Designing
AirPort Networks

Contents

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 instead of your computer. 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. Settings include optimizing base station placement and using the base station as a bridge between your AirPort network and an Ethernet network.

The AirPort Setup Assistant

For initial setup of your base station, use the AirPort Setup Assistant. The Setup Assistant walks you through the base station setup process, transfers the Internet settings from your computer to the AirPort Base Station, and sets up your computer to use AirPort.

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

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 one or two quick adjustments to your base station configuration, like adding a new phone number for your ISP.

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 are configuring a base station that you are attaching to an existing Ethernet network.
- You need to upgrade the base station software.
- You need to configure advanced base station settings like channel frequency, closed networks, access control, or port mapping.

2

AirPort Network Designs

Configuring your base station involves three basic steps:

1   Set up the AirPort network.

Here you name the network your base station will create, and set some 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 dial-up Internet service provider (ISP)
- using a DSL modem or cable modem
- through an existing Ethernet network

3   Set advanced options.

Finally, you can fine-tune your network design by

- optimizing placement of the base station
- setting access control
- setting up port mapping
- using the base station as a bridge
- setting up roaming

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

Make sure that you have set up your computer and base station with the Setup Assistant before you use the AirPort Admin Utility. To modify the base station configuration, you first need to 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 selected 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 appears saying that you can't open the base station's configuration:

1 Make sure that you have selected 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, refer to 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. If you need to change the channel frequency of your AirPort network, or you would like to create a closed network, you should use the AirPort Admin Utility.
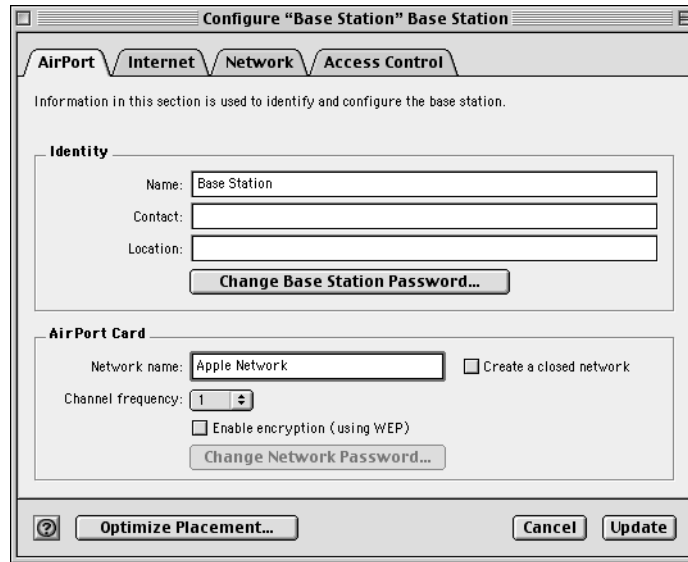
To set up the AirPort network, open your base station's configuration in the AirPort Admin Utility and fill in the information in the AirPort panel.

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.

Naming the AirPort Network

Give your AirPort network a name. This is what appears in the AirPort application and Control Strip module on the AirPort computers that join your AirPort network.

Creating a Network Password

To keep your network private, click the "Enable encryption (using WEP)" checkbox to require users to enter a password to join your network. The default password is *public.* To change the password, click "Change Network Password."

Changing the Channel Frequency

The channel frequency 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), it is unlikely that you will need to change the channel frequency. If you are setting up multiple base stations in a school or office, you should use different channel frequencies for base stations that are within approximately 150 feet of each other.

Adjacent base stations should have at least 3 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.

Note: 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, client computers must follow these steps:

1 Click the settings triangle in the AirPort application.

2 Select the "Allow closed networks" checkbox.

3 Select "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 Dial-up Internet Service Provider (ISP)

In most circumstances, 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

- you are connecting the base station to a previously established Ethernet network that has a DHCP server

Note: The AirPort Base Station is not compatible with America Online or ISPs that use nonstandard connection methods.

