RADIUS for UNIX Administrator's Guide

Lucent Technologies
Remote Access Business Unit
4464 Willow Road
Pleasanton, CA 94588
925-737-2100
800-458-9966

February 1999

950-1185C

Copyright and Trademarks

PortMaster, ComOS, and ChoiceNet are registered trademarks of Lucent Technologies, Inc. RADIUS ABM, PMVision, IRX, and PortAuthority are trademarks of Lucent Technologies, Inc. All other marks are the property of their respective owners.

Disclaimer

Lucent Technologies, Inc. makes no express or implied representations or warranties with respect to the contents or use of this manual, and specifically disclaims any implied warranties of merchantability or fitness for a particular purpose. Lucent Technologies, Inc. further reserves the right to revise this manual and to make changes to its content at any time, without obligation to notify any person or entity of such revisions or changes.

Contents

About This Guide

The *RADIUS for UNIX Administrator's Guide* provides complete installation, configuration, and troubleshooting instructions for the Remote Authentication Dial-In User Service (RADIUS) invented by the Remote Access Business Unit of Lucent Technologies, Inc.—formerly Livingston Enterprises, Inc. This guide covers RADIUS server release 2.1 for UNIX platforms.

RADIUS can be used with the PortMaster® family of products available from Lucent Remote Access, as well as with the ChoiceNet® client/server packet-filtering software.

To install and configure these products, see "PortMaster Documentation."

Audience

This guide is designed to be used by qualified system administrators and network managers. Knowledge of UNIX and basic networking concepts is required to successfully install RADIUS for UNIX. If you use RADIUS with third-party products—such as ActivCard or SecurID—you also must be familiar with their installation, configuration, and use.

PortMaster Documentation

The following manuals are available from Lucent Remote Access. The hardware installation guides are included with most PortMaster products; other manuals can be ordered through your PortMaster distributor or directly from Lucent.

The manuals are also provided as PDF and PostScript files on the *PortMaster Software CD* shipped with your PortMaster.

In addition, you can download PortMaster information and documentation from **http://www.livingston.com**.

- *ChoiceNet Administrator's Guide*

  This guide provides complete installation and configuration instructions for ChoiceNet server software.

- *PortMaster Command Line Reference*

  This reference provides the complete description and syntax of each command in the ComOS command set.

- *PortMaster Configuration Guide*

  This guide provides a comprehensive overview of networking and configuration for PortMaster products.

- PortMaster hardware installation guides

  These guides contain complete hardware installation instructions. An installation guide is shipped with each PortMaster.

- *PortMaster Routing Guide*

  This guide describes routing protocols supported by PortMaster products, and how to use them for a wide range of routing applications.

- *PortMaster Troubleshooting Guide*

  This guide can be used to identify and solve software and hardware problems in the PortMaster family of products.

- *RADIUS for UNIX Administrator's Guide*

  This guide provides complete installation and configuration instructions for Lucent Remote Authentication Dial-In User Service (RADIUS) software on UNIX platforms.

- *RADIUS for Windows NT Administrator's Guide*

  This guide provides complete installation and configuration instructions for Lucent Remote Authentication Dial-In User Service (RADIUS) software on the Microsoft Windows NT platform.

ActivCard Documentation

If you are using the ActivEngine and ActivAdmin products from ActivCard, Inc., refer to the current manual set for your software version.

For UNIX, the current manuals are

- *ActivEngine for UNIX Systems Installation and Administration Guide*
- *ActivAdmin for UNIX Systems User Guide*

Contact ActivCard for the manuals. Additionally, ActivCard might have application notes that you might find useful. See Appendix E, "Contact Information for Third-Party Products," for information on how to contact ActivCard, Inc.

Security Dynamics Documentation

If you are using the ACE/Server security software from Security Dynamics, Inc., refer to the current manual set for your software version.

For UNIX, the current manuals are

- *ACE/Server v 2.3 Installation Guide*
- *ACE/Server v 2.3 for UNIX Administration Manual*

Contact Security Dynamics for the manuals. See Appendix E, "Contact Information for Third-Party Products," for information on how to contact Security Dynamics, Inc.

Additional References

RFCs

To find a Request for Comments (RFC) online, visit the website of the Internet Engineering Task Force (IETF) at **http://www.ietf.org/**.

RFC 768, *User Datagram Protocol*
RFC 791, *Internet Protocol*
RFC 1321, *The MD5 Message-Digest Algorithm*
RFC 1700, *Assigned Numbers*
RFC 1824, *Requirements for IP Version 4 Routers*
RFC 1825, *Security Architecture for the Internet Protocol*
RFC 1826, *IP Authentication Header*
RFC 1827, *IP Encapsulating Payload*
RFC 1828, *IP Authentication Using Keyed MD5*
RFC 1829, *The ESP DES-CBC Transform*
RFC 2138, *Remote Authentication Dial In User Service (RADIUS)*
RFC 2139, *RADIUS Accounting*

Books

Building Internet Firewalls. D. Brent Chapman and Elizabeth D. Zwicky. Sebastopol, CA: O'Reilly & Associates, Inc., 1995. (ISBN 1-56592-124-0)

DNS and BIND, 2nd ed. Paul Albitz and Cricket Liu. Sebastopol, CA: O'Reilly & Associates, Inc., 1992. (ISBN 1-56592-236-0)

Firewalls and Internet Security: Repelling the Wily Hacker. William R. Cheswick and Steven M. Bellovin. Reading, MA: Addison-Wesley Publishing Company, 1994. (ISBN 0-201-63357-4) (Japanese translation: ISBN 4-89052-672-2). Errata are available at **ftp://ftp.research.att.com/dist/internet_security/firewall.book**.

Internet Routing Architectures. Bassam Halabi. San Jose, CA: Cisco Press, 1997. (ISBN 1-56205-652-2)

Internetworking with TCP/IP, Volume 1: Principles, Protocols, and Architecture. Douglas Comer. Prentice Hall, Inc. 1995. (ISBN 0-13-216987-8 (v.1))

Routing in the Internet. Christian Huitema. Upper Saddle River, NJ: Prentice Hall PTR, 1995. (ISBN 0-13-132192-7)

TCP/IP Illustrated, Volume 1: The Protocols. W. Richard Stevens. Reading, MA: Addison-Wesley Publishing Company. 1994. (ISBN 0-201-63346-9)

TCP/IP Network Administration. Craig Hunt. Sebastopol, CA: O'Reilly & Associates, Inc. 1994. (ISBN 0-937175-82-X)

Document Conventions

The following conventions are used in this guide:

Convention	Use	Examples
Bold font	Indicates a user entry—a command, menu option, button, or key—or the name of a file, directory, or utility, except in code samples.	• Enter **version** to display the version number. • Press **Enter**. • Open the **permit_list** file.

Convention	Use	Examples
Italic font	Identifies a command-line placeholder. Replace with a real name or value.	• **set** *Ether0* **address** *Ipaddress* • Replace *Area* with the name of the OSPF area.
Square brackets ([ ])	Enclose optional keywords and values in command syntax.	• **set nameserver** [**2**] *Ipaddress* • **set** *S0* **destination** *Ipaddress* [*Ipmask*]
Curly braces ({ })	Enclose a required choice between keywords and/or values in command syntax.	**set syslog** *Logtype* {[**disabled**] [*Facility.Priority*]}
Vertical bar (|)	Separates two or more possible options in command syntax.	· **set** *S0*|*W1* **ospf on**|**off** · **set** *S0* **host default**|**prompt**|*Ipaddress*

Document Advisories

Note – means take note. Notes contain information of importance or special interest.

Caution – means be careful. You might do something—or fail to do something—that results in equipment failure or loss of data.

Warning – means danger. You might do something—or fail to do something—that results in personal injury or equipment damage.

Contacting Lucent Remote Access Technical Support

The PortMaster comes with a 1-year hardware warranty.

For all technical support requests, record your PortMaster ComOS version number and report it to the technical support staff or your authorized sales channel partner.

New releases and upgrades of PortMaster software are available by anonymous FTP from **ftp://ftp.livingston.com/pub/le/**.

In North America you can schedule a 1-hour software installation appointment by calling the technical support telephone number listed below. Appointments must be scheduled at least one business day in advance.

For the EMEA Region

If you are an Internet service provider (ISP) or other end user in Europe, the Middle East, Africa, India, or Pakistan, contact your local Lucent Remote Access sales channel partner. For a list of authorized sales channel partners, see the World Wide Web at **http://www.livingston.com/International/EMEA/distributors.html**.

If you are an authorized Lucent Remote Access sales channel partner in this region, contact the Lucent Remote Access EMEA Support Center Monday through Friday between the hours of 8 a.m. and 8 p.m. (GMT+1), excluding French public holidays.

- By voice, dial +33-4-92-92-48-48.
- By fax, dial +33-4-92-92-48-40.
- By electronic mail (email) send mail to **emea-support@livingston.com.**

For North America, Latin America, and the Asia Pacific Region

Contact Lucent Remote Access Monday through Friday between the hours of 7 a.m. and 5 p.m. (GMT –8).

- By voice, dial 800-458-9966 within the United States (including Alaska and Hawaii), Canada, and the Caribbean, or +1-925-737-2100 from elsewhere.
- By fax, dial +1-925-737-2110.
- By email, send mail as follows:

  - From North America and Latin America to **support@livingston.com**.
  - From the Asia Pacific Region to **asia-support@livingston.com**.
- Using the World Wide Web, see **http://www.livingston.com/**.

PortMaster Training Courses

Lucent Remote Access offers hands-on, technical training courses on PortMaster products and their applications. For course information, schedules, and pricing, visit the Lucent Remote Access website at **http://www.livingston.com/tech/training/index.html**.

Subscribing to PortMaster Mailing Lists

Lucent Remote Access maintains the following Internet mailing lists for PortMaster users:

- **portmaster-users**—a discussion of general and specific PortMaster issues, including configuration and troubleshooting suggestions. To subscribe, send email to **majordomo@livingston.com** with **subscribe portmaster-users** in the body of the message.

  The mailing list is also available in a daily digest format. To receive the digest, send email to **majordomo@livingston.com** with **subscribe portmaster-users-digest** in the body of the message.

- **portmaster-radius**—a discussion of general and specific RADIUS issues, including configuration and troubleshooting suggestions. To subscribe, send email to **majordomo@livingston.com** with **subscribe portmaster-radius** in the body of the message.

  The mailing list is also available in a daily digest format. To receive the digest, send email to **majordomo@livingston.com** with **subscribe portmaster-radius-digest** in the body of the message.

- **portmaster-announce**—announcements of new PortMaster products and software releases. To subscribe, send email to **majordomo@livingston.com** with **subscribe portmaster-announce** in the body of the message. All announcements to this list also go to the portmaster-users list. You do not need to subscribe to both lists.

Introducing RADIUS 1

Introduction to RADIUS

The Remote Authentication Dial-In User Service (RADIUS) is a client/server security protocol created by Lucent Remote Access. RADIUS is an Internet draft standard protocol. See RFCs 2138 and 2139 for more information on RADIUS.

User profiles are stored in a central location, known as the RADIUS server. RADIUS clients (such as a PortMaster communications server) communicate with the RADIUS server to authenticate users. The server specifies back to the client what the authenticated user is authorized to do. Although the term **RADIUS** refers to the network protocol that the client and server use to communicate, it is often used to refer to the entire client/server system.

Overview of RADIUS Features

RADIUS offers the following features:

- Security

  In large networks, security information can be scattered throughout the network on different devices. RADIUS allows user information to be stored on one host, minimizing the risk of security loopholes. All authentication and access to network services is managed by the host functioning as the RADIUS server.

- Flexibility

  RADIUS software from Lucent Remote Access—version 2.0 and higher—can be used with any communications server that supports the RADIUS protocol as long as you own at least one Lucent Remote Access PortMaster. For more information see the Software License Agreement at **http://www.livingston.com/license.html**.

  RADIUS server software for UNIX platforms is distributed in source code format to Lucent Remote Access PortMaster customers. Using modifiable "stubs," RADIUS can be adapted to work with existing security systems and protocols. You adapt the RADIUS server to your network, rather than adjusting your network to work with RADIUS.

Note – Lucent Remote Access does not support modified RADIUS code.

- Simplified management

  The RADIUS server stores security information in text files at a central location; you add new users to the database or modify existing user information by editing these text files.

- Extensive auditing capabilities

  RADIUS provides extensive accounting trail capabilities, referred to as **RADIUS accounting**. Information collected in a log file can be analyzed for security purposes or used for billing.

The RADIUS for UNIX server version 2.1 is available in ready-to-run binary form for the following operating systems:

- Alpha Digital UNIX 4.0
- BSD/OS 2.0 and 3.0
- HP-UX 10.20
- IBM RS6000 AIX 4.2
- Redhat Linux 5.0
- SGI IRIX 6.3
- Slackware Linux 2.0.30
- Solaris 2.5.1
- Solaris x86 2.5.1
- SunOS 4.1.4

How RADIUS Works

RADIUS performs three primary functions. The RADIUS for UNIX server version 2.1 adds enhancements for ease of use.

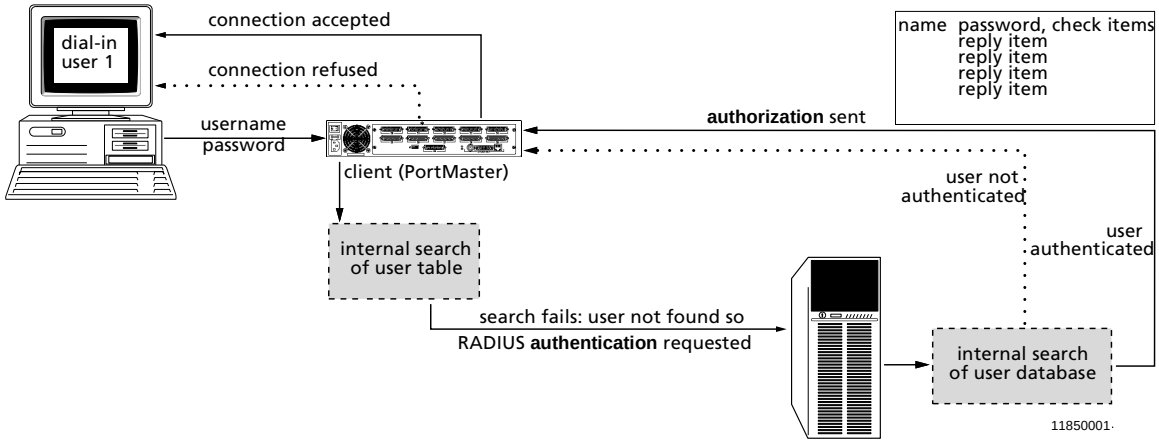
Basic RADIUS Functions

The primary functions of RADIUS are authentication, authorization, and accounting. Figure 1-1shows the authentication and authorization process.

- Authentication

  RADIUS determines whether users are eligible to receive requested services. Authentication information is stored in either a local **users** file or database cache, or accessed from external authentication mechanisms such as a UNIX password file, ActivCard ActivEngine database, or SecurID ACE/Server database.

Figure 1-1 RADIUS Authentication and Authorization



For example, when user *bob* attempts to log in to a PortMaster, the following authentication sequence takes place:

1. The PortMaster prompts *bob* for his username and password, and then compares the username-password pair to the PortMaster user table.
2. The PortMaster sends an **access-request** message to the RADIUS server if the following conditions are met:
   - Username is not found in the user table
   - Security for the port is set to **on**
   - RADIUS settings are configured on the PortMaster

The access-request message contains the information necessary for the RADIUS server to authenticate the user.

3. The RADIUS server checks its **users** file to determine if an entry for user *bob* is present. For *bob*'s login to be successful, a matching username or DEFAULT entry must be found.

4. User *bob* is either accepted or rejected:

   – If a matching entry is found in the RADIUS **users** file, if the password requirement is met, and if all check items in the **users** file are matched by additional attributes in the access-request message, the RADIUS server sends an **access-accept** message to the PortMaster indicating that *bob* has been successfully authenticated. It also sends authorization information—reply items—about the services *bob* can access and configuration information about *bob*'s connection.

   – If the password request is not satisfied or if other check items—specified in the RADIUS **users** file—fail, the RADIUS server sends an **access-reject** message to the PortMaster indicating that the authentication attempt has failed. The PortMaster terminates *bob*'s connection attempt.

   If third-party software—such as ActivCard or SecurID—is used, the user might be prompted for more information before being accepted or rejected.

- Authorization

  Authorization controls access to specific services on the network by configuring the user's session. Once a user is authenticated, RADIUS reports to the PortMaster what a user is authorized (permitted) to access. For example, user *bob* might be authorized to use the Point-to-Point Protocol (PPP) for his connection, be assigned IP address 192.168.200.4, and have to filter his traffic using packet filters **std.ppp.in** and **std.pp.out**.

- Accounting

  RADIUS accounting stores usage information for dial-in users. This information is often used for billing purposes. When the user is authenticated and the session has been configured according to the authorization information, an accounting start record is created. When the user's session is terminated, an accounting stop record is created. See Chapter 8, "Implementing RADIUS Accounting," for more information.

Ease-of-Use Enhancements

RADIUS 2.1 for UNIX provides the following enhancements to improve RADIUS functionality:

- Proxy RADIUS

  Proxy RADIUS enables your RADIUS server to forward authentication requests from a PortMaster or other network access server (NAS) to a remote RADIUS server and to pass the reply back to the NAS. This feature enables cooperating Internet service providers (ISPs) to handle dial-in service requests from each other's users. Corporate users can easily forward packets from local to remote networks.

  You create a **proxy** file in the **/etc/raddb** directory on the forwarding server and, if necessary, on the remote server. Each line in the **proxy** file contains the hostname or IP address of a remote server, the secret shared between the forwarding server and the remote server, and the realm of the remote server in the proxy chain. Each entry can specify the ports the remote server uses for RADIUS authentication and accounting as well as certain keywords to affect server behavior.

Note – Usernames with an embedded at sign (**@**) are treated as proxy realms.

- iPass protocol support

  The iPass protocol enables you to provide global roaming Internet access. To use iPass with RADIUS 2.1, you must do the following:

  a. Register at the iPass, Inc. website, **http://www.ipass.com/**.

  b. Add the keyword **ipass** to the entries of the appropriate remote servers in your **/etc/raddb/proxy** file.

  c. Run **iradiusd** instead of **radiusd**.

Note – If you run iPass and ActivCard or Securid, for configuration information send email to **support@livingston.com**.

- ActivCard support

  RADIUS now supports ActivCard authentication on the following platforms supported by ActivCard 2.1: AIX, HP-UX, Solaris, and Sun-OS. ActivCard authenticates users by means of dynamic passwords generated by a handheld token

using the public Digital Encryption Standard (DES) algorithm. The RADIUS server can forward all requests specified by the user profiles to the ActivCard server. Perform the following steps to enable user authentication via ActivCard:

a. Install the ActivCard server on either the same host as the RADIUS server or on a different host.

b. Create the file **/etc/raddb/config.aeg** on the host where the RADIUS server resides.

c. Specify Auth-Type = ActivCard as a check item in the user profiles of all ActivCard users.

d. Run the daemon **sradiusd** instead of **radiusd**.

- Accounting signatures required

  RADIUS 2.1 strictly complies with RFC 2139. The server discards unsigned accounting packets—packets with invalid request authenticator attributes—and logs an error message. If you want to use RADIUS accounting, you must run RADIUS 2.1 with ComOS 3.3.1 or later. You can use **radiusd -o** to run RADIUS 2.1 if you have noncompliant RADIUS clients. In this case, RADIUS logs unsigned accounting records and flags them with Request-Authenticator = None.

- Virtual ports

  You can restrict the number of logins permitted to specified telephone numbers.

  a. Install the RADIUS accounting and authentication servers on the same host.

  b. Create the file **/etc/raddb/vports** with the format shown in the following sample file:

```
# Called-Station-ID       Number of logins permitted
9255550020                20
9255550021                30
9255550022                25
```

  c. Issue the command **radiusd -s** to run the server in single-thread mode.

Note – The virtual ports feature does not provide an exact control. Logins that occur before **radiusd** starts running are not considered in the count. Accounting records that are sent to the backup accounting server are not considered in the count. This feature **cannot** provide simultaneous login limits for individual users because it is based on Called-Station-Id rather than Calling-Station-Id.

- Vendor-specific attributes

  RADIUS 2.1 supports RFC-compliant vendor-specific attributes, including the two new Lucent Remote Access attributes introduced in ComOS 3.8: LE-Advice-of-Charge and LE-Terminate-Detail.

  The LE-Advice-of-Charge value is a string included in RADIUS accounting stop records generated by ComOS 3.8 or later. This string provides any advice-of-charge information passed along by the telephone company on the ISDN D channel.

  The LE-Terminate-Detail value is a string included in RADIUS accounting stop records generated by ComOS 3.8 or later. This string provides a detailed description of the reason the session terminated.

  The RADIUS 2.1 dictionary file uses the following syntax to define vendor-specific attributes that conform to RFC 2138:

```
#
# Vendor-Specific attributes use the SMI Network Management Private
# Enterprise Code from the "Assigned Numbers" RFC
#

VENDOR       Livingston              307

# Livingston Vendor-Specific Attributes (requires ComOS 3.8 and RADIUS
s# 2.1)

ATTRIBUTE    LE-Terminate-Detail     2       string     Livingston
ATTRIBUTE    LE-Advice-of-Charge     3       string     Livingston
```

- Alternate password file

  You can run **radiusd -f** *Filepath* to specify a password file other than **/etc/passwd**.

- Address binding

  You can force the RADIUS server to bind to a specific IP address to listen for requests by running **radiusd -i** *Ipaddress*. You might find this useful if you are running RADIUS on a multihomed host or a host with a virtual IP address.

Note – When using hosts that are multihomed or that have virtual IP addresses, remember RADIUS clients ignore replies that do not originate from the primary or secondary RADIUS server specified on the client.

- Improved messages

  The **syslog** message for many kinds of rejected access-requests now includes the Calling-Station-Id—if known—enabling you to track down where the failed login attempts are dialing from. Here is an example **syslog** message:

  ```
  Jul 10 21:10:50 ra radius[14870]:unix_pass: password for "bob" at 5551234
  failed
  ```

  Failures are currently logged for unknown users and for failed logins where the user profile included Auth-Type = System.

  Other syslog messages are more detailed, including the UDP port and RADIUS message ID for easier tracking. The following example syslog message shows a RADIUS packet being forwarded from UDP port 1093 and ID #139 for the source IP address to UDP port 1645 and ID #17 for the destination IP address:

  ```
  Jul 10 21:10:50 ra radius[14870]:forwarding request from
  192.168.96.6/1093.139 to 172.16.3.24/1645.17 for edu.com
  ```

- Enhanced debugging

  You can turn on RADIUS debugging by sending a SIGUSR1 signal to **radiusd**. Sending a SIGUSR2 signal to **radiusd** turns debugging off. The RADIUS server logs a short summary message of **radiusd** activity when either signal is sent and when **radiusd** is exited. See "Turning on the Debug Function" on page A-5 for instructions.

Feature No Longer Supported

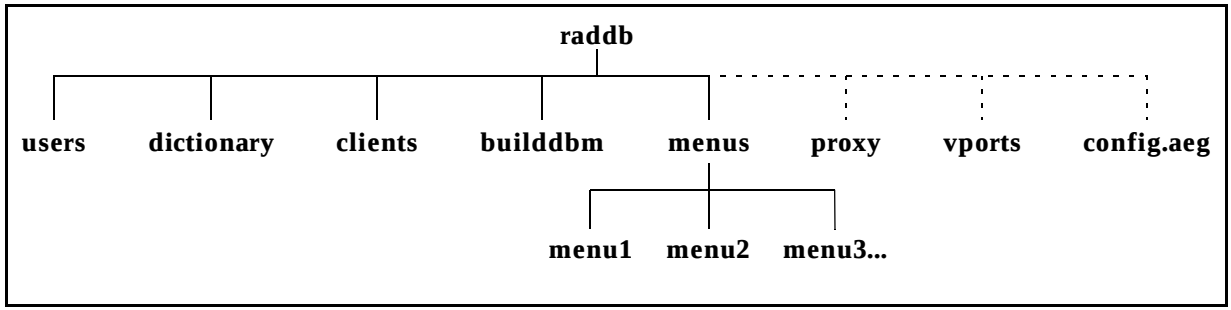
The obsolete RADPASS feature is no longer available.

RADIUS Directory Structure

RADIUS server files are stored in the **raddb** (RADIUS database) directory. The **raddb** directory is typically placed within the **/etc** directory. Lucent Remote Access recommends that you use this default.

The **raddb** directory contains files and subdirectories organized as shown in Figure 1-2 and explained in the list that follows. A dotted line indicates an optional file.

Figure 1-2 RADIUS Directory Structure



- The **users** file stores user profiles, which consist of authentication and authorization information for all users authenticated with RADIUS.
- The **dictionary** file contains information used to parse user access requests and generate responses. It lists attribute numbers, names, and the data type expected for attribute values. Attributes appear in client-server communications and accounting records and are used to create user profiles. After you modify this file, you must restart RADIUS to apply your changes.
- The **clients** file contains the IP addresses of all RADIUS clients and the secrets shared between the clients and the RADIUS server(s).
- The **builddbm** utility enables you to convert the **users** file into DBM format for faster look-ups.
- The **menus** subdirectory contains individual menu text files. You can optionally use menus to provide users with different login options once the users have been authenticated.
- The **proxy** file stores information about the remote servers to which the local server can forward authentication requests. This information includes the hostname or IP address, shared secret, and the remote realm.
- The **vports** file contains Called-Station-IDs and the number of logins permitted via each telephone number.
- The **config.aeg** file contains the configuration settings that specify how RADIUS connects to an ActivCard server. This optional file is needed only if you are using ActivEngine with RADIUS. See Chapter 6, “Installing and Configuring ActivCard,” for more information.

The RADIUS server uses the User Datagram Protocol (UDP) and the following UDP ports:

- Port 1645 for authentication
- Port 1646 for accounting
- Ports 1650 and 1651 for proxy

If different ports are assigned to these services in the **/etc/services** file, RADIUS uses those ports in preference to the default ports listed above. You can also specify different UDP ports by using the **radiusd -p** *portnumber* command on UNIX hosts. Port 1812 is reserved for RADIUS authentication and port 1813 is reserved for RADIUS accounting. See Appendix C, "RADIUS Options," for more information.

Note – PortMaster products use ports 1645, 1646, 1650, and 1651 by default; this is specified by ComOS and cannot be modified in ComOS versions prior to 3.8. If you change the port number as stated above, RADIUS might work with other network access servers (NASs) but cannot authenticate users or gather accounting data for accesses to PortMaster products unless they are running ComOS version 3.8 or later.

RADIUS Installation and Configuration

Table 1-1 provides a quick overview of the tasks required to install and configure RADIUS.

Table 1-1 Overview of RADIUS Installation and Configuration Tasks

Task	Instructions
1. Select a host to use as the RADIUS server.	See "Getting Started" on page 2-1.
2. Install the RADIUS server software on the host.	• See "Installing RADIUS on a UNIX Host" on page 2-3
3. Configure client information on the RADIUS server.	See "Modifying the clients File" on page 3-1.

Table 1-1 Overview of RADIUS Installation and Configuration Tasks *(Continued)*

Task	Instructions
4. Configure the PortMaster as a RADIUS client.	See one of the following: • "Configuring the PortMaster Using the Command Line Interface" on page 3-2." • "Configuring the PortMaster Using PMVision" on page 3-4."
5. Configure user profiles.	See Chapter 4, "Configuring User Information."
6. You can optionally define menus to enable authenticated users to select different login options.	See Chapter 5, "Configuring RADIUS Menus."
8. You can optionally install and configure ActivCard.[1]	See Chapter 6, "Installing and Configuring ActivCard."
7. You can optionally install and configure SecurID.[2]	See Chapter 7, "Installing and Configuring SecurID."
9. You can optionally install and configure RADIUS accounting.	See Chapter 8, "Implementing RADIUS Accounting."
10. You can optionally configure RADIUS proxy service.	See Chapter 9, "Configuring RADIUS Proxy Service."

1. This installation requires ActivCard software. If you use this software, you must run **sradiusd** rather than **radiusd**. If you use this software with iPass, send email to **support@livingston.com**.

