Configuring Authentication Types

This chapter describes how to configure authentication types on the access point. This chapter contains these sections:

- Understand Authentication Types, page 6-2
- Configure Authentication Types, page 6-9
- Matching Access Point and Client Device Authentication Types, page 6-16

Understand Authentication Types

This section describes the authentication types that you can configure on the access point. The authentication types are tied to the SSIDs that you configure for the access point. If you want to serve different types of client devices with the same access point, you can configure multiple SSIDs. See Chapter 3, "Configuring Multiple SSIDs," for complete instructions on configuring multiple SSIDs.

Before a wireless client device can communicate on your network through the access point, it must authenticate to the access point using open or shared-key authentication. For maximum security, client devices should also authenticate to your network using MAC-address or EAP authentication, authentication types that rely on an authentication server on your network.

Note By default, the access point sends reauthentication requests to the authentication server with the service-type attribute set to authenticate-only. However, some Microsoft IAS servers do not support the authenticate-only service-type attribute. Changing the service-type attribute to login-only ensures that Microsoft IAS servers recognize reauthentication requests from the access point. Use the **dot11 aaa authentication attributes service-type login-only** global configuration command to set the service-type attribute in reauthentication requests to login-only.

The access point uses several authentication mechanisms or types and can use more than one at the same time. These sections explain each authentication type:

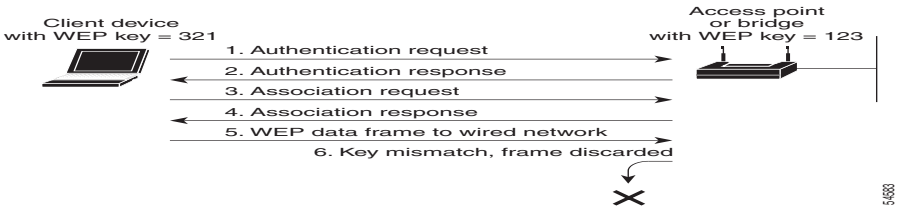
- Open Authentication to Access Point, page 6-2
- Shared Key Authentication to Access Point, page 6-3
- EAP Authentication to Network, page 6-4
- MAC Address Authentication to the Network, page 6-5
- Combining MAC-Based, EAP, and Open Authentication, page 6-6
- Using WPA Key Management, page 6-6
- Using WPA Key Management, page 6-6

Open Authentication to Access Point

Open authentication allows any device to authenticate and then attempt to communicate with the access point. Using open authentication, any wireless device can authenticate with the access point, but the device can communicate only if its WEP keys match the access point's. Devices not using WEP do not attempt to authenticate with an access point that is using WEP. Open authentication does not rely on a RADIUS server on your network.

Figure 6-1 shows the authentication sequence between a device trying to authenticate and an access point using open authentication. In this example, the device's WEP key does not match the access point's key, so it can authenticate but not pass data.

Figure 6-1 Sequence for Open Authentication



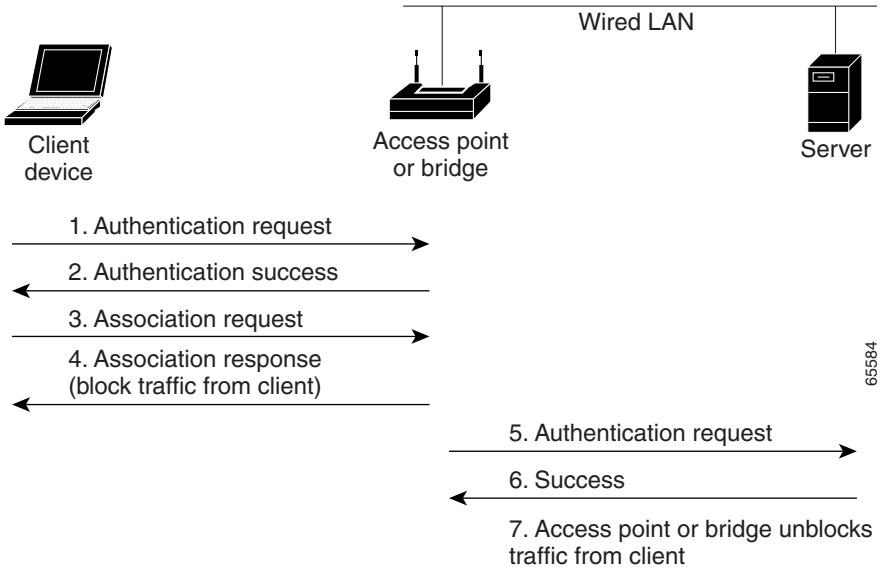
Shared Key Authentication to Access Point

Cisco provides shared key authentication to comply with the IEEE 802.11b standard. However, because of shared key's security flaws, Cisco recommends that you avoid using it.

