

Designing  
AirPort Networks 2





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# Getting Started

## 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.

AirPort technology allows you to

- create a wireless network in your home or school using an AirPort Base Station, then connect to the Internet and share the connection among several computers simultaneously. Your entire family 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 Base Station and surf the World Wide 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 AirPort Works

Traditionally, sharing data 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 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 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 50 meters (168 feet). Range in a wireless network may vary with site conditions.

## How Wireless Internet Access Is Provided

Wireless Internet access requires an AirPort Card, an AirPort 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.

With AirPort, you do not establish a wireless connection with your ISP directly. You set up a wireless connection to a base station that is connected to the Internet. 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.

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

- Connect a telephone line, DSL or cable modem to the AirPort Base Station. The AirPort Base Station receives Web pages 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 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.

Though some ISPs that use connection scripts or terminal login windows are not supported, you can select certain AirPort-compatible connection scripts in the AirPort Setup Assistant or AirPort Admin Utility.

## Configuring AirPort Base Station Internet Access

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

To set up more complex configurations, use the AirPort Admin Utility and follow the instructions in Chapter 3.

## The AirPort Setup Assistant

The AirPort Setup Assistant 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 settings for the internal modem, Ethernet, or PPP over Ethernet (PPPoE) that you have received from your ISP. You can also give your 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.

To use the AirPort Setup Assistant:

- *In Mac OS X*
  - 1 Open the AirPort Setup Assistant, located in the Utilities folder in the Applications folder on your hard disk.
  - 2 Select “Set up your computer to join an existing AirPort network” or “Set up an AirPort Base Station,” depending on what you are setting up.
  - 3 Follow the onscreen instructions.
- *In Mac OS 9*
  - 1 Open the AirPort Setup Assistant, located in the AirPort folder in the Apple Extras folder in the Applications (Mac OS 9) folder on your hard disk.
  - 2 Select “Set up your computer to join an existing AirPort network” or “Set up an AirPort Base Station,” depending on what you are setting up.
  - 3 Follow the onscreen instructions.

## The AirPort Admin Utility

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

### When to Use the AirPort Admin Utility

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

To use the AirPort Admin Utility:

- *In Mac OS X*
  - 1 Open the AirPort Admin Utility, located in the Utilities folder in the Applications folder on your hard disk.
  - 2 Select your base station and click Configure. Enter a password if necessary. (The default password for a base station is *public*.)
- *In Mac OS 9*
  - 1 Open the AirPort Admin Utility, located in the AirPort folder in the Apple Extras folder in the Applications (Mac OS 9) folder on your hard disk.
  - 2 Select your base station and click Configure. Enter a password if necessary. (The default password for a base station is *public*.)



# Network Basics

This chapter contains information about your computer's network settings, what they do, and how to adjust them in Mac OS 9 and Mac OS X. It also describes the software used for IP and AirPort networking and how the software differs in Mac OS 9 and Mac OS X.

To exploit all the power and flexibility of AirPort, you may need to change the networking 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 networking 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 select an AirPort network:

- *In Mac OS X*, use the AirPort status icon in the menu bar to turn on AirPort and choose an available AirPort network.
- *In Mac OS 9*, use the AirPort Control Strip module 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

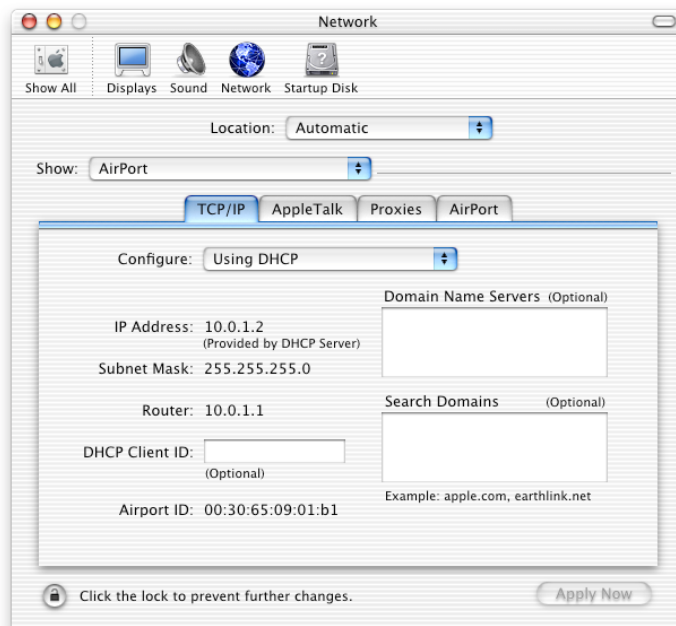
Configuring IP consists of two steps:

- selecting a networking interface
- selecting a configuration method

*In Mac OS X*

- 1 Open the Show pop-up menu in the Network pane of System Preferences, then choose Ethernet if you are connecting to an Ethernet network, or AirPort if you are connecting to an AirPort network.
- 2 In the TCP/IP pane, 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 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.

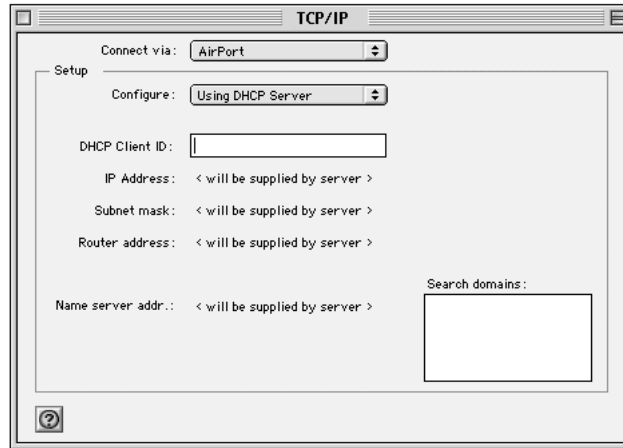
For example, below is the Network pane of System Preferences in Mac OS X, configured to use AirPort for the network interface and DHCP for the TCP/IP configuration.



*In Mac OS 9*

- 1 Open the “Connect via” pop-up menu in the TCP/IP control panel, then choose Ethernet if you are connecting to an Ethernet network, or AirPort if you are connecting to an AirPort network.
- 2 Choose the configuration method from the Configure pop-up menu.  
The three most frequently used methods are PPP, DHCP, and Manually.

Below is the TCP/IP control panel in Mac OS 9, configured to connect to a network via AirPort and receive an IP address from the DHCP server.



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

## Software Used for IP Networking in Mac OS X

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

### Network Preferences

Use the TCP/IP pane in the Network pane of System 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 connect to a network, use the Configure pop-up menu in the top portion of the pane.

To configure how you connect to the Internet, use the remaining fields. 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 Internet connection 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 in the Configuration pop-up menu.

