



# Mac OS X Server

Network Services Administration  
Version 10.6 Snow Leopard



🍏 Apple Inc.  
© 2009 Apple Inc. All rights reserved.

The owner or authorized user of a valid copy of Mac OS X Server software may reproduce this publication for the purpose of learning to use such software. No part of this publication may be reproduced or transmitted for commercial purposes, such as selling copies of this publication or for providing paid-for support services.

Every effort has been made to ensure that the information in this manual is accurate. Apple Inc. is not responsible for printing or clerical errors.

Apple  
1 Infinite Loop  
Cupertino, CA 95014-2084  
408-996-1010  
[www.apple.com](http://www.apple.com)

Use of the “keyboard” Apple logo (Option-Shift-K) for commercial purposes without the prior written consent of Apple may constitute trademark infringement and unfair competition in violation of federal and state laws.

Apple, the Apple logo, AirPort, AppleScript, AppleShare, AppleTalk, Bonjour, Firewire, iCal, iChat, iTunes, Snow Leopard, Mac, Macintosh, Mac OS, QuickTime, Xgrid, Xsan, and Xserve are trademarks of Apple Inc., registered in the U.S. and other countries.

Finder is a trademark of Apple Inc.

Java and all Java-based trademarks and logos are trademarks or registered trademarks of Sun Microsystems, Inc. in the U.S. and other countries.

UNIX is a registered trademark of The Open Group.

Other company and product names mentioned herein are trademarks of their respective companies. Mention of third-party products is for informational purposes only and constitutes neither an endorsement nor a recommendation. Apple assumes no responsibility with regard to the performance or use of these products.

019-1418/2009-08-01

# Contents

11	<b>Preface: About This Guide</b>
11	What's New in Network Services
11	What's in This Guide
12	Using Onscreen Help
13	Documentation Map
14	Viewing PDF Guides Onscreen
14	Printing PDF Guides
14	Getting Documentation Updates
15	Getting Additional Information
16	<b>Chapter 1: Linking Your Network to the Internet</b>
16	About Gateway Setup Assistant
17	Running Gateway Setup Assistant
18	Connecting a Wired LAN to the Internet
19	Connecting a Wired LAN and Wireless Clients to the Internet
21	Connecting a Wireless LAN to the Internet
23	About Network Services
25	<b>Chapter 2: Working with DHCP Service</b>
26	DHCP Setup Overview
26	Before Setting Up DHCP Service
26	Creating Subnets
27	Assigning IP Addresses Dynamically
27	Using Static IP Addresses
28	Locating the DHCP Server
28	Interacting with Other DHCP Servers
28	Using Multiple DHCP Servers on a Network
28	Assigning Reserved IP Addresses
28	Getting More Information About the DHCP Process
29	Turning DHCP Service On
29	Setting Up DHCP Service
29	Creating Subnets in DHCP Service
31	Configuring Log Settings for DHCP Service

32	Starting DHCP Service
32	Managing DHCP Service
32	Stopping DHCP Service
33	Changing Subnet Settings in DHCP Service
34	Deleting Subnets from DHCP Service
34	Disabling Subnets Temporarily
35	Changing IP Address Lease Times for a Subnet
35	Setting the DNS Server for a DHCP Subnet
36	Setting LDAP Options for a Subnet
37	Setting WINS Options for a Subnet
39	Assigning Static IP Addresses Using DHCP
40	Removing or Changing Static Address Maps
41	Monitoring DHCP Service
41	Checking DHCP Service Status
42	Viewing DHCP Log Entries
42	Viewing the DHCP Client List
43	Common Network Configurations That Use DHCP
43	Using DHCP to Provide IP Addresses Behind a NAT Gateway
43	Workgroup Configuration
44	Student Lab Configuration
45	Coffee Shop Configuration
46	Configuring DHCP to Use an Extra LDAP Server URL
47	DHCP Service for Mac OS X Clients Using DHCP with a Manual Address
48	Configuring DHCP on Clients
48	Configuring a Static IP Address on a Client
48	Where to Find More Information
49	<b>Chapter 3: Working with DNS Service</b>
50	DNS Zones
50	Primary Zones
50	Secondary Zones
50	Forward Zones
51	DNS Machine Records
52	Bonjour and Link-Local Addressing
52	Before You Set Up DNS Service
53	Setting Up DNS Service for the First Time
56	Turning DNS Service On
56	Upgrading DNS Configuration
56	Setting Up DNS Service
57	Configuring DNS Service Primary Zone Settings
59	Configuring DNS Service Secondary Zone Settings
59	Configuring DNS Service Bonjour Settings
60	Configuring DNS Service Settings

62	Starting DNS Service
62	Managing DNS Service
62	Checking DNS Service Status
63	Viewing DNS Service Logs
64	Changing DNS Log Detail Levels
64	Viewing DNS Service Statistics
65	Stopping DNS Service
65	Enabling or Disabling Zone Transfers
66	Enabling Recursion
67	Managing DNS Zones
67	Adding a Primary Zone
68	Adding a Secondary Zone
68	Adding a Forward Zone
69	Changing a Zone
69	Deleting a Zone
70	Importing a BIND Zone File
70	Managing DNS Records
71	Adding an Alias Record to a DNS Zone
71	Adding a Machine Record to a DNS Zone
72	Adding a Service Record to a DNS Zone
73	Changing a Record in a DNS Zone
74	Deleting a Record from a DNS Zone
74	Securing the DNS Server
74	DNS Spoofing
75	Server Mining
76	DNS Service Profiling
76	Denial of Service (DoS)
76	Service Piggybacking
77	Common Network Administration Tasks That Use DNS Service
77	Configuring DNS for Mail Service
79	Setting Up Namespace Behind a NAT Gateway
80	Network Load Distribution (Round Robin)
81	Hosting Several Internet Services with a Single IP Address
81	Hosting Multiple Domains on the Same Server
82	Configuring a Client to use Your DNS Server
82	Where to Find More DNS Information
83	<b>Chapter 4: Working with Firewall Service</b>
83	About Firewall Service
85	Basic Firewall Practices
85	Firewall Startup
86	About Firewall Rules
86	What a Firewall Rule Is

87	Using Address Ranges
89	Rule Mechanism and Precedence
90	Multiple IP Addresses
90	Editing IPv6 Firewall Rules
91	Firewall Setup Overview
92	Turning Firewall Service On
93	Setting Up Firewall Service
93	Configuring Address Groups Settings
94	Configuring Services Settings
96	Configuring Firewall Logging Settings
96	Configuring Advanced Settings
96	Starting Firewall Service
97	Managing Firewall Service
97	Stopping Firewall Service
97	Disabling Firewall Service
98	Creating an Address Group
98	Editing or Deleting an Address Group
99	Duplicating an Address Group
99	Adding to the Services List
100	Editing or Deleting Items in the Services List
100	Configuring Advanced Firewall Rules
102	Editing or Deleting Advanced Firewall Rules
103	Changing the Order of Advanced Firewall Rules
103	Troubleshooting Advanced Firewall Rules
104	Enabling Stealth Mode
104	Adaptive Firewall
105	Resetting the Firewall to the Default Setting
105	Monitoring Firewall Service
105	Checking the Status of Firewall Service
106	Viewing Firewall Active Rules
107	Viewing the Firewall Service Log
108	Viewing Denied Packets
109	Viewing Packets Logged by Firewall Rules
109	Practical Firewall Examples
109	Using Firewall with NAT
109	Blocking Web Access to Internet Users
110	Logging Internet Access by Local Network Users
111	Blocking Junk Mail
112	Permitting a Customer to Access the Apple File Server
112	Common Network Administration Tasks That Use Firewall Service
112	Preventing Denial of Service (DoS) Attacks
113	Controlling or Enabling Peer-to-Peer Network Usage
114	Controlling or Enabling Network Game Usage

114	Preventing Network Virus Propagation
114	TCP and UDP Port Reference
115	1–499
116	500–3999
118	4000–50999
119	A–Z by Service
123	Where to Find More Information
124	<b>Chapter 5: Working with NAT Service</b>
124	Using NAT with Other Network Services
124	NAT LAN Configuration Overview
126	Turning NAT Service On
126	Configuring NAT Service
127	Configuring Port Forwarding
128	Port Forwarding Examples
130	Testing Port Forwarding Rules
130	Starting and Stopping NAT Service
131	Creating a Gateway Without NAT
132	Monitoring NAT Service
132	Viewing the NAT Status Overview
132	Viewing the NAT Service Log and Log Path
133	Common Network Administration Tasks That Use NAT
133	Linking a LAN to the Internet Through One IP Address
135	Setting Up a LAN Party for Gaming
135	Setting Up Virtual Servers
138	Where to Find More Information
139	<b>Chapter 6: Working with VPN Service</b>
139	VPN and Security
140	Transport Protocols
140	Authentication Method
141	Using VPN Service with Users in a Third-Party LDAP Domain
141	Before You Set Up VPN Service
142	Configuring Other Network Services for VPN
142	VPN Setup Overview
143	Turning VPN Service On
143	Setting Up VPN Service
143	Configuring L2TP Settings
146	Configuring PPTP Settings
149	Configuring Client Information Settings
150	Configuring VPN Logging Settings
150	Starting VPN Service
151	Managing VPN Service

151	Stopping VPN Service
151	Configuring VPN Network Routing Definitions
153	Limiting VPN Access to Specific Users or Groups
153	Limiting VPN Access to Specific Incoming IP Addresses
155	Supplementary Configuration Instructions
155	Enabling VPN-PPTP Access for Users in an LDAP Domain
156	Offering SecurID Authentication with VPN Server
157	Monitoring VPN Service
157	Viewing a VPN Status Overview
158	Changing the Log Detail Level for VPN Service
158	Viewing the VPN Log
159	Viewing VPN Client Connections
159	Common Network Administration Tasks That Use VPN
159	Linking a Computer at Home with a Remote Network
161	Accessing a Computing Asset Behind a Remote Network Firewall
162	Linking Remote Network Sites
162	About the Site-To-Site VPN Administration Tool
166	Setting up a VPN Connection on a Client
167	Where to Find More Information About L2TP/IPSec
168	<b>Chapter 7: Working with RADIUS</b>
168	RADIUS Setup Overview
169	Turning RADIUS On
169	Setting Up RADIUS
169	Configuring RADIUS Using the Configuration Assistant
171	Adding AirPort Base Stations to a RADIUS Server
171	Adding Bonjour Enabled AirPort Base Stations to a RADIUS Server
172	Remotely Configuring AirPort Base Stations
172	Configuring RADIUS to Use Certificates
173	Archiving RADIUS Service Logs
174	Starting or Stopping RADIUS Service
175	Managing RADIUS
175	Checking RADIUS Status
175	Viewing RADIUS Logs
175	Editing RADIUS Access
176	Deleting AirPort Base Stations
176	Editing an AirPort Base Station Record
177	Saving an AirPort Base Station Internet Connect File
178	<b>Chapter 8: Working with NTP Service</b>
178	How NTP Works
179	Using NTP on Your Network
179	Setting Up NTP Service

179	Configuring NTP Service on Clients
180	Where to Find More Information About NTP
<b>181</b>	<b>Chapter 9: Working with Mobile Access Service</b>
181	About Mobile Access Server
182	Using SSL with Mobile Access Server
182	About Proxied Authentication Mechanisms
183	About Split DNS
184	Mobile Access Service Configuration Overview
184	Turning Mobile Access Service On
185	Setting Up Mobile Access Service
185	Configuring Mobile Access Service Address Book Settings
186	Configuring Mobile Access Service iCal Settings
187	Configuring Mobile Access Service Mail Settings
188	Configuring Mobile Access Service Web Settings
189	Granting Access to Mobile Access Service Proxies
190	Starting Mobile Access Service
190	Monitoring Mobile Access Service
190	Checking Mobile Access Service Status
191	Viewing Mobile Access Service Logs
191	Stopping Mobile Access Service
191	Optional HTTP Configurable Items
192	Where to Find More Information
<b>193</b>	<b>Chapter 10: Supporting a VLAN</b>
193	What a VLAN Is
194	Setting Up Client Membership for a VLAN
194	Where to Find More Information About VLANs
<b>195</b>	<b>Chapter 11: Supporting IPv6</b>
196	IPv6 Enabled Services
196	Support for IPv6 Addresses in Server Admin
196	IPv6 Addresses
196	IPv6 Notation
197	IPv6 Reserved Addresses
197	IPv6 Addressing Model
197	IPv6 Address Types
198	Creating an IPv4 to IPv6 Gateway
198	Where to Find More Information About IPv6
<b>199</b>	<b>Appendix: Command-Line Parameters for Network Services</b>
199	DHCP Service Settings
200	DHCP Subnet Settings Array

200	About Subnet IDs
202	About Static Map IDs
203	Viewing the Location of the DHCP Service Log
203	DNS serveradmin Commands
203	Firewall Service Settings
204	Firewall serveradmin Commands
204	Using ipfilter Groups with the Rules Array
205	ipfilter Rules Array
205	NAT Service Settings
206	NAT serveradmin Commands
206	VPN Service Settings
210	VPN serveradmin Commands
210	RADIUS Settings
211	Transport Level Security
211	Radius Clients
212	Enabling PPP Dial-In Service
212	Restoring the Default Configuration for Server Services
214	<a href="#">Index</a>

# About This Guide

## This guide explains how to configure and administer Mac OS X Server network services.

Mac OS X Server version 10.6 includes several network services that help you manage and maintain your network.

## What's New in Network Services

Network services offers the ability to configure a Mobile Access Server for your Address Book, Mail, Web, and iCal servers.

## What's in This Guide

This guide includes the following sections:

- Chapter 1, “Linking Your Network to the Internet,” tells you how to use Gateway Setup Assistant to link your network to the Internet.
- Chapter 2, “Working with DHCP Service,” tells you how to configure and use DHCP to assign IP addresses on your network.
- Chapter 3, “Working with DNS Service,” tells you how to use Mac OS X Server as a domain name server.
- Chapter 4, “Working with Firewall Service,” tells you how to maintain network security using a firewall.
- Chapter 5, “Working with NAT Service,” tells you how to configure and use NAT to connect many computers to the Internet with only one public IP address.
- Chapter 6, “Working with VPN Service,” tells you how to configure and use VPN to allow remote users to access your private LAN securely.
- Chapter 7, “Working with RADIUS,” tells you how to configure and use RADIUS Service to authorize Open Directory users and groups so they can access AirPort Base Stations on a network.
- Chapter 8, “Working with NTP Service,” tells you how to enable your server as a time server.

- Chapter 9, “Working with Mobile Access Service,” tells you how to enable your server as a Mobile Access Server.
- Chapter 10, “Supporting a VLAN,” tells you about VLAN support for some server hardware configurations.
- Chapter 11, “Supporting IPv6,” tells you about IPv6 and the services that support IPv6 addressing.
- “Command-Line Parameters for Network Services,” describes command-line parameters for specific network services.

**Note:** Because Apple periodically releases new versions and updates to its software, images shown in this book may be different from what you see on your screen.

## Using Onscreen Help

You can get task instructions onscreen in Help Viewer while you’re managing Mac OS X Server. You can view help on a server, or on an administrator computer. (An administrator computer is a Mac OS X computer with Mac OS X Server administrator software installed on it.)

### To get the most recent onscreen help for Mac OS X Server:

- Open Server Admin or Workgroup Manager and then:
  - Use the Help menu to search for a task you want to perform.
  - Choose Help > Server Admin Help or Help > Workgroup Manager Help to browse and search the help topics.

The onscreen help contains instructions taken from *Advanced Server Administration* and other advanced administration guides.

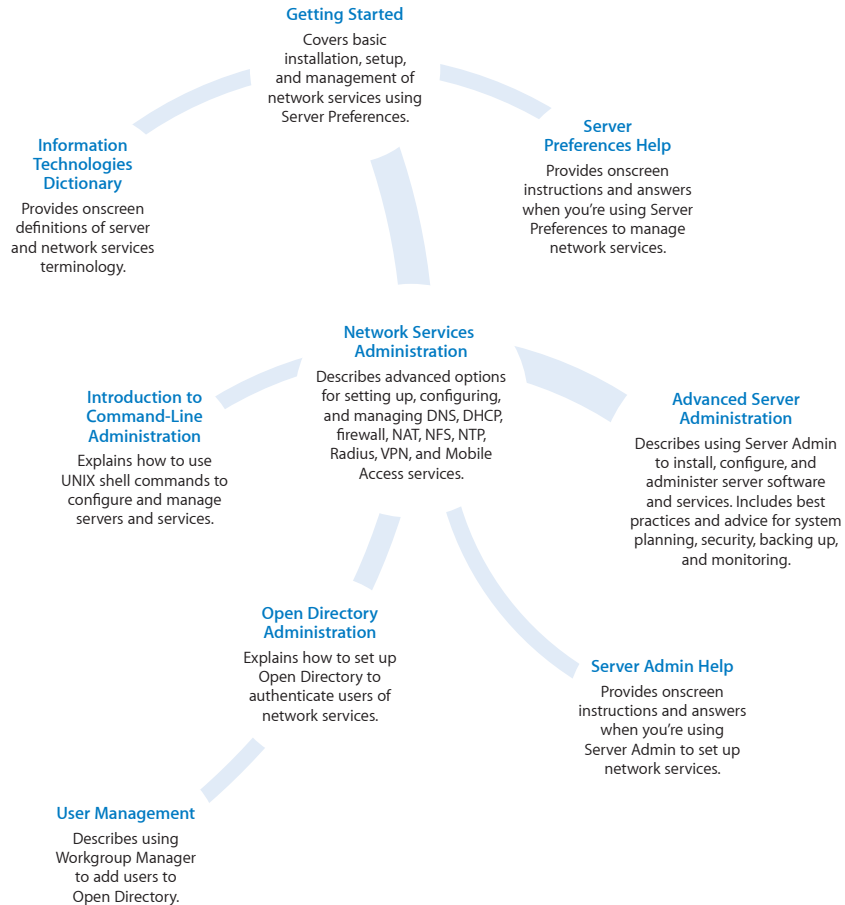
### To see the most recent server help topics:

- Make sure the server or administrator computer is connected to the Internet while you’re getting help.

Help Viewer automatically retrieves and caches the most recent server help topics from the Internet. When not connected to the Internet, Help Viewer displays cached help topics.

# Documentation Map

Mac OS X Server has a suite of guides that cover management of individual services. Each service may depend on other services for maximum utility. The documentation map below shows some related guides that you may need in order to fully configure your network services to your specifications. You can get these guides in PDF format from the Mac OS X Server Resources website at [www.apple.com/server/macosx/resources/](http://www.apple.com/server/macosx/resources/).



## Viewing PDF Guides Onscreen

While reading the PDF version of a guide onscreen:

- Show bookmarks to see the guide’s outline, and click a bookmark to jump to the corresponding section.
- Search for a word or phrase to see a list of places where it appears in the guide. Click a listed place to see the page where it occurs.
- Click a cross-reference to jump to the referenced section. Click a web link to visit the website in your browser.

## Printing PDF Guides

If you want to print a guide, you can take these steps to save paper and ink:

- Save ink or toner by not printing the cover page.
- Save color ink on a color printer by looking in the panes of the Print dialog for an option to print in grays or black and white.
- Reduce the bulk of the printed document and save paper by printing more than one page per sheet of paper. In the Print dialog, change Scale to 115% (155% for *Getting Started*). Then choose Layout from the untitled pop-up menu. If your printer supports two-sided (duplex) printing, select one of the Two-Sided options. Otherwise, choose 2 from the Pages per Sheet pop-up menu, and optionally choose Single Hairline from the Border menu. (If you’re using Mac OS X v10.4 or earlier, the Scale setting is in the Page Setup dialog and the Layout settings are in the Print dialog.)

You may want to enlarge the printed pages even if you don’t print double sided, because the PDF page size is smaller than standard printer paper. In the Print dialog or Page Setup dialog, try changing Scale to 115% (155% for *Getting Started*, which has CD-size pages).

## Getting Documentation Updates

Periodically, Apple posts revised help pages and new editions of guides. Some revised help pages update the latest editions of the guides.

- To view new onscreen help topics for a server application, make sure your server or administrator computer is connected to the Internet and click “Latest help topics” or “Staying current” in the main help page for the application.
- To download the latest guides in PDF format, go to the Mac OS X Server documentation website at [www.apple.com/server/resources/](http://www.apple.com/server/resources/).

- An RSS feed listing the latest updates to Mac OS X Server documentation and onscreen help is available. To view the feed, use an RSS reader application such as Safari or Mail and go to:  
`feed://helposx.apple.com/rss/snowleopard/serverdocupdates.xml`

## Getting Additional Information

For more information, consult these resources:

- *Read Me documents*—get important updates and special information. Look for them on the server discs.
- *Mac OS X Server website* ([www.apple.com/server/macosx/](http://www.apple.com/server/macosx/))—enter the gateway to extensive product and technology information.
- *Mac OS X Server Support website* ([www.apple.com/support/macosxserver/](http://www.apple.com/support/macosxserver/))—access hundreds of articles from Apple’s support organization.
- *Apple Discussions website* ([discussions.apple.com/](http://discussions.apple.com/))—share questions, knowledge, and advice with other administrators.
- *Apple Mailing Lists website* ([www.lists.apple.com/](http://www.lists.apple.com/))—subscribe to mailing lists so you can communicate with other administrators using email.
- *Apple Training and Certification website* ([www.apple.com/training/](http://www.apple.com/training/))—hone your server administration skills with instructor-led or self-paced training, and differentiate yourself with certification.
- *OpenLDAP website* ([www.openldap.org](http://www.openldap.org))—learn about the open source software that Open Directory uses to provide LDAP directory service.
- *MIT Kerberos website* ([web.mit.edu/kerberos/www/](http://web.mit.edu/kerberos/www/))—get background information and specifications for the protocol that Open Directory uses to provide robust single sign-on authentication.
- *Berkeley DB website* ([www.oracle.com/database/berkeley-db/](http://www.oracle.com/database/berkeley-db/))—investigate feature descriptions and technical documentation for the open source database that Open Directory uses to store LDAP directory data.
- *RFC3377, “Lightweight Directory Access Protocol (v3): Technical Specification”* ([www.rfc-editor.org/rfc/rfc3377.txt](http://www.rfc-editor.org/rfc/rfc3377.txt))—lists a set of eight other Request for Comment (RFC) documents with overview information and detailed specifications for the LDAPv3 protocol.

# Linking Your Network to the Internet

# 1

Use Gateway Setup Assistant to guide you through the initial setup of your server to serve as a gateway between your private network and the Internet.

Gateway Setup Assistant guides you through configuring your server to connect to the Internet. You make further changes to the service configuration using Server Admin. For network services, see the relevant section in this book for instructions.

## About Gateway Setup Assistant

Gateway Setup Assistant helps you quickly and easily set up Mac OS X Server v10.6 to share your Internet connection with your local network. After you configure a few settings, the assistant can start sharing the server connection.

Depending on your configuration choices, the assistant performs the following when it sets up the server:

- Assigns the server a static IP address for each internal network interface.  
The address assigned is 192.168.x.1. The value used for x is determined by the network interface's order in the Network System Preference pane. For example, for the first interface on the list, x is 0; for the second interface, x is 1.
- Enables DHCP to allocate addresses on the internal network, removing existing DHCP subnets.
- Sets aside specific internal (192.168.x.x) addresses for DHCP use.  
Without VPN started, each interface can allocate addresses from 192.168.x.2 to 192.168.x.254.
- (Optional) Enables VPN to permit authorized external clients to connect to the local network.  
VPN L2TP is enabled, so you must enter a shared secret (a passphrase) for client connections to use.
- Sets aside specific internal addresses (192.168.x.x) for VPN use.

If VPN is selected, half of the allotted IP addresses in the DHCP range are reserved for VPN connections. The addresses 192.168.x.128–192.168.x.254 are allotted to VPN connections.

- Enables the firewall to help secure the internal network.  
Address groups are added for each internal network interface, with all traffic permitted from the newly created DHCP address ranges to any destination address.
- Enables network address translation (NAT) on the internal network and adds a NAT divert rule to the IP firewall to direct network traffic to the correct computer. This also protects the internal network from unsolicited external connections.
- Enables DNS on the server, configured to cache lookups, to improve DNS response for internal clients.

When configuring these settings, you can review the proposed changes before committing to them and overwriting existing settings.

You can make further changes to the service configuration using Server Admin. For network services, see the relevant section in this book for information.

If you run the Gateway Setup Assistant again, it overwrites manual settings you made.

## Running Gateway Setup Assistant

You run Gateway Setup Assistant from the NAT Service Overview pane in Server Admin.

### To run Gateway Setup Assistant:

- 1 Open Server Admin and connect to the server.
- 2 Click Settings, then click Services.
- 3 Select the NAT checkbox, then click Save.
- 4 Click the triangle at the left of the server.  
The list of services appears.
- 5 From the expanded Servers list, select NAT.
- 6 Click Overview.
- 7 Click Gateway Setup Assistant.
- 8 Follow the directions in the assistant, click Continue after each page, read the final configuration summary carefully, and make sure you approve of the settings before finalizing the configuration.

**WARNING:** Although you can use the Gateway Setup Assistant to configure remote servers, you can accidentally cut off your administrator access to the remote server.

## Connecting a Wired LAN to the Internet

You can use Gateway Setup Assistant to connect a wired LAN to the Internet. Your LAN can consist of any number of computers connected to each other through Ethernet hubs and switches, but the LAN must have one point of contact with the Internet (the gateway).

Your gateway has one connection to the Internet and one connection to the LAN. All other computers access the Internet through your gateway. You can configure your Mac OS X server to be a gateway to the Internet, which requires that your server have two Ethernet ports (en0 and en1). Port en0 should be connected to the Internet and en1 should be connected to your LAN.

After this process, computers on the LAN:

- Can get IP addresses and network settings that were configured using DHCP
- Can access the Internet if the gateway is connected to the Internet
- Can't be accessed by unauthorized network connections originating from the Internet
- Can be accessed over the Internet by authorized VPN clients (if VPN is configured)
- Can benefit from DNS lookup caching in the gateway, which speeds DNS resolution

### To connect a wired LAN to the Internet:

- 1 Plug the connection to the Internet into Ethernet 1 (en0) port.
- 2 Plug the connection to your LAN into Ethernet 2 (en1) port.
- 3 Open Server Admin and connect to the server.
- 4 Click Settings, then click Services.
- 5 Select the NAT checkbox.
- 6 Click Save.
- 7 Click the triangle at the left of the server.

The list of services appears.

- 8 From the expanded Servers list, select NAT.
- 9 Click Overview, then click Gateway Setup Assistant.
- 10 Click Continue.

If your server has existing DHCP, DNS, NAT, and VPN configurations, you are prompted to overwrite those configurations. To overwrite configurations, click Overwrite to continue.

- 11 From the Gateway WAN Interface pop-up menu, choose Ethernet 1 (en0) for your WAN interface, then click Continue.
- 12 From the list of network interfaces, select the Ethernet 2 checkbox for you LAN interface and click Continue.

Your LAN interface is the one connected to your local network. Computers on the LAN share the server's Internet connection through the server's WAN interface.

If your server has more than one interface available (Ethernet port 2, Ethernet port 3, and so on), choose those you want to enable.

- 13 (Optional) If you want to make your gateway server a VPN entry point to your LAN, select the Enable VPN for this server checkbox.

If you enable VPN, you need a shared secret. A shared secret is a passphrase that users provide to connect to the VPN gateway. It should be a very secure passphrase, not the password of a user or administrator on the gateway server.

To set a very secure passphrase, use Password Assistant in Account Preferences. For more information, see *Mac OS X Server Security Configuration*.

For more information, see Chapter 6, "Working with VPN Service."

- 14 Click Continue.
- 15 Inspect and confirm your setup.
- 16 Click Continue.

NAT and all dependent services will be configured and started.

- 17 Click Close.

### Options

You can fine-tune the settings of this base configuration, but you perform additional configuration in Server Admin.

For example, you can use Server Admin to assign IP addresses to specific computers. To do this, add static address mappings in DHCP Service settings. For more information, see Chapter 2, "Working with DHCP Service."

You can also change firewall settings to permit connections from the Internet to the LAN. To do this, change the firewall settings, open up IP ports as needed, and configure port forwarding (by editing UNIX files from the command line) to designate which computer on the LAN is to accept incoming traffic.

## Connecting a Wired LAN and Wireless Clients to the Internet

You can use Gateway Setup Assistant to connect a wired LAN and wireless clients to the Internet. Your LAN can consist of any number of computers connected to each other through Ethernet hubs and switches, but the LAN must have one point of contact with the Internet (the gateway).

Your LAN must also have an AirPort Base Station to connect the wireless computers to the wired network. Your wireless clients must be able to connect to the AirPort Base Station's wireless network to be linked to the wired LAN.

After this process, computers on the LAN and those connected to the AirPort Base Station:

- Can get IP addresses and network settings configured using DHCP
- Can access the Internet, if the gateway is connected to the Internet
- Can't be accessed by unauthorized network connections originating from the wired connection to the Internet
- Can be accessed over the Internet by authorized VPN clients (if VPN is configured)
- Can benefit from DNS lookup caching in the gateway, which speeds DNS resolution

**To connect a wired LAN and wireless clients to the Internet:**

- 1 Plug the connection to the Internet into Ethernet 1 (en0) port .
- 2 Plug the connection to your LAN into Ethernet 2 (en1) port.
- 3 Connect the AirPort Base Station port (the WAN port, if there are two) to the wired network.
- 4 Using AirPort Utility, configure the Base Station to connect using Ethernet and to get its address using DHCP.

You can open it from the /Applications/Utilities/ folder.

- 5 Select the Base Station and then choose Manual Setup from the Base Station menu.
- 6 Enter the Base Station password if necessary.
- 7 Click Internet in the toolbar, then click Internet Connection.
- 8 From the Connect Using pop-up menu, choose Ethernet.
- 9 From the Configure IPv4 pop-up menu, choose Using DHCP.
- 10 From the Connection Sharing pop-up menu, choose Off (Bridge Mode).
- 11 To change Base Station settings, click Update.
- 12 Open Server Admin and connect to the server.
- 13 Click Settings, then click Services.
- 14 Select the NAT checkbox.
- 15 Click Save.
- 16 Click the triangle at the left of the server.

The list of services appears.

- 17 From the expanded Servers list, select NAT.
- 18 Click Overview, then click Gateway Setup Assistant.
- 19 Click Continue.
- 20 For your WAN (Internet) interface, designate Ethernet 1.
- 21 For your LAN (sharing) interface, designate Ethernet 2.

Your LAN interface is the one connected to your local network. Computers on the LAN share the server's Internet connection through the server's WAN interface.

If your server has more than one interface available (Ethernet port 2, Ethernet port 3, and so on), choose those you want to enable.

- 22 Choose whether to make this gateway a VPN entry point to your LAN.

If you enable VPN, you need a shared secret. A shared secret is a passphrase that users must provide to securely connect to the VPN gateway. It should be a very secure passphrase, not a password of a user or administrator on the gateway server.

To set a very secure passphrase, use Password Assistant in Account Preferences. For more information, see *Mac OS X Server Security Configuration*.

For more information about VPN, see Chapter 6, "Working with VPN Service."

- 23 Inspect and confirm the changes.

### Options

You can fine-tune the settings of this base configuration, but you perform additional configuration in Server Admin.

For example, you can use Server Admin to assign IP addresses to specific computers. To do this, add static address mappings in the DHCP section's Settings tab. For more information, see Chapter 2, "Working with DHCP Service."

You can also change firewall settings to permit connections from the Internet to the LAN. To do this, change the firewall settings, opening up IP ports as needed, and configure port forwarding in the NAT pane to designate which computer on the LAN is to accept incoming traffic.

## Connecting a Wireless LAN to the Internet

Connecting wireless clients to the Internet through a Mac OS X Server gateway provides the following advantages over using AirPort Base Station built-in functions:

- Advanced firewall control
- DHCP allocation of static IP addresses
- DNS caching
- Incoming VPN connections to the LAN

If you do not need these advanced functions, use the AirPort Base Station to connect your wireless clients to the Internet without using Mac OS X Server between the Base Station and the Internet.

To take advantage of the gateway's features, you use the Base Station as a bridge between your wireless clients and the gateway. Each client connects to the Base Station, and the Base Station sends network traffic through the gateway.

Wireless clients must be able to connect to the AirPort Base Station's wireless network to be linked to the gateway.

After this process, computers connected to the AirPort Base Station:

- Can get IP addresses and network settings configured using DHCP
- Can access the Internet if the gateway is connected to the Internet
- Can't be accessed by unauthorized network connections originating from the wired connection to the Internet
- Can be accessed over the Internet by authorized VPN clients (if VPN is configured)
- Can benefit from DNS lookup caching in the gateway, which speeds DNS resolution

**To connect a wired LAN and wireless clients to the Internet:**

- 1 Plug the connection to the Internet into the Ethernet 1 (en0) port.
- 2 Connect the AirPort Base Station port (the WAN port, if there are two) to the Ethernet 2 (en1) port.
- 3 Using AirPort Utility, configure the Base Station to connect using Ethernet and to get its address using DHCP.

You can open it from the /Applications/Utilities/ folder.

- 4 Select a Base Station and then choose Manual Setup from the Base Station menu.
- 5 Enter the Base Station password if necessary.
- 6 Click Internet in the toolbar, then click Internet Connection.
- 7 From the Connect Using pop-up menu, choose Ethernet.
- 8 From the Configure IPv4 pop-up menu, choose Using DHCP.
- 9 From the Connection Sharing pop-up menu, choose Off (Bridge Mode).
- 10 To change Base Station settings, click Update.
- 11 Open Server Admin and connect to the server.
- 12 Click Settings, then click Services.
- 13 Select the NAT checkbox.
- 14 Click Save.
- 15 Click the triangle at the left of the server.

The list of services appears.

- 16 From the expanded Servers list, select NAT.
- 17 Click Overview, then click Gateway Setup Assistant.
- 18 Click Continue.
- 19 For your WAN (Internet) interface, designate Built-In Ethernet 1.
- 20 For your LAN (sharing) interface, designate Built-In Ethernet 2.

Your LAN interface is the one connected to your local network. Computers on the LAN share the server's Internet connection through the server's WAN interface.

If your server has more than one interface available (Ethernet port 2, Ethernet port 3, and so on), choose those you want to enable.

- 21 Choose whether to make this gateway a VPN entry point to your LAN.

If you enable VPN, you need a shared secret. A shared secret is a passphrase that users must provide to securely connect to the VPN gateway. It should be a very secure passphrase, not a password of a user or administrator on the gateway server.

To set a very secure passphrase, use Password Assistant in Account Preferences. For more information, see *Mac OS X Server Security Configuration*.

For more information about VPN, see Chapter 6, "Working with VPN Service."

- 22 Inspect and confirm the changes.

### Options

You can fine-tune the settings from this base configuration but you perform additional configuration in Server Admin.

For example, you can use Server Admin to assign IP addresses to specific computers. To do this, add static address mappings in the DHCP section's Settings tab. For more information, see Chapter 2, "Working with DHCP Service."

You can also change firewall settings to permit connections from the Internet to the LAN. To do this, change the firewall settings, opening up IP ports as needed, and configure port forwarding in the NAT pane to designate which computer on the LAN is to accept incoming traffic.

## About Network Services

Mac OS X Server uses the `xinetd` process to manage many UNIX network services, such as FTP, finger, and so on. `xinetd` listens for requests on specific TCP/IP sockets and is a secure replacement for `inetd`. However, because `xinetd` does not handle RPC services well, `inetd` and `xinetd` are included with Mac OS X.

`xinetd` does the same things as `inetd`, with the added security benefits of access control based on source address, destination address, and time, and provides extensive logging, efficient containment of denial-of-service attacks, and the ability to bind services to specific interfaces.

The configuration files for `xinetd` provide a mapping of services to the executable that should be run to service a request for a given service.

For example, if you enable FTP file sharing, the `ftpd` process is not started immediately. Instead, the configuration file is updated to reflect that `xinetd` should listen for `ftp` requests, and when it receives one, it should launch `ftpd` to service the request.

When the first `ftp` request comes in to the computer, `xinetd` receives the request and then launches `ftpd` to handle it. In this way, `xinetd` can keep the number of services running on a computer lower by launching only those that are requested by a client.

`inetd` and `xinetd` have their own configuration files. `inetd` uses one file, `inetd.conf`, to map a service to its executable. Standard services that `inetd` handles are listed in the file.

`xinetd` uses a different configuration file for each service it provides. In the `/etc/xinetd.d/` folder, there are configuration files for each service that `xinetd` handles. If you enable FTP sharing, Mac OS X modifies the configuration file `/etc/xinetd.d/ftp`. For more information about `xinetd`, see [www.xinetd.org](http://www.xinetd.org).

## Use this chapter to set up and manage DHCP service in Mac OS X Server.

If your organization has more clients than IP addresses, you can benefit from using Dynamic Host Configuration Protocol (DHCP) service. IP addresses are assigned as needed, and when they're not needed, they can be used by other clients. You can use a combination of static and dynamic IP addresses for your network.

DHCP service lets you administer and distribute IP addresses to computers from your server. When you configure the DHCP server, you assign a block of IP addresses that can be made available to clients.

Each time a computer configured to use DHCP starts up, it looks for a DHCP server on your network. If it finds a DHCP server, the client computer then requests an IP address. The DHCP server checks for an available IP address and sends it to the computer with a *lease period* (the length of time the client computer can use the address) and configuration information.

For more information about static and dynamic allocation of IP addresses, see "Before Setting Up DHCP Service" on page 26.

Organizations can benefit from the features of DHCP service, such as the ability to set Domain Name System (DNS) and Lightweight Directory Access Protocol (LDAP) options for computers without needing to configure each client.

You can use the DHCP module in Server Admin to:

- Configure and administer DHCP service
- Create and administer subnets
- Configure DNS, LDAP, and Windows Internet Naming Service (WINS) options for client computers
- View DHCP address leases

## DHCP Setup Overview

Here is an overview of the basic steps for setting up DHCP service.

**Note:** If you used Gateway Setup Assistant to configure ports on your server when you installed Mac OS X Server, some DHCP information is already configured. Follow the steps in this section to finish configuring DHCP service. You can find more information about settings for each step in “Managing DHCP Service” on page 32.

### Step 1: Before you begin

For issues to keep in mind when you set up DHCP service, read “Before Setting Up DHCP Service” on page 26.

### Step 2: Turn DHCP service on

Before configuring DHCP service, turn on DHCP. See “Turning DHCP Service On” on page 29.

### Step 3: Create subnets

Use Server Admin to create a pool of IP addresses that are shared by the client computers on your network. You create one range of shared addresses per subnet. These addresses are assigned by the DHCP server when a client issues a request. See “Creating Subnets in DHCP Service” on page 29.

### Step 4: Configure DHCP log settings

You can log the activity and errors in DHCP service to help you identify use patterns and problems with your server.

DHCP service records diagnostic messages in the system log file. To keep this file from growing too large, you can suppress most messages by changing log settings in the Logging pane of DHCP service settings. See “Configuring Log Settings for DHCP Service” on page 31.

### Step 5: Start DHCP service

After you configure DHCP, start the service to make it available. See “Starting DHCP Service” on page 32.

## Before Setting Up DHCP Service

This section provides information about creating subnets, assigning static and dynamic IP addresses, locating your server on the network, and avoiding reserved IP addresses.

### Creating Subnets

Subnets are groupings of computers on a network that simplify administration. You can organize subnets any way that is useful to you. For example, you can create subnets for different groups in your organization or for different floors of a building.

After you group computers into subnets, you can configure options for all computers on a subnet at one time instead of setting options for individual computers.

Each subnet needs a way to connect to other subnets. A hardware device called a *router* typically connects subnets.

## Assigning IP Addresses Dynamically

With dynamic address allocation, an IP address is assigned for a limited period of time (the lease time) or until the computer doesn't need the IP address, whichever comes first.

By using short leases, DHCP can reassign IP addresses on networks that have more computers than IP addresses. Leases are renewed if the address isn't needed by another computer.

Addresses allocated to virtual private network (VPN) clients are distributed much like DHCP addresses, but they don't come out of the same range of addresses as DHCP. If you plan on using VPN, be sure to leave some addresses unallocated by DHCP for use by VPN. To learn more about VPN, see Chapter 6, "Working with VPN Service."

