



# Designing AirPort Extreme Networks



# Contents

<b>Chapter 1</b>	<b>5 Getting Started</b>
	5 About AirPort
	6 How AirPort Works
	6 How Wireless Internet Access Is Provided
	7 Configuring AirPort Extreme Base Station Internet Access
	7 AirPort Setup Assistant
	7 AirPort Admin Utility
	8 Extending the Range of Your AirPort Network
	8 Printing Via an AirPort Extreme Base Station
	8 Sharing Your Computer's Internet Connection
<b>Chapter 2</b>	<b>11 Network Basics</b>
<b>Chapter 3</b>	<b>15 AirPort Extreme Network Designs</b>
	16 Using the AirPort Setup Assistant
	16 Using AirPort Admin Utility
	17 Setting Up the AirPort Network
	21 Configuring and Sharing Internet access
	40 Setting Advanced Options
	52 Solving Problems
	52 More Information About AirPort
<b>Chapter 4</b>	<b>53 Behind the Scenes</b>
	53 Basic Networking
	56 Using the AirPort Extreme Base Station
	57 Items That Can Cause Interference With AirPort



## About AirPort

AirPort offers an easy and affordable way to provide wireless Internet access and networking anywhere in the home, classroom, or office. Instead of using traditional cables to create a network, AirPort uses wireless local area network (LAN) technology to provide wireless communication between computers. Through a wireless network you can access the Internet, share files, play multiplayer games, and more.

Using AirPort technology, you can:

- Create a wireless network in your home or school using an AirPort Extreme Base Station, then connect to the Internet and share the connection among several computers simultaneously. An entire family or classroom can be on the Internet at the same time.
- Set up a wireless connection to your standard computer network. AirPort-equipped computers can then have access to an entire network without being connected with a cable.
- Connect multiple computers in a wireless “Computer-to-Computer” network so that you can share files or play network games.

You can set up an AirPort Extreme Base Station and connect to the Internet without wires in minutes. But since the AirPort Extreme 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.

**Note:** Some of the AirPort features described in this book are available only in Mac OS X version 10.2.3 or later. If you are using an earlier version of Mac OS X, images shown in this book may be slightly different from what you see on your screen.

## How AirPort Works

Traditionally, sharing files and information between computers required them to be connected by wires. With AirPort, the data is transferred between computers using radio waves through a wireless network.

There are two ways to create a wireless network:

- You can use an AirPort-equipped computer to create a temporary “Computer-to-Computer” network, which other AirPort-equipped computers within range can join.
- You can create a more permanent wireless network using a base station. In this kind of network, all wireless communication goes through the base station to the Internet or to other computers on the network.

You can also incorporate AirPort technology into an existing Ethernet network by connecting an AirPort Extreme Base Station to the network. This allows non-AirPort computers to communicate with AirPort computers.

The typical indoor range for an AirPort connection is up to 150 feet (45 meters). Range in a wireless network may vary with site conditions.

## How Wireless Internet Access Is Provided

Wireless Internet access requires an AirPort Card or an AirPort Extreme Card, an AirPort Extreme Base Station, and an account with an Internet service provider (fees may apply). Some Internet service providers (ISPs) are not currently compatible with AirPort. Some cable modem and DSL providers may not be compatible with AirPort. Contact your service provider for more information.

AirPort technology is similar to a cordless telephone. The handset of the cordless phone makes a wireless connection to the base, which is connected to the telephone system. Likewise, with AirPort, your computer does not establish a wireless connection with your ISP directly. You set up a wireless connection from the computer to a base station that is connected to the Internet by a wire, such as a telephone line or DSL line.

Use AirPort to provide wireless Internet access and share a single Internet connection among multiple computers in the following ways:

- Connect the AirPort Extreme Base Station to a DSL or cable modem. If the base station has an internal modem, you can connect it to a telephone line. The AirPort Extreme Base Station receives webpages and email content from the Internet via its Internet connection and then sends it to AirPort-equipped computers, using the wireless network.
- Connect the AirPort Extreme Base Station to an existing network that already has Internet access, such as in a school or small office. AirPort-equipped computers connect wirelessly to the base station and receive network and Internet content.

## Configuring AirPort Extreme Base Station Internet Access

Like your computer, the AirPort Extreme Base Station must be set up with the appropriate hardware and Internet Protocol (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 asks a series of questions to determine how the base station's other interfaces should be set up.

To set up more complex configurations, you use AirPort Admin Utility. For more information about the AirPort Setup Assistant and AirPort Admin Utility, see the following sections.

### AirPort Setup Assistant

The AirPort Setup Assistant, located in Applications/Utilities, walks you through base station setup and changes your computer's Internet settings to use AirPort instead of a wired connection.

Use the AirPort Setup Assistant to enter the settings your base station needs to connect to the Internet. Enter the settings you received from your ISP for the internal modem, Ethernet, or PPP over Ethernet (PPPoE). You can also give your AirPort network a name and password. When you have finished entering the settings, the AirPort Setup Assistant transfers the settings to your base station and your base station shares its Internet connection with computers that join its AirPort network.

For instructions on using the AirPort Setup Assistant, see "Using the AirPort Setup Assistant" on page 16.

### AirPort Admin Utility

AirPort Admin Utility is a convenient way to make quick adjustments to your base station configuration. The AirPort Extreme Base Station's advanced networking features can be configured only with AirPort Admin Utility.

#### When to Use AirPort Admin Utility

Use AirPort Admin Utility when:

- 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, DHCP lease time, access control, WAN privacy, power controls, remote dial-in or port mapping

For instructions on using AirPort Admin Utility, see “Using AirPort Admin Utility” on page 16.

## Extending the Range of Your AirPort Network

You can extend the range of your network by using AirPort Admin Utility to set up wireless connections between multiple base stations in your network, known as a Wireless Distribution System (WDS), or to connect the base stations via Ethernet. If your base station has an antenna port, you can also extend the range of your wireless network by connecting an Apple-certified external antenna to the antenna port.

## Printing Via an AirPort Extreme Base Station

If you have a USB printer connected to the base station, computers on the AirPort network can print to the printer by selecting the printer via Rendezvous in Print Center, located in Applications/Utilities. You must use Mac OS X version 10.2.3 or later to print to a USB printer via an AirPort Extreme Base Station. Check the AirPort website at [www.apple.com/airport](http://www.apple.com/airport) for a list of supported printers.

## Sharing Your Computer’s Internet Connection

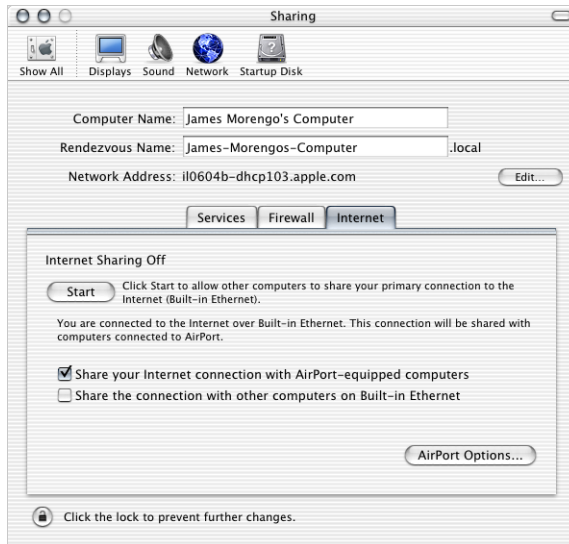
If you have an AirPort Card installed in your computer and you are connected to the Internet, you can share your Internet connection with other computers using Mac OS X version 10.2 or later. This is sometimes called using your computer as a *software base station*.

You can share your Internet connection as long as your computer is connected to the Internet. If your computer goes to sleep or is restarted, or if you lose your Internet connection, you need to restart Internet sharing.



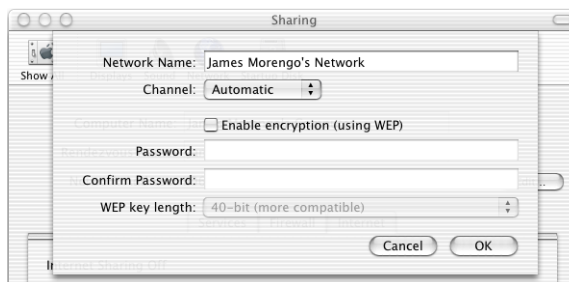
## To start Internet sharing:

- 1 Open System Preferences, click Sharing, and then click the Internet tab.
- 2 Select how you would like to share your Internet connection, then click Start. You can choose to share your Internet connection with AirPort-equipped computers, computers with built-in Ethernet, or both.



**Note:** If your Internet connection and your local network use the same port (built-in Ethernet, for example), contact your ISP before you turn on Internet sharing. In some cases (if you use a cable modem, for example) you might unintentionally affect the network settings of other ISP customers, and your ISP might terminate your service to prevent you from disrupting its network.

- 3 If you select “Share your Internet connection with AirPort-equipped computers,” click AirPort Options to give your network a name and password.





This chapter contains information about your computer's network settings, what they do, and how to adjust them in Mac OS X. It also describes the software used for IP and AirPort networking.

To exploit all the power and flexibility of AirPort, you may need to change the network settings on your computer or your base station.

If you make frequent changes to your network settings, it helps to be aware of what the settings do and what they mean. Understanding these network basics makes configuring and adjusting your computer and AirPort network settings simple and easy.

Configuring your computer involves two steps:

- Selecting a network (Ethernet or AirPort)
- Configuring Internet Protocol (IP)

### **Step 1: Select your network**

To select an Ethernet network, connect an Ethernet cable to the Ethernet port on your computer and to an open port on your Ethernet network.

To create or join an AirPort network, use the AirPort status menu in the menu bar to turn on AirPort and choose an available AirPort network.

Once you are connected, both types of networks work the same way.

### **Step 2: Configure IP on your computer**

Configuring IP consists of two steps:

- Selecting a networking interface
- Selecting a configuration method

#### **To configure IP:**

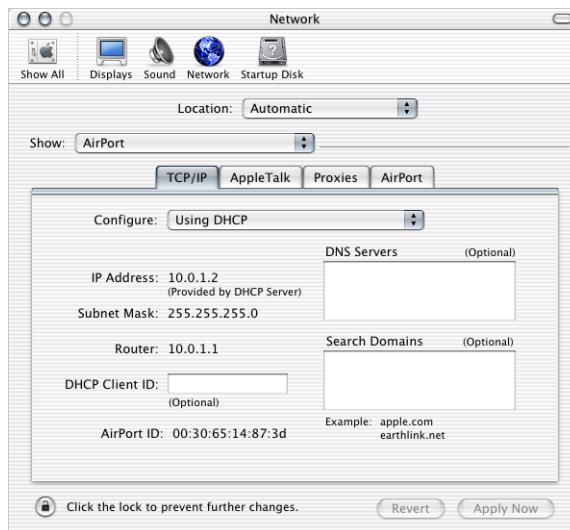
- 1 Open the Network pane of System Preferences, and then choose Ethernet from the Show pop-up menu if you are connecting to an Ethernet network, or AirPort if you are connecting to an AirPort network.