During shared key authentication, the access point sends an unencrypted challenge text string to any device attempting to communicate with the access point. The device requesting authentication encrypts the challenge text and sends it back to the access point. If the challenge text is encrypted correctly, the access point allows the requesting device to authenticate. Both the unencrypted challenge and the encrypted challenge can be monitored, however, which leaves the access point open to attack from an intruder who calculates the WEP key by comparing the unencrypted and encrypted text strings. Because of this weakness, shared key authentication can be less secure than open authentication. Like open authentication, shared key authentication does not rely on a RADIUS server on your network.

Figure 6-2 shows the authentication sequence between a device trying to authenticate and an access point using shared key authentication. In this example the device's WEP key matches the access point's key, so it can authenticate and communicate.

Figure 6-2 Sequence for Shared Key Authentication

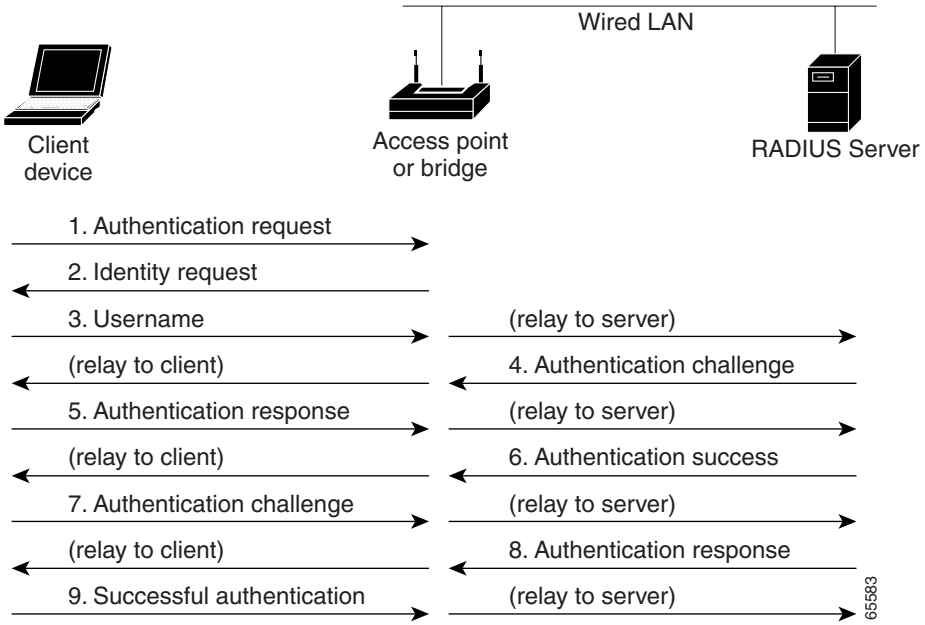


EAP Authentication to Network

This authentication type provides the highest level of security for your wireless network. By using the Extensible Authentication Protocol (EAP) to interact with an EAP-compatible RADIUS server, the access point helps a wireless client device and the RADIUS server to perform mutual authentication and derive a dynamic unicast WEP key. The RADIUS server sends the WEP key to the access point, which uses it for all unicast data signals that it sends to or receives from the client. The access point also encrypts its broadcast WEP key (entered in the access point's WEP key slot 1) with the client's unicast key and sends it to the client.

When you enable EAP on your access points and client devices, authentication to the network occurs in the sequence shown in Figure 6-3:

Figure 6-3 Sequence for EAP Authentication



In Steps 1 through 9 in Figure 6-3, a wireless client device and a RADIUS server on the wired LAN use 802.1x and EAP to perform a mutual authentication through the access point. The RADIUS server sends an authentication challenge to the client. The client uses a one-way encryption of the user-supplied password to generate a response to the challenge and sends that response to the RADIUS server. Using information from its user database, the RADIUS server creates its own response and compares that to the response from the client. When the RADIUS server authenticates the client, the process repeats in reverse, and the client authenticates the RADIUS server.

When mutual authentication is complete, the RADIUS server and the client determine a WEP key that is unique to the client and provides the client with the appropriate level of network access, thereby approximating the level of security in a wired switched segment to an individual desktop. The client loads this key and prepares to use it for the logon session.

