CRYPTOCard Authentication

Using PAM for Linux and Solaris

Quick Start Guide

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Change History

Issue Date	Changes
2003.02.25	Initial document release Linux and Solaris
2003.04.28	Extends PAM authenticated logon

1. PAM for Linux and Solaris

This section deals primarily with the installation of the CRYPTOCard PAM modules. For more in-depth information on PAM configuration and a description of other modules please visit http://www.us.kernel.org/pub/linux/libs/pam/

The Linux PAM modules are located in:	**/lib/security**
The Linux application-specific configuration files are in:	**/etc/pam.d**
The Solaris PAM modules are located in:	**/usr/lib/security**
The Solaris application-specific configuration files are in:	**/etc/pam.conf**

The Linux/Solaris username and the CRYPTOCard Token/username must be identical.

Even though CRYPTOCard authentication is being used, the CRYPTOCard user must have an account on the Linux/Solaris system in order for the users to connect. When a user logs on to a Unix system, the system reads the passwd file to find the user's group, default shell and home directory. If this information does not exist, the user will fail to authenticate**.** This condition does not apply if NIS/NIS+/NFS or LDAP is being used.

An application must be PAM-aware in order to use a PAM module. The most common PAM configuration files are login, ftp, and sshd. Please consult the application's documentation to determine if it is PAM-aware.

1.1 Compiling the PAM module

Login as root. Extract the package to a temporary location then enter the CRYPTOCard PAM module source directory. In order to compile the module for your system type:

```
make
```

On Linux copy pam_radius_auth.so to /lib/security as pam_radius_auth.so:

```
cp pam_radius_auth.so  /lib/security/pam_radius_auth.so
```

On Solaris copy pam_radius_auth.so to /usr/lib/security as pam_radius_auth.so.1

```
cp pam_radius_auth.so  /usr/lib/security/pam_radius_auth.so.1
```

(If you receive any errors while compiling, please see the **Troubleshooting** Section)

1.2 Server Configuration File (RADIUS)

When the CRYPTOCard PAM module is used it searches for a file called **server** in the **/etc/raddb** directory. This file contains the location of the RADIUS servers, the shared secret, and the order in which each RADIUS server will be checked. A generic server configuration file called **pam_radius_auth.conf** can be found in the CRYPTOCard PAM module source directory.

This file must be renamed and placed into the **/etc/raddb** directory.

Verify that an **/etc/raddb** directory exists. If it does not type:

```
mkdir /etc/raddb
```

Now, copy the generic server configuration file over to the **/etc/raddb** directory by going into the CRYPTOCard PAM module source directory and typing:

```
mv pam_radius_auth.conf  /etc/raddb/server
```

Below is an example of the default server configuration file. Blank lines or lines beginning with # are considered as comments or simply ignored.

```
# pam_radius_auth configuration file.  Save as: /etc/raddb/server
# server[:port]       shared_secret         timeout (s)

127.0.0.1:1812        testing123            1
192.168.21.4:1812     testing123            3

# having localhost in your radius configuration is a Good Thing
# See the INSTALL file for pam.conf hints
```

The columns are as follows:

Server	[:port]	shared_secret	timeout (default 3 seconds)

The timeout field controls the time the module waits before deciding if the server has failed to respond. This setting is optional.

If multiple RADIUS Server lines exist, they are tried in order. If the server fails to respond, it is skipped and the next server is used.

A RADIUS port **must** be specified in the server file. Check your /etc/services file to determine the RADIUS port you are using. The netstat command can also be used to verify the RADIUS server port. Type the following to check the port:

Ex. **`netstat –an | grep 1812`** or **`netstat –an | grep 1645`**

Note: Official RADIUS port numbers 1812 or 1645.

1.3 Securing the RADIUS Server Configuration

Once the server file is completed, it MUST be secured in order to prevent tampering. The following procedure will secure the server file.