## Using Static IP Addresses

Static IP addresses are assigned to a computer or device once and then don't change. You can assign static IP addresses to computers that must have a continuous Internet presence, such as web servers. Other devices that must be continuously available to network users, such as printers, can also benefit from static IP addresses.

Static IP addresses can be set up manually by entering the IP address on the computer (or other device) that is assigned the address, or by configuring DHCP to provide the same address to a specific computer or device on each request.

Manually configured static IP addresses avoid potential issues that some services can have with DHCP-assigned addresses, and they don't suffer from the delay that DHCP requires to assign an address.

DHCP-assigned addresses permit address configuration changes at the DHCP server rather than at each client.

Don't include manually assigned static IP address ranges in the range distributed by DHCP.

You can set up DHCP to always serve the same address to the same computer. For more information, see "Assigning Static IP Addresses Using DHCP" on page 39.

## Locating the DHCP Server

When a computer looks for a DHCP server, it broadcasts a message. If your DHCP server is on a different subnet from the computer, make sure the routers that connect your subnets can forward client broadcasts and DHCP server responses.

A relay agent or router on your network that can relay BootP communications will work for DHCP. If you don't have a means to relay BootP communications, place the DHCP server on the same subnet as your client.

## Interacting with Other DHCP Servers

You might already have DHCP servers on your network, such as AirPort Base Stations.

Mac OS X Server can coexist with other DHCP servers as long as each DHCP server uses a unique pool of IP addresses. However, you might want your DHCP server to provide an LDAP server address for client autoconfiguration in managed environments.

Because AirPort Base Stations can't provide an LDAP server address, if you want to use the autoconfiguration feature, you must set up AirPort Base Stations in Ethernet-bridging mode and have Mac OS X Server provide DHCP service.

If AirPort Base Stations are on separate subnets, configure your routers to forward client broadcasts and DHCP server responses as described previously.

To provide DHCP service with AirPort Base Stations, you must manually enter LDAP server addresses of computers. You can't use the client autoconfiguration feature.

## Using Multiple DHCP Servers on a Network

You can have multiple DHCP servers on the same network. However, they must be configured properly to prevent interference with each other. Each server needs a unique pool of IP addresses to distribute.

## Assigning Reserved IP Addresses

Some IP addresses can't be assigned, including addresses reserved for loopback and for broadcasting. Your ISP won't assign these addresses to you. If you try to configure DHCP to use these addresses, you're warned that the addresses are invalid and you must enter valid addresses.

## Getting More Information About the DHCP Process

Mac OS X Server uses a daemon process named `bootpd` that is responsible for the DHCP service's address allocation. For more information about `bootpd` and its advanced configuration options, see the `bootpd` man page.

## Turning DHCP Service On

Before you can configure DHCP settings, you must turn on DHCP service in Server Admin.

**To turn DHCP service on:**

- 1 Open Server Admin and connect to the server.
- 2 Click Settings.
- 3 Click Services.
- 4 Select the DHCP checkbox.
- 5 Click Save.

## Setting Up DHCP Service

Set up DHCP service by configuring the following items in Server Admin:

- **Subnet.** Create a pool of IP addresses that are shared by computers on your network.
- **Log Level.** Configure the DHCP event log level.

The following sections describe the tasks for configuring these settings and how to start DHCP service when you finish.

## Creating Subnets in DHCP Service

Subnets are groupings of computers on the same network that can be organized by location (for example, different floors of a building) or by usage (for example, all eighth-grade students). Each subnet has at least one range of IP addresses assigned to it.

**To create a subnet:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select DHCP.
- 4 Click Subnets.
- 5 Click the Add (+) button.
- 6 Enter a descriptive name for the new subnet.
- 7 Enter a starting and ending IP address for this subnet range.  
Addresses must be contiguous and they can't overlap with other subnet ranges.
- 8 Enter the subnet mask for the network address range.
- 9 From the pop-up menu, choose the network interface that will host DHCP service.

- 10 Enter the IP address of the router for this subnet.

If the server you're configuring is the router for the subnet, enter this server's internal LAN IP address as the router's address.

- 11 Define a lease time in hours, days, weeks, or months.
- 12 If you want to set DNS, LDAP, or WINS information for this subnet, enter these now.

For more information, see "Setting the DNS Server for a DHCP Subnet" on page 35, "Setting LDAP Options for a Subnet" on page 36, and "Setting WINS Options for a Subnet" on page 37.

- 13 Click Save.
- 14 To enable the subnet, select the Enable checkbox.
- 15 Click Save.

**From the command line:**

The `subnetID` parameter is a unique number that identifies the subnet. It can be any number not assigned to another subnet on the server. Also, it can include embedded hyphens (-).

**Note:** Include the special first setting (ending with `= create`). This is how you tell `serveradmin` to create the settings array with the specified subnet ID.

- To create a DHCP subnet:

```
$ sudo serveradmin settings
dhcp:subnets:_array_id:subnetID = create
dhcp:subnets:_array_id:subnetID:descriptive_name = description
dhcp:subnets:_array_id:subnetID:net_range_start = start-address
dhcp:subnets:_array_id:subnetID:net_range_end = end-address
dhcp:subnets:_array_id:subnetID:net_mask = mask
dhcp:subnets:_array_id:subnetID:selected_port_name =port
dhcp:subnets:_array_id:subnetID:dhcp_router = router
dhcp:subnets:_array_id:subnetID:lease_time_secs = lease-time
dhcp:subnets:_array_id:subnetID:dhcp_enabled = (yes|no)
Control-D
```

- To view DHCP configurations settings:

```
$ sudo serveradmin settings dhcp
```

Parameter	Description
<code>subnetID</code>	A unique number that identifies the subnet. Can be any number not assigned to another subnet on the server. Can include embedded hyphens (-).
Other parameters	The standard subnet settings described in “Command-Line Parameters for Network Services.”

For information about setting DHCP subnet parameters, see “Command-Line Parameters for Network Services.”

For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Configuring Log Settings for DHCP Service

You can choose the level of detail you want for DHCP service logs:

- **Low (errors only):** Indicates conditions where you must take immediate action (for example, if the DHCP server can’t start up). This level corresponds to `bootpd` reporting in quiet mode with the “-q” flag.
- **Medium (errors and warnings):** Alerts you to conditions where data is inconsistent but the DHCP server can still operate. This level corresponds to default `bootpd` reporting.
- **High (all events):** Records activity by DHCP service, including routine functions. This level corresponds to `bootpd` reporting in verbose mode with the “-v” flag.

### To set up the log detail level:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select DHCP.
- 4 Click Settings.
- 5 From the Log Level pop-up menu, choose the logging option you want.
- 6 Click Save.

### From the command line:

The `value` can be ["LOW" | "MEDIUM" | "HIGH"].

- To set up the log detail level:

```
$ sudo serveradmin set dhcp:logging_level = value
```

For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Starting DHCP Service

You start DHCP service to provide IP addresses to users. You must have at least one subnet created and enabled.

### To start DHCP service:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.

The list of services appears.

- 3 From the expanded Servers list, select DHCP.
- 4 Click the Start DHCP button (below the Servers list).

If the Firewall service is running, a warning appears asking you to verify that all ports used by DHCP are open. Click OK.

The service runs until you stop it. It restarts when your server is restarted.

### From the command line:

- To start DHCP service:

```
$ sudo serveradmin start dhcp
```

For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Managing DHCP Service

This section describes how to set up and manage DHCP service on Mac OS X Server. It includes starting the service, creating subnets, and setting optional settings such as LDAP or DNS for a subnet.

## Stopping DHCP Service

When starting or stopping DHCP, you must have at least one subnet created and enabled.

### To stop DHCP service:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select DHCP.
- 4 Click the Stop DHCP button (below the Servers list).
- 5 Click Stop Now.

**From the command line:**

- To stop DHCP service:

```
$ sudo serveradmin stop dhcp
```

For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Changing Subnet Settings in DHCP Service

Use Server Admin to change DHCP subnet settings. You can change IP address range, subnet mask, network interface, router, or lease time.

**To change subnet settings:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select DHCP.
- 4 Click Subnets.
- 5 Select a subnet.
- 6 Make the changes you want.

These changes can include adding DNS, LDAP, or WINS information. You can also redefine address ranges or redirect the network interface that responds to DHCP requests.

- 7 Click Save.

If DHCP is running, you are prompted to restart DHCP for your change to take effect. Otherwise, your changes take effect the next time you start DHCP.

**From the command line:**

- To change a DHCP setting:

```
$ sudo serveradmin settings dhcp:setting = value
```

- To change several DHCP settings:

```
$ sudo serveradmin settings
dhcp:setting = value
dhcp:setting = value
dhcp:setting = value
[...]
Control-D
```

- To view all DHCP settings:

```
$ sudo serveradmin settings dhcp
```

Parameter	Description
<i>setting</i>	A DHCP service setting.
<i>value</i>	A relevant value for the setting.

For information about setting DHCP subnet parameters, see “Command-Line Parameters for Network Services.”

For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Deleting Subnets from DHCP Service

You can delete subnets and subnet IP address ranges so they are no longer distributed to computers.

### To delete subnets or address ranges:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select DHCP.
- 4 Click Subnets.
- 5 Select a subnet.
- 6 Click the Delete (–) button.
- 7 Click Save.

If DHCP is running, you are prompted to restart DHCP for your change to take effect. Otherwise, your changes take effect the next time you start DHCP.

## Disabling Subnets Temporarily

You can temporarily shut down a subnet without losing its settings. No IP addresses from the subnet’s range are distributed on the selected interface to any computer until you reenable the subnet.

### To disable a subnet:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select DHCP.
- 4 Click Subnets.
- 5 Deselect the Enable checkbox next to the subnet you want to disable.
- 6 Click Save.

If DHCP is running, you are prompted to restart DHCP for your change to take effect. Otherwise, your changes take effect the next time you start DHCP.

## Changing IP Address Lease Times for a Subnet

You can change how long IP addresses on a subnet are available to computers.

**To change the lease time for a subnet:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select DHCP.
- 4 Click Subnets.
- 5 Select a subnet.
- 6 From the Lease Time pop-up menu, choose a time scale (hours, days, weeks, or months).
- 7 In the Lease Time field, enter a number.
- 8 Click Save.

If DHCP is running, you are prompted to restart DHCP for your change to take effect. Otherwise, your changes take effect the next time you start DHCP.

## Setting the DNS Server for a DHCP Subnet

You can determine the DNS servers and default domain name a subnet should use. DHCP service provides this information to computers in the subnet.

**To set DNS options for a subnet:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select DHCP.
- 4 Click Subnets.
- 5 Select a subnet.
- 6 Click DNS.
- 7 Enter the primary and secondary name server IP addresses you want DHCP clients to use.
- 8 Enter the default domain of the subnet.
- 9 Click Save.

If DHCP is running, you are prompted to restart DHCP for your change to take effect. Otherwise, your changes take effect the next time you start DHCP.

#### From the command line:

You must use the same *subnetID* that was used to create the subnet.

- To set DNS options for a subnet:

```
$ sudo serveradmin settings
dhcp:subnets:_array_id:subnetID:dhcp_domain_name_server:_array_index:0 =
    dns-server-1
dhcp:subnets:_array_id:subnetID:dhcp_domain_name_server:_array_index:1 =
    dns-server-2
dhcp:subnets:_array_id:subnetID:dhcp_domain_name = domain
Control-D
```

Parameter	Description
<i>subnetID</i>	A unique number that identifies the subnet. Can be any number not assigned to another subnet on the server. Can include embedded hyphens (-).
<i>dns-server-n</i>	To specify additional DNS servers, add <code>dhcp_domain_name_server</code> settings, incrementing <code>_array_index:n</code> for each additional value.
Other parameters	The standard subnet settings described in “Command-Line Parameters for Network Services.”

For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Setting LDAP Options for a Subnet

You can use DHCP to automatically provide your clients with LDAP server information rather than manually configuring each client’s LDAP information. The order in which the LDAP servers appear in the list determines their search order in the automatic Open Directory search policy.

If you are using this Mac OS X Server as an LDAP master, LDAP options are populated with the necessary configuration information. If your LDAP master server is another computer, you must know the domain name or IP address of the LDAP database that you want to use, and you must know the LDAP search base.

#### To set LDAP options for a subnet:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.

The list of services appears.

- 3 From the expanded Servers list, select DHCP.
- 4 Click Subnets.
- 5 Select a subnet.
- 6 Click LDAP.
- 7 Enter the domain name or IP address of the LDAP server for this subnet.
- 8 Enter the search base for LDAP searches.
- 9 If you're using a nonstandard port, enter the LDAP port number.
- 10 If necessary, select LDAP over SSL.

Use this option to secure LDAP communication.

- 11 Click Save.

If DHCP is running, you are prompted to restart DHCP for your change to take effect. Otherwise, your changes take effect the next time you start DHCP.

#### From the command line:

You must use the same `subnetID` that was used to create the subnet.

- To set LDAP options for a subnet:

```
$ sudo serveradmin settings
dhcp:subnets:_array_id:subnetID:dhcp_ldap_url:_array_index:0 = ldap-
server
Control-D
```

Parameter	Description
<code>subnetID</code>	A unique number that identifies the subnet. Can be any number not assigned to another subnet on the server. Can include embedded hyphens (-).
Other parameters	The standard subnet settings described in "Command-Line Parameters for Network Services."

For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Setting WINS Options for a Subnet

You can give more information to computers running Windows on a subnet by adding Windows-specific settings to the DHCP-supplied network configuration data. These Windows-specific settings permit Windows clients to browse Network Neighborhood.

You must know the domain name or IP address of the Windows Internet Naming Service/NetBIOS Name Server (WINS/NBNS) primary and secondary servers (usually the IP address of the DHCP server), and the NetBIOS over TCP/IP (NBT) node type.

The following are possible node types:

- **Hybrid (h-node):** Checks the WINS server and then broadcasts.
- **Peer (p-node):** Checks the WINS server for name resolution.
- **Broadcast (b-node):** Broadcasts for name resolution (most commonly used).
- **Mixed (m-node):** Broadcasts for name resolution and then checks the WINS server.

The NetBIOS Datagram Distribution (NBDD) server works with NBNS to route datagrams to computers on a different subnet.

The NetBIOS Scope ID isolates NetBIOS communication on a network. The NetBIOS Scope ID is appended to the NetBIOS name of the computer. Computers that have the same NetBIOS Scope ID can communicate.

NBDD Server and the NetBIOS Scope ID are typically not used, but you might need to use them depending on your Windows clients' configuration and Windows network infrastructure.

#### To set WINS options for a subnet:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select DHCP.
- 4 Click Subnets.
- 5 Select a subnet.
- 6 Click WINS.
- 7 Enter the domain name or IP address of the WINS/NBNS primary and secondary servers for this subnet.
- 8 Enter the domain name or IP address of the NBDD server for this subnet.
- 9 From the pop-up menu, choose the NBT node type.
- 10 Enter the NetBIOS Scope ID.
- 11 Click Save.

If DHCP is running, you are prompted to restart DHCP for your change to take effect. Otherwise, your changes take effect the next time you start DHCP.

#### From the command line:

You must use the same *subnetID* that was used to create the subnet.

- To set WINS options for a subnet:

```
$ sudo serveradmin settings  
dhcp:subnets:_array_id:subnetID:WINS_secondary_server = wins-server-2
```

```

dhcp:subnets:_array_id:subnetID:WINS_primary_server = wins-server-1
dhcp:subnets:_array_id:subnetID:WINS_NBDD_server = nbdd-server
dhcp:subnets:_array_id:subnetID:WINS_node_type = node-type
dhcp:subnets:_array_id:subnetID:WINS_scope_id = scope-ID
Control-D

```

Parameter	Description
<i>subnetID</i>	A unique number that identifies the subnet. Can be any number not assigned to another subnet on the server. Can include embedded hyphens (-).
Other parameters	The standard subnet settings described in "Command-Line Parameters for Network Services."

For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Assigning Static IP Addresses Using DHCP

You can always assign the same address to specific computers. This helps simplify configuration when using DHCP and lets you have static servers or services.

To keep the same IP address for a computer, you must know the computer's Ethernet address (also known as the MAC or hardware address). Each network interface has its own Ethernet address.

If a computer is connected to a wired network and a wireless network, it uses a different Ethernet address for each network connection.

### To assign static IP addresses:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select DHCP.
- 4 Click Static Maps.
- 5 Click Add Computer.
- 6 Enter the name of the computer.
- 7 In the Network Interfaces list, click the column to enter the following information:
  - MAC address of the computer that needs a static address.
  - IP address you want to assign to the computer.
- 8 If your computer has other network interfaces that require static IP addresses, click the Add (+) button and enter the IP address you want to assign for each interface.

9 Click OK.

10 Click Save.

If DHCP is running, you are prompted to restart DHCP for your change to take effect. Otherwise, your changes take effect the next time you start DHCP.

**From the command line:**

- To assign a static map:

```
$ sudo serveradmin settings
dhcp:static_maps:_array_id:examplehost/mapID = create
dhcp:static_maps:_array_id:examplehost/mapID:ip_address = "1.2.3.4"
dhcp:static_maps:_array_id:examplehost/mapID:name = "examplehost"
dhcp:static_maps:_array_id:examplehost/mapID:en_address =
    "00:30:a1:a2:a1:23"
Control-D
```

Static Map Parameter	Description
<i>mapID</i>	A unique ID code for the map entry. The ID must be unique for each static map defined on the server.
<i>ip_address</i>	IP address of host.
<i>name</i>	Host's DNS name.
<i>en_address</i>	Host's Ethernet address.

For information about static map IDs, see "Command-Line Parameters for Network Services."

For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

### Removing or Changing Static Address Maps

You can change static mappings or remove them as needed.

**To change a static address map:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select DHCP.
- 4 Click Static Maps.
- 5 Select a mapping to Edit or Remove.
- 6 Click the Edit button or the Remove button.

If you are editing the mapping, make changes you want, then click OK.

## 7 Click Save.

If DHCP is running, you are prompted to restart DHCP for your change to take effect. Otherwise, your changes take effect the next time you start DHCP.

## Monitoring DHCP Service

You can use the following methods to monitor and troubleshoot DHCP service:

- Monitor the computers that are using the service by viewing the client list.
- Monitor the log files generated by the service.
- Use service logs to troubleshoot network problems.

The following sections discuss these aspects of DHCP service.

## Checking DHCP Service Status

The status overview shows the following summary of DHCP service.

- Whether the service is running
- How many clients it has
- When the service was started
- How many IP addresses are statically assigned from your subnets
- The last time the client database was updated

### To view DHCP service status:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.

The list of services appears.

- 3 From the expanded Servers list, select DHCP.
- 4 Click Overview to view whether the service is running, when it started, the number of static maps, the number of clients connected, and when the last database update occurred.

### From the command line:

- To see summary status of DHCP service:

```
$ sudo serveradmin status dhcp
```

- To see detailed status of the DHCP service:

```
$ sudo serveradmin fullstatus dhcp
```

For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Viewing DHCP Log Entries

If you've enabled logging for DHCP service, you can check the system log for DHCP errors.

The log view is the system.log file filtered for `bootpd`. Use the Filter field to search for specific entries.

### To view DHCP log entries:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select DHCP.
- 4 Click Log.
- 5 To search for specific entries, use the Filter field (upper right corner).

### From the command line:

- To view DHCP log entries:

```
$ tail log-file
```

For information about viewing DHCP logs, see "Connecting a Wired LAN to the Internet" on page 18.

For information about `tail`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Viewing the DHCP Client List

The DHCP Clients window gives the following information for each client:

- The IP address served to the client
- The number of days of lease time left (or the number of hours and minutes, if less than 24 hours)
- The DHCP client ID (usually the same as the hardware address)
- The computer name
- The hardware address

### To view the DHCP client list:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select DHCP.
- 4 Click Clients.

To sort the list by different criteria, click a column heading.

## Common Network Configurations That Use DHCP

The following section contains example DHCP configurations for network uses. These include a workgroup configuration, a student lab configuration, and a coffee shop configuration.

When you set up a private network, you choose IP addresses from the blocks of IP addresses reserved by the Internet Assigned Numbers Authority (IANA) for private intranets:

- 10.0.0.0–10.255.255.255 (10/8 prefix)
- 172.16.0.0–172.31.255.255 (172.16/12 prefix)
- 192.168.0.0–192.168.255.255 (192.168/16 prefix)

### Using DHCP to Provide IP Addresses Behind a NAT Gateway

You use DHCP to provide IP addresses to computers behind a Network Address Translation (NAT) gateway.

Although not strictly necessary (because NAT can be used with static IP addresses instead of DHCP), this enables easy configuration of computers.

For more information, see “Linking a LAN to the Internet Through One IP Address” on page 133.

### Workgroup Configuration

Imagine you have a small workgroup with its own DHCP address group. You can have an IP-connected printer, a file server, and an Open Directory server (on or off the subnet) for user management purposes.

To use DHCP in this setting, you must already have:

- A working, configured firewall that permits LDAP and printer (IP printing) connections.

For more information, see Chapter 4, “Working with Firewall Service.”

- A working, configured Open Directory or LDAP server with users defined.

For more information, see *Open Directory Administration* and *User Management*.

For this example, configuring DHCP involves static IP address mapping and additional client network settings. You could configure it like this:

- For a printer that must be given a static IP address, make sure the allocated DHCP address range does not include the truly static IP address of the printer. If the printer can be configured to accept an address using DHCP, don’t worry about an overlap.

For more information, see “Using Static IP Addresses” on page 27.

- For a file server that must always be assigned the same address, use Mac OS X Server's static IP mapping to always assign the same IP address to its Ethernet address.

For more information, see "Assigning Static IP Addresses Using DHCP" on page 39.

- For DHCP configuration, set the LDAP options for DHCP clients. This gives computers their needed directory information.

For more information, see "Setting LDAP Options for a Subnet" on page 36.

- For client configuration on Mac OS X client computers, make sure the IPv4 configuration method in the Network pane of System Preferences is set to DHCP.

This configuration allows computers to be managed by an LDAP or Open Directory server, getting their network configuration information from DHCP. They can have access to truly static IP address or consistently assigned IP addresses on the same network. You also get centralized configuration for all computers.

## Student Lab Configuration

The student lab configuration example is very much like the workgroup configuration example, but it adds NetBoot as an extra service that uses DHCP.

Along with DHCP providing centralized networking configuration, NetBoot standardizes startup environments by having each computer start up from a disk image on a central NetBoot server.

The configuration would be like the workgroup configuration example, with the following differences:

- There might be static-address resources.  
This depends on the lab composition. You might have a class printer or file server, but if you use a mobile cart that moves from classroom to classroom, you won't take a server and printer to each class.
- NetBoot must be enabled and configured, along with firewall settings to support it.  
Any client on the network can be set to start up from the NetBoot server. New computers can be deployed by setting the startup disk of the computer to the NetBoot image. No further configuration is necessary, and computers can be repurposed easily, because the hard disk can remain unchangeable.

With this configuration, computers on the network can be managed with an LDAP or Open Directory server, getting their network configuration information from DHCP. The computing environment is also centrally configured for all computers. New computers can be added or swapped out with minimal effort.

## Coffee Shop Configuration

The coffee shop configuration is an example configuration for a dynamic addressing environment, one that requires no user management and provides no services other than web access, DNS access, or other service.

This example is characterized by lots of mobile users who pass through, use the Internet access, and move on.

This configuration can easily be used in situations like a college-commons wireless network or a wired courtesy office for visiting consultants.

**WARNING:** If you host temporary unauthenticated users, make sure sensitive information on your LAN is protected behind a firewall on another network.

To use DHCP in this setting, you must have a working firewall configured for web access outbound traffic and DNS outbound lookups only. You might need to place this network outside your firewall and make sure the DHCP allocated IP addresses' network traffic is strictly controlled and monitored.

For more information, see Chapter 4, "Working with Firewall Service."

In this example, you might want to configure DHCP service like this:

- **Make networking configuration automatic.** Set DHCP clients to get network configuration through DHCP.
- **Don't set options that clients shouldn't have.** Don't give DHCP clients more information about your organization than necessary using LDAP. You might want to configure Windows clients to have more network options.

For more information, see "Setting WINS Options for a Subnet" on page 37.

- **Limit resource use.** Having many users on a subnet can lead to a lot of bandwidth use, so reduce the number of DHCP clients that can be connected simultaneously by restricting the number of addresses to be allocated.

For more information, see "Creating Subnets in DHCP Service" on page 29.

- **Keep address turnover high.** Make the lease times on addresses as short as practical. This way, as users come and go, the addresses can be quickly reallocated.

For more information, see "Creating Subnets in DHCP Service" on page 29.

- **Monitor your traffic.** Keep a close eye on DHCP connections and clients, firewall rule packet logging, or other monitoring tools. Open access points can be a liability if they are not guarded vigilantly.

## Configuring DHCP to Use an Extra LDAP Server URL

The Server Admin application's DHCP module enables administrators to specify a single LDAP server URL for each subnet. If you want to specify multiple LDAP server URLs, you can edit the `/etc/bootpd.plist` file or use the `serveradmin` command-line tool (from a Terminal window).

### Editing the `/etc/bootpd.plist` file to add multiple LDAP server URLs

After you create a subnet using DHCP in Server Admin and specify a single LDAP server URL, you can inspect and modify settings by editing the `/etc/bootpd.plist` file:

- 1 Open the `/etc/bootpd.plist` file in an editor.

- 2 Locate the tag `<string>` between the tag `<array>` of the `dhcp_ldap_url` key.

```
<key>dhcp_ldap_url</key>
<array>
<string>ldap://server.example.com/dc=server,dc=example,dc=com</string>
</array>
```

- 3 Add another LDAP server URL by inserting a `<string>` tag below the existing `<string>` tag and entering your LDAP server URL between the open `<string>` and closed `</string>` tags.

```
<key>dhcp_ldap_url</key>
<array>
<string>ldap://server.example.com/dc=server,dc=example,dc=com</string>
<string>ldap://server2.example.com/dc=server2,dc=example,dc=com</string>
</array>
```

- 4 Save the `bootpd.plist` file and exit your editor.

- 5 If DHCP is running, restart DHCP service so it can pick up the revised configuration.

Using Terminal, you would enter:

```
$ sudo serveradmin stop DHCP
$ sudo serveradmin start DHCP
```

### Using `serveradmin` to add multiple LDAP server URLs

After you create a subnet using Server Admin DHCP and specify a single LDAP server URL, you can inspect and modify settings using `serveradmin`. Do the following.

- 1 Inspect DHCP subnet settings in Terminal by entering:

```
$ sudo serveradmin settings dhcp:subnets
```

Example result (excerpt):

```
...
dhcp:subnets:_array_id:498D8E6D-88A8-4048-8B3C-14D96F317447:dhcp_ldap_
url:_array_index:0 = "http://ldapxxx:123/basename1"
...
```

- 2 Prepare a file with the `serveradmin` commands to add a second LDAP Server URL.

Because the individual elements of the `dhcp_ldap_url` array are not individually accessible, you cannot use the `serveradmin create/delete` idiom.

Example file contents:

```
dhcp:subnets:_array_id:498D8E6D-88A8-4048-8B3C-14D96F317447:dhcp_ldap_
url:_array_index:0 = "http://ldapxxx:123/basename1"
dhcp:subnets:_array_id:498D8E6D-88A8-4048-8B3C-14D96F317447:dhcp_ldap_
url:_array_index:1 = "http://ldapyyy:234/basename2"
```

**Note:** The array indexes start with 0. The old URL entry must be present even though you are just adding a second one. The entries must be in order.

- 3 Use the `serveradmin` tool to apply the settings from the file by entering:

```
$ sudo serveradmin settings < filename
```

Example result (the settings are confirmed):

```
dhcp:subnets:_array_id:498D8E6D-88A8-4048-8B3C-14D96F317447:dhcp_ldap_
url:_array_index:0 = "http://ldapxxx:123/basename1"
dhcp:subnets:_array_id:498D8E6D-88A8-4048-8B3C-14D96F317447:dhcp_ldap_
url:_array_index:1 = "http://ldapyyy:234/basename2"
```

- 4 If DHCP is running, restart DHCP service so it can pick up the revised configuration by entering:

```
$ sudo serveradmin stop DHCP
```

```
$ sudo serveradmin start DHCP
```

## DHCP Service for Mac OS X Clients Using DHCP with a Manual Address

The DHCP section of Server Admin permits each subnet address range to be enabled or disabled. When the subnet is enabled, the DHCP server allocates addresses in its range and dispenses other network information to clients that are configured as Using DHCP.

When the subnet is disabled, the DHCP server does not allocate addresses from the subnet address range pool but it does dispense other network information (such as DNS and LDAP server addresses) to clients that are configured as “Using DHCP with manual address” (static maps), as long as the client address is in the subnet range.

Enabling and disabling the subnet disables automatic address allocation for the address range, but it does *not* disable DHCP server responses to a client whose address is in the subnet range.

## Configuring DHCP on Clients

You can configure clients to use DHCP to obtain IP addresses.

**To configure DHCP on clients:**

- 1 Choose Apple > System Preferences, and then click Network.
- 2 Select the network connection service for your account (such as Built-in Ethernet) from the Services list.
- 3 Select Using DHCP from the Configure pop-up menu.

## Configuring a Static IP Address on a Client

You can configure clients to use static IP addresses.

**To configure static IP addresses on a client:**

- 1 Choose Apple > System Preferences, and then click Network.
- 2 Select the network connection service for your account (such as Built-in Ethernet) from the Services list.
- 3 From the Configure pop-up menu, choose one of the following methods:
  - *Manually*: enter the IP address, subnet mask, router, and DNS information in the appropriate fields.
  - *Using DHCP with manual address*: enter the IP address and DNS information in the appropriate fields.

If your DHCP server is using static mapping, configure your client computers to use DHCP. When your client computers connect to your network they will always obtain the same IP address. The static mapping uses the MAC address of the client computer to determine the IP address the client gets assigned to.

## Where to Find More Information

Request for Comments (RFC) documents provide an overview of a protocol or service and explain how the protocol should behave.

If you're a novice server administrator, you'll probably find the background information in an RFC helpful. If you're an experienced server administrator, you can find technical details about a protocol in its RFC document.

You can search for RFC documents by number at [www.ietf.org/rfc.html](http://www.ietf.org/rfc.html).

For details about DHCP, see RFC 2131.

For more information about advanced configuration options, see the `bootpd` man page.

## Use this chapter to set up, secure, and manage DNS service on your network.

When users want to connect to a network resource such as a web or file server, they typically request it by domain name (such as `www.example.com`) rather than by IP address (such as `192.168.12.12`). The Domain Name System (DNS) is a distributed database that maps IP addresses to domain names so users can find the resources by name rather than by numerical address.

A DNS server keeps a list of domain names and the IP addresses associated with each name. When a computer needs to find the IP address for a name, it sends a message to the DNS server, which is also known as a *name server*.

The name server looks up the IP address and sends it back to the computer. If the name server doesn't have the IP address locally, it sends messages to other name servers on the Internet until the IP address is found.

Setting up and maintaining a DNS server is a complex process. Therefore, many administrators rely on their Internet Service Provider (ISP) for DNS service. In this case, you only need to configure your network preferences with the IP address of the name server, which is provided by your ISP.

If you don't have an ISP to handle DNS requests for your network and any of the following are true, you must set up your own DNS service:

- You can't use DNS from your ISP or other source.
- You plan on making frequent changes to the name space and want to maintain it yourself.
- You have a mail server on your network and you have difficulties coordinating with the ISP that maintains your domain.
- You have security concerns because your network's computer names and addresses are accessible to an outside organization (your ISP).

Mac OS X Server uses Berkeley Internet Name Domain (BIND) v9.4.1 for its implementation of DNS protocols. BIND is an open source implementation and is used by most name servers on the Internet.

## DNS Zones

Zones are the basic organizational unit of DNS. Zones contain records and are defined by how they acquire those records and how they respond to DNS requests.

There are three basic zones:

- Primary
- Secondary
- Forward

Other kinds of zones are not covered here.

### Primary Zones

A primary zone has the master copy of the zone's records and provides authoritative answers to lookup requests.

### Secondary Zones

A secondary zone is a copy of a primary zone and is stored on a secondary name server. It has the following characteristics:

- Each secondary zone has a list of primary servers that it contacts for updates to records in the primary zone. Secondaries must be configured to request the copy of the primary zone data.
- Secondary zones use zone transfers to get copies of the primary zone data.
- Secondary name servers can take lookup requests like primary servers.

By using several secondary zones linked to one primary, you can distribute DNS query loads across several computers and make sure that lookup requests are answered if the primary name server is down.

Secondary zones also have a refresh interval. This interval determines how often the secondary zone checks for changes from the primary zone. You can change the zone refresh interval by using BIND's configuration file. For more information, see the BIND documentation.

### Forward Zones

A forward zone directs lookup requests for that zone to other DNS servers. Forward zones don't do zone transfers.

Often, forward zone servers are used to provide DNS service to a private network behind a firewall. In this case, the DNS server must have access to the Internet and a DNS server outside the firewall.

Forward zones also cache responses to queries they pass on. This can improve the performance of lookups by clients that use the forward zone.

Server Admin does not support creation or modification of a forward zone. To create a forward zone, you must configure BIND manually at the command line. For details, see the BIND documentation.

## DNS Machine Records

Each zone contains a number of records. These records are requested when a computer translates a domain name (like `www.example.com`) to an IP number. Web browsers, mail clients, and other network applications rely on zone records to contact the correct server.

Primary zone records are queried by others across the Internet so they can connect to your network services.

There are several kinds of DNS records available for configuration by Server Admin:

- **Address (A):** Stores the IP address associated with a domain name.
- **Canonical Name (CNAME):** Stores an alias in connection with the real name of a server. For example, `mail.apple.com` might be an alias for a computer with a real canonical name of `MailSrv473.apple.com`.
- **Mail Exchanger (MX):** Stores the domain name of the computer used for mail in a zone.
- **Name Server (NS):** Stores the authoritative name server for a zone.
- **Pointer (PTR):** Stores the domain name of an IP address (reverse lookup).
- **Text (TXT):** Stores a text string as a response to a DNS query.
- **Service (SRV):** Stores information about the services a computer provides.
- **Hardware Info (HINFO):** Stores information about a computer's hardware and software.

Mac OS X Server simplifies the creation of these records by focusing on the computer being added to the zone rather than the records themselves. When you add a computer record to a zone, Mac OS X Server creates the zone records that resolve to a computer address. With this model, you can focus on what your computers *do* in your domain, rather than *which* record types apply to its functions.

If you need access to other kinds of records, you must edit the BIND configuration files manually. For details, see the BIND documentation.

## Bonjour and Link-Local Addressing

With Bonjour, you can share nearly anything, including files, media, printers, and other devices, in innovative and easier ways. It simplifies traditional network-based activities like file sharing and printing by providing dynamic discoverability of file servers and Bonjour-enabled network printers.

Bonjour begins by simplifying the otherwise complex process of configuring devices for a network. To communicate with other devices using IP, a device needs special information like an IP address, a subnet mask, DNS addresses, a DNS name, and preconfigured search paths. Understanding these cryptic details and performing the subsequent configuration can be daunting for the average user.

When a new computer or device is added to a network by means of autoconfiguration, like a DHCP server, Bonjour configures the device using a technique called link-local addressing. (If a DHCP server is available, Bonjour uses the assigned IP address.)

With link-local addressing, the computer randomly selects an IP address from a predefined range of addresses set aside by the Internet Assigned Numbers Authority (IANA) for link-local addressing and assigns that address to itself. Addresses are in the range 169.254.xxx.xxx.

The device then sends a message over the network to determine whether another device is using the address. If the address is in use, the device randomly selects addresses until it finds one that is available. When the device has assigned itself an IP address, it can send and receive IP traffic on the network.

Mac OS X Server v10.5 or later supports Wide-Area Bonjour browsing that allows computers and devices that support Bonjour to communicate across LANs, subnets, and the Internet.

## Before You Set Up DNS Service

This section contains information to consider before setting up DNS on your network. Because the issues involved with DNS administration are complex and numerous, do not set up DNS service on your network unless you're an experienced DNS administrator.

A good source of information about DNS is *DNS and BIND, 5th edition*, by Paul Albitz and Cricket Liu (O'Reilly and Associates, 2006).

**Note:** Apple can help you locate a network consultant to implement DNS service. You can contact Apple Professional Services and Apple Consultants Network on the web at [www.apple.com/services](http://www.apple.com/services) or [consultants.apple.com](http://consultants.apple.com).

Consider creating a mail alias, such as “hostmaster,” that receives mail and delivers it to the person that runs the DNS server at your site. This permits users and other DNS administrators to contact you regarding DNS problems.

You should set up at least one primary and one secondary name server. That way, if the primary name server shuts down, the secondary name server can continue to provide service. A secondary server gets its information from the primary server by periodically copying all domain information from the primary server.

After a name server is provided with the name/address pair of a host in another domain (outside the domain it serves), the information is cached, ensuring that IP addresses for recently resolved names are stored for later use.

DNS information is usually cached on your name server for a set time, referred to as a *time-to-live* (TTL) value. When the TTL value for a domain name/IP address pair has expired, the entry is deleted from the name server’s cache and your server requests the information as needed.

## Setting Up DNS Service for the First Time

If you’re using an external DNS name server and you entered its IP address in the Gateway Setup Assistant, you don’t need to do anything else.

If you’re setting up your own DNS server, follow the steps in this section.

### Step 1: Register your domain name

Domain name registration is managed by IANA. IANA registration makes sure that domain names are unique across the Internet. (For more information, see [www.iana.org](http://www.iana.org).)

If you don’t register your domain name, your network can’t communicate over the Internet.

After you register a domain name, you can create subdomains as long as you set up a DNS server on your network to track the subdomain names and IP addresses.

For example, if you register the domain name `example.com`, you could create subdomains such as `host1.example.com`, `mail.example.com`, or `www.example.com`. A server in a subdomain could be named `primary.www.example.com` or `backup.www.example.com`.

The DNS server for `example.com` tracks information for its subdomains, such as host (computer) names, static IP addresses, aliases, and mail exchangers.

If your ISP handles your DNS service, you must inform them of changes you make to your domain name, including added subdomains.

The range of IP addresses used with a domain must be clearly defined before setup. These addresses are used exclusively for one specific domain, never by another domain or subdomain. Coordinate the range of addresses with your network administrator or ISP.

## Step 2: Learn and plan

If you're new to DNS, learn and understand DNS concepts, tools, and features of Mac OS X Server and BIND. See "Where to Find More DNS Information" on page 82.

When you're ready, plan your DNS service. Consider the following questions:

- Do you need a local DNS server? Does your ISP provide DNS service? Can you use multicast DNS names instead?
- How many servers do you need? How many additional servers do you need for backup DNS purposes? For example, should you designate a second or third computer for DNS service backup?
- What is your security strategy to deal with unauthorized use?
- How often should you schedule periodic inspections or tests of DNS records to verify data integrity?
- How many services or devices (such as intranet websites or network printers) need a name?

There are two ways to configure DNS service on Mac OS X Server:

- **Use Server Admin.** This is the recommended method. For instructions, see "Setting Up DNS Service" on page 56.
- **Edit the BIND configuration file.** BIND is the set of programs used by Mac OS X Server that implements DNS. One of those programs is the *name daemon*, or *named*. To set up and configure BIND, you must change the configuration file and the zone file. The configuration file is `/etc/named.conf`.

The zone file name is based on the name of the zone. For example, the zone file `example.com` is `/var/named/example.com.zone`.

If you edit `named.conf` to configure BIND, don't change the `inet` settings of the `controls` statement. Otherwise, Server Admin can't retrieve status information for DNS.

The `inet` settings should look like this:

```
controls {
    inet 127.0.0.1 port 54 allow {any;}
    keys { "rndc-key"; };
};
```

**Important:** In Mac OS X Server v10.6, the configuration and zone files used by Server Admin have changed. If you edit `named.conf` and zone files manually from Terminal, the information is used by DNS. However, the information does not appear in the DNS zones pane of Server Admin. Also, changes made in Server Admin are not made to `named.conf`.

### **Step 3: Turn DNS service on**

Before configuring DNS service, turn on DNS. See “Turning DNS Service On” on page 56.

### **Step 4: Create a DNS zone and add machine records**

Use Server Admin to set up DNS zones. See “Configuring DNS Service Primary Zone Settings” on page 57. After adding a primary zone, Server Admin creates a name server record with the same name as the Source of Authority (SOA).

