, access points must use the firmware versions listed on page 5-31.

- All necessary infrastructure devices such as access points and servers must be properly configured for LEAP authentication.

Note Cisco recommends the use of strong passwords for LEAP authentication in order to minimize the risk of successful attacks by rogue access points. Refer to the "Creating Strong Passwords" section on page 10-11 for tips on creating strong passwords.

Follow these steps to enable LEAP authentication for this profile.

Step 1 Check the **Wi-Fi Protected Access (WPA)** check box under Network Authentication on the Network Security screen if you want to enable WPA. This parameter enables the client adapter to associate to access points using WPA.

Note Refer to the "Wi-Fi Protected Access (WPA)" section on page 5-27 for additional information.

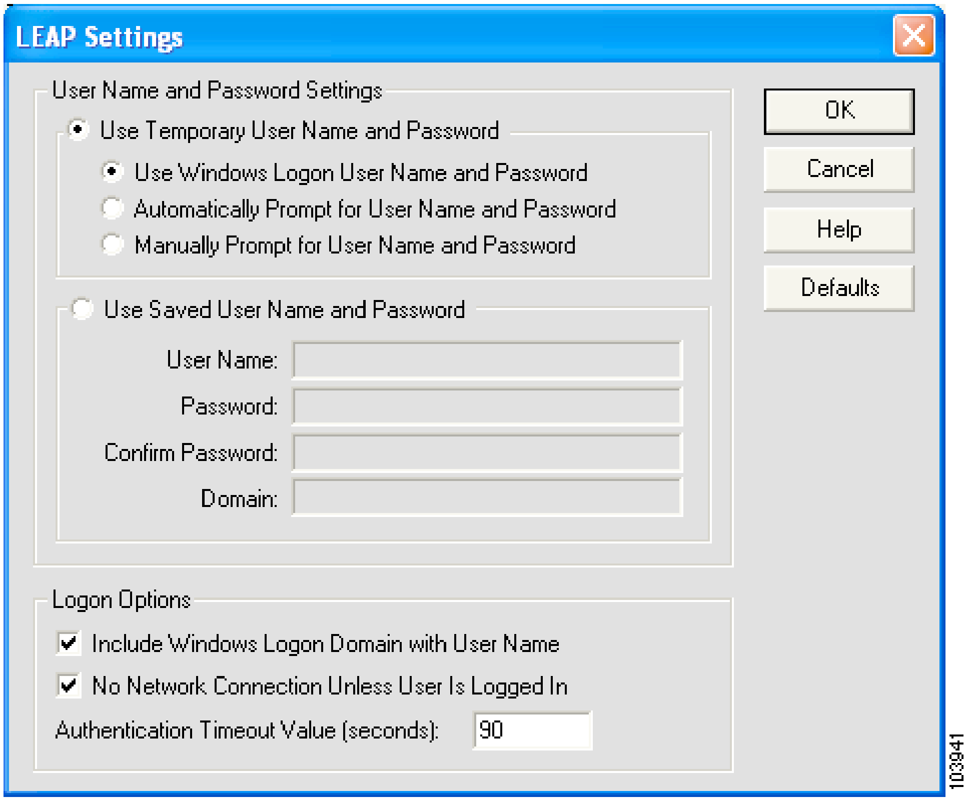
Step 2 Choose **LEAP** or **LEAP (WPA)**.

> **Note** This option is available only if you chose the LEAP security module during installation.

> **Note** When you choose this option, dynamic WEP (if WPA is disabled) or TKIP (if WPA is enabled) is set automatically.

Step 3 Click the **Configure** button. The LEAP Settings screen appears (see Figure 5-7).

Figure 5-7 LEAP Settings Screen



LEAP Settings

User Name and Password Settings

● Use Temporary User Name and Password

● Use Windows Logon User Name and Password
○ Automatically Prompt for User Name and Password
○ Manually Prompt for User Name and Password

○ Use Saved User Name and Password

User Name:
Password:
Confirm Password:
Domain:

Logon Options

☑ Include Windows Logon Domain with User Name
☑ No Network Connection Unless User Is Logged In
Authentication Timeout Value (seconds): 90

Step 4 Choose 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).

> **Note** The Use Saved User Name and Password option is available only if the Allow Saved LEAP User Name and Password option was enabled (set to Yes) during installation.

Step 5 Perform one of the following:

- If you selected Use Temporary User Name and Password in Step 4, choose one of the following options:
  - **Use Windows Logon 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 option is the default setting.
  - **Automatically Prompt for User Name and Password**—Requires you to enter a separate LEAP username and password (which are registered with the RADIUS server) in addition to your regular Windows login in order to start the LEAP authentication process.
  - **Manually Prompt for User Name and Password**—Requires you to manually invoke the LEAP authentication process as needed using the Manual Login option from the Commands drop-down menu. 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 4, follow these steps:

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

  Note Usernames are limited to 64 ASCII characters in the software included in Install Wizard version 1.3 or later and to 32 ASCII characters in previous Install Wizard versions. Passwords are limited to 32 ASCII characters. However, if a domain name is entered in the Domain field, the sum of the username and domain name is limited to 63 ASCII characters in the software included in Install Wizard version 1.3 or later and to 31 characters in previous Install Wizard versions.

  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.

  Note If you are using the software included in Install Wizard version 1.3 or later, you can include the domain name in the User Name field as follows: *username@domain*.com (provided that your RADIUS server supports this format). A maximum of 64 ASCII characters can be entered for the *username@domain*.com string. If you include the domain name in the User Name field, the Domain field becomes disabled.

Step 6 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 If you selected to use a saved username and password but do not check the **Include Windows Logon Domain with User Name** check box, the Domain field becomes unavailable, and a domain name is not passed to the RADIUS server.

Step 7 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 8 In the Authentication Timeout Value field, enter the amount of time (in seconds) before a LEAP authentication attempt is considered to be failed and an error message appears.

Range: 10 to 300 seconds

Default: 90 seconds

Step 9 Click **OK** to exit the LEAP Settings screen.

Step 10 Check the **Allow Fast Roaming (CCKM)** check box on the Network Security screen if you want to enable fast roaming for your client adapter.

- Checking this check box enables the client adapter to use CCKM when associated to an access point that uses CCKM or to associate to access points that are not using CCKM.
- Unchecking this check box prevents the client adapter from using CCKM even with access points that use it.

Default: Unchecked

Note Refer to the "Fast Roaming (CCKM)" section on page 5-28 for additional information.

Step 11 Check the **Allow Association to both WPA and non-WPA authenticators** check box if you want to allow the client adapter to associate to access points that are configured for LEAP authentication with:

- WPA enabled (associates with WPA security)
- WPA disabled or not supported (associates without WPA security)
- Cisco migration mode, where WPA is optional (associates without WPA security)

If this check box is not checked, the client adapter can associate only to access points that are configured for LEAP authentication with WPA.

Default: Unchecked

Note This parameter is available only if you enable WPA.

Step 12 Click **OK** to exit the Network Security screen and return to the Profile Manager screen. On the Profile Manager screen, click **OK** or **Apply** to save your changes.

Step 13 Follow these steps if the Microsoft 802.1X supplicant is installed on your computer and 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. Choose the **Wireless Networks** tab. Uncheck the **Use Windows to configure my wireless network settings** check box unless you are using Windows XP Service Pack 1.

b. Click the **Authentication** tab.

Note In Windows Service Pack 1, the Authentication tab has moved from its previous location. To access it, make sure the **Use Windows to configure my wireless network settings** check box is checked. Click 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, and choose 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 Service Pack 1, uncheck the **Use Windows to configure my wireless network settings** check box on the Wireless Networks screen and click **OK**.

Step 14 Refer to Chapter 6 for instructions on authenticating using LEAP.

Enabling EAP-FAST

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

- 350 series and CB20A client adapters must use the software included in Install Wizard version 1.3 or later on a computer running Windows 2000 or XP.
- Access points to which your client adapter may attempt to authenticate must use the following firmware versions or later: 11.23T (340 and 350 series access points), 11.54T (1200 series access points), or Cisco IOS Release 12.2(4)JA (1100 series access points).