During the logon session, the RADIUS server encrypts and sends the WEP key, called a *session key*, over the wired LAN to the access point. The access point encrypts its broadcast key with the session key and sends the encrypted broadcast key to the client, which uses the session key to decrypt it. The client and access point activate WEP and use the session and broadcast WEP keys for all communications during the remainder of the session.

There is more than one type of EAP authentication, but the access point behaves the same way for each type: it relays authentication messages from the wireless client device to the RADIUS server and from the RADIUS server to the wireless client device. See the "Assigning Authentication Types to an SSID" section on page 6-9 for instructions on setting up EAP on the access point.

Note If you use EAP authentication, you can select open or shared key authentication, but you don't have to. EAP authentication controls authentication both to your access point and to your network.

MAC Address Authentication to the Network

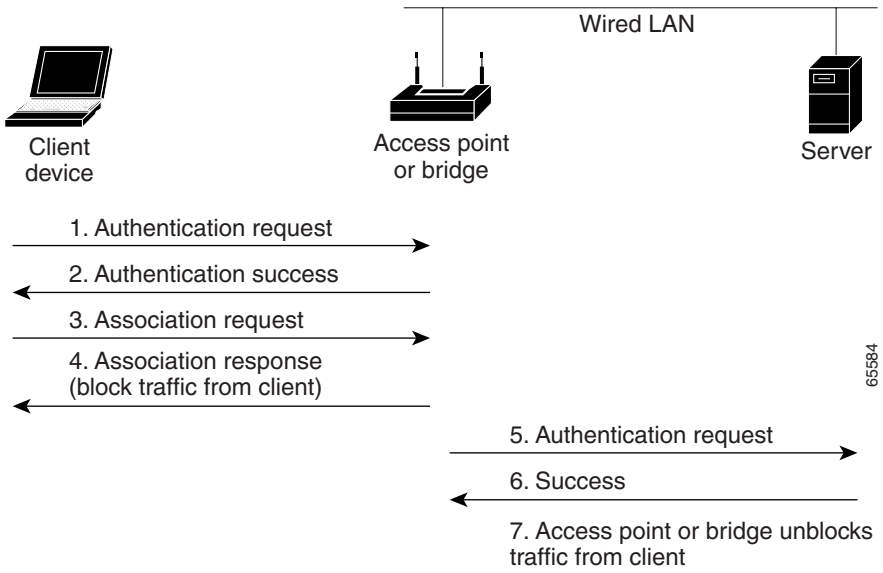
The access point relays the MAC address of the wireless client device to a RADIUS server on your network, and the server checks the address against a list of allowed MAC addresses. Intruders can create counterfeit MAC addresses, so MAC-based authentication is less secure than EAP authentication. However, MAC-based authentication provides an alternate authentication method for client devices that do not have EAP capability. See the "Assigning Authentication Types to an SSID" section on page 6-9 for instructions on enabling MAC-based authentication.

Tip If you don't have a RADIUS server on your network, you can create a list of allowed MAC addresses on the access point's Advanced Security: MAC Address Authentication page. Devices with MAC addresses not on the list are not allowed to authenticate.

Tip If MAC-authenticated clients on your wireless LAN roam frequently, you can enable a MAC authentication cache on your access points. MAC authentication caching reduces overhead because the access point authenticates devices in its MAC-address cache without sending the request to your authentication server. See the "Configuring MAC Authentication Caching" section on page 6-14 for instructions on enabling this feature.

Figure 6-4 shows the authentication sequence for MAC-based authentication.

Figure 6-4 Sequence for MAC-Based Authentication



Combining MAC-Based, EAP, and Open Authentication

You can set up the access point to authenticate client devices using a combination of MAC-based and EAP authentication. When you enable this feature, client devices that associate to the access point using 802.11 open authentication first attempt MAC authentication; if MAC authentication succeeds, the client device joins the network. If MAC authentication fails, the access point waits for the client device to attempt EAP authentication. See the "Assigning Authentication Types to an SSID" section on page 6-9 for instructions on setting up this combination of authentications.

Using WPA Key Management

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

WPA key management supports two mutually exclusive 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). Using WPA, the server generates the PMK dynamically and passes it to the access point. Using WPA-PSK, 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.