For each zone you create, Mac OS X Server creates a reverse lookup zone. Reverse lookup zones translate IP addresses to domain names. (Compare with normal lookups, which translate domain names to IP addresses.)

Use Server Admin to add records to your zone. Create an Address record for every computer or device (such as a printer or file server) that has a static IP address and needs a name. Various DNS zone records are created from DNS machine entries.

### **Step 5: Configure secondary zones**

If necessary, use Server Admin to configure secondary zones. See “Configuring DNS Service Secondary Zone Settings” on page 59.

### **Step 6: Configure Bonjour**

Use Server Admin to configure Bonjour settings. See “Configuring DNS Service Bonjour Settings” on page 59.

### **Step 7: Configure logging**

Use Server Admin to specify the information that gets logged by DNS service and to specify the location of the log file. See “Changing DNS Log Detail Levels” on page 64.

### **Step 8: (Optional) Set up a mail exchange (MX) record**

If you provide mail service over the Internet, set up an MX record for your server. See “Configuring DNS for Mail Service” on page 77.

### **Step 9: Configure your firewall**

Configure your firewall to make sure DNS service is protected from attack and accessible to your clients. See Chapter 4, “Working with Firewall Service.”

### **Step 10: Start DNS service**

Mac OS X Server includes a simple interface for starting and stopping DNS service. See “Starting DNS Service” on page 62.

## Turning DNS Service On

Before you can configure DNS settings, turn on DNS service in Server Admin.

To turn DNS service on:

- 1 Open Server Admin and connect to the server.
- 2 Click Settings.
- 3 Click Services.
- 4 Select the DNS checkbox.
- 5 Click Save.

## Upgrading DNS Configuration

Mac OS X Server v10.6 has been modified to manage DNS entries more efficiently. To take advantage of this, DNS records created on versions prior to Mac OS X Server v10.5 must be upgraded.

After you upgrade to Mac OS X Server v10.6 and turn on DNS in Server Admin, the upgrade pane appears the first time you click DNS. (The upgrade pane appears only if you upgraded to Mac OS X Server v10.6 from a version prior to Mac OS X Server v10.5. It does not appear if Mac OS X Server v10.6 was newly installed.)

The upgrade pane has two options:

- **Don't Upgrade:** If you choose to not upgrade your configuration, you cannot use Server Admin to automatically configure DNS. You can manually configure files using the `/etc/named.conf` file for DNS configuration and the `/var/named` file for Zone configuration.
- **Upgrade:** The Upgrade option converts DNS file records and then allows access to the DNS panes of Server Admin.

When upgrading, backup files are created. If the files must be restored, they can be restored manually. Backup files are saved in the same folders where the original files are located.

## Setting Up DNS Service

Set up DNS service by configuring the following three groups of settings in Server Admin:

- **Zones.** Use to configure a primary zone and computers that are part of the zone and to configure a copy of a primary zone stored on a secondary name server. This also sets information that determines if you permit zone transfers.
- **Bonjour.** Use to configure Wide-Area Bonjour browsing which allows you to extend Bonjour browsing to function beyond the local subnet and across the Internet.

- **Settings.** Use to configure and manage logs for DNS service and to set recursion for DNS service.

The following sections describe how to configure these settings and how to start DNS service when you finish.

## Configuring DNS Service Primary Zone Settings

Use Server Admin to create a local DNS zone file and add records to it.

***Important:*** In Mac OS X Server v10.6, the configuration and zone files used by Server Admin have changed. If you edit the `named.conf` and zone files manually from Terminal, the information is used by DNS. However, the information does not appear in the DNS zones pane of Server Admin. Also, changes made in Server Admin are not made to the `named.conf` file. It is recommended that you use Server Admin.

### To configure DNS service zone settings:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select DNS.
- 4 Click Zones.
- 5 Click Add Zone, then choose “Add Primary Zone (Master).”
- 6 Select the new zone.
- 7 In the Primary Zone Name field, enter the zone name.  
This is the fully qualified domain name of the primary server.
- 8 Enter the mail address of the zone’s administrator.
- 9 Select “Allows zone transfer” to permit secondary zones to get copies of the primary zone data.
- 10 Add name servers for this zone by clicking the Add (+) button and entering the name in the Name Servers field.
- 11 Add mail exchangers for this zone by clicking the Add (+) button and entering the name in the Mail Exchangers field.  
This field is the basis for the computer’s MX record.
- 12 Specify a mail server precedence number in the Priority field.  
Delivering mail servers try to deliver mail at lower numbered mail servers first. For more information, see “Configuring DNS for Mail Service” on page 77.
- 13 Click Expiration and enter the number of hours for each setting.

- Enter the amount of time the zone is valid. This is the zone's time to live (TTL) value. It determines how long query response information can remain cached in remote DNS systems before requerying the authoritative server.
- Enter the interval of time that the secondary zones should refresh from the primary zone.
- Enter the interval of time between each retry if the refresh of the secondary zone fails.
- Enter the amount of time after refreshing before the zone data expires.

**14** Click Add Record, then choose "Add Alias (CNAME)."

To see a list of records for a zone, click the triangle at the left of the zone.

**15** Select newAlias listed under the primary zone.

You can add as many aliases as you want.

**16** In the Alias Name field, enter the alternate name for your computer.

If you want to use the fully qualified name for the Alias, select the Fully Qualified checkbox and enter the fully qualified domain name.

This field is the basis for CNAME records of the computer. Reverse lookup Pointer records are created for the computer.

**17** In the Destination field, enter the computer name you are creating the alias for.

If you want to use the fully qualified name for the Destination, select the Fully Qualified checkbox and enter the fully qualified domain name.

**18** Click Add Record, then choose "Add Machines (A)."

**19** Select newMachine listed under the primary zone, then enter the following machine information.

- In the Machine Name field, enter the hostname of the computer.  
This field is the basis for the A record of the computer. Reverse lookup Pointer records are created for the computer.
- Click the Add (+) button, then enter the IP address of the computer.
- Enter information about the hardware and software of the computer in the relevant text boxes.  
These are the basis for the HINFO record of the computer.
- Enter comments about the computer in the Comments text box.  
This field is the basis for the TXT record of the computer. You can store almost any text string in the comments text box up to 255 ASCII characters.  
For example, you can include the physical location of the computer (Upstairs server closet B) or the computer's owner (John's Computer) or any other information about the computer.

- 20 Click Add Record, then choose “Add Service (SRV).”

The DNS SRV record is an entry that informs client computers that a service is on a domain. These records help computers with the location of a service on a domain.

For more information, see “Adding a Service Record to a DNS Zone” on page 72.

- 21 Under the primary zone, select a service type and then enter the service information.
- 22 Click Save.

## Configuring DNS Service Secondary Zone Settings

A secondary zone is a copy of a primary zone stored on a secondary name server. Each secondary zone keeps a list of primary servers that it contacts for updates to records in the primary zone.

Secondary zones must be configured to request the copy of the primary zone data. Secondary zones use zone transfers to get copies of the primary zone data.

Secondary name servers can take lookup requests like primary servers.

### To add a secondary zone:

- 1 Make sure the primary server is correctly configured and that zone transfers are enabled on the primary server; then open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select DNS.
- 4 Click Zones.
- 5 Click Add Zone, then choose “Add Secondary Zone (Slave).”
- 6 Select the new zone.
- 7 In the Secondary Zone Name field, enter a zone name.

The zone name is the same as the primary zone defined on the primary name server.

- 8 Below the Primary DNS Servers list, click the Add (+) button.
- 9 Enter the IP addresses for each primary server in this secondary zone.
- 10 Click Save.

## Configuring DNS Service Bonjour Settings

With Bonjour, you can easily connect a computer or other device to an existing wired or wireless Ethernet network, or you can create instant networks of multiple devices without additional network configuration.

If your computer or devices supports Bonjour, it broadcasts and discovers services from other computers or devices using Bonjour. You can quickly and easily network computers and devices that support Bonjour.

Bonjour requires no configuration for computers or devices on your local subnet. All devices that are on the same subnet, that support Bonjour, and have it turned on, find each other. However, to provide Bonjour-browsing across subnets or on the Internet, you must set up a dedicated Bonjour browse domain that allows Bonjour supported devices to locate services from anywhere on the Internet.

Using Server Admin you can designate any domain you set up in DNS as the domain for Bonjour browsing. You can then add SRV records to the designated Bonjour browsing domain for each service type.

These services appear on computers that have the Bonjour browsing domain entered as a search domain in Network Preferences. You can add the designated Bonjour browsing domain to the search domain of each computer manually or through DHCP.

For mobile clients its recommended to enter the search domain manually so they have Bonjour browsing access from anywhere. For more information about adding SRV records, see “Adding a Service Record to a DNS Zone” on page 72.

**To configure DNS service Bonjour settings:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select DNS.
- 4 Click Bonjour.
- 5 Select the “Enable automatic client Bonjour browsing for domain” checkbox and enter the Fully Qualified Domain Name (FQDN) of the domain used for Bonjour browsing (for example, *bonjour.company.com*).

This sets a default Bonjour browsing domain for primary zones.

- 6 Click Save.

## Configuring DNS Service Settings

You use the Settings pane in DNS to set the detail level of the DNS service log. You might want a highly detailed log for debugging or a less detailed log that only shows critical warnings.

You set recursive queries, which the DNS server fully answers (or gives an error). If the query is unanswered, it is forwarded to the IP addresses you add in the Forwarder IP Addresses list.

**To configure DNS settings:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.

The list of services appears.

- 3 From the expanded Servers list, select DNS.
- 4 Click Settings.
- 5 From the Log Level pop-up menu, choose the detail level as follows:
  - Choose Critical to record only critical errors, such as hardware errors.
  - Choose Error to record errors not including warning messages.
  - Choose Warning to record warnings and errors.
  - Choose Notice to record only important messages, warnings, and errors.
  - Choose Information to record most messages.
  - Choose Debug to record all messages.

The log location is `/Library/Logs/`.

- 6 Below the “Accept recursive queries from the following networks” list, click the Add (+) button to add networks that recursive queries are accepted from, then enter the network address in the list.
- 7 Below the “Forwarder IP Addresses” list, click the Add (+) button to add networks that unauthorized queries get forwarded to, then enter the network address in the list.
- 8 Click Save.

**From the command line:**

- To view a setting:

```
$ sudo serveradmin settings dns:setting
```

- To view a group of settings:

```
$ sudo serveradmin settings dns:zone:_array_id:localhost:*
```

Enter as much of the name as you want, stopping at a colon (:), and then entering an asterisk (\*) as a wildcard for the remaining parts of the name.

- To view all service configuration settings:

```
$ sudo serveradmin settings dns
```

To modify your server’s DNS configuration, use `serveradmin`. However, you’ll probably find it more straightforward to work with DNS and BIND using the standard tools and techniques described in the many books on the subject. (For an example, see *DNS and BIND* by Paul Albitz and Cricket Liu.)

For information about DNS `serveradmin` commands, see “DNS `serveradmin` Commands” on page 203. For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Starting DNS Service

Use Server Admin to start DNS service.

Remember to restart DNS service when you make changes to DNS service in Server Admin.

### To start DNS service:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.

The list of services appears.

- 3 From the expanded Servers list, select DNS.
- 4 Click Start DNS (below the Servers list).

The service can take a few seconds to start.

### From the command line:

- To start the service:

```
$ sudo serveradmin start dns
```

For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Managing DNS Service

This section describes typical tasks you might perform after you set up DNS service on your server. Initial setup information appears in “Setting Up DNS Service” on page 56.

More advanced features require configuring BIND from the command line and are not covered here.

You might want to monitor DNS status to:

- Troubleshoot name resolution problems
- Verify how often DNS service is used
- Look for unauthorized or malicious DNS service use

## Checking DNS Service Status

You can use Server Admin to check the status of DNS service.

### To check DNS service status:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.

The list of services appears.

- 3 From the expanded Servers list, select DNS.

- 4 Click Overview to see whether the service is running, when it was started, and the number of zones allocated.
- 5 Click Log to review the service log.

Use the Filter field above the log to search for specific entries.

**From the command line:**

- To see summary status of the service:

```
$ sudo serveradmin status dns
```

- To see detailed status of the service:

```
$ sudo serveradmin fullstatus dns
```

For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Viewing DNS Service Logs

DNS service creates entries in the system log for error and alert messages. The log file is named `log`. You can filter the log to narrow the number of viewable log entries and make it easier to find those you want to see.

**To view logs:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select DNS.
- 4 Click Log and use the Filter field above the log to search for specific entries.

**From the command line:**

- To view the latest entries in a log:

```
$ tail log-file
```

- To display the log path:

```
$ sudo serveradmin command dns:command = getLogPaths
```

The default log path is `/Library/Logs/named.log`.

For information about `tail` and `serveradmin`, see their man pages. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Changing DNS Log Detail Levels

You can change the detail level of the DNS service log. You might want a highly detailed log for debugging or a less detailed log that only shows critical warnings.

**To change the log detail level:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select DNS.
- 4 Click Settings.
- 5 Choose the detail level from the Log Level pop-up menu as follows:
  - Choose Critical to record only critical errors, such as hardware errors.
  - Choose Error to record errors not including warning messages.
  - Choose Warning to record warnings and errors.
  - Choose Notice to record only important messages, warnings, and errors.
  - Choose Information to record most messages.
  - Choose Debug to record all messages.
- 6 Click Save.

## Viewing DNS Service Statistics

To view a summary of the DNS service workload, use the `serveradmin getStatistics` command.

**To view statistics:**

- Enter the following from the command line in Terminal:

```
$ sudo serveradmin command dns:command = getStatistics
```

The computer responds with output similar to the following:

```
dns:queriesArray:_array_index:0:name = "NS_QUERIES"  
dns:queriesArray:_array_index:0:value = -1  
dns:queriesArray:_array_index:1:name = "A_QUERIES"  
dns:queriesArray:_array_index:1:value = -1  
dns:queriesArray:_array_index:2:name = "CNAME_QUERIES"  
dns:queriesArray:_array_index:2:value = -1  
dns:queriesArray:_array_index:3:name = "PTR_QUERIES"  
dns:queriesArray:_array_index:3:value = -1  
dns:queriesArray:_array_index:4:name = "MX_QUERIES"  
dns:queriesArray:_array_index:4:value = -1  
dns:queriesArray:_array_index:5:name = "SOA_QUERIES"  
dns:queriesArray:_array_index:5:value = -1
```

```
dns:queriesArray:_array_index:6:name = "TXT_QUERIES"  
dns:queriesArray:_array_index:6:value = -1  
dns:nxdomain = 0  
dns:nxrrset = 0  
dns:reloadedTime = ""  
dns:success = 0  
dns:failure = 0  
dns:recursion = 0  
dns:startedTime = "2003-09-10 11:24:03 -0700"  
dns:referral = 0
```

For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Stopping DNS Service

Use Server Admin to stop DNS service.

### To stop DNS service:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select DNS.
- 4 Click Stop DNS (below the Servers list).
- 5 Click Stop Now.

The service might take a few seconds to stop.

### From the command line:

- To stop the service:  

```
$ sudo serveradmin stop dns
```

For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Enabling or Disabling Zone Transfers

In DNS, zone data is replicated among authoritative DNS servers by means of zone transfers. Secondary DNS servers (secondaries) use zone transfers to acquire their data from primary DNS servers (primaries). You must enable zone transfers if you want to use secondaries.

### To enable or disable zone transfers:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.

The list of services appears.

- 3 From the expanded Servers list, select DNS.
- 4 Click Zones.
- 5 Select the primary zone you want to change.
- 6 Click General.
- 7 Select or deselect “Allows zone transfer” to permit secondary zones to get copies of the primary zone data.
- 8 Click Save.

### Enabling Recursion

Recursion fully resolves domain names into IP addresses. Applications depend on the DNS server to perform this function. Other DNS servers that query your DNS servers don't need to perform the recursion.

To prevent malicious users from changing the primary zone's records (referred to as cache poisoning) and to prevent unauthorized use of the server for DNS service, you can restrict recursion. However, if you restrict your private network from recursion, your users can't use your DNS service to look up names outside of your zones.

Disable recursion only if:

- No clients are using this DNS server for name resolution.
- No servers are using it for forwarding.

#### To enable recursion:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.

The list of services appears.

- 3 From the expanded Servers list, select DNS.
- 4 Click Settings.
- 5 Click the Add (+) button below the “Accept recursive queries from the following networks” list.
- 6 Enter the IP addresses for the servers that DNS will accept recursive queries from.  
You can also enter IP address ranges.
- 7 Click Save.

If you enable recursion, consider disabling it for external IP addresses but enabling it for LAN IP addresses by editing BIND's named.conf file. However, edits you make to named.conf will not show up in the DNS section of Server Admin. You can completely disable recursion by removing all entries from the network list. For more information about BIND, see [www.isc.org/sw/bind](http://www.isc.org/sw/bind).

## Managing DNS Zones

DNS zones are managed using Server Admin. The following sections describe how to manage and modify DNS zones.

### Adding a Primary Zone

Use Server Admin to add a primary zone to your DNS server.

#### To add a primary zone:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select DNS.
- 4 Click Zones.
- 5 Click Add Zone, then choose "Add Primary Zone (Master)."
- 6 Select the new zone.
- 7 In the Primary Zone Name field, enter the zone name.  
This is the fully qualified domain name of the primary server.
- 8 Enter the mail address of the zone's administrator.
- 9 Select "Allows zone transfer" to permit secondary zones to get copies of the primary zone data.
- 10 Add nameservers for this zone by clicking the Add (+) button and entering the name in the Nameservers field.
- 11 Add mail exchangers for this zone by clicking the Add (+) button and entering the name in the Mail Exchangers field.  
This field is the basis for the computer's MX record.
- 12 In the Priority field, specify a mail server precedence number.  
Delivering mail servers try to deliver mail at lower numbered mail servers first. For more information, see "Configuring DNS for Mail Service" on page 77.
- 13 Click Expiration and enter the number of hours for each setting:

- Enter the amount of time the zone is valid. This is the zone's time to live (TTL) setting. It determines how long query response information can remain cached in remote DNS systems before requerying the authoritative server.
- Enter the interval of time that the secondary zones should refresh from the primary zone.
- Enter the interval of time between each retry if the refresh of the secondary zone fails.
- Enter the amount of time after refreshing before the zone data expires.

14 Click Save.

## Adding a Secondary Zone

Use Server Admin to add a secondary zone to your DNS server.

You perform the following steps on the secondary server.

### To add a secondary zone:

- 1 Make sure the primary server is correctly configured and that zone transfers are enabled on the primary server.
- 2 On the secondary server, open Server Admin and connect to the secondary server.
- 3 Click the triangle at the left of the server.

The list of services appears.

- 4 From the expanded Servers list, select DNS.
- 5 Click Zones.
- 6 Click Add Zone, then click "Add Secondary Zone (Slave)."
- 7 Select the new zone.
- 8 In the Secondary Zone Name field, enter a zone name.

The zone name is the same as the primary zone defined on the primary name server.

- 9 Below the Primary Zone addresses list, click the Add (+) button.
- 10 Enter the IP addresses for each primary server in the secondary zone.
- 11 Click Save.

## Adding a Forward Zone

A forward zone directs lookup requests to other DNS servers. The forward zone also caches previous lookup requests for enhanced speed.

Use Server Admin to add a forward zone to your DNS server.

### To add a forward zone:

- 1 Open Server Admin and connect to the server.

- 2 Click the triangle at the left of the server.

The list of services appears.

- 3 From the expanded Servers list, select DNS.
- 4 Click Settings.
- 5 Click the Add (+) button below the Forwarder IP Addresses list.
- 6 Enter the IP addresses for the master servers for the forward zone.

A forward zone directs lookup requests to other DNS servers. The forward zone also caches previous lookup requests for enhanced speed.

- 7 Click Save.

## Changing a Zone

Use Server Admin to change zone settings. You might need to change the administrator mail address or domain name of a zone.

### To change a zone:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select DNS.
- 4 Click Zones.
- 5 Select the zone you want to change.
- 6 Change the zone information as needed.
- 7 Click Save.

## Deleting a Zone

When you delete a zone, all records associated with it are deleted.

### To delete a zone:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select DNS.
- 4 Click Zones.
- 5 Select the zone you want to delete.
- 6 Click Remove below the Zones list.
- 7 Click Save.

## Importing a BIND Zone File

You might already have a BIND zone file from a DNS server of another platform. If so, instead of entering the information in Server Admin manually, you can use the BIND zone file directly with Mac OS X Server.

Using an existing zone file requires:

- Root access permissions to the BIND configuration file (/etc/named.conf)
- The working zone directory (/var/named/)
- A basic knowledge of BIND and the Terminal application

Otherwise, use the Server Admin DNS tools.

**Important:** In Mac OS X Server v10.6, the configuration and zone files used by Server Admin have changed. If you edit named.conf and zone files manually from Terminal, the information is used by DNS. However, the information does not appear in the DNS zones pane of Server Admin. Also, changes made in Server Admin are not made to named.conf. It is recommended that you use Server Admin.

### To import a zone file:

- 1 Verify that you have root privileges.
- 2 Add the zone directive to the BIND configuration file, /etc/named.conf.

For example, for zone xyz.com described in zone file db.xyz.com in the working zone folder /var/named/, the zone directive might look like this:

```
zone "xyz.com" IN { // Forward lookup zone for xyz.com
    type master; // It's a primary zone
    file "db.xyz.com"; // Zone info stored in /var/named/db.xyz.com
    allow-update { none; };
};
```

- 3 Confirm that the zone file is added to the /var/named/ working zone folder.
- 4 Restart the DNS service using Server Admin.

## Managing DNS Records

Each zone contains a number of records that are requested when a client computer translates a domain name (like www.example.com) to an IP number.

Web browsers, mail clients, and other network applications rely on a zone's records to contact the correct server.

The following sections describe how to add, modify, and delete DNS records.

## Adding an Alias Record to a DNS Zone

You must add records for each computer the DNS primary zone has responsibility for. Do not add records for computers the zone doesn't control.

An alias record or canonical name (CNAME) record is used to create aliases that point to other names. If you want this computer to have more than one name, add alias records to the zone.

### To add a DNS alias record:

1 Open Server Admin and connect to the server.

2 Click the triangle at the left of the server.

The list of services appears.

3 From the expanded Servers list, select DNS.

4 Click Zones.

5 Select the zone this record is to be added to.

6 Click Add Record, then choose Add Alias (CNAME).

This adds the alias record to the zone.

7 Select newAlias listed under the primary zone, then enter the alias information.

In the Alias Name field, enter the alternate name for your computer.

If you want to use the fully qualified name for the Alias, select the Fully Qualified checkbox and enter the fully qualified domain name.

This field is the basis for CNAME records of the computer. Reverse lookup Pointer records are created for the computer.

Add as many aliases as you want.

8 In the Destination field, enter the computer name you are creating the alias for.

If you want to use the fully qualified name for the Destination, select the Fully Qualified checkbox and enter the fully qualified domain name.

9 Click Save.

Add as many aliases as you want by adding additional alias records.

## Adding a Machine Record to a DNS Zone

You must add records for each computer the DNS primary zone has responsibility for. Do not add records for computers the zone doesn't control.

A machine record or address (A) record is used to associate a domain name with an IP address. Therefore, there can be only one machine for each IP address because there can't be duplicate IP addresses in a zone.

#### To add a DNS machine record:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.

The list of services appears.

- 3 From the expanded Servers list, select DNS.
- 4 Click Zones.
- 5 Select the zone this record is to be added to.
- 6 Click Add Record, then choose Add Machine (A).

This adds the machine record to the zone.

- 7 Select newMachine listed under the zone, then enter the following machine information.

- In the Machine Name field, enter the hostname of the computer.  
This field is the basis for the A record of the computer. Reverse lookup Pointer records are created for the computer.
- Click the Add (+) button, then enter the IP address of the computer.
- Enter any information about the hardware and software of the computer in the relevant text boxes. These are the basis for the HINFO record of the computer.
- Enter any comments about the computer in the Comment text box.

This field is the basis for the TXT record of the computer.

You can store up to 255 ASCII characters in the comments text box. You can include the physical location of the computer (for example, Upstairs server closet B), the computer's owner (for example, John's Computer), or other information about the computer.

- 8 Click Save.

### Adding a Service Record to a DNS Zone

Service (SRV) records are used to define services available on a domain. These records help computers with the location of a service on a domain.

#### To add a DNS service record:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.

The list of services appears.

- 3 From the expanded Servers list, select DNS.
- 4 Click Zones.
- 5 Select the zone this record is to be added to.

- 6 Click Add Record, then choose Add Service (SRV).  
This adds the service record to the zone.
- 7 In the Service Name field, enter the well-known name of the service.
- 8 From the Service Type pop-up menu, select a service type.  
If the service type for the service you are providing is not listed, you can enter the name in the Service Type field. The service you are providing should use a syntax similar to *\_application protocol name.\_tcp | \_udp*.
- 9 In the Host field, enter the DNS name of the server that is providing the service.
- 10 If you want to use the fully qualified domain name of the domain server, select the Fully Qualified checkbox.
- 11 In the Port field, enter the port number for the service you are providing.  
For example, if you are providing http service, you would use port 80.
- 12 In the Priority field, enter priority number.  
The priority number is used when multiple hosts are configured for the same service. The priority determines which host is tried first.
- 13 In the Weight field, enter a weight number.  
The weight number is used as a relative weight for records with the same priority.
- 14 In the TXT field, enter additional information about the service.  
This creates a TXT record for the service.
- 15 Click Save.

### Changing a Record in a DNS Zone

If you change the namespace for the domain, you must update DNS records as often as that namespace changes. Upgrading hardware or adding to a domain name might also require updating DNS records.

You can duplicate a record and then edit it, saving configuration time.

#### To change a record:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select DNS.
- 4 Click Zones.
- 5 Click the triangle at the left of the zone that has the computer record to be edited.  
The list of records appears.

- 6 Select the record to be edited and make changes in the fields below the list.
- 7 Click Save.

### Deleting a Record from a DNS Zone

When a computer is no longer associated with a domain name or usable address, delete the associated records.

**To delete a record:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select DNS.
- 4 Click Zones.
- 5 Click the triangle at the left of the zone that has the computer record to be deleted.  
The list of records appears.
- 6 Select the record to be deleted and click Remove below the list.
- 7 Click Save.

### Securing the DNS Server

DNS servers are targeted by malicious computer users (hackers). DNS servers are susceptible to several kinds of attacks. By taking extra precautions, you can prevent the problems and downtime associated with hackers.

Several kinds of security attacks are associated with DNS service:

- DNS spoofing
- Server mining
- DNS service profiling
- Denial of service (DoS) attacks
- Service piggybacking

### DNS Spoofing

DNS spoofing is adding false data to the DNS server's cache. This enables hackers to:

- Redirect real domain name queries to alternative IP addresses.

For example, a falsified A record for a bank could point a computer user's browser to a different IP address that is controlled by the hacker. A duplicate website could fool users into giving their bank account numbers and passwords to the hacker.

Also, a falsified mail record could enable a hacker to intercept mail sent to or from a domain. If the hacker then forwards that mail to the correct mail server after copying the mail, this can go undetected.

- Prevent proper domain name resolution and access to the Internet.  
This is the most benign of DNS spoof attacks. It merely makes a DNS server appear to be malfunctioning.

The most effective method to guard against these attacks is vigilance. This includes maintaining up-to-date software and auditing DNS records regularly.

If exploits are found in the current version of BIND, the exploits are patched and a security update is made available for Mac OS X Server. Apply all such security patches. Regular audits of your DNS records can help prevent these attacks.

## Server Mining

Server mining is the practice of getting a copy of a complete primary zone by requesting a zone transfer. In this case, a hacker pretends to be a secondary zone to another primary zone and requests a copy of the primary zone's records.

With a copy of your primary zone, the hacker can see what kinds of services a domain offers and the IP addresses of the servers that offer them. He or she can then try specific attacks based on those services. This is reconnaissance before another attack.

To defend against this attack, specify which IP addresses have permission to request zone transfers (your secondary zone servers) and deny all others.

Zone transfers are accomplished over TCP on port 53. To limit zone transfers, block zone transfer requests from anyone but your secondary DNS servers.

### To specify zone transfer IP addresses:

- 1 Create a firewall filter that permits only IP addresses that are inside your firewall to access TCP port 53.
- 2 Follow the instructions in "Configuring Advanced Firewall Rules" in Chapter 4, "Working with Firewall Service," using the following settings:
  - *Packet*: Allow
  - *Port*: 53
  - *Protocol*: TCP
  - *Source IP*: the IP address of your secondary DNS server
  - *Destination IP*: the IP address of your primary DNS server

## DNS Service Profiling

Another common reconnaissance technique used by malicious users is to profile your DNS service. First a hacker makes a BIND version request. The server reports what version of BIND is running. Then the hacker compares the response to known exploits and vulnerabilities for that version of BIND.

To defend against this attack, configure BIND to respond with something other than what it is.

**To alter BIND's version response:**

- 1 Open a command-line text editor (for example vi, emacs, or pico).
- 2 Open named.conf for editing.
- 3 To the options brackets of the configuration file, add the following:  

```
version "[your text, maybe 'we're not telling!']";
```
- 4 Save named.conf.

## Denial of Service (DoS)

This kind of attack is common and easy. A hacker sends so many service requests and queries that a server uses all its processing power and network bandwidth trying to respond. The hacker prevents legitimate use of the service by overloading it.

It is difficult to prevent this type of attack before it begins. Constant monitoring of the DNS service and server load enables an administrator to catch the attack early and mitigate its damaging effect.

The easiest way to guard against this attack is to block the offending IP address with your firewall. See “Configuring Advanced Firewall Rules” on page 100. Unfortunately, this means the attack is already underway and the hacker’s queries are being answered and the activity logged.

## Service Piggybacking

This attack is done not so much by malicious intruders but by common Internet users who learn the trick from other users. They might feel that the DNS response time with their own ISP is too slow, so they configure their computer to query another DNS server instead of their own ISP’s DNS servers. Effectively, there are more users accessing the DNS server than were planned for.

You can guard against this type of attack by limiting or disabling DNS recursion. If you plan to offer DNS service to your own LAN users, they need recursion to resolve domain names, but don’t provide this service to Internet users.

To prevent recursion entirely, see “Enabling Recursion” on page 66.

The most common balance is permitting recursion for requests coming from IP addresses in your own range but denying recursion to external addresses.

BIND enables you to specify this in its configuration file, `named.conf`. Edit `named.conf` to include the following:

```
options {  
    ...  
    allow-recursion{  
        127.0.0.0/8;  
        [your internal IP range of addresses, like 192.168.1.0/27];  
    };  
};
```

For more information, see the BIND documentation.

## Common Network Administration Tasks That Use DNS Service

The following sections illustrate common network administration tasks that require DNS service.

### Configuring DNS for Mail Service

To provide mail service on your network, you must set up DNS so that incoming mail is sent to the correct mail host on your network.

When you set up mail service, you define a series of hosts, known as *mail exchangers* or *MX hosts*, each of which has a defined priority level. The host with the highest priority gets the mail first. If that host is unavailable, the host with the next highest priority gets the mail, and so on.

Suppose the mail server's host name is *reliable* in the *example.com* domain. Without an MX record, users mail addresses would include the name of your mail server computer, like this: `user-name@reliable.example.com`.

To change the mail server or redirect mail, you must notify potential senders of a new address for your users, or you can create an MX record for each domain you want handled by your mail server and direct the mail to the correct computer.

When you set up an MX record, include a list of potential computers that can receive mail for a domain. That way, if the server is busy or down, mail is sent to another computer.

Each computer on the list is assigned a precedence number (its priority). The one with the lowest number is tried first. If that computer isn't available, the computer with the next lowest number is tried, and so on.

When a computer receives the mail, it holds the mail and sends it to the main mail server when the main server becomes available, and then the main mail server delivers the mail.

Following is an example of an MX record that includes three computers that can receive mail for the example.com domain:

**example.com**

10 reliable.example.com

20 our-backup.example.com

30 last-resort.example.com

MX records are used for outgoing mail too. When your mail server sends mail, it looks at the MX records to see whether the destination is local or somewhere else on the Internet, then the process above happens in reverse.

If the main server at the destination is not available, your mail server tries every available computer on that destination's MX record list until it finds one that accepts the mail.

Configuring DNS for mail service involves creating MX records in DNS for your mail servers. If your ISP provides DNS service, contact the ISP so they can enable your MX records. Follow these steps only if you provide your own DNS service.

You might want to set up multiple servers for redundancy. If so, create an MX record for each auxiliary server.

**To enable MX records for your mail server:**

1 Open Server Admin and connect to the server.

2 Click the triangle at the left of the server.

The list of services appears.

3 From the expanded Servers list, select DNS.

4 Click Zones.

5 Select the zone this record is to be added to.

6 Click the triangle at the left of the zone.

The list of records appear.

7 Click Add Record, then choose Add Machine (A).

This adds a machine record to the zone.

8 In the Machine Name field, enter the hostname of the computer.

If you want to use the fully qualified name of the computer, select the Fully Qualified checkbox and enter the fully qualified domain name of the computer.

This field is the basis for the A record of the computer. Reverse lookup pointer records are created for the computer.

- 9 Click the Add (+) button and enter the IP addresses for the computer.
- 10 In the relevant text boxes, enter information about the hardware and software of the computer.
- 11 In the Comment text box, enter comments about the computer.

This field is the basis for the TXT record of the computer.

You can store up to 255 ASCII characters in the comments text box. You can include the physical location of the computer (for example, Upstairs server closet B), the computer's owner (for example, John's Computer), or any other information about the computer.
- 12 Click Save.
- 13 To add other names that you want this computer to have, click Add Record and choose Add Alias (CNAME).

Add as many aliases as you want for your server.
- 14 In the Alias Name field, enter the alternate name for your computer.

If you want to use the fully qualified name for the Alias, select the Fully Qualified checkbox and enter the fully qualified domain name.

This field is the basis for the CNAME records of the computer. Reverse lookup pointer records are created for the computer.
- 15 In the Destination field, enter the computer name you are creating the alias for.

If you want to use the fully qualified name for the Destination, select the Fully Qualified checkbox and enter the fully qualified domain name.
- 16 Click Save.
- 17 From the expanded Servers list, select Mail.
- 18 Click Settings, then click Advanced.
- 19 Click Hosting.
- 20 Click the Add (+) button next to the Local Host Aliases Field.
- 21 In the Local Host Alias field, enter the alias name you created earlier.
- 22 Click OK, then click Save.
- 23 Repeat Steps 7 through 22 for each mail server.

### Setting Up Namespace Behind a NAT Gateway

If you're behind a NAT gateway, you have a set of IP addresses that are usable only in the NAT environment. If you were to assign a domain name to these addresses outside the NAT gateway, none of the domain names would resolve to the correct computer. For more information about NAT, see Chapter 5, "Working with NAT Service."

However, you can run DNS service behind the gateway, assigning host names to NAT IP addresses. This way, if you're behind the NAT gateway, you can enter domain names rather than IP addresses to access servers, services, and workstations.

Your DNS server should also have a Forwarding zone to send DNS requests outside of the NAT gateway to permit resolution of names outside the routed area.

Your client networking settings should specify the DNS server behind the NAT gateway. The process of setting up one of these networks is the same as setting up a private network. For more information, see "Linking a LAN to the Internet Through One IP Address" on page 133.

If you set up namespace behind the NAT gateway, names entered by users outside the gateway won't resolve to addresses behind it. Set the DNS records outside the NAT-routed area to point to the NAT gateway and use NAT port forwarding to access computers behind the NAT gateway. For more information, see "Configuring Port Forwarding" on page 127.

Mac OS X's Multicast DNS feature permits you to use hostnames on your local subnet that end with the .local suffix without enabling DNS. Any service or device that supports Multicast DNS permits the use of user-defined namespace on your local subnet without setting up and configuring DNS.

## Network Load Distribution (Round Robin)

BIND permits simple load distribution using an address-shuffling method known as *round robin*. You set up a pool of IP addresses for several hosts mirroring the same content, and BIND cycles the order of these addresses as it responds to queries.

Round robin can't monitor current server load or processing power. It only cycles the order of an address list for a given host name.

You enable round robin by adding multiple IP address entries for a given hostname. For example, suppose you want to distribute web server traffic between three servers on your network that all mirror the same content. The servers have the IP addresses 192.168.12.12, 192.168.12.13, and 192.168.12.14. You would add three machine records with three IP addresses, each with the same domain name.

When DNS service encounters multiple entries for one host, its default behavior is to answer queries by sending this list in a cycled order. The first request gets the addresses in the order A, B, C. The next request gets the order B, C, A, then C, A, B, and so on.

To mitigate the effects of local caching, you might want the zone's time-to-live (TTL) number to be fairly short.

## Hosting Several Internet Services with a Single IP Address

You can have one server that supplies all Internet services (such as mail or web). These services can run on one computer with a single IP address.

You can have multiple host names in the same zone for a single server. For example, you might want to have the domain name `www.example.com` resolve to the same IP address as `ftp.example.com` or `mail.example.com`. This domain appears to be several servers to anyone accessing the services, but they are all one server at one IP address.

Setting up DNS records for this service is easy: add aliases to the machine DNS record. Setting up DNS names for these services does not enable or configure the services. It provides names that are easy to remember for each service offered. This can simplify setup and configuration of the client software for each service.

For example, for every service you want to show, do the following:

- Create `mail.example.com` to enter on mail clients.  
Be sure to select the mail server checkbox on the machine pane.
- Create `www.example.com` to enter on web browsers.
- Create `afp.example.com` for Apple File Sharing in the Finder.
- Create `ftp.example.com` to enter on FTP clients.

As your needs grow, you can add computers to the network to handle these services. Then, remove the alias from the machine's DNS record and create a record for the new machine, and your client's settings can remain the same.

## Hosting Multiple Domains on the Same Server

One server can supply all Internet services (such as mail or web) for several domain names. For example, the domain name `www.example.com` can resolve to the same IP address as `www.server.org`. This domain appears as servers, but they are all one server at one IP address.

Setting up DNS records for this service is easy: add a DNS zone and then add host names and server information to that zone.

Setting up DNS names for these services does not enable or configure the service for the domain names. This configuration is used with virtual domain hosting in mail and web services.

## Configuring a Client to use Your DNS Server

You can configure clients to use a DNS server to convert internet names to IP addresses so you don't to know the IP address of a server you are trying to reach.

**To configure a DNS server on a client:**

- 1 Choose Apple > System Preferences, and then click Network.
- 2 Select the network connection services you use to connect to the Internet (such as Ethernet) from the services list.
- 3 Enter the IP address for the primary DNS server you want to use in the DNS Server field.

You can enter addresses for several servers by entering a comma between the addresses.

To find out which DNS server you should be using, check with your network administrator.

DNS server addresses are provided automatically by DHCP service. For more information about DHCP service, see "Setting Up DHCP Service" on page 29, "Assigning IP Addresses Dynamically" on page 27, and "Configuring DHCP on Clients" on page 48.

## Where to Find More DNS Information

For more information about DNS and BIND, see the following:

- *DNS and BIND, 5th edition*, by Paul Albitz and Cricket Liu (O'Reilly and Associates, 2006)
- The International Software Consortium website: [www.isc.org](http://www.isc.org) and [www.isc.org/sw/bind](http://www.isc.org/sw/bind)
- The DNS Resources Directory: [www.dns.net/dnsrd](http://www.dns.net/dnsrd)

Request for Comments (RFC) documents provide an overview of a protocol or service and explain how the protocol should behave.

If you're a novice server administrator, you'll probably find some of the background information in an RFC helpful.

If you're an experienced server administrator, you can find technical details about a protocol in its RFC document.

You can search for RFC documents by number at [www.ietf.org/rfc.html](http://www.ietf.org/rfc.html).

- A, PTR, CNAME, MX (For more information, see RFC 1035.)
- AAAA (For more information, see RFC 1886.)

## Use this chapter to set up and manage Firewall service in Mac OS X Server.

Firewall service is software that protects network applications running on your Mac OS X Server computer.