- 2 Click the TCP/IP tab, and then choose the configuration method from the Configure pop-up menu.

The three most frequently used methods are PPP, DHCP, and Manually.

- PPP is used for dialup connections to your ISP and 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.

For example, below is the Network pane of System Preferences, configured to use AirPort for the network interface and DHCP for the TCP/IP configuration.



If you have trouble connecting to the Internet, check these network and IP configurations on your computer first.

## Software Used for IP Networking

You'll frequently use several preferences and applications on your computer for networking. Here's what each is used for:

### Network Preferences

Use the Show pop-up menu to configure how you connect to the network or the Internet, for example via AirPort or Ethernet.

Use the TCP/IP pane of Network preferences to configure your computer for IP networking. The information in this pane must be correct to connect to the Internet.

To configure how you receive an IP address, for example manually or via DHCP, use the Configure pop-up menu in the top portion of the pane.

Use the remaining fields to fill in the other information you need in order to connect to the Internet. Contact your ISP or network administrator for the information to type in these fields.

### Internet Connect Application

Use the Internet Connect application to specify the phone number, user name, and password for making a dialup connection to the Internet with your computer. If you use a dialup connection to the Internet, the AirPort Setup Assistant transfers the settings in the Internal Modem portion of the Internet Connect application to the base station.

If you use AirPort to connect to the Internet, choose AirPort from the Configuration pop-up menu.

### AppleTalk

AppleTalk is a protocol used in local networks. Use the AppleTalk pane of Network preferences to set up AppleTalk networking.

### Location Management

Use the Location pop-up menu in Network preferences to manage sets of TCP/IP, AppleTalk, and Internet Connect configurations. After you create your locations, you can switch all of your network settings by choosing a location from the Location pop-up menu in Network preferences. For more information about network locations, see Mac Help, available in the Help menu.

## Software Used for AirPort Networking in Mac OS X

### Internet Connect Application

Use the Internet Connect application to:

- Turn AirPort on or off
- Monitor the signal quality of the AirPort wireless connection
- Find the Base Station ID (the hardware address of your AirPort Extreme Base Station)
- See the connection status of an AirPort Extreme Base Station that is configured to connect to a dialup ISP
- Select an AirPort network
- Create or join a Computer-to-Computer network
- Join a closed network

### AirPort Status Menu

Use the AirPort status icon in the menu bar to:

- Turn AirPort on or off
- Monitor the signal quality of the AirPort wireless connection
- Select an AirPort network
- Open the Internet Connect application
- Create or join a Computer-to-Computer network

### AirPort Setup Assistant

Use the AirPort Setup Assistant to:

- Set up your computer to join an existing AirPort network
- Set up an AirPort Extreme Base Station

### AirPort Admin Utility

Use AirPort Admin Utility to set optional advanced settings and to:

- Download the base station configuration to your computer
- Modify the configuration on your base station
- Upload the modified configuration to the base station
- Upgrade the base station software

This chapter provides overview information on the types of AirPort networks you can set up.

Configuring your base station to implement a network design involves three steps:

## **Step 1: Setting up the AirPort network**

Computers communicate with the AirPort Extreme Base Station over the AirPort wireless network. Setting up the AirPort network created by the base station includes options to name the wireless network, assign a password needed to join the wireless network, and others.

## **Step 2: Configuring and sharing Internet access**

When computers use AirPort to access the Internet, the base station connects to the Internet and transmits information to the computers over the AirPort network. You provide the base station with settings appropriate for your ISP and configure how the base station shares this connection with other computers.

## **Step 3: Setting advanced options**

These settings are optional for most users. They include using the base station as a bridge between your AirPort network and an Ethernet network, controlling access to an AirPort network, setting up a Wireless Distribution System (WDS) to extend the AirPort network to other base stations, and fine-tuning other AirPort settings.

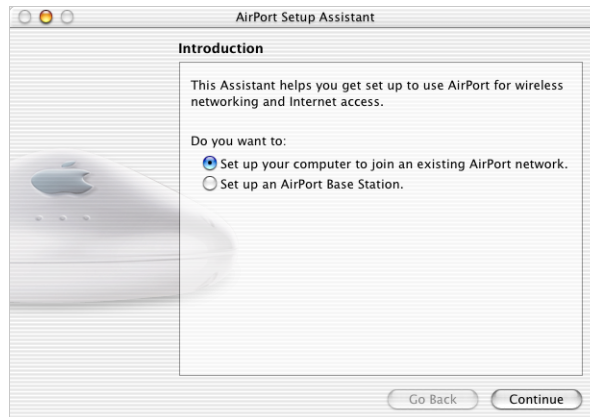
For specific instructions on all these steps, refer to the sections later in this chapter.

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

## Using the AirPort Setup Assistant

To set up and configure your computer or base station to use AirPort for wireless networking and Internet access, use the AirPort Setup Assistant.

- 1 Open the AirPort Setup Assistant, located in Applications/Utilities.
- 2 Select “Set up your computer to join an existing AirPort network” or “Set up an AirPort Base Station.”



- 3 Follow the onscreen instructions and enter the settings from your ISP.

## Using AirPort Admin Utility

To modify the base station configuration, open the configuration with AirPort Admin Utility.

### To open your base station's configuration:

- 1 Open AirPort Admin Utility, located in Applications/Utilities.
- 2 Select your base station and click Configure.
- 3 Enter the base station password if necessary. The default base station password is *public*.

### 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 status menu.
- 2 Make sure your network and TCP/IP settings are configured properly.

Choose AirPort from the Show pop-up menu in the Network pane of System Preferences. Then choose Using DHCP from the Configure pop-up menu in the TCP/IP pane.



### If you can't open the base station's configuration:

- 1 Make sure your network and TCP/IP settings are configured properly.  
Choose AirPort from the Show pop-up menu in the Network pane of System Preferences. Then choose Using DHCP from the Configure pop-up menu in the TCP/IP pane.
- 2 Make sure you entered the AirPort Extreme Base Station password correctly. The default password is *public*. If you have forgotten the base station password, you can reset it to *public* by resetting the base station.

Press and hold the reset button for one second.

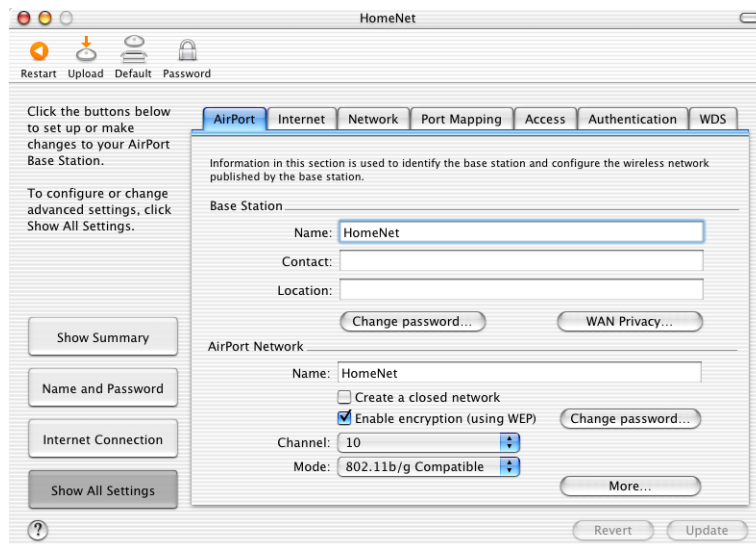
### If you are on an Ethernet network that has other base stations, or you are using Ethernet to connect to the base station:

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

## Setting 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. Open the setup assistant, located in Applications/Utilities. Follow the onscreen instructions and enter the information from your ISP.

To configure a network manually or set advanced options, open your base station's configuration in AirPort Admin Utility, located in Applications/Utilities. Enter the information in the AirPort pane.



## Naming the Base Station

Give the base station an easily identifiable name. This 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 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*. It is a good idea to change the base station password to prevent unauthorized changes to the base station.

If the base station password is not changed from *public*, you will not be prompted for a password when you select it from the Select Base Station list and click Configure.

## Naming the AirPort Network

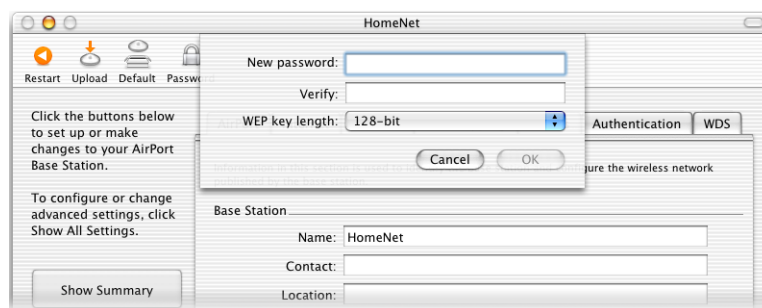
Give your AirPort network a name. This name appears in the AirPort status menu on the AirPort-equipped computers that are in range of your AirPort network.

## 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 password.”

## Using 128-Bit Encryption

Your AirPort Extreme Base Station supports 128-bit encryption, a higher standard of protection for networks. When you enable encryption using WEP and click “Change password” in the AirPort Network portion of the AirPort pane, you can choose between standard 40-bit encryption (which gives maximum compatibility) or 128-bit encryption (which provides maximum security) from the “WEP key length” pop-up menu.



If you choose 128-bit encryption, only computers with 128-bit encryption-capable wireless networking cards will be able to join your network. If you choose 40-bit encryption, computers with 40-bit and 128-bit encryption-capable wireless networking cards will be able to join your wireless network, but they will join with only 40-bit encryption.

## Joining a 128-Bit Encrypted Wireless Network

If you want to join a wireless network that requires 128-bit encryption, you have two options for entering a password, depending on the password scheme the network administrator has set up.

If you were given a password that is 13 characters, enter it exactly. Thirteen-character passwords are usually case-sensitive.