What It Looks Like

AirPort Base Station

Ethernet hub

Phone jack (to Internet)
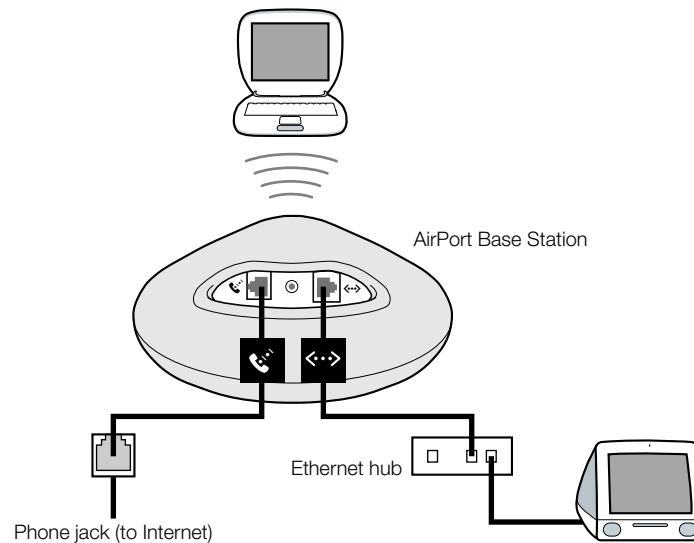
How It Works

- 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.

- With AirPort-to-Ethernet bridging enabled, AirPort and Ethernet computers can communicate with each other through the base station using AppleTalk.

What You Need

Components	Check √	Comments
Working dial-up ISP account using standard PPP	Make sure you have the following: ■ ISP phone number ■ account name and password ■ DNS address	You can get this information from the Remote Access control panel and the TCP/IP control panel on the computer you use to access the Internet. If you do not have DNS information in the TCP/IP control panel on your computer, 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 cables		If you only want to add one computer to your network using Ethernet, you can use an Ethernet crossover cable to connect it directly to the base station.
Ethernet hub		If you want to add more than one computer using Ethernet, use 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, 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.

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

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

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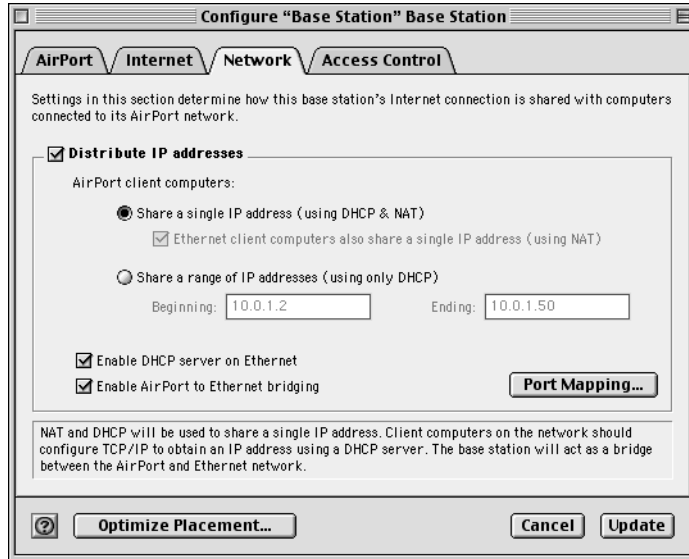
■ To share Internet access over Ethernet, click the "Ethernet client computers also share a single IP address (using NAT)" and "Enable DHCP server on Ethernet" checkboxes.

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 click 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 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 using non-IP protocols like AppleTalk.

4 If you want to adjust optional advanced settings, go to "Step 3: Set Advanced Options" on page 26. 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.