Note To use WPA or fast roaming (CCKM), access points must use Cisco IOS Release 12.2(11)JA or later. To use the Reporting Access Points That Fail LEAP or EAP-FAST Authentication and Fast Roaming features, access points must use the firmware versions listed on page 5-34.

- All necessary infrastructure devices such as access points, servers, gateways, and user databases must be properly configured for EAP-FAST authentication.

Follow these steps to enable EAP-FAST authentication for this profile.

Step 1 Check the **Wi-Fi Protected Access (WPA)** check box under Network Authentication on the Network Security screen if you want to enable WPA. This parameter enables the client adapter to associate to access points using WPA.

Note Refer to the "Wi-Fi Protected Access (WPA)" section on page 5-27 for additional information.

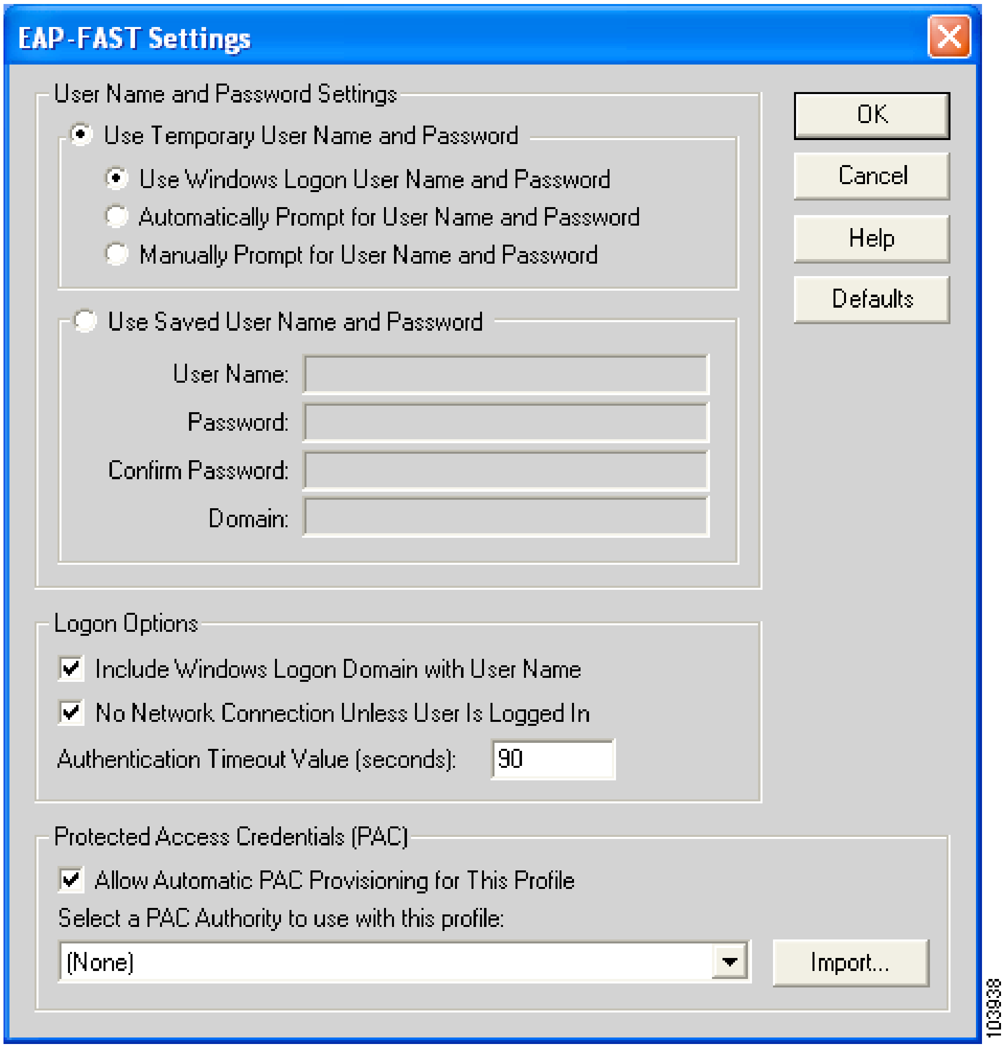
Step 2 Choose **EAP-FAST** or **EAP-FAST (WPA)**.

Note This option is available only if you selected the EAP-FAST security module during installation.

Note When you choose this option, dynamic WEP (if WPA is disabled) or TKIP (if WPA is enabled) is set automatically.

Step 3 Click **Configure**. The EAP-FAST Settings screen appears (see Figure 5-8).

Figure 5-8 EAP-FAST Settings Screen



User Name and Password Settings

● Use Temporary User Name and Password

● Use Windows Logon User Name and Password
○ Automatically Prompt for User Name and Password
○ Manually Prompt for User Name and Password

○ Use Saved User Name and Password

User Name:
Password:
Confirm Password:
Domain:

Logon Options

☑ Include Windows Logon Domain with User Name
☑ No Network Connection Unless User Is Logged In

Authentication Timeout Value (seconds): 90

Protected Access Credentials (PAC)

☑ Allow Automatic PAC Provisioning for This Profile

Select a PAC Authority to use with this profile:

(None)

Step 4 Choose one of the following EAP-FAST username and password setting options:

- **Use Temporary User Name and Password**—Requires you to enter the EAP-FAST 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 an EAP-FAST 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).

Note The Use Saved User Name and Password option is available only if the Allow Saved EAP-FAST User Name and Password option was enabled (set to Yes) during installation.

Step 5 Perform one of the following:

- If you selected Use Temporary User Name and Password in Step 4, choose one of the following options:
  - **Use Windows Logon User Name and Password**—Causes your Windows username and password to also serve as your EAP-FAST username and password, giving you only one set of credentials to remember. After you log in, the EAP-FAST authentication process begins automatically. This option is the default setting.
  - **Automatically Prompt for User Name and Password**—Requires you to enter a separate EAP-FAST username and password (which are registered with the RADIUS server) in addition to your regular Windows login in order to start the EAP-FAST authentication process.
  - **Manually Prompt for User Name and Password**—Requires you to manually invoke the EAP-FAST authentication process as needed using the Manual Login option from the Commands drop-down menu. You are not prompted to enter an EAP-FAST 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 4, follow these steps:

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

  Note Usernames are limited to 64 ASCII characters, and passwords are limited to 32 ASCII characters. However, if a domain name is entered in the Domain field, the sum of the username and domain name is limited to 63 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 or include it in the User Name field as follows: *username*@*domain*.com. A maximum of 64 ASCII characters can be entered for the *username*@*domain*.com string, and this format must be supported by your RADIUS server.

  Note If you include the domain name in the User Name field, the Domain field becomes disabled.

Step 6 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 If you chose to use a saved username and password but do not check the **Include Windows Logon Domain with User Name** check box, the Domain field becomes unavailable, and a domain name is not passed to the RADIUS server.

Step 7 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 8 In the Authentication Timeout Value field, enter the amount of time (in seconds) before an EAP-FAST authentication attempt is considered to be failed and an error message appears.

Range: 10 to 300 seconds

Default: 90 seconds

Step 9 Perform one of the following:

- If you want to enable automatic PAC provisioning, check the **Allow Automatic PAC Provisioning for This Profile** check box. A protected access credentials (PAC) file is obtained automatically as needed (for instance, when a PAC expires, when the client adapter accesses a different server, when the EAP-FAST username cannot be matched to a previously provisioned PAC, etc.). This is the default setting. If you choose this option, go to Step 11.
- If you want to enable manual PAC provisioning, uncheck the **Allow Automatic PAC Provisioning for This Profile** check box. You must choose a PAC authority or manually import a PAC file. If you choose this option, go to Step 10.

Note The Allow Automatic PAC Provisioning for This Profile option is available only if the Allow Auto-Provisioning? option was enabled (set to Yes) during installation. If this option is not available, you must enable manual PAC provisioning.

Note LDAP user databases support only manual PAC provisioning while Cisco Secure ACS internal, Cisco Secure ODBC, and Windows NT/2000/2003 domain user databases support both automatic and manual PAC provisioning.