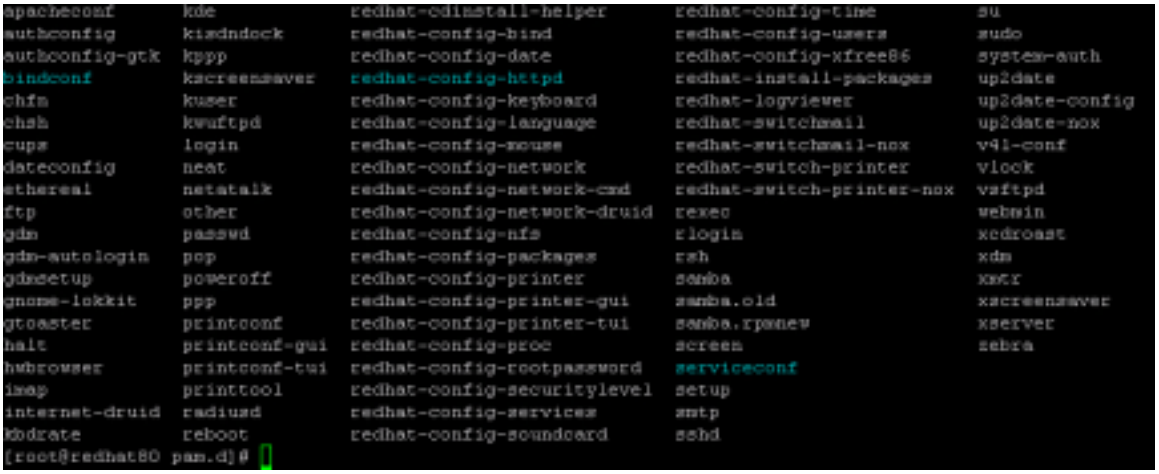
```
chown root /etc/raddb/

chmod go -rwx /etc/raddb

chmod go -rwx /etc/raddb/server
```

1.4 Configuring application-specific configuration files

The last step in setting up the CRYPTOCard PAM module is to configure the PAM-aware application you would like to implement. All the applications listed in the **/etc/pam.d** directory or the pam.conf file are PAM-aware. CRYPTOCard only offers support for the PAM aware application listed in the Linux and Solaris PAM Configuration examples section listed below. In theory, the CRYPTOCard module will work for most applications in the **pam.d** directory.



(To see a complete listing of PAM module types, control flags and arguments please see the **Troubleshooting** section).

1.5 CRYPTOCard only and Mixed Mode Authentication

Authentication can be setup in two ways: CRYPTOCard only and Mixed mode authentication. Each method can be applied to most PAM enabled applications.

1.5.1 CRYPTOCard Only Authentication

CRYPTOCard only authentication will force all users to authenticate to a configured daemon with a CRYPTOCard token. A root CRYPTOCard token should **never** be created. If root access is required, logon with a CRYPTOCard token then use the su command to login as root.

By default, no easyRADIUS configuration changes are needed to enforce CRYPTOCard only authentication.

Here is an example of a CRYPTOCard only authentication PAM configuration file. As you can see, the pam_radius_auth.so module's control-flag is set to required and the reference to the Unix authentication PAM module has been removed.

On Linux		
Module Type	**Control Flag**	**Module Path & arguments**
#%PAM-1.0		
auth	**Required**	**/lib/security/pam_radius_auth.so**
auth	Required	/lib/security/pam_nologin.so
account	Required	/lib/security/pam_stack.so service=system-auth
account	Required	/lib/security/pam_permit.so
password	Required	/lib/security/pam_stack.so service=system-auth
session	Required	/lib/security/pam_stack.so service=system-auth
session	Optional	/lib/security/pam_console.so

On Solaris			
Service	**Module Type**	**Control Flag**	**Module Path & Arguments**
login	**auth**	**required**	**/usr/lib/security/pam_radius_auth.so**
login	account	requisite	/usr/lib/security/pam_roles.so.1
login	account	required	/usr/lib/security/pam_projects.so.1
login	account	required	/usr/lib/security/pam_unix.so.1

For more in-depth PAM examples refer to the Linux – Pam Configuration Examples and/or Solaris - Configuring the pam.conf file section.

1.5.2 Mixed Mode Authentication

Mixed mode authentication is the most flexible method as it allows the system administrator to gradually migrate static password users to CRYPTOCard token users. Essentially mixed mode will allow Unix users to authenticate via the existing system authentication method until their CRYPTOCard token is created and it is placed within a CRYPTOCard group.

This method can only be used with NIS/NIS+/NFS or LDAP.