2. This installation requires ACE/Server and ACE/Client software. If you use this software, you must run **sradiusd** rather than **radiusd**. If you use this software with iPass, send email to **support@livingston.com**.

Configuring a RADIUS Server 2

This chapter includes the following topics:

Getting Started

Before installing and configuring RADIUS software, select a host or hosts to use as a RADIUS server and determine one or more shared secrets for authentication.

Selecting a RADIUS Server Host

Primary RADIUS Authentication Server. Select or create a host with the following characteristics to use as a RADIUS authentication server:

- Secure physical location
- Root access limited to the security officer or system administrator
- Limited number of user accounts—preferably none
- Basic memory and disk space

Lucent Remote Access suggests the following additional characteristics for the host:

- Inaccessibility from outside your local network
- Absence of public network services such as email, FTP, HTTP, netnews, Telnet, **rlogin**, and **rcp**.

Note – RADIUS performance varies with the number of users being authenticated and with other demands on the server. Running public network services or other applications on the server concurrently with RADIUS can consume most of your CPU resources. You can experience a reduction in RADIUS performance—such as access denials or dropped calls—if you have insufficient CPU resources on the host. Lucent Remote Access strongly recommends that you do **not** run a Web server on the RADIUS

for UNIX server. If you do, a sudden increase in hits on the Web server can adversely affect your RADIUS processes, and you might be subject to malicious attacks by this approach.

Secondary RADIUS Authentication Server. Lucent Remote Access recommends the use of a secondary RADIUS server with the same security and performance characteristics as the primary server. The PortMaster always queries the primary RADIUS server first; if the server does not respond, it is queried a second time. Then both the primary and secondary servers are queried up to eight more times at 3-second intervals until one responds or until 3 seconds after the tenth query without a response. At this point, the login attempt fails.

RADIUS Accounting Server. If you implement RADIUS accounting, you must also select one or more RADIUS accounting servers. The RADIUS accounting server can be located on the same host as the RADIUS server used for authentication, or on a separate host. See Chapter 8, "Implementing RADIUS Accounting," for more information.

Secondary RADIUS Accounting Server. You can define a secondary accounting server to serve as a backup if the primary server cannot be contacted. The PortMaster always sends accounting packets to the primary RADIUS accounting server first, and retries it once every 45 seconds. If the primary server does not respond within 10 minutes, or if more than 50 accounting packets are waiting to be sent, the PortMaster sends the accounting packets to the secondary RADIUS accounting server. This behavior is subject to change in future releases of ComOS.

Determining a Shared Secret

Each PortMaster using RADIUS shares an authentication key—called the **shared secret**—with its RADIUS server(s). The shared secret consists of up to 15 printable, nonspace, ASCII characters. The RADIUS server can have a different shared secret with each PortMaster client, or the RADIUS server can have the same shared secret for multiple PortMaster clients. Different, nontrivial shared secrets are recommended for each PortMaster.

You configure the shared secret on each RADIUS server and the PortMaster. It is stored as clear text in the **clients** file on the RADIUS server and in the nonvolatile memory of the PortMaster. See Chapter 3, "Adding a RADIUS Client", for more information.

Installing RADIUS on a UNIX Host

Use one of the following installation methods:

- Install RADIUS with the **pminstall** utility
- Install RADIUS without **pminstall**.

Note – Although **pminstall** is shipped on the Lucent Remote Access *PortMaster Software CD*, always use the latest version of **pminstall**, available via anonymous FTP from **ftp://ftp.livingston.com/pub/le/software**.

Installation with pminstall

To install RADIUS using **pminstall**, complete the following steps:

1. **Log in to the selected RADIUS server as root.**
2. **Mount the CD using the instructions in the CD booklet.**

   For the instructions here, an example mount point of **/cdrom** is used. Change this as needed for your operating system and mount point.

3. **Enter the following command to install the PortMaster software:**

   ```
   /cdrom/lei/unix/setup
   ```

4. **Enter the** /usr/portmaster/pminstall **command at the UNIX prompt.**

   The following list of choices appears:

   ```
   % /usr/portmaster/pminstall

   1. PortMaster Internet Address Setup
   2. Host Installation
   3. PortMaster Upgrade
   4. Host Upgrade
   5. Install RADIUS
   6. Install ChoiceNet
   7. Exit

   Please select an option from above:
   ```

5. **Choose the** Install RADIUS **option to install all RADIUS files.**

   The server prompts you for directory names:

   ```
   Database installation directory (/etc/raddb):
   RADIUS accounting log directory (/usr/adm/radacct):
   Directory to install radiusd in (/etc):
   ```

6. **Provide directory information for RADIUS files by one of the following methods:**

   – Select the default directory (shown in parentheses) by pressing the **Return** or **Enter** key.

   – Enter the appropriate directory.

7. **When RADIUS installation is complete, select the** Exit **option to quit** pminstall**.**

8. **Enter the following command to start the RADIUS server:**

   ```
   /etc/radiusd
   ```

   The **radiusd** process spawns RADIUS accounting as a child process.

Note – radiusd is a standalone process; it cannot be run from **/etc/inetd.conf**.

For usage of options with the **radiusd** command, see Appendix C, "RADIUS Options." Running **radiusd -b** enables you to use cached user profiles. Lucent Remote Access recommends caching user profiles when the **users** file contains more than 500 users. See "Configuring Database Caching of User Profiles" on page 4-40 for more information.

9. **Go to Chapter 3, "Adding a RADIUS Client."**

Installation without pminstall

To install RADIUS without **pminstall**, complete the following steps:

1. **If you are running the Network Information Service (NIS) or NIS+, add the following lines to the services NIS map on your NIS master and push the maps.**

   ```
   radius      1645/udp   radiusd
   radacct     1646/udp
   ```

Note – Pushing the maps updates the database to include recently entered information. Use the **make** *mapname* command on the NIS master. For more details, consult your UNIX system documentation.

2. **Log in to the selected RADIUS server as root.**

3. **Mount the CD using the instructions in the CD booklet.**

   For the instructions here, an example mount point of **/cdrom** is used. Change this as needed for your operating system and mount point.

Note – RADIUS server version 1.16 required you to specify the RADIUS ports by adding the lines shown in Step 1 to the **/etc/services** file. RADIUS server versions 2.0 and higher use ports 1645 and 1646 by default and do not require modification of **/etc/services**. However, if nondefault ports are specified in the **/etc/services** file, the values assigned override the default values. You can use **radiusd** with the **-p** option to override both the default RADIUS values and any values specified in the **/etc/services** file.

4. **As root, enter the following commands on the RADIUS server:**

   ```
   umask 022
   mkdir -p /etc/raddb /usr/adm/radacct
   chmod 700 /etc/raddb /usr/adm/radacct
   ```

   The commands in this example create two directories, **raddb** and **radacct**. All RADIUS files (except the **radiusd** executable) are stored in the **/etc/raddb** directory. The **radacct** directory is used to store RADIUS accounting logs.

   The **umask** and **chmod** commands affect the **raddb** and **radacct** directory permissions; root access is required for read, write, and execute privileges.

Caution – If you are upgrading from an existing installation of RADIUS, save the files in **/etc/raddb** before performing Step 5.

5. **Copy all files in** /cdrom/lei/unix/radius/raddb **to the** /etc/raddb **directory:**

   ```
   cp -r /cdrom/lei/unix/radius/raddb/* /etc/raddb
   ```

   In RADIUS for UNIX version 2.0 or later, the **raddb** directory contains three files—**users**, **clients**, and **dictionary**—and the **menus** directory.

6. **Copy the** radiusd **file to the** /etc **directory (or if you prefer, to another directory such as** /usr/sbin**). Replace** *platform* **with the name of the CD-ROM directory for your operating system—for example,** sun4_4.1**:**

   ```
   cp /cdrom/lei/unix/platform/radiusd /etc/radiusd
   ```

7. **Copy the** builddbm **utility to** /etc/raddb/builddbm**. Replace** *platform* **with the name of the CD-ROM directory for your operating system—for example,** sun4_4.1**:**

   ```
   cp /cdrom/lei/unix/platform/builddbm /etc/raddb/builddbm
   ```

8. **If you are using proxy service, create the** /etc/raddb/proxy **file.**

   See Chapter 9, "Configuring RADIUS Proxy Service," for information on configuring proxy service.

9. **Use the** radiusd **command to start RADIUS:**

   ```
   /etc/radiusd
   ```

   The **radiusd** daemon spawns the RADIUS accounting server as a child process. For more information about RADIUS accounting, see Chapter 8.

   If you are using iPass, run **iradiusd** instead of **radiusd**. If you are using ActivCard authentication, run **sradiusd** instead of **radiusd**.

Note – radiusd is a standalone process; it cannot be run from **/etc/inetd.conf**.

For usage of options with the **radiusd** command, see Appendix C, "RADIUS Options." Running **radiusd -b** enables you to use cached user profiles. Lucent Remote Access recommends caching user profiles when the **users** file contains more than 500 users. See "Configuring Database Caching of User Profiles" on page 4-40 for more information.

10. **To start the** radiusd **daemon each time the operating system is booted, place following script in your system start-up scripts:**

```
# Start RADIUS
#
if [ -x /etc/radiusd ]; then
    echo "RADIUS"
    /etc/radiusd #add flags here
fi
```

Consult your UNIX system documentation for more information. Example start-up scripts are **/etc/rc.local** for SunOS 4.1.4, **/etc/rc2.d/S99radiusd** for Solaris 2.5.1, or **/etc/rc.d/rc.local** for Linux.

Note – radiusd does not need to be restarted each time the clients or users files are modified. This daemon needs to be restarted only when the dictionary file is modified.

11. **Go to Chapter 3, "Adding a RADIUS Client."**

Adding a RADIUS Client 3

This chapter includes the following topics:

This chapter describes adding a PortMaster as a RADIUS client. There are two steps to adding a RADIUS client:

1. **Modify the** clients **file to add the PortMaster and shared secret.**
2. **Configure the following on the PortMaster and save the configuration changes.**
   - Security enabled on all ports
   - IP addresses of the primary and optional alternate RADIUS authentication servers; optionally configure an authentication port number different from the default
   - IP addresses of the primary and optional alternate RADIUS accounting servers, if accounting is to be performed; optionally configure an accounting port number different from the default
   - RADIUS shared secret

You configure RADIUS clients using the PortMaster command line interface (see "Configuring the PortMaster Using the Command Line Interface" on page 3-2) or using a graphical user interface (GUI) (see "Configuring the PortMaster Using PMVision" on page 3-4).

Modifying the clients File

The **clients** file is a flat text file installed on the RADIUS server. The **clients** file stores information about RADIUS clients, including each client's name or IP address and its shared secret. Use any text editor to edit the **/etc/raddb/clients** file.

1. **Verify that only root users have read and write access to the** clients **file.**

   The **clients** file contains the shared secrets for the RADIUS clients, and this information must be protected from unauthorized access.

   The permissions on a UNIX host look like this:

   ```
   -rw-------  1 root daemon 802 Jul 15 00:21 clients
   ```

2. **To add a client, enter the client's name or IP address and the shared secret. To add a comment line, start the line with the number sign (#).**

   Shared secrets must consist of 15 or fewer printable, nonspace, ASCII characters. There is no limit to the number of clients that you can add to this file.

   Here are some examples of client names and shared secrets:

   ```
   #Client Name      Shared Secret
   #-----------------------------
   portmaster1       wP4OcQO
   portmaster2       A3X445A
   192.168.1.2       wer369st
   ```

Note – Lucent Remote Access recommends that you use IP addresses to avoid the DNS lookup time entailed by using client names and possible incorrect name translation.

3. **Go to one of the following sections to configure the PortMaster as a RADIUS client:**

   – "Configuring the PortMaster Using the Command Line Interface" in the next section

   – "Configuring the PortMaster Using PMVision" on page 3-4

Configuring the PortMaster Using the Command Line Interface

To configure the PortMaster using the command line interface, complete the following steps.

1. **Enable port security on all ports using the following command:**

   ```
   Command> set all security on
   ```

The PortMaster tries to authenticate each user attempting to log in to a port by looking up the user in its user table. RADIUS authenticates users when port security is enabled **and** the user is not found in the user table. When port security is disabled and the user is not found in the PortMaster user table, RADIUS is **not** used and the user is passed through to the login host without further authentication.

2. **Enter the IP address, and optionally the authentication port number, of the primary RADIUS server using the following command:**

   ```
   Command> set authentic Ipaddress [Uport]
   ```

   The default RADIUS authentication port, 1645, is used if you specify a port number of **0** or do not specify a port number.

3. **You can optionally specify a secondary (alternate) RADIUS server:**

   ```
   Command> set alternate Ipaddress [Uport]
   ```

   The PortMaster consults the primary RADIUS server first. If the server does not respond within 3 seconds, it is queried a second time; then both servers are queried up to eight additional times at 3-second intervals.

4. **To log activity using RADIUS accounting, enter the IP address, and optionally the accounting port number, of the primary accounting server:**

   ```
   Command> set accounting Ipaddress [Uport]
   ```

   The default RADIUS accounting port, 1646, is used if you specify a port number of **0** or do not specify a port number.

5. **You can optionally specify a secondary (alternate) accounting server:**

   ```
   Command> set accounting 2 Ipaddress [Uport]
   ```

   Lucent Remote Access recommends the use of a secondary RADIUS accounting server. The PortMaster always sends accounting packets to the primary RADIUS accounting server first, and retries it once every 45 seconds. If the primary server does not respond within 10 minutes, or if there are more than 50 accounting packets waiting to be sent, the PortMaster sends the accounting packets to the secondary RADIUS accounting server.

6. **Enter the secret shared by the PortMaster and RADIUS server using the** set secret **command:**

   ```
   Command> set secret String
   ```

This is the same shared secret entered in the **clients** file on the RADIUS server (see page 3-1).

Note – The shared secret is a string of up to 15 printable, nonspace, ASCII characters. If a secret longer than 15 characters is specified, an error message is displayed. Secrets in the **clients** file and configured on the PortMaster are case-sensitive and must match exactly.

7. **Save your changes using the** save all **command; then reset all ports:**

```
Command> save all
Command> reset all
```

Caution – Resetting all ports disconnects any user sessions in progress. Resetting is only necessary when changes have been made to serial ports.

8. **Continue to Chapter 4, "Configuring User Information."**

Configuring the PortMaster Using PMVision

You can use the PMVision™ application, a Java GUI, instead of the command line, to configure your PortMaster clients. PMVision provides all configuration options available through the older PMconsole™ interface.

Perform the following steps to configure a PortMaster as a client. Refer to the PMVision online help for more information on using PMVision. After configuring the client using PMVision, go to Chapter 4, "Configuring User Information."

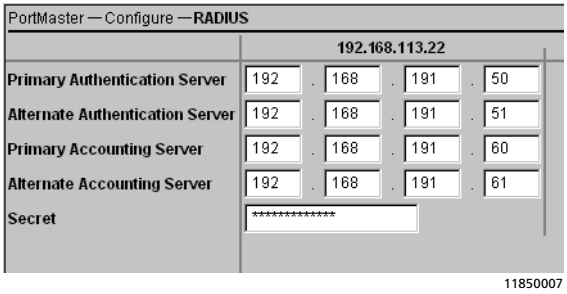
1. **From PMVision, select** PortMaster➡Configure➡RADIUS **to display the RADIUS configuration panel.**
2. **Select the PortMaster you want to configure as a RADIUS client.**
3. **Enter the IP address of the primary authentication server.**
4. **Optionally, enter the IP address of a secondary authentication server.**
5. **Enter the IP address of the primary accounting server.**
6. **Optionally, enter the IP address of a secondary accounting server.**
7. **Enter the shared secret.**

   For security, the shared secret is not displayed in the field.

8. Click Save....

Figure 3-1 shows a close-up of the RADIUS panel with saved configuration settings.

Figure 3-1 Detail View of RADIUS Configuration on PMVision



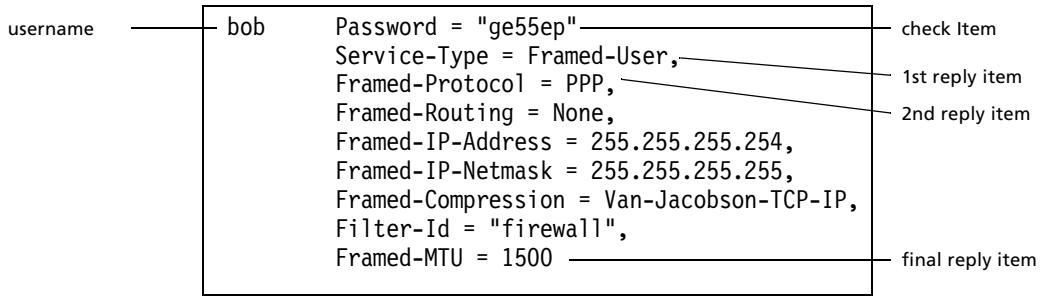
Note – The PMVision display varies depending on the version of ComOS running on the selected PortMaster. For example, if the selected PortMaster is running ComOS 4.0 or later, the RADIUS configuration panel enables you to select the ports used by the authentication and accounting servers.

Configuring User Information 4

This chapter includes the following topics:

The RADIUS **users** file is a flat text file on the RADIUS server. The **users** file stores authentication and authorization information for all users authenticated with RADIUS. Each user must be represented by a **profile** that consists of three parts: the **username**, a list of **check items**, and a list of **reply items**. Figure 4-1 displays an example.

Figure 4-1 User Profile



Note – Lucent Remote Access recommends that you create a single user profile and test RADIUS authentication and authorization for that user. If the test is successful, create and test profiles representative of other user types before proceeding to create all your user profiles.

User Profile Format

User profiles must be separated from each other by an empty line. The first line of a user profile consists of the username followed by the check items. The username is separated from the check items by spaces or tabs. This first line must not exceed 255 characters. All subsequent lines of the profile are individual reply items. Each reply item line must begin with a space or tab. Each reply item, except for the final line in the profile, must end with a comma.

You can add comments to the **users** file by beginning comment lines with a number sign (#).

Caution – Do not place comments within a user profile. Comments in a user profile prevent any reply item following the comment from being processed and sent to the client. Place comments either before or after the user profile.

The contents of each user profile are case-sensitive. Definitions for all attributes and values are in the dictionary file and can be viewed with any text editor.

Caution – Modifying the contents of the dictionary file incorrectly can cause RADIUS to fail to authenticate users correctly or cause other problems.

See "Default User Profiles" on page 4-4 for information on the special profile, DEFAULT. Several common user profiles are listed in "Example PPP User Profile" on page 4-40. All check items are summarized in Table 4-1 on page 4-7. All reply items are summarized in Table 4-2 on page 4-19. Attributes and values used to create user profiles are defined in the dictionary.

Username. The username is the first part of each user profile and must start in the first column. Usernames consist of up to 63 printable, nonspace, ASCII characters. If ActivCard, SecurID, or a system password file is used for authentication, the username must conform to any limitations imposed on the username by the host.

Caution – Do not use white space within a username. In RADIUS 2.1, access-requests are rejected if the username contains a space or tab. If a user enters a username with trailing spaces or tabs, the access-request is rejected.

Check Items. Check items are listed on the first line of a user profile, following the username and separated from it by white space. The line in the user profile that contains the username and check items must not exceed 255 characters. Check items must be separated by commas. Do not place a comma after the final check item. For an access-request (see "How RADIUS Works" on page 1-2) to succeed, all check items in the user profile must be satisfied by information from the access-request or by related information from the local system, such as group membership in the access-request.

In Figure 4-1, *bob*'s password is the only check item. To successfully authenticate *bob*, the RADIUS server must receive this password in bob's access-request.

The following example shows the first line of a user profile. To successfully authenticate *ann*, the RADIUS server must receive the specified password, *ann* must be logging in on port 23 of the NAS, and she must be a member of the engineer group.

```
ann      Password = "8f4kv$s", NAS-Port = 23, Group = "engineer"
```

Note – If no check items are included in the user profile, the user is rejected.

Reply Items. Reply items are placed one per line. Each line begins with white space. Each line ends with a comma, except for the final reply item. Reply items give the PortMaster authorization information about the user's connection—for example, whether PPP or SLIP is used or whether the user's IP address is negotiated. In Figure 4-1, Framed-Protocol is a reply item. The value of Framed-Protocol is PPP, indicating that *bob* uses PPP for his connection.

If all check items in the user profile are satisfied by the access-request, the RADIUS server sends the reply items to the PortMaster to configure the connection.

Matching User Profiles

When a user logs in, the RADIUS server searches the **users** file for a matching profile. The following components of a profile must match the access-request for authentication to occur:

1. username
2. password check item
3. other check items

The username matches if **any** of the following conditions are met:

- The username in the profile is identical to the login name in the access-request.
- The username in the profile is **DEFAULT** or **DEFAULT**#, where # is any integer. See "Default User Profiles" on page 4-4 for more information.

The password matches if it is identical to that entered by the user. The password can be stored locally in the profile or remotely in a separate file. If you use an additional level of password security, you can specify the additional password authentication step in the profile.

All check items specified in a profile also must be present in the access-request packet or satisfied by local system information, for a match to occur.

Editing User Profiles

User profiles are maintained in the **users** file. On a UNIX host, use any text editor to edit the **/etc/raddb/users** file.

Default User Profiles

When the RADIUS server receives a login name from a PortMaster, the server scans the **users** file for a matching username, starting from the top of the file. If a match is located, RADIUS attempts to authenticate the user with the information in that user profile. If a matching user profile is not found during the scan, but a DEFAULT profile is located, RADIUS attempts to use the DEFAULT profile for authentication. The DEFAULT profile is typically used when the Auth-Type is System, SecurID, or ActivCard.

Caution – You must place DEFAULT profiles at the end of the **users** file. RADIUS stops scanning profiles when a matching DEFAULT profile is found and ignores any user profiles located after a DEFAULT user profile.

In the following example, user *bob*'s password is stored in a system password file. When he attempts to connect to the network, RADIUS scans the **users** file to determine if it contains a matching user profile. If a matching profile is not found before the DEFAULT profile is found, the DEFAULT profile is used. Because the DEFAULT profile includes **Framed-Protocol = PPP** as a reply item, PPP is used for *bob*'s connection

```
DEFAULT         Auth-Type = System
                Service-Type = Framed-User,
                Framed-Routing = None,
                Framed-Protocol = PPP,
                Framed-IP-Address = 255.255.255.254,
                Framed-MTU = 1500
```

RADIUS for UNIX 2.0 and later versions permit multiple DEFAULT user profiles. In place of a username, the first line of DEFAULT profiles start as follows:

- **DEFAULT**, with all capital letters. You can use this for multiple DEFAULT profiles if the profiles include different check items.
- If there are multiple default profiles you can append a number to the end of the profile name—for example, DEFAULT1, DEFAULT2, and so on:

```
DEFAULT1        Auth-Type = System, Called-Station-Id = 9255551234
                (reply items)

DEFAULT2        Auth-Type = System, Called-Station-Id = 9255554971
                (reply items)
```

In the following example, the **Prefix** and **Suffix** check items distinguish between the DEFAULT profiles. See "Username Prefixes and Suffixes" on page 4-12 for more information on using prefixes and suffixes. When users add the prefix or suffix to their username, the RADIUS server matches them to the corresponding DEFAULT profile.

In the example shown on the next page, assume that user *bob*'s password is stored in a system password file and that there is no profile with a username of **bob** in the RADIUS **users** file.

Suppose *bob* logs in as **Pbob**. When the first DEFAULT profile is found by RADIUS, the server strips the initial **P** from **Pbob** and looks in the system password file for a password associated with **bob**. If the password matches the one user *bob* entered, then he is authenticated as a PPP user.

```
DEFAULT         Auth-Type = System, Prefix = "P"
                Service-Type = Framed-User,
                Framed-Routing = None,
                Framed-Protocol = PPP,
                Framed-IP-Address = 255.255.255.254,
                Framed-MTU = 1500

DEFAULT         Auth-Type = System, Suffix = "%S"
                Service-Type = Framed-User,
                Framed-Routing = None,
                Framed-Protocol = SLIP,
                Framed-IP-Address = 255.255.255.254,
                Framed-Compression = None,
                Framed-MTU = 1006

DEFAULT         Auth-Type = System
                Service-Type = Login-User,
                Login-IP-Host = 172.16.1.4
                Login-Service = Telnet
```

If *bob* logs in as **bob%S**, the first DEFAULT profile is not used because there is no initial **P** present in the login name. When the second DEFAULT profile is found by RADIUS, the server strips the ending **%S** from **bob%S** and looks in the system password file for a password associated with **bob**. If the password matches the one user *bob* entered, then he is authenticated as a SLIP user.

If *bob* logs in as **bob**, the first two DEFAULT profiles are not used because the Prefix and Suffix check items do not match. When the third DEFAULT profile is found by RADIUS, the server looks in the system password file for a password associated with **bob**. If the password matches the one user *bob* entered, then he is authenticated as a Telnet user.

Check Items

Check items are used to authenticate the user. Table 4-1 describes all check items that can be used in RADIUS user profiles. Called-Station-Id, Calling-Station-Id, and Connect-Rate can be used as check items only if the RADIUS client is capable of sending them in an access-request. Called-Station-Id and Calling-Station-Id are supported over an ISDN Primary Rate Interface (PRI) on a PortMaster 3 running ComOS 3.7 or later and on a PortMaster 4 running ComOS 4.0 or later, and over an ISDN Basic Rate Interface (BRI) on other PortMaster products running ComOS 3.7 or later. Connect-Rate is supported only on a PortMaster 4 running ComOS 4.0 or later or a PortMaster 3 running ComOS 3.7 or later.

Note – Although it is not considered a check item, be sure that the username appears as the first item on the first, or check item, line of the user profile.

Table 4-1 User Profile Check Items

Item	Options	Explanation
Auth-Type	Local	User's password is stored in the RADIUS users file. Default.
	System	User's password is stored in a system password file.
	ActivCard	User is authenticated via ActivEngine software
	SecurID	User is authenticated via ACE/Server software.
	Reject	User always fails authentication.
Called-Station-Id	String of numerals	Telephone number called by user. Available in ComOS 3.7 for ISDN BRI and PortMaster 3 ISDN PRI. Available in ComOS 4.0 for PortMaster 4 ISDN PRI.
Calling-Station-Id	String of numerals	Telephone number user is calling from. Available in ComOS 3.7 for ISDN BRI and PortMaster 3 ISDN PRI. Available in ComOS 4.0 for PortMaster 4 ISDN PRI.
Connect-Rate	String of numerals	Maximum connection rate permitted, in bps. Available for the PortMaster 3 running ComOS 3.7 or later or the PortMaster 4 running ComOS 4.0 or later.
Crypt-Password	User's password	User's password is stored in UNIX crypt format. CHAP authentication attempts fail if Crypt-Password is used, even if the password is correct.

Table 4-1 User Profile Check Items *(Continued)*

Item	Options	Explanation
Expiration	Must be specified in *"Mmm dd yyyy"* format	Date that user's password expires.
Framed-Protocol	PPP	PPP is used for the connection. Can also be used as a reply item.
Group	String of characters in double quotation marks (" ")	Groups that user belongs to.
NAS-IP-Address	IP address	PortMaster IP address.
NAS-Port	Number	The PortMaster port number that the user is dialed in to (for example, NAS-Port = S2).
NAS-Port-Type	ISDN	ISDN port.
	Async	Asynchronous port.
	Sync	Synchronous port.
	ISDN-V120	ISDN in V.120 mode.
	ISDN-V110	ISDN in V.110 mode.
Password	String of characters in double quotation marks (" ")	User's password.
Prefix	String of characters in double quotation marks (" ")	Removed from beginning of username before checking password.
Service-Type	Call-Check	Authenticates the user at the point of entry on a NAS before answering the call. The NAS must support an ISDN Primary Rate Interface (PRI). You must also configure the call-check feature on the NAS.
	Framed-User	User uses PPP or SLIP for the connection. Can also be used as a reply item.

Table 4-1 User Profile Check Items *(Continued)*

Item	Options	Explanation
	Outbound-User	User makes outbound connections via Telnet. Can also be used as a reply item.
Suffix	String of characters in double quotation marks (“ ”)	Removed from end of username before checking password.

Passwords

If you are using ComOS 3.5 or later, the user's local password can be up to 48 printable, nonspace, ASCII characters. If you are using an earlier version of ComOS, the password must not exceed 16 characters. The password check item must be contained within double quotation marks. In addition to the password itself, you can specify two different password characteristics in a user profile: the password's location and its expiration date.

