

# Designing AirPort Networks





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# Getting Started

You can set up an AirPort Base Station and surf the Web without wires in minutes. But since the AirPort Base Station is a flexible and powerful networking device, you can also create an AirPort network that does much more. If you want to design an AirPort network that provides Internet access to non-AirPort computers via Ethernet, or take advantage of some of the base station's more advanced features, use this document to design and implement your network.

## How to Use This Document

Chapter 2, "AirPort Network Designs," shows you how to use the AirPort Admin Utility to configure an AirPort Base Station by outlining different AirPort network designs. If a design uses a networking term or refers to a software utility you are not familiar with, you can refer to Chapter 3, "Behind the Scenes."

The AirPort network design process has three steps:

- 1 Set up your AirPort wireless network.

The AirPort wireless network is the way AirPort-equipped computers communicate with the AirPort Base Station. Setting up the AirPort network includes naming the wireless network created by the base station, changing the password needed to join the wireless network, and other options.

- 2 Set up the base station to get and share Internet access.

When you use AirPort to access the Internet, the base station connects to the Internet and transmits information to computers on the AirPort network. You provide the base station with the settings appropriate for connecting with your Internet service provider (ISP) and configure how the base station shares this connection with other computers.

- 3 Set advanced options.

These settings are optional for most users. Options include optimizing base station placement, using the base station as a bridge between your AirPort network and an Ethernet network, controlling access to an AirPort network, and fine-tuning other AirPort settings.

## The AirPort Setup Assistant

The AirPort Setup Assistant walks you through the base station setup process, transfers the Internet settings from your computer to the AirPort Base Station, and changes your computer's Internet settings to use AirPort instead of a wired connection.

When you complete the Setup Assistant, your base station shares its Internet connection with computers that join its AirPort network.

**Note:** Because the Setup Assistant transfers your computer's Internet settings to the base station, you must configure your computer to access the Internet normally (via Ethernet, for example) before you use the Setup Assistant to configure a base station.

## The AirPort Admin Utility

The AirPort Base Station has some advanced networking features that can only be configured with the AirPort Admin Utility. The AirPort Admin Utility is also a convenient way to make quick adjustments to your base station configuration.

### When to Use the AirPort Admin Utility

- You want to provide Internet access to computers that connect to the base station using Ethernet.
- You have already set up your base station, but you need to change one setting, such as the phone number for your ISP.
- You need to configure advanced base station settings such as channel frequency, closed networks, base station density, multicast rate, DHCP lease time, access control, or port mapping.

# AirPort Network Designs

Configuring your base station involves three steps:

**1** Set up the AirPort network.

Here you name the network your base station will create and set general options for it.

**2** Configure and share Internet access.

Here you set up the base station's access to the Internet and specify how to share that access with computers on the network. The way you do this depends on how the base station connects to the Internet:

- through a dialup Internet service provider (ISP)
- using a DSL modem or cable modem
- through an existing Ethernet network

**3** Set advanced options.

You can fine-tune your network design by

- using the base station as a bridge
- setting up roaming
- optimizing placement of the base station
- setting access control
- setting multicast rate
- setting interference robustness
- setting up port mapping
- setting DHCP lease time

You can do most of your setup tasks with the AirPort Setup Assistant. To set advanced options, you need to use the AirPort Admin Utility.

## Notes on Using the AirPort Admin Utility

To modify the base station configuration, you open it on your computer.

To open your base station's configuration:

- 1 Open the AirPort Admin Utility, located in the AirPort folder in the Apple Extras folder on your hard disk.
- 2 Select your base station and click Configure.
- 3 Enter the base station password.

### **If you don't see your base station in the Select Base Station window:**

- 1 Make sure that you have joined the AirPort network created by your base station using the AirPort application or AirPort Control Strip module.
- 2 Make sure that you have chosen AirPort in the "Connect via" pop-up menu and Using DHCP Server in the Configure pop-up menu in the TCP/IP control panel.

### **If a message says that you can't open the base station's configuration:**

- 1 Make sure that you have chosen AirPort in the "Connect via" pop-up menu and Using DHCP Server in the Configure pop-up menu in the TCP/IP control panel.
- 2 Make sure you entered the AirPort Base Station password correctly. The default password is *public*. If you have forgotten the base station password, you can reset it to *public* and clear the network password by resetting the base station. Use the instructions in the "Troubleshooting" section of the *Setting Up the AirPort Base Station* manual that came with your base station.

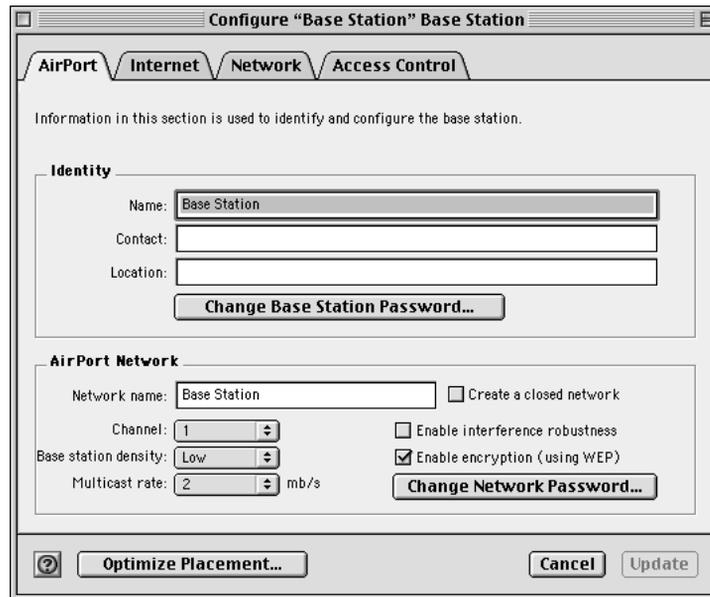
### **If you are on an Ethernet network that has other base stations, or you are using Ethernet to connect to the base station:**

The AirPort Admin Utility scans the Ethernet network you are connected to in order to create the list of base stations in the Configure Base Station window. As a result, when you open the AirPort Admin Utility, you may see base stations that you cannot configure.

If you are using Ethernet to configure the base station, see the document called "Installation Instructions" that came with your AirPort software.

## Step 1: Set Up the AirPort Network

The first step in configuring your base station is setting up the AirPort network it will create. You can set up most AirPort networks using the AirPort Setup Assistant. To configure a network manually, use the AirPort Admin Utility. You can also use the Admin utility to set or change advanced options (see “Step 3: Set Advanced Options” on page 28).



To set up the AirPort network manually, open your base station's configuration in the AirPort Admin Utility and fill in the information in the AirPort panel.

### Naming the Base Station

Giving the base station an easily identifiable name makes it easy for administrators to locate a specific base station on an Ethernet network with multiple base stations. The optional Contact and Location fields may also be helpful if you have more than one AirPort Base Station on your network.

### Changing the Base Station Password

The base station password protects the base station configuration so that only the administrator can modify it. The default password is *public*.

### Naming the AirPort Network

Give your AirPort network a name. This name appears in the AirPort application and Control Strip module on the AirPort computers that are in range of your AirPort network.

## Creating a Network Password

To protect your network, click the “Enable encryption (using WEP)” checkbox to require users to enter a password to join your network. To change the password, click Change Network Password.

## Changing the Channel

The “channel” is the radio frequency over which your base station is set to communicate. If you are using only one base station (for example, at home), you probably won't need to change the channel frequency. If you are setting up multiple base stations in a school or office, use different channel frequencies for base stations that are within approximately 150 feet of each other.

