

The Linux-PAM System Administrators' Guide

**Andrew G. Morgan <morgan@kernel.org>
Thorsten Kukuk <kukuk@thkukuk.de>**

The Linux-PAM System Administrators' Guide

by Andrew G. Morgan and Thorsten Kukuk

Version 0.99.7.0, 16. January 2007

Abstract

This manual documents what a system-administrator needs to know about the *Linux-PAM* library. It covers the correct syntax of the PAM configuration file and discusses strategies for maintaining a secure system.

1. Introduction	1
2. Some comments on the text	2
3. Overview	3
4. The Linux-PAM configuration file	5
4.1. Configuration file syntax	5
4.2. Directory based configuration	7
4.3. Example configuration file entries	8
5. Security issues	10
5.1. If something goes wrong	10
5.2. Avoid having a weak 'other' configuration	10
6. A reference guide for available modules	11
6.1. pam_access - logdaemon style login access control	11
6.2. pam_cracklib - checks the password against dictionary words	14
6.3. pam_debug - debug the PAM stack	17
6.4. pam_deny - locking-out PAM module	18
6.5. pam_echo - print text messages	19
6.6. pam_env - set/unset environment variables	21
6.7. pam_exec - call an external command	23
6.8. pam_faildelay - change the delay on failure per-application	24
6.9. pam_filter - filter module	25
6.10. pam_ftp - module for anonymous access	26
6.11. pam_group - module to modify group access	27
6.12. pam_issue - add issue file to user prompt	29
6.13. pam_keyinit - display the keyinit file	31
6.14. pam_lastlog - display date of last login	32
6.15. pam_limits - limit resources	33
6.16. pam_listfile - deny or allow services based on an arbitrary file	36
6.17. pam_localuser - require users to be listed in /etc/passwd	38
6.18. pam_loginuid - record user's login uid to the process attribute	39
6.19. pam_mail - inform about available mail	40
6.20. pam_mkhomedir - create users home directory	42
6.21. pam_motd - display the motd file	43
6.22. pam_namespace - setup a private namespace	43
6.23. pam_nologin - prevent non-root users from login	47
6.24. pam_permit - the promiscuous module	47
6.25. pam_rhosts - grant access using .rhosts file	48
6.26. pam_rootok - gain only root access	49
6.27. pam_securetty - limit root login to special devices	50
6.28. pam_selinux - set the default security context	51
6.29. pam_shells - check for valid login shell	53
6.30. pam_succeed_if - test account characteristics	53
6.31. pam_tally - login counter (tallying) module	55
6.32. pam_time - time controlled access	58
6.33. pam_umask - set the file mode creation mask	60
6.34. pam_unix - traditional password authentication	61
6.35. pam_userdb - authenticate against a db database	63
6.36. pam_warn - logs all PAM items	65
6.37. pam_wheel - only permit root access to members of group wheel	66
6.38. pam_xauth - forward xauth keys between users	67
7. See also	70
8. Author/acknowledgments	71
9. Copyright information for this document	72

Chapter 1. Introduction

Linux-PAM (Pluggable Authentication Modules for Linux) is a suite of shared libraries that enable the local system administrator to choose how applications authenticate users.

In other words, without (rewriting and) recompiling a PAM-aware application, it is possible to switch between the authentication mechanism(s) it uses. Indeed, one may entirely upgrade the local authentication system without touching the applications themselves.

Historically an application that has required a given user to be authenticated, has had to be compiled to use a specific authentication mechanism. For example, in the case of traditional UN*X systems, the identity of the user is verified by the user entering a correct password. This password, after being prefixed by a two character ``salt'', is encrypted (with `crypt(3)`). The user is then authenticated if this encrypted password is identical to the second field of the user's entry in the system password database (the `/etc/passwd` file). On such systems, most if not all forms of privileges are granted based on this single authentication scheme. Privilege comes in the form of a personal user-identifier (UID) and membership of various groups. Services and applications are available based on the personal and group identity of the user. Traditionally, group membership has been assigned based on entries in the `/etc/group` file.

It is the purpose of the *Linux-PAM* project to separate the development of privilege granting software from the development of secure and appropriate authentication schemes. This is accomplished by providing a library of functions that an application may use to request that a user be authenticated. This PAM library is configured locally with a system file, `/etc/pam.conf` (or a series of configuration files located in `/etc/pam.d/`) to authenticate a user request via the locally available authentication modules. The modules themselves will usually be located in the directory `/lib/security` or `/lib64/security` and take the form of dynamically loadable object files (see `dlopen(3)`).

Chapter 2. Some comments on the text

Before proceeding to read the rest of this document, it should be noted that the text assumes that certain files are placed in certain directories. Where they have been specified, the conventions we adopt here for locating these files are those of the relevant RFC (RFC-86.0, see bibliography"). If you are using a distribution of Linux (or some other operating system) that supports PAM but chooses to distribute these files in a different way you should be careful when copying examples directly from the text.

As an example of the above, where it is explicit, the text assumes that PAM loadable object files (the *modules*) are to be located in the following directory: `/lib/security/` or `/lib64/security` depending on the architecture. This is generally the location that seems to be compatible with the Filesystem Hierarchy Standard (FHS). On Solaris, which has its own licensed version of PAM, and some other implementations of UN*X, these files can be found in `/usr/lib/security`. Please be careful to perform the necessary transcription when using the examples from the text.

Chapter 3. Overview

For the uninitiated, we begin by considering an example. We take an application that grants some service to users; **login** is one such program. **Login** does two things, it first establishes that the requesting user is whom they claim to be and second provides them with the requested service: in the case of **login** the service is a command shell (bash, tcsh, zsh, etc.) running with the identity of the user.

Traditionally, the former step is achieved by the **login** application prompting the user for a password and then verifying that it agrees with that located on the system; hence verifying that as far as the system is concerned the user is who they claim to be. This is the task that is delegated to *Linux-PAM*.

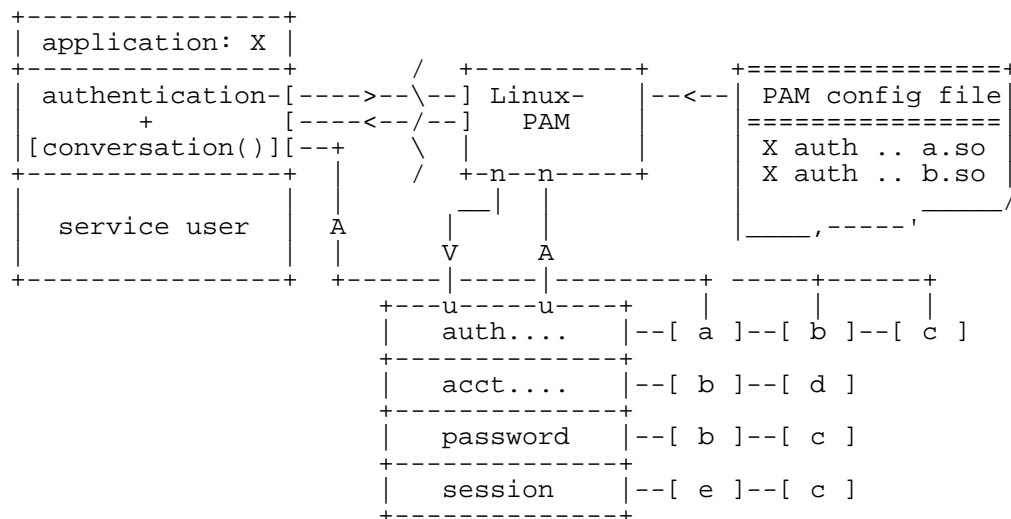
From the perspective of the application programmer (in this case the person that wrote the **login** application), *Linux-PAM* takes care of this authentication task -- verifying the identity of the user.

The flexibility of *Linux-PAM* is that *you*, the system administrator, have the freedom to stipulate which authentication scheme is to be used. You have the freedom to set the scheme for any/all PAM-aware applications on your Linux system. That is, you can authenticate from anything as naive as *simple trust* (**pam_permit**) to something as paranoid as a combination of a retinal scan, a voice print and a one-time password!

To illustrate the flexibility you face, consider the following situation: a system administrator (parent) wishes to improve the mathematical ability of her users (children). She can configure their favorite "Shoot 'em up game" (PAM-aware of course) to authenticate them with a request for the product of a couple of random numbers less than 12. It is clear that if the game is any good they will soon learn their *multiplication tables*. As they mature, the authentication can be upgraded to include (long) division!

Linux-PAM deals with four separate types of (management) task. These are: *authentication management*; *account management*; *session management*; and *password management*. The association of the preferred management scheme with the behavior of an application is made with entries in the relevant *Linux-PAM* configuration file. The management functions are performed by *modules* specified in the configuration file. The syntax for this file is discussed in the section below.

Here is a figure that describes the overall organization of *Linux-PAM*:



By way of explanation, the left of the figure represents the application; application X. Such an application interfaces with the *Linux-PAM* library and knows none of the specifics of its configured authentication

tion method. The *Linux-PAM* library (in the center) consults the contents of the PAM configuration file and loads the modules that are appropriate for application-X. These modules fall into one of four management groups (lower-center) and are stacked in the order they appear in the configuration file. These modules, when called by *Linux-PAM*, perform the various authentication tasks for the application. Textual information, required from/or offered to the user, can be exchanged through the use of the application-supplied *conversation* function.

If a program is going to use PAM, then it has to have PAM functions explicitly coded into the program. If you have access to the source code you can add the appropriate PAM functions. If you do not have access to the source code, and the binary does not have the PAM functions included, then it is not possible to use PAM.