Password Locations

Use the Auth-Type check item to specify the type of authentication to use for a particular user. Auth-Type can be set to one of the following: Local, System, Reject, ActivCard, or SecurID. If this check item is omitted from the user profile, Local is used.

- Local

  To indicate that a user's password is stored in the RADIUS **users** file, use the **Local** Auth-Type.

  To set the user's password, use the Password check item as shown in the following example line from a user profile:

```
bob        Auth-Type = Local, Password = "ge55ep"
```

Note – If no Auth-Type is specified in a profile, then the RADIUS server assumes Auth-Type = Local. Typically, you include the Password check item. If you do not include the Password item—that is, if no check items are specified in the profile—then the user is rejected.

- System

  To indicate that a user's password is stored in a system password file, use the System Auth-Type:

  ```
  bob         Auth-Type = System
  ```

  System can be a password file in UNIX, such as **/etc/passwd**, **/etc/shadow**, or a password map in NIS or NIS+. When the RADIUS server receives a username-password pair from the client and the Auth-Type = System, the server queries the operating system to determine if there is a matching username-password pair.

  The System Auth-Type is equivalent to the **Password = "UNIX"** check item in RADIUS server version 1.16, which is also permitted in RADIUS server versions 2.0 and 2.1 for backward compatibility:

  ```
  bob         Password = "UNIX"
  ```

- ActivCard

  To specify that the user's password is to be authenticated by ActivCard, use the ActivCard Auth-Type:

  ```
  bob         Auth-Type = ActivCard
  ```

  See Chapter 6, "Installing and Configuring ActivCard," for instructions.

- SecurID

  To specify that the user's password is to be authenticated by a SecurID ACE/Server, use the SecurID Auth-Type:

  ```
  bob         Auth-Type = SecurID
  ```

  To use a SecurID passcode, the RADIUS server must be configured as an ACE/Client and you must have an ACE/Server configured—either on the same or a different host. See Chapter 7, "Installing and Configuring SecurID," for instructions.

- Reject

  To reject the user's authentication attempt without having to delete the user profile from the **users** file, use the Reject Auth-Type:

  ```
  bob         Auth-Type = Reject
  ```

  The Reject Auth-Type feature enables you to disable the user account temporarily.

Note – The RADIUS server rejects any access-request with an unknown Auth-Type and logs an error message.

Password Expiration Date

To disable logins after a particular date, complete the following steps:

1. **Specify the date of expiration using the Expiration check item.**

   The date must be specified in **"***Mmm dd yyyy***"** format, as in the following example:

   ```
   bob        Password = "ge55gep", Expiration = "Dec 04 1996"
   ```

2. **Edit the Password-Expiration and Password-Warning values in the dictionary to meet your security needs.**

   For example

   ```
   VALUE      Server-Config      Password-Expiration      30
   VALUE      Server-Config      Password-Warning         5
   ```

   The first parameter, Password-Expiration, turns on expiration if the value is greater than 0 (zero), but has no other effect.

   Password-Warning controls when users are notified that their accounts are about to expire. In the example above, users receive warning messages when they log in, starting 5 days before their password expiration date.

   You can turn account expiration off by making these two lines in the RADIUS dictionary into comments.

Note – A mechanism to permit users to change their passwords is outside the scope of RADIUS.

3. **If you modified the dictionary file, stop and restart the** radiusd **daemon.**

Password Encryption

- Use the Crypt-Password check item if you store the user's password in UNIX crypt format:

  ```
  bob        Crypt-Password = "ijFYNcSNctBYg"
  ```

The PortMaster RADIUS client encrypts the password that the user enters at login and sends the encrypted password to the RADIUS server. The server compares this password with the encrypted password stored in one of the following locations:

- The user profile in **/etc/raddb/users**, if Auth-Type = Local
- A system password file, such as **/etc/passwd** or **/etc/shadow**, if Auth-Type = System

The encrypted password in this example corresponds to a password of *abcdefgh*. You must use the UNIX **crypt** command to encrypt user passwords to store in the user profile. The UNIX **passwd** command encrypts passwords and stores them in the system password file.

Note – Crypt-Password can be used with scripted logins or with PAP. It cannot be used with CHAP.

Username Prefixes and Suffixes

Use the Prefix and Suffix check items to allow a network user to access multiple services by adding a series of characters to the beginning or end of his username. Prefix and suffix strings must consist of 16 or fewer printable, nonspace, ASCII characters. The prefix and suffix strings must be contained within double quotation marks.

When a user logs in, the RADIUS server searches through the **users** file for a profile that matches the login. If a profile has a Prefix or Suffix check item, the server strips away the specified prefix or suffix character(s) from the login name before checking the password. If the server does not find a profile that matches the login, the RADIUS server tries to match the login against a DEFAULT user profile.

Consider the following example **users** file:

```
Pliesel         Auth-Type = System, Prefix = "P"
                Framed-Protocol = PPP,
                Service-Type = Framed-User,
                Framed-Routing = None,
                Framed-IP-Address = 255.255.255.254,
                Filter-Id = "firewall",
                Framed-MTU = 1500
```

```
DEFAULT         Auth-Type = System, Suffix = "%slip"
                Framed-Protocol = SLIP,
                Service-Type = Framed-User,
                Framed-Routing = None,
                Framed-IP-Address = 255.255.255.254,
                Filter-Id = "firewall",
                Framed-MTU = 1500
```

In this example, *liesel*'s username and password are stored in a system password file. If *liesel* specifies a username of **Pliesel** when attempting to connect to the PortMaster, the RADIUS server looks up the username. When the profile for **Pliesel** is found, the Prefix check item matches because the login name begins with a **P**. This cues the server to strip away the specified prefix character and check the system password file for *liesel*'s password. If a password match is found, **Pliesel** is connected as a PPP user.

If *liesel* specifies a username of **liesel%slip** when she logs in, the RADIUS server finds no match until it gets to the DEFAULT entry. The Suffix check item matches because the login name ends with **%slip**. This cues the server to strip away the specified suffix characters and check the system password file for *liesel*'s password. The server next checks the system password for *liesel*. If a password match is found for *liesel*, **liesel%slip** is connected as a SLIP user.

In the next example, the **users** file has no provision for username prefixes:

```
liesel          Auth-Type = System
                Framed-Protocol = PPP,
                Service-Type = Framed-User,
                Framed-Routing = None,
                Framed-IP-Address = 255.255.255.254,
                Filter-Id = "firewall",
                Framed-MTU = 1500

DEFAULT         Auth-Type = System, Suffix = "%slip"
                Framed-Protocol = SLIP,
                Service-Type = Framed-User,
                Framed-Routing = None,
                Framed-IP-Address = 255.255.255.254,
                Filter-Id = "firewall",
                Framed-MTU = 1500
```

Again, *liesel*'s username and password are stored in a system password file. Suppose *liesel* logs in as **Pliesel**. There are no profiles with a username of **Pliesel** or a Prefix check item specifying **P**. The RADIUS server cannot find a matching user profile and rejects the connection attempt.

Prefixes and suffixes are most useful when defined in a DEFAULT user profile. See "Default User Profiles" on page 4-4 for information on using prefixes and suffixes in a DEFAULT profile.

Called-Station-Id

You can use the number that the user is calling as a check item. Suppose user *mario* calls in using your toll-free access number, 1-800-555-4973. With the user profile shown in the following example, *mario* fails authentication. He can only be authenticated if he calls in to 510-555-1234.

```
mario           Password = "ge55gep", Called-Station-Id = "5105551234"
                Service-Type = Framed-User,
                Framed-Routing = None,
                Framed-Protocol = PPP
```

Note – Use of the Called-Station-Id check item requires that the Called-Station-Id attribute be included in the access-request. A PortMaster 4 running ComOS 4.0 or later and a PortMaster 3 running ComOS 3.7 or later send this attribute—if it is available—to the RADIUS server as part of the access-request. Other PortMaster products running ComOS 3.7 or later send this information as part of the access-request over ISDN Basic Rate Interfaces (BRIs). If the Called-Station-Id attribute is not sent, the Called-Station-Id check item fails to match and the user is rejected.

Calling-Station-Id

You can use the number that the user is calling from as a check item. In the following example, *cissy* is authenticated if she calls from 209-555-5678. If she calls from any other number, she fails authentication.

```
cissy           Password = "ge55gep", Calling-Station-Id = "2095555678"
                Service-Type = Framed-User,
                Framed-Routing = None,
                Framed-Protocol = PPP
```

Note – Use of the Calling-Station-Id check item requires that the Calling-Station-Id attribute be included in the access-request. A PortMaster 4 running ComOS 4.0 or later and a PortMaster 3 running ComOS 3.7 or later send this attribute—if it is available—to the RADIUS server as part of the access-request. Other PortMaster products running ComOS 3.7 or later send this information as part of the access-request if the user is connecting to an ISDN BRI port. If the Calling-Station-Id attribute is not sent, the Called-Station-Id check item fails to match and the user is rejected.

Client Information

Use the NAS-IP-Address check item to specify the IP address of a particular PortMaster. When this setting is used as a check item in a user profile, the user must be attempting to start a connection on the specified PortMaster for the connection to succeed.

Use the NAS-Port check item to specify a particular PortMaster port. To be successfully authenticated, the user must be attempting to log in to this port:

```
bob             Password = "ge55gep", NAS-Port = 23
```

Use the NAS-Port-Type check item to specify the type of port. Options for the NAS-Port-Type are as follows: **Analog**, **Async**, **Sync**, **ISDN**, **ISDN-V120**, or **ISDN-V110**. The PortMaster must run ComOS release 3.3.1 or later to support NAS-Port-Type.

The following example displays a user profile containing the NAS-IP-Address and NAS-Port-Type settings:

```
bob     Password = "ge55gep", NAS-IP-Address = 192.168.1.54, NAS-Port-Type = ISDN
        Service-Type = Framed-User,
        Framed-Routing = None,
        Framed-Protocol = PPP
```

Connect-Rate

The Connect-Rate check item can be used with PortMaster 3 and PortMaster 4 clients. Use this to specify the maximum connection rate permitted for a user.

In the following example, with a connection rate of 28800bps, *babar* fails authentication if he attempts to connect to the PortMaster 3 at a higher rate—for example, 33600bps or 56000bps:

```
babar           Auth-Type = System, Connect-Rate = 28800
                Service-Type = Framed-User,
                Framed-Routing = None,
                Framed-Protocol = PPP
```

You can use this check item to restrict access to users of low-speed modems. In the following example, any user dialing in with a connection rate less than or equal to 14399bps is rejected:

```
DEFAULT         Auth-Type = Reject, Connect-Rate = 14399
                Service-Type = Framed-User
```

Note – Use of the Connect-Rate check item requires that the Connect-Info attribute be included in the access-request. The PortMaster 4 running ComOS 4.0 or later and the PortMaster 3 running ComOS 3.7 or later send the Connect-Info attribute as part of the access-request. If Connect-Info is not sent, the Connect-Rate check item is ignored.

Framed-Protocol

Framed-Protocol is primarily used as a reply item, but you can also use the Framed-Protocol check item in the user profile for PPP autodetection by the PortMaster:

```
bob             Auth-Type = System, Framed-Protocol = PPP
```

See "Configuring a PPP or SLIP User" on page 4-25 for more information.

Group

You can define a **group** of users to restrict authentication when specifying Auth-Type = System. If a user profile contains the Group check item, only users that are defined as members of the specified group are authenticated.

The Group string consists of up to 63 printable, nonspace, ASCII characters. The group must be contained within double quotation marks.

If you specify multiple groups in a user profile, the user must be a member of every group specified to be authenticated. In the following example, user *ann* is authenticated only if *ann* is a member of both the *engineer* group and the *hardware* group:

```
ann             Auth-Type = System, Group = "engineer", Group = "hardware"
```

On UNIX hosts, groups are defined in **/etc/group** or via NIS. Refer to your system documentation for instructions on creating groups and adding members to groups.

Service-Type

Service-Type is generally used as a reply item, but it can be used with either of the following values as a check item. See "Specifying the Type of Service" on page 4-22 for more information on the Service-Type reply item.

Call-Check

You can authenticate a user before the NAS accepts the call by specifying the Call-Check value for Service-Type.

```
5105551234      Service-Type = Call-Check, Calling-Station-Id = "5105551234"
```

You can determine whether to answer a call based upon the values for the Calling-Station-Id or the Called-Station-Id check items. Some example uses of Call-Check are the following:

- Service class support
  - For example, a service provider can offer toll-free dial-up service and minimize toll charges incurred over the toll-free number. Call-Check allows the service provider to answer the call based upon the Calling-Station-Id (the number from which the call originated). If a call does not come from a calling station assigned to the toll-free service, the PortMaster returns a busy signal rather than accepting the call. The service provider avoids incurring charges associated with answering the call if the caller (calling station) is not defined for this service. This service also provides an additional means of security by ensuring that a user dials in from a specified number, removing the need for dialback users.
  - Another example of a service class support is guest dial-up, where a service provider allows guests to dial up via a specified called number—Called-Station-Id.
- TCP-Clear tunneling

  TCP-Clear tunnels are similar to Layer 2 Tunneling Protocol (L2TP) tunnels, but are available only on PortMaster products. TCP-clear tunnels can be established for SLIP, asynchronous, and PPP connections.

You can enable the call-check feature on a PortMaster supporting an ISDN Primary Rate Interface (PRI), such as the PortMaster 3 or PortMaster 4. The setup packet sent by the telephone company or line provisioner to the NAS includes the Called-Station-Id (the number dialed), Calling-Station-Id (the number the user is dialing from), or both. These

numbers are available over the D channel of a PRI. The PortMaster sends a RADIUS access-request to the server for any incoming call before accepting the call. The access-request packet includes the following:

- Attribute User-Name set to the value of the Calling-Station-Id, if known, or to "No-Call-Id".
- Attribute Service-Type set to Call-Check
- Attribute Called-Station-Id set to the number called

For example, a PortMaster 3 supports call-check and expects to receive one of the following replies to an access-request:

- RADIUS access-accept with the reply items to configure the session, such as connecting the user via a **netdata** connection to a given host and TCP port.
- RADIUS access-accept with no reply items. This reply instructs the NAS to accept the call and apply the usual RADIUS authentication process to the login.
- RADIUS access-reject to reject the call.

Framed-User

You can use the Service-Type = Framed-User check item to authenticate users who make their connections using PPP.

Outbound-User

Use the Service-Type = Outbound-User check item to restrict a user to outbound accesses to network device ports. You must use the same attribute and value—Service-Type = Outbound-User—as a reply item in the user profile. See "Granting a User Outbound Telnet Access" on page 4-34 for more information.

Reply Items

Reply items can authorize or apply any of the following: type of service provided, callback information, routing information, connection protocol, timeouts, port limits, menus, maximum MTU, filters, remote login information, and termination menus. Table 4-2 summarizes the reply items you can include in user profiles.

Table 4-2 User Profile Reply Items

Item	Options	Explanation
Callback-Id	Location name in double quotation marks (“ ”)	Specify only for Service-Type = Callback-Framed-User. Location must be in PortMaster location table.
Callback-Number	Phone number in double quotation marks (“ ”)	Specify only for Service-Type = Callback-Login-User.
Filter-Id	Filter name	Filter name to be used for packet or access filtering on the interface.
Framed-Compression	None	If this reply item is omitted, Van Jacobson TCP/IP header compression is used.
	Van-Jacobson-TCP-IP	Van Jacobson TCP/IP header compression is used for the connection. Default.
Framed-IP-Address	IP Address	The user’s IP address.
Framed-IP-Netmask	Netmask	The user’s netmask.
Framed-IPX-Network	Dotted decimal IPX network number	IPX network number.
Framed-MTU	Number	Number of bytes in maximum transmission unit (MTU).
Framed-Protocol	PPP	PPP is used for the connection.
		Can also be used as a check item.
	SLIP	SLIP is used for the connection.

Table 4-2 User Profile Reply Items *(Continued)*

Item	Options	Explanation
Framed-Route	Destination IP address	The IP address of the destination network.
	Gateway IP address	The IP address of the gateway to the destination network.
	Metric	The number of routing hops to the destination network. Also known as the hop count.
Framed-Routing	None	Disables RIP on the interface.
	Broadcast	The interface sends RIP updates.
	Listen	The interface listens for RIP updates.
	Broadcast-Listen	The interface sends and listens for RIP updates.
Idle-Timeout	In seconds	Specifies the idle time limit for a session.
Login-IP-Host	IP address	Address of the remote host.
Login-Service	Telnet	Establishes a Telnet connection to the remote host.
	Rlogin	Establishes an rlogin connection to the remote host.
	TCP-Clear	Establishes a TCP clear connection to the remote host.
	PortMaster	Establishes a connection to the remote host using the PortMaster login service.
Login-TCP-Port	TCP port number	TCP port number of the Login-Service.
Menu	Menu name in double quotation marks (“ ”)	Defines a menu in a user record. See Chapter 5, “Configuring RADIUS Menus.”

Table 4-2 User Profile Reply Items *(Continued)*

Item	Options	Explanation
Port-Limit	Number of B channels for ISDN Multilink PPP or Multilink V.120	Specifies the maximum number of B channels a user can use.
Session-Timeout	In seconds	Specifies the time limit for a session.
Service-Type	Administrative-User	Grants user full access to all configuration commands.
	Callback-Login-User	Calls user back and connects via Telnet, **rlogin**, PortMaster, or TCP-Clear login service.
	Callback-Framed-User	Calls user back and establishes a framed connection (PPP or SLIP). Location must be specified in PortMaster location table.
	Framed-User	User uses PPP or SLIP for the connection. Can also be used as a check item.
	Login-User	User connects via Telnet, **rlogin**, PortMaster, or TCP-Clear login service.
	NAS-Prompt-User	Grants user limited access to commands (nonconfiguration only).
	Outbound-User	User makes outbound connections via Telnet. Can also be used as a check item.
Termination-Menu	Menu name in double quotation marks (“ ”)	Menu to display after service is terminated.

Specifying the Type of Service

You must specify characteristics of the service that is provided to the user by specifying the desired Service-Type in each user profile. The reply items in each user profile determine how the user's session is configured on the PortMaster. Table 4-3 defines each Service-Type value. Refer to the sections following the table for information on how and why you would use each one.

Table 4-3 Service-Type

Service-Type	Explanation
Administrative-User	The PortMaster grants the user a full administrative login—as if the user had logged in using **!root**. The user has full configuration ability and access to all operating system commands. This Service-Type is available only with ComOS 3.5 or later versions. for more information about this value, see "Granting a User Administrative Rights" on page 4-24.
Callback-Framed-User	The PortMaster verifies the user's identity by disconnecting the port and dialing the user back using a specified location table entry. When the user's identity is verified, PPP or SLIP is used for the connection. To specify the callback location, see "Using Callback to Authenticate a User" on page 4-24.
Callback-Login-User	The PortMaster verifies the user's identity by disconnecting the port and dialing the user back at a specified number. The user's identity must be verified before the connection is permitted. To specify the callback location, see "Using Callback to Authenticate a User" on page 4-24.

Table 4-3 Service-Type *(Continued)*

Service-Type	Explanation
Call-Check	You can enable services without authenticating the user at the point of entry on a PortMaster that supports an ISDN Primary Rate Interface (PRI), such as the PortMaster 3. You must also configure the call-check feature on the PortMaster. For more information on this value, see "Call-Check" on page 4-17.
Framed-User	The user makes a connection via PPP or SLIP. See "Configuring a PPP or SLIP User" on page 4-25.
Login-User	The user connects via the Telnet, **rlogin**, or PortMaster service (**in.pmd**), or via TCP-Clear (**netdata**). See "Configuring a Login User" on page 4-31
NAS-Prompt-User	The PortMaster grants the user a limited administrative login. A PortMaster user can use the following commands: **ifconfig**, **ping**, **ptrace**, **reboot**, **reset**, **set console**, **set debug**, **show**, **traceroute**, and any nonconfiguration commands. The following commands are not permitted on a PortMaster: **add**, **delete**, **erase**, **save**, **tftp**, and any **set** commands except **set console** or **set debug**. This Service-Type is available only with ComOS 3.5 or later versions. See "Granting a User Administrative Rights" on page 4-24.
Outbound-User	The user uses Telnet for outbound connections. See "Granting a User Outbound Telnet Access" on page 4-34.

Note – If the RADIUS for UNIX server is used with a NAS other than a PortMaster product, the Administrative-User and NAS-Prompt-User Service-Types must not be used unless the other vendor's implementation of these types is compatible with the Lucent

Remote Access implementation. The remainder of this appendix explains how to set reply items on a PortMaster NAS. Remember, you **must** own at least one PortMaster product to legally use Lucent RADIUS.

Granting a User Administrative Rights

You can grant a user administrative access to a PortMaster running ComOS 3.5 or later by specifying either of the following values for Service-Type:

- Administrative-User
- NAS-Prompt-User

Administrative-User. You can grant a user full PortMaster administrative ability by specifying Service-Type = Administrative-User. The user can configure the PortMaster client and can use all PortMaster commands.

```
bob             Password = "ge55gep"
                Service-Type = Administrative-User
```

NAS-Prompt-User. You can grant a user limited PortMaster administrative ability by specifying Service-Type = NAS-Prompt-User value. The user can use the following commands: **ifconfig**, **ping**, **ptrace**, **reboot**, **reset**, **set console**, **set debug**, **show**, and **traceroute**.

```
bob             Password = "ge55gep"
                Service-Type = NAS-Prompt-User
```

The user cannot configure the PortMaster client and cannot use these commands: **add**, **delete**, **erase**, **save**, **tftp**, and any **set** commands except **set console** or **set debug**.

Using Callback to Authenticate a User

You can authenticate a user with callback by specifying either of the following values for Service-Type:

- Callback-Framed-User
- Callback-Login-User

Callback-Framed-User. When a user's Service-Type is Callback-Framed-User, you must specify a location using the Callback-Id reply item.

```
elfego          Password = "ke$&54su"
                Service-Type = Callback-Framed-User,
                Callback-Id = "elfego_home"
```

After the RADIUS server authenticates *elfego*, it sends an access-accept message including the Callback-Id to the PortMaster. The PortMaster checks its local location table; if there is a matching location name, it makes the connection using that location's settings.

Note – To create location table entries, see the information on configuring dial-out locations in the *PortMaster Configuration Guide*.

Callback-Login-User. When a user's Service-Type is Callback-Login-User, you must specify a telephone number using the Callback-Number reply item.

```
elfego          Password = "ke$&54su"
                Service-Type = Callback-Login-User,
                Callback-Number = "9,1-800-555-1234"
```

After the RADIUS server authenticates the user, it sends an access-accept message including the Callback-Number to the PortMaster. The PortMaster calls the user back at the specified number. The PortMaster follows the ATDT command set. It ignores hyphens in the number received from RADIUS and treats commas as pauses. If the user is reached successfully, the PortMaster prompts the user to reenter the password and then sets up the connection.

When a user's Service-Type is Callback-Login-User or Login-User, you can supply additional information:

- Service used to connect to the host—See "Configuring a Login User" on page 4-31.
- Name or IP address of the remote host—See "Login-IP-Host" on page 4-32.
- TCP port number—See "Login-TCP-Port" on page 4-33.

Configuring a PPP or SLIP User

Specify Service-Type = Framed-User if the user is making the connection via PPP or SLIP. You must add the Framed-Protocol reply item to the user profile and specify whether PPP or SLIP is used.

```
jake            Auth-Type = System
                Service-Type = Framed-User,
                Framed-Protocol = SLIP,
                Framed-MTU = 1006,
                Filter-Id = "firewall"
```

Framed-Protocol can also be used as a check item for PPP autodetection by the PortMaster. See "Framed-Protocol" on page 4-16 for more information on the Framed-Protocol check item.

You can specify a packet filter to be used for each PPP or SLIP session, as shown here. See "Applying Packet Filters" on page 4-30 for more information. Access filters are applied to login users; see "Applying Access Filters" on page 4-34 for information.

Use the Framed-MTU reply item to configure the number of bytes in the maximum transmission unit (MTU) for a user's connection. Framed-MTU is used only for PPP and SLIP connections. For PPP connections, Framed-MTU can be between 100 and 1520 bytes. SLIP connections can have an MTU between 100 and 1006 bytes. On IPX networks, set Framed-MTU to at least 600 bytes.

Note – If PPP negotiates an MTU for the connection, the Framed-MTU setting is ignored.

Enabling and Disabling Compression

Van Jacobson TCP/IP header compression is enabled by default. To disable compression, set the Framed-Compression value to **None**.

```
Framed-Compression = None
```

To reenable compression, set the Framed-Compression value to **Van-Jacobson-TCP-IP**.

```
Framed-Compression = Van-Jacobson-TCP-IP
```

Specifying an IP Address for the User

Use the Framed-IP-Address reply item to specify the user's IP address:

```
jake            Auth-Type = System
                Service-Type = Framed-User,
                Framed-Routing = None,
                Framed-Protocol = PPP,
                Framed-IP-Address = 172.28.1.1
```

When Framed-IP-Address is set to 255.255.255.255, the PortMaster negotiates the address with the end node (dial-in user). When it is set to 255.255.255.254 (or omitted), the PortMaster assigns an IP address to the dial-in user from the assigned address pool.

Note – To create an assigned address pool for the PortMaster, use the **set assigned_address** *Ipaddress* command on the PortMaster, where *Ipaddress* is the first IP address in the address pool. See the *PortMaster Configuration Guide* for more information on assigned address pools.

Applying a Subnet Mask to the Address

Use the Framed-IP-Netmask reply item as follows to specify a subnet mask. The subnet mask is applied to the address specified for the user in the Framed-IP-Address reply item. The PortMaster uses the specified value to update its routing table when the user logs in.

```
jake            Auth-Type = System
                Service-Type = Framed-User,
                Framed-Routing = None,
                Framed-Protocol = PPP,
                Framed-IP-Address = 192.168.10.232,
                Framed-IP-Netmask = 255.255.255.192
```

In this example, a netmask of 255.255.255.192 is used. The user is allocated a 64-host subnet. The subnet allocated to *jake* includes hosts with addresses from 192.168.10.193 through 192.168.10.255.

If this reply item is omitted, the default subnet mask of 255.255.255.255 is used. Use the Framed-IP-Netmask reply item with caution because it affects both routing and Proxy Address Resolution Protocol (Proxy ARP) on the PortMaster. Using Framed-IP-Netmask adds a temporary route to the routing table on the PortMaster. See the *PortMaster Routing Guide* for more information.

Note – This reply item requires ComOS 3.5 or later. You must use the **set user-netmask on** command to enable the PortMaster to use the netmask value. If the command **set user-netmask off** has been issued on the PortMaster, the default subnet mask of 255.255.255.255 is applied to all connections regardless of what the RADIUS server returns. Before using this reply item, read about the **set user-netmask** command in the *PortMaster Configuration Guide* or the *PortMaster Command Line Reference*.

Adding a Route to the PortMaster Routing Table

Use the Framed-Route reply item to add a route to the PortMaster routing table when service to the user begins. Three pieces of information are required: the destination IP address, gateway IP address, and metric (hop count).

```
jake            Auth-Type = System
                Service-Type = Framed-User,
                Framed-Routing = None,
                Framed-Protocol = PPP,
                Framed-IP-Address = 172.28.1.1,
                Framed-Route = "172.28.1.0 172.28.1.1 1"
```

In this example, 172.28.1.0 is the IP address of a destination network, 172.28.1.1 is the IP address of the gateway for this network, and 1 is the metric.

If 0.0.0.0 is specified as the gateway IP address, the user's specific IP address is substituted for the gateway.

In ComOS 3.5 or later, you can use the classless interdomain routing (CIDR) format for the Framed-Route, which identifies the number of high-order bits in the destination IP address, as shown in the following example.

```
jake            Auth-Type = System
                Service-Type = Framed-User,
                Framed-Routing = None,
                Framed-Protocol = PPP,
                Framed-IP-Address = 172.28.1.1,
                Framed-Route = "172.28.1.0/28 172.28.1.1 1"
```

See the *PortMaster Configuration Guide* for more information on CIDR.

Configuring RIP on the User's Interface

Use the Framed-Routing reply item to control how Routing Information Protocol (RIP) is used on the user's interface. Table 4-4explains RIP options.