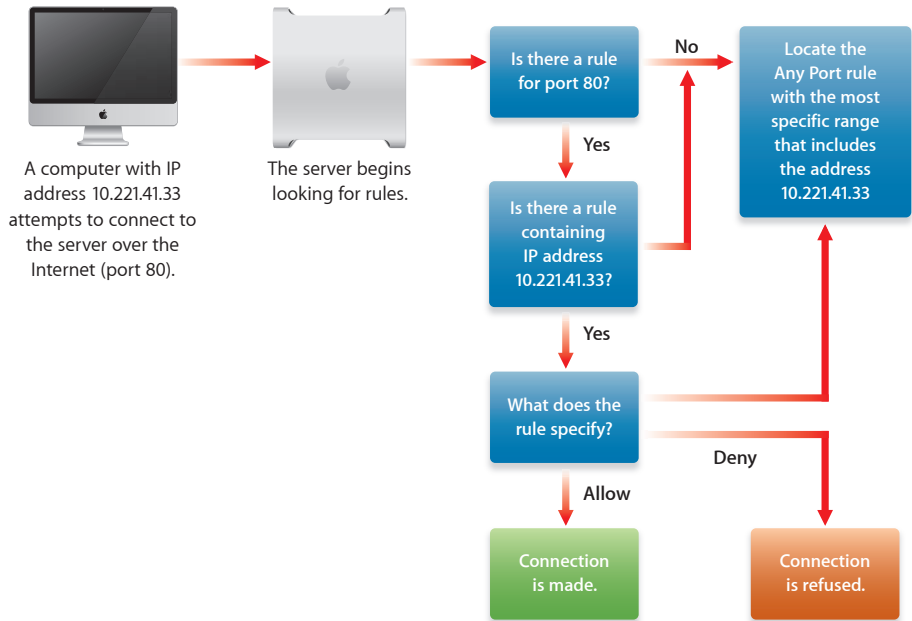
Turning on Firewall service is similar to erecting a wall to limit access to your network. Firewall service scans incoming IP packets and rejects or accepts these packets based on rules you use to configure Firewall service.

You can restrict access to any IP service running on the server, and you can customize rules for incoming clients or for a range of client IP addresses.

### About Firewall Service

You configure Firewall service using Server Admin. You can also configure some settings by manually editing configuration files.

The illustration below shows an example firewall process.



Services such as Web and FTP are identified on your server by a Transmission Control Protocol (TCP) or User Datagram Protocol (UDP) port number. When a computer tries to connect to a service, Firewall service scans the rule list for a matching port number.

When a packet arrives at a network interface and the firewall is enabled, the packet is compared to each rule, starting with the lowest-numbered (highest-priority) rule. When a rule matches the packet, the action specified in the rule (such as permit or deny) is taken. Then, depending on the action, more rules can be applied.

The rules you set are applied to TCP packets and to UDP packets. In addition, you can set up rules for restricting Internet Control Message Protocol (ICMP) or Internet Group Management Protocol (IGMP) using advanced rule creation.

**Important:** When you start Firewall service the first time, only ports essential to remote administration of the server are open, including secure shell (22) and several others. Other ports are dynamically opened to permit specific responses to queries initiated from the server. To permit remote access to other services on your computer, open more ports using the Services section of the Settings pane.

If you plan to share data over the Internet and you don't have a dedicated router or firewall to protect your data from unauthorized access, you must use Firewall service. This service works well for small to medium businesses, schools, and small or home offices.

Large organizations with a firewall can use Firewall service to exercise a greater degree of control over their servers. For example, workgroups in a large business, or schools in a school system, can use Firewall service to control access to their own servers.

Firewall service also provides stateful packet inspection, which determines whether an incoming packet is a legitimate response to an outgoing request or part of an ongoing session. This permits packets that would otherwise be denied.

## Basic Firewall Practices

By default, Mac OS X Server uses a simple model for a useful, secure firewall. If a firewall is too restrictive, the network behind it can be too isolated. If a firewall is too permissive, it fails to secure the assets behind it.

Adhering to the following aspects of the basic model provides maximum flexibility and utility with minimum risk:

- Permit essential IP activity.

Essential IP activity includes those network activities necessary to use IP and function in an IP environment. These activities include operations such as loopback and are expressed as high-priority (low-numbered) rules, visible in the Advanced pane of Firewall service settings. These rules are configured for you.

- Permit service-specific activity.

Service-specific activity refers to network packets destined for specific service ports, such as Web service or Mail service. By permitting traffic to access ports with designated, configured services, you permit access through the firewall on a per-service basis.

These services are expressed as medium-priority rules and correspond to check boxes in the Service pane of Firewall settings. You make these changes based on your settings and address groups.

- Deny packets not already permitted.

This is the final catch-all practice. If a packet or traffic to a port is unsolicited, the packet or traffic is discarded and not permitted to reach its destination. This is expressed as low-priority (high-numbered) rules, visible in the Advanced pane of Firewall service settings. A basic set of deny rules for the firewall is created by default.

## Firewall Startup

Although the firewall is treated as a service by Server Admin, it is not implemented by a running process like other services. It is simply a set of behaviors in the kernel, controlled by the `ipfw` and `sysctl` tools. To start and stop the firewall, Server Admin sets a switch using the `sysctl` tool.

When the computer starts, a startup item named IPFilter checks the `/etc/hostconfig` file for the `IPFILTER` flag. If it is set, use the `sysctl` tool to enable the firewall as follows:

```
$ sysctl -w net.inet.ip.fw.enable=1
```

Otherwise, disable the firewall as follows:

```
$ sysctl -w net.inet.ip.fw.enable=0
```

The rules loaded in the firewall remain regardless of this setting. They are ignored when the firewall is disabled.

Like most startup items, the IPFilter startup item opens in a predetermined order and only after prerequisite startup items have completed. In Mac OS X Server, the login window is presented while startup items can still be running. It is therefore feasible to log in before the firewall has activated its configured settings.

The startup item that sets up the firewall should generally finish a few minutes after starting the system.

## About Firewall Rules

When you start Firewall service, the default configuration denies access to incoming packets from remote computers except through ports for remote configuration. This provides a high level of security. Stateful rules are in place as well, so responses to outgoing queries initiated by your computer are also permitted.

You can then add IP rules to permit server access to those clients who require access to services. To learn how IP rules work, read the following section. To learn how to create IP rules, see “Managing Firewall Service” on page 97.

## What a Firewall Rule Is

A firewall rule is a set of characteristics for an IP packet, coupled with an action to be taken for each packet that matches the characteristics. The characteristics might include the protocol, source or destination address, source or destination port, or network interface.

Addresses might be expressed as a single IP address or might include a range of addresses.

A service port might be expressed as a single value, a list of values, or a range of values.

The IP address and subnet mask together determine the range of IP addresses the rule applies to, and can be set to apply to all addresses.

## Using Address Ranges

When you create an address group using Server Admin, you enter an IP address and a subnet mask. The three types of address notations permitted are:

- A single address: 192.168.2.1
- A range expressed with CIDR notation: 192.168.2.1/24
- A range expressed with netmask notation: 192.168.2.1:255.255.255.0

Server Admin shows the resulting address range. You can change the range by changing the subnet mask.

When you indicate a range of potential values for any segment of an address, that segment is called a *wildcard*. The following table gives examples of address ranges created to achieve specific goals.

Goal	Example IP address	Enter this in the address field	Address range affected
Create a rule that specifies a single IP address.	10.221.41.33	10.221.41.33 or 10.221.41.33/32	10.221.41.33 (single address)
Create a rule that leaves the fourth segment as a wildcard.	10.221.41.33	10.221.41.33/24	10.221.41.0 to 10.221.41.255
Create a rule that leaves part of the third segment and all of the fourth segment as a wildcard.	10.221.41.33	10.221.41.33/22	10.221.40.0 to 10.221.43.255
Create a rule that applies to all incoming addresses.		Select "Any"	All IP addresses

## IP Address

IP addresses consist of four segments with values between 0 and 255 (the range of an 8-bit number), separated by dots (for example, 192.168.12.12).

The segments in IP addresses go from general to specific. For example, the first segment might belong to all computers in a company and the last segment might belong to a specific computer on one floor of a building.

## Subnet Mask

A subnet mask indicates the segments in the specified IP address that can vary on a network and by how much. The subnet mask is given in Classless InterDomain Routing (CIDR) notation. It consists of the IP address followed by a slash (/) and a number from 1 to 32, called the IP prefix.

An IP prefix identifies the number of significant bits used to identify a network.

For example, 192.168.2.1/16 means that the first 16 bits (the first two sets of numbers separated by periods) are used to represent the network (so every machine on the network begins with 192.168) and the remaining 16 bits (the last two numbers separated by periods) are used to identify hosts. Each machine has a unique set of trailing numbers.

Subnet masks can be given in another notation, which is the IP address followed by a colon (:) and the netmask. A netmask is a group of 4 numbers, each from 0 to 255, separated by periods equivalent to the slash in CIDR notation.

Addresses with subnet masks in CIDR notation correspond to address notation subnet masks.

CIDR	Corresponds to netmask	Number of addresses in the range
/1	128.0.0.0	$4.29 \times 10^9$
/2	192.0.0.0	$2.14 \times 10^9$
/3	224.0.0.0	$1.07 \times 10^9$
/4	240.0.0.0	$5.36 \times 10^8$
/5	248.0.0.0	$1.34 \times 10^8$
/6	252.0.0.0	$6.71 \times 10^7$
/7	254.0.0.0	$3.35 \times 10^7$
/8	255.0.0.0	$1.67 \times 10^7$
/9	255.128.0.0	$8.38 \times 10^6$
/10	255.192.0.0	$4.19 \times 10^6$
/11	255.224.0.0	$2.09 \times 10^6$
/12	255.240.0.0	$1.04 \times 10^6$
/13	255.248.0.0	$5.24 \times 10^5$
/14	255.252.0.0	$2.62 \times 10^5$
/15	255.254.0.0	$1.31 \times 10^5$
/16	255.255.0.0	65536
/17	255.255.128.0	32768
/18	255.255.192.0	16384

CIDR	Corresponds to netmask	Number of addresses in the range
/19	255.255.224.0	8192
/20	255.255.240.0	4096
/21	255.255.248.0	2048
/22	255.255.252.0	1024
/23	255.255.254.0	512
/24	255.255.255.0	256
/25	255.255.255.128	128
/26	255.255.255.192	64
/27	255.255.255.224	32
/28	255.255.255.240	16
/29	255.255.255.248	8
/30	255.255.255.252	4
/31	255.255.255.254	2
/32	255.255.255.255	1

## Rule Mechanism and Precedence

The rules in the Firewall Settings Services pane operate with the rules shown in the Advanced pane.

Usually, the broad rules in the Advanced pane block access for all ports. These are lower-priority (higher-numbered) rules and are applied after the rules in the Services pane.

The rules created with the Services pane open access to specific services and are higher priority. They take precedence over those created in the Advanced pane.

If you create multiple rules in the Advanced pane, the precedence for a rule is determined by the rule number. This number corresponds to the order of the rule in the Advanced pane.

Rules can be reordered by dragging them in the list in the Firewall Settings Advanced pane.

For most normal uses, opening access to designated services in the Advanced pane is sufficient. If necessary, you can add more rules using the Advanced pane.

## Multiple IP Addresses

A server can support multiple homed IP addresses, but Firewall service applies one set of rules to all server IP addresses. If you create multiple alias IP addresses, the rules you create apply to all of those IP addresses.

## Editing IPv6 Firewall Rules

When you configure and use Firewall service in Server Admin, by default `ipfw` and `ip6fw` are started. However, all IPv6 traffic except for local traffic is blocked.

You can override the IPv6 rules by using the `ip6fw` tool, but after Firewall service or the server is restarted your rules are overwritten.

Using Server Admin, you can control how a firewall manages the IPv6 firewall with the following two keys in the `/etc/ipfilter/ip_address_groups.plist` file:

```
<key>IPv6Mode</key>
<string>DenyAllExceptLocal</string>
<key>IPv6Control</key>
<true/>
```

The `IPv6Mode` key allows you to control which IPv6 rules are applied. There are three possible settings for the `IPv6Mode` string:

- `DenyAllExceptLocal`
- `DenyAll`
- `NoRules`

By default, the `IPv6Mode` key has the string set to `DenyAllExceptLocal`. This setting applies the following rules, which denies all IPv6 traffic but permits local network traffic:

```
add 1 allow udp from any to any 626
add 1000 allow all from any to any via lo0
add 1100 allow all from any to ff02::/16
65000 deny ipv6 from any to any
```

If you set the `IPv6Mode` string to `DenyAll`, only the following rule is applied, blocking all IPv6 traffic.

```
65000 deny ipv6 from any to any
```

If you set the `IPv6Mode` string to `NoRules`, no rules are created for IPv6. If your network is entirely IPv6, you might want to use this rule and use the `ip6fw` tool to create override rules for IPv6 and create a script that reapplies the rules when Firewall service or the server restarts.

The IPv6Control key allows you to set a Boolean value that determines if `ip6fw` starts or stops when `ipfw` starts or stops. If the value is set to true, `ip6fw` starts and stops when `ipfw` start or stops. If the value is set to false, only `ipfw` starts or stops. By default the value is set to true.

## Firewall Setup Overview

After you decide the types of rules to configure, use the following steps to set up Firewall service. If you need more help to perform these steps, see “Setting Up Firewall Service” on page 93 and the other topics referred to in the steps.

### Step 1: Learn and plan

If you’re new to working with Firewall service, learn and understand firewall concepts, tools, and features of Mac OS X Server and BIND. For more information, see “About Firewall Rules” on page 86.

Then determine which services you want to provide access to. Mail, Web, and FTP services generally require access from computers on the Internet. File and Print services are more likely to be restricted to your local subnet.

After you decide the services to protect using Firewall service, determine the IP addresses you want to permit access to your server and the IP addresses you want to deny access to your server. Then configure the suitable rules.

### Step 2: Turn Firewall service on

In Server Admin, select Firewall and click Start Firewall. By default, this blocks all incoming ports except those used to configure the server remotely. If you’re configuring the server locally, turn off external access immediately.

**Important:** If you add or change a rule after starting Firewall service, the new rule affects connections established with the server. For example, if you deny access to your FTP server after starting Firewall service, computers connected to your FTP server are disconnected.

### Step 3: Configure Firewall Address Groups settings

Create an IP address group that the firewall rules will apply to. By default, an IP address group is created for all incoming IP addresses. Rules applied to this group affect all incoming network traffic. See “Configuring Address Groups Settings” on page 93.

### Step 4: Configure Firewall Services settings

Activate service rules for each address group. In the Services pane, you can activate rules based on address groups as destination IP numbers. See “Configuring Services Settings” on page 94.

### Step 5: Configure Firewall Logging settings

Use logging settings to enable Firewall service event logging. You can also set what types and how many packets get logged. See “Configuring Firewall Logging Settings” on page 96.

### Step 6: Configure Firewall Advanced settings

Configure advanced firewall rules to further configure other services, strengthen network security, and fine-tune your network traffic through the firewall. See “Configuring Advanced Firewall Rules” on page 100.

By default, all UDP traffic is blocked, except traffic arriving in response to an outgoing query. Apply rules to UDP ports sparingly, if at all, because denying some UDP responses could inhibit normal networking operations.

If you configure rules for UDP ports, don't select the “Log all allowed packets” option in the Firewall Logging settings pane in Server Admin. Because UDP is a connectionless protocol, every packet to a UDP port is logged if you select this option.

To learn how IP rules work, read “About Firewall Rules” on page 86.

### Step 7: Turn Firewall service on

You turn Firewall service on using Server Admin. See “Starting Firewall Service” on page 96.

**Important:** If you add or change a rule after starting Firewall service, the new rule affects connections established with the server. For example, if you deny all access to your FTP server after starting Firewall service, computers connected to your FTP server are disconnected.

## Turning Firewall Service On

Before you can configure firewall settings, you must turn Firewall service on in Server Admin.

### To turn Firewall service on:

- 1 Open Server Admin and connect to the server.
- 2 Click Settings.
- 3 Click Services.
- 4 Select the Firewall checkbox.
- 5 Click Save.

### From the command line:

- To start the service:

```
$ sudo serveradmin start ipfilter
```

For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Setting Up Firewall Service

You set up Firewall service by configuring the following settings on the Settings pane for Firewall service in Server Admin.

- **Address Groups:** Use to configure groups of IP addresses that firewall rules are applied to.
- **Services:** Use to configure which services are permitted to send and receive information through the firewall.
- **Logging:** Use to enable Firewall service event logging and set the type and number of packets that are recorded.
- **Advanced:** (Optional) Use to configure advanced rules and set rule precedence.

The following sections describe the tasks for configuring these settings and how to start Firewall service after you configure it.

### Configuring Address Groups Settings

You can define groups of IP addresses for firewall rules. Then you can use these groups to organize and target the rules.

The “any” address group is for all addresses. Two other IP address groups are present by default, intended for the entire 10-net range of private addresses and the entire 192.168-net range of private addresses.

Addresses can be listed as individual addresses (192.168.2.2), IP addresses and subnet mask in CIDR notation (192.168.2.0/24), or IP addresses and subnet mask in netmask notation (192.168.2.0:255.255.255.0).

#### To configure address group settings:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select Firewall.
- 4 Click Settings, then click Address Groups.
- 5 Below the Address Group pane, click the Add (+) button.
- 6 In the Group name field, enter a group name.

- 7 Use the Add (+) and Delete (-) buttons to enter the IP addresses you want the rules to affect.

To indicate any IP address, use the word “any.”

- 8 Click OK.
- 9 Click Save.

## Configuring Services Settings

By default, Firewall service permits all UDP connections and blocks incoming TCP connections on ports that are not essential for remote administration of the server. Also, by default, stateful rules are in place that permit specific responses to outgoing requests.

Before you turn on Firewall service, make sure you’ve set up rules permitting access from IP addresses you choose; otherwise, no one can access your server.

You can easily permit standard services through the firewall without advanced and extensive configuration. Standard services include:

- SSH access
- Web service
- Apple File service
- Windows File service
- FTP service
- Printer Sharing
- DNS/Multicast DNS
- ICMP Echo Reply (incoming pings)
- IGMP
- PPTP VPN
- L2TP VPN
- QTSS media streaming
- iTunes Music Sharing

**Important:** If you add or change a rule after starting Firewall service, the new rule affects connections established with the server. For example, if you deny all access to your FTP server after starting firewall service, computers connected to your FTP server are disconnected.

**To configure firewall standard services:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.

The list of services appears.

- 3 From the expanded Servers list, select Firewall.
- 4 Click Settings, then click Services.
- 5 From the “Editing Services for” pop-up menu, select an address group.
- 6 For the address group, choose to permit all traffic from any port or to permit traffic on designated ports.
- 7 For each service you want the address group to use, select Allow.  
If you don’t see the service you need, add a port and description to the services list.  
To create a custom rule, see “Configuring Advanced Settings” on page 96.
- 8 Click Save.

**From the command line:**

- To view a setting:

```
$ sudo serveradmin settings ipfilter:setting
```

- To view a group of settings:

```
$ sudo serveradmin settings ipfilter:ipAddressGroups:*
```

Enter as much of the name as you want, stopping at a colon (:), and then entering an asterisk (\*) as a wildcard for the remaining parts of the name.

- To view all service configuration settings:

```
$ sudo serveradmin settings ipfilter
```

- To change a setting:

```
$ sudo serveradmin settings ipfilter:setting = value
```

- To change several settings:

```
$ sudo serveradmin settings
ipfilter:setting = value
ipfilter:setting = value
ipfilter:setting = value
[...]
Control-D
```

Parameter	Description
<i>setting</i>	An <code>ipfilter</code> service setting. See “Command-Line Parameters for Network Services.”
<i>value</i>	A value for the setting.

For information about command-line parameters, see “Command-Line Parameters for Network Services” on page 199. For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Configuring Firewall Logging Settings

You can choose the types of packets to log. You can log the packets that are denied access, the packets that are permitted access, or both.

Each logging option can generate many log entries, but you can limit the volume of entries by:

- Logging only permitted packets or denied packets, instead of all packets
- Logging packets only as long as necessary
- Using the Logging Settings pane to limit the total number of packets
- Adding a count rule in the Advanced Settings pane to record the number of packets that match the characteristics you're interested in measuring

### To set up firewall logs:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select Firewall.
- 4 Click Settings, then click Logging.
- 5 Select the "Enable logging" checkbox and choose to log permitted packets, denied packets, or a designated number of packets.
- 6 Click Save.

## Configuring Advanced Settings

You use the Advanced Settings pane in Server Admin to configure specific rules for Firewall service. This is an optional configuration step for Firewall service.

For more information, see "Configuring Advanced Firewall Rules" on page 100.

## Starting Firewall Service

By default, Firewall service blocks incoming TCP connections and denies UDP packets, except those received in response to outgoing requests from the server.

Before you turn on Firewall service, make sure you've set up rules permitting access from IP addresses you choose; otherwise, no one can access your server.

If you add or change a rule after starting Firewall service, the new rule affects connections established with the server. For example, if you deny all access to your FTP server after starting Firewall service, computers connected to your FTP server are disconnected.

#### To start Firewall service:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select Firewall.
- 4 Click the Start Firewall button below the Servers list.

## Managing Firewall Service

After you have set up Firewall service, you can use Server Admin to perform day-to-day management tasks.

### Stopping Firewall Service

You use Server Admin to stop Firewall service.

#### To stop Firewall service:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select Firewall.
- 4 Click Stop Firewall.
- 5 Click Stop Now.

#### From the command line:

- To stop the service:

```
$ sudo serveradmin stop ipfilter
```

For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

### Disabling Firewall Service

You can disable Firewall service using Terminal.

#### To disable Firewall service:

- In Terminal, enter the following at the command line:

```
$ sudo /usr/sbin/sysctl -w net.inet.ip.fw.enable=0
```

For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Creating an Address Group

Use Server Admin to create address groups for Firewall service.

### To create an address group:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select Firewall.
- 4 Click Settings, then click Address Groups.
- 5 Below the IP Address Groups list, click the Add (+) button.
- 6 In the Group name field, enter a group name.
- 7 Use the Add (+) and Delete (–) buttons to enter the addresses and subnet mask you want the rules to affect.

To indicate any IP address, use the word “any.”

- 8 Click OK.
- 9 Click Save.

## Editing or Deleting an Address Group

You can edit address groups to change the range of IP addresses affected. The default address group is for all addresses. You can remove address groups from your firewall rule list. The rules associated with those addresses are also deleted.

Addresses can be listed as individual addresses (192.168.2.2), IP address and network mask in CIDR notation (192.168.2.0/24), or IP address and network mask in netmask notation (192.168.2.0:255.255.255.0).

### To edit or delete an address group:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select Firewall.
- 4 Click Settings, then click Address Groups.
- 5 From the IP Address Groups list, select the group name.
- 6 Choose from the following:
  - To edit an IP address group, click the Edit (/) button below the list.
  - To delete an IP address group, click the Delete (–) button below the list.
- 7 Edit the Group name or addresses as needed and click OK.
- 8 Click Save.

## Duplicating an Address Group

You can duplicate address groups from your firewall rule list. This can help speed configuration of similar address groups.

### To duplicate an address group:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select Firewall.
- 4 Click Settings, then click Address Groups.
- 5 From the IP Address Groups list, select the group name.
- 6 Below the IP Address Groups list, click the Duplicate button.
- 7 Make the required modifications and click OK.
- 8 Click Save.

## Adding to the Services List

You can add custom ports to the Services list. This enables you to open specific ports to address groups without creating an advanced IP rule.

### To add to the Services list:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select Firewall.
- 4 Click Settings, then click Services.
- 5 Below the services list, click the Add (+) button.
- 6 Enter a rule name for the service.
- 7 Enter a single port (for example, 22) or a port range (for example, 650-750).
- 8 Choose a protocol.

If you want a protocol other than TCP or UDP, use the Advanced settings to create a custom rule.

- 9 Click OK
- 10 Click Save.

## Editing or Deleting Items in the Services List

You can remove or edit the ports the Services list. This enables you to customize service choices for ease of configuration.

### To change the Services list:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select Firewall.
- 4 Click Settings, then click Services.
- 5 Select the service you want to change, then do the following:
  - To edit the service list, click the Edit (/) button below the services list.
  - To delete the service list, click the Delete (-) button below the services list.
- 6 Edit the name, port, or protocol as needed, and click OK.
- 7 Click Save.

## Configuring Advanced Firewall Rules

You use the Advanced Settings pane in Server Admin to configure specific rules for Firewall service. Firewall rules contain originating and destination IP addresses with subnet masks. They also specify what to do with incoming network traffic. You can apply a rule to all IP addresses, a specific IP address, or a range of IP addresses.

Addresses can be listed as individual addresses (192.168.2.2), IP address and subnet mask in CIDR notation (192.168.2.0/24), or IP address and subnet mask in netmask notation (192.168.2.0:255.255.255.0).

### To set up an advanced firewall rule:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select Firewall.
- 4 Click Settings, then click Advanced.
- 5 Click the Add (+) button.  
Alternatively, you can select a rule similar to the one you want to create, click Duplicate, and then click Edit.
- 6 In the Action pop-up menu, select whether this rule permits or denies access.  
If you choose Other, enter the action desired (for example, log).
- 7 From the Protocol pop-up menu, choose a protocol.

If you choose Other, enter the protocol desired (for example, icmp, esp, ipencap).

- 8 From the Service pop-up menu, choose a service.

To select a nonstandard service port, choose Other.

- 9 If desired, choose to log all packets that match the rule.

- 10 For the source of filtered traffic, choose an address group from the Source:Address pop-up menu.

If you don't want to use an existing address group, choose Other and enter the source IP address range (using CIDR notation) you want to filter.

If you want it to apply to any address, choose "any" from the pop-up menu.

- 11 If you selected a nonstandard service port, enter the source port number.

- 12 For the destination of filtered traffic, choose an address group from the Destination:Address pop-up menu.

If you don't want to use an existing address group, choose Other and enter the destination IP address range (using CIDR notation).

If you want it to apply to any address, choose "any" from the pop-up menu.

- 13 If you selected a nonstandard service port, enter the destination port number.

- 14 From the Interface pop-up menu that this rule will apply to, choose In or Out.

In refers to the packets being sent to the server.

Out refers to the packets being sent from the server.

- 15 If you select Other, enter the interface name (en0, en1, fw1, and so on).

- 16 Click OK.

- 17 Click Save to apply the rule immediately.

#### From the command line:

- To add a rule:

```
$ sudo serveradmin settings
ipfilter:rules:_array_id:rule = create
ipfilter:rules:_array_id:rule:source = source
ipfilter:rules:_array_id:rule:protocol = protocol
ipfilter:rules:_array_id:rule:destination = destination
ipfilter:rules:_array_id:rule:action = action
ipfilter:rules:_array_id:rule:enableLocked = (yes|no)
ipfilter:rules:_array_id:rule:enabled = (yes|no)
ipfilter:rules:_array_id:rule:log = (yes|no)
ipfilter:rules:_array_id:rule:readOnly = (yes|no)
ipfilter:rules:_array_id:rule:source-port = port
```

Parameter	Description
<i>rule</i>	A unique rule number.
Other parameters	The standard rule settings described under “Command-Line Parameters for Network Services.”

### Adding Rules by Modifying ipfw.conf

An `ipfw` configuration, or ruleset, is made of a list of rules numbered from 1 to 65535. The file where you can define your rules is `/etc/ipfilter/ipfw.conf`. Firewall service reads this file but doesn’t modify it. Its contents are annotated and include commented-out rules you can use as models.

Packets are passed to `ipfw` from a number of places in the protocol stack. (Depending on the source and destination of the packet, `ipfw` can be invoked multiple times on the same packet.) The packet passed to the firewall is compared with each rule in the firewall ruleset. When a match is found, the action corresponding to the matching rule is performed.

**Important:** Misconfiguring the firewall can put your computer in an unusable state, possibly shutting down network services and requiring console access to regain control of it.

You can configure `ipfw` with a variety of commands.

For information about command-line parameters, see “Command-Line Parameters for Network Services.” For information about `serveradmin` and `ipfw`, see their man pages. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

### Editing or Deleting Advanced Firewall Rules

You can remove or edit advanced firewall rules. If you think you’ll use a rule again and only want to disable it, you can deselect the rule rather than deleting it.

If you edit a rule after turning on Firewall service, your changes affect connections established with the server. For example, if computers are connected to your web server and you change the rule to deny all access to the server, connected computers are disconnected.

#### To change an advanced firewall rule:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select Firewall.

- 4 Click Settings, then click Advanced.
- 5 Select the rule you want to change, then do the following:
  - To edit the services list, click the Edit (/) button below the Advanced Rules list.
  - To delete a rule, click the Delete (-) button below the Advanced Rules list.
- 6 Edit the rule as needed, and click OK.

Default rules, which are designated by the lock icon, cannot be edited or deleted.
- 7 Click Save.

## Changing the Order of Advanced Firewall Rules

The priority level of an advanced firewall rule is determined by its order in the Advanced Rules list. Default rules that are locked cannot be reordered in the list.

### To change the rule order:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.

The list of services appears.
- 3 From the expanded Servers list, select Firewall.
- 4 Click Settings, then click Advanced.
- 5 Drag the rules to reorder them in the needed sequence.

Default rules, which are designated by the lock icon, cannot be reordered.
- 6 Click Save.

## Troubleshooting Advanced Firewall Rules

Advanced firewall configuration settings accept any input, assuming you are correctly configuring a rule.

Errors are not noticed until the rules are saved and Server Admin applies all rules using the `ipfw` command. Then, the first rule with a syntax error causes the operation to stop, and an error message is logged.

This error message does not indicate which rule is invalid, but all valid rules before the invalid one are loaded in the firewall.

The following section describes how you can determine which rule is invalid.

### To determine which rule is invalid:

- 1 Read the error message in the log.
- 2 Wait a few minutes for Server Admin to show the active rules in the Firewall Overview pane.

- 3 Compare the list of active rules in the Firewall Overview pane with the rule list in the Settings section.
- 4 Inspect the contents of `/etc/ipfilter/ipfw.conf.apple` file to see which rules Server Admin tried to load in the firewall.

The first rule in the file that is not present in the Firewall Overview pane is likely the invalid one. However, there might be more invalid rules after that one.

- 5 If the rule corresponds to one from the Advanced Settings pane, disable it or correct it.

Disabled rules appear in the `/etc/ipfilter/ipfw.conf.apple` file preceded by a comment character so they are not processed by the `ipfw` tool.

## Enabling Stealth Mode

You can hide your firewall by choosing not to send a connection failure notification to any connection that is blocked by the firewall. This is called stealth mode and it effectively hides your server's closed ports.

For example, if a network intruder tries to connect to your server, even if the port is blocked, he or she knows that there is a server and can find other ways to intrude.

If stealth mode is enabled, instead of being rejected, the hacker won't receive notification that an attempted connection took place.

### To enable stealth mode:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select Firewall.
- 4 Click Settings, then click Advanced.
- 5 Select "Enable for TCP," "Enable for UDP," or both, as needed.
- 6 Click Save.

## Adaptive Firewall

Mac OS X v10.6 uses an adaptive firewall that dynamically generates a firewall rule if a user has 10 consecutive failed login attempts. The generated rule blocks the user's computer for 15 minutes, preventing the user from attempting to log in.

The adaptive firewall helps to prevent your computer from being attacked by unauthorized users. The adaptive firewall does not require configuration and is active when you turn on your firewall.

## Resetting the Firewall to the Default Setting

A server can become unreachable for remote administration due to an error with the firewall configuration. In such a case, you must reset the firewall to its default state so Server Admin can access the server.

This recovery procedure requires you to use the command-line interface and must be done by an administrator who has physical access to the server.

**To reset the firewall to its default setting:**

- 1 Disconnect the server from the Internet.
- 2 Restart the server in single-user mode by holding down the Command–s keys during startup.
- 3 Remove or rename the address groups file found at `/etc/ipfilter/ip_address_groups.plist`.
- 4 Remove or rename the ipfw configuration file found at `/etc/ipfilter/ipfw.conf`.
- 5 Force-flush the firewall rules by entering the following in Terminal:

```
$ ipfw -f flush
```

- 6 Edit the `/etc/hostconfig` file and set `IPFILTER=-YES-`.
- 7 Complete the startup sequence in the login window by entering `exit`:

The computer starts up with the default firewall rules and firewall enabled. Use Server Admin to refine the firewall configuration.

- 8 Log in to your server's local administrator account to confirm that the firewall is restored to its default configuration.
- 9 Reconnect your host to the Internet.

## Monitoring Firewall Service

Firewalls are a network's first line of defense against malicious computer users (hackers). To maintain the security of your computers and user information, you must monitor firewall activity and deter potential threats. This section explains how to log and monitor your firewall.

### Checking the Status of Firewall Service

Use Server Admin to check the status of Firewall service.

**To check Firewall service status:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select Firewall.

- 4 Click Overview to see whether the service is running, the number of active static and dynamic rules configured, the number of matching packets, and the number of bytes in matching packets handled by the firewall.
- 5 Click Log to review the Firewall service log.

To search for specific entries, use the Filter field above the log.

- 6 To view a list of active firewall rules, click Active Rules.

A list of rules appears, with a description of each rule in `ipfw` code format, the priority, packet count, and total bytes handled.

#### From the command line:

- To see summary status of the service:

```
$ sudo serveradmin status ipfilter
```

- To see detailed status of the service, including rules:

```
$ sudo serveradmin fullstatus ipfilter
```

For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Viewing Firewall Active Rules

Use Server Admin to view a simple summary of active firewall rules.

The Active Rules pane shows the number of packets and bytes associated with each rule.

When a change is made to the configuration of the firewall using Server Admin, the old firewall rules are flushed, new rules are generated and saved in a file, and the `ipfw` command is invoked to load the rules into service.

As part of the flush operation, the number of packets and bytes associated with each rule are cleared.

The Active Rules pane provides a snapshot of the state of the firewall. When viewing this pane, dynamic rules might be shown with static rules.

Dynamic rules come and go in a matter of seconds, in response to network activity. They are the result of rules that include a keep-state clause (stateful rules). The Active Rules pane shows the rule number of the stateful rule that was triggered to create the dynamic rule.

#### To view active firewall rules:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.

The list of services appears.

- 3 From the expanded Servers list, select Firewall.
- 4 Click Active Rules.

A list of the rules appears, with a description of each rule in ipfw code format, the priority, packet count, and total bytes handled.

### Viewing the Firewall Service Log

Each rule you set up in Server Admin corresponds to rules in the underlying firewall software. Log entries show you when the rule was applied, the IP address of the client and server, and other information.

The log view shows the contents of `/var/log/ipfw.log`. You can refine the view using the text filter box.

#### To view the Firewall service log:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select Firewall.
- 4 Click Log.

To search for specific entries, use the Filter field above the log.

#### From the command line:

- To view the latest entries in the log:

```
$ tail log-file
```

To see where the `ipfilter` service log is located, use the `serveradmin getLogPaths` command.

- To view the log path:

```
$ sudo serveradmin command ipfilter:command = getLogPaths
```

The computer responds with output similar to the following:

```
ipfilter:systemLog = <system-log>
```

Value	Description
<code>log-file</code>	The name of the log file.
<code>&lt;system-log&gt;</code>	The location of the ipfilter service log. Default = <code>/var/log/ipfw.log</code> .

The filters you create in Server Admin correspond to rules in the underlying filtering software. Log entries show you the rule applied, the IP address of the client and server, and other information.

For information about `tail` and `serveradmin`, see their man pages. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

Here are examples of firewall log entries and how to read them.

#### Log Example 1:

```
Dec 12 13:08:16 ballch5 mach_kernel: ipfw: 65000 Unreach TCP
      10.221.41.33:2190 192.168.12.12:80 in via en0
```

This entry shows that Firewall service used rule 65000 to deny (unreach) the remote client at 10.221.41.33:2190 from accessing server 192.168.12.12 on Web port 80 through Ethernet port 0.

#### Log Example 2:

```
Dec 12 13:20:15 mayalu6 mach_kernel: ipfw: 100 Accept TCP
      10.221.41.33:721 192.168.12.12:515 in via en0
```

This entry shows that Firewall service used rule 100 to permit the remote client at 10.221.41.33:721 to access the server 192.168.12.12 on the LPR printing port 515 through Ethernet port 0.

#### Log Example 3:

```
Dec 12 13:33:15 smithy2 mach_kernel: ipfw: 10 Accept TCP
      192.168.12.12:49152 192.168.12.12:660 out via lo0
```

This entry shows the NAT divert rule applied to an outbound packet. In this case it diverts the rule to service port 660, which is the port the NAT daemon uses.

## Viewing Denied Packets

Viewing denied packets can help you identify problems and troubleshoot Firewall service.

#### To view denied packets:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select Firewall.
- 4 Click Settings, then click Logging.
- 5 Make sure “Log all denied packets” is selected.

If you have not turned on logging for a rule, see “Editing or Deleting Advanced Firewall Rules” on page 102.

- 6 To view log entries, click Log.
- 7 In the text filter box, enter the word “unreach.”

## Viewing Packets Logged by Firewall Rules

Viewing the packets filtered by firewall rules can help you identify problems and troubleshoot Firewall service.

**To view filtered packets:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select Firewall.
- 4 Click Settings, then click Logging.
- 5 Make sure “Log all allowed packets” is selected.

If you have not turned on logging for a rule, see “Editing or Deleting Advanced Firewall Rules” on page 102.

- 6 To view log entries, click Log.
- 7 Enter the word “Accept” in the text filter box.

## Practical Firewall Examples

The firewall rules you set up work together to provide security for your network. The examples that follow show how to use rules to achieve specific goals.

### Using Firewall with NAT

You must enable the firewall to use NAT. Enabling NAT creates a divert rule in the firewall configuration.

Although Server Admin permits NAT service and Firewall service to be enabled and disabled independently, NAT service can operate only if both NAT and Firewall services are enabled. An essential part of NAT is the packet divert rule used in the firewall.

The firewall rule you set up instructs the firewall how to route network traffic coming from the network behind the NAT gateway. When you have a LAN behind a NAT gateway, you must create or know the address group that corresponds to the LAN.

For detailed information about setting up a NAT LAN, see “Linking a LAN to the Internet Through One IP Address” on page 133.

### Blocking Web Access to Internet Users

This section describes how you can permit users on your subnet to access your server’s Web service and deny access to the general public on the Internet.

For this example, the local network has a private IP address range of 10.0.1.1 to 10.0.1.254 and the server Web service is at 10.0.2.1 on the server en2 port.

### To block web access using an advanced rule:

- 1 In Server Admin, create an address group named “LAN” with the address range 10.0.1.1/24.

This includes all addresses in the 10.0.1.x subnet range.

For more information, see “Creating an Address Group” on page 98.

- 2 Create an advanced rule with the following settings:

- Action: Allow
- Protocol: TCP
- Service: Web
- Source address group: LAN
- Destination address: Other 10.0.2.1
- Interface: en2

For more information, see “Configuring Advanced Firewall Rules” on page 100.

### To block web access using standard rules:

- 1 In Server Admin, create an address group named “Web Server” with the address 10.0.2.1.

For more information, see “Creating an Address Group” on page 98.

- 2 Click Settings, then click Services.
- 3 From the “Editing Services for” pop-up menu, choose the “Web Server” address group.
- 4 Select “Allow only traffic to these ports.”
- 5 Select the HTTP- web service checkbox.
- 6 Click Save.

## Logging Internet Access by Local Network Users

This section describes how you can log allow and deny packets.

### To log Internet access by local network users:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select Firewall.
- 4 Click Settings, then click Logging.
- 5 Select the “Enable Logging” checkbox.
  - To log all allowed packets, select the “Log all allowed packets” checkbox.
  - To log all deny packets, select the “Log all denied packets” checkbox.

- 6 In the “Maximum number of packets to log” field, enter the maximum number of packets that you want to be logged.

The default is 1000.

- 7 Click Save.
- 8 Click Logging.
- 9 Select the “Enable logging” checkbox.
- 10 Select “Log all allowed packets.”

The logs are visible in the Log pane.

## Blocking Junk Mail

This section describes how to reject mail from a junk mail sender with an IP address of 17128.100.0 (for example) and accept all other Internet mail.

**Important:** To block incoming SMTP mail, set up specific address ranges in rules you create. For example, if you set a rule on port 25 to deny mail from all addresses, you prevent mail from being delivered to users.