Chapter 4. The Linux-PAM configuration file

When a *PAM* aware privilege granting application is started, it activates its attachment to the PAM-API. This activation performs a number of tasks, the most important being the reading of the configuration file(s): `/etc/pam.conf`. Alternatively, this may be the contents of the `/etc/pam.d/` directory. The presence of this directory will cause Linux-PAM to ignore `/etc/pam.conf`.

These files list the *PAMs* that will do the authentication tasks required by this service, and the appropriate behavior of the PAM-API in the event that individual *PAMs* fail.

4.1. Configuration file syntax

The syntax of the `/etc/pam.conf` configuration file is as follows. The file is made up of a list of rules, each rule is typically placed on a single line, but may be extended with an escaped end of line: ``\<LF>'`. Comments are preceded with `#` marks and extend to the next end of line.

The format of each rule is a space separated collection of tokens, the first three being case-insensitive:

service type control module-path module-arguments

The syntax of files contained in the `/etc/pam.d/` directory, are identical except for the absence of any *service* field. In this case, the *service* is the name of the file in the `/etc/pam.d/` directory. This filename must be in lower case.

An important feature of *PAM*, is that a number of rules may be *stacked* to combine the services of a number of *PAMs* for a given authentication task.

The *service* is typically the familiar name of the corresponding application: *login* and *su* are good examples. The *service-name*, *other*, is reserved for giving *default* rules. Only lines that mention the current service (or in the absence of such, the *other* entries) will be associated with the given service-application.

The *type* is the management group that the rule corresponds to. It is used to specify which of the management groups the subsequent module is to be associated with. Valid entries are:

account	this module type 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.
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 or other privileges through its credential granting properties.
password	this 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) type.
session	this module type 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.

The third field, *control*, indicates the behavior of the PAM-API should the module fail to succeed in its authentication task. There are two types of syntax for this control field: the simple one has a single simple keyword; the more complicated one involves a square-bracketed selection of *value=action* pairs.

For the simple (historical) syntax valid *control* values are:

required	failure of such a PAM will ultimately lead to the PAM-API returning failure but only after the remaining <i>stacked</i> modules (for this <i>service</i> and <i>type</i>) have been invoked.
requisite	like <i>required</i> , 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 not insignificant concerns of exposing a sensitive password in a hostile environment.
sufficient	success of such a module is enough to satisfy the authentication requirements of the stack of modules (if a prior <i>required</i> module has failed the success of this one is <i>ignored</i>). A failure of this module is not deemed as fatal to satisfying the application that this type has succeeded. If the module succeeds the PAM framework returns success to the application immediately without trying any other modules.
optional	the success or failure of this module is only important if it is the only module in the stack associated with this <i>service+type</i> .
include	include all lines of given type from the configuration file specified as an argument to this control.

For the more complicated syntax valid *control* values have the following form:

```
[value1=action1 value2=action2 ...]
```

Where *valueN* corresponds to the return code from the function invoked in the module for which the line is defined. It is selected from one of these: *success*, *open_err*, *symbol_err*, *service_err*, *system_err*, *buf_err*, *perm_denied*, *auth_err*, *cred_insufficient*, *authinfo_unavail*, *user_unknown*, *maxtries*, *new_authtok_reqd*, *acct_expired*, *session_err*, *cred_unavail*, *cred_expired*, *cred_err*, *no_module_data*, *conv_err*, *authtok_err*, *authtok_recover_err*, *authtok_lock_busy*, *authtok_disable_aging*, *try_again*, *ignore*, *abort*, *authtok_expired*, *module_unknown*, *bad_item* and *default*.

The last of these, *default*, implies 'all *valueN*'s not mentioned explicitly. Note, the full list of PAM errors is available in `/usr/include/security/_pam_types.h`. The *actionN* can be: an unsigned integer, *n*, signifying an action of 'jump over the next *n* modules in the stack', or take one of the following forms:

ignore	when used with a stack of modules, the module's return status will not contribute to the return code the application obtains.
bad	this action indicates that the return code should be thought of as indicative of the module failing. If this module is the first in the stack to fail, its status value will be used for that of the whole stack.
die	equivalent to bad with the side effect of terminating the module stack and PAM immediately

returning to the application.

- ok this tells PAM that the administrator thinks this return code should contribute directly to the return code of the full stack of modules. In other words, if the former state of the stack would lead to a return of *PAM_SUCCESS*, the module's return code will override this value. Note, if the former state of the stack holds some value that is indicative of a modules failure, this 'ok' value will not be used to override that value.
- done equivalent to ok with the side effect of terminating the module stack and PAM immediately returning to the application.
- reset clear all memory of the state of the module stack and start again with the next stacked module.

Each of the four keywords: required; requisite; sufficient; and optional, have an equivalent expression in terms of the [...] syntax. They are as follows:

- required [success=ok new_authtok_reqd=ok ignore=ignore default=bad]
- requisite [success=ok new_authtok_reqd=ok ignore=ignore default=die]
- sufficient [success=done new_authtok_reqd=done default=ignore]
- optional [success=ok new_authtok_reqd=ok default=ignore]

module-path is either the full filename of the PAM to be used by the application (it begins with a '/'), or a relative pathname from the default module location: */lib/security/* or */lib64/security/*, depending on the architecture.

module-arguments are a space separated list of tokens that can be used to modify the specific behavior of the given PAM. Such arguments will be documented for each individual module. Note, if you wish to include spaces in an argument, you should surround that argument with square brackets.

```
squid auth required pam_mysql.so user=passwd_query passwd=mada \
      db=eminence [query=select user_name from internet_service \
      where user_name='%u' and password=PASSWORD('%p') and \
      service='web_proxy']
```

When using this convention, you can include '[' characters inside the string, and if you wish to include a ']' character inside the string that will survive the argument parsing, you should use '\['. In other words:

```
[...[\]]...      -->    ..[...]..
```

Any line in (one of) the configuration file(s), that is not formatted correctly, will generally tend (erring on the side of caution) to make the authentication process fail. A corresponding error is written to the system log files with a call to *syslog(3)*.

4.2. Directory based configuration

More flexible than the single configuration file is it to configure libpam via the contents of the /

`etc/pam.d/` directory. In this case the directory is filled with files each of which has a filename equal to a service-name (in lower-case): it is the personal configuration file for the named service.

The syntax of each file in `/etc/pam.d/` is similar to that of the `/etc/pam.conf` file and is made up of lines of the following form:

```
type control module-path module-arguments
```

The only difference being that the service-name is not present. The service-name is of course the name of the given configuration file. For example, `/etc/pam.d/login` contains the configuration for the *login* service.

4.3. Example configuration file entries

In this section, we give some examples of entries that can be present in the *Linux-PAM* configuration file. As a first attempt at configuring your system you could do worse than to implement these.

If a system is to be considered secure, it had better have a reasonably secure *'other'* entry. The following is a paranoid setting (which is not a bad place to start!):

```
#
# default; deny access
#
other    auth      required      pam_deny.so
other    account   required      pam_deny.so
other    password  required      pam_deny.so
other    session   required      pam_deny.so
```

Whilst fundamentally a secure default, this is not very sympathetic to a misconfigured system. For example, such a system is vulnerable to locking everyone out should the rest of the file become badly written.

The module **pam_deny** (documented in a later section) is not very sophisticated. For example, it logs no information when it is invoked so unless the users of a system contact the administrator when failing to execute a service application, the administrator may go for a long while in ignorance of the fact that his system is misconfigured.

The addition of the following line before those in the above example would provide a suitable warning to the administrator.

```
#
# default; wake up! This application is not configured
#
other    auth      required      pam_warn.so
other    password  required      pam_warn.so
```

Having two **'other auth'** lines is an example of stacking.

On a system that uses the `/etc/pam.d/` configuration, the corresponding default setup would be achieved with the following file:

```
#
# default configuration: /etc/pam.d/other
#
auth      required      pam_warn.so
auth      required      pam_deny.so
account   required      pam_deny.so
password  required      pam_warn.so
password  required      pam_deny.so
session   required      pam_deny.so
```

This is the only explicit example we give for an `/etc/pam.d/` file. In general, it should be clear how to transpose the remaining examples to this configuration scheme.

On a less sensitive computer, one on which the system administrator wishes to remain ignorant of much of the power of *Linux-PAM*, the following selection of lines (in `/etc/pam.d/other`) is likely to mimic the historically familiar Linux setup.

```
#
# default; standard UN*X access
#
auth      required      pam_unix.so
account   required      pam_unix.so
password  required      pam_unix.so
session   required      pam_unix.so
```

In general this will provide a starting place for most applications.

Chapter 5. Security issues

5.1. If something goes wrong

Linux-PAM has the potential to seriously change the security of your system. You can choose to have no security or absolute security (no access permitted). In general, *Linux-PAM* errs towards the latter. Any number of configuration errors can dissable access to your system partially, or completely.

The most dramatic problem that is likely to be encountered when configuring *Linux-PAM* is that of *deleting* the configuration file(s): `/etc/pam.d/*` and/or `/etc/pam.conf`. This will lock you out of your own system!

To recover, your best bet is to restore the system from a backup or boot the system into a rescue system and correct things from there.

5.2. Avoid having a weak `other' configuration

It is not a good thing to have a weak default (*other*) entry. This service is the default configuration for all PAM aware applications and if it is weak, your system is likely to be vulnerable to attack.

Here is a sample "other" configuration file. The **pam_deny** module will deny access and the **pam_warn** module will send a syslog message to *auth.notice*:

```
#
# The PAM configuration file for the `other' service
#
auth      required    pam_deny.so
auth      required    pam_warn.so
account   required    pam_deny.so
account   required    pam_warn.so
password  required    pam_deny.so
password  required    pam_warn.so
session   required    pam_deny.so
session   required    pam_warn.so
```

Chapter 6. A reference guide for available modules

Here, we collect together the descriptions of the various modules coming with Linux-PAM.