### AppleTalk

AppleTalk is a protocol used on local networks. Use the AppleTalk tab of Network preferences to specify the interface to be used for 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 Apple menu. For more information about the network locations, see Mac Help 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 Base Station)
- find the AirPort ID (the hardware address of your AirPort Card)
- see the connection status of an AirPort Base Station that is configured for a dialup ISP
- select an AirPort network
- create or join a Computer-to-Computer network
- allow the selection of closed networks

### AirPort Status Icon in the Menu Bar

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 Base Station

### AirPort Admin Utility

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

- download the base station configuration to your computer
- modify the configuration on your computer
- upload the modified configuration to the base station
- upgrade the base station software

## Software Used for IP Networking in Mac OS 9

You'll frequently use several control panels on your computer for networking in Mac OS 9. 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 how you connect to a network, use the "Connect via" pop-up menu.

To configure how you connect to the Internet, use the remaining fields of the control panel. Contact your ISP or network administrator for the information to type in these fields.

### Remote Access Control Panel

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

### AppleTalk Control Panel

Use the AppleTalk control panel to specify the interface to be used for AppleTalk networking. For consistent IP networking, AppleTalk should be set to use the same interface as the TCP/IP control panel.

### Location Manager Control Panel

Use the Location Manager control panel to manage sets of TCP/IP, AppleTalk, and Remote Access control panel configurations. After you create your locations, you can switch all of your network settings by choosing a location from the control panel. For more information about the Location Manager, see Mac Help in the Help menu.

## Software Used for AirPort Networking in Mac OS 9

### AirPort Application

Use the AirPort 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 Base Station)
- find the AirPort ID (the hardware address of your AirPort Card)
- see the connection status of an AirPort Base Station that is configured for a dialup ISP
- select an AirPort network
- configure your computer to be a software base station
- create or join a Computer-to-Computer network
- allow the selection of closed networks

### AirPort Control Strip Module

Use the AirPort Control Strip module to

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

### AirPort Setup Assistant

Use the AirPort Setup Assistant to

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

### AirPort Admin Utility

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

- download the base station configuration to your computer
- modify the configuration on your computer
- upload the modified configuration to the base station
- upgrade the base station software





# AirPort Network Designs

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

## **Step 1: Set up the AirPort 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.

## **Step 2: Configure and share Internet access**

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

## **Step 3: Set 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, and fine-tuning other AirPort settings.

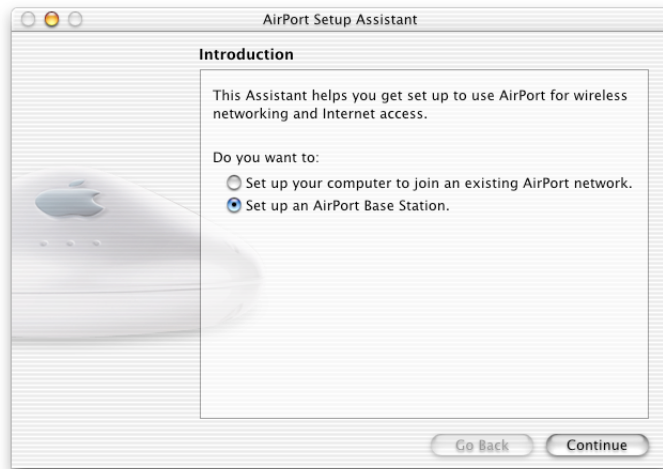
You can do most of your setup and configuration tasks with the AirPort Setup Assistant. To set advanced options, you need to use the AirPort Admin Utility.

**Note:** The images in this chapter show the AirPort software in Mac OS X v10.1. If you are using AirPort in Mac OS 9, the images may be slightly different, but the software behaves the same way.

## 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 the Utilities folder inside the Applications folder in Mac OS X, and in the Apple Extras folder in the Applications (Mac OS 9) folder in Mac OS 9.
- 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 the AirPort Admin Utility

To modify the base station configuration, you open the configuration with the AirPort Admin Utility on your computer.

To open your base station's configuration:

- 1 Open the AirPort Admin Utility.
- 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 status icon in the menu bar in Mac OS X or the AirPort Control Strip module in Mac OS 9.
- 2 Make sure your network and TCP/IP settings are configured properly.
  - *In Mac OS X*, 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 on the TCP/IP tab.
  - *In Mac OS 9*, choose AirPort from the "Connect via" pop-up menu and Using DHCP Server from the Configure pop-up menu in the TCP/IP control panel.

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

- 1 Make sure your network and TCP/IP settings are configured properly.
  - *In Mac OS X*, 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 on the TCP/IP tab.
  - *In Mac OS 9*, choose AirPort from the "Connect via" pop-up menu and Using DHCP Server from 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.

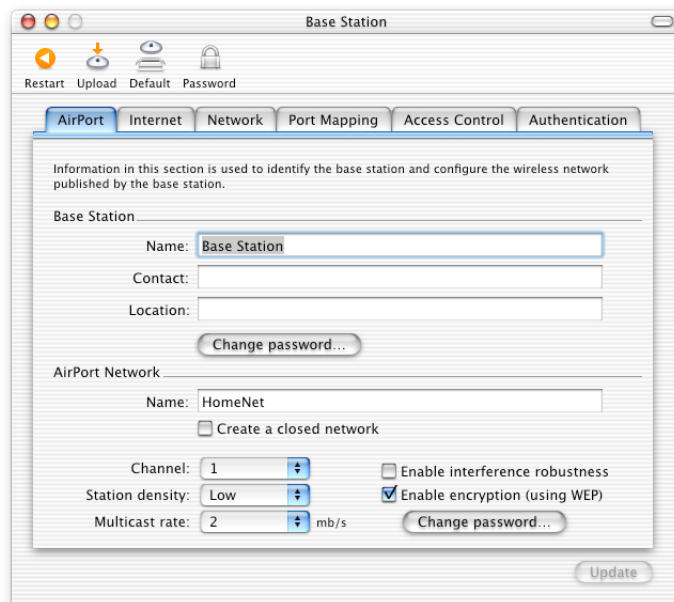
### **If you are on an Ethernet network that has other base stations, or you are using Ethernet to connect to the base station:**

The AirPort Admin Utility scans the Ethernet network to create the list of base stations in the Select 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 from a non-AirPort computer, see the document called "Installation Instructions" that came on your AirPort software CD.

## 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. Open the setup assistant, located in the Utilities folder in the Applications folder in Mac OS X, and in the AirPort folder in the Apple Extras folder inside the Applications (Mac OS 9) folder in Mac OS 9. 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 the AirPort Admin Utility, located in the Utilities folder in the Applications folder on your hard disk in Mac OS X, and in the AirPort folder in the Apple Extras folder inside the Applications (Mac OS 9) folder on your hard disk in Mac OS 9. 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 AirPort Base Station on your network.