To enabled mixed mode authentication remove all the DEFAULT entries in the /etc/cryptocard/users file then add the following:

```
DEFAULT Group = "CRYPTOCard", Auth-Type = CRYPTOCard DEFAULT Auth-Type
= Pam
```

The default group entry (“CRYPTOCard”) must match a group within CRYPTOAdmin. An example of the modified users file follows:

```
#
#  Default 'test' user, for poking easyRADIUS from the local machine.
#
#  WARNING: You MUST comment out this section once easyRADIUS is running,
#  in order to prevent any security breaches with the test user!
#
test    Password = "password", NAS-IP-Address = 127.0.0.1
        Reply-Message = "Test succeeded: easyRADIUS is running.",
        Reply-Message = "Please delete the test user to prevent unauthorized logins"

#
# Setup all accounts to be checked against the CRYPTOCard database
# (Unless a password was already given earlier in this file).
#

DEFAULT Group = "CRYPTOCard", Auth-Type = CRYPTOCard

DEFAULT Auth-Type = Pam

# Insert users to be authenticated via CRYPTOCard tokens below this point


# On no match, the user is denied access.

# End of file
```

A **radiusd** PAM application file for easyRADIUS must be created in the **/etc/pam.d** directory. Type the following to use the login file as a template (this should transfer all the appropriate module configuration settings for NIS/NIS+/NFS or LDAP):

```
cp /etc/pam.d/login /etc/pam.d/radiusd
```

Note: The radiusd PAM file must not include a CRYPTOCard PAM module entry.

On Solaris, the pam.conf file must include a radiusd section. The following entries must be placed in the pam.conf file:

radiusd	auth	required	/usr/lib/security/pam_unix.so.1
radiusd	account	requisite	/usr/lib/security/pam_roles.so.1
radiusd	account	required	/usr/lib/security/pam_projects.so.1
radiusd	account	required	/usr/lib/security/pam_unix.so.1
radiusd	password	required	/usr/lib/security/pam_unix.so.1
radiusd	session	required	/usr/lib/security/pam_unix.so.1

Replace the radiusd **auth** sections /usr/lib/security/pam_unix.so.1 entry with the appropriate NIS/NIS+/NFS or LDAP module.

1.6 Solaris -Configuring the pam.conf file

The following examples are for several PAM aware applications. PAM aware applications that require **root** authentication should not use CRYPTOCard authentication. CRYPTOCard authentication should only be used for End Users or administrators with root privileges. If mixed mode authentication is required, refer to the CRYPTOCard only and Mixed Mode Authentication section.

The default **pam.conf** file is extremely basic. Most daemons use the **login** or **other** section in the **pam.conf** file for authentication and accounting. The default pam.conf file (Solaris 8) looks like this:

Pam.conf			
Authentication Management			
login	auth	required	/usr/lib/security/pam_unix.so.1
telnet	auth	required	/usr/lib/security/pam_unix.so.1
rlogin	auth	sufficient	/usr/lib/security/pam_rhosts_auth.so.1
rlogin	auth	required	/usr/lib/security/pam_unix.so.1
dtlogin	auth	required	/usr/lib/security/pam_unix.so.1
rsh	auth	required	/usr/lib/security/pam_rhosts_auth.so.1
other	auth	sufficient	/usr/lib/security/pam_unix.so.1
dtsession	auth	required	/usr/lib/security/pam_unix.so.1

Account Management			
login	account	requisite	/usr/lib/security/pam_roles.so.1
login	account	required	/usr/lib/security/pam_projects.so.1
login	account	required	/usr/lib/security/pam_unix.so.1
dtlogin	account	requisite	/usr/lib/security/pam_roles.so.1
dtlogin	account	required	/usr/lib/security/pam_projects.so.1
dtlogin	account	required	/usr/lib/security/pam_unix.so.1
other	account	requisite	/usr/lib/security/pam_roles.so.1
other	account	required	/usr/lib/security/pam_projects.so.1
other	account	required	/usr/lib/security/pam_unix.so.1

Session Management			
other	session	required	/usr/lib/security/pam_unix.so.1

Password Management			
other	password	required	/usr/lib/security/pam_unix.so.1

As you can see, daemon specific entries do not exist. Daemon specific authentication, accounting, session, and password management entries must be placed within the pam.conf file in order to enable CRYPTOCard authentication.

Note: The CRYPTOCard PAM module must never be placed in the authentication management section of the **other** entry in the pam.conf file.