Table 4-4 Framed-Routing Options

Option	Explanation
None	Disables RIP on the interface.
Broadcast	The interface sends RIP updates.
Listen	The interface listens for RIP updates.
Broadcast-Listen	The interface sends and listens for RIP updates.

In the following example, Framed-Routing is set to **None** so that the interface neither sends nor listens for RIP updates.

```
sri             Password = "4r2tkgbp"
                Service-Type = Framed-User,
                Framed-Routing = None,
                Framed-Protocol = PPP
```

The usefulness of the Idle-Timeout reply item is reduced if RIP is active on the user's interface because updates are sent every 30 seconds, keeping the port active rather than idle. See "Idle-Timeout" on page 4-36 for information on the Idle-Timeout reply item.

Typically, Framed-Routing is set to **None** for user connections, and is set to **Broadcast** or **Broadcast-Listen** for connections to routers that require routing updates via RIP. See the *PortMaster Routing Guide* and the *PortMaster Command Line Reference* for more information.

Configuring an IPX Network Connection

When an IPX network is used for a particular user's connection, you must include the Framed-IPX-Network reply item in the user profile. The PortMaster supports IPX over PPP.

Specify Framed-IPX-Network in dotted decimal notation (*xx.xx.xx.xx*). For example, the hexadecimal network number 123456 must be expressed as 0.18.52.86.

```
ajit            Password = "testing"
                Service-Type = Framed-User,
                Framed-Routing = None,
                Framed-Protocol = PPP,
                Framed-IPX-Network = 0.18.52.86
```

On a UNIX system, the following Perl script converts an IPX hexadecimal network number to dotted decimal notation:

```
#!/usr/local/bin/perl
# hex   - convert ip addresses to hexadecimal and vice versa
for (@ARGV) {
          if (/\./) {               # convert . to hex
                    @octets = split(/\./,$_);
                    for $octet (@octets) {
                              printf "%02X",$octet;
                    }
                    print "\n";
          } else {                   # convert hex to .
                    $buf = '';
                    while (s/\w\w//) {
                              $buf .= hex($&).'.';
                    }
                    $buf =~ s/\.$/\n/;
                    print $buf;
          }
}
```

Applying Packet Filters

Use the Filter-Id reply item to associate packet filters with each PPP or SLIP user authenticated with RADIUS. In the following example, the **firewall** filter is used during a connection:

```
rakshah         Password = "yj8hg355"
                Service-Type = Framed-User,
                Framed-Routing = None,
                Framed-Protocol = PPP,
                Filter-Id = "firewall"
```

For the Filter-Id attribute to initiate filtering, the filter must be previously defined on the PortMaster and the rule set must contain at least one rule. If you specify a Filter-Id in the user profile, but do not define the filter, then no filtering is performed. If you define the filter, but do not create any rules in the filter, then no filtering is performed.

You must define filters in the filter table on each PortMaster that the user accesses, unless you are using ChoiceNet. See the *ChoiceNet Administrator's Guide* for information on ChoiceNet and how it provides storage for filters in a central site.

To control whether the filter restricts incoming or outgoing traffic, the filter defined on the PortMaster must have an **.in** or **.out** suffix attached to its name. In the previous example, the filter **firewall.in** is used as a filter for packets entering the PortMaster via the interface, and **firewall.out** is used as an output filter for packets leaving the PortMaster via the interface.

Do not specify the **.in** and **.out** suffixes in the user profile. When a user dials in to the PortMaster, the **.in** or **.out** suffix is automatically appended to the filter name provided by RADIUS for UNIX.

Note – To configure filters on a PortMaster, see the information on configuring filters in the *PortMaster Configuration Guide*. Filters specified in RADIUS for UNIX can also be dynamically loaded via ChoiceNet. For more information see the *ChoiceNet Administrator's Guide*.

Configuring a Login User

If the user is logging in to your system, specify either of the following values for Service-Type:

- **Callback-Login-User**

  Specify Callback-Login-User when you want to call the user back to at a specified telephone number before authorizing service. See "Using Callback to Authenticate a User" on page 4-24.

- **Login-User**

  Specify Login-User for all other login connections:

```
sri             Auth-Type = System
                Service-Type = Login-User
```

You can specify an access filter to be used for each login session. See "Applying Access Filters" on page 4-34.

When a user's Service-Type is Callback-Login-User or Login-User, you can supply additional information:

- Service used to connect to the host
- Name or IP address of the remote host
- TCP port number.

Login-Service

When a user's Service-Type is Login-User or Callback-Login-User, you can use the Login-Service reply item to specify the service used to connect to the host.

If you do not use this reply item, the PortMaster login service is used by default. Table 4-5 describes all Login-Service values.

Table 4-5 Login-Service

Login-Service	**Description**
Telnet	Establishes a Telnet connection to the remote host. Port 23 is the default.
Rlogin	Establishes an **rlogin** connection to the remote host.
TCP-Clear	Establishes a TCP clear connection to the remote host. 8-bit data is passed through this connection without interpretation. This option is the equivalent of the **netdata** login service on the PortMaster. Port 6000 is the default.
PortMaster	Establishes a connection to the remote host using the PortMaster login service. To use this setting with UNIX versions of RADIUS, you must install the **in.pmd** daemon on the remote host.

Login-IP-Host

When a user's Service-Type is Login-User or Callback-Login-User, you can use the Login-IP-Host reply item to specify the name or IP address of the remote host. You can specify more than one host by using multiple Login-IP-host attributes.

If you do not use this reply item to specify a remote host, the PortMaster default host is used. See the *PortMaster Command Line Reference* for information on setting the default host.

In following example, the user is authenticated and then called back at the Callback-Number. If this call is successfully authenticated, a Telnet connection to host 192.168.1.76 is established.

```
uma             Password = "gk4u4p"
                Service-Type = Callback-Login-User,
                Login-IP-Host = 192.168.1.76,
                Login-Service = Telnet,
                Callback-Number = "9,1-800-555-1234"
```

If Login-IP-Host is set to 0.0.0.0 or omitted, the host defined for the port in the PortMaster is used. If Login-IP-Host is set to 255.255.255.255, the user must enter the hostname or the host's IP address at the **host:** prompt that appears.

If the user is to log in to a particular TCP port on the remote host, specify the port number with the Login-TCP-Port reply item. See "Login-TCP-Port" on page 4-33.

Login-TCP-Port

When a user's Service-Type is Login-User or Callback-Login-User, you can use the Login-TCP-Port reply item to specify the port number if the user is to log in to a particular TCP port on the remote host. This reply item is often used with the Outbound-User reply item (see "Granting a User Outbound Telnet Access" on page 4-34) and the Login-IP-Host reply item (see "Login-IP-Host" on page 4-32).

In following example, the user is authenticated and then called back at the Callback-Number. If authentication is successful, a Telnet connection to port 6220 on host 192.168.1.76 is established.

```
uma             Password = "gk4u4p"
                Service-Type = Callback-Login-User,
                Login-IP-Host = 192.168.1.76,
                Login-Service = Telnet,
                Login-TCP-Port = 6220,
                Callback-Number = "9,1-800-555-1234"
```

If Login-TCP-Port is omitted, the port defined for Telnet service on the PortMaster is used. The default port number for Telnet is 23.

Applying Access Filters

An access filter is a filter associated with a login user. Use the Filter-Id reply item to associate an access filter with a host prompt login user authenticated with RADIUS for UNIX. In the following example, the **restricthost** filter is used to restrict the hosts that the user can access during a connection:

```
sunil           Password = "76patel5rj"
                Service-Type = Login-User,
                Login-IP-Host = 255.255.255.255,
                Login-Service = Telnet,
                Login-TCP-Port = 23,
                Filter-Id = "restricthost"
```

Note – Access filters only restrict the host(s) a user can access. They do not restrict what the user can access from that host.

For the Filter-Id attribute to initiate filtering, the filter must be previously defined and the rule set must contain at least one rule. If you specify a Filter-Id in the user profile, but do not define the filter, then no filtering is performed. If you define the filter, but do not create any rules in the filter, then no filtering is performed.

You must define access filters in the filter table on each PortMaster the user accesses, using the same name as the Filter-Id. The access filter name defined in the user profile must be exactly the same as the filter name defined on the PortMaster. The PortMaster does not append an extension to the name of an access filter, unlike packet filters.

Note – ChoiceNet cannot be used with access filters.

Granting a User Outbound Telnet Access

Specify Service-Type = Outbound-User to enable a user to gain outbound access to network device ports using Telnet. This feature is supported in ComOS version 3.3.2 or later. To use this feature, you must set the relevant asynchronous ports on your PortMaster as either host-controlled devices, using the command **set** *S0* **device** *Device* **network** *Mode*, or as devices capable of two-way operation, using the command **set** *S0* **twoway** *Device* **network** *Mode*. See the *PortMaster Command Line Reference* for more information on setting the PortMaster port type.

To restrict users to outbound access, the user profile must include this same attribute and value—Service-Type = Outbound-User—as a check item. The Login-TCP-Port setting can be used to specify the TCP port for the connection; the port number must be between 10000 and 10100 inclusive.

```
roxy            Password = "ge55gep", Service-Type = Outbound-User
                Service-Type = Outbound-User,
                Login-Service = Telnet,
                Login-TCP-Port = 10000
```

In this example, when *roxy* attempts an outbound connection, the PortMaster client checks its local user table for an entry for the user. If *roxy* is not found in the user table, the PortMaster sends an access-request to the RADIUS server indicating that *roxy* is an Outbound-User.

The RADIUS for UNIX server examines *roxy*'s profile in the **users** file. If Outbound-User is included as a reply item, the PortMaster is notified to permit the connection.

Configure the PortMaster as shown in the following example. This example configures port S1; however, you can configure multiple ports to listen at different TCP port numbers or at the same TCP port number to create a pool of devices.

```
Command> set s1 device /dev/network
Command> set s1 service_device telnet 10000
Command> set s1 modem off
```

Setting Timeouts

You can apply the following two kinds of timeouts to any session:

- Idle-Timeout
- Session-Timeout

Note – Idle-Timeout and Session-Timeout values are specified in **seconds** in the RADIUS user profiles. Timeout values set directly on the PortMaster using the PortMaster command line interface or the PMVision™ graphical user interface (GUI) are specified in **minutes**, by default.

Idle-Timeout

Use Idle-Timeout to specify the number of seconds a session can be idle before it is disconnected. Idle-Timeout can range from 2 seconds to 14400 seconds (4 hours) and is rounded down to a multiple of 60 if greater than 240.

Note – An Idle-Timeout value of **0** in the user profile is overridden by the Idle-Timeout setting configured on the PortMaster. Any Idle-Timeout value in the user profile greater than zero overrides the Idle-Timeout setting configured on the PortMaster.

In this example, if the session is inactive longer than 600 seconds (10 minutes), *greta* is disconnected.

```
greta           Password = "ge55gep"
                Service-Type = Framed-User,
                Framed-Routing = None,
                Framed-Protocol = PPP,
                Idle-Timeout = 600
```

Note – The effectiveness of the Idle-Timeout reply item can be reduced if RIP is active on the user's interface because updates are sent every 30 seconds, keeping the port active rather than idle. See "Configuring RIP on the User's Interface" on page 4-29 for information on using the RIP reply item.

Session-Timeout

Use Session-Timeout to specify the time limit for a session. If this reply item appears in a user profile, the user is disconnected when the time limit is reached. Session-Timeout is specified as a particular number of seconds, up to a maximum of 31536000 (1 year).

In the following example, *adil* is automatically disconnected after 7200 seconds (2 hours):

```
adil            Password = "khan235f3"
                Service-Type = Framed-User,
                Framed-Routing = None,
                Framed-Protocol = PPP,
                Session-Timeout = 7200
```

Suppose you want to impose a time limit on connections to a particular port. For example, you want to provide a means for users to only check their email (using a filter) and don't want the users tying up the port. In the following example, users connected

on port 10 of NAS 10.10.10.1 are automatically disconnected after 600 seconds (10 minutes):

```
DEFAULT         Auth-Type = System, NAS-IP-Address = 10.10.10.1, NAS-Port = 10
                Service-Type = Framed-User,
                Framed-Routing = None,
                Framed-Protocol = PPP,
                Session-Timeout = 600,
                Filter-Id = "emailonly"
```

Using Menus

You can specify menus to be used when the user is authenticated or when the user ends a session. See Chapter 5, "Configuring RADIUS Menus," for more information.

Menu

Use the Menu reply item to call a menu by reference. The Menu reply item is the only reply item in the user profile when a menu is referenced.

```
DEFAULT         Auth-Type = System
                Menu = "menu1"
```

In this example, after the user is authenticated, the **menu1** menu is displayed and the user is prompted to make a selection. When the user selects a menu option, the corresponding service is provided.

Termination-Menu

Use Termination-Menu to present a menu to the user when the service ends. If a Termination-Menu reply item is not included in the user profile, the user is disconnected immediately after a SLIP, PPP, or login session.

```
mia             Password = "soon86yee"
                Service-Type = Framed-User,
                Framed-Routing = None,
                Framed-Protocol = PPP,
                Termination-Menu = "mainmenu"
```

Note – If you want to disconnect the line when the service ends, do not use the Termination-Menu attribute.

Controlling the Number of Available Ports

Use the Port-Limit reply item to control the maximum number of ports available for a Multilink PPP or Multilink V.120 connection. Port-Limit applies only to ISDN and (with ComOS 3.8 or later) asynchronous connections; other connection types are not affected.

The Port-Limit value can be as high as the maximum number of B channels available for the ISDN ports. For example, if a PortMaster has 15 ISDN BRI ports, the Port-Limit value can be as high as 30.

In the following example, *red*'s connection can use only one B channel:

```
red             Password = "9pg$lac", NAS-Port-Type = ISDN
                Service-Type = Framed-User,
                Framed-Routing = None,
                Framed-Protocol = PPP,
                Port-Limit = 1
```

Note – The Port-Limit reply item only limits multilink connections. It does not prevent simultaneous logins.

Using RADIUS with PAP and CHAP

You can use RADIUS with Password Authentication Protocol (PAP) or Challenge Handshake Authentication Protocol (CHAP).

PAP

The PortMaster sends the PAP ID and password to the RADIUS server in an access-request packet as the User-Name and User-Password. The PortMaster includes the Service-Type = Framed-User and Framed-Protocol = PPP attributes in the request as a hint to the RADIUS server that PPP service is expected.

To authenticate a user with PAP, user profiles can include Auth-Type = Local, Auth-Type = System, or Auth-Type = SecurID.

CHAP

For CHAP, the PortMaster generates a random challenge and sends it to the user. The user returns a CHAP response, CHAP ID, and CHAP username. The PortMaster then sends an access-request packet to the RADIUS server with the CHAP username as the User-Name and with the CHAP ID and CHAP response as the CHAP-Password. The random challenge can either be included in the CHAP-Challenge attribute or, if it is 16 octets long, it can be placed in the Request Authenticator field of the access-request packet. The PortMaster includes the attributes Service-Type = Framed-User and Framed-Protocol = PPP as a hint to the RADIUS server that PPP service is expected.

The RADIUS server does the following:

1. Looks up a password based on the User-Name.
2. Uses MD5 to encrypt the password, the CHAP ID octet, and the CHAP challenge.
3. Compares the result to the CHAP-Password.
4. If the items in Steps 2 and 3 match, the server sends an access-accept packet to the PortMaster. If there is no match, the server sends back an access-reject packet.

CHAP requires that the user's password be available on the RADIUS host in unencrypted (clear text) format so that the server can encrypt the CHAP challenge and compare the result to the CHAP response. If the password is not available in clear text, the server sends an access-reject to the client.

To force all PPP communication to use CHAP authentication, do the following:

1. **Set the Auth-Type = Local.**

   This is the default value.

2. **Set passwords in clear text; they must not be encrypted.**

3. **Turn off PAP and turn on CHAP by using the following commands on the PortMaster:**

```
Command> set pap off
Command> set chap on
```

Configuring Database Caching of User Profiles

RADIUS offers database support for caching user profiles to increase the speed and efficiency of user lookups. Lucent Remote Access recommends caching user profiles when the **users** file contains more than 500 users.

The **builddbm** utility included with RADIUS for UNIX converts the **users** text file to the UNIX DBM format, which increases the speed of user lookups.

To run **builddbm**, use the following commands:

```
cd /etc/raddb
./builddbm
```

RADIUS uses the new database when it receives its next authentication request.

To run the **radiusd** daemon after the users file is converted to DBM, run **radiusd** with the **-b** option:

```
/etc/radiusd -b
```

The **builddbm** utility generates **users.dir** and **users.pag** files that are used by the **radiusd** daemon. On some versions of UNIX a single **users.db** file is created instead. If duplicate **users** file profiles are present, **builddbm** prints the number of profiles and identifies the line number of the duplicate profiles.

Note – After the **users** file has been converted to the **.dbm** format, you must run **builddbm** again if you make any changes to the user profiles.

Example PPP User Profile

User profiles can be configured in a number of ways to fit network security requirements. The following example illustrates a typical RADIUS profile for a PPP user:

```
masha           Password = "ge55gep"
                Service-Type = Framed-User,
                Framed-Routing = None,
                Framed-Protocol = PPP,
                Framed-IP-Address = 255.255.255.254,
                Framed-Compression = Van-Jacobson-TCP-IP,
                Framed-MTU = 1500,
                Filter-Id = "firewall"
```

In this example, user *masha* has password **ge55gep**. She is a Framed-User, which indicates that she uses SLIP or PPP for her connections. In the following line, Framed-Protocol is specified as PPP.

An IP address of 255.255.255.254 is specified, indicating that an IP address is assigned to *masha* from the PortMaster assigned address pool.

Note – To create an assigned address pool, see the *PortMaster Configuration Guide*.

Framed-Routing is set to **None**, which disables RIP for *masha*'s interface. RIP packets are not sent or listened for. Van Jacobson TCP/IP compression is used for the connection, and the MTU is set to 1500 bytes.

The Filter-Id identifies the packet filter(s) used for the connection if any are defined on the PortMaster or in ChoiceNet; **firewall.in** is used as an input filter and **firewall.out** is used as an output filter.

Configuring RADIUS Menus 5

RADIUS menus enable a user to select different login options after being authenticated. The user only needs a single username for all options rather than a different username for each connection option.

RADIUS menus are implemented as text files located in the **menus** subdirectory on the RADIUS server, typically **/etc/raddb/menus**. The number of menu files under the **menus** directory is unlimited. A menu file can accommodate up to 2KB of display data plus menu selection entries. Menus can refer to other menus.

Menu File Format

A menu file consists of the following elements:

- An initial line containing only the keyword **menu**
- Additional lines of text to be displayed to the user
- A line containing only the keyword **end**
- One or more menu selection entries
- The DEFAULT menu selection entry

The **menu** and **end** keywords indicate the start and end of the text displayed to the user. Text between the **menu** and **end** keywords can be any printable ASCII characters up to a maximum of 2Kb. The text in the menu file is case-sensitive.

Each menu selection entry consists of the menu choice shown at the beginning of a line, followed by one or more lines of reply items—one per line—starting with spaces or tabs. You can enter comments among the menu selection entries by starting each comment line with a number sign (**#**).

The special menu choice DEFAULT must be the last menu selection entry. The DEFAULT menu is called when the user enters no choice or a choice that does not match a menu selection entry in the menu file.

Use the special menu choice EXIT for a menu selection—such as “Quit”—that disconnects the user.

Single-Level Menu

A single-level menu does not refer to other menus. The following example shows a file named **/etc/raddb/menus/menu_welcome** for a single-level menu with three options:

```
menu
      *** Welcome to EDU OnLine ***
Please select an option:

      1.  Start SLIP session
      2.  Start PPP Session
      3.  Quit

      Option:
end
# This is a single-level menu called menu_welcome
1
      Service-Type = Framed-User,
      Framed-Protocol = SLIP,
      Framed-IP-Address = 255.255.255.254,
      Framed-Routing = None,
      Framed-MTU = 1006,
      Termination-Menu = "menu_welcome"
#
2
      Service-Type = Framed-User,
      Framed-Protocol = PPP,
      Framed-IP-Address = 255.255.255.254,
      Framed-Routing = None,
      Termination-Menu = "menu_welcome"
#
3
      Menu = "EXIT"
#
DEFAULT
      Menu = "menu_welcome"
```

In the single-level menu example, after RADIUS authenticates the user, **menu_welcome** is displayed and the user is prompted to select a service from this menu. Once the user has finished the SLIP or PPP session, the termination menu—also **menu_welcome** in this case—is displayed and the user is prompted to select a new

service. If a Termination-Menu reply item is not included in the list of reply items corresponding to the user's menu selection, the user is disconnected immediately after the SLIP or PPP session.

Nested Menus

Nested menus refer to other menus. In the following example menu file, the menu that the user sees has an **other** option; if selected, this option displays a second menu:

```
menu
*** Welcome to the Internet Service ***
Please enter an option:
      ppp - Start PPP session
      telnet - Begin login session with a host
      other - Display a second menu
Option:
end
# This is a nested menu called menu_internet
ppp
      Service-Type = Framed-User,
      Framed-Protocol = PPP,
      Framed-IP-Address = 255.255.255.254,
      Framed-Routing = None,
      Framed-MTU = 1500
#
telnet
      Service-Type = Login-User,
      Login-IP-Host = 172.16.1.81,
      Login-Service = Telnet,
      Login-TCP-Port = 23
#
other
      Menu = "menu_other"
#
DEFAULT
      Menu = "menu_internet"
```

Termination Menus

Termination menus are presented to users when their service ends. The termination menu value must be contained within double quotation marks. The Termination-Menu reply item in the user's profile calls the menu.

With a user profile as shown in the following example, user *bob* sees **menu1** when he finishes his PPP session. When *bob* selects a menu option, the corresponding service is provided. He can begin another session or he can quit.

```
bob             Password = "ge55gep"
                Service-Type = Framed-User,
                Framed-Protocol = PPP
                Framed-IP-Address = 255.255.255.254,
                Framed-Routing = None,
                Termination-Menu = "menu1"
```

Menus Called by Reference

Any user profile in the **users** file—including the DEFAULT profile—can call a menu by reference. The Menu reply item is the only reply item in the user profile when a menu is referenced.

```
DEFAULT         Auth-Type = System
                Menu = "menu1"
```

In this example, after any user is authenticated via the DEFAULT profile, the **menu1** menu is displayed and the user is prompted to make a selection. When the user selects a menu option, the corresponding service is provided.

Menu Filenames

You must create the menu filename in the **menus** subdirectory on the RADIUS server, described on page 5-1. Menu names can consist of up to 120 printable, nonspace, ASCII characters; in the **users** file the menu name must be enclosed in double quotation marks (" ").

Installing and Configuring ActivCard 6

ActivCard, Inc. provides an additional level of security in user identification and authentication by using ActivCard tokens to generate codes and ActivEngine software to process the codes. This system of software and hardware authentication is often referred to as **ActivCard**.

This chapter is an overview of the installation and basic configuration of ActivEngine and ActivAdmin software when used with RADIUS. This chapter includes the following topics:

This information is intended to serve as a quick reference guide for the ActivEngine and ActivAdmin software. Refer to the ActivCard manual set for detailed features of ActivCard and future ActivCard software releases.

Note – Lucent Remote Access Technical Support does not provide support for ActivEngine and ActivAdmin installation and configuration. See Appendix E, "Contact Information for Third-Party Products," for information on how to contact ActivCard, Inc. Lucent Remote Access Technical Support provides support for RADIUS when used with ActivCard products only after you have verified that all ActivCard components are working properly.

The ActivCard software version 2.2 has the following requirements:

- Solaris 2.4 or Solaris 2.5 platform
- Standard UNIX TCP/IP network protocol
- 5MB free disk space for the ActivEngine software

Recommended disk space is 10MB for the ActivEngine database—necessary size depends on the number of registered tokens and users

Note – ActivEngine software is also supported on Windows NT platforms. RADIUS server 2.1 is currently available only on UNIX platforms.

Overview of ActivCard Components

The ActivCard authentication system (generally referred to simply as *ActivCard*) consists of the following components:

- ActivEngine server

  Processes the username (referred to as *login ID* in ActivCard documentation) and a token-generated dynamic password entered by the user. ActivEngine then authenticates the user and either provides or rejects access to the secured application.

- ActivAdmin

  Software that initializes, assigns, unlocks, and resynchronizes tokens; manages the ActivEngine database of users and tokens; and applies and revokes access privileges. ActivAdmin includes standard token profiles for Master tokens and for ActivCard server solutions. ActivAdmin functionality includes:

- Token

  A small, handheld device that generates dynamic (one-time-use) passwords for user authentication. ActivCard tokens can generate dynamic passwords in two modes:

  – Asynchronous or challenge/response mode. The token generates a dynamic password based on the challenge—issued by the ActivEngine server when the user logs in—entered on the token by the user. The user then enters the password on the UNIX system to complete authentication.

  – Synchronous mode. The token generates a dynamic password based on its authentication counter. When the user enters this password on the system, the ActivEngine server compares it with the password the server generates based on the authentication counter stored in its database for that token.

  ActivCard tokens have an optical interface that enables automated authentication. ActivCard supports several token models with different features, such as secret value extraction, server authentication, and data certification.

- ActivCoupler

  A device—also known as the Initialization Cradle—that exchanges data between the host UNIX system and an ActivCard token via the machine's serial port. You must use the ActivCoupler to initialize tokens. The ActivCoupler can make it easier for users to access multiple services on a frequent, recurring basis.

- ActivEngine API

  Client software that submits user's authentication requests to the ActivEngine server. All ActivCard products are integrated with the ActivEngine client API.

How ActivCard Works with RADIUS

Note – To use RADIUS for UNIX version 2.1 with ActivCard, you must run the **sradiusd** daemon rather than **radiusd**. If you are using both ActivCard and iPass, contact **support@livingston.com**.

Determine which token profile to apply to each user needing access to the system or application secured by ActivCard. Use ActivAdmin to do the following:

- Initialize user tokens with the token profile
- Assign the initialized tokens to users
- Store the token data and assignment information in the ActivEngine database

You can install the ActivAdmin and ActivEngine components on the same host or on different hosts as long as the ActivEngine is accessible via TCP/IP.

When ActivCard is used with RADIUS, a connection proceeds as described below. This example assumes you have established a challenge-response keyword, enabling the user to choose between asynchronous and synchronous authentication.

1. A remote user initiates a connection by dialing in to the PortMaster.
2. The PortMaster prompts the user for a username and password.
3. The user enters the username and password.
   - If the user chooses asynchronous authentication, the password is the challenge-response keyword.

- If the user chooses synchronous authentication, the password is a one-time password generated by the token. The user first enters a memorized personal identification number (PIN) on the token and presses the **SECRET** key on the token keypad. The token, which is synchronized with the ActivEngine, displays the one-time password.

4. The PortMaster forwards the username and password to the RADIUS server for authentication.
5. The RADIUS server examines the **users** file, scanning for the appropriate username. When the profile is located, it is examined to determine the user's authentication type.
6. When the RADIUS server discovers that the authentication type is ActivCard, it forwards the username and password to the ActivEngine.
7. ActivEngine examines its database for the username and verifies the user's identity based on the password expected for the token.

   If the user entered the challenge-response keyword, ActivCard responds with a challenge string. The user enters a memorized personal identification number (PIN) on the token, presses the **AUTH** key on the token keypad, and enters the challenge. The token generates and displays a one-time password that the user enters to respond to the challenge. ActivEngine evaluates this response to verify the user.
8. ActivEngine sends the result of the database lookup (identity verified or not verified) to the RADIUS server.
9. If the user's identity has been verified by ActivEngine, the RADIUS server sends an access-accept message to the PortMaster with the session configuration information from the RADIUS user profile. If ActivEngine has rejected the user, the RADIUS server sends an access-reject message to the PortMaster.

Installing the ActivEngine Components on a UNIX Host

This section summarizes the steps you perform to install the ActivEngine components. See the *ActivEngine for UNIX Systems Installation and Administration Guide* for detailed instructions.

1. **Determine the following information before beginning installation:**

   – Directory where you want to install ActivEngine. The default directory is **/usr/aeg**.

   – ActivEngine identifier—a unique name of up to 20 characters. Valid characters are the lowercase and uppercase alphabets, numerals 0-9, and the underscore (_) character.

   – IP address or Domain Name System (DNS) hostname of the system where you want to install the ActivEngine server. If you do not enter the IP address during installation, the DNS hostname of the current system is used by default.