6.1. pam_access - logdaemon style login access control

```
pam_access.so [ debug ] [ nodefgroup ] [ accessfile=file ] [ fieldsep=sep ] [ listsep=sep ]
```

6.1.1. DESCRIPTION

The `pam_access` PAM module is mainly for access management. It provides logdaemon style login access control based on login names, host or domain names, internet addresses or network numbers, or on terminal line names in case of non-networked logins.

By default rules for access management are taken from config file `/etc/security/access.conf` if you don't specify another file.

6.1.2. DESCRIPTION

The `/etc/security/access.conf` file specifies (*user/group, host*), (*user/group, network/netmask*) or (*user/group, tty*) combinations for which a login will be either accepted or refused.

When someone logs in, the file `access.conf` is scanned for the first entry that matches the (*user/group, host*) or (*user/group, network/netmask*) combination, or, in case of non-networked logins, the first entry that matches the (*user/group, tty*) combination. The permissions field of that table entry determines whether the login will be accepted or refused.

Each line of the login access control table has three fields separated by a ":" character (colon):

```
permission:users/groups:origins
```

The first field, the *permission* field, can be either a "+" character (plus) for access granted or a "-" character (minus) for access denied.

The second field, the *users/group* field, should be a list of one or more login names, group names, or *ALL* (which always matches). To differentiate user entries from group entries, group entries should be written with brackets, e.g. (*group*).

The third field, the *origins* field, should be a list of one or more tty names (for non-networked logins), host names, domain names (begin with "."), host addresses, internet network numbers (end with "."), internet network addresses with network mask (where network mask can be a decimal number or an internet address also), *ALL* (which always matches) or *LOCAL* (which matches any string that does not contain a "." character). If supported by the system you can use *@netgroupname* in host or user patterns.

The *EXCEPT* operator makes it possible to write very compact rules.

If the `nodefgroup` is not set, the group file is searched when a name does not match that of the logged-in user. Only groups are matched in which users are explicitly listed. However the PAM module does not look at the primary group id of a user.

The "#" character at start of line (no space at front) can be used to mark this line as a comment line.

6.1.3. OPTIONS

<code>accessfile=/path/to/access.conf</code>	Indicate an alternative <code>access.conf</code> style configuration file to override the default. This can be useful when different services need different access lists.
<code>debug</code>	A lot of debug informations are printed with <code>syslog(3)</code> .
<code>fieldsep=separators</code>	This option modifies the field separator character that <code>pam_access</code> will recognize when parsing the access configuration file. For example: <code>fieldsep= </code> will cause the default <code>:</code> character to be treated as part of a field value and <code> </code> becomes the field separator. Doing this may be useful in conjunction with a system that wants to use <code>pam_access</code> with X based applications, since the <code>PAM_TTY</code> item is likely to be of the form "hostname:0" which includes a <code>:</code> character in its value. But you should not need this.
<code>listsep=separators</code>	This option modifies the list separator character that <code>pam_access</code> will recognize when parsing the access configuration file. For example: <code>listsep=,</code> will cause the default <code> </code> (space) and <code>\t</code> (tab) characters to be treated as part of a list element value and <code>,</code> becomes the only list element separator. Doing this may be useful on a system with group information obtained from a Windows domain, where the default built-in groups "Domain Users", "Domain Admins" contain a space.
<code>nodefgroup</code>	The group database will not be used for tokens not identified as account name.

6.1.4. MODULE SERVICES PROVIDED

All services are supported.

6.1.5. RETURN VALUES

<code>PAM_SUCCESS</code>	Access was granted.
<code>PAM_PERM_DENIED</code>	Access was not granted.
<code>PAM_IGNORE</code>	<code>pam_setcred</code> was called which does nothing.
<code>PAM_ABORT</code>	Not all relevant data or options could be gotten.
<code>PAM_USER_UNKNOWN</code>	The user is not known to the system.

6.1.6. FILES

<code>/etc/security/access.conf</code>	Default configuration file
----------------------------------------	----------------------------

6.1.7. EXAMPLES

These are some example lines which might be specified in `/etc/security/access.conf`.

User *root* should be allowed to get access via *cron*, X11 terminal `:0`, *tty1*, ..., *tty5*, *tty6*.

```
+ : root : crond :0 tty1 tty2 tty3 tty4 tty5 tty6
```

User *root* should be allowed to get access from hosts which own the IPv4 addresses. This does not mean that the connection have to be a IPv4 one, a IPv6 connection from a host with one of this IPv4 addresses does work, too.

```
+ : root : 192.168.200.1 192.168.200.4 192.168.200.9
```

```
+ : root : 127.0.0.1
```

User *root* should get access from network `192.168.201.` where the term will be evaluated by string matching. But it might be better to use `network/netmask` instead. The same meaning of `192.168.201.` is `192.168.201.0/24` or `192.168.201.0/255.255.255.0`.

```
+ : root : 192.168.201.
```

User *root* should be able to have access from hosts *foo1.bar.org* and *foo2.bar.org* (uses string matching also).

```
+ : root : foo1.bar.org foo2.bar.org
```

User *root* should be able to have access from domain *foo.bar.org* (uses string matching also).

```
+ : root : .foo.bar.org
```

User *root* should be denied to get access from all other sources.

```
- : root : ALL
```

User *foo* and members of netgroup *admins* should be allowed to get access from all sources. This will only work if netgroup service is available.

```
+ : @admins foo : ALL
```

User *john* and *foo* should get access from IPv6 host address.

```
+ : john foo : 2001:4ca0:0:101::1
```

User *john* should get access from IPv6 net/mask.

```
+ : john : 2001:4ca0:0:101::/64
```

Disallow console logins to all but the shutdown, sync and all other accounts, which are a member of the wheel group.

```
:-:ALL EXCEPT (wheel) shutdown sync:LOCAL
```

All other users should be denied to get access from all sources.

```
- : ALL : ALL
```

6.1.8. AUTHORS

The logdaemon style login access control scheme was designed and implemented by Wietse Venema. The pam_access PAM module was developed by Alexei Nogin <alexei@nogin.dnrtm.ru>. The IPv6 support and the network(address) / netmask feature was developed and provided by Mike Becher <mike.becher@lrz-muenchen.de>.

6.2. pam_cracklib - checks the password against dictionary words

pam_cracklib.so [...]

6.2.1. DESCRIPTION

This module can be plugged into the *password* stack of a given application to provide some plug-in strength-checking for passwords.

The action of this module is to prompt the user for a password and check its strength against a system dictionary and a set of rules for identifying poor choices.

The first action is to prompt for a single password, check its strength and then, if it is considered strong, prompt for the password a second time (to verify that it was typed correctly on the first occasion). All being well, the password is passed on to subsequent modules to be installed as the new authentication token.

The strength checks works in the following manner: at first the *Cracklib* routine is called to check if the password is part of a dictionary; if this is not the case an additional set of strength checks is done. These checks are:

Palindrome	Is the new password a palindrome of the old one?
Case Change Only	Is the new password the the old one with only a change of case?
Similar	<p>Is the new password too much like the old one? This is primarily controlled by one argument, <i>difok</i> which is a number of characters that if different between the old and new are enough to accept the new password, this defaults to 10 or 1/2 the size of the new password whichever is smaller.</p> <p>To avoid the lockup associated with trying to change a long and complicated password, <i>difignore</i> is available. This argument can be used to specify the minimum length a new password needs to be before the <i>difok</i> value is ignored. The default value for <i>difignore</i> is 23.</p>
Simple	Is the new password too small? This is controlled by 5 arguments <i>minlen</i> , <i>dcredit</i> , <i>ucredit</i> , <i>lcredit</i> , and <i>ocredit</i> . See the section on the arguments for the details of how these work and there defaults.
Rotated	Is the new password a rotated version of the old password?
Already used	Was the password used in the past? Previously used passwords are to be found in <i>/etc/security/opasswd</i> .

This module with no arguments will work well for standard unix password encryption. With md5 encryption, passwords can be longer than 8 characters and the default settings for this module can make it hard for the user to choose a satisfactory new password. Notably, the requirement that the new password contain no more than 1/2 of the characters in the old password becomes a non-trivial constraint. For ex-

ample, an old password of the form "the quick brown fox jumped over the lazy dogs" would be difficult to change... In addition, the default action is to allow passwords as small as 5 characters in length. For a md5 systems it can be a good idea to increase the required minimum size of a password. One can then allow more credit for different kinds of characters but accept that the new password may share most of these characters with the old password.

6.2.2. OPTIONS

debug	This option makes the module write information to syslog(3) indicating the behavior of the module (this option does not write password information to the log file).
type=XXX	The default action is for the module to use the following prompts when requesting passwords: "New UNIX password: " and "Re-type UNIX password: ". The default word <i>UNIX</i> can be replaced with this option.
retry=N	Prompt user at most <i>N</i> times before returning with error. The default is <i>1</i>
difok=N	This argument will change the default of 5 for the number of characters in the new password that must not be present in the old password. In addition, if 1/2 of the characters in the new password are different then the new password will be accepted anyway.
difignore=N	How many characters should the password have before difok will be ignored. The default is 23.
minlen=N	The minimum acceptable size for the new password (plus one if credits are not disabled which is the default). In addition to the number of characters in the new password, credit (of +1 in length) is given for each different kind of character (<i>other</i> , <i>upper</i> , <i>lower</i> and <i>digit</i>). The default for this parameter is 9 which is good for a old style UNIX password all of the same type of character but may be too low to exploit the added security of a md5 system. Note that there is a pair of length limits in <i>Cracklib</i> itself, a "way too short" limit of 4 which is hard coded in and a defined limit (6) that will be checked without reference to minlen. If you want to allow passwords as short as 5 characters you should not use this module.
dcredit=N	(<i>N</i> >= 0) This is the maximum credit for having digits in the new password. If you have less than or <i>N</i> digits, each digit will count +1 towards meeting the current minlen value. The default for dcredit is 1 which is the recommended value for minlen less than 10. (<i>N</i> < 0) This is the minimum number of digits that must be met for a new password.
uccredit=N	(<i>N</i> >= 0) This is the maximum credit for having upper case letters in the new password. If you have less than or <i>N</i> upper case letters each letter will count +1 towards meeting the current minlen value. The default for ucredit is 1 which is the recommended value for minlen less than 10.