### Changing the Base Station Password

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

## Naming the AirPort Network

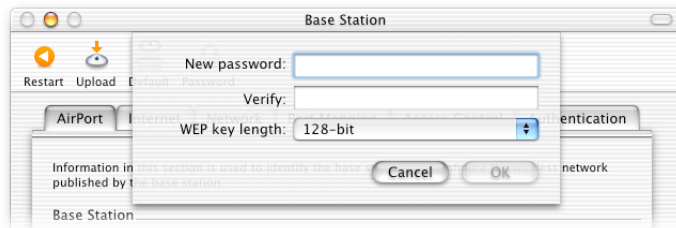
Give your AirPort network a name. This name appears in the AirPort status icon in the menu bar on the AirPort computers that are in range of your AirPort network.

## Creating a Network Password

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

## Using 128-Bit Encryption

Your AirPort 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 (maximum compatibility) or 128-bit encryption (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 Base Station. Users must enter the exact network name to join the AirPort network.

To create a closed network:

- 1 Open the Admin Utility, select your base station, and click Configure.
- 2 On the AirPort tab, click the “Create a closed network” checkbox.

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

- 1 Click the AirPort status icon in the menu bar of Mac OS X, or click the AirPort Control Strip module in Mac OS 9, 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 the AirPort Admin Utility to modify the configuration of a base station with a closed network. To use the AirPort Admin Utility to set other advanced options, see “Step 3: Set advanced options” on page 43.

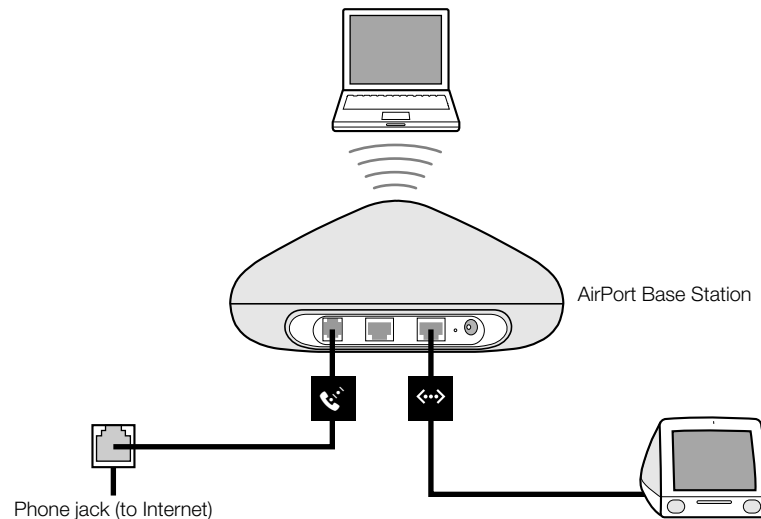
## Step 2: Configure and share Internet access

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)

In most cases, you can implement this design with the AirPort Setup Assistant. You only need to use the AirPort Admin Utility if you need to 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 the Internet using its internal modem.
- Computers using AirPort or Ethernet can connect to the Internet through the AirPort Base Station.
- AirPort and Ethernet computers communicate with each other through the base station using AppleTalk and other networking protocols.



## What You Need

Components	Check ✓	Comments
Working dialup ISP account using standard PPP	Make sure you have the following: <ul style="list-style-type: none"><li>■ ISP phone number</li><li>■ account name and password</li><li>■ DNS address</li></ul>	You can get this information (except the account password) from the 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 Admin Utility.
AirPort Base Station		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.

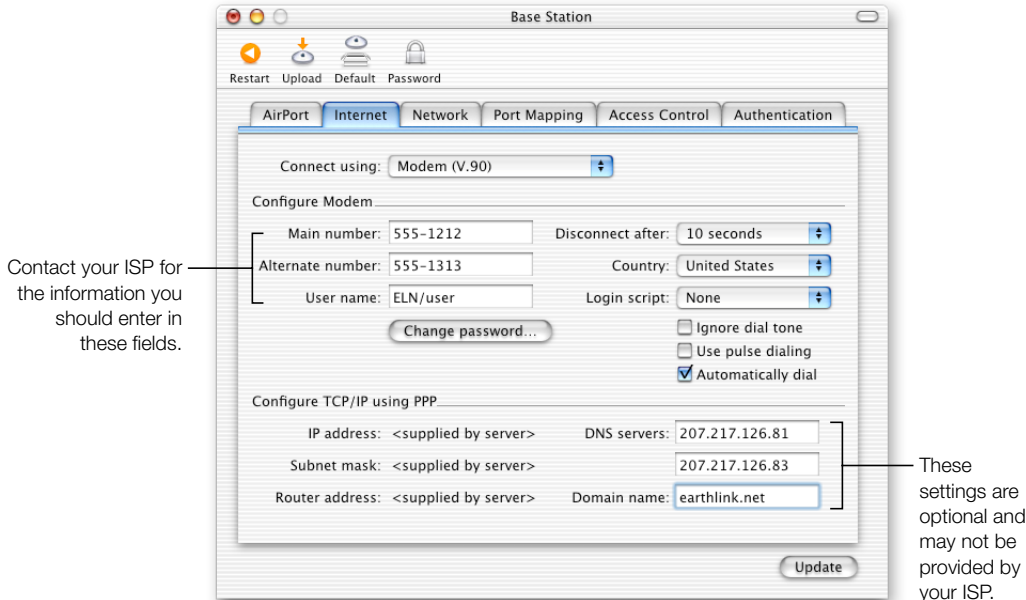
## What to Do

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

- 1 Open the setup assistant, located in the Utilities folder in the Applications folder in Mac OS X or in the AirPort folder in the Apple Extras folder in the Applications (Mac OS 9) folder on your hard disk in Mac OS 9.
- 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.

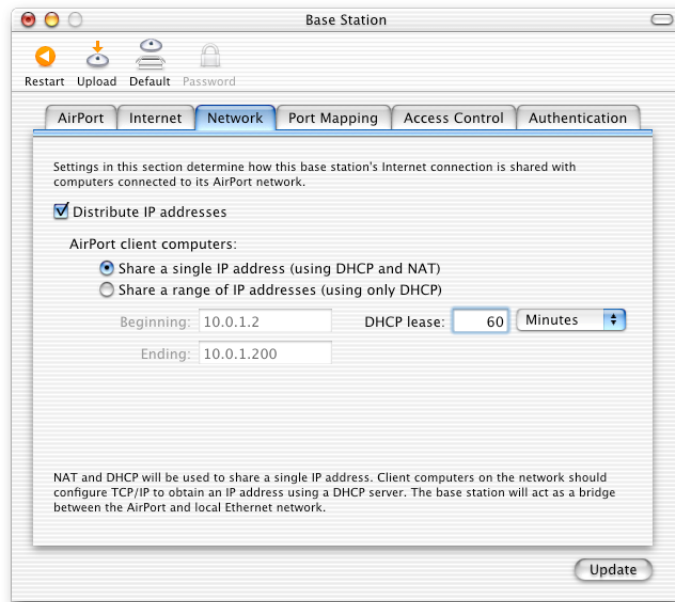
If you are using the AirPort Admin Utility to configure the AirPort Base Station for Internet access:

- 1 Open the base station's configuration in the AirPort Admin Utility. Select your base station and click Configure.
- 2 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.