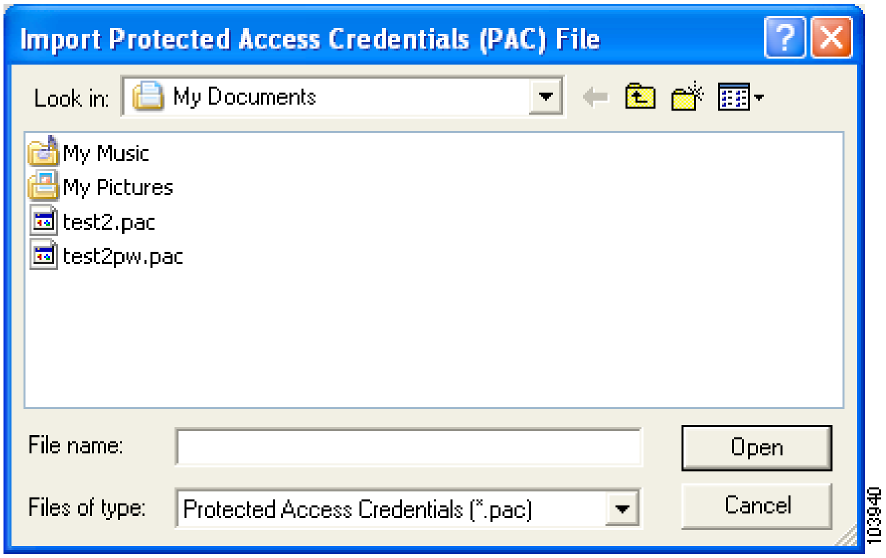
Note Provisioning occurs only upon initial negotiation of the PAC or upon PAC expiration. After the PAC is provisioned, it serves as the per-user key by which authentication transactions are secured.

Step 10 Perform one of the following to enable manual PAC provisioning:

- From the Select a PAC Authority To Use with This Profile drop-down list, select the PAC authority that is associated with the network defined by the profile's SSID. The list contains the names of all the PAC authorities from which you have previously provisioned a PAC.
- If the PAC authority drop-down list is empty or does not contain the name of a desired PAC authority, follow these steps to import a PAC file:

a. Click the **Import** button. The Import Protected Access Credentials (PAC) File screen appears (see Figure 5-9).

Figure 5-9 Import Protected Access Credentials (PAC) File Screen



Import Protected Access Credentials (PAC) File

Look in: My Documents

My Music
My Pictures
test2.pac
test2pw.pac

File name:

Files of type: Protected Access Credentials (*.pac)

b. Find the location of the PAC file in the Look in box. The default location is My Documents.

> **Note** If you browse to a different location to obtain the PAC, the new location becomes the default location going forward.

c. Click the PAC file (*.pac) so that it appears in the File name box at the bottom of the screen.

> **Note** The filename and extension of PAC files is determined by the PAC authority that issues them, but the standard file extension is *pac*.

d. Click the **Open** button.

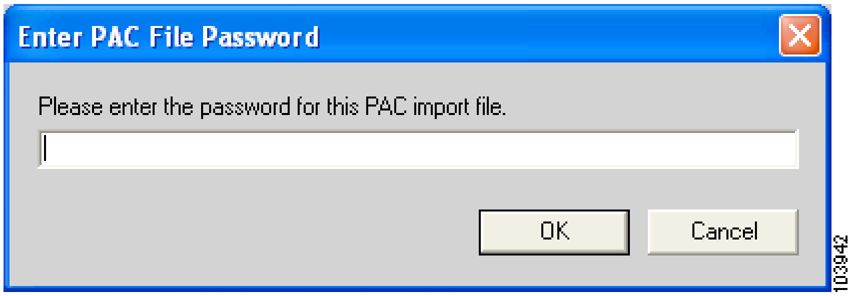
e. If a message appears indicating that the PAC file you are about to import will be made accessible to all users of your system, click **Yes**. If you click **No**, the PAC file is not imported.

Note The PAC file you are about to import will be made accessible to all users of your system if your profile is configured for global PACs. Global PACs are enabled when you choose the Use Saved User Name and Password option, uncheck the No Network Connection Unless User Is Logged In check box on the EAP-FAST Settings screen, or use the Novell Network login prompt or any other third-party login application that does not share its credentials with the EAP-FAST supplicant.

Note If you try to import a PAC file with the same PAC ID as a previously imported PAC file, you are asked if you want to overwrite the existing PAC. If you click **Yes**, the existing PAC is replaced by the new one from the imported file.

f. If the Enter PAC File Password screen appears (see Figure 5-10), enter the PAC file password and click **OK**.

Figure 5-10 Enter PAC File Password Screen


Enter PAC File Password

Please enter the password for this PAC import file.

Note PAC file passwords are optional. The PAC authority determines whether to issue PAC files that require user-supplied passwords. Nevertheless, all PAC files (even those without passwords) are encrypted and protected. PAC file passwords are different from EAP-FAST passwords and need to be entered only once, at the time a PAC is imported.

g. The PAC file is imported and added to your PAC database, and the name of the PAC authority that issued the PAC file is added to the PAC authority drop-down list on the EAP-FAST Settings screen. Choose the desired PAC authority from the list.

Step 11 Click **OK** to exit the EAP-FAST Settings screen.

Step 12 Check the **Allow Fast Roaming (CCKM)** check box on the Network Security screen if you want to enable fast roaming for your client adapter.

- Checking this check box enables the client adapter to use CCKM when associated to an access point that uses CCKM or to associate to access points that are not using CCKM.
- Unchecking this check box prevents the client adapter from using CCKM even with access points that use it.

Default: Unchecked

Note Refer to the "Fast Roaming (CCKM)" section on page 5-28 for additional information.

Step 13 Check the **Allow Association to both WPA and non-WPA authenticators** check box if you want to allow the client adapter to associate to access points that are configured for EAP-FAST authentication with:

- WPA enabled (associates with WPA security)
- WPA disabled or not supported (associates without WPA security)
- Cisco migration mode, where WPA is optional (associates without WPA security)

If this check box is not checked, the client adapter can associate only to access points that are configured for EAP-FAST authentication with WPA.

Default: Unchecked

Note This parameter is available only if you enable WPA.

Step 14 Click **OK** to exit the Network Security screen and return to the Profile Manager screen. On the Profile Manager screen, click **OK** or **Apply** to save your changes.

Step 15 Follow these steps if the Microsoft 802.1X supplicant is installed on your computer and 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. Choose the **Wireless Networks** tab. Uncheck the **Use Windows to configure my wireless network settings** check box unless you are using Windows XP Service Pack 1.

b. Click the **Authentication** tab.

Note In Windows Service Pack 1, the Authentication tab has moved from its previous location. To access it, make sure the **Use Windows to configure my wireless network settings** check box is checked. Click 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, and choose 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 Service Pack 1, uncheck the **Use Windows to configure my wireless network settings** check box on the Wireless Networks screen and click **OK**.

Step 16 If you imported a PAC file in Step 10, you may want to consider deleting it from its original location, depending on your organization’s policy. PAC files are similar to ID cards and should be protected from unauthorized access. Such action would prevent exposure of the PAC by having multiple storage locations. Contact your system administrator to determine your organization’s policy on PAC security.

Step 17 Refer to Chapter 6 for instructions on authenticating using EAP-FAST.