### To prevent junk mail from being delivered to users:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select Firewall.
- 4 Select Address Groups.
- 5 To create an address range, click the Add (+) button and enter a name for the address group in the Group name field.
- 6 To indicate the junk mail sender’s address, enter 17128.100.0 in the “Addresses in group” list by clicking the Add (+) button and entering the address.
- 7 Click OK.
- 8 Click Services
- 9 From the “Editing Services for” pop-up menu, choose the newly created address group.
- 10 Select “Allow only traffic from to these ports.”
- 11 To disable mail transfer, deselect the “Mail SMTP Standard” checkbox in the ports list.
- 12 Click Save.

## Permitting a Customer to Access the Apple File Server

This section provides an example of how to permit a customer with an IP address of 10.221.41.33 to access an Apple file server.

**To grant a customer access to the Apple file server:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select Firewall.
- 4 Click Settings, then click Services.
- 5 From the “Editing Services for” pop-up menu, choose “any.”
- 6 Select “Allow only traffic to these ports.”
- 7 In the service pane, deselect “Apple Filing Protocol (AFP).”
- 8 Select Address Groups.
- 9 To create an address range, click the Add (+) button.
- 10 Name the address group.
- 11 To indicate the customer’s address, enter 10.221.41.33 in the address range field.
- 12 Click OK.
- 13 Click Services.
- 14 Select the newly created address group.
- 15 To enable file access, select “Apple File Service” in the service pane.
- 16 Click Save.

## Common Network Administration Tasks That Use Firewall Service

Your firewall is the first line of defense against unauthorized network intruders, malicious users, and network virus attacks that can harm data or abuse network resources. This section describes common uses of Firewall service in network administration.

### Preventing Denial of Service (DoS) Attacks

When the server receives a TCP connection request from a client that is denied access, by default the server sends a reply rejecting the connection. This stops the denied client from resending over and over again.

However, a malicious user can generate a series of TCP connection requests from a denied IP address and force the server to keep replying, locking out others who are trying to connect to the server. This is one type of DoS attack.

**Important:** DoS attacks are rare, so make these settings only if you think your server might be vulnerable to an attack. If you deny ICMP echo replies, services that use ping to locate network services can't detect your server.

**To prevent ping DoS attacks:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select Firewall.
- 4 Click Settings, then click Services.
- 5 Select the "any" address group.
- 6 Select "Allow only traffic to these ports."
- 7 Deselect "ICMP-Echo reply message (replies to outgoing pings)."
- 8 Click Save.

## Controlling or Enabling Peer-to-Peer Network Usage

Sometimes network administrators must control the use of Peer-to-Peer (P2P) file sharing applications. Such applications might use network bandwidth and resources improperly or disproportionately. P2P file sharing might also pose a security or intellectual property risk for a business.

You can disable P2P networking by blocking incoming and outgoing traffic on the port number used by the P2P application. You must determine the port used for each P2P network in question. By default, Mac OS X Server's firewall blocks all ports not specifically opened.

You can limit P2P network usage to IP addresses behind the firewall. To do so, open the P2P port for your LAN interface but continue to block the port on the interface connected to the Internet (the WAN interface). To learn how to make a firewall rule, see "Configuring Advanced Firewall Rules" on page 100.

## Controlling or Enabling Network Game Usage

Sometimes network administrators must control the use of network games. The games might use network bandwidth and resources improperly or disproportionately.

You can disable network gaming by blocking traffic incoming and outgoing on the port number used by the game. You must determine the port used for each network game in question. By default, Mac OS X Server's firewall blocks all ports not specifically opened.

You can limit network game usage to IP addresses behind the firewall. To do so, open the relevant port on your LAN interface but continue to block the port on the interface connected to the Internet (the WAN interface). Some games require a connection to a gaming service for play, so this might not be effective. To learn how to make a firewall rule, see "Configuring Advanced Firewall Rules" on page 100.

You can open the firewall to specific games, permitting network games to connect to other players and game services outside the firewall. To do this, open up the relevant port on your LAN and WAN interface. Some games require more than one port to be open. For networking details, consult the game's documentation. To learn how to make a firewall rule, see "Configuring Advanced Firewall Rules" on page 100.

## Preventing Network Virus Propagation

A virus can quickly propagate through your network and infect your computers. For example, if a computer on your network becomes infected with a virus, that computer can propagate the virus through your entire network.

One common avenue that a virus uses to propagate through your network is by mail. You can prevent a virus from propagating through mail by scanning mail with clamav and keeping your virus definitions updated.

You can prevent other avenues of propagation by only running services that you need, using good network topology and good passwords.

The most important method is to keep your network computers up-to-date. Your computer should be set to check for updates once or twice a week.

For more information about preventing network viruses see *Mac OS X Server Security Configuration*.

## TCP and UDP Port Reference

The following tables show the TCP and UDP port numbers commonly used by Mac OS X computers and Mac OS X Servers. Use these ports when you set up access rules. To view the RFCs referenced in the tables, see [www.faqs.org/rfcs](http://www.faqs.org/rfcs).

## 1–499

Port	Description	Reference
7 TCP, UDP	Echo	RFC 792
20 TCP	FTP data	RFC 959
21 TCP	FTP control	RFC 959
22 TCP, UDP	Secure Shell (SSH); Open Directory replica setup	Para
23 TCP, UDP	Telnet	RFC 854
25 TCP, UDP	Mail: SMTP	RFC 821
53 TCP, UDP	DNS	RFC 1034
67 UDP	DHCP server (BootP), NetBoot server	
68 UDP	DHCP client	
69 UDP	Trivial File Transfer Protocol (TFTP)	
79 TCP, UDP	Finger	RFC 1288
80 TCP	HTTP—web	RFC 2068
88 TCP, UDP	Kerberos V5 KDC	RFC 1510
106 TCP, UDP	Open Directory Password Server (with 3659)	
110 TCP, UDP	Mail: POP3	RFC 1081
111 TCP, UDP	Remote Procedure Call (RPC)	RFC 1057
113 TCP, UDP	Authentication service	RFC 931
115 TCP	Simple File Transfer Protocol (SFTP)	
119 TCP	Network News Transfer Protocol (NNTP)	RFC 977
123 TCP, UDP	Network Time Protocol	RFC 1305
137 TCP, UDP	Windows Name Service (WINS)	
138 TCP, UDP	Windows NETBIOS browsing	
139 TCP	Windows file and print service (SMB/CIFS)	RFC 100
143 TCP	Mail: IMAP	RFC 2060
161 UDP	Simple Network Management Protocol (SNMP)	

Port	Description	Reference
192 UDP	AirPort administration	
201–208 TCP	AppleTalk	
311 TCP	Server Admin over SSL, AppleShare IP remote web administration, Server Monitor, Server Admin (servermgrd), Workgroup Manager (DirectoryService)	
389 TCP	LDAP (directory)	RFC 2251
407 TCP, UDP	Timbuktu	
427 TCP, UDP	SLP (Service Location Protocol)	
443 TCP	HTTPS—secure web over SSL	
445 TCP	Microsoft Domain Server	
465 TCP	Mail: SMTP	
497 TCP, UDP	Dantz Retrospect	

## 500–3999

Port	Description	Reference
500 UDP	VPN ISAKMP/IKE	
513 UDP	Who	
514 TCP	Shell, syslog	
514 UDP	Syslog	
515 TCP	LPR print spooling	RFC 1179
532 TCP	NetNews	
548 TCP	AFP (Apple Filing Protocol)	
554 TCP, UDP	QTSS RTSP streaming	RFC 2326
587 TCP	Mail: SMTP submission	
591 TCP	FileMaker web access	
600–1023 TCP, UDP	Mac OS X RPC-based services	
625 TCP	Remote Directory Access	
626 UDP	Serial number support for Mac OS X Server	
631 TCP, UDP	IPP printer sharing	
636 TCP	LDAP over SSL	

Port	Description	Reference
660 TCP	Server administration using Server Settings	
687 TCP	Server administration using Server Admin	
749 TCP, UDP	Kerberos administration and changepw using the kadmind command-line tool	
985 TCP	NetInfo static port	
993 TCP	Mail: IMAP over SSL	
995 TCP, UDP	Mail: POP3 over SSL	
1099, 8043 TCP	Remote RMI and RMI/IIOP access to JBoss	
1220 TCP	QTSS administration	
1694 TCP	IP Failover	
1701 UDP	VPN L2TP	
1723 TCP	VPN PPTP	RFC 2637
2000 TCP	Mail: Custom filtering (sieve)	
2049 TCP, UDP	Network File System (NFS)	
2336 TCP	Mobile account sync	
2399 TCP	FileMaker data access layer	
3004 TCP	iSync	
3031 TCP, UDP	Program Linking, remote AppleEvents	
3283 TCP, UDP	Apple Remote Desktop (with 5900)	
3306 TCP	MySQL	
3632 TCP	XCode distributed compiler	
3659 TCP, UDP	Open Directory Password Server (with 106)	
3689 TCP	iTunes music sharing	
3690 TCP	Subversion version control	

## 4000–50999

Port	Description
4111 TCP	XGrid
4500 UDP	VPN IKE NAT traversal
5003 TCP, UDP	FileMaker name binding and transport
5060 UDP	iChat session initiation
5100 TCP	Camera and scanner sharing
5190 TCP UDP	iChat, AOL Instant Messenger, and iChat file transfer
5222 TCP	iChat Server (Jabber/XMPP)
5223 TCP	iChat Server (Jabber/XMPP) over SSL
5269 TCP	iChat Server to server (Jabber/XMPP)
5297 UDP	iChat local subnet
5298 TCP, UDP	iChat local subnet
5678 UDP	iChat AV behind NAT
5353 UDP	Multicast DNS (Bonjour, mDNSResponder)
5432 TCP	Apple Remote Desktop 2.0 database
5900 TCP, UDP	VNC (Mac OS X screen sharing, Apple Remote Desktop 2.0)
5988, 5989 TCP	Apple Remote Desktop 2.0 CIM/OpenWBEM
6970–6999 UDP	QTSS RTP streaming
7070 TCP, UDP	QTSS RTSP Automatic Router Configuration Protocol (ARCP)
7777 TCP	iChat Server—file transfer proxy
8000–8999 TCP	Web service
8000–8001 TCP	QTSS MP3 streaming
8005 TCP	Tomcat remote shutdown
8008, 8443 TCP	iCal Server and iCal Server SSL
8080 TCP	HTTP—web service alternative (Apache 2 default)
8088 TCP	Software Update server

Port	Description
8080, 8443, 9006 TCP	Tomcat standalone and JBoss
8800, 8843 TCP	Address Book Server and Address Book Server SSL
9007 TCP	Tomcat remote web server access to AJP port
16384–16403 UDP	iChat audio/video RTP and RTCP
42000–42999 TCP	iTunes radio streams
49152–65535 TCP	FTP service PASV port range
50003 TCP, UDP	FileMaker Server service (Windows) or daemon (Mac OS X)
50006 TCP, UDP	FileMaker Server Helper service (Windows) or daemon (Mac OS)

## A–Z by Service

Port	Service
548 TCP	AFP (Apple Filing Protocol)
192 UDP	AirPort administration
3283 TCP, UDP	Apple Remote Desktop (with 5900)
5988, 5989 TCP	Apple Remote Desktop 2.0 CIM/OpenWBEM
5432 TCP	Apple Remote Desktop 2.0 database
201–208 TCP	AppleTalk
113 TCP, UDP	Authentication service
5100 TCP	Camera and scanner sharing
497 TCP, UDP	Dantz Retrospect
68 UDP	DHCP client
67 UDP	DHCP server (BootP), NetBoot server
53 TCP, UDP	DNS
7 TCP, UDP	Echo
2399 TCP	FileMaker data access layer
5003 TCP, UDP	FileMaker name binding and transport
50006 TCP, UDP	FileMaker Server Helper service (Windows) or daemon (Mac OS)

Port	Service
50003 TCP, UDP	FileMaker Server service (Windows) or daemon (Mac OS X)
591 TCP	FileMaker web access
79 TCP, UDP	Finger
21 TCP	FTP control
20 TCP	FTP data
49152–65535 TCP	FTP service PASV port range
443 TCP	HTTPS—secure web over SSL
80 TCP	HTTP—web
8080 TCP	HTTP—web service alternative (Apache 2 default)
16384–16403 UDP	iChat audio/video RTP and RTCP
5678 UDP	iChat AV behind NAT
5297 UDP	iChat local subnet
5298 TCP, UDP	iChat local subnet
5222 TCP	iChat Server (Jabber/XMPP)
5223 TCP	iChat Server (Jabber/XMPP) over SSL
5269 TCP	iChat Server to server (Jabber/XMPP)
7777 TCP	iChat Server—file transfer proxy
5060 UDP	iChat session initiation
5190 TCP UDP	iChat, AOL Instant Messenger, and iChat file transfer
1694 TCP	IP failover
631 TCP, UDP	IPP printer sharing
3004 TCP	iSync
3689 TCP	iTunes music sharing
42000–42999 TCP	iTunes radio streams
749 TCP, UDP	Kerberos administration and changepw using the kadmind command-line tool
88 TCP, UDP	Kerberos V5 KDC
389 TCP	LDAP (directory)
636 TCP	LDAP over SSL

Port	Service
515 TCP	LPR print spooling
600–1023 TCP, UDP	Mac OS X RPC-based services
2000 TCP	Mail: Custom filtering (sieve)
143 TCP	Mail: IMAP
993 TCP	Mail: IMAP over SSL
110 TCP, UDP	Mail: POP3
995 TCP, UDP	Mail: POP3 over SSL
25 TCP, UDP	Mail: SMTP
587 TCP	Mail: SMTP submission
445 TCP	Microsoft Domain Server
2336 TCP	Mobile account sync
5353 UDP	Multicast DNS (Bonjour, mDNSResponder)
3306 TCP	MySQL
985 TCP	NetInfo static port
532 TCP	NetNews
2049 TCP, UDP	Network File System (NFS)
119 TCP	Network News Transfer Protocol (NNTP)
123 TCP, UDP	Network Time Protocol
3659 TCP, UDP	Open Directory Password Server (with 106)
106 TCP, UDP	Open Directory Password Server (with 3659)
3031 TCP, UDP	Program linking, remote AppleEvents
1220 TCP	QTSS administration
8000–8001 TCP	QTSS MP3 streaming
6970–6999 UDP	QTSS RTP streaming
7070 TCP, UDP	QTSS RTSP Automatic Router Configuration Protocol (ARCP)
554 TCP, UDP	QTSS RTSP streaming
625 TCP	Remote directory access
111 TCP, UDP	Remote procedure call (RPC)

Port	Service
1099, 8043 TCP	Remote RMI and RMI/IIOP access to JBoss
22 TCP, UDP	Secure shell (SSH); Open Directory replica setup
626 UDP	Serial number support for Mac OS X Server
311 TCP	Server Admin over SSL, AppleShare IP remote web administration, Server Monitor, Server Admin (servermgrd), Workgroup Manager (DirectoryService)
687 TCP	Server administration using Server Admin
660 TCP	Server administration using Server Settings
514 TCP	Shell, syslog
115 TCP	Simple File Transfer Protocol (SFTP)
161 UDP	Simple Network Management Protocol (SNMP)
427 TCP, UDP	SLP (Service Location Protocol)
8088 TCP	Software Update server
3690 TCP	Subversion version control
514 UDP	Syslog
23 TCP, UDP	Telnet
407 TCP, UDP	Timbuktu
8005 TCP	Tomcat remote shutdown
9007 TCP	Tomcat remote web server access to AJP port
8080, 8443, 9006 TCP	Tomcat standalone and JBoss
69 UDP	Trivial File Transfer Protocol (TFTP)
5900 TCP, UDP	VNC (Mac OS X screen sharing, Apple Remote Desktop 2.0)
4500 UDP	VPN IKE NAT traversal
500 UDP	VPN ISAKMP/IKE
1701 UDP	VPN L2TP
1723 TCP	VPN PPTP
8000–8999 TCP	Web service
513 UDP	Who
139 TCP	Windows file and print service (SMB/CIFS)
137 TCP, UDP	Windows Name Service (WINS)
138 TCP, UDP	Windows NETBIOS browsing
3632 TCP	XCode distributed compiler
4111 TCP	XGrid

## Where to Find More Information

For more information about accessing and implementing the features of `ipfw`, the tool that controls Firewall service, see the `ipfw` man page.

Request for Comments (RFC) documents provide an overview of a protocol or service and describe how the protocol should behave.

If you're a novice server administrator, you'll probably find the background information in an RFC helpful.

If you're an experienced server administrator, you can find all technical details about a protocol in its RFC document.

The RFC section of the following website contains several RFC numbers for various protocols: [www.ietf.org/rfc.html](http://www.ietf.org/rfc.html).

The Internet Assigned Number Authority (IANA) maintains a list of well known ports and TCP and UDP ports that have been assigned by the organization for various protocols. The list can be found at [www.iana.org/assignments/port-numbers](http://www.iana.org/assignments/port-numbers).

Also, important multicast addresses are documented in the most recent Assigned Numbers RFC, currently RFC 1700.

## Use this chapter to set up and manage NAT service in Mac OS X Server.

Network Address Translation (NAT) is a protocol you use to give multiple computers access to the Internet using only one assigned public or external IP address. NAT permits you to create a private network that accesses the Internet through a NAT router or gateway. NAT is sometimes referred to as IP masquerading.

The NAT router takes traffic from your private network and remembers internal addresses that have made requests. When the NAT router receives a response to a request, it forwards it to the originating computer. Traffic that originates from the Internet does not reach computers behind the NAT router unless port forwarding is enabled.

### Using NAT with Other Network Services

Enabling NAT on Mac OS X Server often requires detailed control over DHCP, so DHCP is configured separately in Server Admin. To learn more about DHCP, see Chapter 2, “Working with DHCP Service.”

Enabling NAT also creates a divert rule in the firewall configuration. Server Admin permits NAT service and Firewall service to be enabled and disabled independently. However for NAT service to function, NAT service and Firewall service must be enabled. This is because an essential part of NAT is the packet divert rule. That rule is added to the firewall when NAT service is enabled, but Firewall service must be turned on for the packet divert rule, or any firewall rule, to have any effect.

### NAT LAN Configuration Overview

To configure a network segment as a NAT LAN, you must complete several steps. Each is necessary to create a functioning private network behind a NAT gateway. A detailed example of the setup is found in “Linking a LAN to the Internet Through One IP Address” on page 133.

You can also configure NAT using Gateway Setup Assistant, which configures each of these services and starts NAT. For more information, see “About Gateway Setup Assistant” on page 16.

The following provides an overview of the configuration process.

**Step 1: Choose your NAT gateway and interface functions**

You must locate the NAT gateway on a Mac OS X Server computer with at least two network interfaces: one to connect to the Internet (the WAN port), and one to connect to your private network segment (the LAN port).

**Step 2: Decide how NAT LAN clients will get IP addresses**

You can assign your own static IP address in the approved ranges for private LANs or you can use Mac OS X Server’s DHCP feature to assign addresses for you.

**Step 3: Configure the gateway’s network settings**

You assign your public IP address to the WAN port and you assign your internal gateway’s address to the LAN port.

**Step 4: Turn NAT service on**

Before configuring NAT service, you must turn NAT on. See “Turning NAT Service On” on page 126.

**Step 5: Configure NAT settings**

Use the NAT settings to set the network interface. See “Configuring NAT Service” on page 126.

**Step 6: Configure port forwarding settings**

Use the Terminal application to direct incoming traffic to your NAT network to a specific IP address behind the NAT gateway. See “Configuring Port Forwarding” on page 127.

**Step 7: Start NAT service**

After you configure NAT, start the service to make it available. See “Starting and Stopping NAT Service” on page 130.

**Step 8: Start Firewall service**

For NAT service to operate, you must enable NAT service and Firewall service. See “Starting Firewall Service” on page 96.

**Step 9: (Conditional) Configure and start DHCP service**

If clients will have their addresses dynamically assigned, configure DHCP and start it now. See Chapter 2, “Working with DHCP Service.”

## Turning NAT Service On

Before you can configure NAT settings, you must turn on NAT service in Server Admin.

### To turn NAT service on:

- 1 Open Server Admin and connect to the server.
- 2 Click Settings.
- 3 Click Services.
- 4 Select the NAT checkbox.
- 5 Click Save.

## Configuring NAT Service

You use Server Admin to indicate which network interface is connected to the Internet or other external network.

Configuring NAT service is not the same as configuring a network segment as a NAT LAN.

### To configure NAT service:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select NAT.
- 4 Click Settings.
- 5 Select “IP Forwarding and Network Address Translation (NAT).”
- 6 From the “External network interface” pop-up menu, choose the network interface that connects to the Internet or external network.
- 7 Click Save.

### From the command line:

- To configure NAT service:

```
$ sudo serveradmin settings
nat:enable_natportmap= value
nat:interface = value
Control-D
```

- To view all settings:

```
$ sudo serveradmin settings nat
```

Parameter	Description
<code>enable_natportmap</code>	yes no Default = yes
<code>interface</code>	The network port. Default = "en0"

For more information about command-line parameters for NAT, see “Command-Line Parameters for Network Services.” For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Configuring Port Forwarding

You can direct traffic coming in to your NAT network to a specific IP address behind the NAT gateway. This is called *port forwarding*.

Port forwarding lets you set up computers on the internal network that handle incoming connections without exposing other computers to outside connections. For example, you could set up a web server behind NAT service and forward incoming TCP connection requests on port 80 to the designated web server.

You can't forward the same port to multiple computers, but you can forward many ports to one computer.

Enabling port forwarding requires the use of the Terminal application and administrator access to root privileges through `sudo`.

You must also create a plist file. The contents of the plist file are used to generate `/etc/nat/natd.conf.apple`, which is passed to the NAT daemon when it is started.

Do not try to edit `/etc/nat/natd.conf.apple` directly. If you use a plist editor instead of a command-line text editor, alter the following procedure to suit.

### To forward port traffic:

- 1 If the file `/etc/nat/natd.plist` doesn't exist, make a copy of the default NAT daemon plist.

```
$ sudo cp /etc/nat/natd.plist.default /etc/nat/natd.plist
```

- 2 Using a Terminal editor, add the following block of XML text to `/etc/nat/natd.plist` before the two lines at the end the file (`</dict>` and `</plist>`), substituting your settings where indicated by italics:

```
<key>redirect_port</key>
  <array>
    <dict>
      <key>proto</key>
```

```

        <string>tcp or udp</string>
        <key>targetIP</key>
        <string>LAN_ip</string>
        <key>targetPortRange</key>
        <string>LAN_ip_range</string>
        <key>aliasIP</key>
        <string>WAN_ip</string>
        <key>aliasPortRange</key>
        <string>WAN_port_range</string>
    </dict>
</array>

```

3 Save your file changes.

4 Enter the following commands in Terminal:

```

$ sudo systemstarter stop nat
$ sudo systemstarter start nat

```

5 Verify that your changes remain by inspecting the `/etc/nat/natd.conf` file.

The changes made, except for comments and those settings that Server Admin can change, are used by server configuration tools (Server Admin, Gateway Setup Assistant, and `serveradmin`).

6 Configure NAT service in Server Admin as needed.

For more information, see “Configuring NAT Service” on page 126.

7 Click Save.

8 Start NAT service.

## Port Forwarding Examples

You can forward ports to an IP address. The ports on the WAN side do not need to be the same as the ports on the LAN side, but they must correspond.

For example, if you forward 10 consecutive ports from the WAN side, you must forward them to 10 consecutive ports on the LAN side, but they don’t need to be the same 10.

### Single Port Forwarding

This example shows the setting to forward TCP port 80 (web service) connections on the WAN address 17.128.128.128 to TCP port 80 (web service) on the private LAN address 192.168.1.1.

Add the following to the `/etc/nat/natd.plist` file:

```

<key>redirect_port</key>
    <array>
        <dict>

```

```

        <key>proto</key>
        <string>tcp</string>
        <key>targetIP</key>
        <string>192.168.1.1</string>
        <key>targetPortRange</key>
        <string>80</string>
        <key>aliasIP</key>
        <string>17.128.128.128</string>
        <key>aliasPortRange</key>
        <string>80</string>
    </dict>
</array>

```

### Multiple Port Forwarding

This example shows the setting to forward TCP and UDP ports 600-1023 (NetInfo, full range) connections on the WAN address 17.128.128.128 to corresponding ports on the private LAN address 192.168.1.1.

Add the following to the `/etc/nat/natd.plist` file:

```

<key>redirect_port</key>
<array>
    <dict>
        <key>proto</key>
        <string>tcp</string>
        <key>targetIP</key>
        <string>192.168.1.1</string>
        <key>targetPortRange</key>
        <string>600-1023</string>
        <key>aliasIP</key>
        <string>17.128.128.128</string>
        <key>aliasPortRange</key>
        <string>600-1023</string>
    </dict>
</array>
<array>
    <dict>
        <key>proto</key>
        <string>udp</string>
        <key>targetIP</key>
        <string>192.168.1.1</string>
        <key>targetPortRange</key>

```

```
<string>600-1023</string>
<key>aliasIP</key>
<string>17.128.128.128</string>
<key>aliasPortRange</key>
<string>60-1023</string>
</dict>
</array>
```

## Testing Port Forwarding Rules

After you configure port forwarding rules you can test them by accessing the service from the public IP address of your NAT router. If you successfully access the services, you have properly configured and tested your port forwarding rule.

For example, if you have a website hosted on a computer with the private IP address of 192.168.1.10 and your NAT router has a public IP address of 219.156.13.13 and a port forwarding rule that forwards port 80 to IP address 192.168.1.10, you would access the website by entering the public IP address (<http://219.156.13.13>) into your web browser.

If your port forwarding rules are correct, your port is forwarded to the computer that is hosting the website (192.168.1.10).

## Starting and Stopping NAT Service

You use Server Admin to start and stop NAT service on your default network interface. Starting NAT service does not start DHCP on the NAT interface, so you must manage LAN addressing separately.

Starting NAT service is not the same as configuring a network segment as a NAT LAN.

For NAT service to operate, you must enable NAT service and Firewall service. For more information, see “Starting Firewall Service” on page 96.

### To start NAT service:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select NAT.
- 4 Click the Start NAT button below the Servers list.

When the service is running, the Stop NAT button is available.

**From the command line:**

- To start NAT service:

```
$ sudo serveradmin start nat
```

- To stop NAT service:

```
$ sudo serveradmin stop nat
```

For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Creating a Gateway Without NAT

You can use a computer as a gateway between network segments without translating IP addresses between public and private ranges. This is called *IP address forwarding*. Mac OS X Server supports IP address forwarding and can be configured using Server Admin.

You can have various network configurations that would use a gateway without NAT. For example, a server might be translating private IP addresses to public addresses using NAT, but your Mac OS X Server gateway might be routing information between private address subnets. Likewise, you might want to run a firewall between network segments in your own LAN.

Any condition in which you'd want to route network traffic through the server without masquerading IP addresses is a condition that involves IP address forwarding.

The steps for creating a gateway for address forwarding are the same as those for creating a NAT LAN. This means that network ports must be properly configured and that Firewall service must be enabled.

**To configure a gateway without NAT service:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select NAT.
- 4 Click Settings.
- 5 Select "IP Forwarding only."
- 6 Click Save.

## Monitoring NAT Service

You might want to monitor NAT service for troubleshooting and security reasons. This section describes how to view the NAT status overview and how to monitor NAT divert activity.

### Viewing the NAT Status Overview

The NAT status overview lets you see if the service is running and how many protocol links are active.

**To see the overview:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select NAT.
- 4 Click Overview to see whether the service is running, when it started, and the number of TCP, UDP, and ICMP links.

**From the command line:**

- To view NAT status overview:

```
$ sudo serveradmin status nat
```

- To see detailed NAT status overview:

```
$ sudo serveradmin fullstatus nat
```

For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

### Viewing the NAT Service Log and Log Path

To view the contents of the NAT service log or to view log paths, use `tail` or another file listing tool.

**To view the latest entries in the log:**

```
$ tail log-file
```

**To view the log path:**

```
$ sudo serveradmin command nat:command = getLogPaths
```

The computer responds with the following output:

```
nat:natLog = <nat-log>
```

Value	Description
<nat-log>	The location of the NAT service log. Default = <code>/var/log/alias.log</code>

For more information about NAT commands, see “Command-Line Parameters for Network Services.” For information about `tail` and `cat`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Common Network Administration Tasks That Use NAT

The following sections illustrate common network administration tasks that use NAT service.

### Linking a LAN to the Internet Through One IP Address

To link a LAN, you need a Mac OS X Server computer with two network interfaces: one to connect to the Internet and one to connect to your private network. The steps below use the following configuration as an example:

- **Ethernet interface names and functions:** Ethernet Built-in (connected to Internet), PCI Ethernet Slot 1 (connected to internal network)
- **Internet or public IP address:** 17.254.0.3 (example only; your IP number is provided by your ISP)
- **Internet or public DNS IP address:** 17.254.1.6 (example only; your IP number is provided by your ISP)
- **Private network IP address range and netmask:** 192.168.0.2–192.168.0.254 (also expressed as 192.168.0.0/24 or 192.168.0.0:255.255.255.0)
- **Server’s private network IP address:** 192.168.0.1
- **LAN client IP address settings:** Configure IPv4 Using DHCP

This last setting is not required because NAT can be used with static IP addresses instead of DHCP. However, configuring this setting makes it easier to configure computers.

#### To configure your NAT LAN:

- 1 On the gateway server, open the Network pane of System Preferences.
- 2 In the active Network screen, make sure the interface “Built-in Ethernet” is at the top of the list of interfaces; if not, drag it to the top of the list.

This sets the default gateway in the routing table. The top interface is always configured for the Internet or WAN.

- 3 Make sure the IP address and settings for “Ethernet 1” are your public address settings from your ISP.

In this example they are:

- IP address: 17.254.0.3
- Netmask: 255.255.252.0
- DNS: 17.254.1.6

- 4 Make sure the IP address and settings for “Ethernet 2” or “PCI Ethernet Slot 1” are your local address settings.

In this example, they are:

- IP address: 192.168.0.1
- Netmask: 255.255.255.0
- DNS: 17.254.1.6

- 5 If necessary, click Apply Now.
- 6 Open Server Admin and connect to the server.
- 7 Click the triangle at the left of the server.

The list of services appears.

- 8 From the expanded Servers list, select DHCP.
- 9 Click Subnets and create a subnet for the internal LAN with the following configuration parameters:

- Subnet name: *<whatever you want>*
- Starting IP address: 192.168.0.2
- Ending IP address: 192.168.0.254
- Subnet mask: 255.255.255.0
- Network interface: en1
- Router: 192.168.0.1
- Lease time: *<whatever you want>*
- DNS: 17.254.1.6

For detailed information about configuring DHCP, see “Creating Subnets” on page 26.

- 10 To start DHCP service, click the Start DHCP button below the Servers list.
- 11 In Server Admin, choose NAT from the expanded Servers list.
- 12 Configure NAT using the following setting:

External network interface: en0

- 13 If necessary, click Save.
- 14 To start NAT service, click the Start NAT button below the Servers list.
- 15 In Server Admin, choose Firewall from the expanded Servers list.
- 16 Create firewall rules to permit access to and from your private network.

For example, create an IP address group named “Private LAN” for the addresses 192.168.0.0/16.

For more information, see “Creating an Address Group” on page 98.

- 17 To start Firewall service, click the Start Firewall button below the Servers list.

- 18 Start any services you want the private LAN to access (web, SSH, file sharing, and so on) using the “Private LAN” group.

For more information, see “Configuring Services Settings” on page 94.

- 19 Start any services you want the Internet to access on your private LAN (web, SSH, file sharing, and so on) using the “any” address group.

For more information, see “Configuring Services Settings” on page 94.

- 20 Click Save.

## Setting Up a LAN Party for Gaming

Some Internet-enabled games allow multiple players to connect online over a LAN. This is known as a *LAN party*. Setting up a LAN party is essentially the same as the process found in “Linking a LAN to the Internet Through One IP Address” on page 133.

Special considerations:

- Open only the ports necessary to play an Internet-enabled game.
- If the game is played only inside the LAN, don’t open the firewall to game ports.
- If you have computers joining and leaving the LAN, use DHCP for client address configuration.

## Setting Up Virtual Servers

A virtual server is a gateway server that sends services behind a NAT firewall to real servers on a port-by-port basis.

For example, suppose you have a NAT gateway called `domain.example.com` with an address of `17.100.0.1` that is set to forward web traffic (port 80) to `10.0.0.5` (port 80) behind the firewall and that sends packet requests for ssh traffic (port 22) to `10.0.0.15` (port 22).

In this example, the NAT gateway is not really serving the web content. The server at `10.0.0.5` is, but it is invisible to the clients browsing the web site.

Viewed from the Internet you have one server, but viewed from behind the NAT barrier, you have as many or as few as you need. You can use this setup for load balancing or as an organizational scheme for the network’s topography.

Virtual servers also enable you to easily reroute network traffic to other computers on the LAN by reconfiguring the gateway.

Virtual servers require three service configurations:

- **NAT:** NAT service must be configured with port forwarding of the virtual port.
- **DNS:** The DNS record for the server should accept a few aliases of common services and resolve them to the same IP address.

- **Firewall:** The firewall must permit traffic on specific ports to have access to the NAT LAN.

In this example, you set up a NAT gateway and route two domain names and services to different computers behind the gateway firewall. Assume the following configuration details:

- **Ethernet interface names and functions:** Ethernet Built-in (connected to Internet), PCI Ethernet Slot 1 (connected to internal network)
- **Internet or public IP address:** 17.100.0.1 (example only, your IP number and netmask information will be provided by your ISP)
- **Private network IP address range and netmask:** 192.168.0.0–192.168.0.255 (also expressed as 192.168.0.0/24 or 192.168.0.0:255.255.255.0)
- **Gateway server's private network IP address:** 192.168.0.1
- **Web server's private network IP address:** 192.168.0.2
- **Mail server's private network IP address:** 192.168.0.3
- **Web and mail server's IP address settings:** Configure IPv4 Using DHCP

This last setting is not required because NAT can be used with static IP addresses instead of DHCP. However, configuring this setting makes it easier to configure computers.

Now all web traffic to `www.example.com` is forwarded to the internal server at 192.168.0.2, and incoming mail traffic sent to `mail.example.com` is delivered to the internal server at 192.168.0.3.

To change the servers behind the NAT (for example, to perform a hardware upgrade), change the DHCP static IP address to the Ethernet addresses of the new servers. The new servers are assigned the existing internal IP addresses designated for web and mail, and the gateway forwards the traffic to the new servers seamlessly.

#### To configure virtual servers:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.

The list of services appears.

- 3 From the expanded Servers list, select DHCP.
- 4 Click Subnets and create an address group for the internal LAN with the following configuration parameters:
  - Subnet name: *<whatever you want>*
  - Starting IP address: 192.168.0.2
  - Ending IP address: 192.168.0.254
  - Subnet mask: 255.255.255.0

- Network interface: en1
- Router: 192.168.0.1
- Lease time: <whatever you want>
- DNS: <provided by ISP>
- Static mapping (web): <web server's Ethernet address> mapped to 192.168.0.2
- Static mapping (mail): <mail server's Ethernet address> mapped to 192.168.0.3

For more information, see “Creating Subnets” on page 26 and “Assigning Static IP Addresses Using DHCP” on page 39.

5 To start DHCP service, click the Start DHCP button (below the Servers list).

6 In Server Admin, choose NAT from the expanded Servers list.

7 Configure NAT using the following setting:

- **External network interface:** en0
- **Port forwarding:** TCP port 80 (web) to 192.168.0.2
- **Port forwarding:** TCP port 25 (mail) to 192.168.0.3

For more information about configuring port forwards, see “Configuring Port Forwarding” on page 127.

8 Click Save.

9 To start NAT service, click the Start NAT button below the Servers list.

10 In Server Admin, choose Firewall from the expanded Servers list.

11 Create Firewall rules to permit access to your private network.

For more information, see “Creating an Address Group” on page 98.

12 Enable the two services you want the Internet to access on your private LAN (web and SMTP mail) using the “any” address group.

For more information, see “Configuring Services Settings” on page 94.

13 Click Save.

14 To start Firewall service, click the Start Firewall button (below the Servers list).

15 Contact your DNS provider (usually your ISP) to add two aliases to your gateway server's DNS record.

Request an A record with the name www.example.com to the IP address 17100.0.1.

Request an MX record with the name mail.example.com to the same IP address.

These records are in addition to existing A and CNAME records for your domain.

## Where to Find More Information

The `natd` daemon process controls NAT service. For information about how to access `natd` features and implement them, see the `natd` man page.

Request for Comments (RFC) documents provide an overview of a protocol or service and details about how the protocol should behave.

If you're a novice server administrator, you'll probably find some of the background information in an RFC helpful.

If you're an experienced server administrator, you can find the technical details about a protocol in its RFC document.

You can search for RFC documents by number at [www.ietf.org/rfc.html](http://www.ietf.org/rfc.html).

For NAT descriptions, see:

- RFC 1631
- RFC 3022

## Use this chapter to set up and manage VPN service in Mac OS X Server.

By configuring a virtual private network (VPN) on your server you can give users a more secure way of remotely communicating with computers on your network.

This chapter describes the VPN authentication method and transport protocols and explains how to configure, manage, and monitor VPN service. It does not include information for configuring VPN clients to use your VPN server.

A VPN consists of computers or networks (nodes) connected by a private link of encrypted data. This link simulates a local connection, as if the remote computer were attached to the local area network (LAN).

VPNs securely connect users working away from the office (for example, at home) to the LAN through a connection such as the Internet. From the user's perspective, the VPN connection appears as a dedicated private link.

VPN technology can also connect an organization to branch offices over the Internet while maintaining secure communications. The VPN connection across the Internet acts as a wide area network (WAN) link between the sites.

VPNs have several advantages for organizations whose computer resources are physically separated. For example, each remote user or node uses the network resources of its Internet Service Provider (ISP) rather than having a direct, wired link to the main location.

### VPN and Security

VPNs stress security by requiring strong authentication of identity and encrypted data transport between the nodes for data privacy and dependability. The following sections contain information about each supported transport and authentication method.

## Transport Protocols

There are two encrypted transport protocols: Layer Two Tunneling Protocol, Secure Internet Protocol (L2TP/IPSec), and Point-to-Point Tunneling Protocol (PPTP). You can enable either or both protocols. Each has its own strengths and requirements.

### L2TP/IPSec

L2TP/IPSec uses strong IPSec encryption to tunnel data to and from network nodes. It is based on Cisco's L2F protocol.

IPSec requires security certificates (self-signed or signed by a certificate authority such as Verisign) or a predefined shared secret between connecting nodes.

The shared secret must be entered on the server and the client.

The shared secret is not a password for authentication, nor does it generate encryption keys to establish secure tunnels between nodes. It is a token that the key management systems use to trust each other.

L2TP is Mac OS X Server's preferred VPN protocol because it has superior transport encryption and can be authenticated using Kerberos.

### PPTP

PPTP is a commonly used Windows standard VPN protocol. PPTP offers good encryption (if strong passwords are used) and supports a number of authentication schemes. It uses the user-provided password to produce an encryption key.

By default, PPTP supports 128-bit (strong) encryption. PPTP also supports the 40-bit (weak) security encryption.

PPTP is necessary if you have Windows clients with versions earlier than Windows XP or if you have Mac OS X v10.2.x clients or earlier.

## Authentication Method

Mac OS X Server L2TP VPN uses Kerberos v5 or Microsoft's Challenge Handshake Authentication Protocol version 2 (MS-CHAPv2) for authentication. Mac OS X Server PPTP VPN exclusively uses MS-CHAPv2 for authentication.

Kerberos is a secure authentication protocol that uses a Kerberos Key Distribution Server as a trusted third party to authenticate a client to a server.

MS-CHAPv2 authentication encodes passwords when they're sent over the network, and stores them in a scrambled form on the server. This method offers good security during network transmission. It is also the standard Windows authentication scheme for VPN.

A Mac OS X Server PPTP VPN can also use other authentication methods. Each method has its own strengths and requirements. These other authentication methods for PPTP are not available in Server Admin.

If you want to use an alternative authentication scheme (for example, to use RSA Security's SecurID authentication), you must edit the VPN configuration file manually. The configuration file is located at `/Library/Preferences/SystemConfiguration/com.apple.RemoteAccessServers.plist`.