*Example:* password12345

If you were given a password that is 26 characters, put a dollar sign (\$) before the password. Twenty-six-character passwords may be case-sensitive.

*Example:* \$12345678901234567890abcdef

If you need additional information on your 128-bit password, contact your network administrator.

## Changing the Channel

The “channel” is the radio frequency over which your base station communicates. If you use only one base station (for example, at home), you probably won’t need to change the channel frequency. If you set 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 Extreme Base Station. Users must enter the exact network name to join the AirPort network.

To create a closed network, select the “Create a closed network” checkbox in the AirPort pane.

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

- 1 Click the AirPort status icon in the menu bar and choose Other from the list of available networks.
- 2 Enter the name and password of the AirPort network.

**Note:** The AirPort Setup Assistant can't create a connection to a base station with a closed network. Use AirPort Admin Utility to modify the configuration of a base station with a closed network. To use AirPort Admin Utility to set other advanced options, see "Setting Advanced Options" on page 40.

### Choosing the Network Mode

Choose 802.11b Only from the Mode pop-up window if computers with 802.11b wireless cards will join the network. The transmission rate of the network will be at 802.11b speed, up to 11 megabits per second. Computers with 802.11g cards will be able to join this network, but will join at 802.11b speed.

Choose 802.11g Only if only computers with 802.11g wireless cards will join the network. The transmission rate of the network will be at 802.11g speed, up to 54 megabits per second. Computers with 802.11b wireless cards will not be able to join this network.

Choose 802.11b/g Compatible if computers with either type of wireless card will join the network. Each client computer will transmit at its highest speed.

### Setting More Options

Click the More button to set the multicast rate of the network, enable interference robustness, and adjust the transmitter power of the base station. Settings in this pane can reduce the range of the base station, and should not be modified without good reason.

#### Setting the multicast rate

Use the "Multicast rate" pop-up menu to set the multicast rate. Increase the rate to improve the performance of certain types of network activity, like video or audio streaming. The increase in performance will reduce the range of the wireless network.

#### Enable interference robustness

Select "Enable interference robustness" when the base station is in an environment with other 2.4 Ghz devices that can interfere with your network. Devices that can cause interference include cordless telephones, some television repeaters, and microwave ovens. For more examples of devices that can cause interference, see "Items That Can Cause Interference With AirPort" on page 57.

**Note:** Client computers using AirPort Extreme wireless cards must choose Interference Robustness from the AirPort status menu in the menu bar to take advantage of this feature.

#### Adjusting transmitter power

Use the Transmitter Power slider to reduce the power the base station uses, and limit the range of the base station. This may be useful in areas where many base stations are in close proximity to each other. Client computers will need to be closer to the base station in order to join the network it creates.

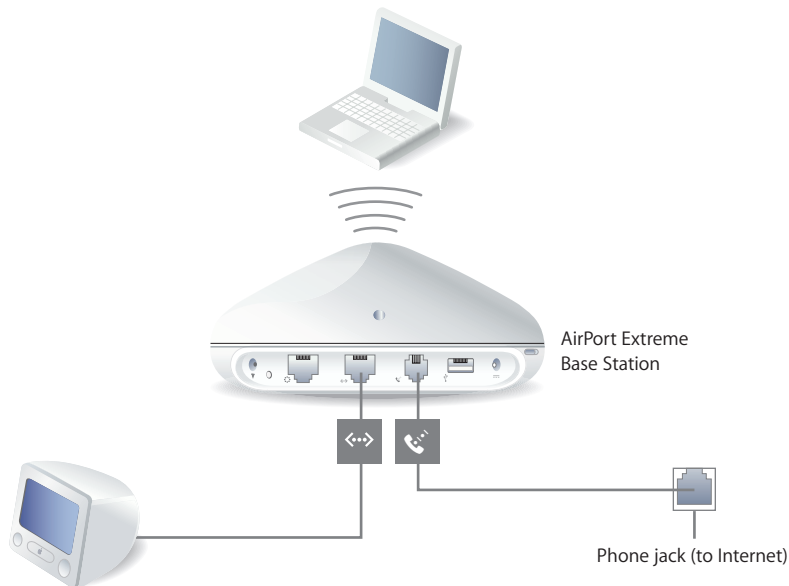
## Configuring and Sharing Internet access

The next step is setting up your base station's Internet connection and 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)

If your AirPort Extreme Base Station came with an internal modem, you can set up its connection to the Internet with the AirPort Setup Assistant. You only need to use AirPort Admin Utility to adjust optional advanced base station settings, such as port mapping or controlling access to your AirPort network.

#### What It Looks Like



#### How It Works

- The base station connects to your ISP and the Internet using its internal modem.
- Computers using AirPort or computers connected to the base station's Ethernet LAN (<=>) port can connect to the Internet through the AirPort Extreme Base Station.
- AirPort computers and Ethernet computers communicate with one another through the base station using AppleTalk and other networking protocols.

## What You Need for a Dialup Connection

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><li>• other information your ISP may provide</li></ul>	You can get this information (except the account password) from the Internet Connect application and Network preferences on the computer you use to access the Internet. If Network preferences on your computer doesn't have DNS information, you may not need to provide DNS information in the AirPort Setup Assistant.
AirPort Extreme Base Station with an internal modem		Place the base station near a phone jack and power outlet.
Ethernet hub		If you want to add more than one computer to your network using Ethernet, you need an Ethernet hub.

### What to Do

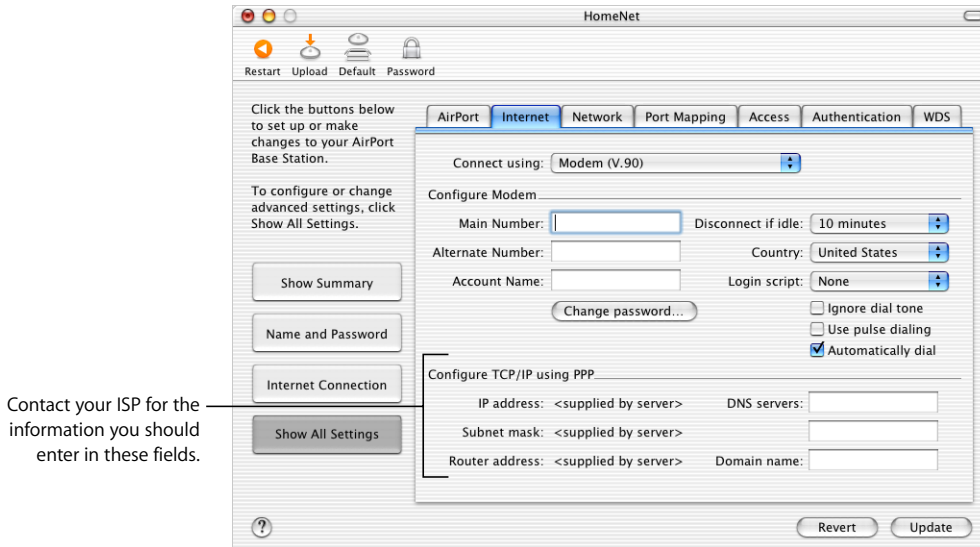
**If you are using the AirPort Setup Assistant to configure the AirPort Extreme Base Station for Internet access:**

- 1 Open the setup assistant, located in Applications/Utilities.
- 2 Select "Set up an AirPort Base Station" and follow the onscreen instructions.
- 3 Enter the phone number and other account information for your ISP.

**If you are using AirPort Admin Utility to configure the AirPort Extreme Base Station for Internet access:**

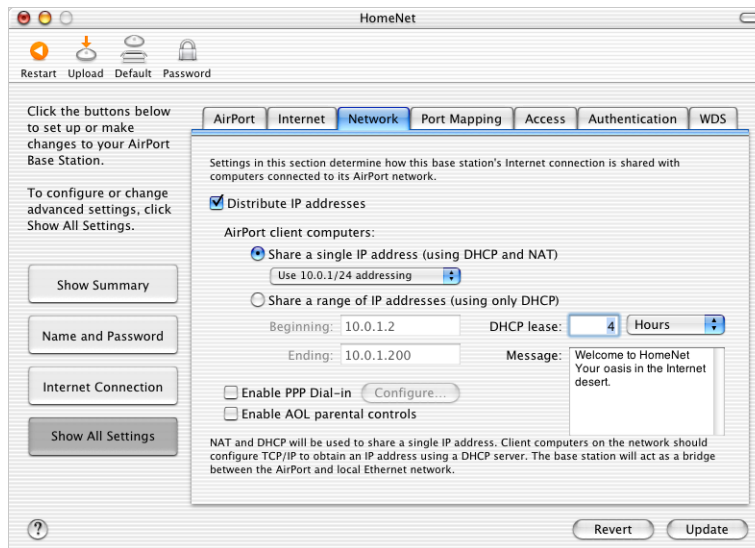
- 1 Open AirPort Admin Utility, located in Applications/Utilities. Select your base station and click Configure.
- 2 Click Show All Settings.

- 3 Click the Internet tab and choose Modem (V.90) from the “Connect using” pop-up menu if you are connecting to an ISP. Enter the phone number and other account information. The “DNS servers” and “Domain name” information may be optional; check with your ISP.



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.

- 4 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 and NAT)” button.



By default, Ethernet client computers share a single IP address using Network Address Translation (NAT). The base station acts as a bridge between the AirPort and local Ethernet networks. When Modem is selected in the “Connect using” pop-up menu in the Internet pane, both the Ethernet LAN (↔) port and the Ethernet WAN (🌐) port are bridged, and both can share a single IP address using NAT.

**Important:** If you are connecting to the Internet by Ethernet or PPPoE, only the Ethernet LAN (↔) port is bridged.

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 one another.

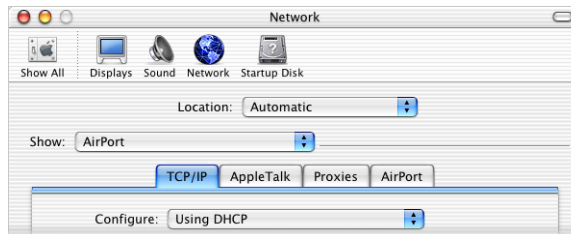
- 5 If you want to adjust optional advanced settings, go to “Setting Advanced Options” on page 40. If you are finished changing settings, click the Update button. Your computer transfers the new settings to the base station. When the transfer is complete, the base station restarts and its new settings are active.