Enabling Host-Based EAP

Before you can enable host-based EAP authentication, your network devices must meet the following requirements:

- Client adapters must support WEP and use the firmware, drivers, utilities, and security modules included in the Install Wizard file.
- The Microsoft 802.1X supplicant must be installed on your Windows device.
- To use WPA, you must use a 350 series or CB20A client adapter with the software included in Install Wizard version 1.2 or later on a computer running Windows 2000 or XP. Also, you must install additional software with WPA support. You can download this software from the URLs provided:
  - Funk Odyssey Client supplicant version 2.2 (for Windows 2000)

    http://www.funk.com/radius/wlan/wlan_c_radius.asp
  - Windows XP Service Pack 1 and Microsoft support patch 815485 (for Windows XP)

    http://www.microsoft.com/WindowsXP/pro/downloads/servicepacks/sp1/default.asp

    http://www.microsoft.com/downloads/details.aspx?FamilyID=009d8425-ce2b-47a4-abec-274845dc9e91&DisplayLang=en

Note Meetinghouse AEGIS Client supplicant version 2.1 or later is also supported for use with Windows 2000 and XP; however, it was not tested with this client adapter software release. You can download the Meetinghouse supplicant from the following URL: http://www.mtghouse.com/support/downloads/index.shtml

- Access points to which your client adapter may attempt to authenticate must use the following firmware versions or later: 12.00T (340, 350, and 1200 series access points) or Cisco IOS Release 12.2(4)JA (1100 series access points).

Note To use WPA or fast roaming, access points must use Cisco IOS Release 12.2(11)JA or later.

- All necessary infrastructure devices such as access points, servers, gateways, and user databases must be properly configured for the authentication type you plan to enable on the client.

This section consists of the following three subsections. Follow the steps in each subsection to enable host-based EAP authentication (EAP-TLS, PEAP, or EAP-SIM) for this profile.

- Enabling Host-Based EAP authentication in ACU
- Enabling WPA (an optional procedure for computers running Windows 2000 or XP)
- Enabling EAP authentication in Windows

Note Because EAP-TLS, PEAP, and EAP-SIM authentication are enabled in the operating system and not in ACU, you cannot switch between these authentication types simply by switching profiles in ACU. You can create a profile in ACU that uses host-based EAP, but you must enable the specific authentication type in Windows (provided Windows uses the Microsoft 802.1X supplicant). In addition, Windows can be set for only one authentication type at a time; therefore, if you have more than one profile in ACU that uses host-based EAP and you want to use another authentication type, you must change authentication types in Windows after switching profiles in ACU.

Enabling Host-Based EAP Authentication in ACU

Follow the steps in this section to set up host-based EAP authentication in ACU.

Step 1 Check the **Wi-Fi Protected Access (WPA)** check box under Network Authentication on the Network Security screen if you want to enable WPA. This parameter enables the client adapter to associate to access points using WPA.

Note Refer to the "Wi-Fi Protected Access (WPA)" section on page 5-27 for additional information.

Step 2 Choose **Host Based EAP (802.1x)** or **Host Based EAP (WPA)**.

Note If WPA is disabled, *802.1x* appears in parentheses. If WPA is enabled, *WPA* appears in parentheses.

Step 3 Choose **Dynamic WEP** under Data Encryption if WPA is not enabled.

Step 4 Click **OK** to return to the Profile Manager screen.

Step 5 Click **OK** or **Apply** on the Profile Manager screen to save your changes.

Step 6 Perform one of the following, depending on your computer's operating system:

- If your computer is running Windows 2000, perform one of the following:
  - If you want to enable WPA, go to the "Enabling WPA (Optional)" section below.
  - If you do not want to enable WPA, 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. Go to the "Enabling EAP Authentication in Windows" section on page 5-54.

- If your computer is running Windows XP, perform one of the following:
  - If you want to enable WPA, double-click **My Computer**, **Control Panel**, and **Network Connections**. Right-click **Wireless Network Connection**. Click **Properties**. The Wireless Network Connection Properties screen appears. Go to the "Enabling WPA (Optional)" section below.
  - If you do not want to enable WPA, double-click **My Computer**, **Control Panel**, and **Network Connections**. Right-click **Wireless Network Connection**. Click **Properties**. The Wireless Network Connection Properties screen appears. If you are using Windows XP Service Pack 1, choose the **Wireless Networks** tab, make sure the **Use Windows to configure my wireless network settings** check box is checked. Click 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** and enter your profile's SSID in the Network name (SSID) field. Go to the "Enabling EAP Authentication in Windows" section on page 5-54.

Enabling WPA (Optional)

Follow the steps in the corresponding section below if you want to enable WPA for this profile. Instructions are different for computers running Windows 2000 and XP.

Enabling WPA on Windows 2000

Follow these steps to enable WPA in Funk Odyssey Client supplicant version 2.2 on a computer running Windows 2000.

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

http://www.funk.com/radius/enterprise/ent_solns.asp

Step 2 Under Manuals, click **Odyssey Client User Guide**.

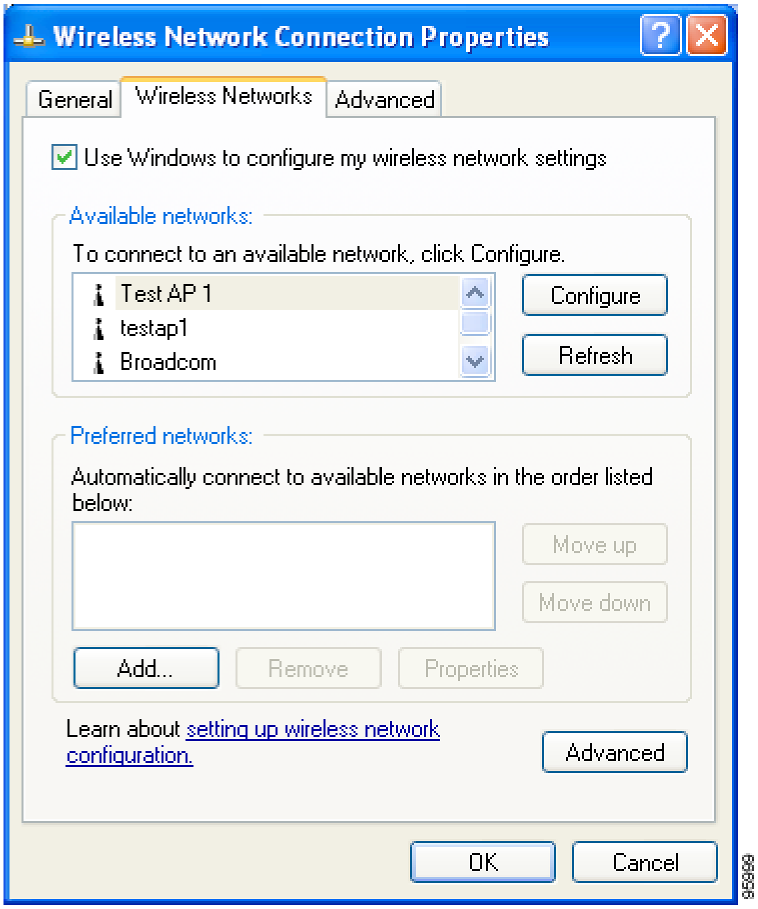
Step 3 Follow the instructions in the user guide to enable WPA and EAP-TLS, PEAP, or EAP-SIM authentication.

Enabling WPA on Windows XP

Follow these steps to enable WPA in Windows XP Service Pack 1 and Microsoft support patch 815485.

Step 1 Choose the **Wireless Networks** tab on the Wireless Network Connection Properties screen. The following screen appears (see Figure 5-11).