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

- 3 Click the Network tab and configure how the base station will share its Internet access with AirPort and Ethernet computers. Select the “Distribute IP addresses” checkbox and the “Share a single IP address (using DHCP 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 network. When Modem is selected in the “Connect using” pop-up menu on the Internet tab, both the Ethernet LAN (↔) port and the Ethernet WAN (🌐) port are bridged, and both can share a single IP address using NAT.

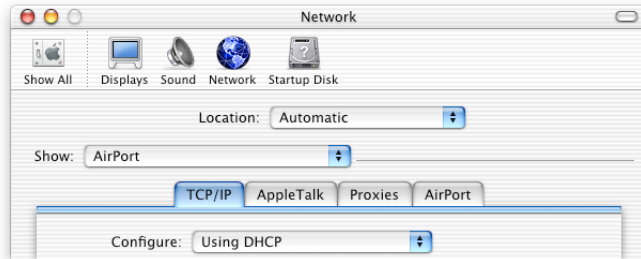
**Important** If you are connecting to the Internet by Ethernet or PPPoE, only the Ethernet LAN (↔) port is bridged.

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 each other.

- 4 If you want to adjust optional advanced settings, go to “Step 3: Set advanced options” on page 43. 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.

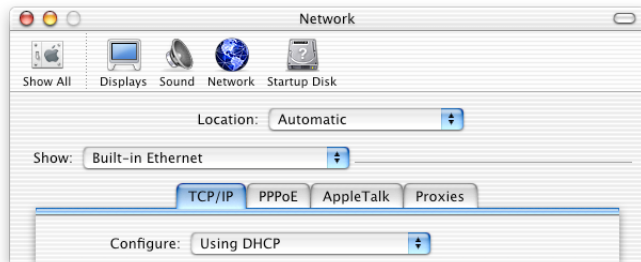
## Setting Up Client Computers

To configure TCP/IP on client computers using AirPort in Mac OS X, choose AirPort from the Show pop-up menu in the Network pane of System Preferences, and Using DHCP Server from the Configure pop-up menu on the TCP/IP tab.



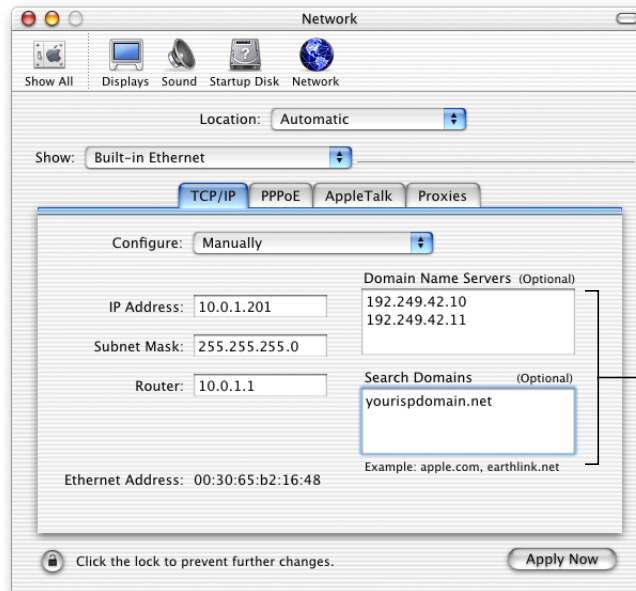
In Mac OS 9, choose AirPort from the “Connect via” pop-up menu and Using DHCP Server from the Configure pop-up menu in the TCP/IP control panel.

If you enabled a DHCP server in step 3, configure TCP/IP on client computers using Ethernet. In Mac OS X, choose Ethernet from the Show pop-up menu in the Network pane of System Preferences, and Using DHCP from the Configure pop-up menu on the TCP/IP tab. In Mac OS 9, choose Ethernet from the “Connect via” pop-up menu and Using DHCP Server from the Configure pop-up menu in the TCP/IP control panel.



If you selected “Share a range of IP addresses (using only DHCP),” you can provide Internet access to Ethernet computers by setting the IP addresses manually. You can then configure TCP/IP manually on Ethernet computers as follows:

- *In Mac OS X*, use the Network pane of System Preferences.



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

- *In Mac OS 9*, use the TCP/IP control panel.

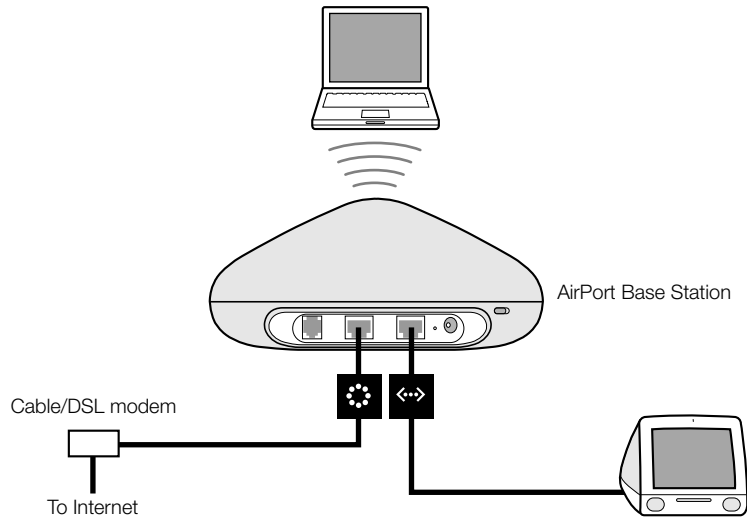
When you configure Ethernet clients manually for a base station that provides NAT services over Ethernet, use IP addresses in the range 10.0.1.201 to 10.0.1.254.

In the “Subnet mask” field, enter 255.255.255.0. In the “Router 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 DSL or Cable Modem

In most cases, you can implement this design with the AirPort Setup Assistant. You only need to use the 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 Base Station.
- AirPort computers and Ethernet computers communicate with each other through the base station using AppleTalk.