1.6.1 FTP

The CRYPTOCard PAM module should only be used to enforce strong user authentication for real users. Using CRYPTOCard authentication for anonymous FTP access is not supported, as it would defeat the purpose of anonymous access.

ftp	auth	required	/usr/lib/security/pam_radius_auth.so.1
ftp	account	required	/usr/lib/security/pam_unix.so.1
ftp	password	required	/usr/lib/security/pam_unix.so.1
ftp	session	required	/usr/lib/security/pam_unix.so.1

Note: The FTP protocol does not support challenge response.

1.6.2 SSHD (OpenSSH)

For security reasons and compatibility with the CRYPTOCard PAM module you must have at least SSH2 version 2.4 for F-Secure or SSH2 version 2.9 for OpenSSH.

sshd	auth	required	/usr/lib/security/pam_radius_auth.so.1
sshd	account	required	/usr/lib/security/pam_unix.so.1
sshd	password	required	/usr/lib/security/pam_unix.so.1
sshd	session	required	/usr/lib/security/pam_unix.so.1

The SSH protocol supports challenge response. To enable challenge response, add the argument **skip_passwd** after the **pam_radius_auth.so** module entry.

sshd	auth	required	/usr/lib/security/pam_radius_auth.so.1 skip_passwd
sshd	account	required	/usr/lib/security/pam_unix.so.1
sshd	password	required	/usr/lib/security/pam_unix.so.1
sshd	session	required	/usr/lib/security/pam_unix.so.1

For challenge response the following changes must also be made to the sshd_config file:

```
PasswordAuthentication no
PermitEmptyPasswords no
ChallengeResponseAuthentication yes
PAMAuthenticationViaKbdInt yes
UsePrivilegeSeparation no
```

Note: UsePrivilegeSeparation was introduced to address a challenge response vulnerability in the SSHD daemon. Older versions of the OpenSSH sshd_config file will not include this setting.

1.6.3 SSHD2 (F-Secure)

sshd2	auth	required	/usr/lib/security/pam_radius_auth.so.1
sshd2	account	required	/usr/lib/security/pam_unix.so.1
sshd2	password	required	/usr/lib/security/pam_unix.so.1
sshd2	session	required	/usr/lib/security/pam_unix.so.1

The SSH protocol supports challenge response. To enable challenge response, add the argument **skip_passwd** after the **pam_radius_auth.so** module entry.

sshd2	auth	required	/usr/lib/security/pam_radius_auth.so.1 skip_passwd
sshd2	account	required	/usr/lib/security/pam_unix.so.1
sshd2	password	required	/usr/lib/security/pam_unix.so.1
sshd2	session	required	/usr/lib/security/pam_unix.so.1

For challenge response the following changes must also be made to the sshd2_config file:

```
PermitEmptyPasswords  no
AllowedAuthentications   pam-1@ssh.com,publickey,password
SshPAMClientPath      {Path to the ssh-pam-client file}
AllowedAuthentications     pam-1@ssh.com,publickey,password
```

1.6.4 Login / Telnet

The login entry affects local console login sessions while telnet affect remote console sessions. Replace the PAM application name with the appropriate entry (login or telnet)

login	auth	required	/usr/lib/security/pam_radius_auth.so.1
login	account	requisite	/usr/lib/security/pam_roles.so.1
login	account	requisite	/usr/lib/security/pam_projects.so.1
login	account	required	/usr/lib/security/pam_unix.so.1
login	password	required	/usr/lib/security/pam_unix.so.1
login	session	required	/usr/lib/security/pam_unix.so.1

Telnet and console login sessions support challenge response. To enable challenge response, add the argument **skip_passwd** to the **pam_radius_auth.so** entry.

login	auth	required	/usr/lib/security/pam_radius_auth.so.1 skip_passwd
login	account	requisite	/usr/lib/security/pam_roles.so.1
login	account	requisite	/usr/lib/security/pam_projects.so.1
login	account	required	/usr/lib/security/pam_unix.so.1
login	password	required	/usr/lib/security/pam_unix.so.1
login	session	required	/usr/lib/security/pam_unix.so.1

1.6.5 Dtlogin (Graphical Desktop Logon)

CRYPTOCard authentication can be enabled for users who logon to CDE, Open Windows or Gnome. In theory, any Desktop manager is supported, as they will all use the configuration settings from the dtlogin pam.conf entry. The following changes to dtlogin enable CRYPTOCard authentication.

dtlogin	auth	required	/usr/lib/security/pam_radius_auth.so.1
dtlogin	account	requisite	/usr/lib/security/ pam_roles.so.1
dtlogin	account	required	/usr/lib/security/ pam_projects.so.1
dtlogin	account	required	/usr/lib/security/ pam_unix.so.1

CRYPTOCard does not support the use of challenge response with dtlogin.