For more information, see "Offering SecurID Authentication with VPN Server" on page 156.

## Using VPN Service with Users in a Third-Party LDAP Domain

To use VPN service for users in a third-party LDAP domain (an Active Directory or Linux OpenLDAP domain), you must be able to use Kerberos authentication. If you need to use MSCHAPv2 to authenticate users, you can't offer VPN service for users in a third-party LDAP domain.

## Before You Set Up VPN Service

Before setting up VPN service, determine which transport protocol you're going to use. The following table shows which protocols are supported by different platforms.

If you have	You can use L2TP/IPSec	You can use PPTP
Mac OS X v10.5 and v10.4.x clients	X	X
Mac OS X v10.3.x clients	X	X
Mac OS X v10.2.x clients		X
Windows clients	X (if Windows XP)	X
Linux or Unix clients	X	X

If you're using L2TP, you must have a Security Certificate (from a certificate authority or self-signed), or a predefined shared secret between connecting nodes. If you use a shared secret, it must also be secure (at least 8 alphanumeric characters, including punctuation and without spaces; preferably 12 or more) and kept secret by users.

If you're using PPTP, make sure all your clients support 128-bit PPTP connections for greatest transport security. Using only 40-bit transport security is a serious security risk.

## Configuring Other Network Services for VPN

Enabling VPN on Mac OS X Server requires detailed control of DHCP. DHCP is configured separately in Server Admin. The IP addresses given to VPN clients cannot overlap with addresses given to local DHCP clients. To learn more about DHCP, see Chapter 2, “Working with DHCP Service,” on page 25.

Enabling VPN also requires Firewall service to be configured. The firewall settings must be able to pass network traffic from external IP addresses through the firewall to the LAN. The firewall settings can be as open or restricted as necessary.

For example, if your VPN clients use a large range of IP addresses (you have many users, each connecting from different ISPs) you might need to open the “any” firewall address group to VPN connections.

If you want to narrow access to a small range of IP addresses, including static ones, you can create an address group that reflects that smaller range, and only enable VPN traffic originating from that list. You must also open the relevant firewall ports for the VPN type you are using (L2TP or PPTP).

Further, a VPN using L2TP must permit traffic for VPN clients on UDP port 4500 (IKE NAT Traversal) if you are using a NAT gateway.

Your specific network configuration can also require other open ports.

## VPN Setup Overview

Here is an overview of the steps for setting up VPN service:

### Step 1: Before you begin

For information to keep in mind before you set up VPN service, read “Before You Set Up VPN Service” on page 141 and “Configuring Other Network Services for VPN” on page 142.

### Step 2: Turn VPN service on

Before configuring VPN service, you must turn it on. See “Turning VPN Service On” on page 143.

### Step 3: Configure VPN L2TP settings

Use Server Admin to enable L2TP over IPsec, set the IP address allocation range, and set the shared secret or security certificate. See “Configuring L2TP Settings” on page 143.

### Step 4: Configure VPN PPTP settings

Use Server Admin to enable PPTP to specify encryption key length and to specify the IP address allocation range. See “Configuring PPTP Settings” on page 146.

### Step 5: Configure VPN Logging settings

Use the Logging settings to enable VPN verbose logging. See “Configuring VPN Logging Settings” on page 150.

### Step 6: Configure VPN Client Information settings

Use Server Admin to configure network settings for VPN clients. See “Configuring Client Information Settings” on page 149.

## Turning VPN Service On

Before you can configure VPN service, you must turn VPN service on in Server Admin.

### To turn VPN service on:

- 1 Open Server Admin and connect to the server.
- 2 Click Settings, then click Services.
- 3 Select the VPN checkbox.
- 4 Click Save.

## Setting Up VPN Service

There are two groups of settings for VPN service in Server Admin:

- **Connections.** Shows you information about users who are connected using VPN.
- **Settings.** Configures and manages L2TP and PPTP VPN service connections.

The following sections describe how to configure these settings and how to start VPN service after you set up VPN.

### Configuring L2TP Settings

Use Server Admin to designate L2TP as the transport protocol.

If you enable this protocol, you must also configure the connection settings. You must designate an IPsec shared secret (if you don't use a signed security certificate), the IP address allocation range to be given to users, and the group that will use the VPN service (if needed).

If L2TP and PPTP are used, each protocol should have a separate, nonoverlapping address range.

When configuring VPN, make sure the firewall allows VPN traffic on needed ports with the following settings:

- For the “any” address group, enable GRE, ESP, VPN L2TP (port 1701), and VPN ISAKMP/IKE (port 500).
- For the “192.168-net” address group, choose to allow all traffic.

For more information, see “Configuring Services Settings” on page 94.

**To configure L2TP settings:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of servers appears.
- 3 From the expanded Servers list, select VPN.
- 4 Click Settings, then click L2TP.
- 5 Select the “Enable L2TP over IPSec” checkbox.
- 6 In the “Starting IP address” field, set the beginning IP address of the VPN allocation range.  
It can’t overlap the DHCP allocation range, so enter 192.168.0.128.
- 7 In the “Ending IP address” field, set the ending IP address of the VPN allocation range.  
It can’t overlap the DHCP allocation range, so enter 192.168.0.255.
- 8 (Optional) You can load-balance VPN by selecting the Enable Load Balancing checkbox and entering an IP address in the Cluster IP address field.
- 9 Choose a PPP authentication type.

If you choose Directory Service and your computer is bound to a Kerberos authentication server, from the Authentication pop-up menu select Kerberos. Otherwise, choose MS-CHAPv2.

If you choose RADIUS, enter the following information:

- **Primary IP Address:** Enter the IP address of the primary RADIUS server.
  - **Shared Secret:** Enter a shared secret for the primary RADIUS server.
  - **Secondary IP Address:** Enter the IP address of the secondary RADIUS server.
  - **Shared Secret:** Enter a shared secret for the secondary RADIUS server.
- 10 Enter the shared secret or select the certificate to use in the IPSec Authentication section.

The shared secret is a common password that authenticates members of the cluster. IPSec uses the shared secret as a preshared key to establish secure tunnels between cluster nodes.

- 11 Click Save.

**From the command line:**

- To configure L2TP settings:

```
$ sudo serveradmin settings  
vpn:vpn:Servers:com.apple.ppp.l2tp:enabled = yes
```

```

vpn:vpn:Server:com.apple.ppp.l2tp:IPv4:DestAddressRanges:_array_index:0 =
    value
vpn:vpn:Server:com.apple.ppp.l2tp:IPv4:DestAddressRanges:_array_index:1 =
    value
vpn:vpn:Server:com.apple.ppp.l2tp:Server:LoadBalancingEnabled = value
vpn:vpn:Server:com.apple.ppp.l2tp:Server:LoadBalancingAddress = value
vpn:vpn:Server:com.apple.ppp.l2tp:PPP:AuthenticatorProtocol:_array_
    index:0 = value
vpn:vpn:Server:com.apple.ppp.l2tp:PPP:AuthenticatorPlugins:_array_index:0
    = value
vpn:vpn:Server:com.apple.ppp.l2tp:Radius:Server:_array_index:0:Address =
    value
vpn:vpn:Server:com.apple.ppp.l2tp:Radius:Server:_array_
    index:0:SharedSecret = value
vpn:vpn:Server:com.apple.ppp.l2tp:Radius:Server:_array_index:1:Address =
    value
vpn:vpn:Server:com.apple.ppp.l2tp:Radius:Server:_array_
    index:1:SharedSecret = value
vpn:vpn:Server:com.apple.ppp.l2tp:IPSec:AuthenticationMethod = value
vpn:vpn:Server:com.apple.ppp.l2tp:L2TP:IPSecSharedSecretValue = value
vpn:vpn:Server:com.apple.ppp.l2tp:IPSec:LocalCertificate = value
Control-D

```

Parameter (vpn:Servers)	Description
com.apple.ppp.l2tp:enabled	Default = no
com.apple.ppp.l2tp: IPv4:DestAddressRanges	Default = <code>_empty_array</code>
com.apple.ppp.l2tp: Server:LoadBalancingEnabled	Default = 0
com.apple.ppp.l2tp: Server:LoadBalancingAddress	Default = 1.2.3.4
com.apple.ppp.l2tp: PPP:AuthenticatorProtocol:_array_ index:n	Default = "MSCHAP2"
com.apple.ppp.l2tp: PPP:AuthenticatorPlugins:_array_ index:n	Default = "DSAuth"

Parameter (vpn:Servers:)	Description
com.apple.ppp.l2tp: Radius:Server:_array_ index:0:Address	Default = 1.1.1.1
com.apple.ppp.l2tp: Radius:Server:_array_ index:0:SharedSecret	Default = 1
com.apple.ppp.l2tp: Radius:Server:_array_ index:0:Address	Default = 2.2.2.2
com.apple.ppp.l2tp: Radius:Server:_array_ index:0:SharedSecret	Default = 2
com.apple.ppp.l2tp: IPSec:AuthenticationMethod	Default = "SharedSecret"
com.apple.ppp.l2tp: L2TP:IPSecSharedSecretValue	Default = ""
com.apple.ppp.l2tp: IPSec:LocalCertificate	Default = ""

For more information about command-line parameters for VPN, see “VPN Service Settings” on page 206. For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Configuring PPTP Settings

Use Server Admin to designate PPTP as the transport protocol.

If you enable this protocol, you must also configure connection settings. You should designate an encryption key length (40 bit or 128 bit), the IP address allocation range to be given to your clients, and the group that will use the VPN service (if needed).

If you use L2TP and PPTP, each protocol should have a separate, nonoverlapping address range.

When configuring VPN, make sure the firewall allows VPN traffic on needed ports with the following settings:

- For the “any” address group, enable GRE, ESP, VPN L2TP (port 1701), and IKE (port 500).
- For the “192.168-net” address group, choose to allow all traffic.

For more information, see “Configuring Services Settings” on page 94.

### To configure PPTP settings:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of servers appears.
- 3 From the expanded Servers list, select VPN.
- 4 Click Settings, then click PPTP.
- 5 Select Enable PPTP.
- 6 In the “Starting IP address” field, set the beginning IP address of the VPN allocation range.  
It can’t overlap the DHCP allocation range, so enter 192.168.0.128.
- 7 In the “Ending IP address” field, set the ending IP address of the VPN allocation range.  
It can’t overlap the DHCP allocation range, so enter 192.168.0.255.
- 8 If needed, select “Allow 40-bit encryption keys in addition to 128-bit” to permit 40-bit and 128-bit key encryption access to VPN.

**WARNING:** 40-bit encryption keys are much less secure but can be necessary for some VPN client applications.

- 9 Choose a PPP authentication type.

If you choose Directory Service and your computer is bound to a Kerberos authentication server, from the Authentication pop-up menu select Kerberos. Otherwise, choose MS-CHAPv2.

If you choose RADIUS, enter the following information:

- **Primary IP Address:** Enter the IP address of the primary RADIUS server.
- **Shared Secret:** Enter a shared secret for the primary RADIUS server.
- **Secondary IP Address:** Enter the IP address of the secondary RADIUS server.
- **Shared Secret:** Enter a shared secret for the secondary RADIUS server.

- 10 Click Save.

### From the command line:

- To configure PPTP Settings:

```
$ sudo serveradmin settings
vpn:vpn:Servers:com.apple.ppp.pptp:enabled = yes
vpn:vpn:Server:com.apple.ppp.pptp:IPv4:DestAddressRanges:_array_index:0 =
    value
vpn:vpn:Server:com.apple.ppp.pptp:IPv4:DestAddressRanges:_array_index:1 =
    value
```

```

vpn:vpn:Server:com.apple.ppp.pptp:PPP:AuthenticatorProtocol:_array_
    index:0 = value
vpn:vpn:Server:com.apple.ppp.pptp:PPP:AuthenticatorPlugins:_array_index:0
    = value
vpn:vpn:Server:com.apple.ppp.pptp:Radius:Server:_array_index:0:Address =
    value
vpn:vpn:Server:com.apple.ppp.pptp:Radius:Server:_array_
    index:0:SharedSecret = value
vpn:vpn:Server:com.apple.ppp.pptp:Radius:Server:_array_index:1:Address =
    value
vpn:vpn:Server:com.apple.ppp.pptp:Radius:Server:_array_
    index:1:SharedSecret = value
vpn:vpn:Server:com.apple.ppp.pptp:PPP:MPPEKeysize40 = value
vpn:vpn:Server:com.apple.ppp.pptp:PPP:MPPEKeysize128 = value
Control-D

```

- To view all VPN service settings:

```
$ sudo serveradmin settings vpn
```

Parameter (vpn:Servers:)	Description
com.apple.ppp.pptp:enabled	Default = no
com.apple.ppp.pptp: IPv4:DestAddressRanges	Default = _empty_array
com.apple.ppp.pptp: PPP:AuthenticatorProtocol:_array_ index:n	Default = "MSCHAP2"
com.apple.ppp.pptp: PPP:AuthenticatorPlugins:_array_ index:n	Default = "DSAuth"
com.apple.ppp.pptp: Radius:Server:_array_ index:0:Address	Default = 1.1.1.1
com.apple.ppp.pptp: Radius:Server:_array_ index:0:SharedSecret	Default = 1

Parameter (vpn:Servers:)	Description
com.apple.ppp.pptp: Radius:Server:_array_ index:0:Address	Default = 2.2.2.2
com.apple.ppp.pptp: Radius:Server:_array_ index:0:SharedSecret	Default = 2
com.apple.ppp.pptp: PPP:MPPEKeysize40	Default = 0
com.apple.ppp.pptp: PPP:MPPEKeysize128	Default = 0

For more information about command-line parameters for VPN, see “VPN Service Settings” on page 206. For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Configuring Client Information Settings

When a user connects to your server through a VPN, that user is given an IP address from your allocated range. This range is not served by a DHCP server, so you must configure the network mask, DNS address, and search domains.

**To configure Client Information settings:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.

The list of servers appears.

- 3 From the expanded Servers list, select VPN.
- 4 Click Settings, then click Client Information.
- 5 Enter the IP address of the DNS server.

Add the gateway computer’s internal IP address (usually something like 192.168.x.1).

- 6 Enter search domains as needed.
- 7 Add network routing definitions as needed.

For more information about network routing definitions, see “Configuring VPN Network Routing Definitions” on page 151.

- 8 Click Save.

## Configuring VPN Logging Settings

You can choose from two levels of detail for VPN service logs.

- **Nonverbose logs:** Describe conditions where you must take immediate action (for example, if the VPN service can't start up).
- **Verbose logs:** Record all activity by the VPN service, including routine functions.

By default, nonverbose logging is enabled.

**To change logging settings to verbose:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of servers appears.
- 3 From the expanded Servers list, select VPN.
- 4 Click Settings, then click Logging.
- 5 Select "Verbose logging" to enable verbose logging.
- 6 Click Save.

## Starting VPN Service

You use Server Admin to start VPN service.

**To start VPN service:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of servers appears.
- 3 From the expanded Servers list, select VPN.
- 4 Click the Start VPN button below the Servers list.

**From the command line:**

- To start VPN service:

```
$ sudo serveradmin start vpn
```

For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Managing VPN Service

This section describes tasks associated with managing VPN service. It includes starting, stopping, and configuring the service.

### Stopping VPN Service

You use Server Admin to stop VPN service.

#### To stop VPN service:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of servers appears.
- 3 From the expanded Servers list, select VPN.
- 4 Click the Stop VPN button below the Servers list.
- 5 Click Stop Now.

#### From the command line:

- To stop VPN service:

```
$ sudo serveradmin stop vpn
```

For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

### Configuring VPN Network Routing Definitions

By using network routing definitions, you can choose whether to route data from VPN clients to an address group through the VPN tunnel (referred to as *private*) or over the VPN user's ISP connection (referred to as *public*).

For example, you can have all VPN client traffic that goes to the LAN IP address range go through the secure tunnel to the LAN, but make all traffic to other addresses be routed through the user's normal, unsecured Internet connection.

This helps you have greater control over what goes through the VPN tunnel.

#### Important Notes About VPN Routing Definitions

- If no routing definitions are added, traffic is routed through the VPN connection by default.
- If routing definitions are added, the VPN connection is no longer set as the default route, and traffic destined for addresses not specifically declared as a private route will not go over the VPN connection.
- DNS lookups go over the VPN connection regardless of the routes that are set.
- Definitions are unordered. They only apply the description that most closely matches the packet being routed.

## Example

Suppose your LAN's IP addresses are 17.x.x.x addresses. If you make no routing definitions, all VPN client network traffic (such as web browser URL requests, LPR printer queue print jobs, and file server browsing) is routed from the client computer through the VPN tunnel to the 17.x.x.x LAN.

You decide that you don't want to manage all traffic to web sites or file servers that aren't located on your network. You can specify what traffic gets sent to the 17.x.x.x network and what goes through the client computer's normal Internet connection.

To limit the traffic the VPN tunnel handles, enter a routing definition designating traffic to the 17.x.x.x network as private, which sends it through the VPN tunnel. In the routing definition table you'd enter 17.0.0.0 255.0.0.0 Private.

Traffic to the LAN is now sent over the VPN connection and, by default, all other addresses not in the definitions table are sent over the client computer's unencrypted Internet connection.

You then decide that there are a few IP addresses in the 17.x.x.x range that you don't want accessed over the VPN connection. You want the traffic to go through the client computer's Internet connection and not pass through the VPN tunnel. The addresses might be outside the firewall and not accessible from the 17.x.x.x LAN.

As an example, to use addresses in the range 17.100.100.x, enter an extra routing definition as follows: 17.100.100.0 255.255.255.0 Public.

Because the address definition is more specific than 17.x.x.x, this rule takes precedence over the broader, more general rule, and traffic heading to any address in the 17.100.100.x range is sent through the client computer's Internet connection.

In summary, if you add routes, any routes you specify as private go over the VPN connection, and any declared as public do not go over the VPN connection. All others not specified also do not go over the VPN connection.

## Setting Routing Definitions

Use Server Admin to set your routing definitions.

### To set routing definitions:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of servers appears.
- 3 From the expanded Servers list, select VPN.
- 4 Click Settings, then click Client Information.
- 5 Click the Add (+) button.

- 6 Enter a destination address range of the packets to be routed by specifying:
  - A base address (for example, 192.168.0.0)
  - A network mask (for example, 255.255.0.0)
- 7 From the Type pop-up menu, select the routing destination.
  - *Private* means to route client traffic through the VPN tunnel.
  - *Public* means to use the normal interface with no tunnel.
- 8 Click OK.
- 9 Click Save.

### Limiting VPN Access to Specific Users or Groups

By default, all users on the server or in the master directory have access to the VPN when it is enabled. You can limit VPN access to specific users for security or ease of administration. You limit access to the VPN by using Mac OS X Server's Access Control List (ACL) feature.

ACLs allow you to designate service access to users or groups on an individual basis. For example, you can use an ACL to permit a user to access a specific file server or shell login, while denying access to all other users on the server.

#### To limit VPN access using ACLs:

- 1 Open Server Admin and connect to the server.
- 2 Click Access.
- 3 Click Services.
- 4 Select "For selected services below."
- 5 In the service access list, select VPN.
- 6 Select "Allow only users and group below."
- 7 To reveal the Users & Groups window, click the Add (+) button.
- 8 Drag users or groups to the access list.
- 9 Click Save.

### Limiting VPN Access to Specific Incoming IP Addresses

You limit access to the VPN by using Firewall service. When configuring the firewall for L2TP and PPTP you must configure GRE, ESP, and IKE to permit VPN access through the firewall.

By default, Firewall service blocks incoming VPN connections, but you can provide limited VPN access to specific IP addresses for security or ease of administration.

**To limit VPN access by IP address:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.

The list of services appears.
- 3 From the expanded Servers list, select Firewall.
- 4 Click Settings.
- 5 Select Advanced, then click the Add (+) button.
- 6 From the Action pop-up menu, choose "Allow."
- 7 From the Protocol pop-up menu, choose an option.
  - If you use L2TP for VPN access, choose UDP.
  - If you use PPTP for VPN access, choose TCP.
- 8 From the Service pop-up menu, choose VPN L2TP or VPN PPTP.

The relevant destination port is added to the Port field.
- 9 (Optional) Select the "Log all packets matching this rule" checkbox.
- 10 From the address pop-up menu of the Source section, choose Other and enter the source IP address range (using CIDR notation) that you want to give access to the VPN.

You can also specify a port in the Port field of the Source section.

Computers that have an IP address in the IP address range that you specified in the source IP address field, communicating on the source port you specified, can connect to the VPN service.
- 11 From the Destination Address pop-up menu, choose the address group that contains the VPN server (for the destination of filtered traffic).

If you don't want to use an existing address group, select Other and enter the destination IP address range (with CIDR notation).

You can also specify a port in the Port field of the Source section.
- 12 From the Interface pop-up menu that this rule applies to, choose "In."

"In" refers to the packets coming into the server.
- 13 Click OK.
- 14 Click the Add (+) button.
- 15 From the Action pop-up menu, choose "Allow."
- 16 From the Protocol pop-up menu, choose a protocol or Other:
  - If you are adding GRE or ESP, choose Other and enter "any" in the field.
  - If you are adding VPN ISAKMP/IKE, choose UDP.
- 17 From the Service pop-up menu, choose a service:

- If you are adding GRE, choose “GRE - Generic Routing Encapsulation protocol.”
  - If you are adding ESP, choose “ESP - Encapsulating Security Payload protocol.”
  - If you are adding VPN ISAKMP/IKE, choose “VPN ISAKMP/IKE.” Destination port 500 is added to the Port field.
- 18 From the Address pop-up menu of the Source section, choose “any.”
  - 19 In the Port field of the Source section, enter “any.”
  - 20 From the Address pop-up menu of the Destination section, choose “any.”
  - 21 In the Port field of the Destination section, enter a port number.  
If you are adding VPN ISAKMP/IKE, enter 500 if it is not shown.
  - 22 From the Interface pop-up menu, choose “Other” and enter “any” in the Other field of the Interface section.
  - 23 Click OK.
  - 24 Repeat steps 14 through 23 for GRE, ESP, and VPN ISAKMP/IKE.
  - 25 Click Save to apply the filter immediately.

## Supplementary Configuration Instructions

This section describes procedures for optional scenarios. They require integration with an existing directory service or with third-party authentication services.

### Enabling VPN-PPTP Access for Users in an LDAP Domain

In Mac OS X v10.5 and later, you can use a command-line tool to enable PPTP-VPN connections for users in an LDAP domain.

This resolves a situation where users can establish a VPN connection using PPTP to a Mac OS X Server that, when established, is not used by network traffic. This situation affects Mac OS X Server v10.3, v10.4, and v10.5.

#### To enable VPN-PPTP access for users in an LDAP domain:

- 1 Run the tool `/usr/sbin/vpnaddkeyagentuser` as root, with the LDAP node (directory where users are present) name as the argument.

For example, if the server running VPN service is the LDAP master, enter the following command in Terminal:

```
$ sudo /usr/sbin/vpnaddkeyagentuser /LDAPv3/127.0.0.1
```

If the server running VPN service is not an LDAP master and the LDAP directory is on a different computer, use the IP address of the LDAP server in the command.

For example, if the LDAP server address is 17.221.67.87, enter the following command in Terminal:

```
$ sudo /usr/sbin/vpnaddkeyagentuser /LDAPv3/17.221.67.87
```

- 2 When prompted, enter the username and password:
  - If the VPN server is the LDAP master, enter the administrator name and password of the server.
  - If the LDAP directory is on a different server, enter the administrator name and password of the server that hosts the LDAP directory (or the administrator name and password used to add users to the LDAP directory in Workgroup Manager).  
The tool adds a user to the LDAP directory and sets up configuration elements in the VPN server so it can support PPTP.
- 3 In the VPN Service Settings pane of Server Admin, configure PPTP.
- 4 Start VPN service.

### Offering SecurID Authentication with VPN Server

RSA Security provides strong authentication. It uses hardware and software tokens to verify user identity. SecurID authentication is available for L2TP and PPTP transports. For details and product offerings, see [www.rsasecurity.com](http://www.rsasecurity.com).

VPN service supports SecurID authentication but it cannot be set up from Server Admin. If you choose this authentication tool, you must change the VPN configuration manually.

#### Set up SecurID:

- 1 From your SecurID server, copy the `sdconf.rec` file to a new folder on your Mac OS X Server named `/var/ace`.

There are several ways to do this. The following illustrates one method:

- a Open Terminal (`/Applications/Utilities/`).
  - b Enter `sudo mkdir /var/ace`.
  - c Enter your administrator password.
  - d In the Dock, click Finder.
  - e From the Go menu, choose `Go > Go to Folder`.
  - f Enter: `/var/ace`.
  - g Click Go.
  - h From your SecurID server, copy the `sdconf.rec` file into the “ace” folder.
  - i If you see a dialog indicating that the “ace” folder cannot be modified, click `Authenticate` to permit the copy.
- 2 Enable EAP-SecurID authentication on VPN service for the protocols you want to use it with.

To use it with PPTP, enter these two commands in Terminal (each only one line):

```
# sudo serveradmin settings vpn:Servers:com.apple.ppp.pptp:PPP:AuthenticatorEAPPlugins:_array_index: 0 = "EAP-RSA"
# sudo serveradmin settings vpn:Servers:com.apple.ppp.pptp:PPP:AuthenticatorProtocol:_array_index:0 = "EAP"
```

To use it with L2TP, enter these two commands in Terminal (each only one line):

```
# sudo serveradmin settings vpn:Servers:com.apple.ppp.l2tp:PPP:AuthenticatorEAPPlugins:_array_index: 0 = "EAP-RSA"
# sudo serveradmin settings vpn:Servers:com.apple.ppp.l2tp:PPP:AuthenticatorProtocol:_array_index:0 = "EAP"
```

- 3 Complete the remaining VPN service configuration tasks using Server Admin.

## Monitoring VPN Service

This section describes tasks associated with monitoring a functioning VPN service. It includes accessing status reports, setting logging options, viewing logs, and monitoring connections.

### Viewing a VPN Status Overview

The VPN Overview gives you a quick status report for enabled VPN services. It tells you how many L2TP and PPTP clients are connected, which authentication method is selected, and when the service was started.

**To view the VPN Status overview:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of servers appears.
- 3 From the expanded Servers list, select VPN.
- 4 Click Overview to see whether the service is running, when it was started, the current connections, which protocols are enabled or disabled, and their authentication type.

**From the command line:**

- To view VPN status:

```
$ sudo serveradmin status vpn
```
- To view a detailed status of the VPN service:

```
$ sudo serveradmin fullstatus vpn
```

For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Changing the Log Detail Level for VPN Service

You can choose from two levels of detail for VPN service logs:

- **Nonverbose:** These logs describe only conditions where you must take immediate action (for example, if VPN service can't start up).
- **Verbose:** These logs record all activity by VPN service, including routine functions.

By default nonverbose logging is enabled.

### To change the VPN log detail to verbose:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of servers appears.
- 3 From the expanded Servers list, select VPN.
- 4 Click Settings, then click Logging.
- 5 Select "Verbose logging" to enable verbose logging.
- 6 Click Save.

## Viewing the VPN Log

Monitoring VPN logs helps you make sure your VPN is running properly. VPN logs can help you troubleshoot problems. The log view shows the contents of the `/var/log/ppp/vpnd.log` file. You can filter the log records with the text filter box in the Log pane of VPN.

### To view the VPN log:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of servers appears.
- 3 From the expanded Servers list, select VPN.
- 4 Click Log.

To search for specific entries, use the Filter field above the log.

### From the command line:

- To view the VPN log:

```
$ tail log-file
```

- To view the log path:

```
$ sudo serveradmin command vpn:command = getLogPaths
```

For information about `tail`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Viewing VPN Client Connections

You can monitor VPN client connections to maintain secure access to the VPN. By viewing the client connection screen, you can see:

- Users connected
- IP address users are connecting from
- IP address your network assigned to users
- Type and duration of connections

You can sort the list by clicking the column headers.

**To view client connections:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of servers appears.
- 3 From the expanded Servers list, select VPN.
- 4 Click Connections.

## Common Network Administration Tasks That Use VPN

This section describes common network administration tasks that use VPN service.

### Linking a Computer at Home with a Remote Network

You can use VPN service to link a computer to a remote network, giving you access to it as if it were physically connected to the LAN. The following is an example of a linked computer configuration:

- **User authentication:** The user can authenticate with a name and password.
- **Desired VPN type:** L2TP
- **Shared secret:** prDwkj49fd!254
- **Internet or public IP address of the VPN gateway:** gateway.example.com
- **Private network IP address range and netmask:** 192.168.0.0–192.168.0.255 (also expressed as 192.168.0.0/24 or 192.168.0.0:255.255.255.0)
- **DHCP starting and ending addresses:** 192.168.0.3–192.168.0.127
- **Private network's DNS IP address:** 192.168.0.2

The result of this configuration is a VPN client that can connect to a remote LAN using L2TP, with full access rights.

#### Step 1: Configure VPN

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.

The list of servers appears.

- 3 From the expanded Servers list, select VPN.
- 4 Click Settings, then click L2TP.
- 5 Select the “Enable L2TP over IPsec” checkbox.
- 6 In the “Starting IP address” field, set the beginning IP address of the VPN allocation range.

It can’t overlap the DHCP allocation range, so enter 192.168.0.128.

- 7 In the “Ending IP address” field, set the ending IP address of the VPN allocation range.  
It can’t overlap the DHCP allocation range, so enter 192.168.0.255.

- 8 In the IPsec Authentication section, enter the shared secret (prDwkj49fd!254).

The shared secret is a common password that authenticates members of the cluster. IPsec uses the shared secret as a preshared key to establish secure tunnels between the cluster nodes.

- 9 Click Save.
- 10 Click Client Information.
- 11 In the DNS Server field, enter the IP address of the internal LAN DNS server (192.168.0.2).
- 12 Leave routing definitions empty.

All traffic from the client will go through the VPN tunnel.

- 13 Click Save.
- 14 Click Start VPN below the Servers list.

### **Step 2: Configure the firewall**

- 1 Create an address group for the VPN allocation range.  
For more information, see “Creating an Address Group” on page 98.
- 2 Open the firewall to external VPN connections by enabling L2TP connections in the “any” address group.

For more information, see “Configuring Services Settings” on page 94.

- 3 Configure the firewall for the VPN address group, permitting or denying ports and services as needed.
- 4 Save your changes.
- 5 Start or restart the firewall.

### **Step 3: Configure the client**

This example is of a Mac OS X client using Network preferences.

- 1 Open System Preferences, then click Network.

- 2 Click the Add (+) button at the bottom of the network connection services list and then choose VPN from the Interface pop-up menu.
- 3 From the VPN Type pop-up menu, choose "L2TP over IPSec".
- 4 In the Service Name field, enter a VPN service name, then click Create.
- 5 In the Server Address field, enter the DNS name or IP address.
  - **Server Address:** gateway.example.com
  - **Account Name:** <the user's short name>
- 6 Click Authentication Settings and enter the following configuration information:
  - **User Authentication:** Use Password <user's password>
  - **Machine Authentication:** Use Shared Secret <prDwkj49fd!254>
- 7 Click OK.

The user can now connect.
- 8 Click Apply.

## Accessing a Computing Asset Behind a Remote Network Firewall

Accessing a single computing asset behind a firewall differs from permitting a client computer to become a node on the remote network.

In the previous example, the VPN user's computer becomes a full participant in the remote LAN. In this scenario, the asset to be accessed is a single file server, with the VPN user's computer having no other contact with the remote LAN.

This scenario assumes information in the section "Linking a Computer at Home with a Remote Network" on page 159, and adds:

- **File server IP address:** 192.168.0.15
- **File server type:** Apple File Sharing

For this scenario, the procedure is similar to that use for "Linking a Computer at Home with a Remote Network" on page 159, with these exceptions:

- In Step 1, part 12, don't leave the routing definitions empty.
- Create a Private route with the IP number of the file server (192.168.0.15 / 255.255.255.255).
- In Step 2, part 3, configure the firewall to only accept Apple File Sharing Protocol connections and DNS from the VPN address group.

VPN users who are now logged in through the VPN gateway can access the file server, and no other network traffic can go through the encrypted gateway.

## Linking Remote Network Sites

You can use a VPN to link a computer to a main network, and you can also link networks.

When two networks are linked they can interact as if they are physically connected. Each site must have its own connection to the Internet but the private data is sent encrypted between the sites.

This type of link is useful for connecting satellite offices to an organization's main office LAN.

### About the Site-To-Site VPN Administration Tool

Linking multiple remote LAN sites to a main LAN requires the use of a command-line utility installed on Mac OS X Server named `s2svpnadmin` (site-to-site VPN admin).

Using `s2svpnadmin` requires the use of and facility with Terminal, and the administrator must have access to root privileges through `sudo`. For more about `s2svpnadmin`, see the `s2svpnadmin` man page.

Linking multiple remote LAN sites to a main LAN can require the creation of a security certificate. The tool `s2svpnadmin` can create links using shared-secret authentication (both sites have a password in their configuration files) or certificate authentication. To use certificate authentication, you must create the certificate before running `s2svpnadmin`.

You can only make site-to-site VPN connections using L2TP/IPSec VPN connections. You cannot link two sites using PPTP and these instructions.

This example uses the following settings:

- **Desired VPN type:** L2TP
- **Authentication:** Using shared secret
- **Shared secret:** prDwkj49fd!254
- **Internet or public IP address of the VPN main LAN gateway ("Site 1"):** A.B.C.D
- **Internet or public IP address of the VPN remote LAN gateway ("Site 2"):** W.X.Y.Z
- **Private IP address of site 1:** 192.168.0.1
- **Private IP address of site 2:** 192.168.20.1
- **Private network IP address range and netmask for site 1:** 192.168.0.0–192.168.0.255 (also expressed as 192.168.0.0/16 or 192.168.0.0:255.255.0.0)
- **Private network IP address range and netmask for site 2:** 192.168.20.0–192.168.20.255 (also expressed as 192.168.20.0/24 or 192.168.0.0:255.255.0.0)
- **Organization's DNS IP address:** 192.168.0.2

The result of this configuration is an auxiliary, remote LAN, connected to a main LAN using L2TP.

### Step 1: Run `s2svpnadmin` on both site gateways

- 1 Open Terminal and start `s2svpnadmin` by entering:

```
$ sudo s2svpnadmin
```

- 2 Enter the relevant number for “Configure a new site-to-site server.”
- 3 Enter an identifying configuration name (no spaces permitted).  
For this example, you could enter “site\_1” on site 1’s gateway, and so on.
- 4 Enter the gateway’s public IP address.  
For this example, enter A.B.C.D on site 1’s gateway and W.X.Y.Z on site 2’s gateway.
- 5 Enter the other site’s public IP address.  
For this example, enter W.X.Y.Z on site 1’s gateway and A.B.C.D on site 2’s gateway.
- 6 Enter “s” for shared secret authentication, and enter the shared secret “prDwkj49fd!254”.  
If you are using certificate authentication, enter “c” and choose the installed certificate that you want to use.
- 7 Enter at least one addressing policy for the configuration.
- 8 Enter a local subnet network address (for example, 192.168.0.0 for site 1 and 192.168.20.0 for site 2).
- 9 For the address range, enter the prefix bits in CIDR notation.  
In this example, the CIDR notation for the subnet range is 192.168.2.0/24 for site 1, so you would enter 24.
- 10 Enter a remote subnet network address (for example, 192.168.20.0 for site 1 and 192.168.0.0 for site 2).
- 11 For the address range, enter the prefix bits in CIDR notation.  
In this example, the CIDR notation for the subnet range is 192.168.2.0/24 for site 1, so you would enter 24.
- 12 If you want to make more policies, indicate it now; otherwise, press Return.  
If you had more sites to connect or a more complex address setup (linking only parts of your main LAN and the remote LAN), you would make more policies for this configuration now.  
Repeat steps 7 through 12 for the new policies.
- 13 Press “y” to enable the site configuration.  
You can verify your settings by choosing to show the configuration details of the server and entering the configuration name (in this example, “site\_1”).
- 14 Exit `s2svpnadmin`.

## Step 2: Configure the firewall on both site gateways

- 1 Create an address group for each server with only the server's public IP address.

In this example, name the first group Site 1 and enter the public IP address of the server. Then name the second group Site 2 and enter the public IP address of the other server.

For more information, see "Creating an Address Group" on page 98.

- 2 Open the firewall to external VPN connections by enabling L2TP (port 1701) connections and IKE NAT Traversal (port 4500) in the "any" address group.

For more information, see "Configuring Services Settings" on page 94.

- 3 Create the following Advanced IP filter rules on both site gateways:

Filter Rule 1	Setting
Action:	Allow
Protocol:	UDP
Source Address:	Site 1
Destination Address:	Site 2
Interface:	Other; enter "isakmp"

Filter Rule 2	Setting
Action:	Allow
Protocol:	UDP
Source Address:	Site 2
Destination Address:	Site 1
Interface:	Other; enter "isakmp"

Filter Rule 3	Setting
Action:	Allow
Protocol:	Other; enter "esp"
Source Address:	Site 1
Destination Address:	Site 2

Filter Rule 4	Setting
Action:	Allow
Protocol:	Other; enter "esp"
Source Address:	Site 2
Destination Address:	Site 1

Filter Rule 5	Setting
Action:	Allow
Protocol:	Other; enter "ipencap"
Source Address:	Site 1
Destination Address:	Site 2

Filter Rule 6	Setting
Action:	Allow
Protocol:	Other; enter "ipencap"
Source Address:	Site 2
Destination Address:	Site 1

Filter Rule 7	Setting
Action:	Allow
Protocol:	Other; enter "gre"
Source Address:	Site 1
Destination Address:	Site 2

Filter Rule 8	Setting
Action:	Allow
Protocol:	Other; enter "gre"
Source Address:	Site 2
Destination Address:	Site 1

For more information about creating advanced rules, see "Configuring Advanced Firewall Rules" on page 100.

These rules permit the encrypted traffic to be passed to both hosts.

- 4 Save your changes.
- 5 Start or restart the firewall, as needed.

### Step 3: =Start VPN service on both site gateways

- 1 For both VPN gateways, open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.

The list of services appears.

- 3 Select VPN from the expanded Servers list.

If you used `s2svpnadmin` correctly, the Start button should be enabled and ready to use.

- 4 Click Start VPN.

You should now be able to access a computer on the remote LAN from the local LAN. To verify the link, use `ping` or some other means.

## Setting up a VPN Connection on a Client

You can use Network preferences to connect to a VPN using Point-to-Point Tunneling Protocol (PPTP) or Layer Two Tunneling Protocol (L2TP over IPSec) on an existing Internet connection. You can also create a VPN L2TP configuration file for client computers running Mac OS X v10.5 or later by using the Remote Access pane of Server Preferences. For more information, see Chapter 7, “Managing Users’ Computers,” in *Getting Started*.

To connect to a VPN, enter configuration settings into Network preferences.

### To set up a VPN connection:

- 1 Choose Apple > System Preferences, and then click Network.
- 2 Click Add (+) at the bottom of the network connection services list and then choose VPN from the pop-up menu.
- 3 Choose what kind of VPN connection you want to set up from the VPN Type pop-up menu, depending on the network you are connecting to, and give the VPN service a name.
- 4 Enter the server address and the account name for the VPN connection.
- 5 Click Authentication Settings and enter the user authentication information you were given by the network administrator.
- 6 After entering the user authentication information, click OK, and then click Connect.

Select “Show VPN status in menu bar” to use the VPN status icon to connect to the network and switch between VPN services.

To remove the VPN configuration, select the VPN network connection service in the list and click Delete (-).

For client computers running an earlier versions of Mac OS X or any version of Windows, they need the following VPN connection information:

- *VPN server or host*: your server’s DNS name or public IP address
- *VPN type*: L2TP over IPSec
- *Shared secret (key) for IPSec*: shown in the VPN pane of Server Preferences when you click Edit and select “Show shared secret”

- *Account name*: the short name of the user's account on your server
- *User password*: the password of the user's account on your server

Client computers behind a firewall that want a VPN connection must configure the firewall to allow traffic on UDP ports 500, 1701, and 4500; on TCP port 1723; and on IP protocol 50.

## Where to Find More Information About L2TP/IPSec

The Internet Engineering Task Force (IETF) is working on formal standards for L2TP/IPsec user authentication. For more information, see [www.ietf.org/ids.by.wg/ipsec.html](http://www.ietf.org/ids.by.wg/ipsec.html).