Adjacent base stations should have at least three channels between their channel frequencies. So if base station A is set to channel 1, base station B should be set to channel 4 or higher.

AirPort-equipped computers automatically tune to the channel frequency your base station is using when they join the AirPort network. If you change the channel frequency, AirPort client computers do not need to make any changes.

## Creating a Closed Network

The closed network option provides additional security by hiding the name of the network created by the AirPort Base Station. Users must enter the exact network name to join the AirPort network.

To join a closed network, users of client computers must follow these steps:

- 1 Click the settings triangle in the AirPort application.
- 2 Select the “Allow closed networks” checkbox.
- 3 Choose Other from the list of available networks in the “Choose network” pop-up menu.
- 4 Enter the name of the AirPort network.

**Note:** The AirPort Setup Assistant can't create a connection to a base station with a closed network. Use the AirPort application to join a closed AirPort network, and use the AirPort Admin Utility to modify the configuration of a base station with a closed network.

## Step 2: Configure and Share Internet Access

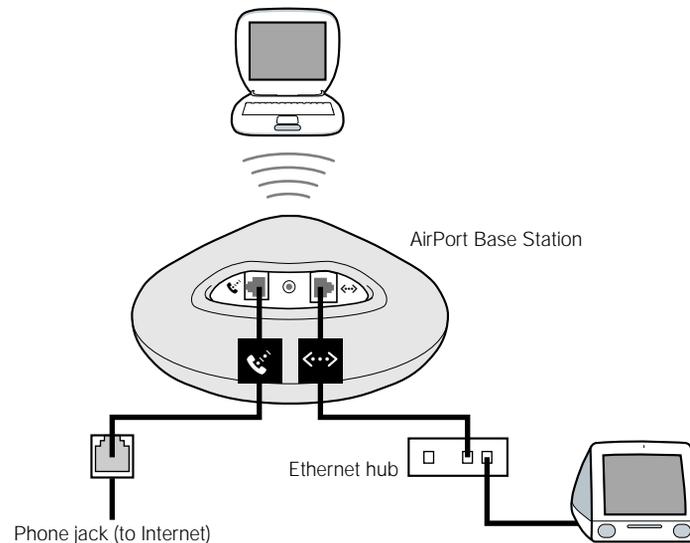
The next step in designing your network is setting up your base station's Internet connection, then sharing its Internet access with client computers. The following three sections tell you what to do depending on how your base station connects to the Internet.

### You're Using a Dialup Internet Service Provider (ISP)

In most cases, you can implement this design with the AirPort Setup Assistant. You only need to use the AirPort Admin Utility if

- you need to use AppleTalk to communicate with computers or AppleTalk printers that are attached to the base station using Ethernet
- you need to adjust optional advanced base station settings

### What It Looks Like



### How It Works

- The base station connects to the Internet using its internal modem.
- Computers using AirPort or Ethernet can connect to the Internet through the AirPort Base Station.
- AirPort and Ethernet computers can communicate with each other through the base station using AppleTalk.

## What You Need

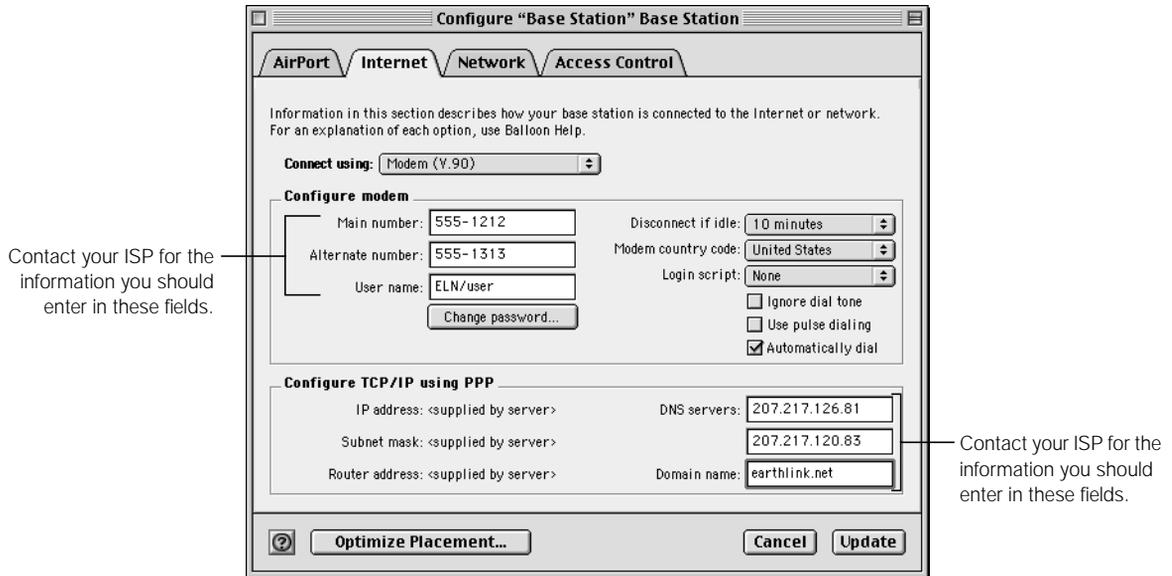
Components	Check ✓	Comments
Working dialup ISP account using standard PPP	Make sure you have the following: <ul style="list-style-type: none"><li>■ ISP phone number</li><li>■ account name and password</li><li>■ DNS address</li></ul>	You can get this information (except the account password) from the Remote Access control panel and the TCP/IP control panel on the computer you use to access the Internet. If the TCP/IP control panel on your computer doesn't have DNS information, you may not need to provide DNS information in the Admin Utility.
AirPort Base Station		Place the base station near a phone jack and power outlet.
Ethernet hub		If you want to add one or more computers to your network using Ethernet, you'll need an Ethernet hub.

## What to Do

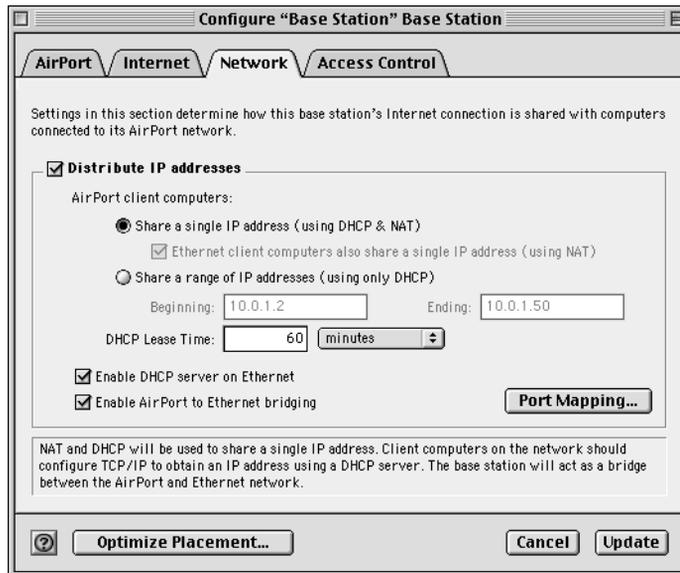
To configure the AirPort Base Station for Internet access:

- 1 Open the base station's configuration in the AirPort Admin Utility. For more information on opening your base station's configuration, see "Notes on Using the AirPort Admin Utility" on page 8.
- 2 Click the Internet tab and choose Modem (V.90) from the "Connect using" pop-up menu. Then enter the phone number and other account information for your ISP.

**Note:** If you have difficulty connecting, you can try to connect at a slower modem speed by choosing Modem (V.34) from the “Connect using” pop-up menu.