**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

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 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 Base Station for Internet access:

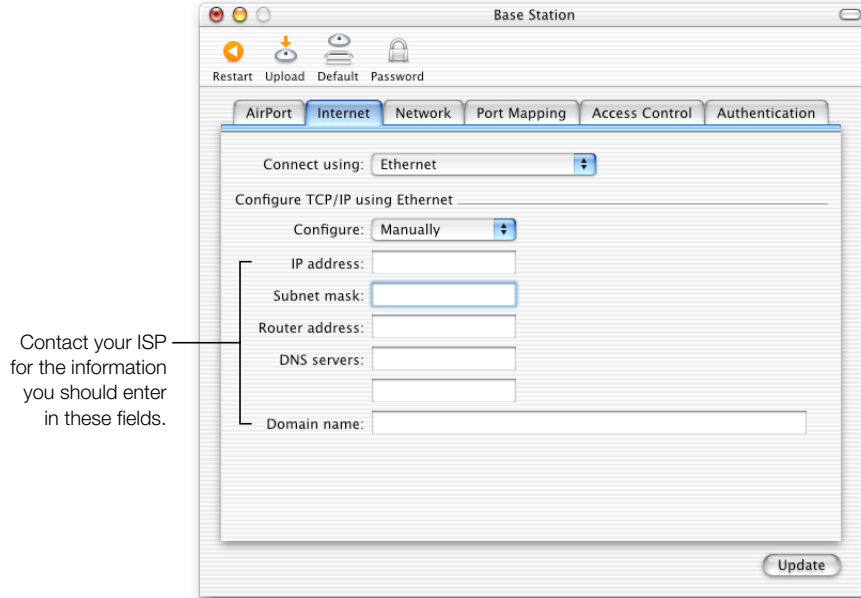
- 1 Open the setup assistant, located in the Utilities folder in the Applications folder in Mac OS X, and in the AirPort folder in the Apple Extras folder inside the Applications (Mac OS 9) folder in Mac OS 9.
- 2 Select “Set up an AirPort Base Station” and follow the onscreen instructions.
- 3 Enter the settings for your ISP.

If you are using the 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 the base station’s configuration in the AirPort Admin Utility. Select your base station and click Configure.
- 3 Click the Internet tab. Choose Ethernet or PPP over Ethernet (PPPoE) from the “Connect using” pop-up menu, depending on which one your ISP requires. If your ISP provided you with PPPoE connection software, such as EnterNet or MacPoET, choose PPPoE. Contact your ISP if you aren’t sure which one to select.
- 4 If you chose Ethernet, choose Manually or Using DHCP from the Configure 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.

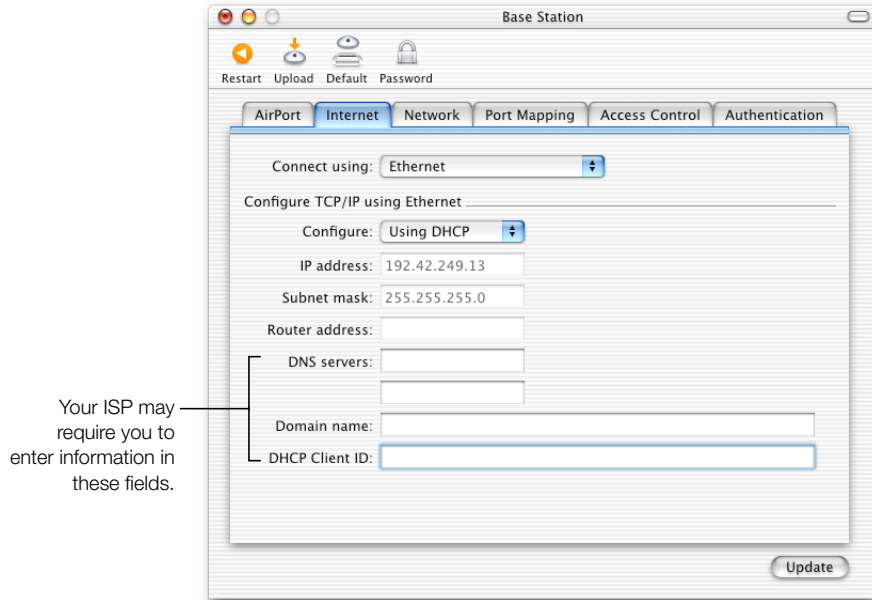
Here's what you'll see if you configure TCP/IP manually (enter your own IP address information in the fields below the Configure pop-up menu):



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

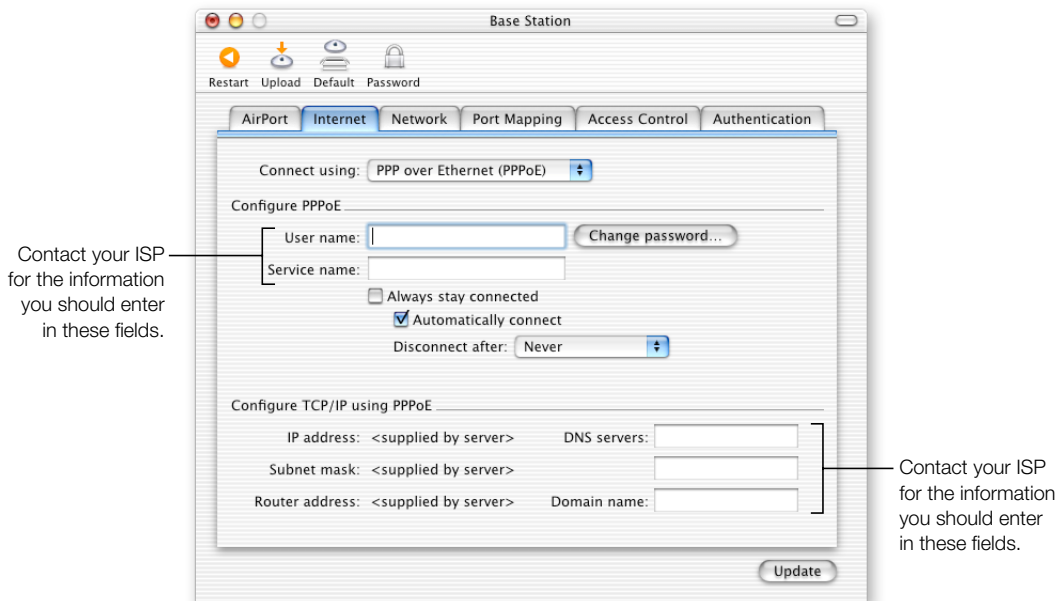


Here's what you'll see if you configure TCP/IP using DHCP (your IP addresses are delivered by the DHCP server):