Request for Comments (RFC) documents provide an overview of a protocol or service and details about how the protocol should behave.

If you're a novice server administrator, you'll probably find some of the background information in an RFC helpful.

If you're an experienced server administrator, you can find all technical details about a protocol in its RFC document.

You can search for RFC documents by number at the website [www.ietf.org/rfc.html](http://www.ietf.org/rfc.html).

- For L2TP description, see RFC 2661.
- For PPTP description, see RFC 2637.
- For Kerberos version 5, see RFC 1510.

Use this chapter to learn how to configure and use Remote Authentication Dial In User Service (RADIUS) to keep your wireless network secure and to make sure it is used only by authorized users.

By configuring a RADIUS server with Open Directory you can secure your wireless environment from unauthorized users.

Wireless networking gives companies greater network flexibility, seamlessly connecting laptop users to the network and giving them the freedom to move within the company while staying connected to the network.

You use RADIUS to authorize Open Directory users and groups so they can access AirPort Base Stations on a network. By configuring RADIUS and Open Directory you can control who has access to your wireless network.

RADIUS works with Open Directory and Password Server to grant authorized users access to the network through an AirPort Base Station. When a user attempts to access an AirPort Base Station, AirPort communicates with the RADIUS server using Extensible Authentication Protocol (EAP) to authenticate and authorize the user.

Users are given access to the network if their user credentials are valid and they are authorized to use the AirPort Base Station. If a user is not authorized, he or she cannot access the network through the AirPort Base Station.

## RADIUS Setup Overview

If you're setting up your own RADIUS server, follow the steps in this section.

### Step 1: Turn RADIUS on

Before configuring service, turn on RADIUS. See "Turning RADIUS On" on page 169.

### Step 2: Add AirPort Base Stations to a RADIUS server

Decide which AirPort Base Stations you want to add to the RADIUS server. See "Adding AirPort Base Stations to a RADIUS Server" on page 171.

### Step 3: Remotely configure an AirPort Base Station

Use Server Admin to configure AirPort Base Stations. See “Remotely Configuring AirPort Base Stations” on page 172.

### Step 4: Configure RADIUS to use certificates

Use Server Admin to configure RADIUS to use certificates to trust Base Stations. See “Configuring RADIUS to Use Certificates” on page 172.

### Step 5: Start RADIUS

To start RADIUS, see “Starting or Stopping RADIUS Service” on page 174.

## Turning RADIUS On

Before you can configure RADIUS settings, you must turn on RADIUS service in Server Admin.

### To turn RADIUS on:

- 1 Open Server Admin and connect to the server.
- 2 Click Settings, then click Services.
- 3 Select the RADIUS checkbox.
- 4 Click Save.

## Setting Up RADIUS

This section describes how to add AirPort Base Stations to your RADIUS server, configure AirPort Base Stations remotely, and configure RADIUS to use certificates to trust AirPort Base Stations.

## Configuring RADIUS Using the Configuration Assistant

Mac OS X Server v10.6 offers a configuration assistant for RADIUS. The configuration assistant guides you through the RADIUS configuration process and lets you start RADIUS.

### To configure RADIUS using the configuration assistant:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select RADIUS.
- 4 Click Overview.
- 5 Click Configure RADIUS Service.
- 6 In the RADIUS Server Certificate pane, select one of the following:

- If you select “Choose an existing certificate,” choose the certificate you want to use from the pop-up menu and click Continue.
  - If you want to create a self-signed certificate, use Certificate Assistant. For more information, see *Advanced Server Administration*.
- 7 From the Available Base Stations list, select the Base Station you want and click Add. Enter the password of the Base Station in the Base Station Password field, then click Add.
- If you want to remove a Base Station from the Selected Base Stations list, select it and click Remove.
- 8 Click Continue.
- 9 In the RADIUS Allow Users pane, you can restrict user access:
- If you select the “Allow all users,” all users will have access to the Base Stations you selected.
  - If you select “Restrict to members of group,” only users of a group can access the Base Stations you selected.
- 10 Click Continue.
- 11 In the RADIUS setting confirmation pane, verify your settings are correct. You can also print or save you RADIUS configuration settings.
- 12 Click Confirm.

**From the command line:**

- To view RADIUS settings:

```
$ sudo radiusconfig -appleversion -getconfig -getconfigxml -nascout
-naslist -naslistxml -ver -help -q
```

- To configure RADIUS parameters:

```
$ sudo radiusconfig -setconfig key value [key value É]
```

Parameter	Description
<i>key</i>	The name of the key to configure in the radiusd.conf or eap.conf files.
<i>value</i>	The value of the key.

For information about RADIUS server settings, see “RADIUS Settings” on page 210. For information about `radiusconfig`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Adding AirPort Base Stations to a RADIUS Server

You use the Base Stations pane of RADIUS in Server Admin to add AirPort Base Stations that will use RADIUS service. You can add up to 64 Base Stations to RADIUS.

**To add AirPort Base Stations to a RADIUS server:**

- 1 On the management computer, open Server Admin.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 In the expanded Servers list, click RADIUS.
- 4 Click Base Stations.
- 5 Below the AirPort Base Stations list, click the Add (+) button.
- 6 Enter the following AirPort Base Station information:
  - **Name:** Specify the name of the AirPort Base Station.
  - **Type:** Specify the model of the AirPort Base Station.
  - **IP Address:** Specify the IP address of the AirPort Base Station.
  - **Shared Secret and Verify:** Specify a shared secret. The shared secret is not a password for authentication, nor does it generate encryption keys to establish secure tunnels between nodes. It is a token that the key management systems use to trust each other. You must enter the shared secret on the server as well as a client.
- 7 Click Add.

## Adding Bonjour Enabled AirPort Base Stations to a RADIUS Server

If your network has AirPort Base Stations that announce themselves using Bonjour, you can use the Base Stations pane of RADIUS in Server Admin to add them to your RADIUS server. You can add up to 64 Base Stations to RADIUS.

**To browse and add Bonjour enabled AirPort Base Stations to a RADIUS server:**

- 1 On the management computer, open Server Admin.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 In the expanded Servers list, click RADIUS.
- 4 Click Base Stations.
- 5 Below the AirPort Base Stations list, click Browse.

A list of AirPort Base Stations found through Bonjour appears. The list shows all AirPort Base Stations on the local subnet of the server and in all Wide-Area Bonjour domain known to the server. This includes search domains listed in Network Preferences that have AirPort Base Stations and AirPort Base Stations you added to a MobileMe account as a Back to My Mac (BTMM) enabled server.

- 6 From the list of AirPort Base Stations, choose an AirPort Base Station you want to add to your RADIUS server.
- 7 In the “Base station password” field, enter the password for the AirPort Base Station.
- 8 Click Add.

When the base station is added it is configured to use WPA2 Enterprise for client authentication through TTLS. It also sets a random shared secret for communication between the Base Station and RADIUS on the server.

The shared secret is not a password for authentication, nor does it generate encryption keys to establish secure tunnels between nodes. It is a token that the key management systems use to trust each other.

### Remotely Configuring AirPort Base Stations

You can remotely configure AirPort Base Stations to use a RADIUS server in Server Admin.

#### To remotely configure AirPort Base Stations to use a RADIUS server:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select RADIUS.
- 4 Click Base Stations.
- 5 In the AirPort Base Stations list, highlight the AirPort Base Station and then click Edit.  
If prompted for a password, enter the AirPort administrator password.
- 6 Click OK.

### Configuring RADIUS to Use Certificates

You can use Server Admin to configure RADIUS to use custom certificates. Using a certificate increases the security and manageability of AirPort Base Stations.

#### To use a custom certificate:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select RADIUS.
- 4 Click Settings.

- 5 From the RADIUS Certificate pop-up menu, choose a certificate.

If you don't have a certificate and want to create one, click Manage Certificates. For more information about creating certificates, see *Advanced Server Administration*.

- 6 Click Save.

#### From the command line:

- To configure RADIUS certificates:

```
$ sudo radiusconfig -installcerts private-key certificate [trusted-ca-list [yes | no [common-name]]]
```

Parameter	Description
<i>private-key</i>	The file path to the client's private key to use in the certificate.
<i>certificate</i>	The file path to the certificate.
<i>trusted-ca-list</i>	The file path to the trusted CA list.
<i>yes</i>	A request to check a certificate revocation list.
<i>no</i>	A request to not check a certificate revocation list.
<i>common-name</i>	The common name.

This command changes `eap.conf` to contain an active TLS section and configures the certificates. This command also replaces the random file and creates the dh file if absent.

For information about `radiusconfig`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Archiving RADIUS Service Logs

RADIUS service creates entries in the system log for error and alert messages. You can archive these log entries.

#### To archive logs:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select RADIUS.
- 4 Click Settings.
- 5 Select the "Archive radiusd log for the past \_\_\_ days" checkbox and enter the number of days you want to archive.
- 6 Click Save.

#### From the command line:

- To configure the rotation of RADIUS service logs:

```
$ sudo radiusconfig -rotatelog [-n file-count] base-file
```

- To configure the automatic rotation of RADIUS service logs:

```
$ sudo radiusconfig -autorotatelog [on | off] [-n file-count]
```

Parameter	Description
<i>file-count</i>	The number of log files to preserve.
<i>base-file</i>	The name of the log file.
on	Enables automatic log rotation.
off	Disables automatic log rotation.

For information about `radiusconfig`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

### Starting or Stopping RADIUS Service

You use Server Admin to start or stop RADIUS. When you stop RADIUS, make sure no users are connected to AirPort Base Stations your RADIUS server manages.

#### To start or stop RADIUS:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select RADIUS.
- 4 Click Start RADIUS or Stop RADIUS below the Servers list.

The service can take a few seconds to start or stop.

#### From the command line:

- To start the RADIUS server:

```
$ sudo radiusconfig -start
```

- To stop the RADIUS server:

```
$ sudo radiusconfig -stop
```

For information about `radiusconfig`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Managing RADIUS

This section describes tasks you might perform after you set up RADIUS on your server.

### Checking RADIUS Status

You can use Server Admin to check the status of RADIUS.

**To check RADIUS status:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select RADIUS.
- 4 Click Overview to see whether the service is running, the number of client base stations, and when it was started.

### Viewing RADIUS Logs

RADIUS creates entries in the system log for error and alert messages. You can filter the log to narrow the number of viewable log entries and make it easier to find the entry you want to see.

**To view logs:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select RADIUS.
- 4 Click Logs.
- 5 Choose a log to view (radiusconfig or radiusd).

### Editing RADIUS Access

You can restrict access to RADIUS by creating a group of users and adding them to the service access control list (SACL) of RADIUS.

**To edit RADIUS access:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select RADIUS.
- 4 Click Settings, then click Edit Allowed Users.
- 5 Select "For selected services below," then select RADIUS.
- 6 Click Services.

- 7 Select "Allow only users and groups below."
- 8 Click the Add (+) button.
- 9 From the Users & Groups window, drag users or groups to the "Allow only users and groups below" list.

If you don't see a recently created user, click the Refresh button (below the Servers list).

If you want to remove users from the "Allow only users and groups below" list, select the users or groups of users and click the Delete ( - ) button.

Only users in the list can use RADIUS service.

## Deleting AirPort Base Stations

You can use Server Admin to delete AirPort Base Stations from the RADIUS server.

When you delete AirPort Base Stations make sure the stations are disconnected from the network. Otherwise, unauthorized users might be able to access your network.

### To delete AirPort Base Stations:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select RADIUS.
- 4 Click Base Stations.
- 5 In the AirPort Base Station list, highlight a Base Station and click Remove.
- 6 Verify you want to remove the Base Station by clicking Remove again.

## Editing an AirPort Base Station Record

You can use Server Admin to edit an AirPort Base Station record on your RADIUS server.

### To edit an AirPort Base Station record:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select RADIUS.
- 4 Click Base Stations.
- 5 In the AirPort Base Station list, highlight the Base Station you want to modify and click the Edit button.
- 6 Modify the Base Station information and click Save.

## Saving an AirPort Base Station Internet Connect File

You can use Server Admin to save an AirPort Base Station internet connect file.

**To save an AirPort Base Station Internet connect file:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select RADIUS.
- 4 Click Base Stations.
- 5 In the AirPort Base Station list, highlight the base station.
- 6 Click Save Internet Connect File.
- 7 In the Save As field, enter the name.
- 8 From the Where pop-up menu, choose the location to save the file.
- 9 In the Wireless Network Name (SSID) field, enter the wireless network name.
- 10 Click Save.

Use this chapter to learn how to set up, configure, and manage Network Time Protocol (NTP) service for time synchronization on your network.

Using NTP service for time synchronization is important for reducing confusion that can be caused if time stamps are out of sync.

From shared file systems to billing services, correct timekeeping is a necessity. However, clocks on computers throughout a network can have widely different time stamps. NTP synchronizes the clocks in networked computers to a reference clock. NTP helps make sure that all computers on a network report the same time.

If an isolated network (or even a single computer) is unsynchronized, services that use time and date stamps (such as Mail service, or Web service with timed cookies) send wrong time and date stamps and are out of synchronization with other computers across the Internet.

For example, a mail message could arrive minutes or years before it was sent (according to the time stamp), and a reply to that message could come before the original was sent.

## How NTP Works

NTP uses Universal Time Coordinated (UTC) as its reference time. UTC is based on an atomic resonance, and clocks that run according to UTC are often referred to as atomic clocks.

On the Internet, authoritative NTP servers (known as *Stratum 1* servers) keep track of the current UTC time. Other subordinate servers (known as *Stratum 2 and 3* servers) regularly query the Stratum 1 servers and estimate the time taken to send and receive the query. They then factor this estimate with the query result to set the Stratum 2 or 3 servers' time. The estimates are correct to the nanosecond.

Your LAN can then query Stratum 3 servers for the time. An NTP client computer on your network then takes the UTC time reference and converts it using its own time zone setting to local time, and sets its internal clock accordingly.

## Using NTP on Your Network

Mac OS X Server can act as an NTP client, receiving authoritative time from an Internet time server, and as an authoritative time server for a network. Your local clients can query your server to set their clocks.

If you set your server to answer time queries, set it to also query an authoritative time server on the Internet.

## Setting Up NTP Service

If you run NTP service on your network, make sure your designated NTP server can access a higher-authority time server. Apple provides a Stratum 2 time server for customer use at [time.apple.com](http://time.apple.com).

Make sure your firewall permits NTP queries to an authoritative time server on UDP port 123, and that it also permits incoming queries from local clients on the same port. For more information, see Chapter 4, “Working with Firewall Service.”

### To set up NTP service:

- 1 Open Server Admin and connect to the server.
- 2 Click Settings, then click Date & Time.
- 3 Make sure your server is configured to “Set date & time automatically.”
- 4 From the pop-up menu, choose the server you want to act as a time server.
- 5 Click General.
- 6 Select the “Network Time Server (NTP)” checkbox.
- 7 Click Save.

## Configuring NTP Service on Clients

If you have a local time server, you can configure your clients to query your time server for the network date and time. By default, clients can query Apple’s time server.

Use the following instructions to set your clients to query your time server.

### To configure NTP on clients:

- 1 Open System Preferences.
- 2 Click Date & Time.

- 3 Select the “Set date & time automatically” checkbox.
- 4 Select and delete the text in the field rather than using the pop-up menu.
- 5 Enter the host name of your time server.

Your host name can be a domain name (such as `time.example.com`) or an IP address.

- 6 Close System Preferences.

## Where to Find More Information About NTP

The working group, documentation, and FAQ for NTP can be found at [www.ntp.org](http://www.ntp.org).

Listings of publicly accessible NTP servers and their use policies can be found at [support.ntp.org/bin/view/Servers/WebHome](http://support.ntp.org/bin/view/Servers/WebHome).

Request for Comments (RFC) documents provide an overview of a protocol or service and details about how the protocol should behave.

If you’re a novice server administrator, you’ll probably find some of the background information in an RFC helpful.

If you’re an experienced server administrator, you can find all technical details about a protocol in its RFC document.

You can search for RFC documents by number at [www.ietf.org/rfc.html](http://www.ietf.org/rfc.html).

The official specification of NTP version 3 is RFC 1305.

Use this chapter to set up and manage a Mobile Access server on your network.

A Mobile Access server provides a way through a corporate firewall for IMAP, SMTP, and for HTTP protocols such as Web service and CalDAV, without using VPN. Mobile Access service allows an administrator to enable secure and convenient access to Mail, Web, and iCal services in the Mac OS X Server environment by sending requests through a layer of increased security and control.

## About Mobile Access Server

The Mobile Access service runs on a server accessible from the public Internet, and provides access to services on one or more other servers (also called origin servers) residing on the private Intranet. The Mobile Access service can provide proxy access to Address Book, iCal, Mail and Web services hosted on other servers.

**Note:** Mobile Access does not provide proxy access to the Mac OS X v10.6 Wiki.

The Mobile Access service provides security and convenience. When properly configured, it is more secure than creating an opening through the firewall to the origin server, and it provides more granular control of access than a VPN connection.

It is also more convenient than a VPN connection. For example, when a user authenticates, the Mobile Access server checks the user's authorization and redirects the user to the origin server (the server that provides the service).

A proxy server has few services on the system and no direct access to sensitive data, making it less vulnerable to exploits. If a security breach occurs, it is limited when compared to a breach of a destination server.

By using a Mobile Access server you provide a single location where user access to services is controlled, unlike VPN which allows access to every machine and network service behind the firewall.

A Mobile Access server can limit which users can authenticate and which services each user can access.

Through the use of SSL a Mobile Access server hides sensitive data over the internet and can provide a checkpoint for extra security measures, including a more restrictive password policy, aggressive firewall rules, signed certificates, and application-layer content filtering.

## Using SSL with Mobile Access Server

When configuring your proxy server, you must use a certificate to ensure that your data transfers are encrypted using SSL. SSL uses a Public Key Infrastructure (PKI) to create and manage certificates used by SSL-enabled services.

There are two methods to use certificates for proxied services. The first is to have unique certificates for each proxied service. The second is to have a single wildcard certificate shared by all proxied services.

On the origin server you also have two methods for implementing certificates. The first method is to use the same certificate used for the proxied service on the proxy server. If the proxy server uses a wildcard certificate for all proxied services, you can also use the wildcard certificate on the origin server. The second method is to use a unique certificate for your origin server.

For more information about creating and using certificate, see *Advanced Server Administration*.

## About Proxied Authentication Mechanisms

When determining which types of authentication you should use for your Mobile Access server, make sure the origin server and the Mobile Access server use the same authentication mechanisms. Mobile Access server does not support Kerberos authentication.

When an origin server is proxied, it is limited to specific authentication mechanisms. For example, when Address Books and iCal are proxied, they only support Basic or Digest authentication over an SSL session.

For information about the authentication methods supported by Mail service when it's proxied, see "Configuring Mobile Access Service Mail Settings" on page 187. For information about the authentication methods supported by Web service when it's proxied, see "Configuring Mobile Access Service Web Settings" on page 188.

## About Split DNS

When you configure a typical Domain Name Server, you assign a domain name to an IP address. For example, `example.sampleserver.com` would have a record on the DNS server assigning it the IP address `72.113.112.97`. With a split DNS configuration, a public and private IP address are assigned to the same domain name.

The public IP address is used for the external network (Internet) and the private IP address is used on the internal network (intranet).

Your ISP must have a DNS record associating the public IP address with your domain name and your internal DNS server must have DNS record associating the private IP address with the same domain name. For example, `example.sampleserver.com` would have the public IP address `172.113.112.97` assigned to it on the ISP's DNS server and the private IP address `192.168.99.10` would be assigned to the same domain name on the internal DNS Server.

Users outside the internal network are directed to IP address `172.113.112.97` and users on the internal network are directed to IP address `192.168.99.10`.

With split DNS, bookmarks to the origin servers (the server providing the service) that the user creates on the internal network also function when the user is outside the network.

To configure split DNS, you must submit a DNS record request to your ISP indicating that you want to assign the public IP address of your proxy servers to your domain name. Then you must add a DNS record on your internal DNS server assigning the private IP address of the origin server to the domain name. For information about creating DNS records, see "Setting Up DNS Service" on page 56.

You must use split DNS to proxy Address Book, iCal, and Web servers with Mobile Access server. Mobile Access server is based on a reverse proxy server. It provides access from the Internet to an Intranet, which is different from a forward proxy that provides access from the Intranet to the Internet.

A Mobile Access server provides a layer of security by providing a strict granular control of access to your network. If a user authenticates with the Mobile Access server and has authorization to use a service it is attempting to access, the Mobile Access server directs the user to the origin server that also requires authentication.

## Mobile Access Service Configuration Overview

To configure Mobile Access service proxies, you must complete several steps. Not every step is necessary for every network environment.

The following section provides an overview of the configuration process.

### **Step 1: Decide which servers will use Mobile Access service**

You must determine which servers will use Mobile Access service.

### **Step 2: Obtain a certificate**

Purchase a certificate from a certificate authority (CA). This certificate is used by Mobile Access service to ensure secure communication.

### **Step 3: Turn Mobile Access service on**

Before configuring Mobile Access service, you must enable Mobile Access service for configuration. See “Turning Mobile Access Service On” on page 184.

### **Step 4: Configure Mobile Access service proxies**

Use the Mobile Access service settings to configure the proxies. See “Setting Up Mobile Access Service” on page 185.

### **Step 5: Grant access to Mobile Access proxies**

You assign users or groups access to Mobile Access service proxies. See “Granting Access to Mobile Access Service Proxies” on page 189.

### **Step 6: Start Mobile Access**

After you configure NAT, start Mobile Access service to make it available. See “Starting Mobile Access Service” on page 190.

## Turning Mobile Access Service On

Before you can configure Mobile Access service settings, you must turn on Mobile Access service in Server Admin.

### **To turn Mobile Access service on:**

- 1 Open Server Admin and connect to the server.
- 2 Click Settings.
- 3 Click Services.
- 4 Select the Mobile Access checkbox.
- 5 Click Save.

## Setting Up Mobile Access Service

Set up Mobile Access service by configuring the following settings in Server Admin:

- **Forward Address Book traffic to internal server.** Use to configure where address book requests are forwarded.
- **Forward iCal traffic to internal server.** Use to configure where iCal requests are forwarded.
- **Forward mail traffic to internal server.** Use to configure where mail requests are forwarded.
- **Forward web traffic to internal servers.** Use to configure where web requests are forwarded.

The following sections describe how to configure these settings and explain how to start Mobile Access service when you finish.

**Note:** The proxy server gracefully restarts when you save certain changes. If the changes require a full restart, you are prompted to approve the full restart.

### Configuring Mobile Access Service Address Book Settings

You use Server Admin to indicate the internal Address Book origin server, set the external and internal ports, and to configure the SSL settings for the Mobile Access server.

When configuring Mobile Access server to proxy Address Book, you must use basic or digest as the method of authentication. Kerberos authentication is not supported.

**To configure Mobile Access Service Address Book settings:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select Mobile Access.
- 4 Click Settings.
- 5 Select the “Forward Address Book traffic to internal server” checkbox.
- 6 In the “Forward Address Book traffic to internal server” field, enter the fully qualified host name of the Address Book server.  
This must be the fully qualified domain name of your internal Address Book server.
- 7 Click Advanced.
- 8 In the Incoming Port field, enter the incoming port number.  
This is the port number that the external request enters the Mobile Access server. The default port is 8843.
- 9 From the Certificate pop-up menu, choose your certificate.

For more information about obtaining signed certificates from a Certificate Authority, see *Advanced Server Administration*.

- 10 In the Address Book Host Port field, enter the port used by your internal Address Book server.

The default is 8554.

- 11 If your internal Address Book server uses SSL, select the Use SSL checkbox.
- 12 Click OK, then click Save.

## Configuring Mobile Access Service iCal Settings

You use Server Admin to indicate the internal iCal origin server, set the external and internal ports, and to configure the SSL settings for the Mobile Access server.

When configuring Mobile Access server to proxy iCal, you must use basic or digest as the method of authentication. Kerberos authentication is not supported.

### To configure Mobile Access service iCal settings:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select Mobile Access.
- 4 Click Settings.
- 5 Select the “Forward iCal traffic to internal server” checkbox.
- 6 In the “Forward iCal traffic to internal server” field, enter the fully qualified host name of the iCal server.

This is the fully qualified domain name of your internal iCal server.

- 7 Click Advanced.
- 8 In the Incoming Port field, enter the incoming port number.

This is the port number used by the external request to access the Mobile Access server. The default port is 8443.

- 9 From the Certificate pop-up menu, choose your certificate.

To create a self-signed certificate, click Manage Certificates from the Certificate pop-up menu. For more information about creating certificates, see *Advanced Server Administration*.

- 10 In the iCal Host Port field, enter the port used by your internal iCal server.

The default is 8443.

- 11 If your internal iCal server uses SSL, select the Use SSL checkbox.
- 12 Click OK, then click Save.

## Configuring Mobile Access Service Mail Settings

You use Server Admin to indicate the internal mail origin server, set the external and internal ports, and to configure the SSL settings for the Mobile Access server. When configuring your mail proxy, your Mobile Access server and origin mail server must have a unique DNS name. You cannot use the same DNS name for both servers.

When configuring Mobile Access server to proxy a mail service, SMTP and IMAP clients accessing the Mobile Access server must use PLAIN (or PLAIN Clear) clear text password authentication over an SSL session as the method of authentication. For example, in the Mail application settings the user must be SSL enabled, and Password, also referred to as PLAIN, must be selected as the method of authentication for SMTP and IMAP.

The table below shows the methods of authentication that are attempted and supported by the proxy when the Mobile Access server attempts to access the origin Mail server using SMTP or IMAP:

Mail Protocol	Authenticaiton Methods
SMTP	<ul style="list-style-type: none"><li>• None</li><li>• PLAIN</li><li>• LOGIN</li><li>• CRAM-MD5</li><li>• SSL (Using STARTTLS on configurable port 25)</li></ul>
IMAP	<ul style="list-style-type: none"><li>• CLEAR</li><li>• PLAIN</li><li>• LOGIN</li><li>• CRAM-MD5</li><li>• SSL (Configurable port 993)</li></ul>

### To configure Mobile Access service mail settings:

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select Mobile Access.
- 4 Click Settings.
- 5 Select the “Forward mail traffic” checkbox.
- 6 In the “Forward IMAP traffic to internal server” field, enter the fully qualified host name of your IMAP server.  
This is the fully qualified domain name of your internal IMAP server.
- 7 In the “Forward SMTP traffic to internal server” field, enter the fully qualified host name of your SMTP server.

This is the fully qualified domain name of your internal SMTP server.

8 Click Advanced.

9 In the Incoming IMAP Port field, enter the incoming port number.

This is the port number used by the external request to enter the Mobile Access server. The default port is 993.

10 From the IMAP Certificate pop-up menu, choose your certificate.

11 In the Incoming SMTP Port field, enter the incoming port number.

This is the port number used by the external request to access the Mobile Access server. The default port is 587.

12 From the SMTP Certificate pop-up menu, choose your certificate.

13 In the IMAP Host Port field, enter the port used by your internal IMAP server.

The default is 143.

14 If your internal IMAP server uses SSL, select the Use SSL checkbox.

15 In the SMTP Host Port field, enter the port used by your internal SMTP server.

The default is 25.

16 Click OK, then click Save.

## Configuring Mobile Access Service Web Settings

You use Server Admin to indicate the internal web origin server, set the external and internal ports, and to configure the SSL settings for the Mobile Access server.

When configuring Mobile Access server to proxy Web service, you must use basic, digest, or session-based as the method of authentication. Kerberos authentication is not supported.

### To configure Mobile Access service web settings:

1 Open Server Admin and connect to the server.

2 Click the triangle at the left of the server.

The list of services appears.

3 From the expanded Servers list, select Mobile Access.

4 Click Settings.

5 Select the “Forward web traffic to internal servers” checkbox.

6 Click the Add (+) button below the “Forward web traffic to internal servers” list.

7 Enter the fully qualified host name of your internal web server.

This is the fully qualified domain name of the internal web server. If more than one web server hosts your site, repeat step 6 to add web servers to the list.

- 8 Click OK, then click Save.

The web proxy of the Mobile Access server works with most web sites. Some web application and links might require more configuration to function.

Consider the following when setting up your web site or web application to be proxied:

- If your web application requires the addresses of the remote client, your application must obtain the client address through the X-Forwarded-For header.
- If possible, keep web links relative, because your scheme might be HTTP internally but will be HTTPS externally.
- If you have links to different hosts within your Intranet that are not proxied, the links do not function through the proxy.

Mac OS X Server v10.6 uses Name-based virtual hosts to simplify the configuration and management of the virtual host. Name-based virtual hosts and SSL are not compatible because SSL requires an IP-specific virtual host. If you use a virtual host, you can continue using SSL through one of the following methods:

- Use port-based virtual hosts (designating separate ports for each proxied web site).
- Use a single wild-card SSL certificate for proxied web sites.

## Granting Access to Mobile Access Service Proxies

Use Server Admin to grant access to Mobile Access service proxies.

**To grant access to Mobile Access service proxies:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select Mobile Access.
- 4 Click Access.
- 5 Select the level of access for the Mobile Access service proxies:
  - To permit everyone to access all proxies, select “Allow access to Address Book, iCal, Mail and Web proxies for everyone.”
  - To permit users or groups to access specific Mobile Access service proxies, select “Allow access to the selected proxies for these users and groups,” click the Add (+) button to open the Users & Groups windows, and then drag users and groups to the list.
- 6 In the list of users and groups, select which Mobile Access Server proxies the users or groups can access.
- 7 Click Save.

## Starting Mobile Access Service

Use Server Admin to start Mobile Access service.

**To start Mobile Access service:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select Mobile Access.
- 4 Click Start Mobile Access (below the Servers list).
- 5 Click Start Now.

The service can take a few seconds to start.

## Monitoring Mobile Access Service

This section describes typical tasks you might perform after you set up Mobile Access service on your server. Initial setup information appears in “Setting Up Mobile Access Service” on page 185.

You might want to monitor Mobile Access service status to:

- Troubleshoot name forwarding problems.
- Verify how often the Mobile Access Service is used.
- Look for unauthorized or malicious Mobile Access service use.

This section discusses the following common monitoring tasks for Mobile Access service.

## Checking Mobile Access Service Status

You can use Server Admin to check the status of Mobile Access service.

**To check Mobile Access service status:**

- 1 Open Server Admin and connect to the server.
- 2 Click the triangle at the left of the server.  
The list of services appears.
- 3 From the expanded Servers list, select Mobile Access.
- 4 Click Overview to see which proxy services are running and the number of requests made on each proxy service.

## Viewing Mobile Access Service Logs

Mobile Access service creates entries in the system log for error and alert messages. You can filter the log to narrow the type of log entries and make it easier to find those you want to see.

### To view Mobile Access service logs:

1 Open Server Admin and connect to the server.

2 Click the triangle at the left of the server.

The list of services appears.

3 From the expanded Servers list, select Mobile Access.

4 Click Log.

5 Select the log you want to see from the View pop-up menu.

You can view Mail access and error logs, HTTP error logs, Calendar access logs, AddressBook access logs, and Web access logs.

Use the Filter field above the log to search for specific entries.

## Stopping Mobile Access Service

Use Server Admin to stop Mobile Access service.

### To stop Mobile Access service:

1 Open Server Admin and connect to the server.

2 Click the triangle at the left of the server.

The list of services appears.

3 From the expanded Servers list, select Mobile Access.

4 Click Stop Mobile Access (below the Servers list).

5 Click Stop Now.

The service might take a few seconds to stop.

### From the command line:

- To stop the service:

```
$ sudo serveradmin stop proxy
```

For information about `serveradmin`, see its man page. For the basics of command-line tool usage, see *Introduction to Command-Line Administration*.

## Optional HTTP Configurable Items

Important aspects of Mobile Access service HTTP can be configured by editing the plist file at `/Library/Preferences/com.apple.securityproxy_http.plist` from the command line.

Configurable items include:

- Strings displayed in authentication pages
- The path to the logo image displayed in authentication pages
- The DNS domain used in authentication cookies
- The duration of authentication cookies

## Where to Find More Information

For more information about proxies, see the following:

- RFC2616 – Hypertext Transfer Protocol – HTTP/1.1 at [www.faqs.org/rfcs/rfc2616.html](http://www.faqs.org/rfcs/rfc2616.html).
- RFC3040 – Internet Web Replication and Caching Taxonomy at [www.faqs.org/rfcs/rfc3040.html](http://www.faqs.org/rfcs/rfc3040.html).
- RFC3143 Known HTTP Proxy/Caching Problems at [www.faqs.org/rfcs/rfc3143.html](http://www.faqs.org/rfcs/rfc3143.html).

Request for Comments (RFC) documents provide an overview of a protocol or service and explain how the protocol should behave.

If you're a novice server administrator, you'll probably find some of the background information in an RFC helpful.

If you're an experienced server administrator, you can find technical details about a protocol in its RFC document.

You can search for RFC documents by number at [www.ietf.org/rfc.html](http://www.ietf.org/rfc.html).

## Use this chapter to set up and manage a virtual local area network (VLAN).

Using a virtual local area network (VLAN) can prevent delays and data loss in environments with extremely high amounts of network traffic.

VLANs enable multiple computers on different physical LANs to communicate with each other as if they were on the same LAN.

Benefits include more efficient network bandwidth use and greater security, because broadcast or multicast traffic is only sent to computers on the common network segment.

Mac OS X Server provides 802.1q VLAN support on Ethernet ports and secondary PCI gigabit Ethernet cards available or included with Xserves and Mac Pro systems. VLAN support conforms to the IEEE standard 802.1q.

### What a VLAN Is

VLANs enable multiple computers on different physical LANs to communicate with each other as if they were on the same LAN.

Benefits include more efficient network bandwidth use and greater security, because broadcast or multicast traffic is only sent to computers on the common network segment.

Mac OS X Server provides 802.1q VLAN support on the Ethernet ports and secondary PCI gigabit Ethernet cards available or included with Xserves and Mac Pro systems. VLAN support conforms to the IEEE standard 802.1q.

## Setting Up Client Membership for a VLAN

To set up and manage VLANs, you use the VLAN area of the Network pane of System Preferences.

Be sure that ports used by non-VLAN devices (non-802.1q-compliant) are configured to transmit untagged frames. If a noncompliant Ethernet device receives a tagged frame, it cannot understand the VLAN tag and drops the frame.

**Note:** The VLAN area of the Network pane is visible only if your hardware, such as an Xserve G5 system, supports this feature.

### To set up a VLAN:

- 1 Log in to your server as an administrator.
- 2 Open the Network pane of System Preferences.
- 3 Click the Action pop-up menu and select Manage Virtual Interfaces.
- 4 Click the Add (+) button and select New VLAN.
- 5 In the VLAN Name field, enter a name for the VLAN.
- 6 In the Tag field, enter a tag (a number between 1 and 4094).

This VLAN tag designates the VLAN ID (VID). Each logical network has a unique VID. Interfaces configured with the same VID are on the same virtual network.

- 7 Select the Interface.
- 8 Click Create.
- 9 Click Done.

## Where to Find More Information About VLANs

See [www.ieee.org](http://www.ieee.org). The VLAN standard is defined by IEEE.

A reference document provides an overview of a protocol and includes details about how the protocol should behave.

If you're a novice server administrator, you'll probably find some of the background information in a reference document helpful.

If you're an experienced server administrator, you can find out technical details about a protocol in its reference document.

The reference document is available at [standards.ieee.org/getieee802/download/802.1Q-1998.pdf](http://standards.ieee.org/getieee802/download/802.1Q-1998.pdf).

Use this chapter to learn about Internet Protocol Version (IPv6) enabled services used by Mac OS X Server, guidelines for using the IPv6 addresses in those services, and IPv6 address types and notation.

IPv6 is the Internet's next generation protocol, designed to replace the current Internet protocol. The current Internet protocol, IP version 4 (IPv4, or just IP), has problems coping with the growth and popularity of the Internet. The main problems for IPv4 are:

- **Limited IP addressing:** IPv4 addresses use 32 bits, meaning there can be only 4,300,000,000 network addresses.
- **Increased routing and configuration burden:** The amount of network overhead, memory, and time required to route IPv4 information is rapidly increasing as more computers connect to the Internet at an increasing rate.
- **End-to-end communication that's routinely circumvented:** This problem is an outgrowth of the IPv4 addressing problem. As the number of computers increased and address shortages became more acute, another addressing and routing service was developed: Network Address Translation (NAT). NAT mediates and separates two network end points. However, this frustrates a number of network services and is limiting.

IPv6 fixes some of these problems and helps prevent others. It improves routing and network autoconfiguration, it increases the number of network addresses to over  $3 \times 10^{38}$ , and it eliminates the need for NAT.

IPv6 is expected to gradually replace IPv4 over a number of years, with the two coexisting during the transition.

## IPv6 Enabled Services

The following services in Mac OS X Server support IPv6 addressing:

- DNS (BIND)
- Firewall
- Mail (POP/IMAP/SMTP)
- Windows (SMB/CIFS)
- Web (Apache 2)

A number of command-line tools installed with Mac OS X Server support IPv6 (for example, ping6 and traceroute6).

## Support for IPv6 Addresses in Server Admin

The services above support IPv6 addresses, but not in Server Admin. IPv6 addresses fail if entered in IP address fields in Server Admin. You can configure IPv6 addresses for these services with command-line tools and by editing configuration files.

## IPv6 Addresses

IPv6 addresses are different from IPv4 addresses. There are changes in address notation, reserved addresses, the address model, and address types.

### IPv6 Notation

IPv4 addresses are 4 bytes long and are expressed in decimals, but IPv6 addresses are 16 bytes long and can be expressed a number of ways.

IPv6 addresses are generally written in the following form:

```
xxxx:xxxx:xxxx:xxxx:xxxx:xxxx:xxxx:xxxx
```

The address is split into pairs of bytes, separated by colons. Each byte is represented as a pair of hexadecimal numbers. The following address is in IPv6 format:

```
2001:DB8:0000:0000:0000:4AC8:C0A8:6420
```

This can be abbreviated as follows:

```
2001:DB8:0:0:0:4AC8:C0A8:6420
```

IPv6 addresses often contain bytes with a zero value, so a shorthand notation is available. The shorthand notation removes the zero values from the text representation and puts the colons next to each other, as follows:

2001:DB8::4AC8:C0A8:6420

Because many IPv6 addresses are extensions of IPv4 addresses, the right-most 4 bytes of an IPv6 address (the right-most 2-byte pairs) can be rewritten in IPv4 notation. Using this mixed notation, the above example can be expressed as:

2001:DB8::4AC8:192.168.100.32

## IPv6 Reserved Addresses

IPv6 reserves two addresses that network nodes can't use for communication purposes:

0:0:0:0:0:0:0 (unspecified address, internal to the protocol)

0:0:0:0:0:0:0:1 (loopback address, like 127.0.0.1 in IPv4)

## IPv6 Addressing Model

IPv6 addresses are assigned to interfaces (for example, your Ethernet card), and not nodes (for example, your computer).

A single interface can be assigned multiple IPv6 addresses. Also, a single IPv6 address can be assigned to several interfaces for load sharing.

Routers don't need an IPv6 address, eliminating the need to configure routers for point-to-point unicasts.

IPv6 doesn't use IPv4 address classes.

## IPv6 Address Types

IPv6 supports the following IP address types:

- Unicast (one-to-one communication)
- Multicast (one-to-many communication)
- Anycast

IPv6 does not support broadcast. Multicast is preferred for network broadcasts.

Otherwise, unicast and multicast in IPv6 are the same as in IPv4. Multicast addresses in IPv6 start with "FF" (255).

Anycast is a variation of multicast. Multicast delivers messages to all nodes in the multicast group, but anycast delivers messages to one node in the multicast group.

## Creating an IPv4 to IPv6 Gateway

Mac OS X Server includes an IPv4-to-IPv6 gateway that enables the deployment of IPv4-based server services in IPv6 networks to support the industry-wide IP transition.

You can configure the IPv4 to IPv6 gateway by setting up “6 to 4” in Network Preferences of your server.

**Important:** You must have a public IPv4 address (an IP address issued by your ISP) and you cannot be behind a gateway or NAT.