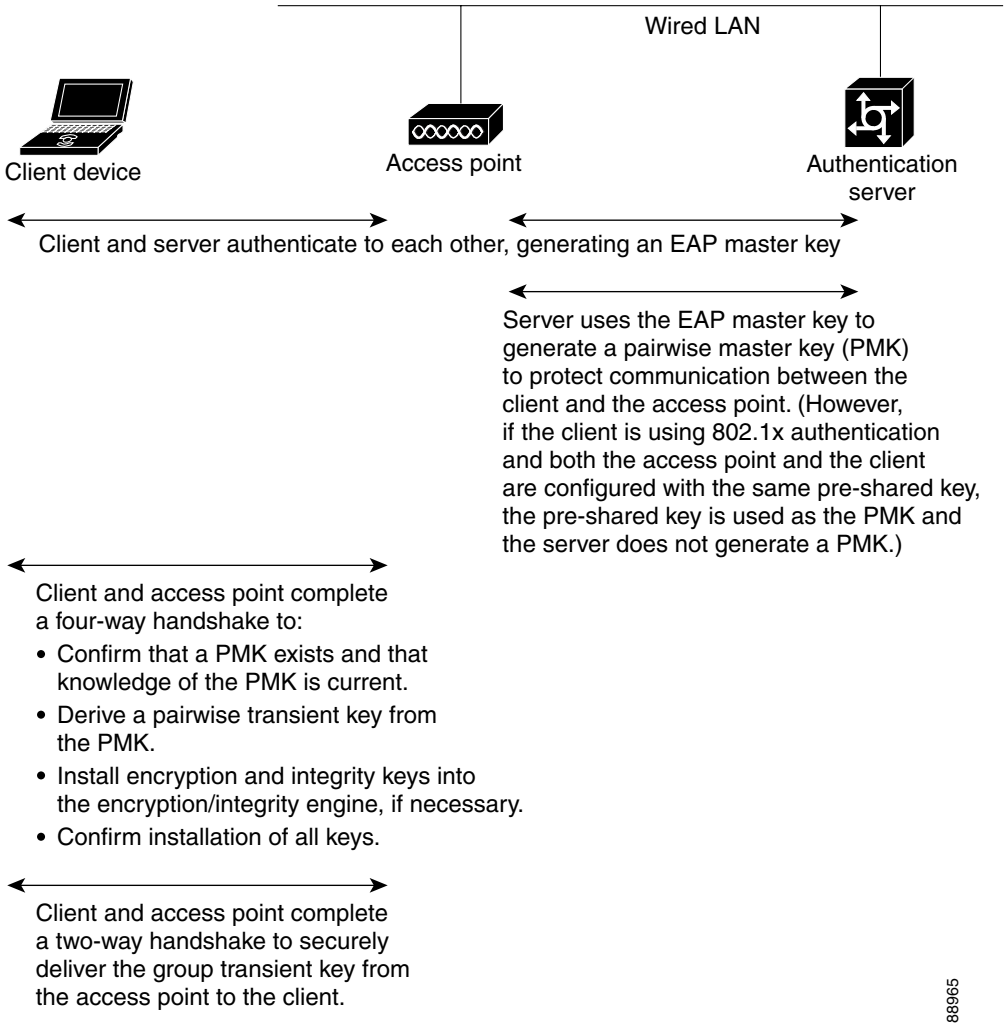
Note In Cisco IOS releases 12.3(4)JA and later, you cannot enable both MAC-address authentication and WPA-PSK.

Note Unicast and multicast cipher suites advertised in WPA information element (and negotiated during 802.11 association) may potentially mismatch with the cipher suite supported in an explicitly assigned VLAN. If the RADIUS server assigns a new vlan ID which uses a different cipher suite from the previously negotiated cipher suite, there is no way for the access point and client to switch back to the new cipher suite. Currently, the WPA protocol does not allow the cipher suite to be changed after the initial 802.11 cipher negotiation phase. In this scenario, the client device is disassociated from the wireless LAN.

See the "Assigning Authentication Types to an SSID" section on page 6-9 for instructions on configuring WPA key management on your access point.

Figure 6-5 shows the WPA key management process.

Figure 6-5 WPA Key Management Process



Software and Firmware Requirements for WPA and WPA-TKIP

Table 6-1 lists the firmware and software requirements required on access points and Cisco client devices to support WPA key management and WPA-TKIP encryption protocols.