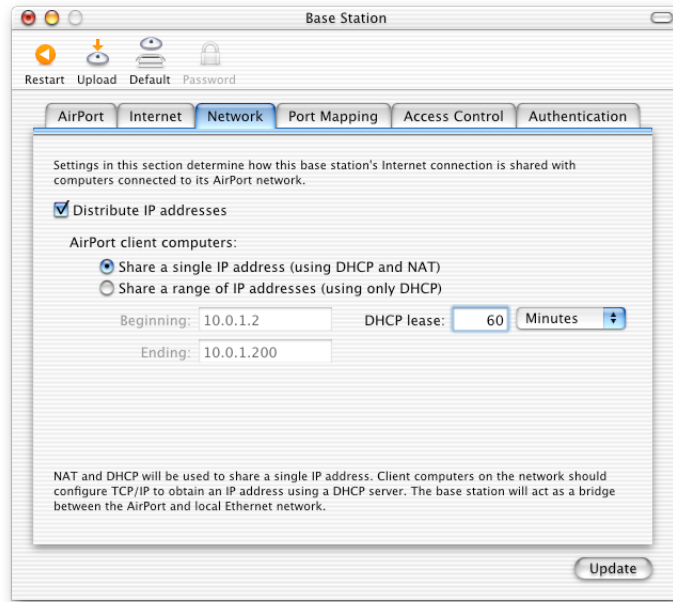
- 5 If you chose PPP over Ethernet (PPPoE) from the “Connect using” pop-up menu, enter the PPPoE settings your ISP provided. Leave the “Service name” field blank unless your ISP requires a service name.

**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 on the Internet tab, and deselect the “Distribute IP addresses” checkbox on the Network tab.

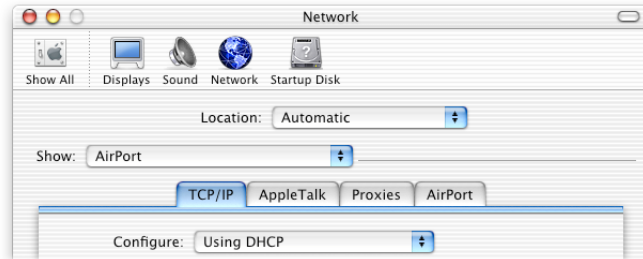
- 6 Click the Network tab and configure how the base station will share its Internet access with AirPort and Ethernet computers.



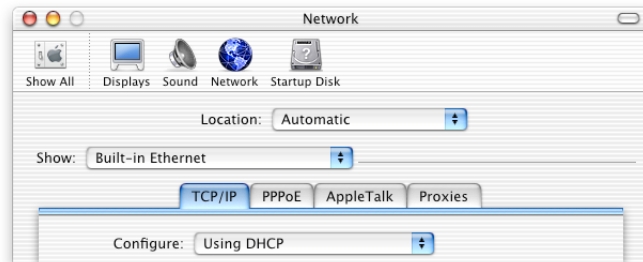
- To share a single Internet connection with AirPort computers, make sure the “Distribute IP addresses” checkbox and the “Share a single IP address (using DHCP and NAT)” button are selected. If you have been given a range of public IP addresses by your ISP, you can select the option to share a range of IP addresses (using only DHCP).
  - If you want to connect an AppleTalk Ethernet printer to the base station or 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 each other using non-IP protocols like AppleTalk.
- 7 If you want to adjust optional advanced settings, go to “Step 3: Set advanced options” on page 43. 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

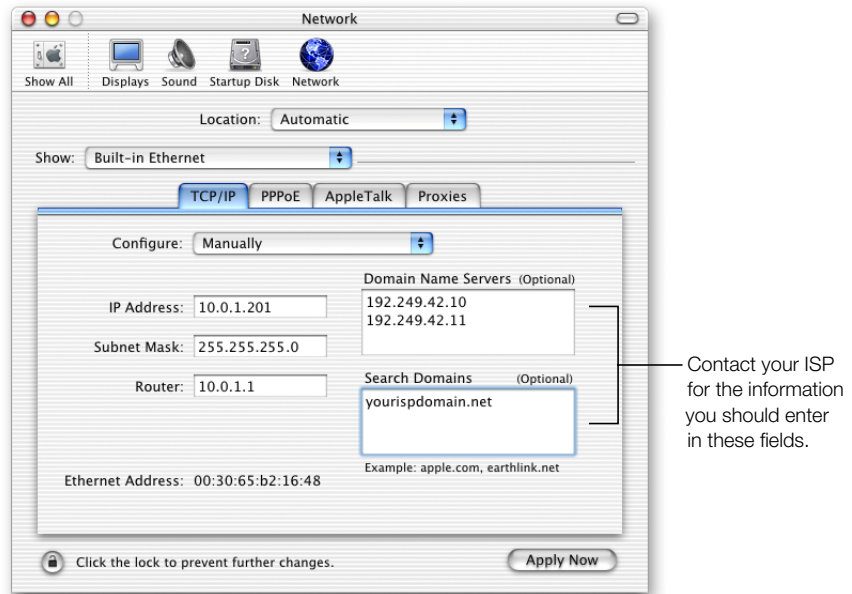
- To configure TCP/IP on client computers using AirPort in Mac OS X, choose AirPort from the Show pop-up menu in the Network pane of System Preferences, and Using DHCP from the Configure pop-up menu on the TCP/IP tab. In Mac OS 9, choose AirPort from the “Connect via” pop-up menu and Using DHCP Server from the Configure pop-up menu in the TCP/IP control panel.



- If you selected “Share a single IP address (using DHCP and NAT)” in step 6, configure TCP/IP on client computers connected to the Ethernet LAN (↔) port by choosing Built-in Ethernet from the Show pop-up menu in the Network pane of System Preferences, and Using DHCP from the Configure pop-up menu on the TCP/IP tab in Mac OS X. In Mac OS 9, choose Ethernet from the “Connect via” pop-up menu and Using DHCP Server from the Configure pop-up menu in the TCP/IP control panel.



- If you didn't select "Share a single IP address (using DHCP and NAT)," you can provide Internet access to Ethernet computers connected to the Ethernet LAN (↔) port. Configure TCP/IP manually on Ethernet computers as follows:  
*In Mac OS X*, use the Network pane of System Preferences.



*In Mac OS 9*, use the TCP/IP control panel.

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.

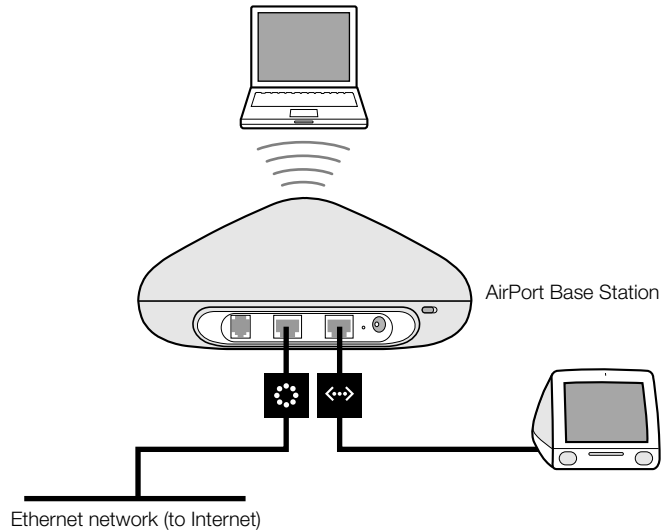
In the "Subnet mask" field, enter 255.255.255.0. In the "Router address" field, enter 10.0.1.1.