Figure 5-11 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:

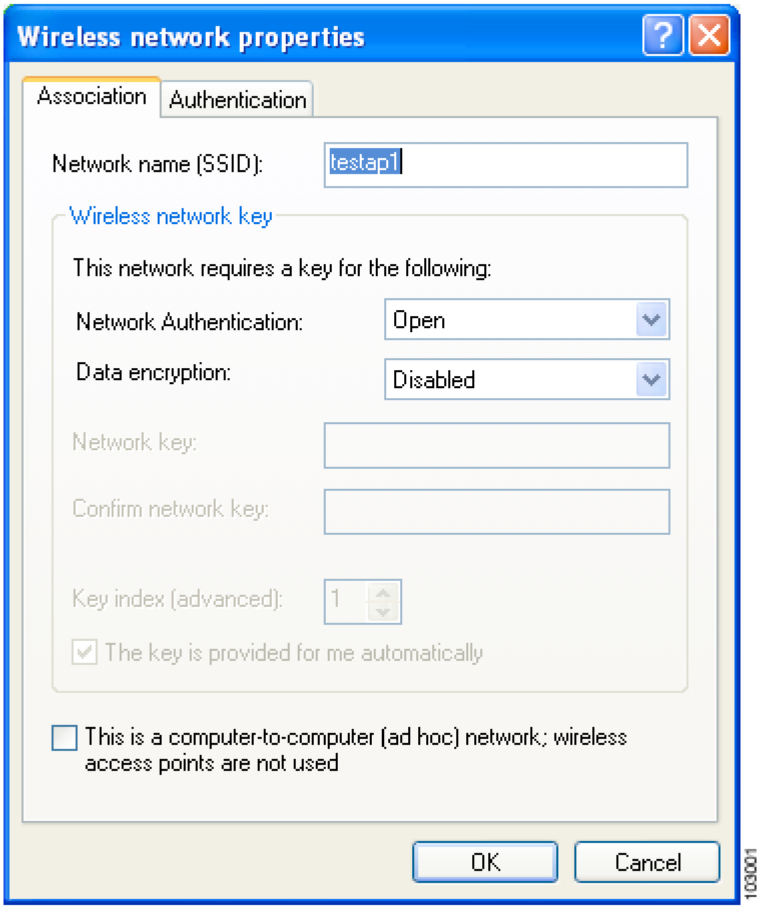
Automatically connect to available networks in the order listed below:

Learn about setting up wireless network configuration.

Step 2 Make sure that the **Use Windows to configure my wireless network settings** check box is checked.

Step 3 Click the SSID of the profile you began setting up in ACU from the list of available networks and click **Configure**. If your profile’s SSID is not listed, click **Add**. The Wireless Network Properties screen appears (see Figure 5-12).

Figure 5-12 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 4 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 your profile in the Network name (SSID) field.

Step 5 Choose **WPA** from the Network Authentication drop-down list. This option enables your client adapter to associate to access points using WPA.

Step 6 Choose **TKIP** from the Data encryption drop-down list.

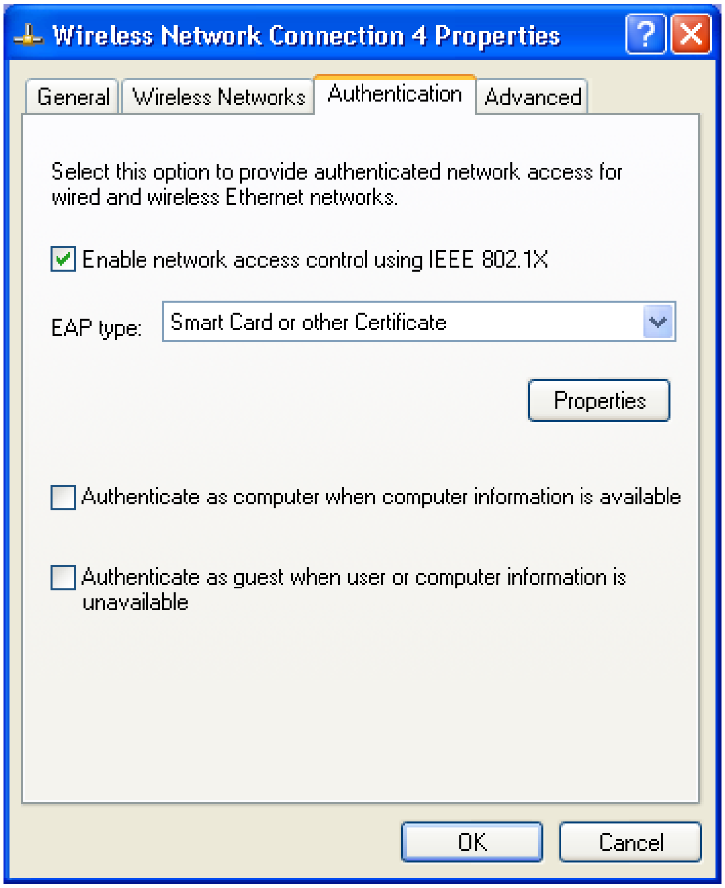
Step 7 Go to the "Enabling EAP Authentication in Windows" section below to enable EAP authentication for this profile.

Enabling EAP Authentication in Windows

Follow the steps in this section to enable EAP authentication in Windows for this profile.

Step 1 Click the **Authentication** tab. The following screen appears (see Figure 5-13).

Figure 5-13 Wireless Network Connection Properties Screen (Authentication Tab)



Wireless Network Connection 4 Properties

Select this option to provide authenticated network access for wired and wireless Ethernet networks.

☑ Enable network access control using IEEE 802.1X

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

Note The Authentication screen shown above appears on computers running Windows 2000 or XP. The screen looks slightly different on computers running Windows XP Service Pack 1.

Step 2 Check the **Enable network access control using IEEE 802.1X** or **Enable IEEE 802.1x authentication for this network** check box if you did not enable WPA.

Step 3 Perform one of the following, depending on the authentication type you want to use:

- If you are planning to use EAP-TLS, go to the "Enabling EAP-TLS" section on page 5-55.
- If you are planning to use PEAP, go to the "Enabling PEAP" section on page 5-57.
- If you are planning to use EAP-SIM, go to the "Enabling EAP-SIM" section on page 5-60.

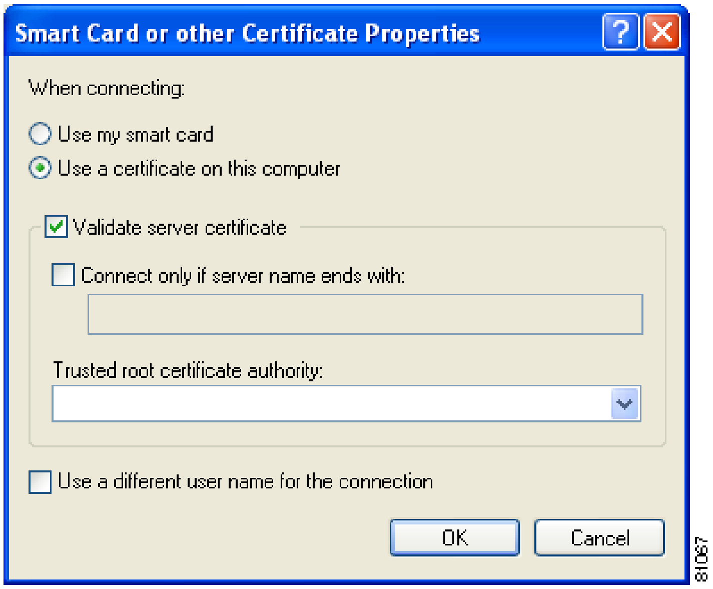
Enabling EAP-TLS

Follow these steps to enable EAP-TLS.

Step 1 For EAP type, choose **Smart Card or other Certificate**.

Step 2 Click **Properties**. The Smart Card or other Certificate Properties screen appears (see Figure 5-14 and Figure 5-15).