**To configure a 6 to 4 gateway:**

- 1 Open System Preferences and click Network.
- 2 Below the list of Interfaces, click the Add (+) button.
- 3 From the Interface pop-up menu, choose “6 to 4”.
- 4 In the Service name field, enter a unique name for the service, then click Create.
- 5 If you have a relay address, choose Manually from the Configure pop-up menu and enter it; otherwise, leave the Configure pop-up menu set to Automatically.
- 6 Click Apply.

## Where to Find More Information About IPv6

The working group for the IPv6 website is [www.ipv6.org](http://www.ipv6.org).

A group of IPv6 enthusiasts maintains a list of applications that support IPv6 at [www.ipv6forum.com](http://www.ipv6forum.com).

Request for Comments (RFC) documents provide an overview of a protocol or service and details about how the protocol should behave.

If you’re a novice server administrator, you’ll probably find some of the background information in an RFC helpful.

If you’re an experienced server administrator, you can find all technical details about a protocol in its RFC document.

You can search for RFC documents by number at [www.ietf.org/rfc.html](http://www.ietf.org/rfc.html).

There are over 29 IPv6 related RFC documents. A list can be found at [www.ipv6.org/specs.html](http://www.ipv6.org/specs.html).

# Command-Line Parameters for Network Services

Use this appendix to find descriptions of undocumented command parameters for specific network services.

Mac OS X Server administrators can use the command line to manage and maintain Mac OS X Server. This appendix further describes command-line parameters for services available with Mac OS X Server.

## DHCP Service Settings

To change settings for DHCP service, use the following parameters with the `serveradmin` tool.

Parameter (dhcp:)	Description
<code>descriptive_name</code>	A textual description of the subnet. Corresponds to the Subnet Name field in the General pane of the subnet settings in Server Admin.
<code>logging_level</code>	"LOW"   "MEDIUM"   "HIGH" Default = "MEDIUM" Corresponds to the Log Detail Level pop-up menu in the Logging pane of DHCP service settings in the Server Admin application.
<code>subnet_status</code>	Default = 0
<code>subnet_defaults:logVerbosity</code>	"LOW"   "MEDIUM"   "HIGH" Default = "MEDIUM"
<code>subnet_defaults:logVerbosityList:_array_index:n</code>	Available values for the logVerbosity setting. Default = "LOW," "MEDIUM," and "HIGH"
<code>subnet_defaults:WINS_node_type</code>	Default = "NOT_SET"

Parameter (dhcp:)	Description
subnet_defaults:routers	Default = empty_dictionary
subnet_defaults:selected_port_key	Default = en0
subnet_defaults:selected_port_key_list:_array_index:n	An array of available ports.
subnet_defaults:dhcp_domain_name	Default = The last portion of the server's host name, for example, example.com.
subnet_defaults:dhcp_domain_name_server:_array_index:n	Default = The DNS server addresses provided during server setup, as listed in the Network pane of the server's System Preferences.
subnets:_array_id:<subnetID>...	An array of settings for a subnet. <subnetID> is a unique identifier for each subnet.

## DHCP Subnet Settings Array

An array of settings listed in the following table is included in DHCP service settings for each subnet you define. You can add a subnet to the DHCP configuration by using `serveradmin` to add an array of these settings.

## About Subnet IDs

In an actual list of settings, <subnetID> is replaced with a unique ID code for the subnet. The IDs generated by the server are random numbers. The only requirement for the ID is that it must be unique among the subnets defined on the server.

Subnet Parameter	Description
subnets:_array_id:<subnetID>:	
dhcp_domain_name	The default domain for DNS searches, for example, example.com. Corresponds to the Default Domain field in the DNS pane of the subnet settings in Server Admin.
dhcp_domain_name_server:_array_index:n	The primary WINS server to be used by clients. Corresponds to the Name Servers field in the DNS pane of the subnet settings in Server Admin.
dhcp_enabled	Whether DHCP is enabled for this subnet. Corresponds to the Enable checkbox in the list of subnets in the Subnets pane of the DHCP settings in Server Admin.

Subnet Parameter <code>subnets:_array_ id:&lt;subnetID&gt;</code> :	Description
<code>dhcp_ldap_url:_array_index:n</code>	The URL of the LDAP folder to be used by clients. Corresponds to the Lease URL field in the LDAP pane of the subnet settings in Server Admin.
<code>dhcp_router</code>	The IPv4 address of the subnet's router. Corresponds to the Router field in the General pane of the subnet settings in Server Admin.
<code>lease_time_secs</code>	Lease time in seconds. Default = "3600" Corresponds to the Lease Time pop-up menu and field in the General pane of the subnet settings in Server Admin.
<code>net_address</code>	The IPv4 network address for the subnet.
<code>net_mask</code>	The subnet mask for the subnet. Corresponds to the Subnet Mask field in the General pane of the subnet settings in Server Admin.
<code>net_range_end</code>	The highest available IPv4 address for the subnet. Corresponds to the Ending IP Address field in the General pane of the subnet settings in Server Admin.
<code>net_range_start</code>	The lowest available IPv4 address for the subnet. Corresponds to the Starting IP Address field in the General pane of the subnet settings in Server Admin.
<code>selected_port_name</code>	The network port for the subnet. Corresponds to the Network Interface pop-up menu in the General pane of the subnet settings in Server Admin.
<code>WINS_NBDD_server</code>	The NetBIOS datagram distribution server IPv4 address. Corresponds to the NBDD Server field in the WINS pane of the subnet settings in Server Admin.

Subnet Parameter <code>subnets:_array_ id:&lt;subnetID&gt;</code>	Description
<code>WINS_node_type</code>	<p>The WINS node type. Can be set to:</p> <ul style="list-style-type: none"> <li>• "" (not set; default)</li> <li>• BROADCAST_B_NODE</li> <li>• PEER_P_NODE</li> <li>• MIXED_M_NODE</li> <li>• HYBRID-H-NODE</li> </ul> <p>Corresponds to the NBT Node Type field in the WINS pane of the subnet settings in Server Admin.</p>
<code>WINS_primary_server</code>	<p>The primary WINS server used by clients.</p> <p>Corresponds to the WINS/NBNS Primary Server field in the WINS pane of the subnet settings in Server Admin.</p>
<code>WINS_scope_id</code>	<p>A domain name such as <code>apple.com</code>.</p> <p>Default = ""</p> <p>Corresponds to the NetBIOS Scope ID field in the WINS pane of the subnet settings in Server Admin.</p>
<code>WINS_secondary_server</code>	<p>The secondary WINS server used by clients.</p> <p>Corresponds to the WINS/NBNS Secondary Server field in the WINS pane of the subnet settings in Server Admin.</p>

## About Static Map IDs

In a list of settings, `mapID` is replaced with a unique ID code for the map entry. The IDs generated by the server are random numbers. The only requirement for this ID is that it must be unique among the static maps defined on the server.

The `mapID` parameter is used by administrative software. It is ignored by the `bootpd` process that provides DHCP service. For more information about `bootpd`, see its man page.

**Note:** Include the special first setting (ending with `= create`). This is how you instruct `serveradmin` to create the settings array with the specified map ID. The static map for a host is identified with the host name, followed by a slash, followed by a unique ID.

To add maps to your DHCP configuration, use the `serveradmin settings` command.

The following is the syntax for creating a static map:

```
$ sudo serveradmin settings
dhcp:static_maps:_array_id:host name:mapID:static map parameter
```

## Viewing the Location of the DHCP Service Log

To view the location of the DHCP service log, use the following command with the `serveradmin` tool.

Command( <code>dhcp:command=</code> )	Description
<code>getLogPaths</code>	Display the location of the DHCP service log.

Value	Description
<code>system-log</code>	The location of the DHCP service log. Default = <code>/var/logs/system.log</code>

To view the log path:

```
$ sudo serveradmin command dhcp:command = getLogPaths
dhcp:systemLog = system-log
```

## DNS serveradmin Commands

Use the following commands with the `serveradmin` tool to obtain information about DNS service.

Command ( <code>dns:command=</code> )	Description
<code>getLogPaths</code>	Find the location of the DNS service log.
<code>getStatistics</code>	Retrieve DNS service statistics.

## Firewall Service Settings

To change settings for the `ipfilter` service, use the following parameters with the `serveradmin` tool.

Parameter ( <code>ipfilter:</code> )	Description
<code>ipAddressGroupsWithRules:_array_ id:&lt;group&gt;...</code>	An array of settings describing the services allowed for specific IP address groups.
<code>rules:_array_id:&lt;rule&gt;:...</code>	Arrays of rule settings, one array per defined rule.
<code>logAllDenied</code>	A parameter that specifies whether to log all denials. Default = <code>no</code>

Parameter (ipfilter:)	Description
ipAddressGroups:_array_id:n:address	The address of a defined IP address group, the first element of an array that defines an IP address group.
ipAddressGroups:_array_id:n:name	The name of a defined IP address group, the second element of an array that defines an IP address group.
logAllAllowed	Whether to log access allowed by rules. Default = no

## Firewall serveradmin Commands

To manage Firewall service, use the following commands with the `serveradmin` tool.

Command(ipfilter:command=)	Description
getLogPaths	Find the location of the log used by the service. Default = <code>/var/log/system.log</code>
getStandardServices	Retrieve a list of standard services as they appear on the General pane of Firewall service settings in Server Admin.
writeSettings	Equivalent to the standard <code>serveradmin settings</code> command, but also returns a setting indicating whether the service must be restarted.

## Using ipfilter Groups with the Rules Array

An array of the following settings is included in the `ipfilter` settings for each defined IP address group.

These arrays aren't part of a standard `ipfw` configuration. They are created in Server Admin to implement the IP address groups in the General pane of Firewall service settings. In an actual list, `<group>` is replaced with an IP address group.

Parameter (ipfilter:)	Description
ipAddressGroupsWithRules:_array_id:<group>:rules	An array of rules for the group.
ipAddressGroupsWithRules:_array_id:<group>:addresses	The group's address.
ipAddressGroupsWithRules:_array_id:<group>:name	The group's name.
ipAddressGroupsWithRules:_array_id:<group>:readOnly	Whether the group is set for read-only.

## ipfilter Rules Array

An array of the following settings is included in the `ipfilter` settings for each defined firewall rule. In an actual list, `<rule>` is replaced with a rule number. You can add a rule by using `serveradmin` to create an array for firewall settings.

Parameter ( <code>ipfilter:</code> )	Description
<code>rules:_array_id:&lt;rule&gt;:source</code>	The source of traffic governed by the rule.
<code>rules:_array_id:&lt;rule&gt;:protocol</code>	The protocol for traffic governed by the rule.
<code>rules:_array_id:&lt;rule&gt;:destination</code>	The destination of traffic governed by the rule.
<code>rules:_array_id:&lt;rule&gt;:action</code>	The action to be taken.
<code>rules:_array_id:&lt;rule&gt;:enabled</code>	Whether the rule is enabled.
<code>rules:_array_id:&lt;rule&gt;:log</code>	Whether activation of the rule is logged.
<code>rules:_array_id:&lt;rule&gt;:readOnly</code>	Whether read-only is set.
<code>rules:_array_id:&lt;rule&gt;:source-port</code>	The source port of traffic governed by the rule.

## NAT Service Settings

To change settings for NAT service, use the following parameters with the `serveradmin` tool.

Parameter ( <code>nat:</code> )	Description
<code>deny_incoming</code>	yes   no Default = no
<code>log_denied</code>	yes   no Default = no
<code>clamp_mss</code>	yes   no Default = yes
<code>reverse</code>	yes   no Default = no
<code>log</code>	yes   no Default = yes
<code>proxy_only</code>	yes   no Default = no

Parameter (nat:)	Description
dynamic	yes no Default = yes
use_sockets	yes no Default = yes
interface	The network port. Default = "en0"
unregistered_only	yes no Default = no
same_ports	yes no Default = yes

## NAT serveradmin Commands

To manage NAT service, use the following commands with the `serveradmin` tool.

Command (nat:command=)	Description
<code>getLogPaths</code>	Find the location of the log used by NAT service.
<code>updateNATRuleInIpfw</code>	Update the firewall rules defined in the <code>ipfilter</code> service to reflect changes in NAT settings.
<code>writeSettings</code>	Equivalent to the standard <code>serveradmin settings</code> command, but also returns a setting indicating whether the service must be restarted.

## VPN Service Settings

To change settings for VPN service, use the following parameters with the `serveradmin` tool.

Parameter (vpn:Servers:)	Description
com.<name>.ppp.l2tp: DNS:OfferedSearchDomains	Default = <code>_empty_array</code>
com.<name>.ppp.pptp: DNS:OfferedSearchDomains	Default = <code>_empty_array</code>
com.<name>.ppp.l2tp: DNS:OfferedServerAddresses	Default = <code>_empty_array</code>

Parameter (vpn:Servers:)	Description
com.<name>.ppp.pptp: DNS:OfferedServerAddresses	Default = <code>_empty_array</code>
com.<name>.ppp.l2tp: Interface:SubType	Default = <code>"L2TP"</code>
com.<name>.ppp.pptp: Interface:SubType	Default = <code>"PPTP"</code>
com.<name>.ppp.l2tp: Interface:Type	Default = <code>"PPP"</code>
com.<name>.ppp.pptp: Interface:Type	Default = <code>"PPP"</code>
com.<name>.ppp.l2tp: IPSec:AuthenticationMethod	Default = <code>"SharedSecret"</code>
com.<name>.ppp.l2tp: IPSec:IdentifierVerification	Default = <code>"None"</code>
com.<name>.ppp.l2tp: IPSec:IPSecSharedSecretEncryption	Default = <code>"Keychain"</code>
com.<name>.ppp.l2tp: IPSec:LocalCertificate	Default = <code>" "</code>
com.<name>.ppp.l2tp: IPSec:LocalIdentifier	Default = <code>" "</code>
com.<name>.ppp.l2tp: IPSec:RemoteIdentifier	Default = <code>" "</code>
com.<name>.ppp.l2tp: IPSec:SharedSecret	Default = <code>"com.apple.ppp.l2tp"</code>
com.<name>.ppp.l2tp: IPv4:ConfigMethod	Default = <code>"Manual"</code>
com.<name>.ppp.pptp: IPv4:ConfigMethod	Default = <code>"Manual"</code>
com.<name>.ppp.l2tp: IPv4:DestAddressRanges	Default = <code>_empty_array</code>

Parameter (vpn:Servers:)	Description
com.<name>.ppp.pptp: IPv4:DestAddressRanges	Default = <code>_empty_array</code>
com.<name>.ppp.l2tp: IPv4:OfferedRouteAddresses	Default = <code>_empty_array</code>
com.<name>.ppp.pptp: IPv4:OfferedRouteAddresses	Default = <code>_empty_array</code>
com.<name>.ppp.l2tp: IPv4:OfferedRouteMasks	Default = <code>_empty_array</code>
com.<name>.ppp.pptp: IPv4:OfferedRouteMasks	Default = <code>_empty_array</code>
com.<name>.ppp.l2tp: IPv4:OfferedRouteTypes	Default = <code>_empty_array</code>
com.<name>.ppp.pptp: IPv4:OfferedRouteTypes	Default = <code>_empty_array</code>
com.<name>.ppp.l2tp: L2TP:Transport	Default = <code>"IPSec"</code>
com.<name>.ppp.l2tp: PPP:ACSPEnabled	Default = <code>1</code>
com.<name>.ppp.pptp: PPP:ACSPEnabled	Default = <code>1</code>
com.<name>.ppp.l2tp: PPP:AuthenticatorACLPlugins	Default = <code>"DSACL"</code>
com.<name>.ppp.pptp: PPP:AuthenticatorACLPlugins	Default = <code>"DSACL"</code>
com.<name>.ppp.l2tp: PPP:AuthenticatorEAPPlugins	Default = <code>"EAP-KRB"</code>
com.<name>.ppp.pptp: PPP:AuthenticatorEAPPlugins	Default = <code>"EAP-RSA"</code>
com.<name>.ppp.l2tp: PPP:AuthenticatorPlugins: <code>_array_</code> <code>index:n</code>	Default = <code>"DSAuth"</code>
com.<name>.ppp.pptp: PPP:AuthenticatorPlugins: <code>_array_</code> <code>index:n</code>	Default = <code>"DSAuth"</code>

Parameter (vpn:Servers:)	Description
com.<name>.ppp.l2tp: PPP:AuthenticatorProtocol:_array_ index:n	Default = "MSCHAP2"
com.<name>.ppp.pptp: PPP:AuthenticatorProtocol:_array_ index:n	Default = "MSCHAP2"
com.<name>.ppp.pptp: PPP:CCPEEnabled	Default = 1
com.<name>.ppp.pptp: PPP:CCPProtocols:_array_index:n	Default = "MPPE"
com.<name>.ppp.l2tp: PPP:IPCPCompressionVJ	Default = 0
com.<name>.ppp.pptp: PPP:IPCPCompressionVJ	Default = 0
com.<name>.ppp.l2tp: PPP:LCPEchoEnabled	Default = 1
com.<name>.ppp.pptp: PPP:LCPEchoEnabled	Default = 1
com.<name>.ppp.l2tp: PPP:LCPEchoFailure	Default = 5
com.<name>.ppp.pptp: PPP:LCPEchoFailure	Default = 5
com.<name>.ppp.l2tp: PPP:LCPEchoInterval	Default = 60
com.<name>.ppp.pptp: PPP:LCPEchoInterval	Default = 60
com.<name>.ppp.l2tp: PPP:LogFile	Default = "/var/log/ppp/vpnd.log"

Parameter (vpn:Servers:)	Description
com.<name>.ppp.pptp: PPP:LogFile	Default = "/var/log/ppp/vpnd.log"
com.<name>.ppp.pptp: PPP:MPPEKeySize40	Default = 0
com.<name>.ppp.pptp: PPP:MPPEKeySize128	Default = 1
com.<name>.ppp.l2tp: PPP:VerboseLogging	Default = 1
com.<name>.ppp.pptp: PPP:VerboseLogging	Default = 1
com.<name>.ppp.l2tp: Server:LogFile	Default = "/var/log/ppp/vpnd.log"
com.<name>.ppp.pptp: Server:LogFile	Default = "/var/log/ppp/vpnd.log"
com.<name>.ppp.l2tp: Server:MaximumSessions	Default = 128
com.<name>.ppp.pptp: Server:MaximumSessions	Default = 128
com.<name>.ppp.l2tp: Server:VerboseLogging	Default = 1
com.<name>.ppp.pptp: Server:VerboseLogging	Default = 1

## VPN serveradmin Commands

To manage VPN service, use the following commands with the `serveradmin` tool.

Command(vpn:command=)	Description
<code>getLogPaths</code>	Find the location of the VPN service log.
<code>writeSettings</code>	Equivalent to the standard <code>serveradmin settings</code> command but also returns a setting indicating whether the service must be restarted.

## RADIUS Settings

To change settings for RADIUS, use the following parameters with the `radiusconfig` tool.

Command Option	Description
<code>-appleversion</code>	Displays the version of the tool, including the build version.
<code>-getconfig</code>	Displays configuration data stored in the <code>radiusd.conf</code> and <code>eap.conf</code> files in an abbreviated, user-friendly format.
<code>-getconfigxml</code>	Displays configuration data stored in the <code>radiusd.conf</code> and <code>eap.conf</code> files in xml plist format.
<code>-nascout</code>	Displays the number of RADIUS clients.
<code>-naslist</code>	Displays the list of RADIUS clients formatted for the <code>clients.conf</code> file.
<code>-naslistxml</code>	Displays the list of RADIUS clients in xml plist format.
<code>-ver</code>	Displays a specific build version.
<code>-help</code>	Displays usage information.
<code>-q</code>	Suppresses prompts.

## Transport Level Security

You can enable or disable Transport Level Security (TLS) by modifying the TLS section of the `eap.conf` file.

### Enabling and disabling TLS

- To enable TLS:
 

```
$ sudo radiusconfig -enable-tls
```
- To disable TLS:
 

```
$ sudo radiusconfig -disable-tls
```

## Radius Clients

Use the `radiusconfig` tool to add, import, remove, and configure RADIUS clients.

### Managing Radius Clients

- To add Radius clients:
 

```
$ sudo radiusconfig -addclient nas-name shortname [type]
```
- To import Radius clients:
 

```
$ sudo radiusconfig -importclients xml-plist-file
```
- To remove Radius clients:
 

```
$ sudo radiusconfig -removeclient nas-name [nas-name ...]
```
- To assign an access control group to a client of the RADIUS service:
 

```
$ sudo radiusconfig -setgroup nas-name group-name
```

Parameter	Description
<i>nas-name</i>	The name of the client.
<i>shortname</i>	The shortname of the client.
<i>type</i>	(Optional) The type of the client.
<i>xml-plist-file</i>	The name of the file, including the path, to import clients from.
<i>group-name</i>	The name of the access control group.

## Enabling PPP Dial-In Service

To set up Point-to-Point Protocol (PPP) Dial-In service, use the `pppd` daemon. For more information, see the `pppd` man page.

The “Examples” section of the man page shows an example of setting up PPP Dial-In service.

## Restoring the Default Configuration for Server Services

When you use applications such as Server Admin to configure a Mac OS X Server service, your settings are stored in places such as a configuration file (.conf), a preference list (.plist), an XML file, or the local directory database.

In some cases, you might want to reset a service to its default settings, which you can do by renaming or deleting a service’s configuration file. Mac OS X Server then creates a default copy of the file.

### To restore NAT service to its default:

- Rename or delete the `natd.plist` file in the `/etc/nat/` folder.

### To restore Firewall service to its default:

- Rename or delete the `ip_address_groups.plist`, `standard_services.plist`, and `ipfw.conf` files in the `/etc/ipfilter/` folder.

### To restore DHCP service to its default:

- 1 Remove the subnet configuration from the `/config/dhcp/` folder in the local directory database by using the `dscl` tool:

```
$ sudo dscl . -delete /config/dhcp
```

- 2 Remove the static Ethernet/IP address static maps from the `/machines/` folder in the local directory database.

The easiest way to do this is to delete the folder:

```
$ sudo dscl . -delete /machines
```

- 3 Recreate the two default records:

```
$ sudo dscl . -create /machines/localhost
$ sudo dscl . -append /machines/localhost ip_address 127.0.0.1
$ sudo dscl . -append /machines/localhost serves ./local
$ sudo dscl . -create /machines/broadcasthost
$ sudo dscl . -append /machines/broadcasthost ip_address 255.255.255.255
$ sudo dscl . -append /machines/broadcasthost serves ../network
```

#### To restore QTSS Publisher service to its default:

- Rename or delete these files:
  - /Library/Application Support/Apple/QTSS Publisher/Links.plist
  - /Library/Application Support/Apple/QTSS Publisher/Poster Images.plist
  - /Library/Caches/com.apple.qtsspublisher.plist

The libraries and templates are in the /Library/Application Support/Apple/QTSS Publisher/\* folder. The content varies, based on what's been uploaded:

#### To restore QTSS service to its default:

- Rename or delete these files:
  - /Library/QuickTimeStreaming/Config/streamingserver.xml
  - /Library/QuickTimeStreaming/Config/relayconfig.xml

#### To delete QTSS qtusers and qtgroups:

- You can also rename or delete the qtusers and qtgroups files, which should then be recreated using `qtpasswd`.
  - /Library/QuickTimeStreaming/Config/qtusers
  - /Library/QuickTimeStreaming/Config/qtgroups

#### To restore DNS service to its default:

- 1 From the /etc/named.conf/var/named/\* folder, remove the files for each forward zone, named similar to my.domain.com.zone.
- 2 From the /etc/named.conf/var/named/\* folder, remove the separate files for each reverse zone, named similar to db.10.1.0.
- 3 Do not remove the localhost.zone, named.ca, or named.local files.

#### To restore VPN service to its default:

- Rename the com.apple.RemoteAccessServers.plist file in the /Library/Preferences/SystemConfiguration/ folder.

#### To restore SERVERMGR\_MAIL service to its default:

- Rename these files:
  - /etc/MailServicesOther.plist
  - /var/mailman/data/listinfo.plist

**A**

- access
  - ACLs 153
  - Firewall service 109, 110, 112
  - LDAP 36, 46, 141, 155
  - RADIUS 175
  - VPN 153, 161
  - web service 109, 110
  - wireless users 168
- ACLs (access control lists) 153
  - See also* access
- adaptive firewall 104
- Address Book 185
- addresses. *See* IP addresses
- AirPort Base Station
  - DHCP 28
  - Internet connection 19
  - RADIUS 168, 169, 171, 172, 175, 176, 177
- aliases
  - email 53
  - zone record 71
- antivirus tools. *See* virus screening
- Apple file server 112
- Apple Filing Protocol service. *See* AFP
- authentication
  - EAP 168
  - Kerberos 140, 141
  - SecurID 156
  - VPN 140, 141
  - See also* RADIUS

**B**

- backups, DNS upgrade 56
- BIND (Berkeley Internet Name Domain) 50, 51, 54, 67, 70, 76
- Bonjour browsing service 52, 59
- BootP (Bootstrap Protocol) 28
- bootpd daemon 28
- Bootstrap Protocol. *See* BootP
- browsers, network 52, 59

**C**

- Canonical Name. *See* CNAME

- certificates 140, 141, 162, 172
  - CIDR (Classless InterDomain Routing) notation 87
  - clients
    - DHCP list of 42
    - home-to-network connections 159
    - IP addresses for 47, 48
    - NTP configuration 179
    - RADIUS 211
    - VPN 141, 149, 159, 161, 166
    - wireless 19, 21, 175, 177
    - See also* users
  - CNAME (Canonical Name) 51
  - coffee shop configuration 45
  - command-line tools
    - DHCP 46, 199
    - DNS 203
    - Firewall service 95, 97, 101, 106, 107, 203
    - IP forwarding 85, 106
    - IPv6 support 196, 197
    - NAT 126, 131, 132, 205
    - RADIUS 170, 173, 174, 210
    - sudo 127
    - sysctl 85
    - VPN 144, 146, 150, 151, 157, 158, 162, 206
    - See also* serveradmin tool
  - configuration
    - Firewall service 91, 93, 94, 96, 100, 102, 103, 104, 105
    - Mac OS X Server file changes 54, 57
    - NAT 79, 124, 126, 128, 130, 133, 135
    - NTP clients 179
    - RADIUS 168, 169, 171, 172, 173
    - restoring service defaults 212
    - VPN 141, 142, 143, 146, 151, 155, 156
    - workgroups 43
    - See also* DHCP, DNS
- D**
- denial of service attack. *See* DoS attack
  - denied packets 108
  - DHCP (Dynamic Host Configuration Protocol)
    - service
    - client list 42

- configuration examples 43, 44, 45
  - default configuration 212
  - DNS server setting 35
  - Internet sharing 16
  - introduction 25
  - IP addresses 35, 39, 40, 48
  - LDAP options 36, 46
  - lease times 27, 35
  - logs 31, 42, 203
  - management of 32, 41
  - NAT 43
  - server interactions 28
  - server location 28
  - settings 199
  - setup 26, 27, 28, 29
  - starting 29, 32
  - static address maps 39, 40, 202
  - status checking 41
  - stopping 32
  - subnets 29, 33, 34, 35, 47, 200
  - VPN 142
  - WINS options 37
  - dial-in service, PPP 212
  - directories. *See* domains, directory
  - directory services, Open Directory 168
  - DNS (Domain Name System) service
    - backups for upgrades 56
    - BIND 50, 51, 54, 70, 76
    - Bonjour 52, 59
    - default configuration 213
    - DHCP subnet options 35
    - email aliases 53
    - Internet sharing 17
    - introduction 49
    - IP addresses 49, 53, 75
    - load distribution 80
    - logs 61, 63, 64
    - machine records 51
    - mail service 77, 78
    - management of 62
    - multiple domain hosting 81
    - multiple service hosting 81
    - NAT gateway 79
    - recursion 61, 66, 76
    - securing server 74, 75, 76
    - settings 60, 203
    - setup 52, 53, 54
    - starting 56, 62
    - statistics 64
    - status checking 62
    - stopping 65
    - virtual server setup 135
    - See also* zones, DNS
  - documentation 13, 14
  - domain name registration 53
  - Domain Name System. *See* DNS
  - domains, directory, LDAP 36, 46, 141, 155
  - DoS attack (denial of service) 76, 112
  - dscl tool 46
  - Dynamic Host Configuration Protocol. *See* DHCP
  - dynamic IP addresses 25, 27
- ## E
- EAP (Extensible Authentication Protocol) 168
  - email aliases, DNS setup 53
  - encryption, VPN protocols 140
  - error messages. *See* troubleshooting
  - Ethernet ID 39
  - Ethernet, VLAN connections 193
  - Extensible Authentication Protocol. *See* EAP
- ## F
- file sharing, P2P 113
  - filters, IP address 109
  - Firewall service
    - access control 109, 110, 112
    - adaptive firewall 104
    - address groups 93, 98, 99
    - advanced rules setup 100, 102, 103, 104, 105
    - best practices 85
    - changing settings 95
    - configuration file 102
    - default configuration 212
    - denied packets 108
    - disabling 97
    - DoS attack prevention 112
    - filtered packets 109
    - game usage control 114
    - Internet sharing 16
    - introduction 83
    - junk mail blocking 111
    - logs 96, 107, 108, 109, 110
    - management of 97, 105
    - NAT 109, 124
    - P2P file sharing 113
    - ports 84, 114
    - resetting server 105
    - rules overview 84, 86, 87, 89, 90
    - settings 93, 94, 95, 96, 99, 100, 203, 204, 205
    - setup overview 91
    - starting 85, 92, 96
    - status checking 105
    - stealth mode 104
    - stopping 97
    - troubleshooting rules 103
    - viewing active rules 106
    - virus management 114
    - VPN 142
  - firewalls 104, 136, 153, 161
    - See also* Firewall service
  - forward zone, DNS 50, 68

## G

gaming 114, 135  
Gateway Setup Assistant 16, 17, 18  
gateways, networking 18, 19, 21, 131, 198  
    *See also* NAT  
groups, VPN access 153

## H

help, using 12  
HINFO (Hardware Info) record 51  
home-to-network VPN connections 159

## I

IANA (Internet Assigned Numbers Authority) 52, 53  
iCal service 186  
importing, zone files 70  
inetd daemon 23  
Internet Assigned Numbers Authority. *See* IANA  
Internet Protocol. *See* IP addresses  
Internet service provider. *See* ISP  
Internet sharing  
    access control 109, 110  
    AirPort wireless clients 19, 21, 175, 177  
    Gateway Setup Assistant 16, 17  
    IPv6 195, 196  
    multiple domains 81  
    NAT 124  
    single IP address method 81  
    wired LAN connection 18, 19, 80  
    WLAN connection 21, 23  
intranets 43  
IP addresses  
    access control for VPN 153  
    assigning 28  
    Bonjour 52  
    BootP 28  
    client 47, 48  
    components of 87  
    DHCP setup 35, 39, 40  
    DNS service 49, 53, 75  
    dynamic 25, 27  
    Firewall service 87  
    groups 93, 98, 99  
    Internet sharing 80, 81  
    IPv6 protocol 195, 196, 197, 198  
    lease times 27, 35  
    multiple 90  
    NAT 79, 133  
    port forwarding 127, 128, 130  
    ranges of 87  
    recursion 66  
    round robin 80  
    static 25, 27, 39, 40, 48  
    VPN 27, 142  
    wildcards in 87

IP forwarding 85, 106  
IP masquerading. *See* NAT  
IPFilter service. *See* Firewall service  
ipfw tool 85, 105, 106  
ipfw.conf file 102  
IPSec (IP security) 140, 143, 162  
IPv6 protocol 90, 195, 196, 197, 198  
ISP (Internet service provider) 49, 53, 139

## J

junk mail screening 111

## K

Kerberos 140, 141

## L

L2TP/IPSec (Layer Two Tunneling Protocol, Secure Internet Protocol) 140, 141, 143, 162  
LANs (local area networks) 18, 19, 139, 162, 194  
    *See also* NAT  
Layer Two Tunneling Protocol, Secure Internet protocol (L2TP/IPSec). *See* L2TP/IPSec  
LDAP (Lightweight Directory Access Protocol) service 36, 46, 141, 155  
lease times, DHCP 27, 35  
link-local addressing 52  
load distribution 80  
local area networks. *See* LANs  
logs  
    DHCP 31, 42, 203  
    DNS 61, 63, 64  
    Firewall service 96, 107, 108, 109, 110  
    Mobile Access service 191  
    NAT service 132  
    RADIUS 173, 175  
    VPN 150, 158

## M

MAC address 39  
Mac OS X Server, configuration file changes 54, 57  
machine records 51, 71  
mail exchanger. *See* MX  
mail service  
    aliases, email 53  
    default configuration 213  
    DNS 77, 78  
    junk mail screening 111  
    Mobile Access 187  
    virus management 114  
Mobile Access service  
    introduction 181  
    logs 191  
    monitoring 190  
    setup 184, 185, 186, 187, 188, 189  
    starting 190

- status checking 190
- stopping 191
- mobile accounts 139
- MS-CHAPv2 authentication 140
- MX (mail exchanger) 51, 77

## N

- name server 51, 53
  - See also DNS
- NAT (Network Address Translation)
  - configuration 79, 124, 126, 127, 128, 130, 133, 135
  - default configuration 212
  - DHCP 43
  - Firewall service 109, 124
  - gaming setup 135
  - gateway without NAT 131
  - Internet sharing 17
  - introduction 124
  - IPv6 protocol 195
  - linking to LAN 133
  - logs 132
  - management of 133
  - monitoring of 132
  - namespace setup 79
  - settings 205, 206
  - starting 126, 130
  - status checking 132
  - stopping 130
  - virtual servers setup 135
- natd daemon 138
- NBDD (NetBios Datagram Distribution) Server 38
- NBNS (NetBios Name Server) 37
- NetBios Scope ID 38
- NetBoot service 44
- Network Address Translation. See NAT
- network services
  - introduction 11
  - management of 23
  - See also DHCP, DNS, Firewall service, IP addresses, NAT, VPN
- NTP (network time protocol) 178, 179

## O

- Open Directory 168
- Open Directory Password Server 168

## P

- P2P (Peer-to-Peer) file sharing 113
- packets, data 102
- passwords, VPN 140
- Peer-to-Peer (P2P) file sharing. See P2P
- piggybacking, service 76
- plist files 127
- pointer record. See PTR record
- Point-to-Point Tunneling Protocol (PPTP). See PPTP

- port forwarding 127, 128, 130
- portable computers 139
  - See also Mobile Access service
- ports
  - Firewall service 84, 114
  - NAT LAN 124
  - VLAN 193
  - VPN 142, 143, 146
- PPP (Point-to-Point Protocol) service 212
- pppd daemon 212
- PPTP (Point-to-Point Tunneling Protocol) 140, 141, 146, 155, 162
- primary zone, DNS 50, 57, 67, 75
- private network 43
  - See also VPN
- problems. See troubleshooting
- profiling, DNS service 76
- protocols
  - BootP 28
  - EAP 168
  - IPv6 195, 196, 197, 198
  - LDAP 36, 46, 141, 155
  - NTP 178, 179
  - SMTP 111
  - TCP 84, 94, 112
  - UDP 84, 92
  - VPN 140, 141, 143, 146, 155, 162
  - See also DHCP
- proxy server settings 181, 189
- PTR record (pointer record) 51

## Q

- QTSS Publisher 213

## R

- RADIUS (Remote Authentication Dial-In User Service)
  - access control 175
  - AirPort Base Station 169, 171, 172, 175, 176, 177
  - introduction 168
  - logs 173, 175
  - management of 175
  - settings 210, 211
  - setup 168, 169, 171, 172, 173
  - starting 169, 174
  - status checking 175
  - stopping 174
- radiusconfig tool 170, 173, 174
- records, managing zone 70, 73, 74
- recursion, DNS 61, 66, 76
- registration, domain name 53
- Remote Authentication Dial-In User Service (RADIUS). See RADIUS
- remote networks 162, 172
- reverse proxy 181
- round robin IP address method 80

routing definitions, VPN 151  
RSA Security 156

## S

s2svpnadmin tool 162  
secondary zone, DNS 50, 59, 68  
SecurID authentication 156  
security  
    DNS 74, 75  
    IPSec 140, 143, 162  
    Mobile Access service 181  
    RADIUS 172  
    VLAN 193  
    VPN 139, 140, 141, 142, 162  
    *See also* access, authentication, Firewall service  
Server Admin 33, 54, 60, 141, 184, 196  
server mining 75  
serveradmin tool  
    DHCP 31, 32, 33  
    DNS 36, 61, 62, 63, 64, 65  
    Firewall service 95, 97, 101, 106, 107  
    LDAP options 37, 46  
    NAT 126, 131, 132  
    static map 40, 41, 42  
    subnets 30, 33  
    VPN 144, 146, 150, 151, 157, 158, 210  
    WINS 38  
servers  
    Apple file server 112  
    DNS 28, 35  
    location of 28  
    multiple DHCP 28  
    name server 51, 53  
    NBDD 38  
    NBNS 38  
    resetting 105  
    securing DNS 74, 75  
    time server 179  
    virtual 135  
Service Configuration Assistant 17  
service (SRV) record. *See* SRV (service) record  
shared files. *See* file sharing  
shared secret files 19, 21, 23, 140, 141, 162  
site-to-site VPN admin 162  
SMTP (Simple Mail Transfer Protocol) 111  
spam. *See* junk mail screening  
spoofing, DNS 74  
SRV (service) record 51, 72  
stateful packet inspection 85  
static IP addresses 25, 27, 39, 40, 48  
static map IDs 202  
stealth mode, Firewall service 104  
Stratum servers 178  
student lab configuration 44  
subdomains 53  
subnet mask 86, 87

subnets

    creating 29  
    deleting 34  
    DHCP 26, 29, 33, 34, 47, 200  
    disabling 34, 47  
    DNS server setting 35  
    LDAP options 36  
    lease time settings 35  
    server location 28  
    WINS 37  
sudo tool 127  
synchronization, time 178, 179  
sysctl tool 85

## T

tail tool 63, 132  
TCP (Transmission Control Protocol) 84, 94, 112  
time server 179  
    *See also* NTP  
time synchronization 178, 179  
time-to-live attribute (TTL) 53, 80  
TLS (Transport Layer Security) protocol 211  
Transmission Control Protocol. *See* TCP  
troubleshooting, Firewall service rules 103  
TTL attribute. *See* time-to-live attribute  
TXT record 51

## U

UCE (unsolicited commercial email). *See* junk mail screening  
UDP (User Datagram Protocol) 84, 92  
universal time coordinated. *See* UTC  
unsolicited mail. *See* junk mail screening  
upgrading, DNS configuration 56  
User Datagram Protocol. *See* UDP  
users  
    mobile 139  
    VPN access 153  
    wireless access 168  
    *See also* clients, RADIUS  
UTC (universal time coordinated) 178

## V

virtual local area network. *See* VLAN  
Virtual Private Network. *See* VPN  
virtual servers, NAT gateway 135, 136  
virus screening 114  
VLAN (virtual local area network) 193, 194  
VPN (Virtual Private Network)  
    access control 153, 161  
    authentication 140  
    clients 141, 149, 159, 161, 166  
    command list 210  
    connections 19, 21, 23, 159, 166  
    default configuration 213

- Internet sharing 16
- introduction 139
- IP address assignment 27, 142
- L2TP settings 143
- LDAP 141, 155
- logs 150, 158
- management of 151, 159
- monitoring 157
- network linking 162
- PPTP settings 146
- protocol support by platform 141
- routing definitions 151
- security 139, 140, 142, 162
- settings 206
- setup 141, 142, 143
- site-to-site 162
- starting 143, 150
- status checking 157
- stopping 151
- supplementary configurations 155, 156

## W

- WAN (wide area network) 139
- web services, access control 109, 110, 188
- wide area network. *See* WAN
- wildcards in IP addresses 87
- WINS (Windows Internet Naming Service) 37
- wireless service. *See* AirPort Base Station, RADIUS
- WLAN (wireless local area network) 21, 23
- workgroups, configuration for 43

## X

- xinetd daemon 23
- Xserve 193

## Z

- zones, DNS
  - adding 67, 68
  - alias records 71
  - BIND zone file 70
  - changing 69
  - deleting 69
  - disabling transfers 65
  - enabling transfers 65
  - forward 68
  - introduction 50
  - machine records 51, 71
  - records management 70, 72, 73, 74
  - security 74
  - setup 57, 59