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 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 chose not to enable a DHCP server on Ethernet, you may still be able to share Internet access with Ethernet computers manually. To share Internet access with Ethernet computers, 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:

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┌─────────────────────────────────────────────────────────────┐
│ □ ═══════════ TCP/IP (Ethernet Configured Manually) ═══════ ▤ │
│                                                               │
│        Connect via: [ Ethernet built-in      ▲▼ ]            │
│   ┌─ Setup ────────────────────────────────────────────────┐ │
│   │     Configure: [ Manually              ▲▼ ]            │ │
│   │                                                         │ │
│   │                                                         │ │
│   │     IP Address: [ 10.0.1.51          ]                 │ │
│   │    Subnet mask: [ 255.255.255.0      ]                 │ │
│   │  Router address: [ 10.0.1.1          ]                 │ │
│   │                                        Search domains:  │ │
│   │  Name server addr.: [ 192.249.42.10 ]  [ yourispdomain.net ] │ │
│   │                     [ 192.249.42.11 ]                  │ │
│   │                                                         │ │
│   └─────────────────────────────────────────────────────────┘ │
│   ⊚                                                           │
└─────────────────────────────────────────────────────────────┘
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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 services over Ethernet, you can use IP addresses in the range from 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.

Important The AirPort Base Station is not currently compatible with ISPs that use PPP over Ethernet (PPPoE) or DHCP Client IDs. For more information about your ISP's connection methods, contact your ISP

What It Looks Like
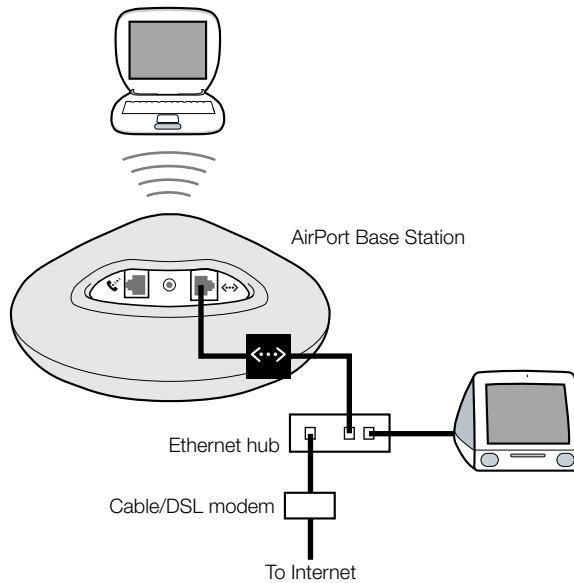
How It Works

- 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		Make sure you connect your cable modem or DSL modem to the uplink port on your Ethernet hub.
Ethernet cables		If you only want to add one computer to your network using Ethernet, you can use an Ethernet crossover cable to connect it directly to the base station.

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 from the "Connect using" pop-up menu, and choose Manually or Using DHCP from the Configure TCP/IP pop-up menu. The one you choose depends on how your ISP provides IP addresses. If your ISP provided you with an IP address and several other numbers with your subscription, you should 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 (you should enter your own IP address information in the fields below the Configure TCP/IP pop-up menu):

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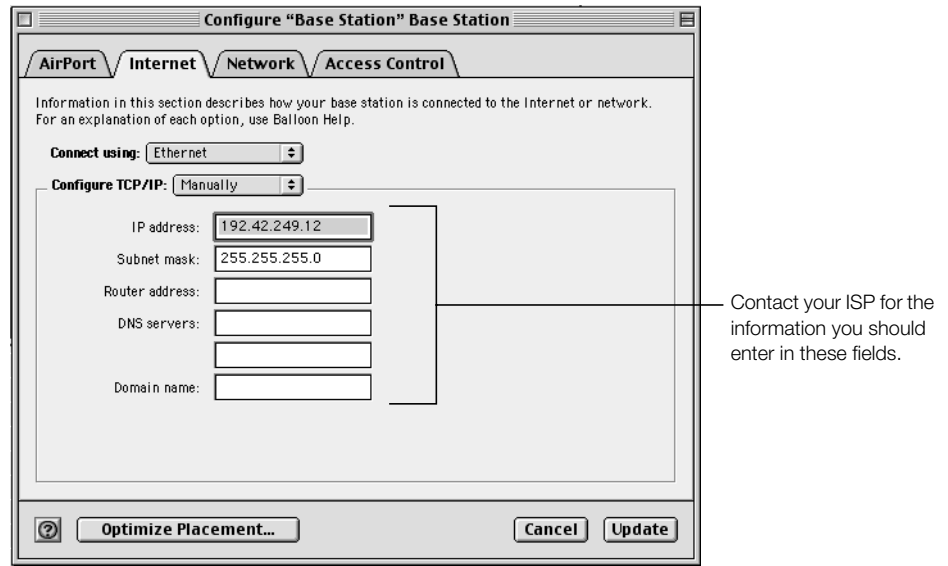
Note: If you have already used the AirPort Setup Assistant to set up your AirPort Base Station, the fields below the Configure TCP/IP pop-up menu may already contain the information appropriate for your ISP.