To support the security combinations in Table 6-1, your access points and client devices must run the following software and firmware versions:

- Cisco IOS Release 12.4(2)T or later on access points
- Install Wizard version 1.2 for 340, 350, and CB20A client devices, which includes these components:
  - PC, LM, and PCI card driver version 8.4
  - Mini PCI and PC-cardbus card driver version 3.7
  - Aironet Client Utility (ACU) version 6.2
  - Client firmware version 5.30.13

Table 6-1 Software and Firmware Requirements for WPA and WPA-TKIP

Key Management and Encryption Protocol	Third Party Host Supplicant[1] Required?	Supported Platform Operating Systems
LEAP with WPA-TKIP	No	Windows XP and 2000
LEAP with WPA	No	Windows XP and 2000
Host-based EAP (such as PEAP, EAP-SIM, and EAP-TLS) with WPA	No[2]	Windows XP
Host-based EAP (such as PEAP, EAP-SIM, and EAP-TLS) with WPA	Yes	Windows 2000
WPA-PSK Mode	No[2]	Windows XP
WPA-PSK Mode	Yes	Windows 2000

1. Such as Funk Odyssey Client supplicant version 2.2 or Meetinghouse Data Communications Aegis Client version 2.1.
2. Windows XP does not require a third-party supplicant, but you must install Windows XP Service Pack 1 and Microsoft support patch 815485.

Note When you configure AES-CCM and **TKIP**-only cipher encryption (not **TKIP + WEP 128** or **TKIP + WEP 40**) on any radio interface or VLAN, every SSID on that radio or VLAN must be set to use WPA key management. If you configure TKIP on a radio or VLAN but you do not configure key management on the SSIDs, client authentication fails on the SSIDs.

Configure Authentication Types

This section describes how to configure authentication types. You attach configuration types to the access point's SSIDs. See Chapter 3, "Configuring Multiple SSIDs," for details on setting up multiple SSIDs. This section contains these topics:

- Assigning Authentication Types to an SSID, page 6-9
- Configuring Authentication Holdoffs, Timeouts, and Intervals, page 6-15

Assigning Authentication Types to an SSID

Beginning in privileged EXEC mode, follow these steps to configure authentication types for SSIDs:

	Command	Purpose
Step 1	**configure terminal**	Enter global configuration mode.
Step 2	**dot11 ssid** *ssid-string*	Create an SSID and enter SSID configuration mode for the new SSID. The SSID can consist of up to 32 alphanumeric characters. SSIDs are case sensitive.

	Command	Purpose
Step 3	**authentication open** [**mac-address** *list-name* [**alternate**]] [[**optional**] **eap** *list-name*]	(Optional) Set the authentication type to open for this SSID. Open authentication allows any device to authenticate and then attempt to communicate with the access point. **Note** The following EAP methods are supported: EAP-MD5, EAP_SIM, EAP-TTLS, EAP-LEAP, EAP-PEAP (v0 and v1), EAP-TLS, AND EAP-FAST. • (Optional) Set the SSID authentication type to open with MAC address authentication. The access point forces all client devices to perform MAC-address authentication before they are allowed to join the network. For *list-name*, specify the authentication method list. Click this link for more information on method lists: http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122cgcr/fsecur_c/fsaaa/scfathen.htm#xtocid2 Use the **alternate** keyword to allow client devices to join the network using either MAC or EAP authentication; clients that successfully complete either authentication are allowed to join the network. • (Optional) Set the SSID authentication type to open with EAP authentication. The access point forces all client devices to perform EAP authentication before they are allowed to join the network. For *list-name*, specify the authentication method list. Use the **optional** keyword to allow client devices using either open or EAP authentication to associate and become authenticated. This setting is used mainly by service providers that require special client accessibility. **Note** An access point configured for EAP authentication forces all client devices that associate to perform EAP authentication. Client devices that do not use EAP cannot use the access point.

	Command	Purpose
Step 4	**authentication shared** [**mac-address** *list-name*] [**eap** *list-name*]	(Optional) Set the authentication type for the SSID to shared key. **Note** Because of shared key's security flaws, Cisco recommends that you avoid using it. **Note** You can assign shared key authentication to only one SSID. • (Optional) Set the SSID's authentication type to shared key with MAC address authentication. For list-name, specify the authentication method list. • (Optional) Set the SSID's authentication type to shared key with EAP authentication. For list-name, specify the authentication method list.
Step 5	**authentication network-eap** *list-name* [**mac-address** *list-name*]	(Optional) Set the authentication type for the SSID to Network-EAP. Using the Extensible Authentication Protocol (EAP) to interact with an EAP-compatible RADIUS server, the access point helps a wireless client device and the RADIUS server to perform mutual authentication and derive a dynamic unicast WEP key. However, the access point does not force all client devices to perform EAP authentication. • (Optional) Set the SSID's authentication type to Network-EAP with MAC address authentication. All client devices that associate to the access point are required to perform MAC-address authentication. For list-name, specify the authentication method list.
Step 6	**authentication key-management** { [**wpa**]} [**optional**]	(Optional) Set the authentication type for the SSID to WPA. If you use the **optional** keyword, client devices other than WPA clients can use this SSID. If you do not use the **optional** keyword, only WPA client devices are allowed to use the SSID. When Network EAP is enabled for an SSID, client devices using LEAP, EAP-FAST, PEAP/GTC, MSPEAP, and EAP-TLS can authenticate using the SSID. To enable WPA for an SSID, you must also enable Open authentication or Network-EAP or both. **Note** Before you can enable WPA, you must set the encryption mode for the SSID's VLAN to one of the cipher suite options. See the "Configure Encryption Types" section on page 5-3 for instructions on configuring the VLAN encryption mode. **Note** If you enable WPA for an SSID without a pre-shared key, the key management type is WPA. If you enable WPA with a pre-shared key, the key management type is WPA-PSK. See the "Configuring Additional WPA Settings" section on page 6-13 for instructions on configuring a pre-shared key.