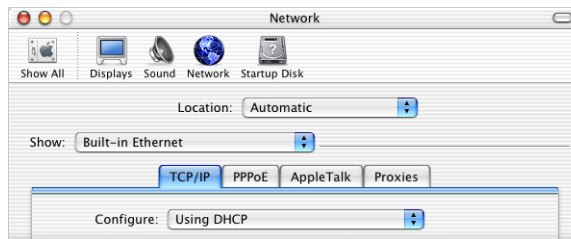
## Setting Up Client Computers

To configure TCP/IP on client computers:

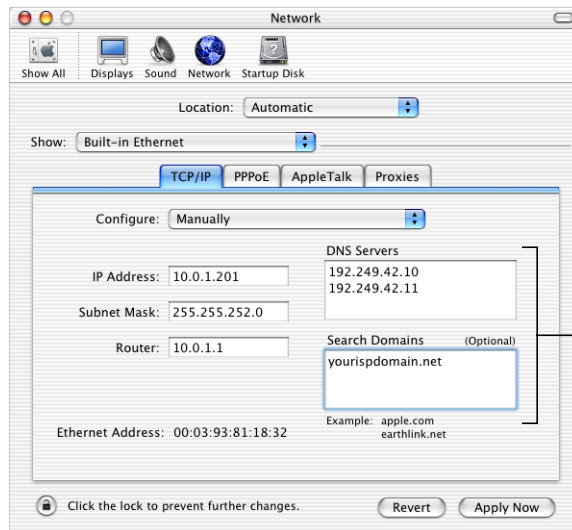
- 1 Open System Preferences on the client computer and click Network.
- 2 Do one of the following:
  - a If the client computer is using AirPort, choose AirPort from the Show pop-up menu and Using DHCP from the Configure pop-up menu in the TCP/IP pane.



- b If you enabled a DHCP server when you set up the base station's network, and the client computer is using Ethernet, choose Built-in Ethernet from the Show pop-up menu and Using DHCP from the Configure pop-up menu in the TCP/IP pane.



- c If you selected “Share a range of IP addresses (using only DHCP)” when you set up the base station’s network, you can provide Internet access to Ethernet client computers by setting the client IP addresses manually. Choose Built-in Ethernet from the Show pop-up menu, and choose Manually from the Configure pop-up menu.



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

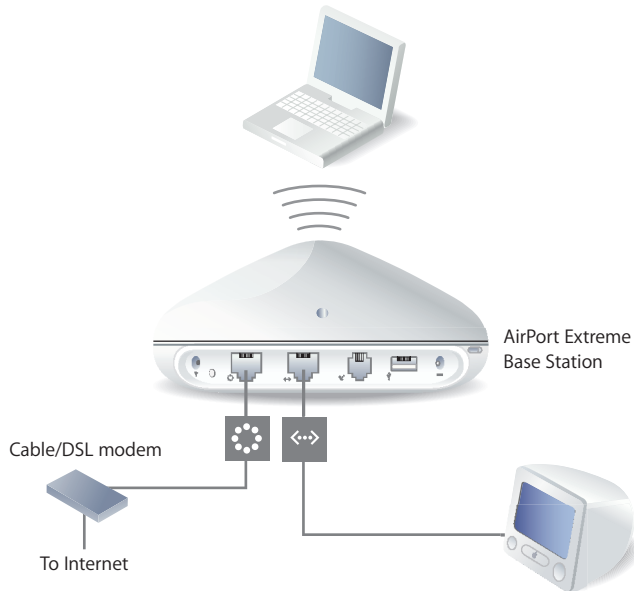
When you configure Ethernet clients manually for a base station that provides NAT services over Ethernet, use IP addresses in the range 10.0.1.201 to 10.0.1.254.

In the Subnet Mask field, enter 255.255.255.0. In the Router 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 DSL or Cable Modem

In most cases, you can implement this design with the AirPort Setup Assistant. You only need to use AirPort Admin Utility to adjust optional advanced base station settings.

### What It Looks Like



### How It Works

- The base station connects to the Internet through its Ethernet WAN (🌐) connection to your DSL or cable modem.
- Computers using AirPort or computers connected to the base station's Ethernet LAN (↔) port connect to the Internet through the AirPort Extreme Base Station.
- AirPort computers and Ethernet computers communicate with one another through the base station.

**Important:** Connect Ethernet computers that are not connected to the Internet to the base station's LAN (↔) port only. Since the base station can provide network services, you must set it up carefully to avoid interfering with other services on your Ethernet network.

## What You Need for a DSL or Cable Modem Connection

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 Network preferences pane on the computer you use to access the Internet through this service provider.
AirPort Extreme Base Station		Place the base station near your DSL or cable modem.
Ethernet hub		If you want to add more than one computer to your network using Ethernet, you need an Ethernet hub.

### What to Do

#### If you are using the AirPort Setup Assistant to configure the AirPort Extreme Base Station for Internet access:

- 1 Open the setup assistant, located in Applications/Utilities.
- 2 Select “Set up an AirPort Base Station” and follow the onscreen instructions.
- 3 Enter the settings for your ISP.

#### If you are using AirPort Admin Utility:

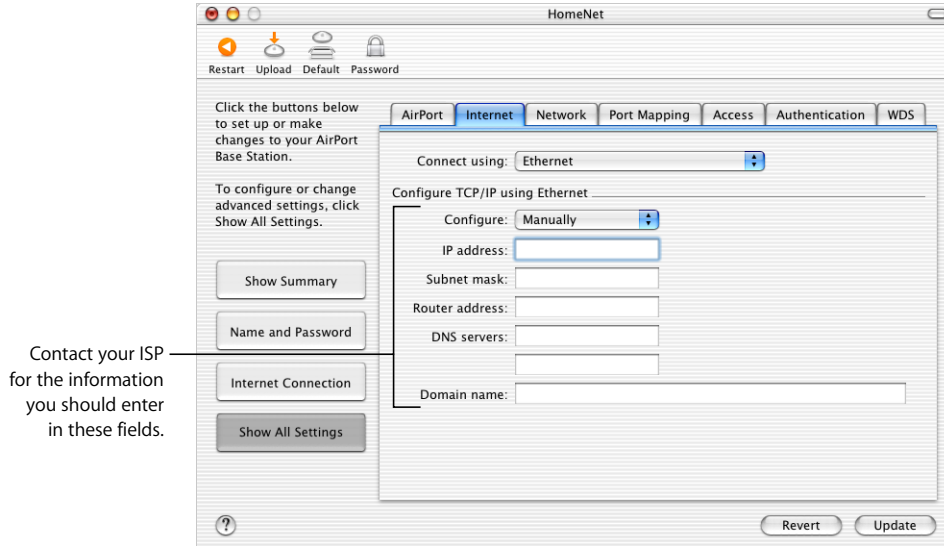
- 1 Make sure that your DSL or cable modem is connected to the Ethernet WAN (⚙️) port on your base station.
- 2 Open AirPort Admin Utility, located in Applications/Utilities. Select your base station and click Configure.
- 3 Click Show All Settings.
- 4 Click the Internet tab. Choose Ethernet or “PPP 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.

**Note:** If you are connecting to the Internet through a router using PPPoE and your base station is connected to the router via Ethernet, you do not need to use PPPoE on your base station. Choose Ethernet from the “Connect using” pop-up menu in the Internet pane, and deselect the “Distribute IP addresses” checkbox in the Network pane. Contact your ISP if you aren’t sure which one to select.

- 5 If you chose Ethernet from the “Connect using” pop-up menu, choose Manually or Using DHCP from the Configure 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.

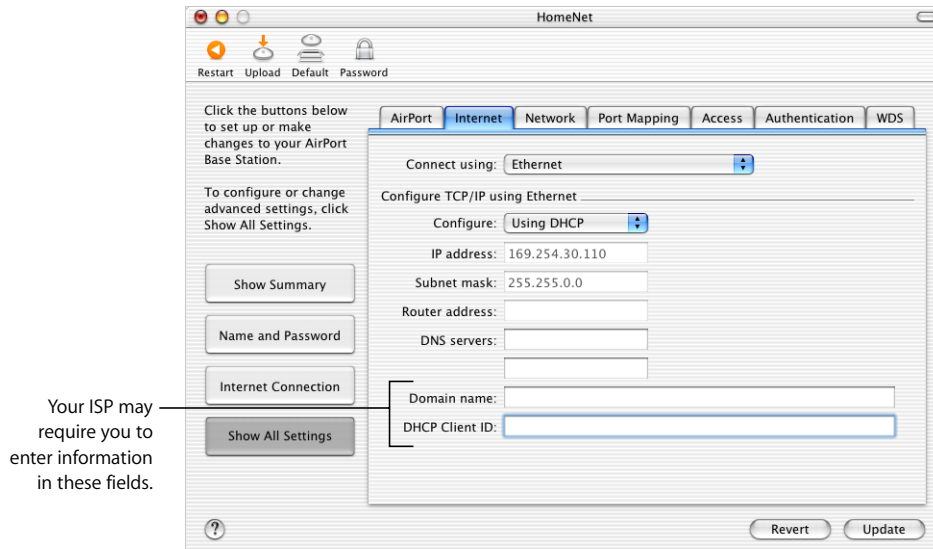
If your ISP asks you for the MAC address of your base station, use the address of the Ethernet WAN (⌘) port, printed on the label on the bottom of the base station.

If you configure TCP/IP manually, choose Manually from the Configure pop-up menu and enter your own IP address information in the fields below the Configure pop-up menu.



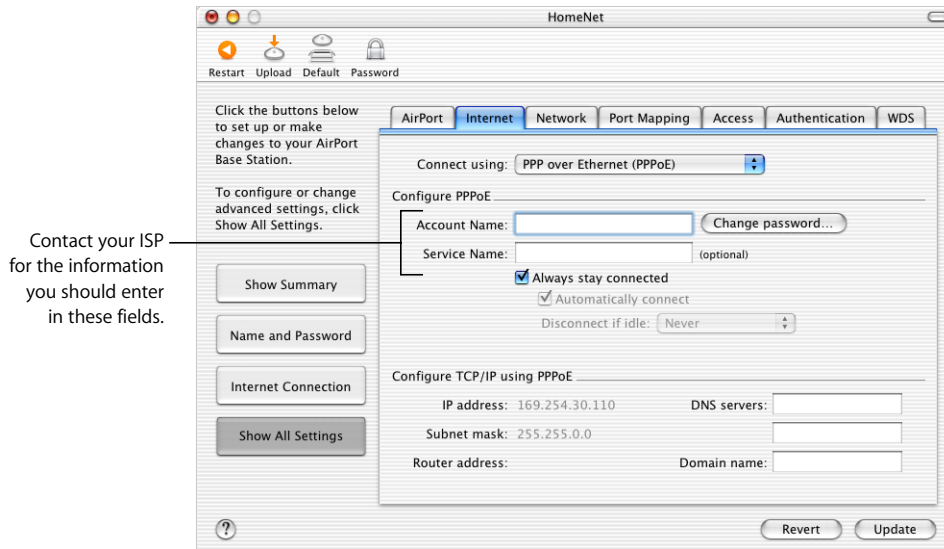
If you have already used the AirPort Setup Assistant to set up your AirPort Extreme Base Station, the fields below the Configure pop-up menu may already contain the information appropriate for your ISP.