Or using DHCP:
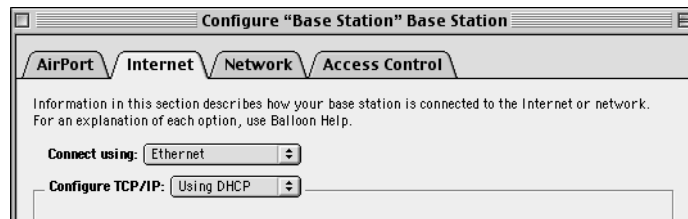
4 Click the Network tab and configure how the base station will share its Internet access with AirPort and Ethernet computers.
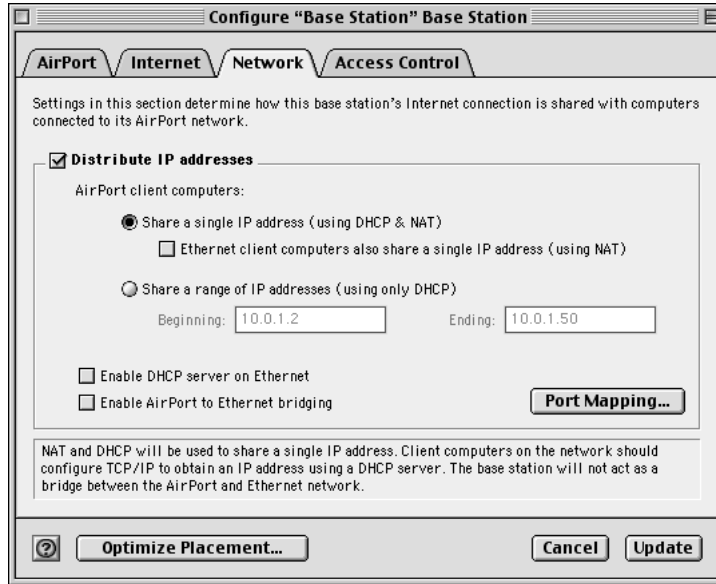
- To share a single Internet connection with AirPort computers, make sure the "Distribute IP addresses" checkbox and the "Share a single IP address (using DHCP & NAT)" button are selected. If you have been given a range of public IP addresses by your ISP, you can select the option to share a range of 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.

5   If you want to adjust optional advanced settings, go to "Step 3: Set Advanced Options" on page 26. 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.
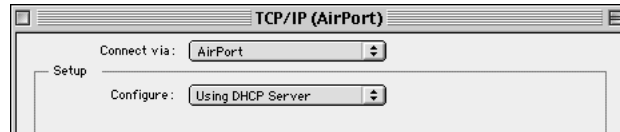
- If you chose to enable a DHCP server on Ethernet in step 4, client computers using Ethernet should configure TCP/IP by choosing Ethernet from the "Connect via" pop-up menu and Using DHCP Server from the Configure pop-up menu.