- 3 Click the Network tab and configure how the base station will share its Internet access with AirPort and Ethernet computers. Select the “Distribute IP addresses” checkbox and the “Share a single IP address (using DHCP & NAT)” button.



- To share Internet access over Ethernet, click the “Ethernet client computers also share a single IP address (using NAT)” and “Enable DHCP server on Ethernet” checkboxes.

**Important** If you are in a school or office environment and you connect the base station to an Ethernet network that already has a DHCP server, do not check the “Enable DHCP server on Ethernet” checkbox. Doing so may adversely affect network services.

- If you want to connect an AppleTalk Ethernet printer to the base station, or you would like to use AppleTalk between computers using AirPort and computers using Ethernet, click the “Enable AirPort to Ethernet bridging” checkbox.

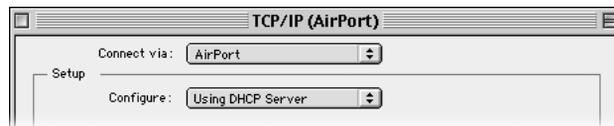
Enabling NAT (Network Address Translation) lets you share a single Internet connection among several computers. Enabling DHCP lets the base station dynamically and automatically assign IP addresses to client computers, which simplifies each computer’s TCP/IP configuration. Bridging allows devices and computers using Ethernet and computers using AirPort to communicate with each other.

- 4 If you want to adjust optional advanced settings, go to “Step 3: Set Advanced Options” on page 28. If you are finished changing settings, click the Update button. Your computer transfers the new settings to the base station. When the transfer is complete, the base station restarts and its new settings are active.

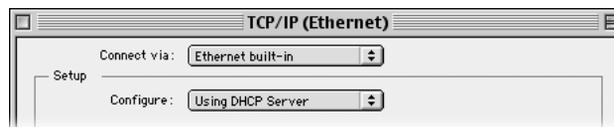
### Setting Up Client Computers

To join your AirPort network, clients can use the AirPort application, AirPort Control Strip module, or AirPort Setup Assistant.

Client computers using AirPort should configure TCP/IP by choosing AirPort from the “Connect via” pop-up menu and Using DHCP Server from the Configure pop-up menu.



If you enabled a DHCP server in step 3, client computers using Ethernet should configure TCP/IP by choosing Ethernet from the “Connect via” pop-up menu and Using DHCP Server from the Configure pop-up menu.



If you didn't enable a DHCP server on Ethernet, you may still be able to share Internet access with Ethernet computers manually. Select the "Ethernet client computers also share a single IP address (using NAT)" checkbox in the Network panel in the AirPort Admin Utility. You can then configure TCP/IP manually on Ethernet computers as follows:

The screenshot shows a window titled "TCP/IP (Ethernet Configured Manually)". Inside the window, there is a "Setup" section with two dropdown menus: "Connect via:" set to "Ethernet built-in" and "Configure:" set to "Manually". Below these are several text input fields: "IP Address:" containing "10.0.1.51", "Subnet mask:" containing "255.255.255.0", "Router address:" containing "10.0.1.1", and "Name server addr.:" containing "192.249.42.10" and "192.249.42.11". To the right of the name server fields is a "Search domains:" field containing "yourispdomain.net". A question mark icon is visible in the bottom-left corner of the window.

Contact your ISP for the information you should enter in these fields.

When you configure Ethernet clients manually for a base station that provides NAT services over Ethernet, you can use IP addresses in the range 10.0.1.51 to 10.0.1.254.

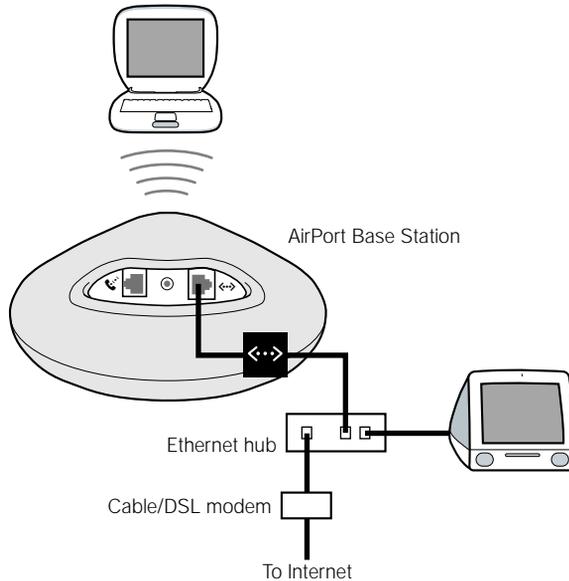
In the "Subnet mask" field, enter 255.255.255.0. In the "Router address" field, enter 10.0.1.1.

Enter the same name server address and search domain information that you entered in the base station configuration.

## You're Using a Cable Modem or DSL Modem

If you do not need to connect Ethernet computers to the base station, you can use the AirPort Setup Assistant to set up the base station. Use the AirPort Admin Utility if you want to share Internet access and exchange files with computers attached to the base station using Ethernet.

### What It Looks Like



### How It Works

- The base station connects to the Internet through its Ethernet connection with your cable modem or DSL modem.
- Computers using AirPort or Ethernet can connect to the Internet through the AirPort Base Station.
- If you select “Enable AirPort to Ethernet bridging,” AirPort computers and Ethernet computers can communicate with each other through the base station using AppleTalk.

## What You Need

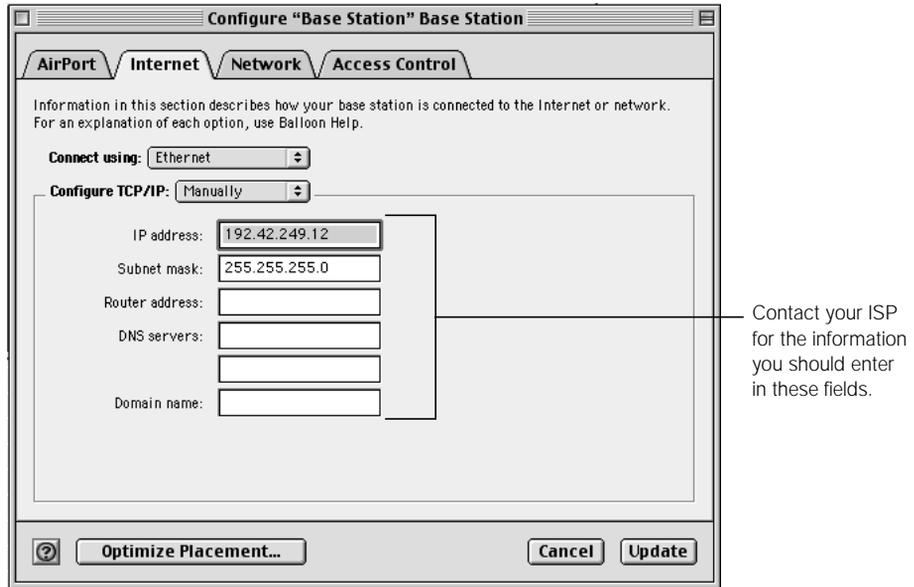
Components	Check ✓	Comments
Internet account with cable modem or DSL service provider	Does your service provider use a static IP or DHCP configuration?	You can get this information from your ISP or the TCP/IP control panel on the computer you use to access the Internet through this service provider.
AirPort Base Station		Place the base station near your cable modem or DSL modem.
Ethernet hub		If you want to add one or more computers to your network using Ethernet, you'll need an Ethernet hub.