Figure 5-14 Smart Card or other Certificate Properties Screen - Windows 2000 or XP



Smart Card or other Certificate Properties

When connecting:

○ Use my smart card

● Use a certificate on this computer

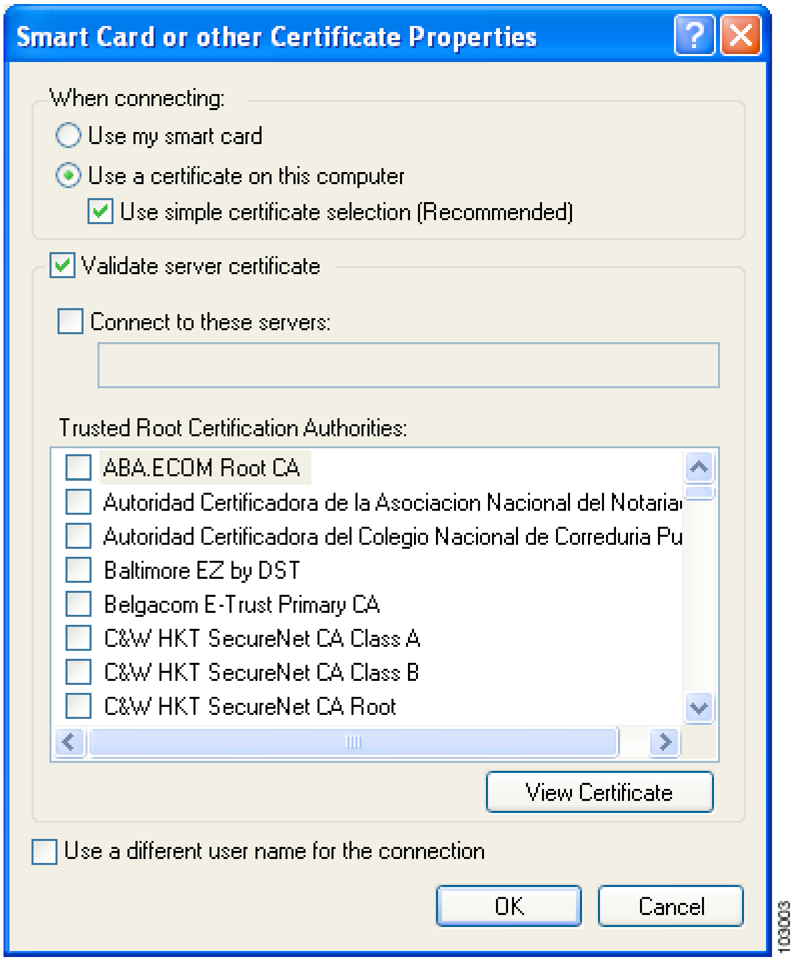
☑ Validate server certificate

□ Connect only if server name ends with:

Trusted root certificate authority:

□ Use a different user name for the connection

Figure 5-15 Smart Card or Other Certificate Properties Screen - Windows XP Service Pack 1



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 3 Choose the **Use a certificate on this computer** option.

Step 4 If your computer is running Windows XP Service Pack 1, make sure the **Use simple certificate selection (Recommended)** check box is selected.

Step 5 Check the **Validate server certificate** check box if server certificate validation is required.

Step 6 If you want to specify the name of the server to connect to, check the **Connect to these servers** or **Connect only if server name ends with** check box and enter the appropriate server name or 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 7 Perform one of the following:

- If your computer is running Windows 2000 or XP, make sure that the name of the certificate authority from which the server certificate was downloaded appears in the Trusted root certificate authority field.
- If your computer is running Windows XP Service Pack 1, check the check box beside the name of the certificate authority from which the server certificate was downloaded in the Trusted Root Certification Authorities field.

Note If you leave this field blank or all check boxes unchecked, you are prompted to accept a connection to the root certification authority during the authentication process.

Step 8 Click **OK** two or three times to save your settings. The configuration is complete.

Step 9 Refer to Chapter 6 for instructions on authenticating using EAP-TLS.

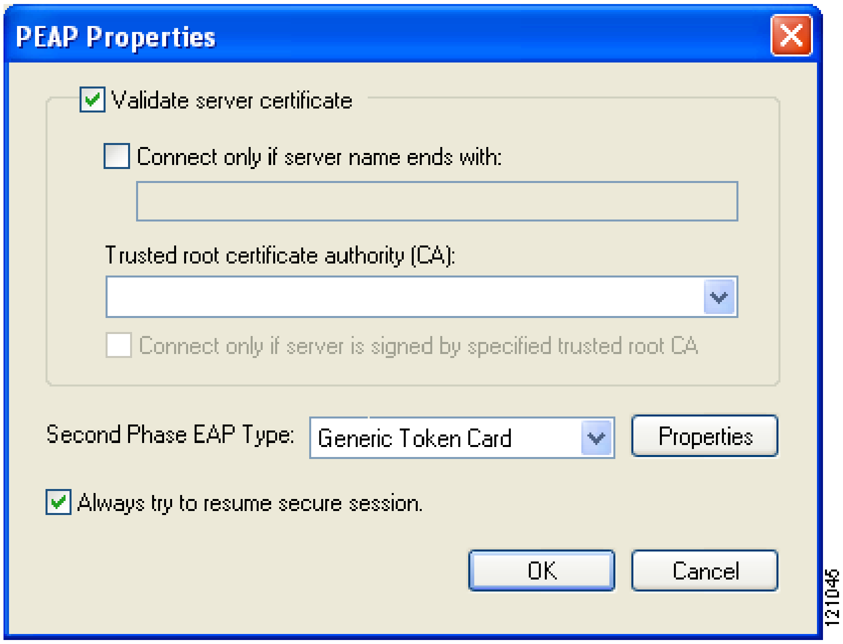
Enabling PEAP

Follow these steps to enable PEAP.

Step 1 For EAP type, choose **PEAP**.

Step 2 Click **Properties**. The PEAP Properties screen appears (see Figure 5-16).

Figure 5-16 PEAP Properties Screen



☑ 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

☑ Always try to resume secure session.

Step 3 Check the **Validate server certificate** check box if server certificate validation is required (recommended).

Step 4 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 5 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 choose 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 6 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.

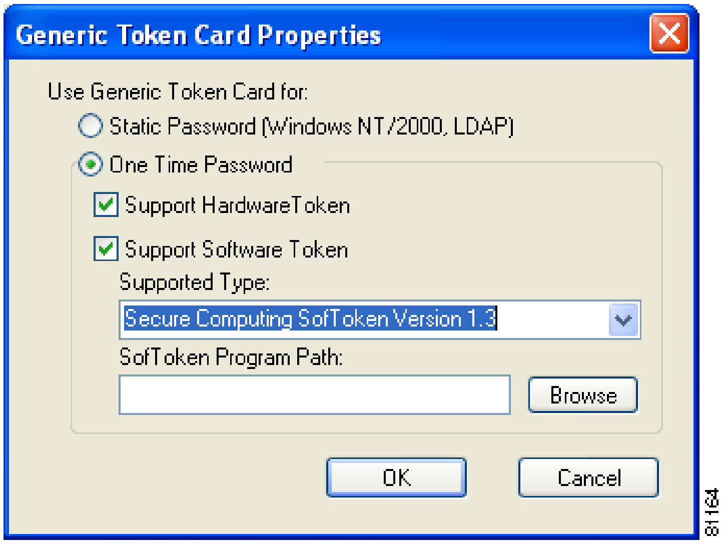
Step 7 Perform one of the following:

- Check the **Always try to resume secure session** check box if you want the PEAP protocol to always attempt to resume the previous session before prompting you to re-enter your credentials.
- Uncheck the **Always try to resume secure session** check box if you want to be prompted to re-enter your username and password whenever your client adapter's radio becomes disassociated (for example, when the card is ejected, the radio is turned off, you wander out of range of an access point, you switch profiles, and so on).

Note Checking this check box gives you the convenience of not having to re-enter your username and password when your client adapter experiences momentary losses of association. The PEAP Session Timeout setting on the Cisco Secure ACS System Configuration - Global Authentication Setup screen controls how long the resume feature is active (that is, the amount of time during which the PEAP session can be resumed without re-entering user credentials). If you leave your device unattended during this timeout period, be aware that someone can resume your PEAP session and access the network.

Step 8 Currently Generic Token Card is the only second phase EAP type available. Click **Properties**. The Generic Token Card Properties screen appears (see Figure 5-17).

Figure 5-17 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 9 Choose either the **Static Password (Windows NT/2000, LDAP)** or the **One Time Password** option, depending on your user database.

Step 10 Perform one of the following:

- If you selected the **Static Password (Windows NT/2000, LDAP)** option in Step 9, go to Step 11.
- If you selected the **One Time Password** option in Step 9, 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 locate 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 11 Click **OK** three times to save your settings. The configuration is complete.

Step 12 Refer to Chapter 6 for instructions on authenticating using PEAP.