If you configure TCP/IP using DHCP, choose Using DHCP from the Configure pop-up menu. Your IP addresses are delivered by the DHCP server.



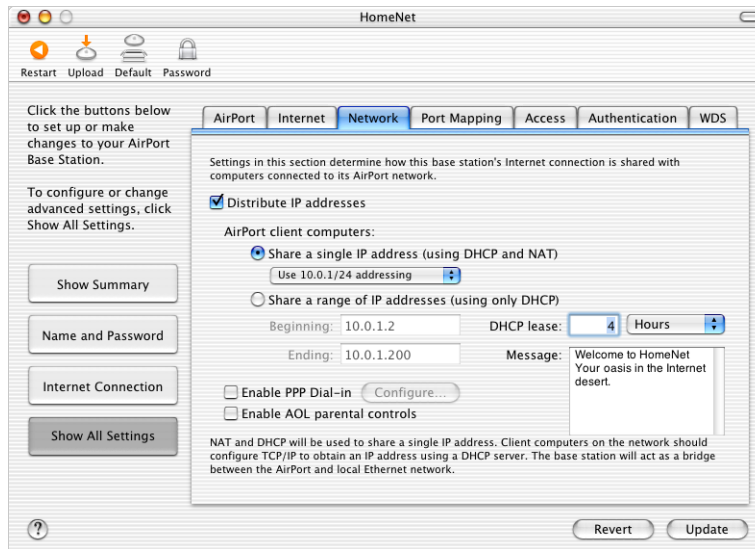
- 6 If you chose "PPP over Ethernet (PPPoE)" from the "Connect using" pop-up menu, enter the PPPoE settings your ISP provided. Leave the Service Name field blank unless your ISP requires a service name. Contact your ISP for the information to enter in the "DNS servers" and "Domain name" fields.

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



If you are connecting to the Internet through a router using PPPoE and your base station is connected to the router via Ethernet, you do not need to use PPPoE on your base station. Choose Ethernet from the "Connect using" pop-up menu in the Internet pane, and deselect the "Distribute IP addresses" checkbox in the Network pane.

- 7 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 “Distribute IP addresses” and “Share a single IP address (using DHCP and NAT)” are selected. If you have been given a range of public IP addresses by your ISP, you can select the “Share a range of IP addresses (using only DHCP)” option.
- If you want to connect an AppleTalk Ethernet printer to the base station or use AppleTalk between wired and wireless computers, make sure the devices are connected to the Ethernet LAN (↔) port on the base station.
- Ethernet computers connected to the Ethernet LAN (↔) port share Internet access and a single IP address (using NAT).
- 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. By default, the base station allows devices and computers using Ethernet and computers using AirPort to communicate with one another using non-IP protocols like AppleTalk.
- If you want to use the parental controls you have set up with your America Online (AOL) account, select the “Enable AOL parental controls” checkbox. This will copy the parental controls to your base station.
- If you want people joining your AirPort network to be greeted with a personal message, type it in the Message field.



- If your base station has an internal modem, select “Enable PPP Dial-in” to allow you to dial in to the AirPort Extreme Base Station from a computer modem over a standard, analog phone line. Dialing in to your base station gives you access to your home network and the Internet through your home network Internet service provider (ISP).

To set up your base station for PPP dial-in:

- a Connect a phone line to the modem (☎) port on your base station.
- b In the Network pane of AirPort Admin Utility, select “Enable PPP Dial-in” and click Configure.
- c Enter the user name and password, and set other options.

Because you set the base station to answer incoming calls, consider using a dedicated phone line for your base station. Other calls coming in on the same line could cause the base station modem to disconnect.

You cannot enable PPP dial-in if the base station is set up to use a PPP connection to your Internet service provider.

With PPP dial-in enabled, the base station is set to share a single IP address (using DHCP and NAT) only; it cannot share a range of IP addresses (using only DHCP).

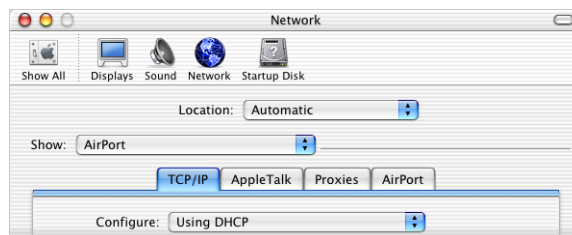
**Note:** If you dial in to your base station from a v.90 modem, the best speed you can expect is the v.34 speed of 33600 bits per second (bps). This is a limitation of the v.90 standard and is not caused by a problem with your modem or base station.

- 8 If you want to adjust optional advanced settings, go to “Setting Advanced Options” on page 40. 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.

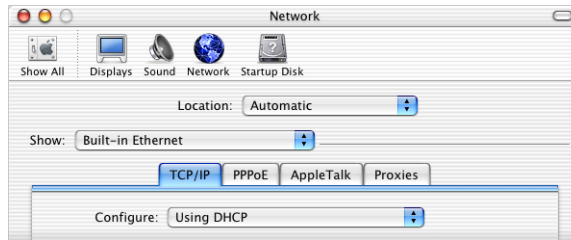
## Setting Up Client Computers

To configure TCP/IP on client computers:

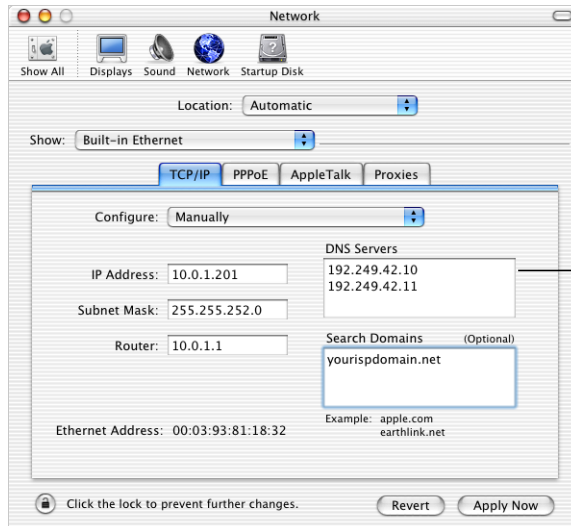
- 1 Open System Preferences on the client computer and click Network.
- 2 Do one of the following:
  - a If the client computer is using AirPort, choose AirPort from the Show pop-up menu and Using DHCP from the Configure pop-up menu in the TCP/IP pane.



- b If you enabled a DHCP server when you set up the base station's network, and the client computer is using Ethernet, choose Built-in Ethernet from the Show pop-up menu and Using DHCP from the Configure pop-up menu in the TCP/IP pane.



- c If you selected "Share a range of IP addresses (using only DHCP)" when you set up the base station's network, you can provide Internet access to Ethernet client computers by setting the client IP addresses manually. Choose Built-in Ethernet from the Show pop-up menu, and choose Manually from the Configure pop-up menu.



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 over Ethernet, you can use IP addresses in the range 10.0.1.201 to 10.0.1.254.

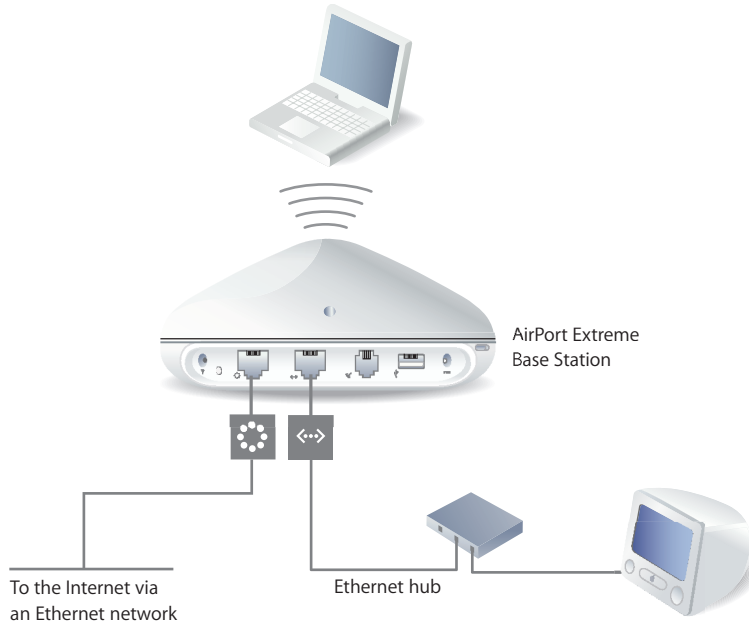
In the Subnet Mask field, enter 255.255.255.0. In the Router field, enter 10.0.1.1.

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 existing Ethernet network. Use AirPort Admin Utility if you need to adjust optional advanced base station settings.

### What It Looks Like



### How It Works

- The base station uses your Ethernet network to communicate with the Internet through the Ethernet WAN (🌐) port.
- AirPort and Ethernet clients access the Internet and the Ethernet network through the AirPort Extreme Base Station.