	Command	Purpose
Step 7	**end**	Return to privileged EXEC mode.
Step 8	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

Use the **no** form of the SSID commands to disable the SSID or to disable SSID features.

This example sets the authentication type for the SSID *batman* to Network-EAP authenticated key management. Client devices using the batman SSID authenticate using the adam server list.

```
router# configure terminal
router(config)# interface dot11radio 0
router(config-if)# ssid batman
router(config-ssid)# authentication network-eap adam
router(config-ssid)# authentication key-management optional
router(config-ssid)# end
```

Configuring WPA Migration Mode

WPA migration mode allows these client device types to associate to the access point using the same SSID:

- WPA clients capable of AES-CCM, TKIP and authenticated key management
- 802.1X-2001 clients (such as legacy LEAP clients and clients using TLS) capable of authenticated key management but not TKIP
- Static-WEP clients not capable of TKIP or authenticated key management

If all three client types associate using the same SSID, the multicast cipher suite for the SSID must be WEP. If only the first two types of clients use the same SSID the multicast key can be dynamic, but if the static-WEP clients use the SSID, the key must be static. The access point can switch automatically between a static and a dynamic group key to accommodate associated client devices. To support all three types of clients on the same SSID, you must configure the static key in key slots 2 or 3.

To set up an SSID for WPA migration mode, configure these settings:

- WPA optional
- A cipher suite containing TKIP and 40-bit or 128-bit WEP
- A static WEP key in key slot 2 or 3

This example sets the SSID migrate for WPA migration mode:

```
router# configure terminal
router(config)# interface dot11radio 0
router(config-if)# encryption mode cipher tkip wep128
router(config-if)# encryption key 3 size 128 12345678901234567890123456 transmit-key
router(config-if)# ssid migrate
router(config-ssid)# authentication open
router(config-ssid)# authentication network-eap adam
router(config-ssid)# authentication key-management wpa optional
router(config-ssid)# wpa-psk ascii batmobile65
router(config-ssid)# exit
```

Configuring Additional WPA Settings

Use two optional settings to configure a pre-shared key on the access point and adjust the frequency of group key updates.

Setting a Pre-Shared Key

To support WPA on a wireless LAN where 802.1x-based authentication is not available, you must configure a pre-shared key on the access point. You can enter the pre-shared key as ASCII or hexadecimal characters. If you enter the key as ASCII characters, you enter between 8 and 63 characters, and the access point expands the key using the process described in the *Password-based Cryptography Standard* (RFC2898). If you enter the key as hexadecimal characters, you must enter 64 hexadecimal characters.

Configuring Group Key Updates

In the last step in the WPA process, the access point distributes a group key to the authenticated client device. You can use these optional settings to configure the access point to change and distribute the group key based on client association and disassociation:

- Membership termination—the access point generates and distributes a new group key when any authenticated device disassociates from the access point. This feature keeps the group key private for associated devices, but it might generate some overhead traffic if clients on your network roam frequently among access points.
- Capability change—the access point generates and distributes a dynamic group key when the last non-key management (static WEP) client disassociates, and it distributes the statically configured WEP key when the first non-key management (static WEP) client authenticates. In WPA migration mode, this feature significantly improves the security of key-management capable clients when there are no static-WEP clients associated to the access point.

Beginning in privileged EXEC mode, follow these steps to configure a WPA pre-shared key and group key update options:

	Command	Purpose
Step 1	**configure terminal**	Enter global configuration mode.
Step 2	**interface dot11radio** { **0** | **1** }	Enter interface configuration mode for the radio interface. The 2.4-GHz radio is radio 0, and the 5-GHz radio is radio 1.
Step 3	**ssid** *ssid-string*	Enter SSID configuration mode for the SSID.
Step 4	**wpa-psk** { **hex** | **ascii** } [**0** | **7**] *encryption-key*	Enter a pre-shared key for client devices using WPA that also use static WEP keys. Enter the key using either hexadecimal or ASCII characters. If you use hexadecimal, you must enter 64 hexadecimal characters to complete the 256-bit key. If you use ASCII, you must enter a minimum of 8 letters, numbers, or symbols, and the access point expands the key for you. You can enter a maximum of 63 ASCII characters.
Step 5	**end**	Return to privileged EXEC mode.