   – Port number for authentication client connections. The default port number is 8866.

   – Port number for administration client connections. The default port number is 8867.

   – Whether you want the ActivEngine server to start automatically during a system reboot. If you choose automatic start, configure the ActivEngine server for automatic startup mode. Otherwise, the system asks you to extract the secret value each time the system is rebooted. Automatic startup mode is less secure than starting the server after each system reboot.

     If you choose not to configure the automatic startup mode during the installation process, you can choose to configure this mode later at any time. Refer to the *ActivEngine for UNIX Systems Installation and Administration Guide* for more information.

   – Name of the serial port on the host system to which the ActivCoupler is connected. The default port is **/dev/ttya**.

2. **Connect an ActivCoupler to the system hosting the ActivEngine server.**

   You initialize the Master token with the ActivCoupler.

3. **Install ActivEngine.**

   See the *ActivEngine for UNIX Systems Installation and Administration Guide* for instructions.

4. **Initialize the ActivEngine database with a Master token and initialize at least one Master token backup.**

See the *ActivEngine for UNIX Systems Installation and Administration Guide* for instructions.

5. **Backup the ActivEngine database.**

   See the *ActivEngine for UNIX Systems Installation and Administration Guide* for instructions.

6. **Use ActivAdmin to initialize end-user tokens with the appropriate token profile.**

   See the *ActivAdmin for UNIX Systems User Guide* for instructions. A slot on each token must be assigned to RADIUS.

7. **Back up the ActivEngine database.**

   See the *ActivEngine for UNIX Systems Installation and Administration Guide* for instructions.

8. **Use ActivAdmin to create a user record for each user that is assigned a token.**

   See the *ActivAdmin for UNIX Systems User Guide* for instructions.

Note – ActivEngine usernames are case-sensitive.

9. **Assign the initialized tokens to users.**

   See the *ActivAdmin for UNIX Systems User Guide* for instructions.

10. **Distribute the initialized tokens to the authorized users.**

Using the ActivEngine Test Utility

You can use the ActivEngine test utility **aegtest** to do the following:

- Verify that the RADIUS for UNIX client application is correctly configured in the ActivEngine database and can connect to the ActivEngine server.
- Test asynchronous and synchronous authentication for a token with a specific application.

Refer to the ActivCard, Inc. application note, *ActivEngine 2.x for UNIX Systems Test Utility* for instructions on using the utility.

RADIUS Configuration for ActivCard

The RADIUS server requires minimal configuration after you have installed the ActivCard software.

1. **From the ActivCard software distribution, copy the file** config.aeg.example **to the** /etc/raddb **directory on the RADIUS server host.**
2. **Rename the file** config.aeg**.**

   RADIUS uses the parameters described in **/etc/raddb/config.aeg** to connect to the ActivCard server.
3. **Specify the ActivEngine configuration parameters in the** config.aeg **file.**
4. **Specify Auth-Type = ActivCard as a check item for all users to be authenticated with ActivCard.**
5. **Run** sradiusd**.**

   If you are using ActivCard authentication, you cannot run **radiusd**.

Example config.aeg File

The text of an example c**onfig.aeg** file is presented below. The comments explain the parameters that you specify in the file. Substitute values relevant to your installation for the values appearing in the parameters.

```
# Rename this file to config.aeg after installing new ActivCard server
# ------------------------------------------------------------------
# This file contains the configuration information necessary for the
# RADIUS server to connect to the ActivEngine, which is the
# ActivCard Authentication Server.
# ------------------------------------------------------------------

# ------------------------------------------------------------------
# ACTIVCARD_APPLICATION: APPLICATION_ID

# ActivCards contain up to four slots. Each slot contains a set
# of independent DES keys and parameters, so that in practice an
# ActivCard is equivalent to four «Tokens». Each of those «Tokens»
# is called a slot and can be used to authenticate through an application
```

```
# to a distinct ActivEngine. The concept that the ActivEngine uses to
# decide which slot is to be used to verify a dynamic password (ultimately
# which key among the set of keys stored for this token) is
# the «Application»: Application (Server) -> Slot (Token)
#
# The following specifies the application to be used to determine the
# token slot associated with RADIUS authentication requests from
# the RADIUS server.
# ------------------------------------------------------------------
ACTIVCARD_APPLICATION: RADIUS
# ------------------------------------------------------------------
# ACTIVCARD_CHALLENGE: challenge_request_keyword
# The ActivCards support simultaneously two authentication codes
# for each given slot. One is a patented time/event synchronous mode
# in which the user just types the one-time password displayed by his token
# instead of the static vulnerable password he was used to. The other is
# the standard X9.9, challenge/response mode.
# ActivCard's users can choose which mode they want to use by
# typing a keyword at the RADIUS password prompt:
#     login: sam
#     password: challenge_request_keyword
# Upon reception of this keyword the ActivCard component embedded in the
# RADIUS server will switch to challenge/response mode and issue a
# challenge (a very good quality random number), and the user will be
# prompted for a dynamic password:
#     login: sam
#     password: challenge_request_keyword
#
#    Challenge/Response Authentication requested...
#    Challenge: 12345678
#    Response:
# The user has to type the challenge into his token and type at the prompt
# the dynamic password produced by the token for that challenge.
# ------------------------------------------------------------------
ACTIVCARD_CHALLENGE: challenge

# ------------------------------------------------------------------
# ACTIVCARD_HOST: 192.168.15.60
# The following parameter indicates the ip address of the machine where the
# ActivEngine is located.
# ------------------------------------------------------------------
ACTIVCARD_HOST: 192.168.15.60
```

```
# ------------------------------------------------------------------
# ACTIVCARD_AUTHPORT: 8866
# The following parameter specifies the port to which the ActivEngine
# will be listening for authentication requests.
# ------------------------------------------------------------------
ACTIVCARD_AUTHPORT: 8866

# ------------------------------------------------------------------
# ACTIVCARD_SESSTIMEOUT: 25
# This parameter specifies the timeout value to use when the RADIUS
# server connects to the ActivEngine.
# ------------------------------------------------------------------
ACTIVCARD_SESSTIMEOUT: 25

# ------------------------------------------------------------------
# ACTIVCARD_SECPOLICY: 0
# This parameter specifies which type of connection will be established
# with the ActivEngine: 0(NEGOTIATE), 1(ENCRYPTED), 2(NON-ENCRYPTED).
# The ActivEngine client component and its server counterpart can establish
# a secure channel based on a Diffie-Hellman key exchange.
# ------------------------------------------------------------------
ACTIVCARD_SECPOLICY: 0

# ------------------------------------------------------------------
# ACTIVCARD_PUBKEY:
# The ActivEngine Diffie-Hellman public key used to establish a secure
# channel between the RADIUS server and the ActivEngine.
#
# At the time of installation of the ActivEngine, a distribution file called
# «aeg.dis» is generated. It contains the information necessary to
# establish the connection to the ActivEngine as well as the value of the
# public key of the ActivEngine
# ------------------------------------------------------------------
ACTIVCARD_PUBKEY: 4807E...get this from the ActivEngine distribution file.
```

Troubleshooting ActivCard

Refer to your ActivCard manuals for information on troubleshooting ActivCard. If you still have problems after trying these solutions, see Appendix E, "Contact Information for Third-Party Products," for information on how to contact ActivCard, Inc.

Installing and Configuring SecurID 7

Security Dynamics Technologies, Inc. provides an additional level of security in user identification and authentication by using SecurID tokens to generate codes and ACE/Server software to process the codes. This software and hardware authentication system is often referred to as **SecurID**.

This chapter is an overview of the installation and basic configuration of ACE/Server and ACE/Client software when used with RADIUS. This chapter includes the following topics:

This information is intended to serve as a quick reference guide for the ACE/Server and ACE/Client software. Certain terms used in this chapter—such as tokencode, PASSCODE, master server, and slave server—are taken from the Security Dynamics documentation. Refer to the Security Dynamics manual set for detailed features of SecurID and future ACE/Server software releases.

Note – Lucent Remote Access Technical Support does not provide support for the ACE/Server and ACE/Client installation and configuration. See Appendix E, "Contact Information for Third-Party Products," for information on how to contact Security Dynamics, Inc. Lucent Remote Access Technical Support provides support for RADIUS when used with ACE/Server and SecurID only after you have verified that the ACE/Server is working properly.

The ACE/Server and ACE/Client software version 2.3 is supported on the following platforms:

- AIX 4.1 on a PowerPC or a RISC/6000
- HP-UX 10.01 on a Hewlett-Packard HP 9000 Series 7*xx* or 8*xx*

- Solaris 2.5.1 on a Sun SPARCstation
- SunOS 4.1.4 on a Sun SPARCstation

Additionally, the ACE/Server software is supported on Windows NT platforms. RADIUS server 2.1 is currently available only on UNIX platforms.

Overview of SecurID Components

The Security Dynamics authentication system (generally referred to as *SecurID*) consists of the following components:

- ACE/Server master

  Stores usernames and serial numbers of tokens and performs calculations to verify the identity of users.

- ACE/Server slave

  Functions as a secondary server to the ACE/Server master.

- ACE/Client

  A computer or other device protected by ACE/Server. ACE/Client software must be installed on these systems.

- Token

  A device that generates a random number known as a **tokencode** (the software might show this as two words: **token code**). A new number is generated and displayed every 60 seconds. Five types of tokens are supported in SecurID: the standard SecurID card, the SecurID Key Fob, SecurID PINPAD card, SecurID Modem, and SoftID. The first three tokens are small, handheld devices.

  RADIUS has been tested with the standard SecurID card, the SecurID Key Fob, and the SecurID PINPAD card.

- PASSCODE

  A two-part password, consisting of a memorized personal identification number (PIN) followed by the current tokencode displayed on the token.

Note – To use RADIUS with SecurID, you typically run the ACE/Server software on the same host as the RADIUS server. If you install the ACE/Server software on a different machine, then you must install the SecurID ACE/Server slave component on the RADIUS server host. The ACE/Server slave must then reference the ACE/Server master.

How SecurID Works with RADIUS

Note – To use RADIUS for UNIX version 2.1 with SecurID, you must run the **sradiusd** daemon rather than **radiusd**. If you are using both SecurID and iPass, contact **support@livingston.com**.

When SecurID is used with RADIUS, a connection proceeds as follows:

1. A remote user initiates a connection by dialing in to the PortMaster.
2. The PortMaster prompts for the user's username and password.
3. The user enters a username. At the password prompt, the user enters a PASSCODE (PIN followed by the currently displayed number on the token).
4. The PortMaster forwards this information to the RADIUS server for authentication.
5. The RADIUS server examines the **users** file, scanning for the appropriate username. When the profile is located, it is examined to determine the user's authentication method.
6. When the RADIUS server discovers that the authentication method is SecurID, it forwards the username and PASSCODE to the ACE/Server for authentication.
7. The ACE/Server examines its database for the username and serial number of the user's token. It uses the serial number to verify the PASSCODE entered by the user. It also verifies that the time on the token is synchronized with the ACE/Server.
8. The ACE/Server sends the result of the database lookup (identity verified or not verified) to the RADIUS server.
9. If the user's identity was verified by the ACE/Server, the RADIUS server sends an access-accept message to the PortMaster along with the additional information from the RADIUS user profile. If the ACE/Server rejected the user's PASSCODE, the RADIUS server sends an access-reject message to the PortMaster.

ACE/Server Installation on a UNIX Host

The SecurID software package consists of a number of applications and utilities. This section provides guidelines for the installation and use of version 2.3 of ACE/Server and ACE/Client, and the **sdadmin** utility. This is not a complete explanation of all SecurID requirements or procedures. Refer to the appropriate Security Dynamics documentation for information on other versions of ACE software.

The master ACE/Server handles the authentication requests passed on to it by the RADIUS server configured as an ACE/Client. The master and client software can be installed on the same host.

You can increase the reliability of the authentication process if you configure the ACE/Client and an ACE/Server slave on a separate host or hosts from the ACE/Server master. In the event the host for the ACE/Server master goes down, the ACE/Server slave handles the authentication requests from the ACE/Client.

These instructions cover the following:

- "Installing ACE/Server and Client Software on a UNIX Host" on page 7-6
- "Administering ACE/Server with sdadmin" on page 7-7
- "Authenticating with sdshell" on page 7-8

This is not a complete explanation of all SecurID requirements or procedures. If you are upgrading an older ACE/Server installation previous to version 2.3, you must read the *ACE/Server v 2.3 for UNIX Administration Manual* from Security Dynamics for instructions.

Note – Read the *ACE/Server v 2.3 Installation Guide* before beginning installation.

SecurID software is not shipped with the PortMaster. To order this software, see Appendix E, "Contact Information for Third-Party Products."

Getting Started

The server on which SecurID is installed has the following requisites. See the *ACE/Server v 2.3 Installation Guide* for more information. These requirements are for SecurID alone, and do not reflect the requirements for RADIUS.

Physical Memory

Security Dynamics recommends 32MB of physical memory. The minimum memory feasible for SecurID is 16MB.

Disk Space

Security Dynamics recommends 1GB of disk space. The minimum feasible disk space for SecurID is 400MB. At least 20 percent of the free disk space must be reserved for ACE/Server database growth.

Hostnames

The ACE/Server's primary hostname—bootname—must be the first name in any list of aliases for that machine if you are using a name service such as NIS or DNS.

Kernel Configuration

Your system's kernel configuration values must be set at or above the minimums specified by Security Dynamics. Table 7-1 shows the values in **/etc/system** for systems running Solaris. If you are running HP-UX, AIX, or SunOS 4.1.4, refer to the *ACE/Server v 2.3 Installation Guide*. Refer to your operating system's manuals for instructions on setting these values.

Table 7-1 Solaris Minimum Kernel Configuration Values

Parameter	Minimum Value
shmsys:shminfo_shmmni	100
shmsys:shminfo_shmseg	16
shmsys:shminfo_shmmax	4194304
semsys:seminfo_semmni	64
semsys:seminfo_semmsl	50
semsys:seminfo_semmns	100
semsys:seminfo_semmnu	100

ACE/Server Service Names and Port Numbers

The SecurID authentication service has a default name of **securid** and default port number of 5500. The SecurID master/slave communication service has a default name of **securidprop** and default port number of 5510. The **sdsetup** utility adds the SecurID UDP and TCP service names and port numbers to the **/etc/services** file.

```
securid         5500/udp            #ACE/Server
securidprop     5510/tcp            #ACE/Server Slave
```

NIS Map

The SecurID authentication service has a default name of **securid** and default port number of 5500. The SecurID master/slave communication service has a default name of **securidprop** and default port number of 5510. If you are using NIS or NIS+, you must add these entries to the services NIS map on your NIS master and push the maps.

```
securid         5500/udp            #ACE/Server
securidprop     5510/tcp            #ACE/Server Slave
```

Pushing the maps updates the database to include recently entered information. Use the **make services** command on the NIS master. For details, consult your UNIX system documentation.

Installing ACE/Server and Client Software on a UNIX Host

The RADIUS 2.*x* server is compatible with ACE/Server versions 2.3 and higher. To install ACE/Server and ACE/Server client, complete the following steps:

1. **Log in as root.**
2. **Read the ACE/Server tape into the** ace_install **directory of the ACE/Server machine.**

   ACE/Server installs its software using the **sdsetup** utility.
3. **Run** sdsetup **to install ACE/Server.**

Note – The **sdsetup** utility cannot be run while the **sdconnect** process or **aceserver** daemon are running. Stop these processes before attempting to run **sdsetup**.

```
ace_install/sdsetup
```

Several options can be used with **sdsetup**. See the *ACE/Server v 2.3 Installation Guide* for more information.

The ACE/Server software is typically installed on the same machine as the RADIUS server. To run ACE/Server on a different machine, you must configure the RADIUS server as an ACE/Server slave. See the *ACE/Server v 2.3 Installation Guide* for instructions on configuring the ACE/Server slave.

4. **Continue to install the ACE/Server client software using** sdsetup**.**

   Complete instructions are given in the *ACE/Server v 2.3 Installation Guide*.

Administering ACE/Server with sdadmin

ACE/Server includes the **sdadmin** administration utility. Using **sdadmin**, you can add and delete users, assign PINs and tokens, and monitor network activity. You can run **sdadmin** in GUI (the default) or character mode.

To use **sdadmin**, complete the following steps:

1. **Ensure that you are in the directory that contains the ACE/Server files.**

   By default, ACE/Server software is installed in the **/usr/ace** directory.

2. **Start the database broker (**sdconnect**) as root:**

   ```
   /usr/ace/sdconnect start
   ```

   To stop the database broker, use the **sdconnect stop** command.

3. **Start the ACE/Server daemon using the following command:**

   ```
   /usr/ace/aceserver start
   ```

   To stop ACE/Server, use the **aceserver stop** command.

4. **Add the following lines to** /etc/rc.local **or equivalent boot file of your UNIX system.**

```
if [ -x /usr/ace/aceserver ]; then
     /usr/ace/aceserver stop
     /usr/ace/sdconnect stop
     /usr/ace/sdconnect start
     /usr/ace/aceserver start
else
     echo "Cannot start aceserver"
fi
```

   These lines automatically start the ACE/Server processes **sdconnect** and **aceserver** after the host is rebooted

5. **Run** sdadmin **in GUI or character mode.**

   Character mode requires the use of the **-c** option:

```
/usr/ace/sdadmin &
or
/usr/ace/sdadmin -c &
```

   To run **sdadmin** in GUI mode, the host's window environment must be an implementation of X11R5 or later. If you are running SunOS, Sun OpenWindows is an X11R4 implementation, and you must therefore install the X11R5 kit shipped with the ACE/Server software. See the *ACE/Server v 2.3 Installation Guide* for instructions.

6. **Using the instructions in the** *ACE/Server v 2.3 for UNIX Administration Manual***, create the client, add users to the database, activate users on the client, and assign tokens to the users.**

7. **Choose a method of PIN assignment using the instructions for PIN administration in the** *ACE/Server v 2.3 for UNIX Administration Manual***.**

   Note that you can assign PINs using RADIUS.

Authenticating with sdshell

You specify which users are required to authenticate with SecurID by modifying their entries in the **/etc/passwd** file. Change the shell specification—typically **/bin/sh** or **/bin/csh**— to **/usr/ace/prog/sdshell**. This modification is applicable to all UNIX clients

except for AIX clients that do not use a name service such as DNS or NIS. For AIX clients that do not use a name service, substitute **sdshell_auth** for the **sdshell** authentication shell.

You can configure PIN assignments so that users must create their own PINs, must use PINs generated by the system, or can choose whether to create a PIN or use one provided to them. The default mode is to enable the user to select either a user-created or system-generated PIN. See the PIN administration information in the *ACE/Server v 2.3 for UNIX Administration Manual* for configuration instructions.

If a user has forgotten her PIN, or you believe the PIN to be compromised, you must change the PIN for that token by setting the token into New PIN mode and clearing the old PIN.

If the authentication shell has been specified, the following prompts appear on the user's screen after the user logs in to the system:

```
Enter PASSCODE:

        Press <Return> to generate a new PIN and display it on the screen,
               or
        Ctrl d to leave your token in New PIN mode:
        ARE YOU PREPARED TO HAVE THE SYSTEM GENERATE A PIN? (y or n) [n]: y

Your screen will automatically clear in 10 seconds.
Your new PIN: XXXX

Wait for the code on your token to change, then log in with the new PIN
Enter PASSCODE:
PASSCODE Accepted
```

The authentication shell instructs the user to enter a new PIN or press **Return** to have a PIN automatically generated. In this example, the user has a PIN generated for her.

If the user's new PASSCODE is accepted, communication between the ACE/Server client and server is successful.

Note – Lucent Remote Access Technical Support does not provide support for the ACE/Server and ACE/Client installation and configuration. See Appendix E, "Contact Information for Third-Party Products," for information on how to contact Security Dynamics, Inc. Lucent Remote Access Technical Support provides support for RADIUS when used with ACE/Server and SecurID only after you have verified that the ACE/Server is working properly.

RADIUS Configuration for SecurID

Each SecurID user must have a profile in the RADIUS **users** file or must use a DEFAULT profile. In the profile, the Auth-Type check item must be SecurID, as shown in the following example:

```
DEFAULT         Auth-Type = SecurID
                Service-Type = Framed-User,
                Framed-Protocol = PPP,
                Framed-Address = 255.255.255.254,
                Framed-Routing = None,
                Framed-MTU = 1500
```

To activate and assign tokens to users authenticated with this DEFAULT profile, use the **sdadmin** utility, as discussed under "Administering ACE/Server with sdadmin" on page 7-7.

When user *bob* dials in to the PortMaster, the following prompts are displayed:

```
login: <enter username>
Password: <enter PIN number followed by a token code>
```

PIN Assignment

When a new user is added to the ACE/Server database, a token is assigned to the user. How the authentication is completed depends on how you have specified PIN generation. You can require the ACE/Server to generate PINs for all users, you can force all users to provide their own PINs, or you can enable specified users to choose the generation method.

Users must provide their PINs in New PIN mode. You can also force other users into New PIN mode if they have forgotten their PINs or if an attacker has learned their PINs.

A user in New PIN mode can create the PIN using RADIUS when dialing in to the network. Refer to information on PIN administration in the *ACE/Server v 2.3 for UNIX Administration Manual* for more information on New PIN mode.

User-Created PIN

When a user in New PIN mode is forced to create a PIN via RADIUS, the user is prompted to enter a new PIN:

```
login: bob
Password: xxxxx
Enter PASSCODE: <token code>
               Enter your new PIN, containing 4 to 8 digits,
                      or
               <Ctrl d> to cancel the new PIN procedure:
```

In this example, when user *bob* dials in to the network, he logs in with his username and UNIX password. When prompted for the PASSCODE—a PIN followed by the token code—*bob* enters the token code displayed on his SecurID device. The PortMaster sends an access-request to the RADIUS server. The ACE/Server searches its database and recognizes user *bob* as a New PIN mode user. It sends an access-challenge to the PortMaster, and *bob* is prompted to enter a new PIN.

After *bob* enters his new PIN, the RADIUS server responds with the following message:

```
Please re-enter new PIN:
Wait for the code on your token to change, then log in with the new PIN
Enter PASSCODE:
PASSCODE accepted
```

User *bob* re-enters the new PIN. After a few seconds, the token code on his SecurID device changes. User *bob* enters the PIN and the token code, and is authenticated. For subsequent logins, *bob* enters his PIN followed by the currently displayed token code when prompted for the PASSCODE.

System-Generated PIN

When you specify that the PIN is generated by the system, the user is prompted to initiate PIN generation. The new PIN is displayed on the screen for the user to memorize.

Note – The system-generated PIN appears for only 10 seconds. After the PIN disappears, it cannot be viewed again.

In the following example, *keiko* logs in with her username and UNIX password for the first time. When prompted for the PASSCODE—a PIN followed by the token code—*keiko* enters the token code displayed on her SecurID device.

```
login: keiko
Password:
Enter PASSCODE: <token code>
               Press <Return> to generate a new PIN and display it on the
screen,
                       or
               <Ctrl d> to leave your token in New PIN mode:
               ARE YOU PREPARED TO HAVE THE SYSTEM GENERATE A PIN? (y or n)
(n): y
```

When prompted, *keiko* indicated that she wants the system to generate her PIN. As shown in the following example, the PIN is displayed, and *keiko* is prompted to enter the new PASSCODE.

```
Your screen will automatically clear in 10 seconds.
Your new PIN: NNNNN
Wait for the code on your token to change, then log in with the new PIN
Enter PASSCODE:
PASSCODE Accepted.
```

For subsequent logins, *keiko* enters her system-generated PIN followed by the currently displayed token code when prompted for the PASSCODE.

Entering an Invalid Token Code

If a user enters a valid PIN and an invalid token code, the token goes into Next Tokencode mode. The user is prompted to enter the next code from the token. This prompt also appears if the user's token is not synchronized with the ACE/Server.

The user must wait until the token code changes and then enter the new token code number at the prompt. After the system verifies the second token code, the user is authenticated.

If an unauthorized user enters a stolen PIN followed by a guessed token code, the person is given three opportunities to enter the correct token code. If three invalid token codes are entered, the unauthorized user is disconnected.

In the following example, *paolo* has entered a valid PIN followed by an invalid token code. The prompt appears, indicating that *paolo*'s token is not synchronized with the ACE/Server, or that *paolo* has entered an invalid token code. User *paolo* must wait for 60 seconds for a new token code and then must enter this code at the prompt. In this example, *paolo* has entered the next code and it has been accepted.

```
login: paolo
Password: <PIN number followed by invalid token code>
Please Enter the Next Code from Your Token: <PIN number followed by next valid
    token code>
PASSCODE Accepted
```

Troubleshooting SecurID

Refer to your SecurID manuals for information on troubleshooting SecurID. If you still have problems after trying these solutions, see Appendix E, "Contact Information for Third-Party Products," for information on how to contact Security Dynamics, Inc.

Implementing RADIUS Accounting 8

RADIUS 2.1 is strictly compliant with RFC 2139. RADIUS accounting logs information about dial-in connections. This information is often used for billing purposes. RADIUS accounting consists of a client/server format. On a UNIX host, transactions are recorded as they occur in a file on the RADIUS accounting server named **/usr/adm/radacct/***portmastername***/detail**.

This chapter includes the following topics:

If you want to use RADIUS accounting, RADIUS 2.1 must be run with ComOS 3.3.1 or later, or with the **-o** option.

How RADIUS Accounting Works

RADIUS accounting consists of an accounting server and accounting clients (PortMaster products). RADIUS accounting starts automatically when the RADIUS server starts. On a UNIX host, the **radiusd** accounting daemon is a child process of the **radiusd** authentication daemon.

The RADIUS accounting server uses the User Datagram Protocol (UDP), and listens for UDP packets at port 1646 by default.

RADIUS accounting consists of the following steps:

1. The PortMaster (accounting client) sends an **accounting-request** packet containing the record of an event to the accounting server. The record is described by the values of RADIUS attributes included in the packet.

For example, when a user is authenticated and connected, the Acct-Status-Type attribute has a value indicating that the request marks the beginning of user service. The RADIUS accounting server logs this event as a start accounting record. The records are recorded in a file called **/usr/adm/radacct/***portmastername***/detail** on the UNIX host.

Note – RADIUS automatically creates the *portmastername* directory and the **detail** file. If the IP address of a PortMaster client cannot be resolved to a hostname, then the name of the directory is the IP address of the PortMaster rather than its name

When the user's connection ends, the Acct-Status-Type attribute has a value indicating that the request marks the end of user service. The RADIUS accounting server records this as a stop accounting record. The stop record contains all the information in the start record plus additional information that describes what occurred during that session, such as Acct-Session-Time.

2. The accounting server sends an **accounting-response** packet back to the PortMaster to acknowledge receipt of the request. The server must send back an acknowledgment when it records the request.

3. If the PortMaster does not receive a response, it continues to send accounting-requests until it receives a response.

   A backoff algorithm is used to determine the delay between accounting-requests if an accounting-response is not received.

4. The PortMaster records the number of seconds that have passed between the event and the current attempt to send the record; this number is the **Acct-Delay-Time** value. As additional time passes before an accounting-response is received, the Acct-Delay-Time is updated.

Table 8-1 lists RADIUS attributes that a PortMaster might send to a RADIUS accounting server. See RFC 2139 for a complete list of accounting attributes. In addition, the RADIUS accounting server includes a timestamp for each entry. Information on the request-authenticator for the accounting-request packet is included if **radiusd** was run with the **-o** flag.

Table 8-1 Common Attributes in **detail** File

User-Name	Called-Station-Id
NAS-IP-Address	Calling-Station-Id
NAS-Port	Acct-Status-Type
Service-Type	Acct-Delay-Time
Framed-Protocol	Acct-Input-Octets
Framed-IP-Address	Acct-Output-Octets
Filter-Id	Acct-Session-Id
Login-IP-Host	Acct-Authentic
Login-Service	Acct-Session-Time
Login-TCP-Port	Acct-Terminate-Cause
Framed-IPX-Network	NAS-Port-Type
LE-Advice-of-Charge	Connect-Info
LE-Terminate-Detail	

Getting Started

Select a host to use as the RADIUS accounting server. This host can be either the same host as the RADIUS server used for authentication or a separate host.