	($N > 0$) This is the minimum number of upper case letters that must be met for a new password.
<code>lcredit=N</code>	($N \geq 0$) This is the maximum credit for having lower case letters in the new password. If you have less than or N lower case letters, each letter will count +1 towards meeting the current <code>minlen</code> value. The default for <code>lcredit</code> is 1 which is the recommended value for <code>minlen</code> less than 10.
	($N < 0$) This is the minimum number of lower case letters that must be met for a new password.
<code>ocredit=N</code>	($N \geq 0$) This is the maximum credit for having other characters in the new password. If you have less than or N other characters, each character will count +1 towards meeting the current <code>minlen</code> value. The default for <code>ocredit</code> is 1 which is the recommended value for <code>minlen</code> less than 10.
	($N < 0$) This is the minimum number of other characters that must be met for a new password.
<code>minclass=N</code>	The minimum number of required classes of characters for the new password. The default number is zero. The four classes are digits, upper and lower letters and other characters. The difference to the <code>credit</code> check is that a specific class if of characters is not required. Instead N out of four of the classes are required.
<code>use_authtok</code>	This argument is used to <i>force</i> the module to not prompt the user for a new password but use the one provided by the previously stacked <i>password</i> module.
<code>dictpath=/path/to/dict</code>	Path to the cracklib dictionaries.

6.2.3. MODULE SERVICES PROVIDED

Only the password service is supported.

6.2.4. RETURN VALUES

<code>PAM_SUCCESS</code>	The new password passes all checks.
<code>PAM_AUTHTOK_ERR</code>	No new password was entered, the username could not be determined or the new password fails the strength checks.
<code>PAM_AUTHTOK_RECOVERY_ERR</code>	The old password was not supplied by a previous stacked module or got not requested from the user. The first error can happen if <code>use_authtok</code> is specified.
<code>PAM_SERVICE_ERR</code>	A internal error occurred.

6.2.5. EXAMPLES

For an example of the use of this module, we show how it may be stacked with the password component of pam_unix(8)

```
#
# These lines stack two password type modules. In this example the
# user is given 3 opportunities to enter a strong password. The
# "use_authtok" argument ensures that the pam_unix module does not
# prompt for a password, but instead uses the one provided by
# pam_cracklib.
#
passwd password required pam_cracklib.so retry=3
passwd password required pam_unix.so use_authtok
```

Another example (in the /etc/pam.d/passwd format) is for the case that you want to use md5 password encryption:

```
##PAM-1.0
#
# These lines allow a md5 systems to support passwords of at least 14
# bytes with extra credit of 2 for digits and 2 for others the new
# password must have at least three bytes that are not present in the
# old password
#
password required pam_cracklib.so \
    difok=3 minlen=15 dcredit= 2 ocredit=2
password required pam_unix.so use_authtok nullok md5
```

And here is another example in case you don't want to use credits:

```
##PAM-1.0
#
# These lines require the user to select a password with a minimum
# length of 8 and with at least 1 digit number, 1 upper case letter,
# and 1 other character
#
password required pam_cracklib.so \
    dcredit=-1 ucredit=-1 ocredit=-1 lcredit=0 minlen=8
password required pam_unix.so use_authtok nullok md5
```

6.2.6. AUTHOR

pam_cracklib was written by Cristian Gafton <gafton@redhat.com>

6.3. pam_debug - debug the PAM stack

```
pam_debug.so [ auth=value ] [ cred=value ] [ acct=value ] [ prechauthtok=value ] [ chauthtok=value ] [ auth=value ] [ open_session=value ] [ close_session=value ]
```

6.3.1. DESCRIPTION

The pam_debug PAM module is intended as a debugging aide for determining how the PAM stack is

operating. This module returns what its module arguments tell it to return.

6.3.2. OPTIONS

<code>auth=value</code>	The <code>pam_sm_authenticate(3)</code> function will return <i>value</i> .
<code>cred=value</code>	The <code>pam_sm_setcred(3)</code> function will return <i>value</i> .
<code>acct=value</code>	The <code>pam_sm_acct_mgmt(3)</code> function will return <i>value</i> .
<code>preauthtok=value</code>	The <code>pam_sm_chauthtok(3)</code> function will return <i>value</i> if the <code>PAM_PRELIM_CHECK</code> flag is set.
<code>chauthtok=value</code>	The <code>pam_sm_chauthtok(3)</code> function will return <i>value</i> if the <code>PAM_PRELIM_CHECK</code> flag is <i>not</i> set.
<code>open_session=value</code>	The <code>pam_sm_open_session(3)</code> function will return <i>value</i> .
<code>close_session=value</code>	The <code>pam_sm_close_session(3)</code> function will return <i>value</i> .

Where *value* can be one of: `success`, `open_err`, `symbol_err`, `service_err`, `system_err`, `buf_err`, `perm_denied`, `auth_err`, `cred_insufficient`, `authinfo_unavail`, `user_unknown`, `maxtries`, `new_authtok_reqd`, `acct_expired`, `session_err`, `cred_unavail`, `cred_expired`, `cred_err`, `no_module_data`, `conv_err`, `authtok_err`, `authtok_recover_err`, `authtok_lock_busy`, `authtok_disable_aging`, `try_again`, `ignore`, `abort`, `authtok_expired`, `module_unknown`, `bad_item`, `conv_again`, `incomplete`.

6.3.3. MODULE SERVICES PROVIDED

The services `auth`, `account`, `password` and `session` are supported.

6.3.4. RETURN VALUES

`PAM_SUCCES` Default return code if no other value was specified, else specified return value.
`S`

6.3.5. EXAMPLES

```
auth    requisite    pam_permit.so
auth    [success=2 default=ok] pam_debug.so auth=perm_denied cred=success
auth    [default=reset]    pam_debug.so auth=success cred=perm_denied
auth    [success=done default=die] pam_debug.so
auth    optional      pam_debug.so auth=perm_denied cred=perm_denied
auth    sufficient     pam_debug.so auth=success cred=success
```

6.3.6. AUTHOR

`pam_debug` was written by Andrew G. Morgan <morgan@kernel.org>.

6.4. pam_deny - locking-out PAM module

`pam_deny.so`

6.4.1. DESCRIPTION

This module can be used to deny access. It always indicates a failure to the application through the PAM framework. It might be suitable for using for default (the *OTHER*) entries.

6.4.2. OPTIONS

This module does not recognise any options.

6.4.3. MODULE SERVICES PROVIDED

All services (`account`, `auth`, `password` and `session`) are supported.

6.4.4. RETURN VALUES

<code>PAM_AUTH_ERR</code>	This is returned by the <code>account</code> and <code>auth</code> services.
<code>PAM_CRED_ERR</code>	This is returned by the <code>setcred</code> function.
<code>PAM_AUTHTOK_ERR</code>	This is returned by the <code>password</code> service.
<code>PAM_SESSION_ERR</code>	This is returned by the <code>session</code> service.

6.4.5. EXAMPLES

```
#%PAM-1.0
#
# If we don't have config entries for a service, the
# OTHER entries are used. To be secure, warn and deny
# access to everything.
other auth      required pam_warn.so
other auth      required pam_deny.so
other account   required pam_warn.so
other account   required pam_deny.so
other password  required pam_warn.so
other password  required pam_deny.so
other session   required pam_warn.so
other session   required pam_deny.so
```

6.4.6. AUTHOR

`pam_deny` was written by Andrew G. Morgan <morgan@kernel.org>

6.5. `pam_echo` - print text messages

`pam_echo.so` [`file=/path/message`]

6.5.1. DESCRIPTION

The *pam_echo* PAM module is for printing text messages to inform user about special things. Sequences starting with the % character are interpreted in the following way:

% The name of the remote host (PAM_RHOST).
H
% The name of the local host.
h
% The service name (PAM_SERVICE).
s
%t The name of the controlling terminal (PAM_TTY).

% The remote user name (PAM_RUSER).
U
% The local user name (PAM_USER).
u

All other sequences beginning with % expands to the characters following the % character.

6.5.2. OPTIONS

file=/path/message The content of the file */path/message* will be printed with the PAM conversion function as PAM_TEXT_INFO.

6.5.3. MODULE SERVICES PROVIDED

All services are supported.

6.5.4. RETURN VALUES

PAM_BUF_ER Memory buffer error.
R
PAM_SUCCES Message was successful printed.
S
PAM_IGNORE PAM_SILENT flag was given or message file does not exist, no message printed.

6.5.5. EXAMPLES

For an example of the use of this module, we show how it may be used to print informations about good passwords:

```
password optional pam_echo.so file=/usr/share/doc/good-password.txt
password required pam_unix.so
```

6.5.6. AUTHOR

Thorsten Kukuk <kukuk@thkukuk.de>

6.6. pam_env - set/unset environment variables

```
pam_env.so [ debug ] [ conffile=conf-file ] [ envfile=env-file ] [ readenv=0/1 ]
```

6.6.1. DESCRIPTION

The pam_env PAM module allows the (un)setting of environment variables. Supported is the use of previously set environment variables as well as *PAM_ITEMS* such as *PAM_RHOST*.