	Command	Purpose
Step 6	**broadcast-key** [**vlan** *vlan-id*] { **change** *seconds* } [**membership-termination**] [**capability-change**]	Use the **broadcast key rotation** command to configure additional updates of the WPA group key.
Step 7	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

This example shows how to configure a pre-shared key for clients using WPA and static WEP, with group key update options:

```
ap# configure terminal
ap(config)# interface dot11radio 0
ap(config-if)# ssid batman
ap(config-ssid)# wpa-psk ascii batmobile65
ap(config-ssid)# exit
ap(config-if)# exit
ap(config)# broadcast-key vlan 87 membership-termination capability-change
```

Configuring MAC Authentication Caching

If MAC-authenticated clients on your wireless LAN roam frequently, you can enable a MAC authentication cache on your access points. MAC authentication caching reduces overhead because the access point authenticates devices in its MAC-address cache without sending the request to your authentication server. When a client device completes MAC authentication to your authentication server, the access point adds the client's MAC address to the cache.

Beginning in privileged EXEC mode, follow these steps to enable MAC authentication caching:

	Command	Purpose
Step 1	**configure terminal**	Enter global configuration mode.
Step 2	**dot11 aaa authentication mac-authen filter-cache** [**timeout** *seconds*]	Enable MAC authentication caching on the access point. Use the **timeout** option to configure a timeout value for MAC addresses in the cache. Enter a value from 30 to 65555 seconds. The default value is 1800 (30 minutes). When you enter a timeout value, MAC-authentication caching is enabled automatically.
Step 3	**exit**	Return to privileged EXEC mode.
Step 4	**show dot11 aaa authentication mac-authen filter-cache** [*address*]	Show entries in the MAC-authentication cache. Include client MAC addresses to show entries for specific clients.
Step 5	**clear dot11 aaa authentication mac-authen filter-cache** [*address*]	Clear all entries in the cache. Include client MAC addresses to clear specific clients from the cache.
Step 6	**end**	Return to privileged EXEC mode.
Step 7	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

Use the **no** form of the **dot11 aaa mac-authen filter-cache** command to disable MAC authentication caching. This example shows how to enable MAC authentication caching with a one-hour timeout:

```
ap# configure terminal
ap(config)# dot11 aaa authentication mac-authen filter-cache timeout 3600
ap(config)# end
```

Configuring Authentication Holdoffs, Timeouts, and Intervals

Beginning in privileged EXEC mode, follow these steps to configure holdoff times, reauthentication periods, and authentication timeouts for client devices authenticating through your access point:

	Command	Purpose
Step 1	**configure terminal**	Enter global configuration mode.
Step 2	**dot11 holdoff-time** *seconds*	Enter the number of seconds a client device must wait before it can reattempt to authenticate following a failed authentication. The holdoff time is invoked when a client fails three login attempts or fails to respond to three authentication requests from the access point. Enter a value from 1 to 65555 seconds.
Step 3	**interface dot11radio** { **0** | **1** }	Enter interface configuration mode for the radio interface. The 2.4-GHz radio is radio 0, and the 5-GHz radio is radio 1.
Step 4	**dot1x client-timeout** *seconds*	Enter the number of seconds the access point should wait for a reply from a client attempting to authenticate before the authentication fails. Enter a value from 1 to 65555 seconds.
Step 5	**dot1x reauth-period** { *seconds* | **server** }	Enter the interval in seconds that the access point waits before forcing an authenticated client to reauthenticate. Enter the **server** keyword to configure the access point to use the reauthentication period specified by the authentication server. If you use this option, configure your authentication server with RADIUS attribute 27, Session-Timeout. This attribute sets the maximum number of seconds of service to be provided to the client before termination of the session or prompt. The server sends this attribute to the access point when a client device performs EAP authentication. **Note** If you configure both MAC address authentication and EAP authentication for an SSID, the server sends the Session-Timeout attribute for both MAC and EAP authentications for a client device. The access point uses the Session-Timeout attribute for the last authentication that the client performs. For example, if a client performs MAC address authentication and then performs EAP authentication, the access point uses the server's Session-Timeout value for the EAP authentication. To avoid confusion on which Session-Timeout attribute is used, configure the same Session-Timeout value on your authentication server for both MAC and EAP authentication.