If you chose not to enable a DHCP server on Ethernet, you may still be able to share Internet access with Ethernet computers manually. To share Internet access with Ethernet computers, 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:

```
┌─────────────────TCP/IP (Ethernet Configured Manually)─────────────────┐
│  □  ═══════════════════════════════════════════════════════════  ▤  │
│                                                                        │
│          Connect via:  [ Ethernet built-in    ◆]                      │
│     ┌─ Setup ──────────────────────────────────────────────────       │
│                                                                        │
│           Configure:  [ Manually           ◆]                         │
│                                                                        │
│                                                                        │
│          IP Address:  [ 10.0.1.51                    ]                 │
│         Subnet mask:  [ 255.255.255.0                ]                 │
│       Router address: [ 10.0.1.1                     ]                 │
│                                                                        │
│                                                    Search domains:     │
│      Name server addr.: [ 192.249.42.10 ]        [ yourispdomain.net ] │
│                         [ 192.249.42.11 ]        [                   ] │
│                                                                        │
│  ⊚                                                                     │
└────────────────────────────────────────────────────────────────────────┘
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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 from 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

AirPort Base Station

Ethernet hub

Ethernet network (to Internet)
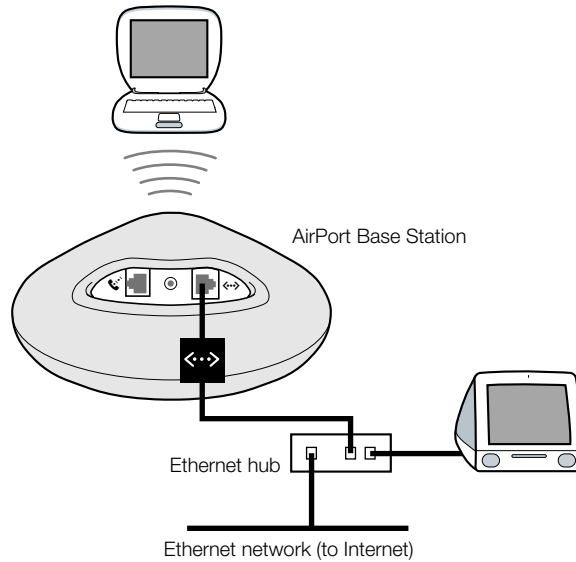
How It Works

- 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 that connects to your Ethernet network to the uplink port. Do not connect the AirPort Base Station to the uplink port on your Ethernet hub.
Ethernet cables		

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 (you should enter your own IP address information in the fields below the Configure TCP/IP pop-up menu):
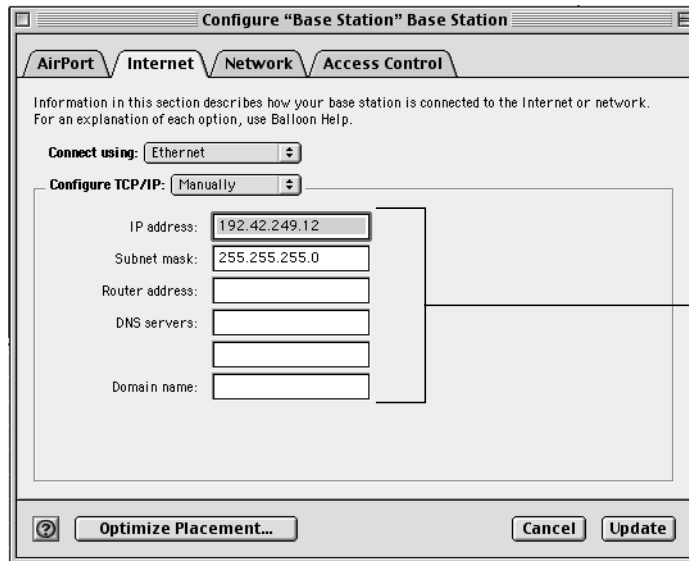
Contact your network administrator for the information you should enter in these fields.

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.

Or using DHCP:
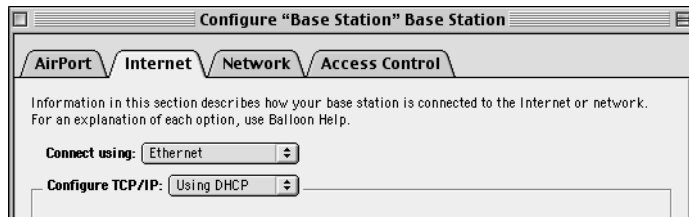
3 Click the Network tab and select whether the base station will share its Internet access with AirPort computers.
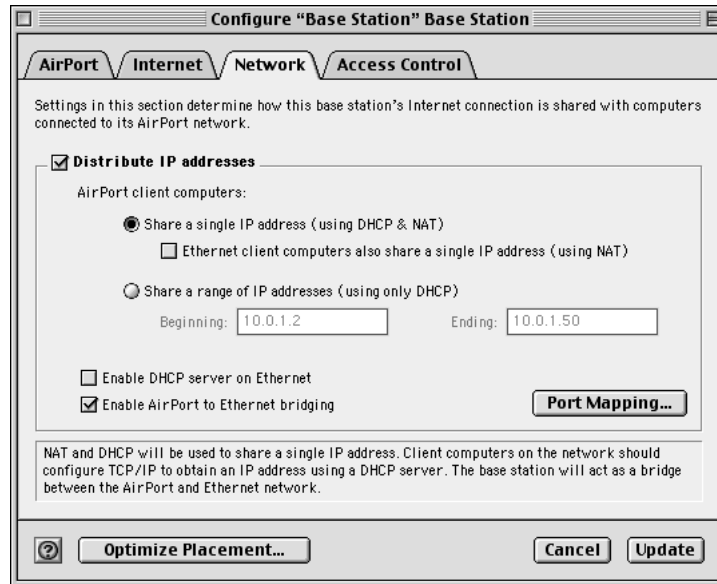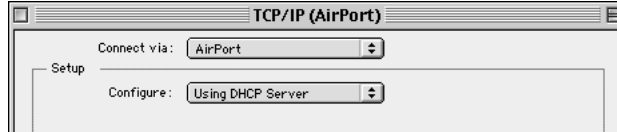

- If you want to use the base station to share a single IP address, click the "Distribute IP addresses" checkbox and the "Share a single IP address (using DHCP & NAT)" button.

- 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 services to AirPort computers, see "Using the AirPort Base Station as a Bridge" on page 26.

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 26. 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.

- 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 and use it as a bridge, connecting the AirPort network to a wired Ethernet network. Used in this way, 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 may also be one way to deal with potential 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 check 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"). As a result, 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.

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.
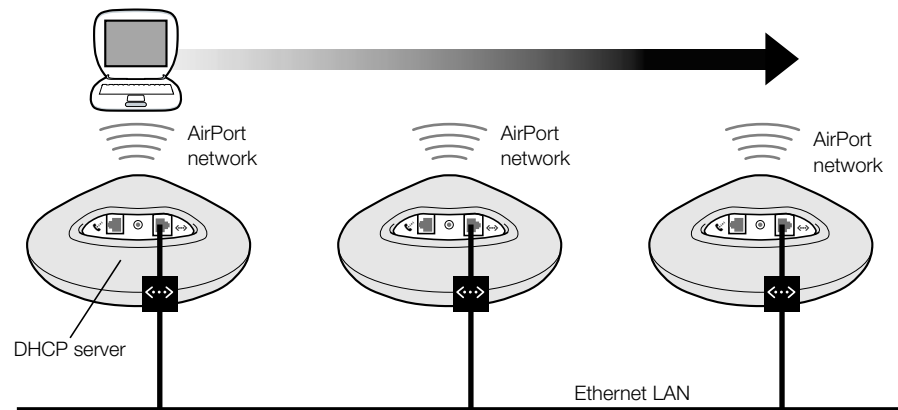
Optimizing Base Station Placement

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.
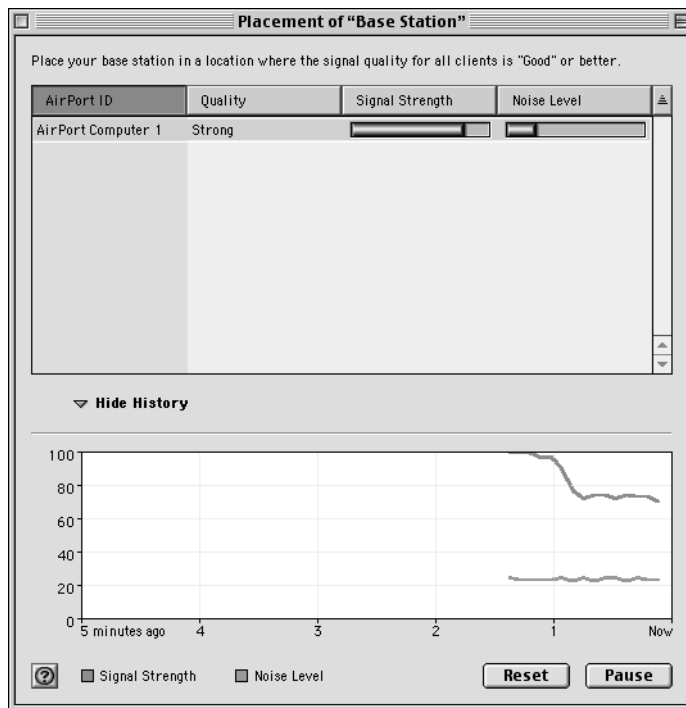
Setting Up Access Control

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 (also 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.

Note: 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.

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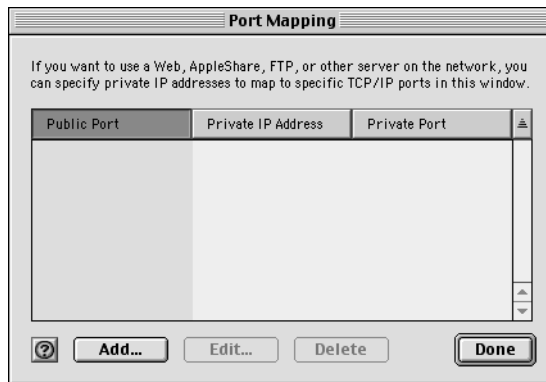
To use port mapping, you must configure TCP/IP manually on the computer that is running the Web, AppleShare, or FTP server.

Note: You do not have to turn off DHCP in order to manually assign a private IP address to one computer on your AirPort network.

Solving Problems

If you are having trouble connecting to the Internet with any of the AirPort network designs, 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.
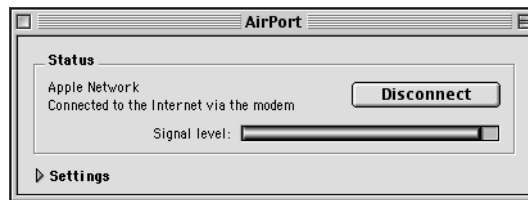
- Check your Internet connection using your computer. If you can't connect with your computer, the problem may be with your Internet connection.

- Check the TCP/IP control panel on your computer. You should have an IP address that begins with the number 10. If you have an IP address that begins with "169," then you are not receiving an IP address from the AirPort Base Station. This means that 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 might 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 do make frequent changes, it helps to be aware of the various network settings and what they mean.