## What You Need for an Ethernet Connection

Components	Check ✓	Comments
AirPort Extreme Base Station		
Ethernet hub		<p>If you want to add more than one computer to your AirPort network using Ethernet, you need an Ethernet hub.</p> <p>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 Extreme Base Station to the uplink port.</p>
Ethernet cables		

### What to Do

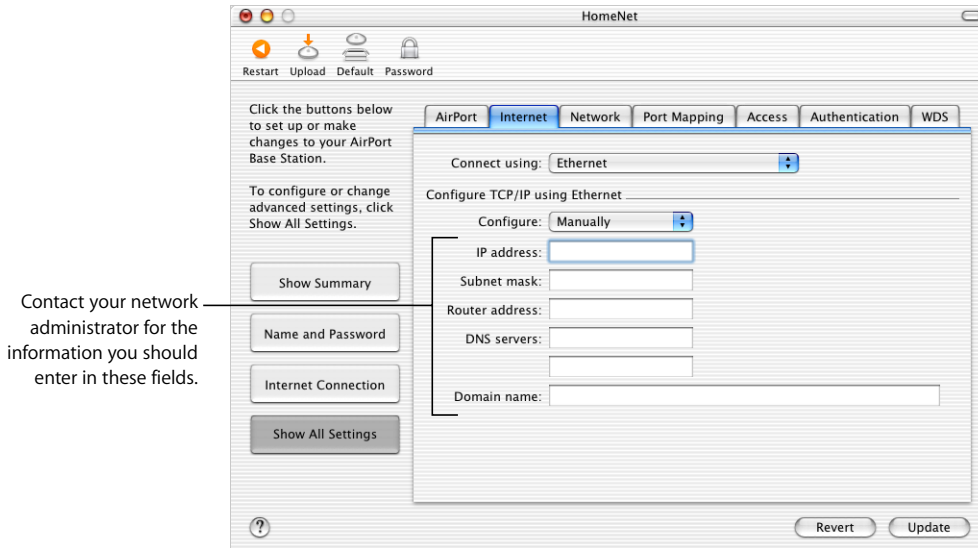
**If you are using the AirPort Setup Assistant to set up a base station on an existing Ethernet network:**

- 1 Open the setup assistant, located in Applications/Utilities.
- 2 Select "Set up an AirPort Base Station" and follow the onscreen instructions.
- 3 Enter the account information you were given by your ISP or network administrator.

**If you are using AirPort Admin Utility:**

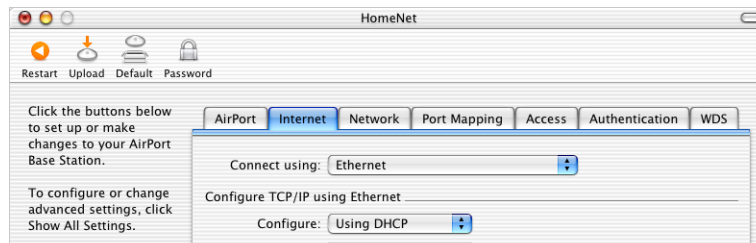
- 1 Open AirPort Admin Utility, located in Applications/Utilities.
- 2 Select your base station and click Configure.
- 3 Click Show All Settings.
- 4 Click the Internet tab and choose Ethernet from the "Connect using" pop-up menu.
- 5 Choose Manually or Using DHCP from the Configure pop-up menu, depending on how IP addresses are provided on your Ethernet network. If you aren't sure, ask your ISP or network administrator.

If your addresses are provided manually, choose Manually from the Configure pop-up menu. Enter your IP address information in the fields below the Configure pop-up menu.

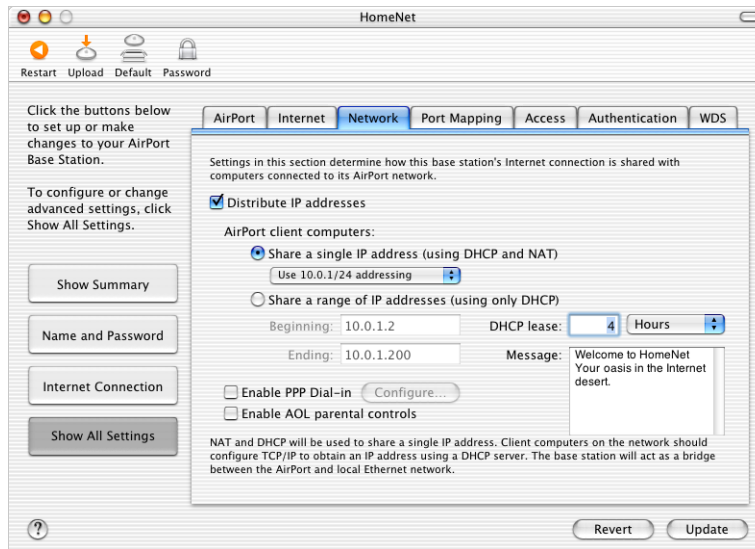


If you have already used the AirPort Setup Assistant to set up your AirPort Extreme Base Station, the fields below the Configure pop-up menu may already contain the appropriate information.

If your IP address is provided by DHCP, choose Using DHCP from the Configure pop-up menu.



- Click the Network tab and select how the base station will share its Internet access with AirPort and Ethernet 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 and 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 Extreme Base Station as a Bridge” on page 40.

**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.

- If you want to use the parental controls you have set up with your America Online (AOL) account, select the “Enable AOL parental controls” checkbox. This will copy the parental controls to your base station. For more information, contact AOL.
- If your base station has an internal modem, select “Enable PPP Dial-in” to allow you to dial in to the AirPort Extreme Base Station from a computer modem over a standard, analog phone line. Dialing in to your base station gives you access to your network and the Internet through your network’s Internet service provider (ISP).

To set up your base station for PPP dial-in:

- a Connect a phone line to the modem (☎) port on your base station.
- b In the Network pane of AirPort Admin Utility, select “Enable PPP Dial-in” and click Configure.
- c Enter the user name and password, and set other options.

Because you set the base station to answer incoming calls, consider using a dedicated phone line for your base station. Other calls coming in on the same line could cause the AirPort Extreme Base Station modem to disconnect.

With PPP dial-in enabled, the base station is set to share a single IP address (using DHCP and NAT) only; it cannot share a range of IP addresses (using only DHCP).

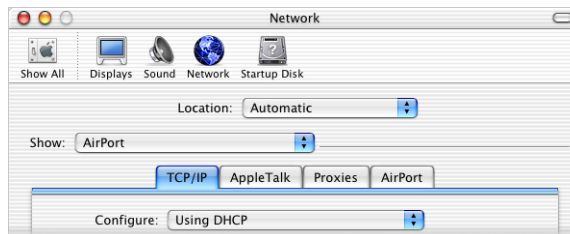
**Note:** If you dial in to your base station from a v.90 modem, the best speed you can expect is the v.34 speed of 33600 bits per second (bps). This is a limitation of the v.90 standard and is not caused by a problem with your modem or base station.

- 7 If you want to adjust optional advanced settings, go to “Setting Advanced Options” on page 40. 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 configure TCP/IP on client computers:

- 1 Open System Preferences on the client computer and click Network.
- 2 Choose AirPort from the Show pop-up menu and Using DHCP from the Configure pop-up menu in the TCP/IP pane for AirPort clients, and Built-in Ethernet from the Show pop-up menu and Using DHCP from the Configure pop-up menu in the TCP/IP pane for Ethernet clients.



### Joining an AirPort Network

To join your AirPort network, clients can choose the network from the AirPort status menu in the menu bar.

## Setting Advanced Options

### Using the AirPort Extreme Base Station as a Bridge

You can turn off the base station's Internet sharing features (which provide IP addresses to AirPort computers using DHCP or NAT) to allow bridging between the network's wireless and wired computers. With bridging turned on, AirPort computers have access to all services on the Ethernet network, and the base station does not provide 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 use the base station as a bridge, all AirPort and Ethernet computers need to have IP addresses set manually and use the same subnet mask.

#### To set up the base station as a bridge:

- 1 Open AirPort Admin Utility (in Applications/Utilities) and open your base station's configuration.
- 2 Click Show All Settings.
- 3 Click the Network tab.
- 4 Deselect the "Distribute IP addresses" checkbox.

### Connecting Additional Base Stations to Your AirPort Network

You can connect additional AirPort Extreme Base Stations to extend the range of your wireless network. You can connect the base stations wirelessly or using Ethernet. A network with base stations connected using Ethernet is known as a *roaming network*. Connecting base stations wirelessly creates what is known as a Wireless Distribution System (WDS).

#### Setting Up Roaming

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

#### To set up roaming:

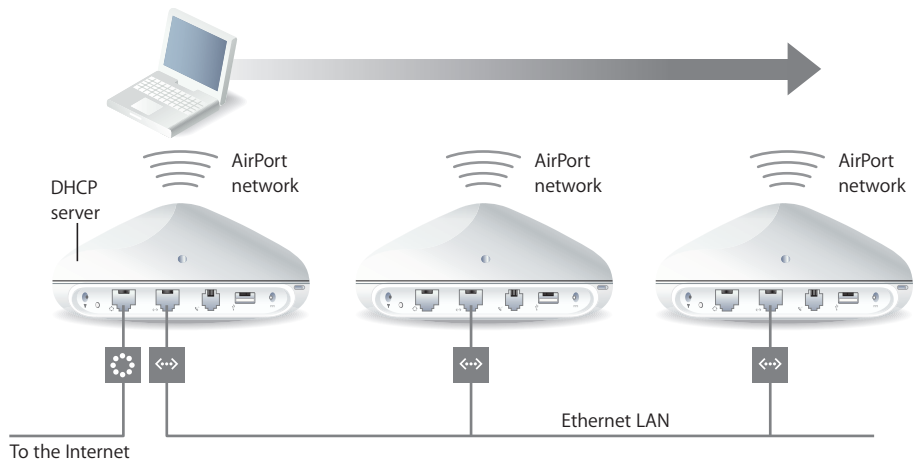
- 1 Connect all of the AirPort Extreme Base Stations to the same subnet on your Ethernet network.
- 2 Give each base station a unique name.
- 3 Give each base station the same network name and password.
- 4 Set up the base stations as bridges, following the instructions in the previous section.



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

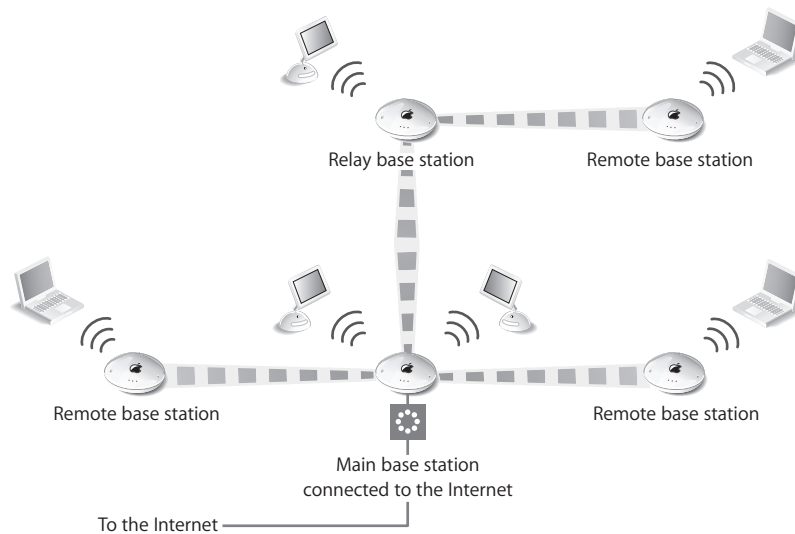
- 1 Set up one base station to act as the DHCP server.
- 2 Set up the other base stations as bridges, following the instructions in the previous section.