By default rules for (un)setting of variables is taken from the config file `/etc/security/pam_env.conf` if no other file is specified.

This module can also parse a file with simple *KEY=VAL* pairs on separate lines (`/etc/environment` by default). You can change the default file to parse, with the *envfile* flag and turn it on or off by setting the *readenv* flag to 1 or 0 respectively.

6.6.2. DESCRIPTION

The `/etc/security/pam_env.conf` file specifies the environment variables to be set, unset or modified by pam_env(8). When someone logs in, this file is read and the environment variables are set according.

Each line starts with the variable name, there are then two possible options for each variable DEFAULT and OVERRIDE. DEFAULT allows and administrator to set the value of the variable to some default value, if none is supplied then the empty string is assumed. The OVERRIDE option tells pam_env that it should enter in its value (overriding the default value) if there is one to use. OVERRIDE is not used, "" is assumed and no override will be done.

```
VARIABLE [DEFAULT=value] [OVERRIDE=value]
```

(Possibly non-existent) environment variables may be used in values using the `${string}` syntax and (possibly non-existent) PAM_ITEMS may be used in values using the `@{string}` syntax. Both the `$` and `@` characters can be backslash escaped to be used as literal values values can be delimited with `"`, escaped `"` not supported. Note that many environment variables that you would like to use may not be set by the time the module is called. For example, HOME is used below several times, but many PAM applications don't make it available by the time you need it.

The `"#"` character at start of line (no space at front) can be used to mark this line as a comment line.

6.6.3. OPTIONS

`conffile=/
path/to/pam_env.conf`

Indicate an alternative `pam_env.conf` style configuration file to override the default. This can be useful when different services need different environments.

`debug`

A lot of debug informations are printed with `syslog(3)`.

`envfile=/
path/to/environment`

Indicate an alternative environment file to override the default. This can be useful when different services need different environments.

`readenv=0/1`

Turns on or off the reading of the file specified by `envfile` (0 is off, 1 is on). By default this option is on.

6.6.4. MODULE SERVICES PROVIDED

The `auth` and `session` services are supported.

6.6.5. RETURN VALUES

`PAM_ABORT` Not all relevant data or options could be gotten.
`PAM_BUF_ERR` Memory buffer error.
`PAM_IGNORE` No `pam_env.conf` and environment file was found.
`PAM_SUCCESS` Environment variables were set.

6.6.6. FILES

<code>/etc/security/pam.conf</code>	Default configuration file
<code>/etc/pam_environment</code>	Default environment file

6.6.7. EXAMPLES

These are some example lines which might be specified in `/etc/security/pam_env.conf`.

Set the `REMOTEHOST` variable for any hosts that are remote, default to "localhost" rather than not being set at all

```
REMOTEHOST    DEFAULT=localhost OVERRIDE=@{PAM_RHOST}
```

Set the `DISPLAY` variable if it seems reasonable

```
DISPLAY       DEFAULT=${REMOTEHOST}:0.0 OVERRIDE=${DISPLAY}
```

Now some simple variables

```
PAGER         DEFAULT=less
MANPAGER      DEFAULT=less
LESS          DEFAULT="M q e h15 z23 b80"
NNTPSERVER    DEFAULT=localhost
PATH          DEFAULT=${HOME}/bin:/usr/local/bin:/bin\
:/usr/bin:/usr/local/bin/X11:/usr/bin/X11
```

Silly examples of escaped variables, just to show how they work.

```
DOLLAR        DEFAULT=\$
```

DOLLARDOLLAR	DEFAULT=	OVERRIDE=\\${DOLLAR}
DOLLARPLUS	DEFAULT=\\${REMOTEHOST}	
ATSIGN	DEFAULT=" "	OVERRIDE=\@

6.6.8. AUTHOR

pam_env was written by Dave Kinchlea <kinch@kinch.ark.com>.

6.7. pam_exec - call an external command

```
pam_exec.so [ debug ] [ seteuid ] [ log=file ] command [ ... ]
```

6.7.1. DESCRIPTION

pam_exec is a PAM module that can be used to run an external command.

6.7.2. OPTIONS

debug	Print debug information.
log=file	The output of the command is appended to file
seteuid	Per default pam_exec.so will execute the external command with the real user ID of the calling process. Specifying this option means the command is run with the effective user ID.

6.7.3. MODULE SERVICES PROVIDED

The services auth, account, password and session are supported.

6.7.4. RETURN VALUES

PAM_SUCCESS	The external command runs successfull.
PAM_SERVICE_ERR	No argument or a wrong number of arguments were given.
PAM_SYSTEM_ERR	A system error occured or the command to execute failed.
PAM_IGNORE	pam_setcred was called, which does not execute the command.

6.7.5. EXAMPLES

Add the following line to /etc/pam.d/passwd to rebuild the NIS database after each local password change:

```
passwd optional pam_exec.so seteuid make -C /var/yp
```

This will execute the command

```
make -C /var/yp
```

with effective user ID.

6.7.6. AUTHOR

pam_exec was written by Thorsten Kukuk <kukuk@thkukuk.de>.

6.8. pam_faildelay - change the delay on failure per-application

```
pam_faildelay.so [ debug ] [ delay=microseconds ]
```

6.8.1. DESCRIPTION

pam_faildelay is a PAM module that can be used to set the delay on failure per-application.

If no delay is given, pam_faildelay will use the value of FAIL_DELAY from /etc/login.defs.

6.8.2. OPTIONS

debug	Turns on debugging messages sent to syslog.
delay=N	Set the delay on failure to N microseconds.

6.8.3. MODULE SERVICES PROVIDED

Only the auth service is supported.

6.8.4. RETURN VALUES

PAM_IGNORE	Delay was successful adjusted.
PAM_SYSTEM_ERR	The specified delay was not valid.

6.8.5. EXAMPLES

The following example will set the delay on failure to 10 seconds:

```
auth optional pam_faildelay.so delay=10000000
```

6.8.6. AUTHOR

pam_faildelay was written by Darren Tucker <dtucker@zip.com.au>.

6.9. pam_filter - filter module

```
pam_filter.so [ debug ] [ new_term ] [ non_term ] run1|run2 filter [ ... ]
```

6.9.1. DESCRIPTION

This module is intended to be a platform for providing access to all of the input/output that passes between the user and the application. It is only suitable for tty-based and (stdin/stdout) applications.

To function this module requires *filters* to be installed on the system. The single filter provided with the module simply transposes upper and lower case letters in the input and output streams. (This can be very annoying and is not kind to termcap based editors).

Each component of the module has the potential to invoke the desired filter. The filter is always executed with the privilege of the calling application and *not* that of the user. For this reason it cannot usually be killed by the user without closing their session.

6.9.2. OPTIONS

debug	Print debug information.
new_term	The default action of the filter is to set the <i>PAM_TTY</i> item to indicate the terminal that the user is using to connect to the application. This argument indicates that the filter should set <i>PAM_TTY</i> to the filtered pseudo-terminal.
non_term	don't try to set the <i>PAM_TTY</i> item.
runX	<p>In order that the module can invoke a filter it should know when to invoke it. This argument is required to tell the filter when to do this.</p> <p>Permitted values for <i>X</i> are <i>1</i> and <i>2</i>. These indicate the precise time that the filter is to be run. To understand this concept it will be useful to have read the pam(3) manual page. Basically, for each management group there are up to two ways of calling the module's functions. In the case of the <i>authentication</i> and <i>session</i> components there are actually two separate functions. For the case of authentication, these functions are <i>pam_authenticate(3)</i> and <i>pam_setcred(3)</i>, here <i>run1</i> means run the filter from the <i>pam_authenticate</i> function and <i>run2</i> means run the filter from <i>pam_setcred</i>. In the case of the session modules, <i>run1</i> implies that the filter is invoked at the <i>pam_open_session(3)</i> stage, and <i>run2</i> for <i>pam_close_session(3)</i>.</p> <p>For the case of the account component. Either <i>run1</i> or <i>run2</i> may be used.</p> <p>For the case of the password component, <i>run1</i> is used to indicate that the filter is run on the first occasion of <i>pam_chauthtok(3)</i> (the <i>PAM_PRELIM_CHECK</i> phase) and <i>run2</i> is used to indicate that the filter is run on the second occasion (the</p>

PAM_UPDATE_AUTHTOK phase).

`filter`

The full pathname of the filter to be run and any command line arguments that the filter might expect.

6.9.3. MODULE SERVICES PROVIDED

The services `auth`, `account`, `password` and `session` are supported.

6.9.4. RETURN VALUES

`PAM_SUCCESS` The new filter was set successfully.

`S`

`PAM_ABORT` Critical error, immediate abort.

6.9.5. EXAMPLES

Add the following line to `/etc/pam.d/login` to see how to configure login to transpose upper and lower case letters once the user has logged in:

```
session required pam_filter.so run1 /lib/security/pam_filter/upperLOWER
```

6.9.6. AUTHOR

`pam_filter` was written by Andrew G. Morgan <morgan@kernel.org>.

6.10. pam_ftp - module for anonymous access

```
pam_ftp.so [ debug ] [ ignore ] [ users=XXX,YYY , ...]
```

6.10.1. DESCRIPTION

`pam_ftp` is a PAM module which provides a pluggable anonymous ftp mode of access.

This module intercepts the user's name and password. If the name is *ftp* or *anonymous*, the user's password is broken up at the `@` delimiter into a `PAM_RUSER` and a `PAM_RHOST` part; these pam-items being set accordingly. The username (`PAM_USER`) is set to *ftp*. In this case the module succeeds. Alternatively, the module sets the `PAM_AUTHTOK` item with the entered password and fails.

This module is not safe and easily spoofable.