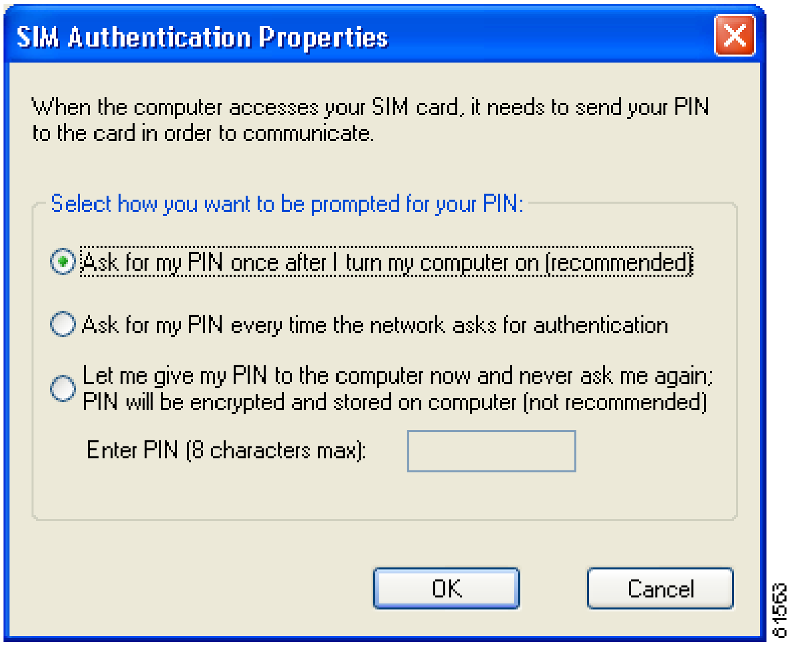
Enabling EAP-SIM

Follow these steps to enable EAP-SIM.

Step 1 For EAP type, choose **SIM Authentication**.

Step 2 Click **Properties**. The SIM Authentication Properties screen appears (see Figure 5-18).

Figure 5-18 SIM Authentication Properties Screen



SIM Authentication Properties

When the computer accesses your SIM card, it needs to send your PIN to the card in order to communicate.

Select how you want to be prompted for your PIN:

● Ask for my PIN once after I turn my computer on (recommended)

○ Ask for my PIN every time the network asks for authentication

○ Let me give my PIN to the computer now and never ask me again; PIN will be encrypted and stored on computer (not recommended)

Enter PIN (8 characters max):

Step 3 To access any resources (data or commands) on the SIM, the EAP-SIM supplicant must provide a valid PIN to the SIM card, which must match the PIN stored on the SIM. Choose one of the following options to specify how the EAP-SIM supplicant should handle the SIM card's PIN:

- **Ask for my PIN once after I turn my computer on (recommended)**—The software does not permanently store the PIN. It prompts you for the PIN once, on the first authentication of every session, where a *session* is defined as the time between power-up and shutdown or reboot.
- **Ask for my PIN every time the network asks for authentication**—The software never stores the PIN; it prompts you for the PIN every time an EAP-SIM authentication is performed. This option is not recommended if your client will be roaming between access points or if session timeouts are implemented (such as for accounting and security purposes).
- **Let me give my PIN to the computer now and never ask me again; PIN will be encrypted and stored on computer (not recommended)**—You need to enter the PIN only once, in the Enter PIN edit box below this option. The software stores the PIN in the registry and retrieves it from there when required. If you choose this option, you must enter the PIN now. The PIN is validated when an authentication attempt is made.

Note This option is not recommended because it enables others to use the SIM without knowing the PIN.

Step 4 Click **OK** twice to save your settings. The configuration is complete.

Step 5 If you are prompted to restart your client adapter, turn off your client adapter's radio, wait a few seconds, and then turn the radio back on. Refer to the "Turning Your Client Adapter's Radio On or Off" section on page 9-16 for instructions.

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

Disabling LEAP, EAP-FAST, or Host-Based EAP

If you ever need to disable LEAP, EAP-FAST, or host-based EAP for a particular profile, follow the instructions below for your EAP authentication type.

Disabling LEAP or EAP-FAST

To disable LEAP or EAP-FAST for a particular profile, choose **None** under Network Authentication on the Network Security screen in ACU, click **OK**, and click **OK** or **Apply** on the Profile Manager screen.

Disabling Host-Based EAP

To disable host-based EAP (EAP-TLS, PEAP, or EAP-SIM) for a particular profile, follow these steps:

Step 1 Choose **None** under Network Authentication on the Network Security screen in ACU and click **OK**.

Step 2 Click **OK** or **Apply** on the Profile Manager screen.

Step 3 Perform one of the following, 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. If you are using Windows XP Service Pack 1, click the **Wireless Networks** tab, click the SSID of the profile for which you are disabling host-based EAP in the Preferred networks list, and click **Properties**.

Step 4 Click the **Authentication** tab.

Step 5 Uncheck the **Enable network access control using IEEE 802.1X** or **Enable IEEE 802.1x authentication for this network** check box.

Step 6 Click **OK**.

Enabling Wi-Fi Multimedia

Wi-Fi Multimedia (WMM) is a component of the IEEE 802.11e wireless LAN standard for quality of service (QoS). It specifically supports priority tagging and queuing. QoS is an access point feature that enables networking professionals to provide preferential treatment to certain traffic at the expense of other traffic. Without QoS, the access point offers best-effort service to each packet, regardless of the packet contents or size. Implementing QoS in a wireless LAN makes network performance more predictable and bandwidth usage more effective.

Cisco recommends that you enable WMM if your computer is running a time-sensitive application for QoS-aware clients such as voice or video (for example, Cisco IP SoftPhone).

QoS and WMM must be enabled on the access point to which the client will associate. These features are supported on the access point in Cisco IOS Release 12.3(2)JA or later. Refer to the documentation for your access point for instructions on enabling these features.

WMM is supported automatically in client adapter firmware version 5.60.08, PC/LM/PCI card driver version 8.6, and mini PCI/CB20A card driver version 3.9, which are included in Install Wizard version 1.5 or later. However, you must enable the Windows QoS Packet Scheduler to ensure WMM support. Follow the instructions below to enable the QoS Packet Scheduler on Windows 2000 or XP.

Note The QoS Packet Scheduler must be installed before you can enable it. It comes preinstalled on Windows XP; however, you must install it on Windows 2000.

Enabling the QoS Packet Scheduler on Windows 2000

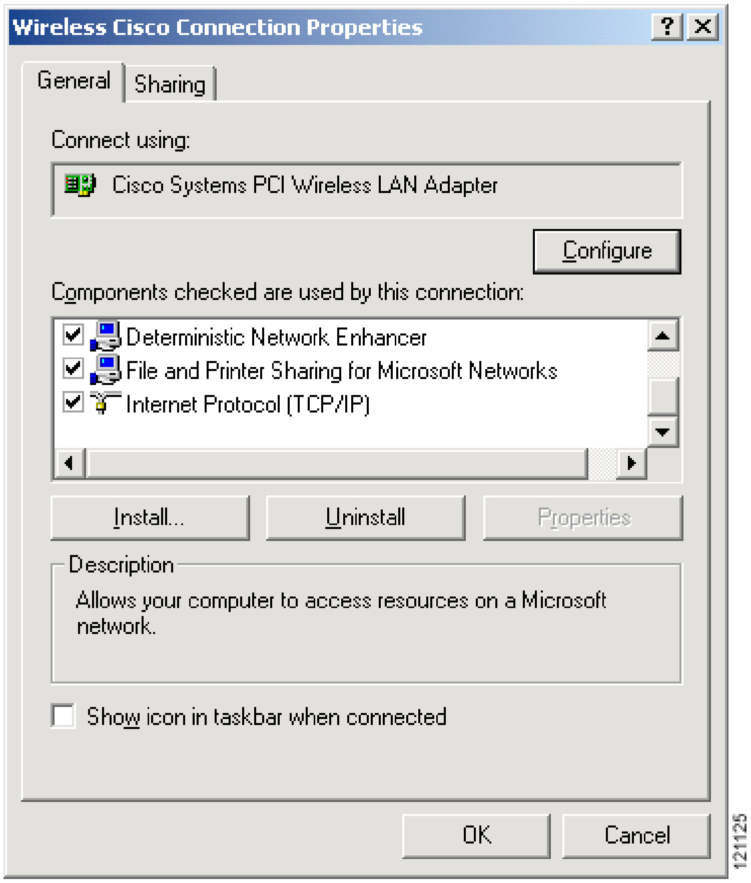
Follow these steps to enable the QoS Packet Scheduler on a computer running Windows 2000.