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 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 clients access the Internet and the Ethernet network through the AirPort Base Station.

## What You Need

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

## What to Do

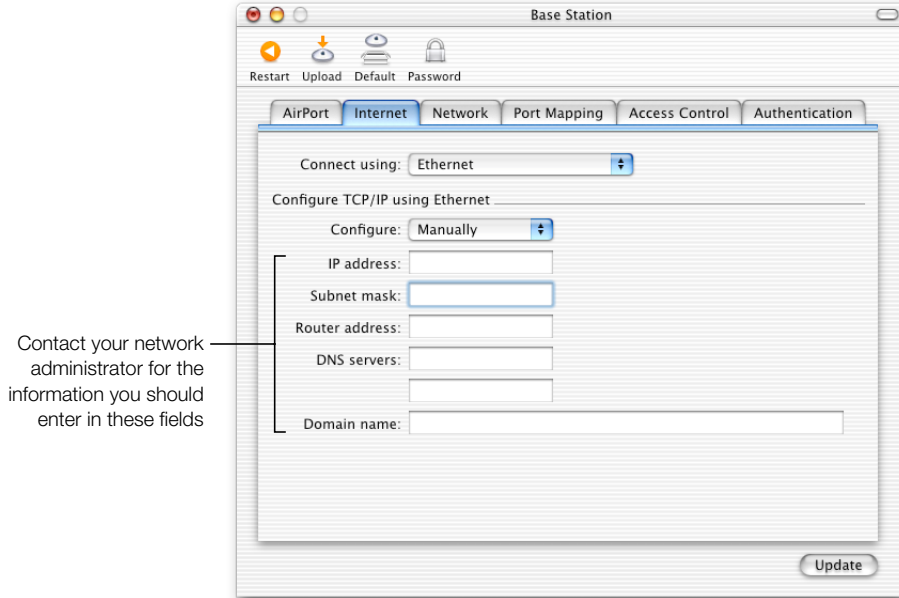
If you are using the AirPort Setup Assistant to set up a base station on an existing Ethernet network:

- 1 Open the setup assistant, located in the Utilities folder in the Applications folder on your hard disk.
- 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 the AirPort Admin Utility:

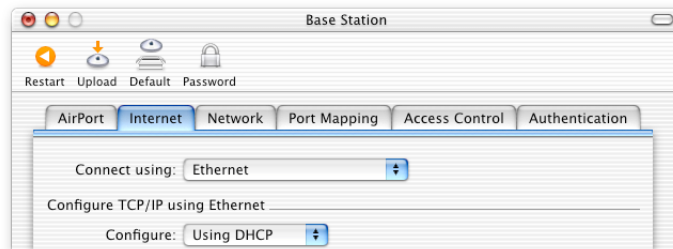
- 1 Open your base station's configuration in the AirPort Admin Utility, located in the Utilities folder in the Applications folder on your hard disk in Mac OS X. In Mac OS 9, the AirPort Admin Utility is located in the AirPort folder in the Apple Extras folder inside the Applications (Mac OS 9) folder. Select your base station and click Configure.
- 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 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.



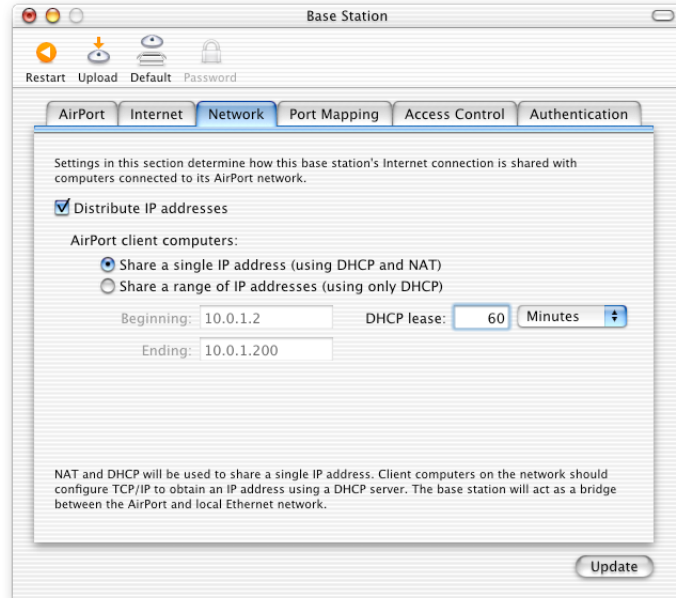
If you have already used the AirPort Setup Assistant to set up your AirPort Base Station, the fields below the Configure pop-up menu may already contain the appropriate information.

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





- 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 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 Base Station as a Bridge” on page 43.

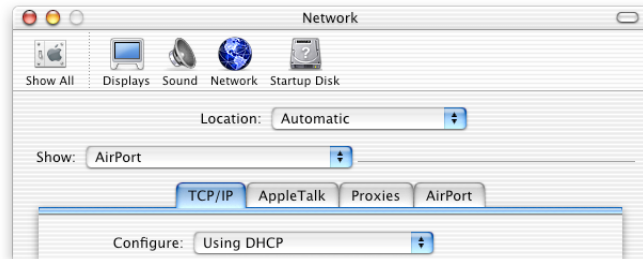
**Important** Since the base station can provide network services, you must set it up carefully to avoid interfering with other services on your Ethernet network.

- 4 If you want to adjust optional advanced settings, go to “Step 3: Set advanced options” on page 43. 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 using AirPort:

- *In Mac OS X*, choose AirPort from the Show pop-up menu in Network preferences and Using DHCP from the Configure pop-up menu on the TCP/IP tab.



- *In Mac OS 9*, choose AirPort from the “Connect via” pop-up menu and Using DHCP Server from the Configure pop-up menu in the TCP/IP control panel.

## Joining an AirPort Network

To join your AirPort network, clients can use the AirPort status icon in the menu bar in Mac OS X or the AirPort Control Strip module in Mac OS 9.

## Step 3: Set advanced options

### Using the AirPort Base Station as a Bridge

You can turn off the base station's Internet sharing features (providing IP addresses to AirPort computers using DHCP or NAT) 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. 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.