	Command	Purpose
Step 6	**countermeasure tkip hold-time** *seconds*	Configure a TKIP MIC failure holdtime. If the access point detects two MIC failures within 60 seconds, it blocks all the TKIP clients on that interface for the holdtime period.
Step 7	**end**	Return to privileged EXEC mode.
Step 8	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

Use the **no** form of these commands to reset the values to default settings.

Matching Access Point and Client Device Authentication Types

To use the authentication types described in this section, the access point authentication settings must match the authentication settings on the client adapters that associate to the access point. Refer to the *Cisco Aironet Wireless LAN Client Adapters Installation and Configuration Guide for Windows* for instructions on setting authentication types on wireless client adapters. Refer to Chapter 5, "Configuring Encryption Types," for instructions on configuring encryption on the access point.

Table 6-2 lists the client and access point settings required for each authentication type.

Note Some non-Cisco client adapters do not perform 802.1x authentication to the access point unless you configure **Open authentication with EAP**. To allow both the Cisco access point clients using LEAP and non-Cisco clients using LEAP to associate using the same SSID, you might need to configure the SSID for both **Network EAP** authentication and **Open authentication with EAP**.

Table 6-2 Client and Access Point Security Settings

Security Feature	Client Setting	Access Point Setting
Static WEP with open authentication	Create a WEP key and enable Use Static WEP Keys and Open Authentication	Set up and enable WEP and enable Open Authentication for the SSID
Static WEP with shared key authentication	Create a WEP key and enable Use Static WEP Keys and Shared Key Authentication	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[1]
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[1]

Table 6-2 Client and Access Point Security Settings (continued)

Security Feature	Client Setting	Access Point Setting
EAP-FAST authentication with WPA	Enable EAP-FAST and Wi-Fi Protected Access (WPA) and enable automatic provisioning or import a PAC file. 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.
802.1x authentication	Enable LEAP	Select a cipher suite and enable Network-EAP for the SSID
802.1x authentication and WPA	Enable any 802.1x authentication method	Select a cipher suite and enable Open authentication and WPA for the SSID (you can also enable Network-EAP authentication in addition to or instead of Open authentication) **Note** To allow both WPA clients and non-WPA clients to use the SSID, enable optional WPA.
802.1x authentication and WPA-PSK	Enable any 802.1x authentication method	Select a cipher suite and enable Open authentication and WPA for the SSID (you can also enable Network-EAP authentication in addition to or instead of Open authentication). Enter a WPA pre-shared key. **Note** To allow both WPA clients and non-WPA clients to use the SSID, enable optional WPA.
EAP-TLS authentication		
If using ACU to configure card	Enable Host Based EAP and Use Dynamic WEP Keys in ACU and select Enable network access control using IEEE 802.1X and Smart Card or Other Certificate as the EAP Type in Windows 2000 (with Service Pack 3) or Windows XP	Set up and enable WEP and enable EAP and Open authentication for the SSID
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 EAP and Open Authentication for the SSID

Table 6-2 Client and Access Point Security Settings (continued)

Security Feature	Client Setting	Access Point Setting
EAP-MD5 authentication		
If using ACU to configure card	Create a WEP key, enable Host Based EAP, and enable Use Static WEP Keys in ACU and select Enable network access control using IEEE 802.1X and MD5-Challenge as the EAP Type in Windows 2000 (with Service Pack 3) or Windows XP	Set up and enable WEP and enable EAP and Open authentication for the SSID
If using Windows XP to configure card	Select Enable network access control using IEEE 802.1X and MD5-Challenge as the EAP Type	Set up and enable WEP and enable EAP and Open Authentication for the SSID
PEAP authentication		
If using ACU to configure card	Enable Host Based EAP and Use Dynamic WEP Keys in ACU and select Enable network access control using IEEE 802.1X and PEAP as the EAP Type in Windows 2000 (with Service Pack 3) or Windows XP	Set up and enable WEP and enable EAP and Open authentication for the SSID
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 Require EAP and Open Authentication for the SSID
EAP-SIM authentication		
If using ACU to configure card	Enable Host Based EAP and Use Dynamic WEP Keys in ACU and select Enable network access control using IEEE 802.1X and SIM Authentication as the EAP Type in Windows 2000 (with Service Pack 3) or Windows XP	Set up and enable WEP with full encryption and enable EAP and Open authentication for the SSID
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 with full encryption and enable Require EAP and Open Authentication for the SSID

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