6.10.2. OPTIONS

`debug`

Print debug information.

<code>ignore</code>	Pay no attention to the email address of the user (if supplied).
<code>ftp=XXX,YYY,...</code>	Instead of <i>ftp</i> or <i>anonymous</i> , provide anonymous login to the comma separated list of users: <i>XXX,YYY,...</i> . Should the applicant enter one of these usernames the returned username is set to the first in the list: <i>XXX</i> .

6.10.3. MODULE SERVICES PROVIDED

Only the auth service is supported.

6.10.4. RETURN VALUES

<code>PAM_SUCCESS</code>	The authentication was successful.
<code>PAM_USER_UNKNOWN</code>	User not known.

6.10.5. EXAMPLES

Add the following line to `/etc/pam.d/ftpd` to handle ftp style anonymous login:

```
#
# ftpd; add ftp-specifics. These lines enable anonymous ftp over
# standard UNIX access (the listfile entry blocks access to
# users listed in /etc/ftpusers)
#
auth    sufficient    pam_ftp.so
auth    required      pam_unix.so use_first_pass
auth    required      pam_listfile.so \
                onerr=succeed item=user sense=deny file=/etc/ftpusers
```

6.10.6. AUTHOR

`pam_ftp` was written by Andrew G. Morgan <morgan@kernel.org>.

6.11. pam_group - module to modify group access

`pam_group.so`

6.11.1. DESCRIPTION

The `pam_group` PAM module does not authenticate the user, but instead it grants group memberships (in the credential setting phase of the authentication module) to the user. Such memberships are based on the service they are applying for.

By default rules for group memberships are taken from config file `/etc/security/group.conf`.

This module's usefulness relies on the file-systems accessible to the user. The point being that once granted the membership of a group, the user may attempt to create a `setgid` binary with a restricted group ownership. Later, when the user is not given membership to this group, they can recover group membership with the precompiled binary. The reason that the file-systems that the user has access to are so significant, is the fact that when a system is mounted *nosuid* the user is unable to create or execute such a binary file. For this module to provide any level of security, all file-systems that the user has write access to should be mounted *nosuid*.

The `pam_group` module functions in parallel with the `/etc/group` file. If the user is granted any groups based on the behavior of this module, they are granted *in addition* to those entries `/etc/group` (or equivalent).

6.11.2. DESCRIPTION

The `pam_group` PAM module does not authenticate the user, but instead it grants group memberships (in the credential setting phase of the authentication module) to the user. Such memberships are based on the service they are applying for.

For this module to function correctly there must be a correctly formatted `/etc/security/group.conf` file present. White spaces are ignored and lines maybe extended with `'\'` (escaped newlines). Text following a `#` is ignored to the end of the line.

The syntax of the lines is as follows:

```
services;ttys;users;times;groups
```

The first field, the *services* field, is a logic list of PAM service names that the rule applies to.

The second field, the *tty* field, is a logic list of terminal names that this rule applies to.

The third field, the *users* field, is a logic list of users or a netgroup of users to whom this rule applies.

For these items the simple wildcard `'*'` may be used only once. With netgroups no wildcards or logic operators are allowed.

The *times* field is used to indicate "when" these groups are to be given to the user. The format here is a logic list of day/time-range entries. The days are specified by a sequence of two character entries, `MoTuSa` for example is Monday Tuesday and Saturday. Note that repeated days are unset `MoMo` = no day, and `MoWk` = all weekdays bar Monday. The two character combinations accepted are `Mo Tu We Th Fr Sa Su Wk Wd Al`, the last two being week-end days and all 7 days of the week respectively. As a final example, `AlFr` means all days except Friday.

Each day/time-range can be prefixed with a `!` to indicate "anything but". The time-range part is two 24-hour times `HHMM`, separated by a hyphen, indicating the start and finish time (if the finish time is smaller than the start time it is deemed to apply on the following day).

The *groups* field is a comma or space separated list of groups that the user inherits membership of. These groups are added if the previous fields are satisfied by the user's request.

For a rule to be active, ALL of `service+ttys+users` must be satisfied by the applying process.

6.11.3. OPTIONS

This module does not recognise any options.

6.11.4. MODULE SERVICES PROVIDED

Only the auth service is supported.

6.11.5. RETURN VALUES

PAM_SUCCESS	group membership was granted.
PAM_ABORT	Not all relevant data could be gotten.
PAM_BUF_ERR	Memory buffer error.
PAM_CRED_ERR	Group membership was not granted.
PAM_IGNORE	pam_sm_authenticate was called which does nothing.
PAM_USER_UNKNOW WN	The user is not known to the system.

6.11.6. FILES

`/etc/security/group.conf` Default configuration file

6.11.7. EXAMPLES

These are some example lines which might be specified in `/etc/security/group.conf`.

Running 'xsh' on tty* (any ttyXXX device), the user 'us' is given access to the floppy (through membership of the floppy group)

```
xsh; tty*&!ttyp*;us;A10000-2400;floppy
```

Running 'xsh' on tty* (any ttyXXX device), the user 'sword' is given access to games (through membership of the floppy group) after work hours.

```
xsh; tty* ;sword;!Wk0900-1800;games, sound  
xsh; tty* ;*;A10900-1800;floppy
```

6.11.8. AUTHORS

pam_group was written by Andrew G. Morgan <morgan@kernel.org>.

6.12. pam_issue - add issue file to user prompt

```
pam_issue.so [ noesc ] [ issue=issue-file-name ]
```

6.12.1. DESCRIPTION

pam_issue is a PAM module to prepend an issue file to the username prompt. It also by default parses escape codes in the issue file similar to some common getty's (using \x format).

Recognized escapes:

`\d` current day
`\l` name of this tty
`\m` machine architecture (`uname -m`)
`\n` machine's network node hostname (`uname -n`)
`\o` domain name of this system
`\r` release number of operating system (`uname -r`)
`\t` current time
`\s` operating system name (`uname -s`)
`\u` number of users currently logged in
`\U` same as `\u` except it is suffixed with "user" or "users" (eg. "1 user" or "10 users")
`\v` operating system version and build date (`uname -v`)

6.12.2. OPTIONS

<code>noesc</code>	Turns off escape code parsing.
<code>issue=issue-file-name</code>	The file to output if not using the default.

6.12.3. MODULE SERVICES PROVIDED

Only the `auth` service is supported.

6.12.4. RETURN VALUES

<code>PAM_BUF_ERR</code>	Memory buffer error.
<code>PAM_IGNORE</code>	The prompt was already changed.
<code>PAM_SERVICE_ERR</code>	A service module error occurred.
<code>PAM_SUCCESS</code>	The new prompt was set successfully.

6.12.5. EXAMPLES

Add the following line to `/etc/pam.d/login` to set the user specific issue at login:

```
auth optional pam_issue.so issue=/etc/issue
```

6.12.6. AUTHOR

`pam_issue` was written by Ben Collins <bcollins@debian.org>.

6.13. `pam_keyinit` - display the keyinit file

```
pam_keyinit.so [ debug ] [ force ] [ revoke ]
```

6.13.1. DESCRIPTION

The `pam_keyinit` PAM module ensures that the invoking process has a session keyring other than the user default session keyring.

The session component of the module checks to see if the process's session keyring is the user default, and, if it is, creates a new anonymous session keyring with which to replace it.

If a new session keyring is created, it will install a link to the user common keyring in the session keyring so that keys common to the user will be automatically accessible through it.

The session keyring of the invoking process will thenceforth be inherited by all its children unless they override it.

This module is intended primarily for use by login processes. Be aware that after the session keyring has been replaced, the old session keyring and the keys it contains will no longer be accessible.

This module should not, generally, be invoked by programs like *su*, since it is usually desirable for the key set to percolate through to the alternate context. The keys have their own permissions system to manage this.

This module should be included as early as possible in a PAM configuration, so that other PAM modules can attach tokens to the keyring.

The `keyutils` package is used to manipulate keys more directly. This can be obtained from:

Keyutils [<http://people.redhat.com/~dhowells/keyutils/>]

6.13.2. OPTIONS

<code>debug</code>	Log debug information with <code>syslog(3)</code> .
<code>force</code>	Causes the session keyring of the invoking process to be replaced unconditionally.
<code>revoke</code>	Causes the session keyring of the invoking process to be revoked when the invoking process exits if the session keyring was created for this process in the first place.

6.13.3. MODULE SERVICES PROVIDED

Only the *session* service is supported.

6.13.4. RETURN VALUES

PAM_SUCCESS	This module will usually return this value
PAM_AUTH_ERR	Authentication failure.
PAM_BUF_ERR	Memory buffer error.
PAM_IGNORE	The return value should be ignored by PAM dispatch.
PAM_SERVICE_ERR	Cannot determine the user name.
PAM_SESSION_ERR	This module will return this value if its arguments are invalid or if a system error such as ENOMEM occurs.
PAM_USER_UNKNO WN	User not known.

6.13.5. EXAMPLES

Add this line to your login entries to start each login session with its own session keyring:

```
session required pam_keyinit.so
```

This will prevent keys from one session leaking into another session for the same user.

6.13.6. AUTHOR

pam_keyinit was written by David Howells, <dhowells@redhat.com>.

6.14. pam_lastlog - display date of last login

```
pam_lastlog.so [ debug ] [ silent ] [ never ] [ nodate ] [ nohost ] [ noterm ] [ nowtmp ]
```

6.14.1. DESCRIPTION

pam_lastlog is a PAM module to display a line of information about the last login of the user. In addition, the module maintains the `/var/log/lastlog` file.

Some applications may perform this function themselves. In such cases, this module is not necessary.