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

Step 2 Right-click your wireless network connection.

Step 3 Click **Properties**. The Wireless Cisco Connection Properties screen appears (see Figure 5-19).

Figure 5-19 Wireless Cisco Connection Properties Screen



Wireless Cisco Connection Properties

Connect using:

Cisco Systems PCI Wireless LAN Adapter

Components checked are used by this connection:

- ☑ Deterministic Network Enhancer
- ☑ File and Printer Sharing for Microsoft Networks
- ☑ Internet Protocol (TCP/IP)

Description

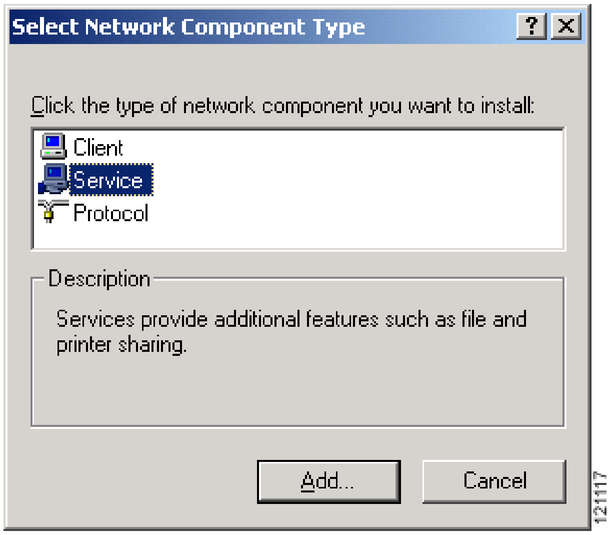
Allows your computer to access resources on a Microsoft network.

□ Show icon in taskbar when connected

Step 4 If the QoS Packet Scheduler is already installed, it is included in the list of components that this connection uses. If it appears in the list, go to Step 8. Otherwise, go to the next step to install it.

Step 5 Click **Install**. The Select Network Component Type screen appears (see Figure 5-20).

Figure 5-20 Select Network Component Type Screen



Select Network Component Type

Click the type of network component you want to install:

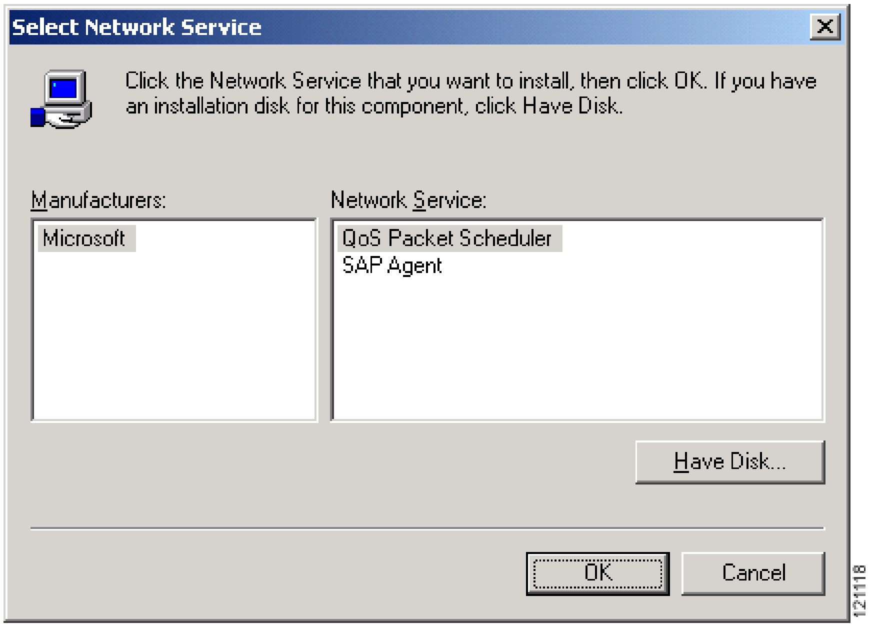
- Client
- Service
- Protocol

Description

Services provide additional features such as file and printer sharing.

Step 6 Choose **Service** and click **Add**. The Select Network Service screen appears (see Figure 5-21).

Figure 5-21 Select Network Service Screen



Select Network Service

Click the Network Service that you want to install, then click OK. If you have an installation disk for this component, click Have Disk.

Manufacturers: Microsoft

Network Service: QoS Packet Scheduler, SAP Agent

Step 7 Click **QoS Packet Scheduler** and **OK**. The Wireless Cisco Connection Properties screen reappears, and the QoS Packet Scheduler is included in the list of connections.

Step 8 Check the **QoS Packet Scheduler** check box if it is not checked.

Step 9 Click **OK**.

Enabling the QoS Packet Scheduler on Windows XP

Follow these steps to enable the QoS Packet Scheduler on a computer running Windows XP.

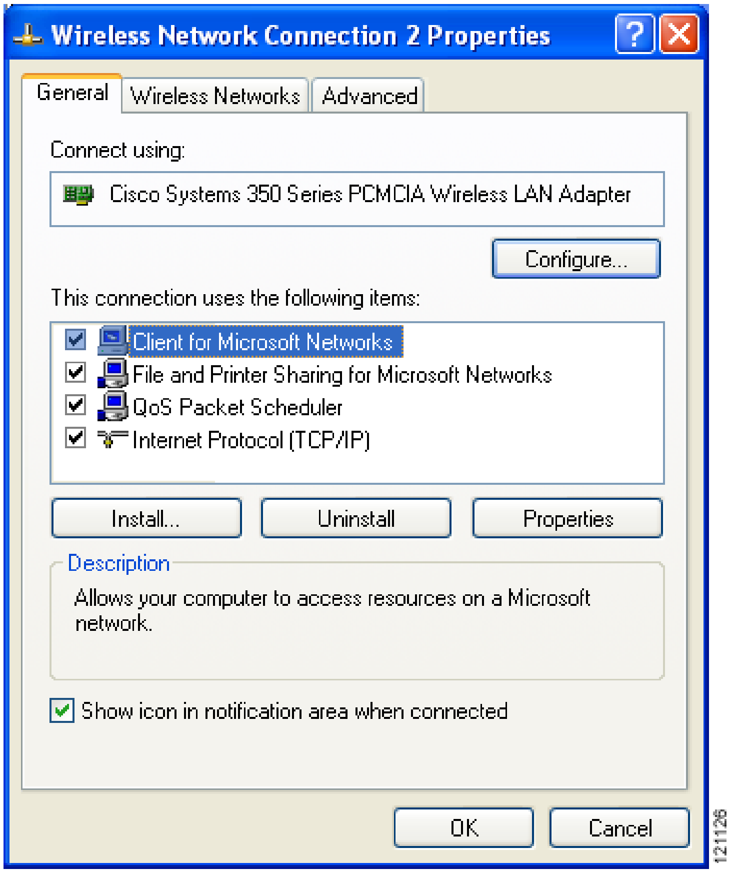
Step 1 Double-click **Control Panel**.

Step 2 Click **Network Connections**.

Step 3 Right-click your wireless network connection.

Step 4 Click **Properties**. The Wireless Network Connection Properties screen appears (see Figure 5-22).

Figure 5-22 Wireless Network Connection Properties Screen



Connect using:

Cisco Systems 350 Series PCMCIA Wireless LAN Adapter

This connection uses the following items:

- ☑ Client for Microsoft Networks
- ☑ File and Printer Sharing for Microsoft Networks
- ☑ QoS Packet Scheduler
- ☑ Internet Protocol (TCP/IP)

Description

Allows your computer to access resources on a Microsoft network.

☑ Show icon in notification area when connected

Step 5 Check the **QoS Packet Scheduler** check box, which appears in the list of items that this connection uses.

Step 6 Click **OK**.