1.7 Linux & Solaris - PAM Configuration Examples

The following examples are for several PAM aware applications. PAM aware applications (su, halt, reboot etc…) that require **root** authentication should not use CRYPTOCard authentication. CRYPTOCard authentication should only be used for End Users or administrators with root privileges. If mixed mode authentication is required, refer to the CRYPTOCard only and Mixed Mode Authentication section. The examples below are based on the PAM configuration files found in RedHat 8.0

CRYPTOCard only supports the configuration examples outlined in this section.

1.7.1 Login / Telnet

The LOGIN PAM file affects telnet and local console login sessions. The following LOGIN PAM configuration file enables CRYPTOCard authentication.

#%PAM-1.0		
auth	required	/lib/security/pam_radius_auth.so
auth	required	/lib/security/pam_nologin.so
account	required	/lib/security/pam_stack.so service=system-auth
account	required	/lib/security/pam_permit.so
password	required	/lib/security/pam_stack.so service=system-auth
session	required	/lib/security/pam_stack.so service=system-auth
session	optional	/lib/security/pam_console.so

Telnet and console login sessions support challenge response. To enable challenge response, make the following configuration changes to the LOGIN PAM file.

#%PAM-1.0		
auth	required	/lib/security/pam_radius_auth.so skip_password
auth	required	/lib/security/pam_nologin.so
account	required	/lib/security/pam_stack.so service=system-auth
account	required	/lib/security/pam_permit.so
password	required	/lib/security/pam_stack.so service=system-auth
session	required	/lib/security/pam_stack.so service=system-auth
session	optional	/lib/security/pam_console.so

The following is an example of a Telnet session using challenge response.

```
Red Hat Linux release 8.0 (Psyche)
Kernel 2.4.18-14 on an i686
login: redhat8
Challenge: 70806383
Enter Response: 517-2311
Last login: Wed Apr  9 15:20:26 from 192.168.10.117
[redhat8@redhat80 redhat8]$
```

1.7.2 FTP / VSFTPD

The CRYPTOCard PAM module should only be used to enforce strong user authentication for real users. Using CRYPTOCard authentication for anonymous FTP access is not supported, as it would defeat the purpose of anonymous access. The following FTP PAM configuration file enables CRYPTOCard authentication.

FTP		
#%PAM-1.0		
auth	required	**/lib/security/pam_listfile.so item=user sense=deny file=/etc/ftpusers onerr=succeed**
auth	required	**/lib/security/pam_radius_auth.so**
auth	required	**/lib/security/pam_shells.so**
account	required	**/lib/security/pam_stack.so service=system-auth**
session	required	**/lib/security/pam_stack.so service=system-auth**

VSFTPD		
#%PAM-1.0		
auth	required	/lib/security/pam_listfile.so item=user sense=deny file=/etc/vsftpd.ftpusers onerr=succeed
auth	required	/lib/security/pam_radius_auth.so
auth	required	/lib/security/pam_shells.so
account	required	/lib/security/pam_stack.so service=system-auth
session	required	/lib/security/pam_stack.so service=system-auth

Note: The FTP protocol does not support challenge response.

1.7.3 SSHD (OpenSSH)

For security reasons and compatibility with the CRYPTOCard PAM module you must have at least SSH2 version 2.4 for F-Secure or SSH2 version 2.9 for OpenSSH.

CRYPTOCard will only provide support for versions of OpenSSH/OpenSSL included with RedHat or any updates provided by RedHat.

#%PAM-1.0		
auth	required	/lib/security/pam_radius_auth.so
auth	required	/lib/security/pam_nologin.so
account	required	/lib/security/pam_stack.so service=system-auth
password	required	/lib/security/pam_stack.so service=system-auth
session	required	/lib/security/pam_stack.so service=system-auth
session	required	/lib/security/pam_limits.so
session	optional	/lib/security/pam_console.so

The SSH protocol supports challenge response. To enable challenge response, make the following configuration changes to the SSHD PAM configuration file.