6.14.2. OPTIONS

debug	Print debug information.
silent	Don't inform the user about any previous login, just update the <code>/var/log/lastlog</code> file.
never	If the <code>/var/log/lastlog</code> file does not contain any old entries for the user, indicate that the user has never previously logged in with a welcome message.

<code>nodate</code>	Don't display the date of the last login.
<code>noterm</code>	Don't display the terminal name on which the last login was attempted.
<code>nohost</code>	Don't indicate from which host the last login was attempted.
<code>nowtmp</code>	Don't update the wtmp entry.

6.14.3. MODULE SERVICES PROVIDED

Only the `session` service is supported.

6.14.4. RETURN VALUES

<code>PAM_SUCCESS</code>	Everything was successful.
<code>PAM_SERVICE_ERR</code>	Internal service module error.
<code>PAM_USER_UNKNOWN</code>	User not known.

6.14.5. EXAMPLES

Add the following line to `/etc/pam.d/login` to display the last login time of an user:

```
session required pam_lastlog.so nowtmp
```

6.14.6. AUTHOR

`pam_lastlog` was written by Andrew G. Morgan <morgan@kernel.org>.

6.15. pam_limits - limit resources

```
pam_limits.so [ change_uid ] [ conf=/path/to/limits.conf ] [ debug ] [ utmp_early ]
```

6.15.1. DESCRIPTION

The `pam_limits` PAM module sets limits on the system resources that can be obtained in a user-session. Users of `uid=0` are affected by this limits, too.

By default limits are taken from the `/etc/security/limits.conf` config file. Then individual files from the `/etc/security/limits.d/` directory are read. The files are parsed one after another in the order of "C" locale. The effect of the individual files is the same as if all the files were concatenated together in the order of parsing. If a config file is explicitly specified with a module option then the files in the above directory are not parsed.

The module must not be called by a multithreaded application.

6.15.2. DESCRIPTION

The syntax of the lines is as follows:

`<domain> <type> <item> <value>`

The fields listed above should be filled as follows:

`<domain>`

- a username
- a groupname, with `@group` syntax. This should not be confused with netgroups.
- the wildcard `*`, for default entry.
- the wildcard `%`, for maxlogins limit only, can also be used with `%group` syntax.

`<type>`

- `hard` for enforcing *hard* resource limits. These limits are set by the superuser and enforced by the Kernel. The user cannot raise his requirement of system resources above such values.
- `soft` for enforcing *soft* resource limits. These limits are ones that the user can move up or down within the permitted range by any pre-existing *hard* limits. The values specified with this token can be thought of as *default* values, for normal system usage.
- for enforcing both *soft* and *hard* resource limits together.

Note, if you specify a type of `'-'` but neglect to supply the item and value fields then the module will never enforce any limits on the specified user/group etc. .

`<item>`

<code>core</code>	limits the core file size (KB)
<code>data</code>	maximum data size (KB)
<code>fsize</code>	maximum filesize (KB)
<code>memlock</code>	maximum locked-in-memory address space (KB)
<code>nofile</code>	maximum number of open files
<code>rss</code>	maximum resident set size (KB)
<code>stack</code>	maximum stack size (KB)
<code>cpu</code>	maximum CPU time (minutes)
<code>nproc</code>	maximum number of processes
<code>as</code>	address space limit (KB)

maxlogins	maximum number of logins for this user
maxsyslogins	maximum number of logins on system
priority	the priority to run user process with (negative values boost process priority)
locks	maximum locked files (Linux 2.4 and higher)
sigpending	maximum number of pending signals (Linux 2.6 and higher)
msqueue	maximum memory used by POSIX message queues (bytes) (Linux 2.6 and higher)
nice	maximum nice priority allowed to raise to (Linux 2.6.12 and higher)
rtprio	maximum realtime priority allowed for non-privileged processes (Linux 2.6.12 and higher)

In general, individual limits have priority over group limits, so if you impose no limits for *admin* group, but one of the members in this group have a limits line, the user will have its limits set according to this line.

Also, please note that all limit settings are set *per login*. They are not global, nor are they permanent; existing only for the duration of the session.

In the *limits* configuration file, the '#' character introduces a comment - after which the rest of the line is ignored.

The pam_limits module does its best to report configuration problems found in its configuration file via syslog(3).

6.15.3. OPTIONS

change_uid	Change real uid to the user for who the limits are set up. Use this option if you have problems like login not forking a shell for user who has no processes. Be warned that something else may break when you do this.
conf=/ path/to/limits.conf	Indicate an alternative limits.conf style configuration file to override the default.
debug	Print debug information.
utmp_early	Some broken applications actually allocate a utmp entry for the user before the user is admitted to the system. If some of the services you are configuring PAM for do this, you can selectively use this module argument to compensate for this behavior and at the same time maintain system-wide consistency with a single limits.conf file.

6.15.4. MODULE SERVICES PROVIDED

Only the `session` service is supported.

6.15.5. RETURN VALUES

PAM_ABORT	Cannot get current limits.
PAM_IGNORE	No limits found for this user.
PAM_PERM_DENIED	New limits could not be set.
PAM_SERVICE_ERR	Cannot read config file.
PAM_SESSION_ERR	Error recovering account name.
PAM_SUCCESS	Limits were changed.
PAM_USER_UNKNOWN	The user is not known to the system.

6.15.6. FILES

`/etc/security/limits.conf` Default configuration file

6.15.7. EXAMPLES

These are some example lines which might be specified in `/etc/security/limits.conf`.

```
*          soft    core      0
*          hard    rss       10000
@student  hard    nproc    20
@faculty   soft    nproc    20
@faculty   hard    nproc    50
ftp        hard    nproc    0
@student  -       maxlogins 4
```

6.15.8. AUTHORS

`pam_limits` was initially written by Cristian Gafton <gafton@redhat.com>

6.16. pam_listfile - deny or allow services based on an arbitrary file

`pam_listfile.so` item=[tty|user|rhost|ruser|group|shell] sense=[allow|deny] file=
`path/filename` onerr=[succeed|fail] [apply=[user|@group]]

6.16.1. DESCRIPTION

`pam_listfile` is a PAM module which provides a way to deny or allow services based on an arbitrary file.

The module gets the `item` of the type specified -- `user` specifies the username, `PAM_USER`; `tty` specifies the name of the terminal over which the request has been made, `PAM_TTY`; `rhost` specifies the name of the remote host (if any) from which the request was made, `PAM_RHOST`; and `ruser` specifies the name of the remote user (if available) who made the request, `PAM_RUSER` -- and looks for an instance of that item in the `file=filename`. `filename` contains one line per item listed. If the item is found, then if `sense=allow`, `PAM_SUCCESS` is returned, causing the authorization request to succeed; else if `sense=deny`, `PAM_AUTH_ERR` is returned, causing the authorization request to fail.

If an error is encountered (for instance, if `filename` does not exist, or a poorly-constructed argument is encountered), then if `onerr=succeed`, `PAM_SUCCESS` is returned, otherwise if `onerr=fail`, `PAM_AUTH_ERR` or `PAM_SERVICE_ERR` (as appropriate) will be returned.

An additional argument, `apply=`, can be used to restrict the application of the above to a specific user (`apply=username`) or a given group (`apply=@groupname`). This added restriction is only meaningful when used with the `tty`, `rhost` and `shell` items.

Besides this last one, all arguments should be specified; do not count on any default behavior.

No credentials are awarded by this module.

6.16.2. OPTIONS

<code>item=[tty user rhost ruser group shell]</code>	What is listed in the file and should be checked for.
<code>sense=[allow deny]</code>	Action to take if found in file, if the item is NOT found in the file, then the opposite action is requested.
<code>file=/path/filename</code>	File containing one item per line. The file needs to be a plain file and not world writeable.
<code>onerr=[succeed fail]</code>	What to do if something weird happens like being unable to open the file.
<code>apply=[user @group]</code>	Restrict the user class for which the restriction apply. Note that with <code>item=[user ruser group]</code> this does not make sense, but for <code>item=[tty rhost shell]</code> it has a meaning.

6.16.3. MODULE SERVICES PROVIDED

The services `auth`, `account`, `password` and `session` are supported.

6.16.4. RETURN VALUES

<code>PAM_AUTH_ERR</code>	Authentication failure.
<code>PAM_BUF_ERR</code>	Memory buffer error.
<code>PAM_IGNORE</code>	The rule does not apply to the <code>apply</code> option.

R	Error in service module.
PAM_SUCCESS	Success.

6.16.5. EXAMPLES

Classic 'ftputers' authentication can be implemented with this entry in `/etc/pam.d/ftpd`:

```
#
# deny ftp-access to users listed in the /etc/ftputers file
#
auth    required      pam_listfile.so \
        onerr=succeed item=user sense=deny file=/etc/ftputers
```

Note, users listed in `/etc/ftputers` file are (counterintuitively) *not* allowed access to the ftp service.

To allow login access only for certain users, you can use a `/etc/pam.d/login` entry like this:

```
#
# permit login to users listed in /etc/loginusers
#
auth    required      pam_listfile.so \
        onerr=fail item=user sense=allow file=/etc/loginusers
```

For this example to work, all users who are allowed to use the login service should be listed in the file `/etc/loginusers`. Unless you are explicitly trying to lock out root, make sure that when you do this, you leave a way for root to log in, either by listing root in `/etc/loginusers`, or by listing a user who is able to *su* to the root account.

6.16.6. AUTHOR

`pam_listfile` was written by Michael K. Johnson <johnsonm@redhat.com> and Elliot Lee <sopwith@cuc.edu>.

6.17. pam_localuser - require users to be listed in /etc/passwd

```
pam_localuser.so [ debug ] [ file=/path/passwd ]
```

6.17.1. DESCRIPTION

`pam_localuser` is a PAM module to help implementing site-wide login policies, where they typically include a subset of the network's users and a few accounts that are local to a particular workstation. Using `pam_localuser` and `pam_wheel` or `pam_listfile` is an effective way to restrict access to either local users and/or a subset of the network's users.