## What to Do

To configure the AirPort Base Station for Internet access:

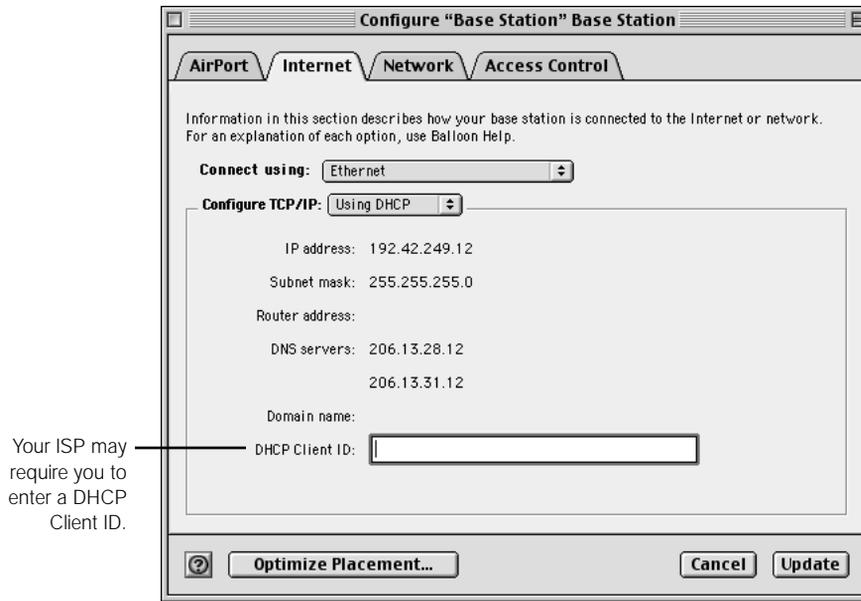
- 1 Make sure that your cable modem or DSL modem is connected to the uplink port on your Ethernet hub.
- 2 Open your base station's configuration in the AirPort Admin Utility. For more information on opening your base station's configuration, see "Notes on Using the AirPort Admin Utility" on page 8.
- 3 Click the Internet tab. Choose Ethernet or PPP over Ethernet (PPPoE) from the "Connect using" pop-up menu, depending on which one your ISP requires. If your ISP provided you with PPPoE connection software, such as EnterNet or MacPoET, choose PPPoE. Contact your ISP if you aren't sure which one to select.
- 4 If you chose Ethernet, choose Manually or Using DHCP from the Configure TCP/IP pop-up menu, depending on how your ISP provides IP addresses. If your ISP gave you an IP address and other numbers with your subscription, use that information to configure the base station IP address manually. If you aren't sure, ask your ISP.

Here's what you'll see if you configure TCP/IP manually (enter your own IP address information in the fields below the Configure TCP/IP pop-up menu):



**Note:** If you have already used the AirPort Setup Assistant to set up your AirPort Base Station, the fields below the Configure TCP/IP pop-up menu may already contain the information appropriate for your ISP.

Here's what you'll see if you use DHCP:



Your ISP may require you to enter a DHCP Client ID.

- 5 If you chose PPP over Ethernet (PPPoE) from the “Connect using” pop-up menu, enter the PPPoE settings your ISP provided. You may not need to enter a service name.

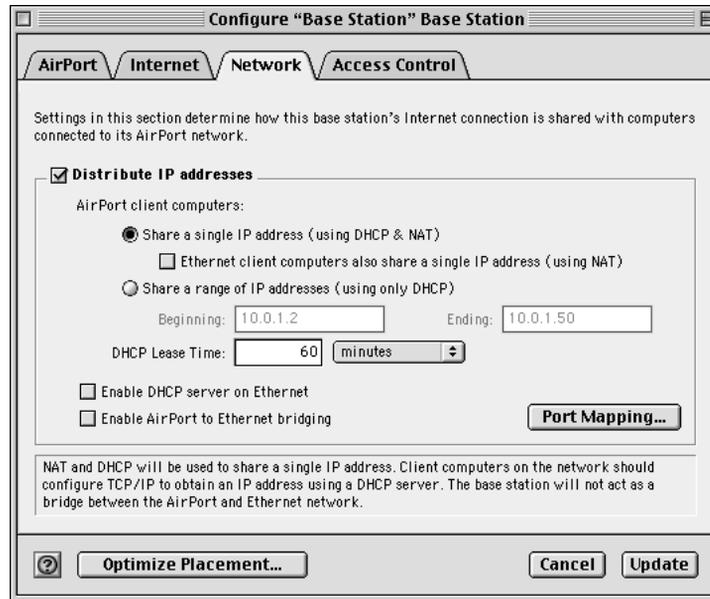
**Note:** With AirPort, you don’t need to use a third-party PPPoE connection application. You can connect to the Internet using AirPort software.

The screenshot shows the 'Configure "Base Station" Base Station' window with the 'Internet' tab selected. The 'Connect using' dropdown is set to 'PPP over Ethernet (PPPoE)'. The 'Configure PPPoE' section contains fields for 'User name', 'Service name', and 'Change password...', along with checkboxes for 'Always stay connected' and 'Automatically connect', and a 'Disconnect if idle' dropdown set to 'Never'. The 'Configure TCP/IP using PPPoE' section shows 'IP address: 192.42.249.12', 'Subnet mask: 255.255.255.0', 'Router address:', 'DNS servers:', and 'Domain name: earthlink.net'. A help icon and 'Optimize Placement...' button are at the bottom left, and 'Cancel' and 'Update' buttons are at the bottom right.

Contact your ISP for the information you should enter in these fields.

Contact your ISP for the information you should enter in these fields.

- 6 Click the Network tab and configure how the base station will share its Internet access with AirPort and Ethernet computers.



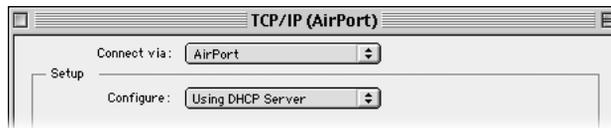
- To share a single Internet connection with AirPort computers, make sure the "Distribute IP addresses" checkbox and the "Share a single IP address (using DHCP & NAT)" button are selected. If you have been given a range of public IP addresses by your ISP, you can select the option to share a range of IP addresses (using only DHCP).
  - If you want to connect an AppleTalk Ethernet printer to the base station, or would like to use AppleTalk between computers using AirPort and computers using Ethernet, click the "Enable AirPort to Ethernet bridging" checkbox.
  - If you want to share Internet access with Ethernet clients, click the "Ethernet client computers also share a single IP address (using NAT)" checkbox.
- Important** Since the base station can provide network services, it must be set up carefully to avoid interfering with your broadband Internet service.
- Do not select "Enable DHCP server on Ethernet" or "Enable AirPort to Ethernet bridging" if you are using a cable modem for Internet access.
  - Do not select "Enable DHCP server on Ethernet" if your base station is configured to get its IP address using DHCP (in the Internet panel).

Enabling NAT lets you share a single Internet connection among several computers. Enabling DHCP lets the base station dynamically and automatically assign IP addresses to client computers, which simplifies each computer's TCP/IP configuration. Bridging allows devices and computers using Ethernet and computers using AirPort to communicate with each other using non-IP protocols like AppleTalk.

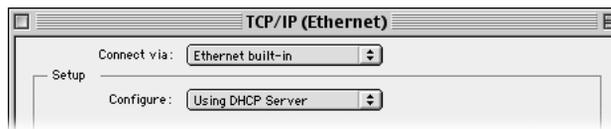
- 7 If you want to adjust optional advanced settings, go to "Step 3: Set Advanced Options" on page 28. If you are finished changing settings, click the Update button. Your computer transfers the new settings to the base station. When the transfer is complete, the base station restarts and its new settings are active.