#%PAM-1.0		
auth	required	/lib/security/pam_radius_auth.so skip_password
auth	required	/lib/security/pam_nologin.so
account	required	/lib/security/pam_stack.so service=system-auth
password	required	/lib/security/pam_stack.so service=system-auth
session	required	/lib/security/pam_stack.so service=system-auth
session	required	/lib/security/pam_limits.so
session	optional	/lib/security/pam_console.so

For challenge response the following changes must also be made to the sshd_config file:

PasswordAuthentication no

PermitEmptyPasswords no

ChallengeResponseAuthentication yes

PAMAuthenticationViaKbdInt yes

UsePrivilegeSeparation no

Note: UsePrivilegeSeparation was introduced to address a challenge response vulnerability in the SSHD daemon. Older versions of the OpenSSH sshd_config file will not include this setting.

1.7.4 KDE / GDM / XDM (Graphical Desktop Logon)

CRYPTOCard authentication can be enabled for users who logon to KDE or Gnome. In theory, any Desktop manager is supported, as they will most likely use XDM, GDM, or KDE as their logon manager. The following changes to either the XDM, GDM or KDE PAM configuration file enables CRYPTOCard authentication.

#%PAM-1.0		
auth	required	/lib/security/pam_radius_auth.so
auth	required	/lib/security/pam_nologin.so
account	required	/lib/security/pam_stack.so service=system-auth
password	required	/lib/security/pam_stack.so service=system-auth
session	required	/lib/security/pam_stack.so service=system-auth
session	optional	/lib/security/pam_console.so

CRYPTOCard does not support using challenge response with graphical logon.

Note: To globally enable a graphical logon on startup edit the /etc/ inittab. Change the "**id:3:initdefault:**" entry to "**id:5:initdefault:**".

1.7.5 XSCREENSAVER

If CRYPTOCard authentication is being enforce for KDE, XDM or GDM CRYPTOCard authentication for xscreensaver should also be enabled. The following configuration will enforce CRYPTOCard authentication.

#%PAM-1.0		
auth	required	/lib/security/pam_radius_auth.so

1.7.6 POP / POPS / IMAP / SMTP

The POP, POPS, IMAP and SMTP daemon can be configured to perform CRYPTOCard authentication each time a user performs a send and/or receive request. The following conditions must be taking into account before implementing CRYPTOCard authentication:

- The end user can no longer use the “Save Password” option in their email client.
- Every time the email client checks for new email, the end user will be prompted to enter a one-time password. If possible, increase the mail retrieval setting to 30 minutes or higher (POP/POPS/IMAP only).
- Every time the email client sends an email, the end user will be prompted to enter a one-time password (SMTP only).
- Challenge response is not supported.

The following changes to the POP/IMAP PAM configuration file will enable CRYPTOCard authentication.

#%PAM-1.0		
auth	required	/lib/security/pam_radius_auth.so
account	required	/lib/security/pam_stack.so service=system-auth

The following changes to the SMTP PAM configuration file will enable CRYPTOCard authentication.

#%PAM-1.0		
auth	required	/lib/security/pam_radius_auth.so
account	required	/lib/security/pam_stack.so service=system-auth

1.7.7 PPP

This section assumes you already have Linux setup as a dialup server. For information on how to setup a Linux dialup server, please read the PPP-HOWTO. Challenge response for PPP is not supported. In order to get PAM and PPPD up and running you must make the following changes to the PPP PAM configuration file.

#%PAM-1.0		
auth	required	/lib/security/pam_nologin.so
auth	required	/lib/security/pam_radius_auth.so
account	required	/lib/security/pam_stack.so service=system-auth
session	required	/lib/security/pam_stack.so service=system-auth

In the **/etc/ppp/options** file you must at least have

```
+pap
-chap
lock
asyncmap 0
crtscts
modem
debug
kdebug 7
login
```

Do not include the "auth" argument in the options file. In the **/etc/mgetty+sendmail/login.config** file make the following adjustments:

```
/AutoPPP/ -      a_ppp /usr/sbin/pppd file /etc/ppp/options
*     -     -     /bin/login @
#*    -     -     /usr/sbin/pppd @
```

2. Troubleshooting

2.1 Authentication problems

If you are experiencing continuous authentication failure try running the services from the console. Shutdown CRYPTOAdmin and easyRADIUS using:

On Linux:

```
/etc/rc.d/init.d/cadmind stop

/etc/rc.d/init.d/radiusd stop
```

Then restart using the debug option

```
/etc/rc.d/init.d/cadmind start debug

/etc/rc.d/init.d/radiusd start debug
```

On Solaris:

```
/etc/init.d/cadmind stop

/etc/init.d/radiusd stop
```

Then restart using the debug option

```
/etc/init.d/cadmind start debug

/etc/init.d/radiusd start debug
```

This will force all output to the console. You should be able to see in real-time all activity coming through the server. You may also want to check the log files (On Linux & Solaris: **/var/log)**. If you are not using easyRADIUS, check the log files of your Third Party RADIUS server.

2.2 Compiling the modules returns an error.

While compiling if you receive a make error, you will have to edit the Makefile to remove the GNU make directives 'ifeq', 'else', etc. You may want to consider getting a more recent version of GNUmake.

2.3 The RADIUS server does not even see the requests

Check the **/etc/raddb/server** file. Make sure that the ip address; port and secret are set up the same as the port and secret between CRYPTOAdmin and you RADIUS Server.

2.4 Accessing a locked out Linux system

If the system has been configured to use mixed mode authentication and the RADIUS servers become inaccessible the RedHat\Solaris server can only be accessed from single mode.

Enabling Single mode on a RedHat system.

RedHat can be configured to use one of two boot managers; **Lilo** and **Grub**.

Lilo

At the Lilo prompt, you can hit the **<Tab>** key to show the list of possible choices. If Lilo is not configured to be interactive, press and hold the **<Alt>** or **<Shift>** key before the "**Lilo**'' message appears. Type a name from the list followed by **single** or **–s**.

linux single or **linux –s**

Make the necessary modifications to the system.

Grub

If you have a GRUB password configured, type **p** and enter the password. Select the version of the kernel that you wish to boot and type **e** for edit. You will be presenting with a list of items in the configuration file for the title you just selected. Select the line that starts with **kernel** and type **e** to edit the line.

kernel /boot/vmlinuz-2.4.18-14 ro root=LABEL=/

Go to the end of the line and type **single** as a separate word. Press the Enter Key to exit edit mode.

kernel /boot/vmlinuz-2.4.18-14 ro root=LABEL=/ single

Back at the GRUB screen, type **b** to boot into single user mode.

Make the necessary modifications to the system.

2.5 PAM module types, control flags and arguments

(This information was gathered from the PAM Administrators Guide. It can be found online at http://www.kernel.org/pub/linux/libs/pam/Linux-PAM-html/pam.html or in the Solaris Man Pages)

A general configuration line has the following form:

module-type	control-flag	module-path	arguments
auth	required	/lib/security/pam_nologin.so	try_first_pass

Module-type: One of (currently) four types of module. The four types are as follows:

Auth: This module type provides two aspects of authenticating the user. Firstly, it establishes that the user is who they claim to be, by instructing the application to prompt the user for a password or other means of identification. Secondly, the module can grant group membership (independently of the /etc/groups file discussed above) or other privileges through its credential granting properties.

Account: This module performs non-authentication based account management. It is typically used to restrict/permit access to a service based on the time of day, currently available system resources (maximum number of users) or perhaps the location of the applicant user---`root' login only on the console.

Session: Primarily, this module is associated with doing things that need to be done for the user before/after they can be given service. Such things include the logging of information concerning the opening/closing of some data exchange with a user, mounting directories, etc.

Password: This last module type is required for updating the authentication token associated with the user. Typically, there is one module for each `challenge/response' based authentication (auth) module-type.

Control flags: The control-flag is used to indicate how the Linux-PAM library will react to the success or failure of the module it is associated with. Since modules can be stacked (modules of the same type execute in series, one after another), the control-flags determine the relative importance of each module.

Required: This indicates that the success of the module is required for the module-type facility to succeed. Failure of this module will not be apparent to the user until all of the remaining modules (of the same module-type) have been executed.

Requisite: Like required, however, in the case that such a module returns a failure, control is directly returned to the application. The return value is that associated with the first required or requisite module to fail. Note this flag can be used to protect against the possibility of a user getting the opportunity to enter a password over an unsafe medium. It is conceivable that such behavior might inform an attacker of valid accounts on a system. This possibility should be weighed against the insignificant concerns of exposing a sensitive password in a hostile environment.