Choose a host with the following characteristics:

- Secure physical location
- Root access limited to the security officer or system administrator
- Limited number of user accounts—preferably none

- Basic memory
- Enough disk space to store the RADIUS accounting **detail** files

  RADIUS accounting data continues to grow unless you archive this information on a regular schedule—weekly or monthly, for example. For typical installations, allocate 50MB per 1000 users per month. If you archive accounting records on the server, you must allocate more storage than this minimum. Keep in mind that allocating too much space is preferable to allocating too little; your usage can vary.

  For example, if you have 1000 users, one port for every 10 users, an average connection time per user of 1 hour, and all ports in use around the clock, one month of logs would require 50MB of disk space:

```
700 bytes/session * 1000 users * 1 port/10 users * 1 session/hour * 24 hours/day * 31 days/month
```

The use of a secondary RADIUS accounting server is recommended. The primary accounting server is always used first; if this server is unavailable, the secondary server is used.

The PortMaster always sends accounting packets to the primary RADIUS accounting server first and retries it once every 45 seconds. If the primary server does not respond within 10 minutes, or if there are more than 50 accounting packets waiting to be sent, the PortMaster sends the accounting packets to the secondary RADIUS accounting server. This behavior is subject to change in future releases of ComOS.

Client Configuration

To configure RADIUS accounting information on a PortMaster, see Chapter 3, "Adding a RADIUS Client."

Accounting Server Configuration

If you have already installed the RADIUS server (**radiusd**) on a host, that server also acts as an accounting server. No further installation is needed.

Installation

To install the RADIUS accounting server on a UNIX host, perform the following steps:

1. **Log in to the selected accounting server as root.**

2. **Create a** radacct **directory within the** /usr/adm **directory and grant full access only to root users:**

```
mkdir /usr/adm/radacct
chmod 700 /usr/adm/radacct
```

RADIUS accounting automatically creates a subdirectory within the **/usr/adm/radacct** directory for each PortMaster serving as a RADIUS accounting client and logs the accounting start and stop records to the **detail** file in the directory.

Configuring Options

Table 8-2 describes the **radiusd** options you can use to modify RADIUS accounting on a UNIX host.

Table 8-2 **radiusd** Accounting Options

Flag	Purpose
-a	Specifies an alternate directory for RADIUS accounting logs. The default directory is **/usr/adm/radacct**.
-o	Enables the RADIUS server to accept accounting packets from RADIUS clients that do not sign the Request-Authenticator according to RFC 2139. With this option, unsigned accounting records are logged and flagged with Request-Authenticator = None. Without this option, accounting packets with an unsigned Request-Authenticator (all zeros) are discarded as invalid. Use this option only if you are using RADIUS accounting details from a PortMaster running ComOS 3.3 or earlier.
-p	Overrides the default UDP port used by the RADIUS authentication server and the nondefault port if it is specified in the **/etc/services** file. The accounting server uses the next higher port. If you specify **radiusd -p** *1812*, authentication uses port 1812 and accounting uses port 1813. The default UDP ports are 1645 for authentication and 1646 for accounting. You must configure your PortMaster to use the same ports specified with this option.
-v	Displays the RADIUS version number without starting the **radiusd** daemon. This flag also applies to the RADIUS authentication server; the RADIUS authentication and accounting servers have the same version number.

Accounting Attributes

For RADIUS accounting to function, a series of accounting attributes are defined in the **dictionary** file on the RADIUS server and appear in the start and stop accounting records. Use the following descriptions of common accounting attributes to help you interpret start and stop records. Refer to RFC 2139 for information on other accounting attributes.

Acct-Authentic

Acct-Authentic records whether the user was authenticated by RADIUS or by the PortMaster user table. Accounting records are not generated for passthrough users, because those users are authenticated by the destination host.

Acct-Delay-Time

The PortMaster records the number of seconds that have passed between the event and the current attempt to send the record; this number is the Acct-Delay-Time value.

You can determine the approximate time of an event by subtracting the Acct-Delay-Time value from the time of the record's arrival on the RADIUS accounting server.

Acct-Input-Octets and Acct-Output-Octets

Acct-Input-Octets records the number of bytes received from the user and Acct-Output-Octets records the number sent to the user during a session. These values appear only in stop records.

Acct-Session-Id

Acct-Session-Id is a unique number assigned to each start and stop record to make it easy to match the start and stop records in a **detail** file, and to eliminate duplicate records.

The Acct-Session-Id is a string consisting of eight uppercase hexadecimal digits. The first two digits (*nn*) increment each time the PortMaster is rebooted. The next six digits begin at *nn*000000 for the first user login after a reboot—and increment up to approximately 16 million logins. This value equals the number of logins made in one year if users log

in once a minute to every port of a 30-port PortMaster. The Acct-Session-Id appears inside double quotation marks. This format is subject to change in future releases of ComOS.

Acct-Session-Time

Acct-Session-Time records the user's connection time in seconds. This information is included only in stop records.

Acct-Status-Type

Acct-Status-Type has two values: **Start** and **Stop**. A start record is created when a user session begins. A stop record is recorded when the session ends.

Acct-Terminate-Cause

The values returned by Acct-Terminate-Cause, which are shown in Table 8-3, indicate the cause of a session's termination. This information appears only in stop records. A NAS is a network access server, such as a PortMaster.

Table 8-3 Session Termination Causes

Termination Cause	Meaning
Admin-Reboot	System administrator is ending service on the NAS—for example, prior to rebooting the NAS.
Admin-Reset	Port was reset by an administrator.
Callback	Callback user was disconnected so port can be used to call the user back.
Host-Request	Session was disconnected or logged out by the Login-IP-Host. This attribute value can indicate normal termination of a login session, or that the remote host has failed or become unreachable.
Idle-Timeout	Idle timer expired for user or port.

Table 8-3 Session Termination Causes*(Continued)*

Termination Cause	Meaning
Lost-Carrier	Session terminated when the modem dropped the Data Carrier Detect (DCD) signal. This value can indicate any of the following: • The user or his modem hung up the telephone from their end; no problem exists. • The line was dropped. • The modem was unable to recover from severe line noise. • The local modem dropped DCD for some other reason.
Lost-Service	Service can no longer be provided—for example, the user's connection to a host was interrupted.
NAS-Error	NAS detected some error other than on the port, which required ending the session.
NAS-Reboot	NAS ended the session to perform a nonadministrative reboot—a system crash.
NAS-Request	NAS ended the session for a nonerror reason not otherwise listed here.
Port-Error	NAS had to reset the port. This error commonly occurs when a device attached to the port causes too many interrupts.
Port-Preempted	NAS ended the session in order to allocate the port to a higher priority use.
Port-Suspended	NAS ended the session to suspend a virtual session.
Port-Unneeded	NAS ended the session because resource usage fell below low-water mark—for example, if a bandwidth-on-demand algorithm decided that the port was no longer needed.
Service-Unavailable	NAS was unable to provide the requested service.
Session-Timeout	Session timer expired for the user.

Table 8-3 Session Termination Causes*(Continued)*

Termination Cause	Meaning
User-Error	Because the NAS received a PPP configuration request or acknowledgment when a session was already established, it terminated the session. This error is caused by a PPP implementation error in the dial-in client.
User-Request	Dial-in PPP client requested that the NAS terminate the connection. This message is expected from a proper PPP client termination.

Timestamp

Timestamp records the time of arrival on the RADIUS accounting host measured in seconds since the epoch (00:00 January 1, 1970 GMT). This attribute provides a machine-friendly version of the logging time at the beginning of the accounting record. To find the actual time of the event, subtract Acct-Delay-Time from Timestamp.

Called-Station-Id and Calling-Station-Id

Called-Station-Id records the telephone number called by the user. Calling-Station-Id records the number the user is called from. This information is recorded when the NAS-Port-Type is ISDN, ISDN-V120, or ISDN-V110 where supported by the local telephone company. On the PortMaster 3 and the PortMaster 4, this information is available for asynchronous calls as well, where supported by the local telephone company.

LE-Advice of Charge and LE-Terminate-Detail

The LE-Advice-of-Charge value is a vendor-specific attribute included in RADIUS accounting stop records generated by ComOS versions 3.8 or later. This string provides any advice-of-charge information passed along by the telephone company on the ISDN D channel.

The LE-Terminate-Detail value is a vendor-specific attribute included in RADIUS accounting stop records generated by ComOS versions 3.8 or later. This string provides a detailed description of the reason the session terminated.

The RADIUS 2.1 dictionary file uses the following syntax to define vendor-specific attributes that conform to RFC 2138:

```
#
# Vendor-Specific attributes use the SMI Network Management Private
# Enterprise Code from the "Assigned Numbers" RFC
#

VENDOR       Livingston              307

# Livingston Vendor-Specific Attributes (requires ComOS 3.8 and RADIUS 2.1)

ATTRIBUTE    LE-Terminate-Detail     2     string   Livingston
ATTRIBUTE    LE-Advice-of-Charge     3     string   Livingston
```

NAS-Port-Type

NAS-Port-Type records the type of port used in the connection. The port type can be any of the following: Async, Sync, ISDN, ISDN-V120, or ISDN-V110.

Request-Authenticator

The Request-Authenticator attribute appears in an accounting record only when the RADIUS server detects a problem with the accounting request's digital signature. A Request-Authenticator of **None** means that the accounting request was not digitally signed and was probably sent by a PortMaster that did not sign the accounting packets because it is running ComOS 3.3 or earlier. In RADIUS for UNIX 2.0 and 2.0.1, if the value for Request-Authenticator is **Unverified**, the accounting request signature did not match the expected value. Ensure that the shared secret on the PortMaster matches the shared secret in the **/etc/raddb/clients** file.

The RADIUS 2.1 server discards unsigned accounting packets—packets with invalid request authenticator attributes—and logs an error message. The following example shows a message resulting from a request on port 1025 from a PortMaster with an IP address of 192.168.1.1:

```
accounting: client 192.168.1.1/1025 sent accounting-request with invalid
request authenticator
```

You can instruct the server to accept unsigned accounting request packets by running **radiusd -o**. With this option, invalid—unsigned—accounting records are logged and flagged with **Request-Authenticator = None**.

Start and Stop Records

Example 1

The following code sample is an example start record in a PortMaster **detail** file.

```
Tue Jul 30 14:48:18 1996
        Acct-Session-Id = "AC000004"
        User-Name = "jaime"
        NAS-IP-Address = 172.16.64.91
        NAS-Port = 1
        NAS-Port-Type = Async
        Acct-Status-Type = Start
        Acct-Authentic = RADIUS
        Service-Type = Login-User
        Login-Service = Telnet
        Login-IP-Host = 172.16.64.25
        Acct-Delay-Time = 0
        Timestamp = 838763298
```

The Acct-Status-Type attribute in the record indicates whether the record was sent when the connection began (Start) or when it ended (Stop). The Acct-Session-Id is listed at the beginning of the record. Note that this value matches the Acct-Session-Id of the stop record on the following page, indicating that these records correspond to the same session.

User-Name specifies the username, in this case, *jaime*. NAS-IP-Address specifies the IP address of the PortMaster. NAS-Port-Type specifies that this is an asynchronous connection. Acct-Authentic specifies that *jaime* is authenticated via RADIUS. Service-Type and Login-Service specify that *jaime* is a login user using Telnet. Login-IP-Host specifies the host that user *jaime* logged in to.

The following code sample is an example stop record that is associated with the start record on the previous page. The Acct-Session-Id of the stop record matches that of the start record on the previous page, indicating that these records correspond to the same session.

```
Tue Jul 30 14:48:39 1996
        Acct-Session-Id = "AC000004"
        User-Name = "jaime"
        NAS-IP-Address = 172.16.64.91
        NAS-Port = 1
        NAS-Port-Type = Async
        Acct-Status-Type = Stop
        Acct-Session-Time = 21
        Acct-Authentic = RADIUS
        Acct-Input-Octets = 22
        Acct-Output-Octets = 187
        Acct-Terminate-Cause = Host-Request
        Service-Type = Login-User
        Login-Service = Telnet
        Login-IP-Host = 172.16.64.25
        Acct-Delay-Time = 0
        Timestamp = 838763319
```

In the stop accounting record, Acct-Session-Time specifies that *jaime*'s connection lasted 21 seconds. Acct-Input-Octets indicates that 22 bytes of incoming traffic were received; Acct-Output-Octets indicates that 187 bytes of outgoing traffic were sent.

The Acct-Terminate-Cause indicates that a Host-Request terminated the session, meaning that *jaime* logged off the host or that the host logged him off. The Acct-Delay-Time is 0 seconds, indicating that the RADIUS accounting server received the accounting-request on the first try.

Note – For more information on accounting attributes, see "Accounting Attributes" on page 8-6.

Example 2

The following is an example of a start record in a PortMaster **detail** file. The start record is for an ISDN PPP connection.

```
Tue Jul  8 08:44:17 1997
        Acct-Session-Id = "1A00014E"
        User-Name = "consolata"
        NAS-IP-Address = 192.168.32.1
        NAS-Port = 0
        NAS-Port-Type = Async
        Acct-Status-Type = Start
        Acct-Authentic = RADIUS
        Connect-Info = "33600 LAPM/V42BIS"
        Called-Station-Id = "5557026"
        Calling-Station-Id = "5105550285"
        Service-Type = Framed-User
        Framed-Protocol = PPP
        Framed-IP-Address = 192.168.32.35
        Acct-Delay-Time = 0
        Timestamp = 868376657
```

The NAS-Port-Type specifies that the user *consolata* has an asynchronous connection. Called-Station-Id and Calling-Station-Id specify the destination and source of the call. Service-Type and Framed-Protocol indicate that user *consolata* is a framed user establishing the connection via PPP.

The example on the following page is the stop record associated with the start record on this page. The stop record indicates that the login time for user *consolata* was 67 seconds. The Acct-Input-Octets and Acct-Output-Octets indicate that the incoming traffic for this session was 5877 bytes, and outgoing traffic was 2418 bytes.

```
Tue Jul  8 08:45:24 1997
        Acct-Session-Id = "1A000014E"
        User-Name = "consolata"
        NAS-IP-Address = 192.168.32.7
        NAS-Port = 0
        NAS-Port-Type = Async
        Acct-Status-Type = Stop
        Acct-Session-Time = 67
        Acct-Authentic = RADIUS
        Connect-Info = "33600 LAPM/V42BIS"
        Acct-Input-Octets = 5877
        Acct-Output-Octets = 2418
        Called-Station-Id = "5557026"
        Calling-Station-Id = "5105550285"
        Acct-Terminate-Cause = User-Request
        Service-Type = Framed-User
        Framed-Protocol = PPP
        Framed-IP-Address = 192.168.32.35
        Acct-Delay-Time = 0
        Timestamp = 868376724
```

Note – Examples of Perl scripts to process the RADIUS accounting logs are available at the Lucent Remote Access FTP site at **ftp://ftp.livingston.com/pub/le/radius/**.

Configuring RADIUS Proxy Service 9

This chapter includes the following topics:

RADIUS for UNIX supports **proxy** service. Proxy service enables a RADIUS for UNIX server—the proxy server—to forward an authentication request from a network access server (NAS) to a remote RADIUS server and return the remote server's reply to the NAS. A common use for proxy service is **roaming**. Roaming permits two or more Internet service providers (ISPs) to allow each other's users to dial in to either ISP's network for service. Users traveling outside the area of one ISP's coverage can access their services through another ISP.

Proxy service also enables an ISP to share its modem pool with that of neighboring ISPs. Suppose that during peak usage hours the modems of an ISP are so busy that some users cannot get through. It can establish a business arrangement with a neighboring ISP—if both are using RADIUS for UNIX, Lucent's Port Authority RADIUS server, or any other proxy-compatible RADIUS server—so that its users can dial in to the neighbor's modem pool.

For example, suppose you run an ISP that has such a modem sharing arrangement. When the users of the other ISP dial in to your modems, your server contacts the ISP's remote server for authentication and authorization information. The remote server authenticates the user and sends, through your server, all the information needed to configure the user's session on your client.

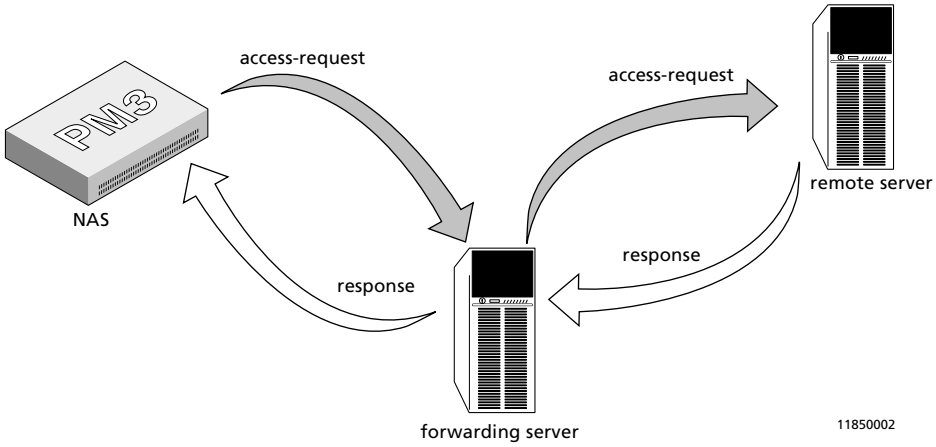
Because you are in a reciprocal arrangement with the other ISP, your users can dial in to it and be forwarded to your server. You and the other ISP can accumulate accounting records for each other's users and determine how the services are billed.

Each ISP with which you have a business relationship can specify a server to act as a remote server for proxy service. In some geographic areas, ISPs are establishing consortia to pool modems throughout the region by using remote servers.

How Proxy Service Works

Suppose the user of another ISP dials in to your ISP. Your network access server—such as a PortMaster—sends its RADIUS access request to the **forwarding server**—your RADIUS server, also known as the proxy server. The RADIUS server parses the remote server's **realm** from the user's request. Your RADIUS server acts as a client to the remote server and shares a secret with it. RADIUS forwards the request to the **remote server** identified by the realm. The remote server sends a response (either access-accept, access-reject, or access-challenge) back to the forwarding server, which sends it back to the NAS. This process is illustrated in Figure 9-1.

Figure 9-1 How Proxy Service Works



If the access-request is accepted, the NAS and the forwarding and remote servers process an accounting-request as follows:

1. The NAS sends an accounting-request to the forwarding server.
2. The forwarding server writes the request to its accounting log.
3. The forwarding server forwards the request to the remote server.
4. The remote server logs the accounting-request and sends an accounting-response to the forwarding server.
5. The forwarding server sends the accounting response to the NAS.

Both your forwarding server, which receives the access request directly from the NAS, and the remote accounting server store the accounting information in the directories **/usr/adm/radacct/***name_or_address***/detail**. The RADIUS daemon on each server creates the *name_or_address* directory. The forwarding server substitutes the name of the NAS for *name_or_address*. If the IP address of the NAS cannot be resolved to a hostname, then the IP address of the NAS is used rather than its name. On the remote server, the name is based on the hostname (or IP address) of the forwarding server the request was received from.

Note – If the request is forwarded across a chain of forwarding servers, the accounting records are stored on all servers in the chain.

Realms. The forwarding server sends the request to the remote server specified by the authentication **realm**. There are two kinds of realms:

- A **named realm** is the part of a user login following the **at** sign (@). For example:
  - If **isolde@cornwall.net** is the user login, **cornwall.net** is the realm.
  - If **sequoyah@cherokee** is the user login, **cherokee** is the realm.

  A domain name is frequently used as the named realm to provide uniqueness.
- A **numbered realm** is a Called-Station-Id. You can establish a number for users to call if they need proxy service, and forward proxy requests based on the number called.

RADIUS searches for numbered realms first. If you are using numbered realms and the RADIUS server must respond to points of presence (POPs) from multiple area codes, you must specify the area code for each PortMaster in the **proxy** file on the RADIUS server.

Here is an example of a proxy file for POPs in two different area codes:

```
tracy.dog.net       frtp67w3g3$1          2095559288
sanramon.dog.net    xst1ru83vm7s3yhp      9255554613
```

With the following example profile, user *bridget* can be authenticated when she calls in to either of the POPs whose numbers are listed in her profile as Called-Station-Ids:

```
bridget         Password = "knppog8"
                Service-Type = Framed-User,
                Framed-Protocol = PPP,
                Framed-IP-Address = 255.255.255.254,
                Framed-Routing = None
```

Note – Usernames with embedded @s—such as **tristram@cornwall.net**—are treated as proxy realms.

Note – RADIUS 2.1 currently supports the old username style, *realm*/*user*. Lucent Remote Access might not support this style in future releases and recommends that you avoid such usernames. The at sign (**@**) always takes precedence over the slash sign (**/**). As a consequence, the **radiusd** daemon interprets *a*/*b*@*c* as user *a*/*b* in the named realm *c*. Lucent Remote Access strongly recommends avoiding such mixed usage.

Proxy-State Attribute. When a forwarding server passes along an access request to another server, the server can add a Proxy-State attribute. The attribute must be returned unmodified in the reply packet, whether that response is an access-accept, an access-reject, or an access-challenge. The forwarding server removes the Proxy-State attribute before sending the response back to the requesting client. Because access-accept and access-reject replies are authenticated on the entire packet contents, the forwarding server must re-sign the packet. See "Request-Authenticator" on page 8-10 for information about packet signatures.

Each forwarding server in a proxy chain can add a Proxy-State attribute after those added by previous servers in the chain. No server can modify or remove any Proxy-State attribute except its own. The reply from the remote server maintains the order of the Proxy-State attributes. Each server in turn then removes the last Proxy-State added—which must be its own—and passes the remaining Proxy-State attributes along when it sends the reply back down the proxy chain to the NAS.

You can include the **old** keyword in the proxy file entry for a remote server to communicate with RADIUS servers that do not support proxy. Using this keyword prevents the server from adding a Proxy-State attribute when it forwards a request and from removing a Proxy-State attribute when it receives the reply.

A summary of the Proxy-State Attribute format is shown below.

Table 9-1 Proxy-State Attribute as Currently Implemented in Lucent RADIUS 2.1

Octet	Contents
0	Numeric code for attribute name. For Proxy-State, the code is **33**.
1	Length of attribute in bytes. This value is currently 30.
2-5	Timestamp—in seconds since epoch—that packet reached forwarding server.

Table 9-1 Proxy-State Attribute as Currently Implemented in Lucent RADIUS

Octet	Contents
6-9	Client IP Address from which packet was received.
10-11	Client source port from which packet was received.
12	ID of packet received from client.
13	Pad byte. This value is currently **0**.
14-29	Client request authenticator.

Note – The Lucent RADIUS Proxy-State attribute consists of an opaque sequence of octets and is subject to change without notice. The attribute value is only meaningful to the server that sent the attribute.

Servers Running Proxy Service

Both the forwarding server and the remote server must be running RADIUS for UNIX version 2.1 or later, or Lucent's Port Authority RADIUS server. Any third-party RADIUS-conforming proxy server can probably work as either the forwarding server or remote server, but Lucent Remote Access has not tested proxy service with other RADIUS servers to determine if they correctly implement proxy. Lucent Remote Access RADIUS versions 2.0.1 and earlier do not support proxy RADIUS. However, a remote server can use the earlier versions of Lucent RADIUS if the proxy file on the forwarding server has the **old** keyword set in its proxy file entry for the remote server.

The RADIUS server uses the following UDP ports by default:

- 1645 for RADIUS authentication
- 1646 for RADIUS accounting
- 1650 for proxy requests and responses
- 1651 for proxy requests and responses

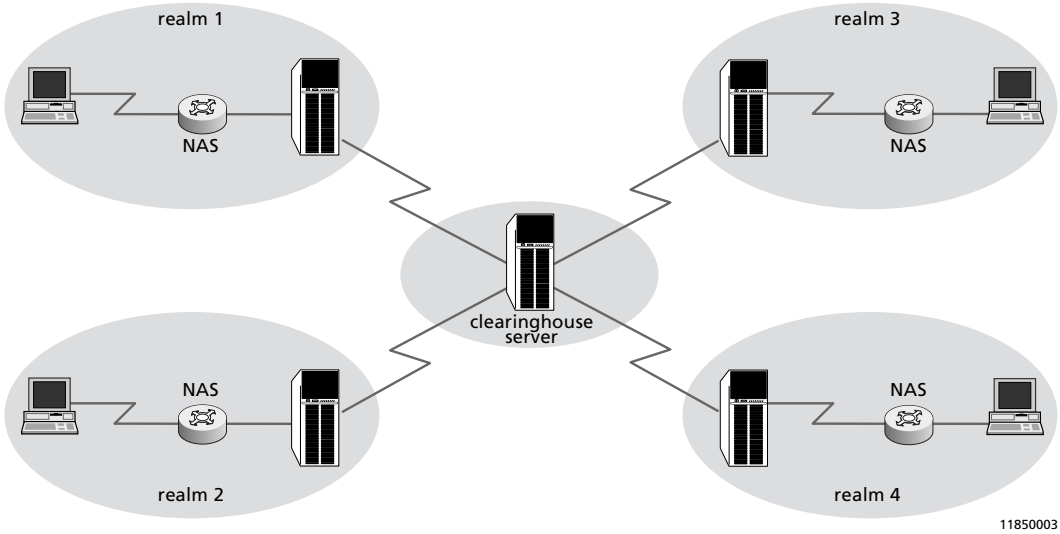
The forwarding and remote servers can run on different operating systems. A RADIUS server can function both as a forwarding server and remote server, acting as a forwarding server for some realms and as a remote server for other realms. A remote server can in turn forward a request to another remote server.

One forwarding server can forward to any number of other forwarding or remote servers, but only one per realm. A remote server can have any number of servers forwarding to it and can provide authentication for any number of realms.

Proxy Confederations

Proxy service requires planning and cooperation between different business entities. The typical implementation involves a confederation of businesses designating a single proxy forwarding server to serve as a **clearinghouse** server. Within each organization's system, the forwarding server knows only the address of the clearinghouse server. The clearinghouse server knows the addresses of all remote servers in the confederation. Figure 9-2 shows how this typical proxy confederation works.

Figure 9-2 One Practical Implementation of Proxy Service



Suppose a NAS sends a proxy request to the RADIUS forwarding server. If the realm is not found in the **proxy** file, the request is forwarded to the clearinghouse server. The clearinghouse server performs the lookup for the request and forwards the request to the desired remote server. The remote server sends the appropriate information back to the clearinghouse server, which in turn passes the information to the original forwarding server.

Each RADIUS server also acts as a remote server to the clearinghouse server. The clearinghouse server functions as both a forwarding server and a remote server to the servers at the ends of the confederation.

If you are using a clearinghouse remote server, you can define it as your default by specifying the realm name **DEFAULT** (all uppercase letters). Proxy requests are forwarded to the DEFAULT server if the named realm has no other entry in the **proxy** file.

Note – You must ensure that the servers in a proxy system do not forward to each other, which creates a forwarding loop that passes packets back and forth between them. For example, this situation occurs if a proxy file has an incorrect entry that associates the realm of the next server in the proxy chain with the IP address of the previous server in the chain.

Configuring Proxy Information on the Server

To use the proxy service, you must configure RADIUS as you would normally, with the following additions:

- You must create a **proxy** file on each forwarding server.
- If you are using any named realms, the remote server must also have a **proxy** file so that it can authenticate them. If you are using only numbered realms, the remote server needs no proxy file.

Caution – Because the **proxy** file contains the shared secrets for the proxy servers, verify that only root users have read and write access to the file.

Components of the proxy File

You create a **proxy** file in the **/etc/raddb** directory on the forwarding server and, if necessary, on the remote server. Each entry or line in the **proxy** file describes one realm.

Here is a sample **proxy** file:

```
#remote server
#hostname or                                              optional ports
#IP address          shared secret          realm         or keywords
#--------------      -----------------      -------       -----------------
radius.edu.net       vdlk4%#p67w3g&g1       edu.net
s134.net.com         ru83vm7xst1shm!p       5551234       1812    1813
net54.edu.net        2hbtr5$w*3m7xstt       5555624
s134.net.com         x56jy76mgpkst          5551134
rad.edu.com          ch5#5eb716erth         edu.com       1645
rad7.com.net         lx4zDFapa3ep           com.net       1645    1646    old
eg.edu.net           e997asepdflj           edu.net       old     secure
```

An entry contains the following information, all separated by spaces or tabs:

- Hostname or IP address of the remote server for the realm—a server acting as a remote server to this server, but which might in turn forward the request.
- Secret shared between this same server and the remote server.
- Realm handled by the remote server.