The base station acting as a DHCP server can receive its IP address from the DHCP server on the Ethernet network.



## Setting Up a Wireless Distribution System (WDS)

When you connect base stations wirelessly in a WDS, you set up the base stations as a main base station, a remote base station, or, if you are using AirPort 3.1 or later, a relay base station.



A main base station is connected to the Internet and shares its connection with remote and relay base stations. A remote base station shares the main base station's Internet connection. A relay base station shares the main base station's Internet connection and transfers the connection to other remote or relay base stations.

All three base station configurations (main, remote and relay) can also share the main base station's Internet connection with client computers wirelessly, or with Ethernet if the client computers are connected to the base station or Ethernet.

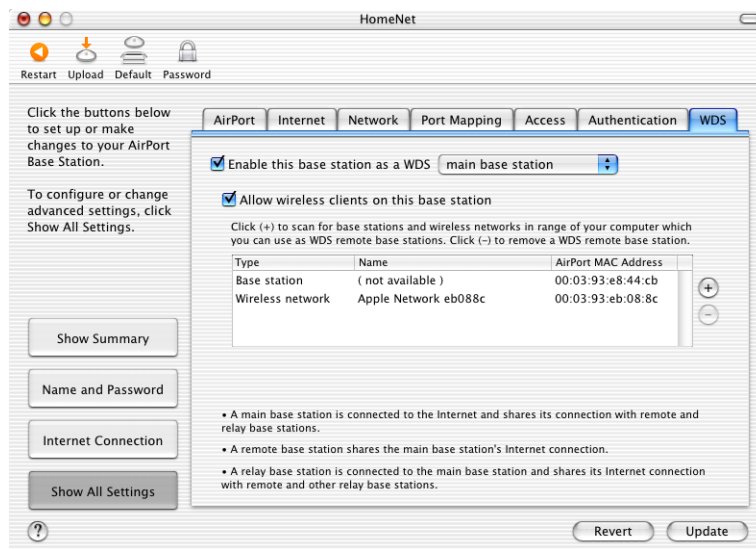
When you set up base stations in a WDS, you need to know the AirPort ID of each base station. The AirPort ID is also known as the MAC address and is printed on the label on the bottom of the base station next to the AirPort (📶) symbol. To make it easier to set up a WDS, place all of the base stations on a table and plug them into a power supply.

As part of the WDS setup process, you might consider giving all the base stations unique names, to make them easier to identify in the future.

**To set up the main base station to share its Internet connection with other base stations:**

- 1 Click the AirPort status menu in the menu bar and choose the wireless network created by the base station you want to set up as the main base station.
- 2 Open AirPort Admin Utility (in Applications/Utilities), select the main base station, and click Configure. Enter the base station password if necessary. If the base station is using the default password of *public*, you will not be prompted for a password.
- 3 Click Show All Settings, and then click the WDS tab.
- 4 Select the “Enable this base station as a WDS” checkbox, and choose “main base station” from the pop-up menu.
- 5 Click the Add (+) button to scan for base stations in range of your computer. Click Rescan if a base station you expect to see doesn’t appear in the list.
- 6 Select the base stations you want to set up as remote base stations. Deselect the “Auto configure as a WDS remote base station” checkbox if you want to set up the remote base station manually.

Select a base station and click the Delete (–) button to remove the base station from the list.



- 7 Click Update to send the new settings to the base stations in the WDS.

After you click Update, you can give each base station a name and password, and choose how the base station receives IP addresses.

Settings for: Base Station

Allow wireless clients on this base station

Network name:

TCP/IP:

IP address:

Subnet mask:

Router address:

This base station is protected by the password "public". For maximum protection, create a password other than "public".

Base Station Password:

Confirm:

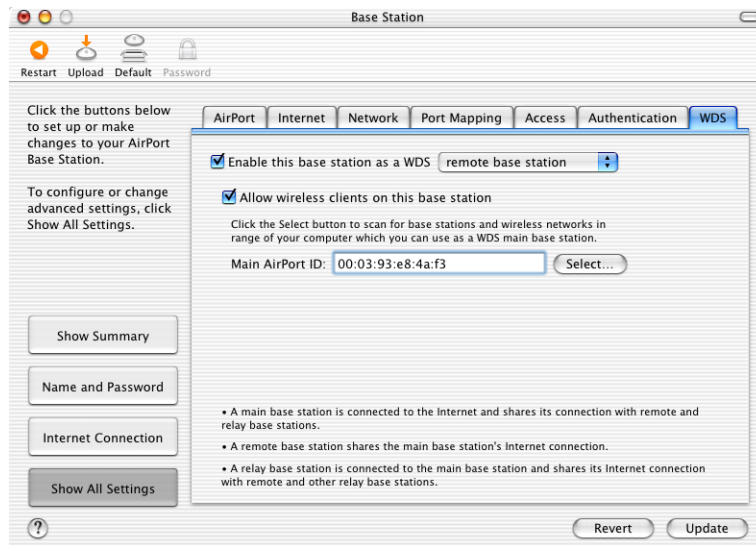
### To set up an additional remote base station to connect to the main base station:

If you want to add additional remote or relay base stations to the WDS after setting up the main and remote base stations, use the AirPort Admin Utility again.

Remote base stations need to be on the same channel as the main base station. Before setting up additional remote base stations, find the channel of the main base station in the AirPort pane of AirPort Admin Utility.

- 1 Click the AirPort status menu in the menu bar and choose the wireless network created by the base station you want to set up as a remote base station.
- 2 Open AirPort Admin Utility (in Applications/Utilities), select the remote base station, and click Configure. Enter the base station password if necessary. If the base station is using the default password of *public*, you will not be prompted for a password.
- 3 Enter the same network password as the main base station if necessary.
- 4 Click Show All Settings.
- 5 Click the AirPort tab and choose the same channel as the main base station from the Channel pop-up menu.
- 6 Click the WDS tab and select the "Enable this base station as a WDS" checkbox, and choose "remote base station" from the pop-up menu.
- 7 Enter the MAC address of the main base station in the Main AirPort ID field. The MAC address is also referred to as the AirPort ID and is printed on the label on the bottom of the base station, next to the AirPort (📶) symbol.

If you don't want to enter the MAC address manually, click Select to scan for base stations in range of your computer and select the base station you want to use as the main base station.



- 8 Click Update to transfer the settings to the base station.

### To set up a relay base station to connect to the main base station and share its connection with additional remote base stations:

If you want to set up a relay base station in the WDS to share its connection with other remote base stations and wireless clients, use the AirPort Admin Utility again.

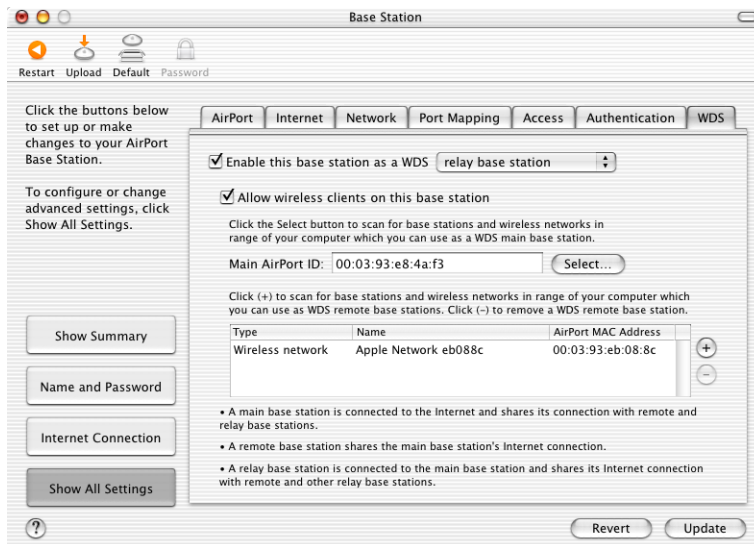
When you set up a relay base station, you also need to set up at least one additional remote base station to share the relay's connection.

Relay and remote base stations need to be on the same channel as the main base station. Before setting up a relay or remote base station, find the channel of the main base station in the AirPort pane of AirPort Admin Utility.

- 1 Click the AirPort status menu in the menu bar to join the wireless network created by the base station you want to set up as the relay base station.
- 2 Open AirPort Admin Utility (in Applications/Utilities), select the relay base station, and click Configure. If the base station is using the default password of *public*, you will not be prompted for a password.
- 3 Enter the same network password as the main base station if necessary.
- 4 Click Show All Settings.
- 5 Click the WDS tab and select the "Enable this base station as a WDS" checkbox, and choose "relay base station" from the pop-up menu.

- 6 Enter the MAC address of the main base station in the Main AirPort ID field. The MAC address is also referred to as the AirPort ID and is printed on the label on the bottom of the base station, next to the AirPort (📶) symbol.

If you don't want to enter the MAC address manually, click Select to scan for base stations in range of your computer and select the base station you want to use as a main base station.



- 7 Click the Add (+) button to scan for base stations in range of your computer. Click Rescan if the base station you expect to see doesn't appear in the list. Deselect the "Auto configure as a WDS remote base station" checkbox if you want to set up the remote base station manually.

Select a base station and click the Delete (-) button to remove a base station from the list.

- 8 Select the base stations you want to set up as remote base stations.
- 9 Click Update to transfer the new WDS settings to the relay and remote base stations.

## Extending the Range of Your AirPort Network

In addition to adding additional base stations to your network, you can attach an Apple-certified external antenna to some models of base stations to extend your network's range. You can attach an omnidirectional antenna to broaden the range of the network in all directions, or you can add a unidirectional antenna to extend the network further in one direction. External antennas are available from your Apple-authorized dealer, Apple retail stores, or the Apple Store at [store.apple.com](http://store.apple.com).

**Note:** After attaching an external antenna, you must unplug the base station's power adapter and then plug it back in.

## Controlling the Range of Your AirPort Network

You can also shorten the range of your AirPort network. This might be useful if you want to control who has access to the network by restricting the range to a single room, for example.