### Setting Up Client Computers

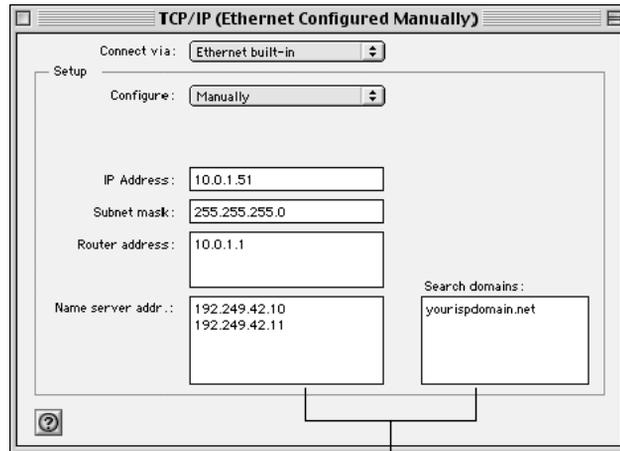
- To join your AirPort network, clients can use the AirPort application, AirPort Control Strip module, or AirPort Setup Assistant.
- Client computers using AirPort should configure TCP/IP by choosing AirPort from the "Connect via" pop-up menu and Using DHCP Server from the Configure pop-up menu.



- If you chose to enable a DHCP server on Ethernet in step 6, client computers using Ethernet should configure TCP/IP by choosing Ethernet from the "Connect via" pop-up menu and Using DHCP Server from the Configure pop-up menu.



- If you chose not to enable a DHCP server on Ethernet, you may still be able to share Internet access with Ethernet computers manually. Select the “Ethernet client computers also share a single IP address (using NAT)” checkbox in the Network panel in the AirPort Admin Utility. You can then configure TCP/IP manually on Ethernet computers as follows:



Contact your ISP for the information you should enter in these fields.

When you configure Ethernet clients manually for a base station that is providing NAT over Ethernet, you can use IP addresses in the range 10.0.1.51 to 10.0.1.254.

In the “Subnet mask” field, enter 255.255.255.0. In the “Router address” field, enter 10.0.1.1.

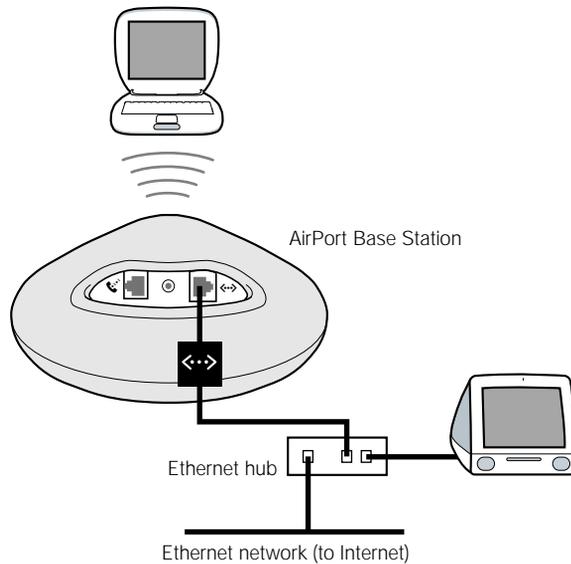
Enter the same name server address and search domain information that you entered in the base station configuration.

## You're Using an Existing Ethernet Network

You can use the AirPort Setup Assistant to set up the base station for Internet access through an Ethernet network. Use the AirPort Admin Utility if

- you want to share Internet access and exchange files with computers attached to the base station using Ethernet
- you want to enable other advanced base station settings

## What It Looks Like



## How It Works

- The base station uses your Ethernet network to communicate with the Internet.
- AirPort clients access the Internet and the Ethernet network through the AirPort Base Station.

## What You Need

Components	Check ✓	Comments
AirPort Base Station		
Ethernet hub		If you use an Ethernet hub, make sure you connect the cable from your Ethernet network to the hub's uplink port. Do not connect the AirPort Base Station to the uplink port.
Ethernet cables		

## What to Do

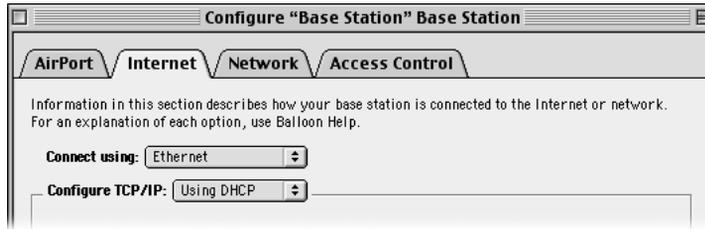
- 1 Open your base station's configuration in the AirPort Admin Utility. For more information on opening your base station's configuration, see "Notes on Using the AirPort Admin Utility" on page 8.
- 2 Click the Internet tab and choose Ethernet from the "Connect using" pop-up menu. You can configure TCP/IP manually or using DHCP. The one you choose depends on how IP addresses are provided on your Ethernet network. If you aren't sure, ask your network administrator.

Here's what you'll see if you configure TCP/IP manually (enter your own IP address information in the fields below the Configure TCP/IP pop-up menu):

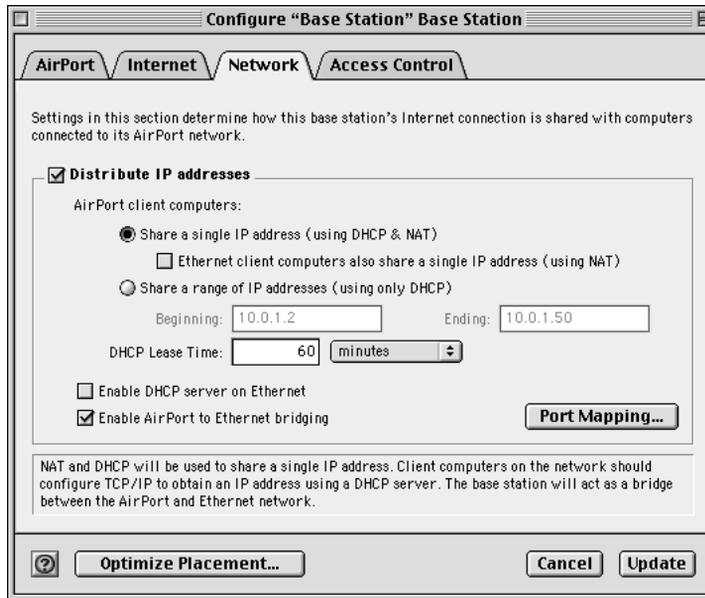
The screenshot shows the 'Configure "Base Station" Base Station' window with the 'Internet' tab selected. The 'Connect using' dropdown is set to 'Ethernet' and 'Configure TCP/IP' is set to 'Manually'. The IP address field is highlighted with a box and contains the value '192.42.249.12'. Other fields include Subnet mask (255.255.255.0), Router address, DNS servers, and Domain name. A callout box points to these fields with the text: 'Contact your network administrator for the information you should enter in these fields.'

**Note:** If you have already used the AirPort Setup Assistant to set up your AirPort Base Station, the fields below the Configure TCP/IP pop-up menu may already contain the appropriate information.

Here's what you'll see if you use DHCP:



- 3 Click the Network tab and select whether the base station will share its Internet access with AirPort computers.



- If you want to use the base station to share a single IP address, click the "Distribute IP addresses" checkbox and the "Share a single IP address (using DHCP & NAT)" button.
- If you want to share a range of public IP addresses, click the "Share a range of IP addresses (using only DHCP)" button.