You can optionally include the following additional information in a **proxy** file entry:

- UDP port number for RADIUS authentication
- UDP port number for RADIUS accounting
- One or more keywords to affect the server behavior
  - **old**—This keyword causes the server to strip the realm from the login name and not attach Proxy-State when forwarding access-requests. Use this keyword when you are forwarding requests to servers with RADIUS versions older than 2.1.

Caution – Use the **secure** keyword with only if you want certain users to be granted administrative privileges.

  - **secure**—This keyword enables the remote server to authorize someone to log in to your NAS with administrative privileges. If this keyword is not present, an access-accept message from the forwarding server to the client that grants administrative access (either Service-Type = Administrative-User or Service-Type = NAS-Prompt-User) is sent to the client as an access-reject.

The RADIUS server generates a **syslog** message similar to the following (shown on three lines for clarity):

```
Jul 10 21:10:00 ra radius[14870]: remote server 192.168.96.6/1645.4
returned insecure service for client 172.16.3.24/1039.17, sending reject
instead
```

– **ipass**—This keyword instructs the server to use the iPass protocol rather than the RADIUS protocol to communicate with the remote server. See Appendix E, "Contact Information for Third-Party Products," for information on how to contact iPass, Inc. for more information.

You can include the optional information in any order in the **proxy** entry, **after** the first three mandatory fields. If you specify only a single UDP port number, the server interprets this as the RADIUS authentication port number. If you specify two UDP port numbers, the first number is interpreted as the RADIUS authentication port and the second number as the RADIUS accounting port. If you do not specify any ports in the proxy entry, the server uses its own port numbers for communication with the remote server.

If a remote server—the final server in the proxy chain—has a **proxy** file, the file must have an entry configured for each of the server's own realms. This entry must include the following information:

- Server's own hostname or IP address
- Unique shared secret—this secret is not configured on any other device
- Realm for which this server is authoritative

Special Realms: DEFAULT and NOREALM

You can include entries in your **proxy** file for the special realms DEFAULT and NOREALM. The following example shows sample DEFAULT and NOREALM entries:

```
center.com.net     e199aespfdx4       DEFAULT
others.com.net     e19aepsfd9x4       NOREALM
```

Requests are forwarded to the DEFAULT server if their named realm has no other entry in the **proxy** file. You might use the DEFAULT realm to define the entry for a clearinghouse server.

When you want users that have no realm to be forwarded to a specific server, you can create a NOREALM entry for that server. Consider the situation where for performance reasons you have configured your network access servers to communicate with many forwarding servers that each have **proxy** files but no local **users** files. You can use the NOREALM entry in each of these proxy files to forward all the local users—those who log in without specifying a realm—to your full RADIUS server for authentication.

The last DEFAULT and NOREALM entries in the proxy file are the ones used. Whenever you update the proxy file, the RADIUS server reads it into memory in its entirety. The RADIUS server uses the copy in memory rather than reading the file each time it needs to access a proxy entry.

On the Forwarding Server

The RADIUS **clients** file must have an entry for the name or IP address and the shared secret of the NAS. If the forwarding server is in a chain of multiple servers, the **clients** file must contain the name or IP address and the shared secret of any servers for which it forwards requests.

The **proxy** file must have an entry for the name or IP address, shared secret, and realm of all remote RADIUS servers. The shared secret in the forwarding server's **proxy** file must match the shared secret in the remote server's **clients** file.

Remote in this instance means a server to which the forwarding server sends a request for authentication. That server might be the ultimate server in the proxy chain and process the request, or it might in turn forward the request on, until the request reaches the ultimate server in the proxy chain and is processed for authentication.

On the Remote Server

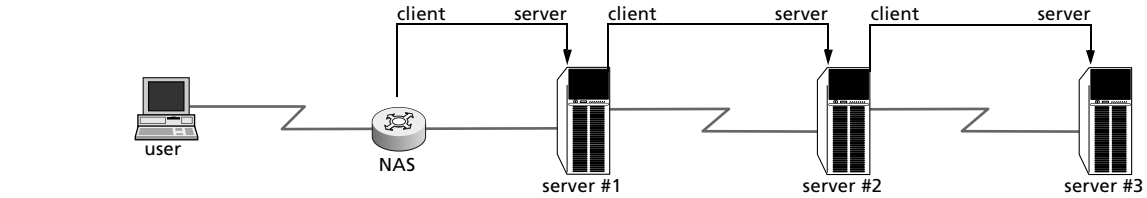
The **clients** file must contain the name or IP address and the shared secret of all forwarding servers. The shared secret must match the shared secret in each forwarding server's **proxy** file.

If any named realms are used, the **proxy** file must contain the name or IP address of the remote server, an unused dummy secret, and the realm for which this remote server is authoritative. If only numbered realms are used, then no **proxy** file needs to be defined on the remote server.

Example Proxy Server Relationships and Configuration Steps

Figure 9-3 illustrates the client/server relationships in a system that includes two forwarding servers and a remote server.

Figure 9-3 Proxy Server Relationships



The NAS is a client to server #1. Server #1 is a client to server #2. Server #2 is a remote server to server #1, and a client to server #3. You must include each client's name or IP address and shared secret in the **clients** file of its associated server. Each client/server pair must share a secret. You must configure each server's **proxy** file to point to the next server in the chain, including the name or IP address, shared secret, and realm of the next server. The secret you configure in the **proxy** file must match the secret configured in the **clients** file of the next server in the chain.

Figure 9-4 shows how secrets are shared between devices in a proxy chain. In this example, shared secrets #2 and #6 can be identical, but need not be. Shared secrets #3 and #5 can be identical, but need not be.

Figure 9-4 Shared Secrets

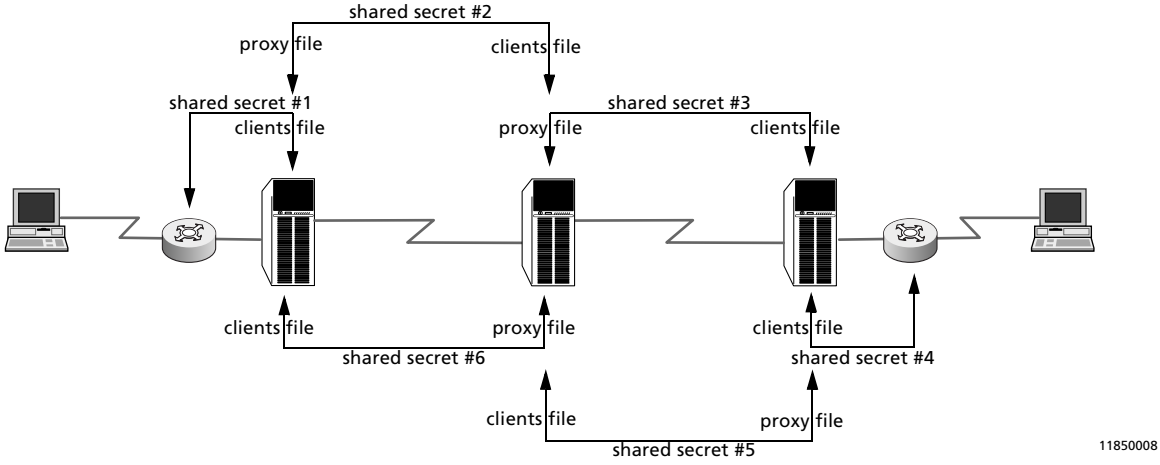


Figure 9-5 provides a detailed example of the proxy relationships shown in Figure 9-3. In this example, the server xroad.net acts as a clearinghouse server for ISPs in Argentina (estancia.net) and New York (redsauce.net). The clearinghouse server proxies requests in both directions.

To properly configure the components of the proxy service shown in Figure 9-5, where each NAS is a PortMaster, the administrators must perform the steps described below. This example considers the case of a user with a home account in New York who travels to Argentina.

1. **On PortMaster** pm1.estancia.net**, enter the following commands to set the RADIUS authentication and accounting servers:**

   ```
   set authentic 192.168.190.21 1645
   set secret ujm49fud3$$
   set accounting 192.168.190.21 1646
   ```

2. **Determine the IP address or fully qualified domain name of each NAS and server.**

   In this example, you have the following from the viewpoint of someone dialing in to the ISP in Argentina:

   – PortMaster named pm1.estancia.net with IP address 192.168.190.20

   – Forwarding server named jorge.estancia.net with an IP address of 192.168.190.21 in the realm estancia.net

   – Clearinghouse server xroad.net with an IP address of 172.30.140.2

   – Remote server named vinnie.redsauce.net with an IP address of 172.16.240.111 in the realm redsauce.net

   – PortMaster named pm22.redsauce.net with IP address 172.16.240.110

3. **On forwarding server** jorge.estancia.net**, configure the following:**

   – Contents of **/etc/raddb/clients**

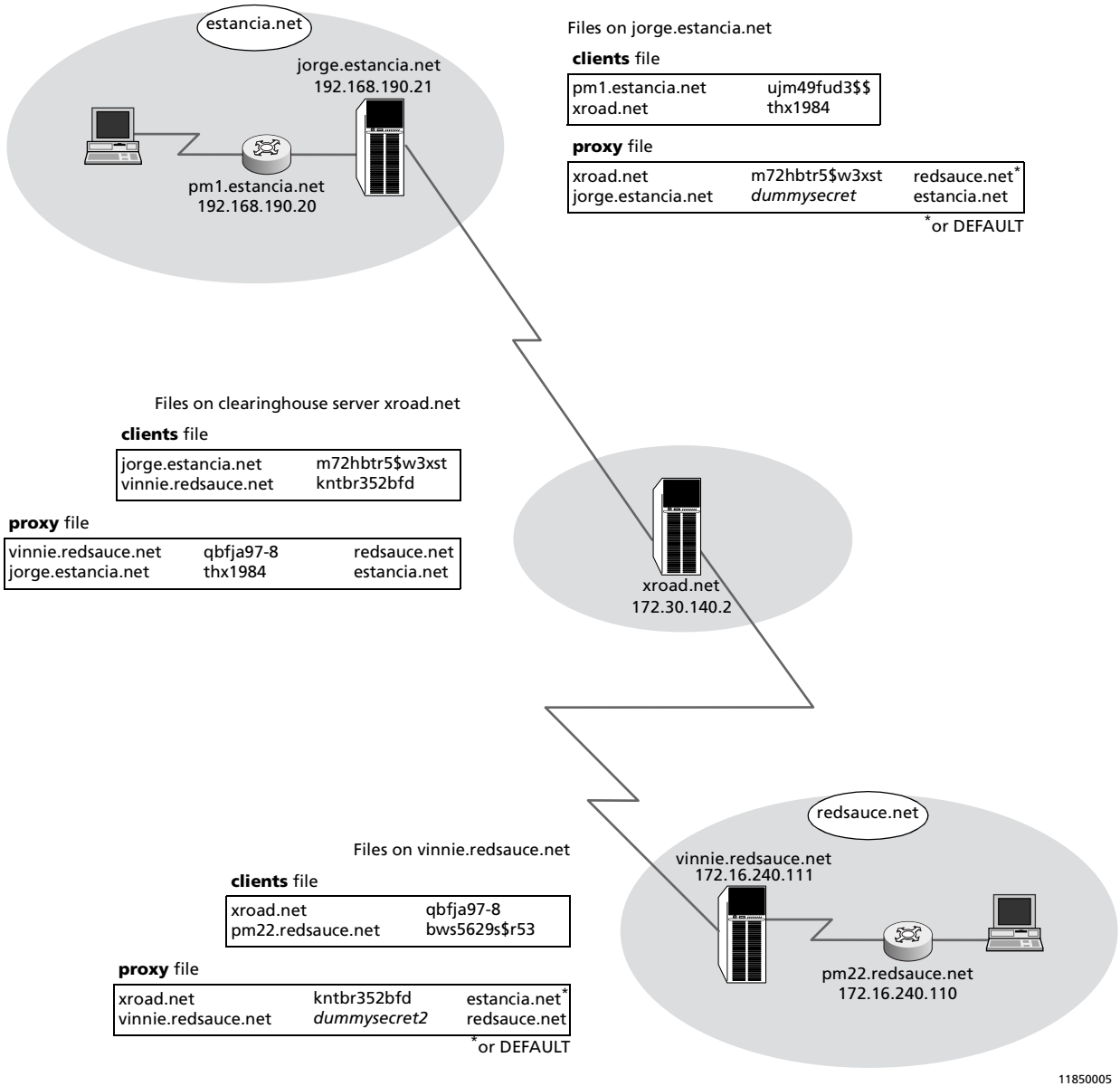
   ```
   pm1.estancia.net      ujm49fud3$$
   xroad.net             thx1984
   ```

   – Contents of **/etc/raddb/proxy**

   ```
   xroad.net             m72hbtr5$w3xst        redsauce.net
   jorge.estancia.net    dummysecret           estancia.net
   ```

   DEFAULT can be substituted for the realm redsauce.net.

Figure 9-5 Proxy Server Relationships



4. **On clearinghouse server xroad.net, configure the following:**

   – Contents of **/etc/raddb/clients**

   ```
   jorge.estancia.net     m72hbtr5$w3xst
   vinnie.redsauce.net    kntbr352bfd
   ```

   – Contents of **/etc/raddb/proxy**

   ```
   vinnie.redsauce.net    qbfja97-8              redsauce.net
   jorge.estancia.net     thx1984                estancia.net
   ```

5. **On remote server** vinnie.redsauce.net**, configure the following:**

   – Contents of **/etc/raddb/clients**

   ```
   xroad.net              qbfja97-8
   pm22.redsauce.net      bws5629s$r53
   ```

   – Contents of **/etc/raddb/proxy**

   ```
   xroad.net              kntbr352bfd            estancia.net
   vinnie.redsauce.net    dummysecret2           redsauce.net
   ```

   DEFAULT can be substituted for the realm estancia.net.

6. **On PortMaster pm22.redsauce.net, enter the following commands to set the RADIUS authentication and accounting servers:**

   ```
   set authentic 172.16.240.111
   set secret bws5629s$r53
   set accounting 172.16.240.111
   ```

7. **Define the user profiles.**

   You must define a user profile in the **users** file of the remote server for each user that is to be authenticated via the remote server.

   If the user's password is stored in the **users** file, an example user profile for *marciano* on vinnie.redsauce.net is the following:

   ```
   marciano                Password = "jmp$f87"
                           Service-Type = Framed-User,
                           Framed-Protocol = PPP,
                           Framed-IP-Address = 255.255.255.254,
                           Framed-Routing = None
   ```

However, if *marciano*'s password is stored in the **/etc/passwd** file, an example user profile is the following:

```
marciano                Auth-Type = System
                        Service-Type = Framed-User,
                        Framed-Protocol = PPP,
                        Framed-IP-Address = 255.255.255.254,
                        Framed-Routing = None
```

If *marciano* goes to Argentina on a business trip and dials in to the network at estancia.net, he must enter **marciano@redsauce.net** at the password login prompt.

8. **Run the** radiusd **daemon on servers jorge.estancia.net, xroad.net, and vinnie.redsauce.net.**

   The RADIUS accounting records for proxy users are logged into the detail file of all the servers.

Troubleshooting RADIUS A

This appendix provides hints and tips for troubleshooting the RADIUS authentication server and the RADIUS accounting server.

Troubleshooting RADIUS Authentication

Most RADIUS authentication problems occur because the server or client was not configured correctly, or because a step was omitted during installation. Carefully check the instructions in Chapter 2, "Configuring a RADIUS Server," and Chapter 3, "Adding a RADIUS Client," to ensure that the authentication server was properly installed and configured.

If you have not solved the problem after reviewing the instructions in Chapter 2 and Chapter 3, read the troubleshooting suggestions in this section. Refer to Appendix B, "RADIUS for UNIX Error Messages," for information on specific error messages.

Checking the radiusd Daemon

1. **Use** radiusd -v **command to display the version number.**
2. **Verify that the** /etc/raddb **directory (or the directory you specify with the** -d **flag) contains the following files:** dictionary**,** users**, and** clients**.**

   If you are using RADIUS menus, check the **menus** subdirectory.
3. **Make sure** /etc/radiusd **is running.**
4. **Use** radiusd -x **to view incoming and outgoing packets from RADIUS.**

Checking the PortMaster

1. **Make sure that security is on for each port:**

```
Command> set all security on
Command> save all
Command> reset all
```

When security is on, the **show** *S0* command displays **(Security)** in the Port Type field of its output.

Note – When you issue the **reset all** command, all connections on serial and asynchronous ports are dropped. On the PortMaster 4, the **reset all** command is issued to a slot; only active connections on that slot are dropped. For all PortMaster products, the console port is not affected by the **reset all** command

2. **Use the** show global **command to verify the following:**
   - RADIUS server IP address is set on the PortMaster
   - Secondary RADIUS server does not have the same IP address as the primary server
3. **Make sure that the PortMaster can contact the RADIUS server:**

   ```
   Command> ping Ipaddress
   ```

4. **Make sure the secret set on the PortMaster with the** set secret *password* **command matches the secret in the** /etc/raddb/clients **file on the RADIUS server.**

   The PortMaster will not display the shared secret; however, you can set the secret again if you are not sure that it is set properly. If you update the shared secret, make sure to use the **save all** command to save the shared secret in the PortMaster nonvolatile memory.

Checking /etc/raddb/users

1. **Items in the user entries are case-sensitive. You must do the following:**
   a. Verify the spelling and capitalization of each line of the **users** file.
   b. Compare keywords against the **/etc/raddb/dictionary** file to ensure that they are the same.
2. **Verify that the user can authenticate with a clear text password before authenticating with Auth-Type = System or Auth-Type = SecurID.**

Host Unavailable

If a "Host Unavailable" message is displayed before a username is entered at the login prompt, then **both** of the following conditions exist:

- Autolog username was set on the port
- Default host is not responding to the login service. The default host is either defined for the port or defined in the PortMaster user table for the user. The login service—**rlogin** or **telnet** or **in.pmd**—is either defined for the port or defined in the PortMaster user table for the user.

If a "Host Unavailable" message is displayed after a username is entered at the login prompt, but before a password is entered, **all** of the following conditions exist:

- Username exists in the local user table
- No password is associated with the username
- Default host is not responding to the login service—**rlogin**, **telnet**, or **in.pmd**

If a "Host Unavailable" message is displayed after a username and password are entered at the login prompt, **either** of the following conditions might exist:

- Security for the port is disabled and the default host is not responding to the login service—**rlogin**, **telnet**, or **in.pmd**
- Security for the port is enabled and the default host is not responding to the login service—**rlogin**, **telnet**, or **in.pmd**

To verify that security is not enabled, enter the following command. If necessary, replace S1 with the port that you are using.

```
Command> show s1
```

If **(Security)** is not displayed in the Port-Type field, enter the following commands to enable security for the port:

```
Command> set s1 security on
Command> reset s1
Command> save all
```

Invalid Login after 30-Second Wait

If the PortMaster sends 10 access-requests at 3-second intervals and then displays an "Invalid Login" message, this message can indicate one of the following problems:

- RADIUS is not running on the server.

  Verify that **/etc/radiusd** is running.

- The RADIUS server is not defined correctly on the PortMaster.

  Check the RADIUS server information using the following commands:

  ```
  Command> show global
  Command> show netcon
  ```

  Look for remote ports of 1645 or 1646 in the **netcon** output.

- No entry exists for the PortMaster in the **/etc/raddb/clients** file. Verify this condition by editing **/etc/raddb/clients** to verify the PortMaster hostname or IP address is correctly defined in the file.

- **radiusd** responses are not getting back to the PortMaster. Do the following:

  – Examine the routing table on the RADIUS server host.

  – Ping the PortMaster from the RADIUS server host.

  – Run **traceroute** on the PortMaster address from the RADIUS server host.

  – Run **traceroute** on the RADIUS server host from the PortMaster.

- The PortMaster is ignoring **radiusd** responses. This occurs when the access-accept or access-reject source address does not match the destination of the access-request packet—the IP address of either the primary or secondary RADIUS server. This is usually caused by one of the following:

  – Multiple IP addresses are assigned to a single Ethernet interface on the RADIUS server host.

  – Multiple Ethernet interfaces are enabled, and the RADIUS server is replying to a request from the PortMaster on an interface different from the interface that received the request.

  You can use the PortMaster packet tracing command **ptrace** to determine where packets are being routed. See the *PortMaster Troubleshooting Guide* for more information.

Turning on the Debug Function

You can run **radiusd -x** to display debugging output. RADIUS version 2.1 or later also enables you to use SIGUSR signals. You can turn on RADIUS debugging by sending a SIGUSR1 signal to **radiusd**. Sending a SIGUSR2 signal to **radiusd** turns debugging off.

1. **Issue one of the following commands, depending on your version of UNIX, to determine the process ID for** radiusd**:**

   ```
   % ps ax | grep radiusd
   ```

   or

   ```
   % ps -ef | grep radiusd
   ```

   If you are running RADIUS in single-threaded mode—**radiusd -s**—this returns a single process ID. If you are not running in single-threaded mode, this returns a process ID for the parent **radiusd** authentication process and a process ID for the child **radiusd** accounting process. You can signal the authentication and accounting processes separately.

2. **Send the desired signal to the process.**

   To turn debugging on:

   ```
   Command> kill -USR1 processid
   ```

   To turn debugging off:

   ```
   Command> kill -USR2 processid
   ```

The RADIUS server logs a short summary message of **radiusd** activity when either message is sent and when **radiusd** is exited.

An example **syslog** message might appear as follows (shown on two lines instead of one for legibility):

```
Mar 19 23:10:50 ra radius[14870]: counters 5 8 / 2 4 / accept 4 reject 1
challenge 0 response 8
```

This messages shows that the RADIUS server received the following:

- 5 packets on port 1645—unless the RADIUS port was specified differently by running **radiusd -p** *Portnumber*
- 8 packets on the RADIUS accounting port

- 2 RADIUS proxy replies
- 4 RADIUS accounting proxy replies

This message also shows that the RADIUS server sent the following:

- 4 access-accept packets
- 1 access-reject
- 0 access-challenges
- 8 accounting responses

The following example **syslog** message is a summary (shown on two lines instead of one for legibility) of memory allocation for each of the four major data structures that **radiusd** uses:

```
Jul 28 09:56:01 ra radius[19340]: memory usage=pair 8/35/4784 peer 0/0/0 req
1/4/570 buf 1/4/570
```

The memory allocation is in the format *x*/*y*/*z*, where *x* is the number allocated but not yet freed, *y* is the high-water mark—the most ever allocated but not freed at one time—and *z* is the total number allocated.

Result of Debug Output

If debug output shows more than one access-reject packet sent for the same ID, check the following:

1. **Check the route back to the PortMaster; ensure that replies are getting to the PortMaster.**
2. **Check to see if the RADIUS server host has more than one Ethernet port or multiple IP addresses are assigned to the same Ethernet interface.**
3. **Check for packet filters between the RADIUS server host and the PortMaster filtering out the RADIUS return packets.**
4. **On the PortMaster, use** ptrace **as follows to show packets returning from the host running** radiusd**.**

   For ComOS versions below 3.7:

   ```
   Command> add filter r
   Command> set filter r 1 permit udp src eq 1645
   ```

```
Command> set filter r 2 permit icmp
Command> ptrace r
```

Note – ptrace on a PortMaster only shows UDP or ICMP packets generated on the PortMaster itself if the PortMaster is running ComOS version 3.7 or later. Outgoing RADIUS access requests are not shown; however, returning packets are displayed. To turn off tracing, use the **ptrace** command with no values. See the *PortMaster Command Line Reference* for more information.

For ComOS version 3.7 or higher:

```
Command> add filter r
Command> set filter r 1 permit udp src eq 1645
Command> set filter r 2 permit udp dst eq 1645
Command> set filter r 3 permit udp src eq 1646
Command> set filter r 4 permit udp dst eq 1646
Command> set filter r 5 permit icmp
Command> ptrace r ext
```

5. **Check the source address of a packet during tracing.**

   A multihomed RADIUS host might be using the wrong source address when replying to access-request packets.

If debugging output shows an access-reject packet right away, check the following:

1. **Check the spelling of the username and password.**

   The capitalization must match exactly.

2. **Check the log file.**

   Check **syslog** for errors from **radiusd**.

3. **Use the** show table user **command to verify that the user is not in the PortMaster user table.**

   The local user table is always checked first during authentication attempts.

4. **If Auth-Type = System is not working, attempt to use a clear text password in the user profile.**

5. **If Auth-Type = System is specified on a UNIX system that has shadow passwords, ensure that** radiusd **is run as root to access the shadow passwords.**

6. **Verify the spelling, capitalization, and syntax of the** /etc/raddb/users **file.**

   If **radiusd** finds any errors in the user profile, it sends an access-reject message and logs an error to **syslog**.

7. **Check that the shared secret in** /etc/raddb/clients **matches the one set on the PortMaster with the** set secret **command**

8. **If you are using PMconsole 3.5 or earlier, ensure that the secret was not inadvertently erased.**

   Pressing the **Return** key with the cursor in the RADIUS Secret field of the RADIUS window erases the secret when the **Save** button is clicked.Lucent Remote Access recommends using PMVision.

Performance Degradation

If you experience a degradation in RADIUS performance, consider the following two possibilities:

- Non-RADIUS processes on the host machine might be using host resources. Review the recommendations in "Selecting a RADIUS Server Host" on page 2-1. Removing non-RADIUS services can free-up host resources.
- User lookups take more time as the number of user profiles on the RADIUS server increases. Lucent Remote Access recommends caching user profiles when the **users** file contains more than 500 users to increase the speed and efficiency of user lookups.

Troubleshooting RADIUS Accounting

Most RADIUS accounting problems occur because a step was skipped during installation. Carefully check the instructions in Chapter 3, "Adding a RADIUS Client," and Chapter 8, "Implementing RADIUS Accounting," to ensure that the accounting server was properly installed and configured.

If you have not solved the problem after reviewing the instructions in Chapter 3 and Chapter 8, do the following:

1. **Verify the RADIUS accounting service directory,** /usr/adm/radacct**, exists.**
2. **Verify that the account used to execute** radiusd **has write permission to the RADIUS accounting service directory.**

3. **Check the RADIUS version number.**

   Run **radiusd -v**.

4. **Make sure that you do not have any other process bound to UDP ports 1645 or 1646.**

   Kill **radiusd** and use the **netstat -a** command. Start **radiusd** and use the **netstat -a** command again.

Note – Note that some UNIX operating systems display the sockets symbolically as **.radius** and **.radacct** rather than .1645 and .1646.

5. **Use the** show global **command to verify that the IP address of the accounting host has been configured on the PortMaster.**

   If it has not been configured, set it using the **set accounting** *Ipaddress* command on the PortMaster, where *Ipaddress* is the IP address of the host running **radiusd**.

6. **Check syslog (auth.warning) for error messages from** radiusd**.**

   During normal use, very few error messages should appear.

7. **Ping the PortMaster from the RADIUS server to check connectivity.**

8. **If the previous suggestions do not solve the problem, run** radiusd -x **on the RADIUS server host and check to determine if accounting records are displayed.**

RADIUS for UNIX Error Messages B

This appendix presents error messages that can be generated by RADIUS for UNIX and explains each message. Actions you can take to correct the error are recommended wherever possible. Error messages are likely to change between releases of RADIUS for UNIX.

Note – If no action is recommended, do the following before you contact Lucent Remote Access Technical Support: Write down the error message exactly and record the output of **radiusd -v** and **uname -a**.

Accounting

The following error messages are related to RADIUS accounting.

```
accounting: client Ipaddress/Portnumber sent accounting-
request with invalid request authenticator
```

Explanation
RADIUS received an accounting packet with an invalid Request-Authenticator on port *Portnumber* from a RADIUS client at *Ipaddress*.

Recommended Action
Check that the shared secret on the client and the server are exactly the same. Case is significant. If the secrets match, next check the version of ComOS on the client if it is a PortMaster. Lucent Remote Access recommends that you run ComOS 3.3.1 or later with RADIUS 2.1 accounting. If any of your PortMaster clients are running ComOS 3.3 or earlier, run **radiusd** with the **-o** option. If this message results from a client that is not a PortMaster, then the client is not compliant with RFC 2139.

```
accounting: could not append to file Filename
```

Explanation
RADIUS was not able to add additional information to the end of the accounting **detail** file, *Filename*.