Sufficient: The success of this module is deemed `sufficient' to satisfy the PAM library that this module-type has succeeded in its purpose. In the event that no previous required module has, failed, no more `stacked' modules of this type are invoked. (Note, in this case subsequent required modules are not invoked.). A failure of this module is not deemed as fatal to satisfying the application that this module-type has succeeded.

Optional: As its name suggests, this control-flag marks the module as not being critical to the success or failure of the user's application for service. In general, Linux-PAM ignores such a module when determining if the module stack will succeed or fail. However, in the absence of any definite successes or failures of previous or subsequent stacked modules this module will determine the nature of the response to the application. One example of this latter case is when the other modules return something like PAM IGNORE.

Arguments: Not all of these options are relevant for all uses of the module.

use_first_pass: Instead of prompting the user for a password, retrieve the password from the previous authentication module. If the password does not exist, return failure. If the password exists, try it, returning success/failure as appropriate.

try_first_pass: Instead of prompting the user for a password, retrieve the password from the previous authentication module. If the password exists, try it, and return success if it passes. If there was no previous password, or the previous password fails authentication, prompt the user with "Enter RADIUS password: ", and ask for another password. Try this password, and return success/failure as appropriate. This is the default for authentication.

skip_passwd: Do not prompt for a password, even if there was none retrieved from the previous layer. Send the previous one (if it exists), or else send a NULL password. If this fails, exit. If an Access-Challenge is returned, display the challenge message, and ask the user for the response. Return success/failure as appropriate. The password sent to the next authentication module will NOT be the response to the challenge. If a password from a previous authentication module exists, it is passed on. Otherwise, no password is sent to the next module.

conf=foo: Set the configuration filename to 'foo'. Default is **/etc/raddb/server**

client_id=bar: Send a NAS-Identifier RADIUS attribute with string 'bar'. If the client_id is not specified, the PAM_SERVICE type is used instead. ('login', 'su', 'passwd', etc.) This feature may be disabled by using 'client_id='. i.e. A blank client ID.

use_authtok: Force the use of a previously entered password. This is needed for pluggable password strength checking i.e. try cracklib to be sure it's secure, then go update the RADIUS server.

accounting_bug: When used, the accounting response vector is NOT validated. This option will probably only be necessary on old (i.e. Livingston 1.16) servers.

2.6 Linux - Example and description of an application configuration file

Login\Telnet		
#%PAM-1.0		
auth	required	/lib/security/pam_securetty.so
auth	sufficient	/lib/security/pam_radius_auth.so
auth	required	/lib/security/pam_pwdb.so try_first_pass shadow nullok
auth	required	/lib/security/pam_nologin.so
account	required	/lib/security/pam_pwdb.so
password	required	/lib/security/pam_cracklib.so
password	required	/lib/security/pam_pwdb.so nullok use_authtok md5 shadow
session	required	/lib/security/pam_pwdb.so
session	optional	/lib/security/pam_console.so

The **first line** allows root to log in from certain areas. All other users are ignored by it. (By default root cannot telnet or ftp into a system).

The **second line** asks the user for their CRYPTOCard password. It then checks with the RADIUS server, if this passes, the user is given a token. Since this is flagged as sufficient, if

the user's password works, PAM skips down to the 5th line, if not PAM moved down to the next line.

The **third line** takes the password that was supplied in line two and runs it's checks on it. If it passes, then it gives it is ok. If the password does not pass (or in the case of root, one wasn't asked for) then the module asks the user for a password. It then runs this new password through it's tests.

The **fourth line** checks to see if the nologin file exists. If it does, then only root is allowed to login. This is for letting root do maintenance without having to remain in single user mode.

The **fifth line** checks the status of the users account. It might do anything from warn them that their password is about to expire, not let them in if their account has expires, or simply be silent and let the user in.

The **sixth line** does a password check and tells the user if their password isn't very good.

The **seventh line** updates any password authentication associated with that user.

The **eighth line** simply logs the username and service-type to syslog.

The **ninth line** authorizes any console programs. As you can see this is optional and won't stop anything, though it does send out a warning if it doesn't pass.

If you encounter a problem that cannot be solved using the tips above, contact support@cryptocard.com or call us at (800) 307-7042 or +1-613-599-2441 Monday through Friday 8:30 am to 5:00 pm EST.