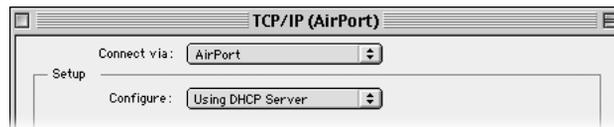
- If you don't want the base station to provide IP addresses (using DHCP or NAT) to AirPort computers, see "Using the AirPort Base Station as a Bridge" on page 28.

**Important** Since the base station can provide network services, you must set it up carefully to avoid interfering with other services on your Ethernet network.

- Do not select "Enable DHCP server on Ethernet" if your base station is configured using DHCP.
- 4 If you want to adjust optional advanced settings, go to "Step 3: Set Advanced Options" on page 28. If you are finished changing settings, click the Update button. Your computer transfers the new settings to the base station. When the transfer is complete, the base station restarts and its new settings are active.

### Setting Up Client Computers

- To join your AirPort network, clients can use the AirPort application, AirPort Control Strip module, or AirPort Setup Assistant.
- Client computers using AirPort should configure TCP/IP by choosing AirPort from the "Connect via" pop-up menu and Using DHCP Server from the Configure pop-up menu.



## Step 3: Set Advanced Options

### Using the AirPort Base Station as a Bridge

You can turn off the base station's Internet sharing features (providing IP addresses to AirPort computers using DHCP or NAT) and use it as a bridge, connecting the AirPort network to a wired Ethernet network. AirPort computers have access to all the services of the Ethernet network, but the base station does not provide any Internet sharing services.

Using the base station as a bridge can be a way to address incompatibilities between the base station's Internet sharing features and your ISP's connection method.

To set up the base station as a bridge:

- 1 Open the AirPort Admin Utility and open your base station's configuration.
- 2 Click the Network tab.
- 3 Remove the checkmark from the "Distribute IP addresses" checkbox.

### Setting Up Roaming

Multiple AirPort Base Stations can be set up to create a single wireless network (a process known as "roaming"). Client computers using AirPort can move from base station to base station with no interruption in service.

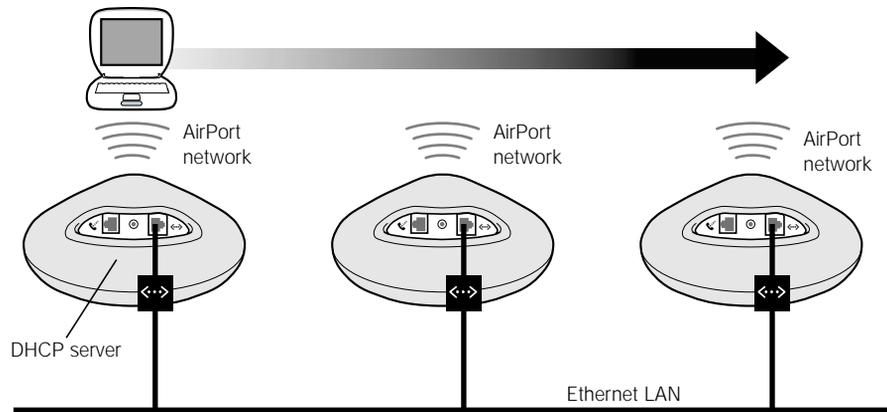
To set up roaming:

- 1 Connect all of the AirPort Base Stations to the same subnet on your Ethernet network.
- 2 Give the same network name and password to each AirPort Base Station.
- 3 Set up the base stations as bridges, following the instructions in the previous section.
- 4 To optimize performance, set the base station density to High, Medium, or Low, depending on how far apart the base stations are from each other (see "Setting Base Station Density" on page 29).

If you want the AirPort Base Station to assign IP addresses using DHCP, also do the following:

- 1 Set up one base station to act as the DHCP server. Set up the other base stations as bridges, following the instructions in the previous section.
- 2 Make sure that the base station set to act as the DHCP server assigns a range of real IP addresses. The private IP addresses used by NAT cannot be used for roaming.

- 3 Make sure that the “Enable DHCP server on Ethernet” checkbox is selected in the Network panel of the AirPort Admin Utility for the one base station acting as the DHCP server.



### Setting Base Station Density

If you're setting up multiple base stations to create a single wireless network (see “Setting Up Roaming,” above), you can improve performance by setting base station density. This setting tells AirPort computers that are in motion to look for and switch to a new base station's signal when the signal strength of the station it is connected to goes below a certain level.

For example, in networks with base stations that are close together, setting base station density to High achieves higher transfer rates by forcing a client to look for a new base station when the signal of the base station it is connected to goes below 11 Mb/s.

Set base station density in the AirPort panel in the Admin Utility.

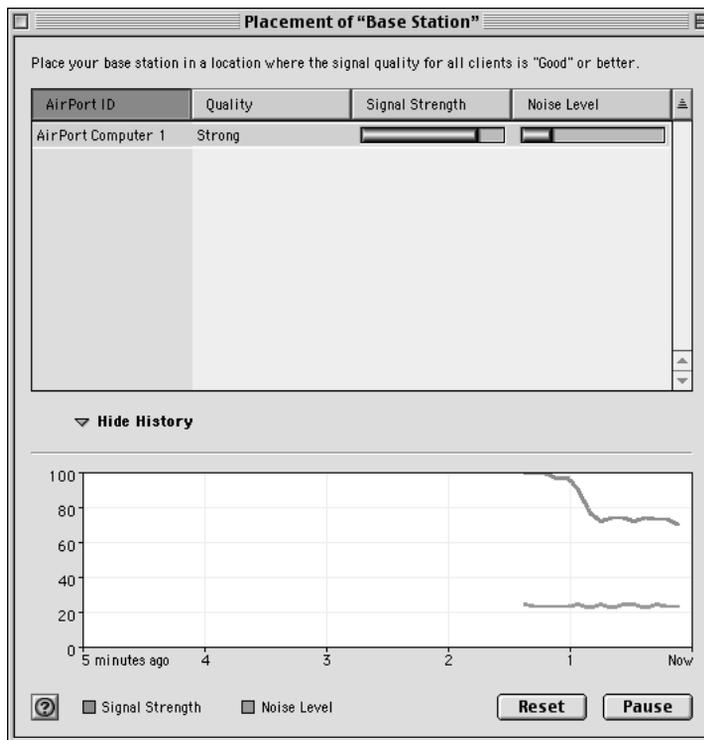
In general, if the base stations in your roaming network are within about 30 meters of each other, set the base station density to High; if they are within about 60 meters, set it to Medium; and if they are within about 120 meters, set it to Low.

## Optimizing Base Station Placement

The AirPort Admin Utility lets you monitor the signal quality of the AirPort computers that have joined your base station's AirPort network. You can use these measurements to determine the best location for your AirPort Base Station.

To optimize placement of your base station:

- 1 Open the AirPort application on all client computers.
- 2 Open the AirPort Admin Utility and open your base station's configuration.
- 3 In the AirPort panel, click Optimize Placement, then click the Show History triangle.
- 4 Monitor the signal quality for all the AirPort computers. Reposition the base station to get the best possible quality for all computers.



## Setting Up Access Control

Access control lets you specify which computers can send or receive information through the base station to the wired network.

Each AirPort-equipped computer has a unique AirPort ID (sometimes known as the “MAC address”). To find the AirPort ID of your computer’s AirPort Card, open the AirPort application and click the Settings triangle. You can restrict access by creating an access control list that includes only the IDs of computers to which you want to give access to your wired network.

To set up the access control list, open your base station’s configuration in the AirPort Admin Utility and click the Access Control tab.

**Important** AirPort access control prevents computers that aren’t on the access control list from accessing the wired network attached to the base station. It does not prevent computers from joining the AirPort wireless network. For information on how to prevent unauthorized computers from joining the AirPort network, see “Step 1: Set Up the AirPort Network” on page 9.