### To shorten the range of your AirPort network:

- 1 Open AirPort Admin Utility (in Applications/Utilities).
- 2 Select your base station and click Configure.
- 3 Click the AirPort tab and then click More.
- 4 Adjust the Transmitter Power slider. The lower the power, the shorter the range.

## Keeping Your Network Secure

Your network is protected by the password you assign to it. However, you can take additional steps to help keep your network secure.

Networks managed by Simple Network Management Protocol (SNMP) may be vulnerable to denial-of-service attacks. SNMP is a network management protocol that is turned on by default in AirPort Admin Utility.

Similarly, if you configure your base station over the WAN port, it may be possible for unauthorized users to change network settings. When remote configuration is enabled, the base station's Rendezvous information (the base station name and IP address) is published over the WAN port. Turning off remote configuration may provide additional security.

### To help protect your network and base station:

- 1 Open AirPort Admin Utility, select your base station, and click Configure.
- 2 Click Show All Settings.
- 3 Click WAN Privacy in the AirPort pane.
- 4 Deselect Enable SNMP Access and Enable Remote Configuration.

## Setting Up Access Control

Access control lets you specify which AirPort 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). You can restrict access by creating an Access Control list that includes only the MAC addresses for computers you want to access your wired network.

To find the MAC address (AirPort ID) of your computer's AirPort Card, click the AirPort tab in the Network pane of System Preferences.

### To set up the Access Control list:

- 1 Open AirPort Admin Utility, select your base station, and click Configure.
- 2 Click Show All Settings.
- 3 Click the Access tab.
- 4 Add the MAC addresses for the computers that will access the network.

**Important:** AirPort access control prevents computers that aren't on the Access Control list from accessing the wired network connected 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 "Setting Up the AirPort Network" on page 17.

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 a RADIUS Server

Using a RADIUS (Remote Authentication Dial-In User Service) server on your network lets you authenticate MAC addresses on a separate computer, so that each base station on the network doesn't need to store the MAC addresses of computers that have access to the network. Instead, all the addresses are stored on a server that is accessed through a specific IP address.



### To set up authentication using a RADIUS server:

- 1 On the server, enter the MAC addresses of the computers that will access the network.
- 2 When the RADIUS server is set up, open AirPort Admin Utility, select your base station, and click Configure.
- 3 Click Show All Settings.
- 4 Click the Authentication tab.
- 5 Select the Use RADIUS Authentication checkbox. Enter the IP address, port, and shared secret of the primary and secondary RADIUS servers.

See the RADIUS documentation that came with your server, or check with the network administrator for more information on setting up the RADIUS server.

The Access Control list and RADIUS work together. When a user tries to join a network that authenticates using Access Control or a RADIUS server, the base station looks first in the Access Control list, and if the MAC address is there the user can join the network. If the MAC address is not in the Access Control list, the base station checks the RADIUS server for the MAC address. If it is there, the user can join the network.

### 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.

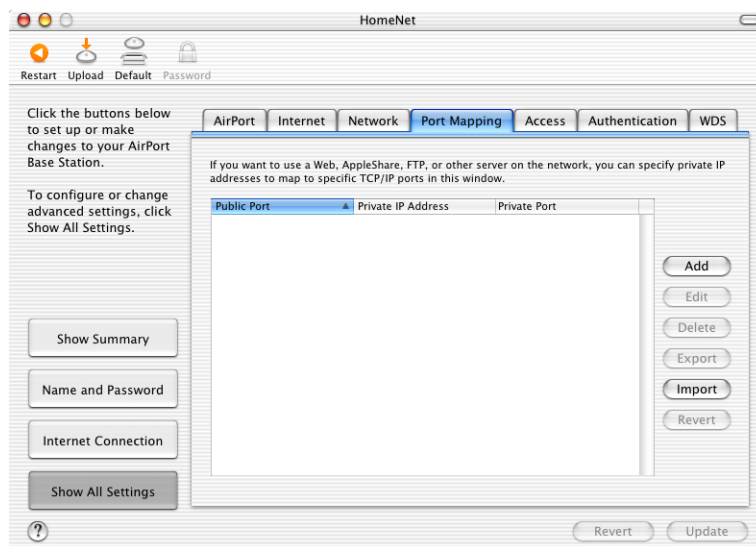
To ensure that requests are routed to your web, AppleShare, or FTP server properly, you need to establish a permanent IP address for your server and provide inbound port mapping information to the AirPort Extreme Base Station.

### To set up inbound port mapping:

- 1 Open AirPort Admin Utility, select your base station, and click Configure.
- 2 Click Show All Settings.
- 3 Click the Port Mapping tab.

In the Port Mapping pane, 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.

You can also set up a computer as a default host to establish a permanent IP address for the computer and provide inbound port mapping information to the AirPort Extreme Base Station. This is sometimes known as a DMZ and is useful when playing some network games or videoconferencing.

**To set up a default host:**

- 1 Open AirPort Admin Utility, select your base station, and click Configure.
- 2 Click Show All Settings.
- 3 Click WAN Privacy.
- 4 Select the Enable Default Host checkbox. The default IP address is 10.0.1.253.
- 5 Enter the same IP address on the host computer.
  - a Open the Network pane of System Preferences on the host computer.
  - b Choose AirPort from the Show pop-up menu.
  - c Choose Manually from the Configure pop-up menu.
  - d Enter the same IP address you entered in the Enable Default Host pane of AirPort Admin Utility.

### 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 schools and other environments where users switch between computers 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 pane of AirPort Admin Utility.

### Connecting a USB Printer to the AirPort Extreme Base Station

You can connect a USB printer to the AirPort Extreme Base Station, so that anyone on the network using Mac OS X v10.2.3 or later can print to that printer.

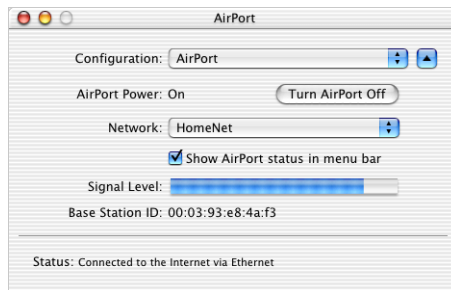
**To use a printer on your network:**

- 1 Connect the printer to the USB port on the AirPort Extreme Base Station.
- 2 On the client computers, open Print Center (located in Applications/Utilities) and choose the printer from the list. If the printer is not in the list, click Add and then choose Rendezvous from the pop-up menu.

## 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. 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 active network ports by choosing Active Network Ports from the Show pop-up menu in the Network pane of System Preferences. Make sure the ports you want to use are selected.
- Open Internet Connect (in the Applications folder on the hard disk) and choose AirPort from the Configuration pop-up menu.



- 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. The IP addresses should be in the range of 10.0.1.1 to 10.0.1.254.
- If the base station is set up as a DHCP server, make sure the “Distribute IP addresses” checkbox is selected in the Network pane of AirPort Admin Utility.

## More Information About AirPort

You can find more information about AirPort in the following locations:

- AirPort Help  
Look in AirPort Help for information on setting up an AirPort network, using an AirPort Extreme Base Station, editing base station settings, avoiding sources of interference, locating additional information on the Internet, and more. Choose Mac Help from the Help menu, click Help Center, and choose AirPort Help from the list.
- World Wide Web  
Apple AirPort website at [www.apple.com/airport](http://www.apple.com/airport)  
Apple Support website at [www.apple.com/support](http://www.apple.com/support)

This chapter defines terms and concepts used when working with computer networks. Use it as a reference to help you understand what is taking place behind the scenes of your AirPort wireless network.

## Basic Networking

### 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. That is why you can go to the Apple website by typing *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 Configuration Protocol)**

DHCP is a method of automatically assigning IP addresses. Instead of permanently 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.

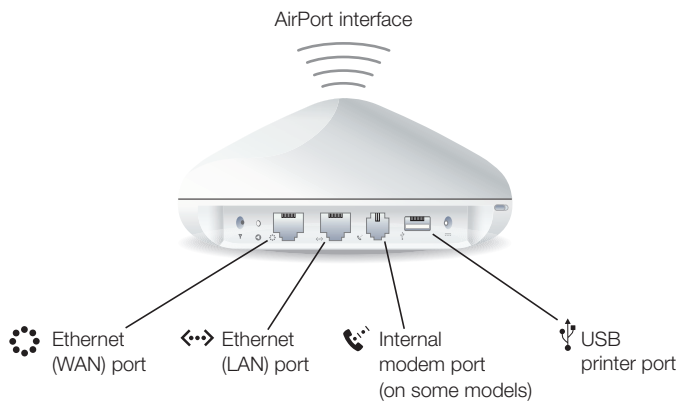
## Using the AirPort Extreme Base Station

This section describes the different network interfaces of the AirPort Extreme Base Station and describes the functions the base station can provide.

### Base Station Interfaces

To configure the AirPort Extreme Base Station, you configure how its networking interfaces will be used. The AirPort Extreme Base Station has five 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. (Available on some models.)
- *Ethernet WAN (🌐) interface:* The Ethernet WAN interface is used to connect DSL or cable modems and connect to the Internet.
- *Ethernet LAN (↔) interface:* The Ethernet LAN interface provides IP services to local Ethernet clients.
- *USB (🖨️) interface:* The USB interface is used to connect a USB printer to the AirPort Extreme Base Station.





## Base Station Functions

- *Bridge*: The AirPort Extreme Base Station is configured by default as a bridge between the wireless AirPort network and the wired Ethernet network. Connecting an AirPort network to an Ethernet network through the base station Ethernet LAN (↔) port bridges the wireless AirPort network to the wired Ethernet network.  
*Important*: If you are connecting an Ethernet network to the base station Ethernet LAN (↔) port, make sure the Ethernet network does not have an Internet connection.
- *NAT router*: One of the most powerful features of the AirPort Extreme 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.

## Items That Can Cause Interference With AirPort

The farther away the interference source, the less likely it is to cause a problem. The following items can cause interference with AirPort communication:

- Microwave ovens
- DSS (Direct Satellite Service) radio frequency leakage
- The original coaxial cable that came with certain types of satellite dishes. Contact the device manufacturer and obtain newer cables.
- Certain electrical devices such as power lines, electrical railroad tracks, and power stations
- Cordless telephones that operate in the 2.4 gigahertz (GHz) range. If you have problems with your phone or AirPort communication, change the channel of your base station.
- Other AirPort networks
- Adjacent base stations using nearby channels. If base station A is set to channel 1, base station B should be set to channel 4 or higher.
- Moving objects that temporarily place metal between your computer and the base station