Recommended Action
Check permissions and ownership of the **detail** file and its directory. Verify that the hard disk has not run out of available storage space.

```
accounting: from Client - unknown client ignored
```

Explanation
An accounting packet was received from a network access server (NAS) that is not identified in the **clients** file.

Recommended Action
Add client to **clients** file if appropriate. Otherwise, apply a filter to prevent access requests from the NAS.

```
acct bind error Errormessage
```

Explanation
At startup, **radiusd** was unable to bind RADIUS accounting on UDP socket 1646 and returned an error message.

Recommended Action
Verify that **radiusd** is not already running. Use **netstat -a** to determine whether UDP port 1646 is in use by some other process. Kill the process that bound the port and restart **radiusd**.

```
acct socket error Errormessage
```

Explanation
At startup, **radiusd** was unable to open RADIUS accounting UDP socket 1646 and returned an error message.

Recommended Action
Verify that **radiusd** is not already running. Use **netstat -a** to determine whether UDP port 1646 is in use by some other process. Kill the process that bound the port and restart **radiusd**.

```
could not fork to spawn accounting daemon
```

Explanation
An operating system error prevented RADIUS from starting the accounting daemon from **radiusd**.

Recommended Action
Consult your system administrator or the UNIX **man** pages.

Authentication

The following error messages are related to RADIUS authentication.

```
auth: access-request from NAS (<Ipaddress>) denied for unknown
user Username
```

Explanation
RADIUS did not authenticate user *Username* attempting access from server *NAS* at IP address *Ipaddress*.

```
auth: access-request from NAS ignored; no user name
```

Explanation
RADIUS received an access request with no username from server *NAS*. this message can result from a malformed authentication request or from the dial-up software.

Recommended Action
Check the client.

```
auth: access-request from unknown client NAS ignored; user
name Username
```

Explanation
RADIUS ignored an access-request by user *Username* from server *NAS*. Any request coming from a NAS not specifically configured in the **clients** file is ignored.

Recommended Action
Add the NAS hostname or IP address to the **clients** file if appropriate. Otherwise, apply a filter to prevent access requests from the NAS.

```
auth bind error Errormessage
```

Explanation
At startup, **radiusd** was unable to bind RADIUS authentication on UDP socket 1645 and returned an error message.

Recommended Action
Verify that **radiusd** is not already running. Use **netstat -a** to determine whether UDP port 1645 is in use by some other process. Kill the process that bound the port and restart **radiusd**.

```
auth socket error Errormessage
```

Explanation
At startup, **radiusd** was unable to open RADIUS authentication UDP socket 1645 and returned an error message.

Recommended Action
Verify that **radiusd** is not already running. Use **netstat -a** to determine whether UDP port 1645 is in use by some other process. Kill the process that bound the port and restart **radiusd**.

```
dropping duplicate request for id Idnumber from NAS
```

Explanation
RADIUS dropped packet *Idnumber* from server *NAS*. Each request contains an ID number. This message is generated if RADIUS receives a request with an ID to which it has already responded in the last five seconds.

Recommended Action
Do the following:

- Check additional error messages containing this ID number for an explanation of why RADIUS did not respond.
- Verify that the RADIUS server is able to respond to the client within 3 seconds. If your **users** file is a flat text file, consider using **builddbm** to convert it to DBM format for faster lookups. You must run **radiusd** with the **-b** option to use the DBM version of the **users** file.
- Verify that the client is represented in the **clients** file.
- Verify that the RADIUS client is configured with the same RADIUS secret that is in the **clients** file.
- Investigate whether the host is overloaded with traffic; if so, consider spreading the load across several hosts.

```
dropping request for id Idnumber from NAS; Number requests
already in queue
```

Explanation
RADIUS is dropping the request for ID *Idnumber* because the queue has grown too large. *Number* indicates the number of requests already in the queue.

Recommended Action
Do the following:

- Check additional error messages containing this ID number for an explanation of why RADIUS did not respond.
- Verify that the RADIUS server is able to respond to the client within 3 seconds. If your **users** file is a flat text file, consider using **builddbm** to convert it to DBM format for faster lookups. You must run **radiusd** with the **-b** option to use the DBM version of the **users** file.
- Verify that the client is represented in the **clients** file.
- Verify that the RADIUS client is configured with the same RADIUS secret that is in the **clients** file.
- Investigate whether the host is overloaded with traffic; if so, consider spreading the load across several hosts.

```
radrecv: fatal system error: out of memory, exiting
```

Explanation
RADIUS ran out of memory while receiving a packet and shut down.

```
radrecv: request from client Client claimed length Number,
only Number2 bytes found
```

Explanation
RADIUS received a packet from client *Client* that was reported to be *Number* of bytes in length but was *Number2* of bytes instead.

Recommended Action
Check client; this message can result from a malformed or corrupted packet.

```
rad_request: child Number not found
```

Explanation
Child process ID *Number* was not found.

```
rad_request: dropped duplicate ID Number
```

Explanation
RADIUS dropped an authentication request with ID *Number* because it had responded to an earlier request with this ID within the last five seconds. A NAS sends duplicate requests if it does not receive a response within three seconds.

Recommended Action
Do the following:

- Identify the first occurrence of the ID and see why it was rejected.
- Make sure that the secret in the **clients** file for the NAS server and the RADIUS secret on the NAS server match exactly.
- Make sure that the RADIUS server is able to respond within three seconds.

```
rad_request: error: mismatched IP addresses in request
Ipaddress != Ipaddress2 for ID Number Number2
```

Explanation
RADIUS received a request from *Ipaddress2* in response to an access-challenge sent to *Ipaddress,* but the addresses do not match.

```
rad_request: error: msgget for key Hexvalue for id Number
returned error Number
```

Explanation
The **msgget** function for the authentication key with a hexadecimal value of *Hexvalue* for packet ID *Number* failed and returned error message *Number*.

```
rad_request: error: msgsnd for key Hexvalue for id Number
returned error Number
```

Explanation
The **msgsend** function for the authentication key with a hexadecimal value of *Hexvalue* for packet ID *Number* failed and returned error message *Number*.

```
unix_group: getgrnam(Group) for "Username" failed
```

Explanation
RADIUS failed to get the group name *Group* from UNIX for user *Username*.

```
unix_group: getpwnam for "Username" failed
```

Explanation
RADIUS failed to get the password name from UNIX for user *Username*.

Clients

The following error messages are related to RADIUS clients.

```
child_authenticate: msgctl for msgid Number returned error:
Errormessage
```

Explanation
During the authentication process, the **msgctl** function for message ID *Number* returned an error message.

```
child_authenticate: msgget for key Hexvalue for id Number
returned error: Errormessage
```

Explanation
During the authentication process, the **msgget** function for the authentication key with a hexadecimal value of *Hexvalue* for packet ID *Number* failed and returned an error message.

```
child_authenticate: msgrcv for msgid Number returned error:
Errormessage
```

Explanation
During the authentication process, the **msgrcv** function for message ID *Number* returned an error message.

```
client Ipaddress not found in client cache
```

Explanation
The IP address *Ipaddress* for a client NAS was not found in the client cache that is generated from the **clients** file.

Recommended Action
Verify that **clients** file contains this client's IP address.

```
client cache entry for Client could not be parsed
```

Explanation
A syntax error occurred in the **clients** file for the client *Client*.

```
could not cache client datum for host Hostname
```

Explanation
RADIUS could not resolve *Hostname* found in the **clients** file into an IP address, or there are multiple entries in the **clients** file for the same client.

Recommended Action
Remove duplicate hosts from the **clients** file.

```
Error: clients file Filename not found
```

Explanation
RADIUS could not find the clients file *Filename*, which is read into memory and cached whenever it changes.

```
Error: could not create temporary client cache file Filename
```

Explanation
RADIUS could not create a temporary client cache file *Filename*.

Recommended Action
Verify that **radiusd** has write permission to **/etc/raddb** (or the directory specified with the **-d** option) and that the hard disk has not run out of available storage space.

```
Error: could not read clients file Filename
```

Explanation
RADIUS cannot open the **clients** file *Filename* for reading.

Recommended Action
Check the permissions on the **clients** file.

Dictionary

The following error messages are related to the RADIUS dictionary.

```
attribute has non-numeric value on line Number of dictionary
Filename
```

Explanation
When parsing the dictionary file *Filename*, RADIUS found an attribute that did not have an associated number on line *Number* of the dictionary.

Recommended Action
Correct the attribute in the dictionary.

```
attribute has unknown type on line Number of dictionary
Filename
```

Explanation
When parsing the dictionary file *Filename*, RADIUS found an unrecognizable attribute line *Number* of the dictionary.

Recommended Action
Correct the attribute in the dictionary.

```
attribute name too long on line Number of dictionary Filename
```

Explanation
When parsing the dictionary file *Filename*, RADIUS found an attribute name on line *Number* of the dictionary that was more that 31 characters long.

Recommended Action
Correct the attribute name in the dictionary.

```
could not read dictionary file Filename
```

Explanation
RADIUS could not open the dictionary file *Filename* for reading.

Recommended Action
Check permissions for the dictionary file.

```
invalid attribute on line Number of dictionary file Filename
```

Explanation
When parsing the dictionary file *Filename*, RADIUS found an invalid attribute on line *Number* of the dictionary.

Recommended Action
Check for syntax errors in the dictionary file. Download the latest dictionary file from **ftp://ftp.livingston.com/pub/le/radius/dictionary**.

```
Invalid value entry on line Number of dictionary Filename
```

Explanation
When parsing the dictionary file *Filename*, RADIUS found an invalid value for an attribute on line *Number* of the dictionary.

Recommended Action
Check for syntax errors in the dictionary file. Download the latest dictionary file from **ftp://ftp.livingston.com/pub/le/radius/dictionary**.

```
ran out of memory after reading line Number of dictionary
Filename
```

Explanation
RADIUS ran out of memory after reading line *Number* of the dictionary file *Filename*.

Recommended Action
Either exit any non-RADIUS processes running on the RADIUS server or upgrade server memory.

```
value has non-numeric value on line Number of dictionary
Filename
```

Explanation
When parsing the dictionary file *Filename*, RADIUS found a nonnumeric value on line *Number* of the dictionary.

```
value name too long on line Number of dictionary Filename
```

Explanation
When parsing the dictionary file *Filename*, RADIUS found a value that was more that 31 characters long on line *Number* of the dictionary.

Menu

The following error messages are related to RADIUS menus.

```
parse error for menu Filename
```

Explanation
RADIUS had trouble analyzing the data found in the menu file *Filename*.

Miscellaneous

The following are miscellaneous error messages.

```
exit on signal Number
```

Explanation
RADIUS quit because a fatal error occurred on signal number *Number.*

```
sending SIGHUP signal to unresponsive child process Number
```

Explanation
RADIUS terminated the child process ID *Number* because the process had not exited.

Recommended Action
Run **radiusd -s** to force RADIUS to run in single-process mode.

```
setexp: system error: out of memory
```

Explanation
The operating system hosting the RADIUS server does not have enough memory for RADIUS to run.

Recommended Action
Either exit any non-RADIUS processes running on the RADIUS server or upgrade server memory.

```
system error: could not fork at startup
```

Explanation
RADIUS is unable to fork a process during startup.

Recommended Action
Do one of the following:

- Determine why the operating system will not let RADIUS fork.
- Use **radiusd -s** to force RADIUS to run in single-process mode.

```
unknown request type Number from NAS ignored
```

Explanation
RADIUS ignored a request from server *NAS* because it could not identify the request type *Number*.

Recommended Action
Check the client.

SecurID

The following error messages are related to SecurID.

```
securid: cannot initialize connection to SecurID server
```

Explanation
RADIUS could not connect to the SecurID server.

Recommended Action
Do the following:

- Verify that SecurID server is functional by testing it with ClientID.
- Verify that you can ping the host running the SecurID server from the host running the RADIUS server.

```
securid: error reading sdconf.rec
```

Explanation
The SecurID configuration file could not be opened for reading

```
securid: SecurID server returned unknown code Number for user
Username
```

Explanation
The SecurID server returned an unknown code *Number* for user *Username*.

Recommended Action
Use the SecurID documentation to identify the unknown code.

```
securid: unexpected STATE="State"
```

Explanation
The State attribute sent in the access-request does not match the one sent in the access-challenge. Most likely the client is doing something wrong.

Users

The following error messages are related to RADIUS users.

```
user_find: unable to parse check-items for user Username
```

Explanation
RADIUS found a syntax error in the first line of the user profile in the **users** file for either user *Username* or the user who attempted access immediately before *Username*.

Recommended Action
Do the following in the user profile for *Username* and the previous user:

- Verify spelling and capitalization in the first line. Attribute values and check items are case-sensitive.
- Verify that commas rather than periods separate items in the first line.
- Verify that each user profile is separated by a blank line.
- Verify that the number of characters in the first line does not exceed 255.

```
user_find: unable to parse check-items in dbm entry for user
Username
```

Explanation
RADIUS found a syntax error in the first line of the user profile for user *Username* in the DBM database generated from the **users** file.

```
user_find: unable to parse reply-items in dbm entry for user
Username
```

Explanation
RADIUS found a syntax error in the reply items of the user profile for user *Username* in the DBM database generated from the **users** file.

```
user_find: unable to parse reply-items for user Username
```

Explanation
RADIUS found a syntax error in the reply items of the user profile in the **users** file for user *Username*.

Recommended Action
Do the following in the reply items in the user profile for *Username*:

- Verify spelling and capitalization. Attribute values and reply item names are case-sensitive.
- Verify that each reply item line contains only one reply item.
- Verify that commas rather than periods separate items in the first line.
- Verify that each reply item line—except the last—ends in a comma.

```
user_find: user record for user Username is too big, Number
exceeds Max
```

Explanation
The user profile in the **users** file for user *Username* is *Number* characters in size and exceeds the maximum number of characters *Max* allowed for the profile.

```
user_find: zero length username rejected
```

Explanation
RADIUS rejected a username with no characters.

```
user_open: could not read user dbm file Filename
```

Explanation
RADIUS could not open the DBM users database *Filename* for reading.

```
user_open: could not read user file Filename
```

Explanation
RADIUS could not open the **users** file *Filename* for reading.

```
userparse: system error: out of memory
```

Explanation
RADIUS ran out of memory while parsing the user profile.

RADIUS Options C

You issue the **radiusd** command with options to perform various actions in RADIUS for UNIX. Table 3-1 describes the actions and commands.

Table 3-1 RADIUS Actions and UNIX Commands

RADIUS Action	**UNIX Command**
To specify an alternate directory for RADIUS accounting.	**radiusd -a** *Directory* The default directory is **/usr/adm/radacct**.
To use the DBM version of the users file. See "Configuring Database Caching of User Profiles" on page 4-40. This option is highly recommended.	**radiusd -b**
To specify an alternate directory for RADIUS configuration files.	**radius -d** *Directory* The default directory is **/etc/raddb**.
To specify a password file other than **/etc/passwd**.	**radiusd -f** *Filepath*
To instruct the RADIUS server to bind to the specific address *Ipaddress* to listen for requests rather than binding to any address. This option is useful for multihomed servers.	**radiusd -i** *Ipaddress*
To specify a RADIUS logfile to use instead of **syslog**.	**radiusd -l** *Filepath*
To enable the RADIUS server to accept accounting packets from RADIUS clients that do not sign packets as required by RFC 2139. With this option, unsigned accounting records are logged and flagged with **Request-Authenticator = None**.	**radiusd -o**

Table 3-1 RADIUS Actions and UNIX Commands *(Continued)*

RADIUS Action	**UNIX Command**
To override the default UDP ports—or nondefault ports specified in the **/etc/services** file—used by the RADIUS authentication and accounting servers.	**radiusd -p** *Portnumber* For backwards compatibility, the default UDP ports are 1645 for authentication, 1646 for accounting, 1650 and 1651 for proxy. Port 1812 is reserved for RADIUS authentication. Port 1813 is reserved for RADIUS accounting. For example, if you specify **radiusd -p 1812**, the following results: • The authentication server uses port 1812 • The accounting server uses port 1813 • Proxy requests and responses are handled on ports 1817 and 1818.
To run RADIUS in single-threaded mode without spawning a child process to handle each authentication request.	**radiusd -s**
To display the version of RADIUS without starting the **radiusd** daemon.	**radiusd -v**
To enable debug mode.	**radiusd -x**
To send debug output to **syslog**.	**radiusd -x -l syslog**.

RADIUS Dictionary D

This appendix lists the RADIUS dictionary, version 1.7. Always use the latest RADIUS dictionary available at **ftp://ftp.livingston.com/pub/le/radius/dictionary**.

```
#-------------------------------------------------------------------------------
-------
#
# @(#)dictionary1. 7 6/1/98 Copyright 1991-1998 Lucent Technologies, Inc
#
#-------------------------------------------------------------------------------
-------
#
#       This file contains dictionary translations for parsing
#       requests and generating responses. All transactions are
#       composed of Attribute/Value Pairs. The value of each attribute
#       is specified as one of 4 data types. Valid data types are:
#
#       string - 0-253 octets
#       ipaddr - 4 octets in network byte order
#       integer - 32 bit value in big endian order (high byte first)
#       date - 32 bit value in big endian order - seconds since
#                                       00:00:00 GMT, Jan. 1,  1970
#
#       Enumerated values are stored in the user file with dictionary
#       VALUE translations for easy administration.
#
#       Example:
#
#       ATTRIBUTE            VALUE
#       -------------------  ---------
#       Framed-Protocol  =   PPP
#       7                =   1   (integer encoding)
#


#
# Obsolete names for backwards compatibility with older users files
# If you want RADIUS accounting logs to use these obsolete names
# instead of the current ones, move this section to the end of the
```

```
# dictionary file and kill and restart radiusd
# If you don't have a RADIUS 1.16 users file that you're still using,
# you can delete or ignore this section.
#
ATTRIBUTE          Client-Id             4                     ipaddr
ATTRIBUTE          Client-Port-Id        5                     integer
ATTRIBUTE          User-Service-Type     6                     integer
ATTRIBUTE          Framed-Address        8                     ipaddr
ATTRIBUTE          Framed-Netmask        9                     ipaddr
ATTRIBUTE          Framed-Filter-Id      11                    string
ATTRIBUTE          Login-Host            14                    ipaddr
ATTRIBUTE          Login-Port            16                    integer
ATTRIBUTE          Old-Password          17                    string
ATTRIBUTE          Port-Message          18                    string
ATTRIBUTE          Dialback-No           19                    string
ATTRIBUTE          Dialback-Name         20                    string
ATTRIBUTE          Challenge-State       24                    string
VALUE              Service-Type          Dialback-Login-User   3
VALUE              Service-Type          Dialback-Framed-User  4
VALUE              Service-Type          Shell-User            6
VALUE              Framed-Compression    Van-Jacobsen-TCP-IP   1
VALUE              Auth-Type             Unix                  1
#
# END of obsolete names for backwards compatibility
#

#
# Vendor-Specific attributes use the SMI Network Management Private
# Enterprise Code from the "Assigned Numbers" RFC
#
VENDOR             Livingston            307

#
# Livingston Vendor-Specific Attributes (requires ComOS 3.8 and RADIUS 2.1)
#
ATTRIBUTE          LE-Terminate-Detail   2          string     Livingston
ATTRIBUTE          LE-Advice-of-Charge   3          string     Livingston

#
# Current names for attributes
#
ATTRIBUTE          User-Name             1                     string
```

```
ATTRIBUTE       Password              2               string
ATTRIBUTE       CHAP-Password         3               string
ATTRIBUTE       NAS-IP-Address        4               ipaddr
ATTRIBUTE       NAS-Port              5               integer
ATTRIBUTE       Service-Type          6               integer
ATTRIBUTE       Framed-Protocol       7               integer
ATTRIBUTE       Framed-IP-Address     8               ipaddr
ATTRIBUTE       Framed-IP-Netmask     9               ipaddr
ATTRIBUTE       Framed-Routing        10              integer
ATTRIBUTE       Filter-Id             11              string
ATTRIBUTE       Framed-MTU            12              integer
ATTRIBUTE       Framed-Compression    13              integer
ATTRIBUTE       Login-IP-Host         14              ipaddr
ATTRIBUTE       Login-Service         15              integer
ATTRIBUTE       Login-TCP-Port        16              integer
ATTRIBUTE       Reply-Message         18              string
ATTRIBUTE       Callback-Number       19              string
ATTRIBUTE       Callback-Id           20              string
ATTRIBUTE       Framed-Route          22              string
ATTRIBUTE       Framed-IPX-Network    23              ipaddr
ATTRIBUTE       State                 24              string
ATTRIBUTE       Class                 25              string
ATTRIBUTE       Vendor-Specific       26              string
ATTRIBUTE       Session-Timeout       27              integer
ATTRIBUTE       Idle-Timeout          28              integer
ATTRIBUTE       Termination-Action    29              integer
ATTRIBUTE       Called-Station-Id     30              string
ATTRIBUTE       Calling-Station-Id    31              string
ATTRIBUTE       NAS-Identifier        32              string
ATTRIBUTE       Proxy-State           33              string
ATTRIBUTE       Acct-Status-Type      40              integer
ATTRIBUTE       Acct-Delay-Time       41              integer
ATTRIBUTE       Acct-Input-Octets     42              integer
ATTRIBUTE       Acct-Output-Octets    43              integer
ATTRIBUTE       Acct-Session-Id       44              string
ATTRIBUTE       Acct-Authentic        45              integer
ATTRIBUTE       Acct-Session-Time     46              integer
ATTRIBUTE       Acct-Terminate-Cause  49              integer
ATTRIBUTE       NAS-Port-Type         61              integer
ATTRIBUTE       Port-Limit            62              integer
ATTRIBUTE       Tunnel-Type           64              integer
ATTRIBUTE       Tunnel-Medium-Type    65              integer
```

```
ATTRIBUTE          Tunnel-Server-Endpoint 67                    string
ATTRIBUTE          Connect-Info           77                    string

#
# Non-Protocol Attributes
# These attributes are used internally by the server
#
ATTRIBUTE          Expiration              21                   date
ATTRIBUTE          Auth-Type              1000                  integer
ATTRIBUTE          Menu                   1001                  string
ATTRIBUTE          Termination-Menu       1002                  string
ATTRIBUTE          Prefix                 1003                  string
ATTRIBUTE          Suffix                 1004                  string
ATTRIBUTE          Group                  1005                  string
ATTRIBUTE          Crypt-Password         1006                  string
ATTRIBUTE          Connect-Rate           1007                  integer

#
# Integer Translations
#

# User Types

VALUE        Service-Type               Login-User            1
VALUE        Service-Type               Framed-User           2
VALUE        Service-Type               Callback-Login-User   3
VALUE        Service-Type               Callback-Framed-User  4
VALUE        Service-Type               Outbound-User         5
VALUE        Service-Type               Administrative-User   6
VALUE        Service-Type               NAS-Prompt-User       7
VALUE        Service-Type               Call-Check            10
VALUE        Service-Type               Call-Check-User       129

# Framed Protocols

VALUE        Framed-Protocol            PPP                   1
VALUE        Framed-Protocol            SLIP                  2

# Framed Routing Values

VALUE        Framed-Routing             None                  0
VALUE        Framed-Routing             Broadcast             1
```

```
VALUE        Framed-Routing              Listen                2
VALUE        Framed-Routing              Broadcast-Listen      3

# Framed Compression Types

VALUE        Framed-Compression          None                  0
VALUE        Framed-Compression          Van-Jacobson-TCP-IP   1

# Login Services

VALUE        Login-Service               Telnet                0
VALUE        Login-Service               Rlogin                1
VALUE        Login-Service               TCP-Clear             2
VALUE        Login-Service               PortMaster            3

# Status Types

VALUE        Acct-Status-Type            Start                 1
VALUE        Acct-Status-Type            Stop                  2

# Authentication Types

VALUE        Acct-Authentic              RADIUS                1
VALUE        Acct-Authentic              Local                 2

# Termination Options

VALUE        Termination-Action          Default               0
VALUE        Termination-Action          RADIUS-Request        1

# NAS Port Types, available in ComOS 3.3.1 and later

VALUE        NAS-Port-Type               Async                 0
VALUE        NAS-Port-Type               Sync                  1
VALUE        NAS-Port-Type               ISDN                  2
VALUE        NAS-Port-Type               ISDN-V120             3
VALUE        NAS-Port-Type               ISDN-V110             4

# Acct Terminate Causes, available in ComOS 3.3.2 and later

VALUE        Acct-Terminate-Cause        User-Request          1
VALUE        Acct-Terminate-Cause        Lost-Carrier          2
```

```
VALUE        Acct-Terminate-Cause        Lost-Service           3
VALUE        Acct-Terminate-Cause        Idle-Timeout           4
VALUE        Acct-Terminate-Cause        Session-Timeout        5
VALUE        Acct-Terminate-Cause        Admin-Reset            6
VALUE        Acct-Terminate-Cause        Admin-Reboot           7
VALUE        Acct-Terminate-Cause        Port-Error             8
VALUE        Acct-Terminate-Cause        NAS-Error              9
VALUE        Acct-Terminate-Cause        NAS-Request            10
VALUE        Acct-Terminate-Cause        NAS-Reboot             11
VALUE        Acct-Terminate-Cause        Port-Unneeded          12
VALUE        Acct-Terminate-Cause        Port-Preempted         13
VALUE        Acct-Terminate-Cause        Port-Suspended         14
VALUE        Acct-Terminate-Cause        Service-Unavailable    15
VALUE        Acct-Terminate-Cause        Callback               16
VALUE        Acct-Terminate-Cause        User-Error             17
VALUE        Acct-Terminate-Cause        Host-Request           18

VALUE         Tunnel-Type                L2TP                   3

VALUE        Tunnel-Medium-Type          PPP                    1

#
# Non-Protocol Integer Translations
#

VALUE        Auth-Type                   Local                  0
VALUE        Auth-Type                   System                 1
VALUE        Auth-Type                   SecurID                2
VALUE        Auth-Type                   Crypt-Local            3
VALUE        Auth-Type                   Reject                 4
VALUE        Auth-Type                   ActivCard              5

#
# Configuration Values
# comment out these two lines to turn account expiration off
#

VALUE        Server-Config               Password-Expiration    30
VALUE        Server-Config               Password-Warning       5
```

Contact Information for Third-Party Products E

This appendix provides contact information for the makers of the following third-party products that might be used with RADIUS for UNIX:

- ActivCard
- iPass
- SecurID

Lucent Remote Access recommends that you visit the corporate website for the product you are interested in to find the most current and complete contact information.

ActivCard

ActivCard products are manufactured by ActivCard, Inc.

Website

http://www.activcard.com

Voice

+33-0-1-42-04-84-00 in Europe

+65-775-3844 in Singapore

+1-510-574-0100 in the United States

Fax

+33-0-1-42-04-84-84 in Europe

+65-775-3044 in Singapore

+1-510-574-0101 in the United States

Email

In Asia-Pacific, contact **techsup@activcard.fr**.

In Europe, contact **techsup@activcard.fr**.

In the United States, contact **techsup@activcard.com**.

iPass

iPass services are provided by iPass, Inc.

Website

http://www.ipass.com

Voice

+65-334-8783 in Singapore

+1-650-237-7300 in the United States

Fax

+65-336-6933 in Singapore

+1-650-237-7321 in the United States

Email

In Asia Pacific, contact **AP@ipass.com**.

In Europe, contact **EU@ipass.com**.

In Latin America, contact **LA@ipass.com**.

In North America, contact **NA@ipass.com**.

In the rest of the world, contact **RW@ipass.com**.

SecurID

SecurID products are manufactured by Security Dynamics Technologies, Inc.

Website

http://www.securid.com

Voice

+44-118-936-2699 in Europe

+1-781-687-7700 in the United States

Tollfree numbers

Belgium 0800-7-5216

Denmark +800-732-8743-1

Finland +800-732-8743-1

France +800-732-8743-1

Germany +800-732-8743-1

Holland +800-732-8743-1

Italy 1677-90847

Norway +800-732-8743-1

Spain 900-9708918

Sweden +800-732-8743-1

Switzerland +800-732-8743-1

United Kingdom 0800-072-5095

United States 800-995-5095

Fax

+44-118-979-5833 in Europe

+1-781-687-7016 in the United States

Email

Contact **info@securid.com**.

Index

Symbols

A

B

C

D

E

F

G

H

I

L

M

N

O

P

R

S

T

U

V

W