You can also add the MAC address of a third-party 802.11 wireless networking card to the access control list. Most third-party cards have the MAC address on a label attached to the metal case of the card.

## Setting Multicast Rate

Setting the multicast rate controls the speed at which the base station transmits multicast and broadcast packets. This is useful if you’re using an application with multicast, such as certain audio/video streaming servers, and you want to control the quality of the transmission.

If you set the multicast rate to a high setting, only clients on the network that are within range and are capable of achieving the speed you set will receive transmissions. You can also set the multicast rate to 1 Mb/s to extend the range of your network beyond the default.

Set the multicast rate in the AirPort panel in the Admin Utility.

**Note:** Higher multicast rates can only be set if the base station density (see “Setting Base Station Density” on page 29) is set to Medium or High, which limits the range of the base station.

## Interference Robustness

If a microwave oven near your base station is used frequently and you experience reliability or performance problems, turn on interference robustness.

Set interference robustness in the AirPort panel in the Admin Utility.

## Using Port Mapping

AirPort uses Network Address Translation (NAT) to share a single IP address with the computers that join the AirPort network. To provide Internet access to multiple computers with one IP address, NAT assigns private IP addresses to each computer on the AirPort network, then matches these addresses with port numbers. The base station creates a port-to-private IP address table entry when a computer on your AirPort (private) network sends a request for information to the Internet.

If you are running a Web, AppleShare, or FTP server on your AirPort network, other computers initiate communication with your server. Since the base station has no table entries for these requests, it has no way of directing the information to the appropriate computer on your AirPort network.

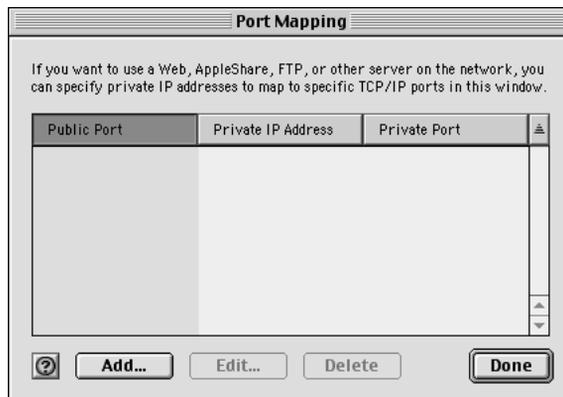
To ensure that requests are routed to your Web, AppleShare, or FTP server properly, you need to establish a permanent IP address for your server and provide inbound port mapping information to the AirPort Base Station.

To set up inbound port mapping:

- 1 Open the AirPort Admin Utility and open your base station's configuration.
- 2 Click the Network tab.
- 3 Click the Port Mapping button.

In the Port Mapping window, click Add and enter the following information:

- *Public Port:* The port number other computers will use to access the services provided by your computer. For example, computers look for Web services on port 80.
- *Private IP Address:* The manually assigned, private IP address of your computer.
- *Private Port:* The port that will be used on your computer to provide services. In most cases, you can use the same number as the public port.



To use port mapping, you must configure TCP/IP manually on the computer that is running the Web, AppleShare, or FTP server.

### Setting DHCP Lease Time

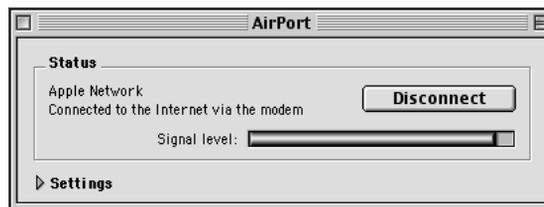
Set the DHCP lease time to control the amount of time that an IP address will be valid for a computer. This feature is especially useful in education and other environments where users change frequently. Using very short leases, DHCP can dynamically reconfigure networks in which there are more computers than available IP addresses.

Set the DHCP lease time in the Network panel in the Admin Utility.

### Solving Problems

If you have trouble connecting to the Internet with any AirPort network design, try the following:

- Make sure the base station is connected to the Internet using the AirPort application. The computers on your AirPort network cannot connect to the Internet if your base station is not connected to the Internet.



- Check your Internet connection using your computer. If you can't connect with your computer, the problem may be with your Internet connection.
- Check the TCP/IP control panel on your computer. Your IP address should begin with the number 10. If it begins with 169, then you are not receiving an IP address from the AirPort Base Station. Either the base station is not configured to provide these services, or your computer is not communicating with the base station.
- Check that computers using AirPort have AirPort selected in the "Connect via" pop-up menu in the TCP/IP control panel, and that computers using Ethernet have Ethernet selected.
- On computers using AirPort, open the AirPort application and check to make sure that the computer has joined the AirPort network created by your base station.
- Restart your computer. This renews the IP address you receive from the base station.
- Make sure that the "Distribute IP addresses" checkbox is selected in the Network panel of the AirPort Admin Utility.



## Behind the Scenes

Using AirPort is easy. Just join your AirPort network, open a Web browser or email application, and you're on the Internet. But to exploit all the power and flexibility of AirPort, you may want to move your computer between different AirPort networks, or give your friends temporary access to your AirPort network. As a result, you may need to change the networking settings on your computer or your base station.

If you make frequent changes, it helps to be aware of network settings and what they mean.

Configuring your computer involves two steps:

- 1 Selecting a network (Ethernet or AirPort).

You select an Ethernet network by connecting a cable to your computer. You select an AirPort network by choosing it in the AirPort application or AirPort Control Strip module. Once you are connected to either type of network, they work in the same way.

- 2 Configuring IP.

To configure your computer to access the network, you choose the appropriate networking interface and define your IP address.

Configuring your base station requires a few more settings than your computer, but it involves many of the same principles. To help you understand these settings, this chapter contains information on the following topics:

- Networking basics
- Configuring your computer for IP connections
- AirPort networking

## Networking Basics

### Packets and traffic

Information travels across a network in chunks called “packets.” Each packet has a “header” that tells where the packet is from and where it’s going, like the address on the envelope when you send a letter. The flow of all these packets on the network is called “traffic.”

### How Information Reaches Its Destination

#### Hardware addresses

Your computer “listens” to all of the traffic on its local network and selects the packets that belong to it by checking for its hardware address (also called the “media access control” or “MAC” address) in the packet header. This address is a number unique to your computer.

Every hardware product used for networking is required to have a unique hardware address permanently embedded in it. Your AirPort Card’s number is called the AirPort ID.

#### IP addresses

Since the Internet is a network of networks (connecting millions of computers), hardware addresses alone are not enough to deliver information on the Internet. It would be impossible for your computer to find its packets in all the world’s network traffic, and impossible for the Internet to move all traffic to every network.

So your computer also has an IP (Internet Protocol) address that defines exactly where and in what network it’s located. IP addresses ensure that your local Ethernet network only receives the traffic intended for it. Like the hierarchical system used to define zip codes, street names, and street numbers, IP addresses are created according to a set of rules, and their assignment is carefully administered.

The hardware address is like your name; it uniquely and permanently identifies you. But it doesn’t offer any clues about your location, so it’s only helpful in a local setting. An IP address is like your street address, which contains the information that helps letters and packages find your house.

### Rules for Sending Information (Protocols)

A protocol is a set of rules that define how communication takes place. For instance, a networking protocol may define how information is formatted and addressed, just as there’s a standard way to address an envelope when you send a letter.

## Important Networking Devices

### **Bridges**

A bridge joins two networks at the hardware level. Other protocols see the two networks as the same.