Configuring your computer involves two important 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 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 networking
- 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, similar to what you write 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. As a networking product, your AirPort Card has a similar number 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.

Put another way, 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. This means that as far as other protocols are concerned, the two networks are 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 modem.

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 both 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 basic steps: selecting a networking interface, and selecting a configuration method.

You select a networking interface in the TCP/IP control panel using the "Connect via" pop-up menu. You should select Ethernet if you are connecting to an Ethernet network, and AirPort if you are connecting to an AirPort network.

To choose the configuration method, use 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 dial-up 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 for networking on your computer. 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 dial-up Internet connection with your computer. If you use a dial-up 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

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 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 dial-up ISP
- select an AirPort network
- configure a software base station
- switch to computer-to-computer mode
- 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
- switch to computer-to-computer mode

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

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:*   Whereas the AirPort interface can only provide IP services locally and the modem interface can only establish connections to the Internet, the Ethernet interface can be configured both to provide IP services to local Ethernet clients, and to connect to the Internet.

AirPort interface

Modem interface   Ethernet interface
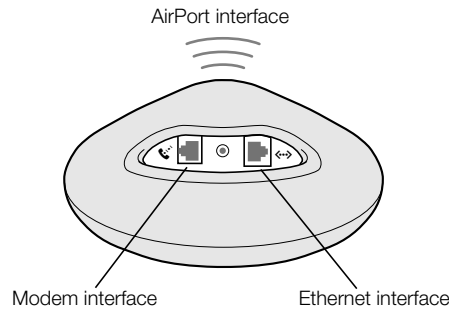
Base station functions

- *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 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.