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

### Setting Up Roaming

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

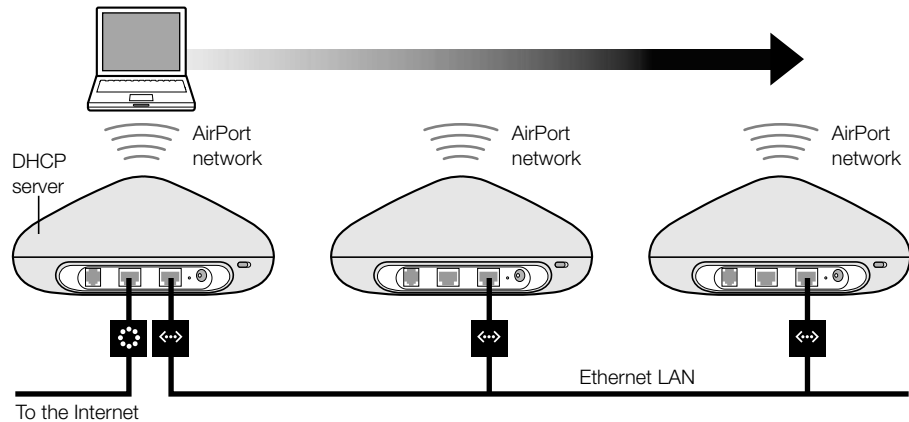
To set up roaming:

- 1 Connect all of the AirPort Base Stations to the same subnet on your Ethernet network.
- 2 Give 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.
- 5 To optimize performance, set the base station density to High, Medium, or Low, depending on how far apart the base stations are (see "Setting Base Station Density" on page 44).

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.
- 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 Base Station Density

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

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

Set base station density on the AirPort tab of the AirPort Admin Utility.

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

## 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 (sometimes 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 in Mac OS X. In Mac OS 9, click the Settings arrow in the AirPort application, located in the AirPort folder in the Apple Extras folder, inside the Applications (Mac OS 9) folder on your hard disk.

To set up the Access Control list, open your base station’s configuration in the AirPort Admin Utility and click the Access Control tab. 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 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 20.

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 is a way of authenticating 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 in an Access Control list. Instead, all the addresses are stored on a server that is accessed through a specific IP address.

Follow the instructions that came with your RADIUS server and enter the MAC addresses of the computers that will access the network. When the RADIUS server is set up, click the Authentication tab in the AirPort Admin Utility, and then select the Use RADIUS Authentication checkbox. Enter the IP address, port, and shared secret of the primary and secondary servers.

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.

## Setting Multicast Rate

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

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

Set the multicast rate on the AirPort tab of the AirPort Admin Utility.

**Note:** Higher multicast rates can only be set if the base station density (see “Setting Base Station Density” on page 44) is set to Medium or High, which limits the range of the base station.

## Interference Robustness

If a microwave oven near your base station is used frequently and you experience performance problems, turn on interference robustness. For a list of items that can cause interference, see “Items That Can Cause Interference With AirPort” on page 53.

Set interference robustness on the AirPort tab of the AirPort Admin Utility.

## Using Port Mapping

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

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

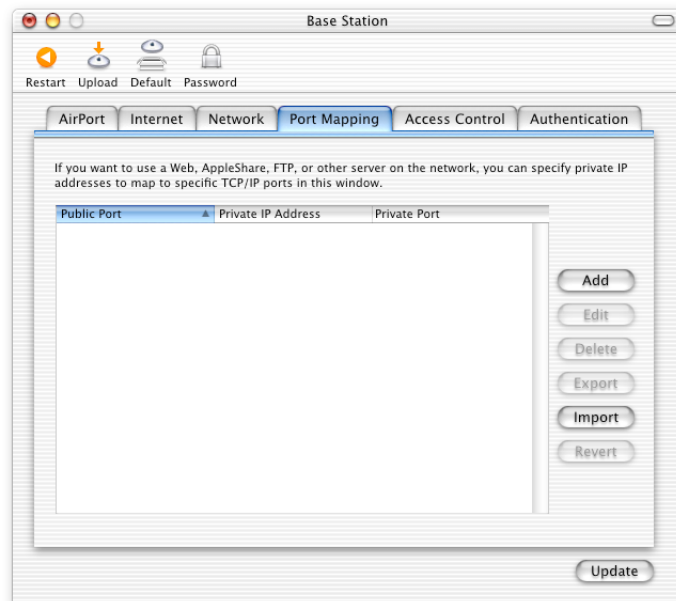
To ensure that requests are routed to your Web, AppleShare, or FTP server properly, you need to establish a permanent IP address for your server and provide inbound port mapping information to the AirPort Base Station.

To set up inbound port mapping:

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

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

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



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

### Setting DHCP Lease Time

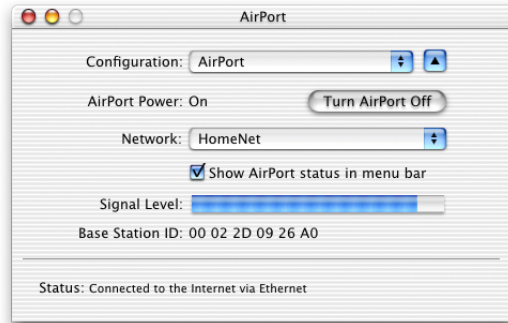
Set the DHCP lease time to control the amount of time that an IP address will be valid for a computer. This feature is especially useful in education and other environments where users change frequently. Using very short leases, DHCP can dynamically reconfigure networks in which there are more computers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

Set the DHCP lease time on the Network tab of the AirPort Admin Utility.

## Solving Problems

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

- Make sure the base station is connected to the Internet. 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.
- On computers using AirPort in Mac OS X, open Internet Connect (in the Applications folder on the hard disk) and choose AirPort from the Configuration pop-up menu. In Mac OS 9, open the TCP/IP control panel and make sure AirPort is selected in the "Connect via" 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.
- If the base station is set up as a DHCP server, make sure the "Distribute IP addresses" checkbox is selected in the Network tab of the AirPort Admin Utility.



# Behind the Scenes

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. This is why you can go to the Apple Web site 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 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

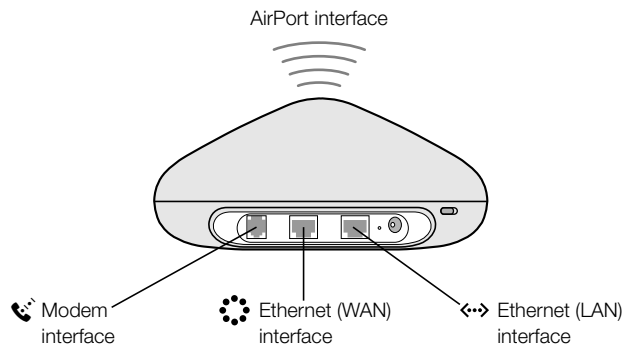
An IP subnet is a local network as defined by IP network numbers. Connecting to a subnet involves connecting to the appropriate hardware network and configuring IP for that network.

## Using the AirPort Base Station

### Base Station Interfaces

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



## Base Station Functions

- *Bridge*: The AirPort 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 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
- 2.4 gigahertz (GHz) phones
- cordless telephones that operate in this 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