### **Routers**

A router connects two IP networks. In contrast to a bridge, which joins networks at the hardware level, a router directs network IP traffic based on information stored in its routing tables. A routing table matches IP addresses with hardware addresses. The router stamps each incoming IP packet with the hardware address that corresponds to that IP address. As a result, the packet can be picked up by the right computer on the hardware network.

### **DNS (Domain Name Server)**

Networks (domains) on the Internet have names that correspond to their IP addresses. A Domain Name Server maintains a list of domain names and their corresponding addresses. This is why you can go to Apple's Web site by entering `www.apple.com`, instead of the IP address.

## Important Networking Terms

### **TCP/IP (Transport Control Protocol/Internet Protocol)**

TCP/IP is a collection of protocols that underlies almost every form of communication on the Internet.

### **DHCP (Dynamic Host Control Protocol)**

DHCP is a method of automatically assigning IP addresses. Instead of assigning addresses to individual users, addresses are assigned by the DHCP server when clients need them. This means that instead of entering several fields of long addresses, users need only to select DHCP as their configuration method for IP networking.

### **PPP (Point-to-Point Protocol)**

PPP is the most common protocol for providing IP services over a dialup modem.

### **PPPoE (Point-to-Point Protocol over Ethernet)**

PPPoE is a protocol used on some DSL lines for providing IP services. It allows DSL network providers to bill customers using their existing PPP equipment. If your ISP provided you with PPPoE connection software, such as EnterNet or MacPoET, then you connect via PPPoE. With AirPort, you do not need to use a third-party PPPoE application.

### **NAT (Network Address Translation)**

NAT is used to share one IP address among several computers. A device set up as a NAT router uses a collection of “private” IP addresses (in the range 10.0.1.2 to 10.0.1.254) to allow several computers to access the Internet using one “public” IP address. When a computer using a private IP address requests information from the Internet, the NAT router keeps a record of the computer making the request, and sends the information to the Internet using its own IP address. When the response comes back from the Internet, the NAT router forwards the packet to the appropriate computer.

### **IP subnet**

An IP subnet is a local network as defined by IP network numbers. Connecting to a subnet involves connecting to the appropriate hardware network and configuring IP for that network.

## **Configuring Your Computer for IP Connections**

To set up your computer for IP connections, you need to make sure your computer is connected to the right network and make sure that IP is configured correctly.

### **Selecting a network**

With an Ethernet network, you choose the network by connecting an Ethernet cable to the Ethernet port on your computer.

With AirPort, you use the AirPort application or Control Strip module to choose an available AirPort network.

### **Configuring IP**

Configuring IP consists of two steps: selecting a networking interface and selecting a configuration method.

You choose a networking interface from the “Connect using” pop-up menu in the TCP/IP control panel. Choose Ethernet if you are connecting to an Ethernet network. Choose AirPort if you are connecting to an AirPort network.

You choose the configuration method from the Configure pop-up menu in the TCP/IP control panel. The three most frequently used methods are PPP, DHCP, and Manually.

- PPP is used for dialup connections to the Internet.
- DHCP is used frequently on Ethernet networks and by DSL or cable modem providers.
- Manual configurations are used on Ethernet networks and sometimes by DSL and cable modem providers. Your network administrator or ISP should provide you with the appropriate configuration information.

If you have trouble connecting to the Internet, check these two items on your computer first.

## Software Used for IP Networking

You'll frequently use several control panels on your computer for networking. Here's what each is used for:

### **TCP/IP control panel**

Use the TCP/IP control panel to configure your computer for IP networking. The information in this control panel must be correct to connect to the Internet.

To configure hardware, use the "Connect via" pop-up menu.

To configure IP settings, use the remaining fields of the control panel.

### **AppleTalk control panel**

AppleTalk is a protocol used on local networks. If you're on a network that uses AppleTalk, you can use the AppleTalk control panel to specify the interface to be used for AppleTalk networking. For consistent IP networking, this should be set to use the same interface as the TCP/IP control panel.

### **Remote Access control panel**

You use the Remote Access control panel to specify the phone number, user name, and password for making a dialup Internet connection with your computer. If you use a dialup connection to the Internet, the AirPort Setup Assistant transfers the settings in your Remote Access control panel to the base station. You do not use the Remote Access control panel when you are connecting via AirPort.

### **Location Manager control panel**

You can use the Location Manager control panel to manage sets of TCP/IP, AppleTalk, and Remote Access control panel configurations. For more information about the Location Manager, see Mac Help in the Help menu.

## AirPort Networking

### Software Used for AirPort Networking

#### **AirPort application**

You use the AirPort application to

- turn AirPort on or off
- monitor the signal quality of the AirPort wireless connection
- find the AirPort ID (hardware address of your AirPort Card)
- see the connection status of an AirPort Base Station that is configured for a dialup ISP
- select an AirPort network
- configure a software base station
- create or join a Computer-to-Computer network
- enable the selection of closed networks

#### **Airport Control Strip module**

You can use the AirPort Control Strip module to

- turn AirPort on or off
- monitor the signal quality of the AirPort wireless connection
- select an AirPort network
- open the AirPort application
- create or join a Computer-to-Computer network

#### **AirPort Admin Utility**

You use the AirPort Admin Utility to set optional advanced settings. The AirPort Admin Utility

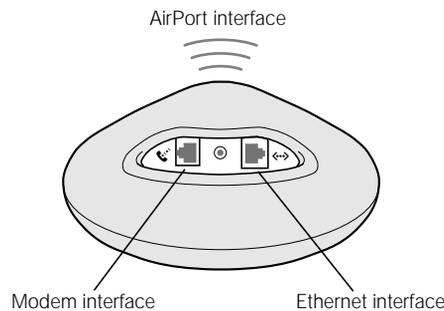
- downloads the base station configuration to your computer
- lets you modify the configuration on your computer
- uploads the modified configuration to the base station
- upgrades the base station software

## Using the AirPort Base Station

### Base station interfaces

To configure the AirPort Base Station, you configure how its networking interfaces will be used. The AirPort Base Station has three hardware networking interfaces:

- *AirPort interface:* The AirPort interface creates an AirPort network for AirPort-equipped computers to join. The base station can provide IP services like DHCP and NAT over this interface. The base station cannot use the AirPort interface to establish a connection with the Internet.
- *Modem interface:* The modem interface is used to establish PPP connections to the Internet. These connections provide IP services to the base station.
- *Ethernet interface:* The Ethernet interface can both provide IP services to local Ethernet clients and connect to the Internet.



### Base station functions

- *Bridge:* By connecting an AirPort network to an Ethernet network, the base station operates as a bridge.

The AirPort Base Station is not configured as a bridge by default. If you want to use the base station in this way, you must use the AirPort Admin Utility to change the base station configuration. See Chapter 2 for more information.

- *NAT router:* One of the most powerful features of the AirPort Base Station is its ability to share one Internet connection with multiple computers. To provide this service, the base station acts as a router. The base station can be configured to provide both bridging services and routing services at the same time.
- *DHCP server:* When you configure the base station to act as a DHCP server, it provides IP addresses to client computers that are configured to obtain IP addresses using DHCP. Using DHCP makes IP configuration simple for client computers, since they don't need to enter their own IP information.

## Configuring AirPort Base Station Internet Access

Like your computer, the AirPort Base Station must be configured with the appropriate hardware and IP networking information to connect to the Internet. To provide the Internet configuration information, you can use the AirPort Setup Assistant to transfer your computer's Internet settings to the base station. The Setup Assistant then uses a series of questions to determine how the base station's other interfaces should be configured.

To set up more complex configurations, use the AirPort Admin Utility and follow the instructions in Chapter 2.