This could also be implemented using `pam_listfile.so` and a very short awk script invoked by cron, but it's common enough to have been separated out.

6.17.2. OPTIONS

<code>debug</code>	Print debug information.
<code>file=/path/passwd</code>	Use a file other than <code>/etc/passwd</code> .

6.17.3. MODULE SERVICES PROVIDED

All services (account, auth, password and session) are supported.

6.17.4. RETURN VALUES

<code>PAM_SUCCESS</code>	The new localuser was set successfull.
<code>PAM_SERVICE_ERR</code>	No username was given.
<code>PAM_USER_UNKNO WN</code>	User not known.

6.17.5. EXAMPLES

Add the following line to `/etc/pam.d/su` to allow only local users in group wheel to use su.

```
account sufficient pam_localuser.so
account required pam_wheel.so
```

6.17.6. AUTHOR

`pam_localuser` was written by Nalin Dahyabhai <nalin@redhat.com>.

6.18. pam_loginuid - record user's login uid to the process attribute

```
pam_loginuid.so [ require_auditd ]
```

6.18.1. DESCRIPTION

The `pam_loginuid` module sets the `loginuid` process attribute for the process that was authenticated. This is necessary for applications to be correctly audited. This PAM module should only be used for entry point applications like: `login`, `sshd`, `gdm`, `vsftpd`, `crond` and `atd`. There are probably other entry point applications besides these. You should not use it for applications like `sudo` or `su` as that defeats the purpose by changing the `loginuid` to the account they just switched to.

6.18.2. OPTIONS

`require_auditd`

This option, when given, will cause this module to query the audit daemon status and deny logins if it is not running.

6.18.3. MODULE SERVICES PROVIDED

The `session` service is supported.

6.18.4. RETURN VALUES

`PAM_SESSION_ERR` An error occurred during session management.

6.18.5. EXAMPLES

```
##PAM-1.0
auth      required      pam_unix.so
auth      required      pam_nologin.so
account    required      pam_unix.so
password   required      pam_unix.so
session    required      pam_unix.so
session    required      pam_loginuid.so
```

6.18.6. AUTHOR

`pam_loginuid` was written by Steve Grubb <sgrubb@redhat.com>

6.19. pam_mail - inform about available mail

```
pam_mail.so [ close ] [ debug ] [ dir=maildir ] [ empty ] [ hash=count ] [ noenv ] [ nopen ] [ quit ] [ standard ]
```

6.19.1. DESCRIPTION

The `pam_mail` PAM module provides the "you have new mail" service to the user. It can be plugged into any application that has credential or session hooks. It gives a single message indicating the *newness* of any mail it finds in the user's mail folder. This module also sets the PAM environment variable, *MAIL*, to the user's mail directory.

If the mail spool file (be it `/var/mail/$USER` or a pathname given with the `dir=` parameter) is a directory then `pam_mail` assumes it is in the *Maildir* format.

6.19.2. OPTIONS

`close`

Indicate if the user has any mail also on logout.

`debug`

Print debug information.

<code>dir=maildir</code>	Look for the users' mail in an alternative location defined by <code>maildir/<login></code> . The default location for mail is <code>/var/mail/<login></code> . Note, if the supplied <code>maildir</code> is prefixed by a '~', the directory is interpreted as indicating a file in the user's home directory.
<code>empty</code>	Also print message if user has no mail.
<code>hash=count</code>	Mail directory hash depth. For example, a <i>hashcount</i> of 2 would make the mail file be <code>/var/spool/mail/u/s/user</code> .
<code>noenv</code>	Do not set the <i>MAIL</i> environment variable.
<code>nopen</code>	Don't print any mail information on login. This flag is useful to get the <i>MAIL</i> environment variable set, but to not display any information about it.
<code>quiet</code>	Only report when there is new mail.
<code>standard</code>	Old style "You have..." format which doesn't show the mail spool being used. This also implies "empty".

6.19.3. MODULE SERVICES PROVIDED

The *auth* and *account* services are supported.

6.19.4. RETURN VALUES

<code>PAM_BUF_ERR</code>	Memory buffer error.
<code>PAM_SERVICE_ERR</code>	Badly formed arguments.
<code>PAM_SUCCESS</code>	Success.
<code>PAM_USER_UNKNOWN</code>	User not known.

6.19.5. EXAMPLES

Add the following line to `/etc/pam.d/login` to indicate that the user has new mail when they login to the system.

```
session optional pam_mail.so standard
```

6.19.6. AUTHOR

`pam_mail` was written by Andrew G. Morgan <morgan@kernel.org>.

6.20. pam_mkhome - create users home dir-

ectory

```
pam_mkhomedir.so [ silent ] [ umask=mode ] [ skel=skel_dir ]
```

6.20.1. DESCRIPTION

The pam_mkhomedir PAM module will create a users home directory if it does not exist when the session begins. This allows users to be present in central database (such as NIS, kerberos or LDAP) without using a distributed file system or pre-creating a large number of directories. The skeleton directory (usually `/etc/skel/`) is used to copy default files and also set's a umask for the creation.

The new users home directory will not be removed after logout of the user.

6.20.2. OPTIONS

<code>silent</code>	Don't print informative messages.
<code>umask=<i>mask</i></code>	The user file-creation mask is set to <i>mask</i> . The default value of mask is 0022.
<code>skel=/ <i>path/to/skel/directory</i></code>	Indicate an alternative skel directory to override the default <code>/etc/skel</code> .

6.20.3. MODULE SERVICES PROVIDED

Only the `session` service is supported.

6.20.4. RETURN VALUES

<code>PAM_BUF_ERR</code>	Memory buffer error.
<code>PAM_CRED_INSUFFICIENT</code>	Insufficient credentials to access authentication data.
<code>PAM_PERM_DENIED</code>	Not enough permissions to create the new directory or read the skel directory.
<code>PAM_USER_UNKNOWN</code>	User not known to the underlying authentication module.
<code>PAM_SUCCESS</code>	Environment variables were set.

6.20.5. EXAMPLES

A sample `/etc/pam.d/login` file:

```
auth      requisite pam_securetty.so
auth      sufficient pam_ldap.so
auth      required   pam_unix.so
auth      required   pam_nologin.so
account   sufficient pam_ldap.so
account   required   pam_unix.so
password  required   pam_unix.so
```

session	required	pam_mkhomedir.so	skel=/etc/skel/	umask=0022
session	required	pam_unix.so		
session	optional	pam_lastlog.so		
session	optional	pam_mail.so	standard	

6.20.6. AUTHOR

pam_mkhomedir was written by Jason Gunthorpe <jgg@debian.org>.

6.21. pam_motd - display the motd file

pam_motd.so [motd=*/path/filename*]

6.21.1. DESCRIPTION

pam_motd is a PAM module that can be used to display arbitrary motd (message of the day) files after a successful login. By default the `/etc/motd` file is shown. The message size is limited to 64KB.

6.21.2. OPTIONS

motd=*/path/filename* The */path/filename* file is displayed as message of the day.

6.21.3. MODULE SERVICES PROVIDED

Only the `session` service is supported.

6.21.4. RETURN VALUES

PAM_IGNORE This is the only return value of this module.
E

6.21.5. EXAMPLES

The suggested usage for `/etc/pam.d/login` is:

session optional pam_motd.so motd=/etc/motd

6.21.6. AUTHOR

pam_motd was written by Ben Collins <bcollins@debian.org>.

6.22. pam_namespace - setup a private namespace

```
pam_namespace.so [ debug ] [ unmnt_remnt ] [ unmnt_only ] [ require_selinux ] [ gen_hash ] [ ignore_config_error ] [ ignore_instance_parent_mode ] [ no_unmount_on_close ]
```

6.22.1. DESCRIPTION

The `pam_namespace` PAM module sets up a private namespace for a session with polyinstantiated directories. A polyinstantiated directory provides a different instance of itself based on user name, or when using SELinux, user name, security context or both. If an executable script `/etc/security/namespace.init` exists, it is used to initialize the namespace every time a new instance directory is setup. The script receives the polyinstantiated directory path and the instance directory path as its arguments.

The `pam_namespace` module disassociates the session namespace from the parent namespace. Any mounts/unmounts performed in the parent namespace, such as mounting of devices, are not reflected in the session namespace. To propagate selected mount/unmount events from the parent namespace into the disassociated session namespace, an administrator may use the special shared-subtree feature. For additional information on shared-subtree feature, please refer to the `mount(8)` man page and the shared-subtree description at <http://lwn.net/Articles/159077> and <http://lwn.net/Articles/159092>.

6.22.2. DESCRIPTION

This module allows setup of private namespaces with polyinstantiated directories. Directories can be polyinstantiated based on user name or, in the case of SELinux, user name, sensitivity level or complete security context. If an executable script `/etc/security/namespace.init` exists, it is used to initialize the namespace every time a new instance directory is setup. The script receives the polyinstantiated directory path and the instance directory path as its arguments.

The `/etc/security/namespace.conf` file specifies which directories are polyinstantiated, how they are polyinstantiated, how instance directories would be named, and any users for whom polyinstantiation would not be performed.

When someone logs in, the file `namespace.conf` is scanned where each non comment line represents one polyinstantiated directory with space separated fields as follows:

```
polydir instance_prefix method list_of_uids
```

The first field, *polydir*, is the absolute pathname of the directory to polystantiate. Special entry `$HOME` is supported to designate user's home directory. This field cannot be blank.

The second field, *instance_prefix* is the string prefix used to build the pathname for the instantiation of *<polydir>*. Depending on the polyinstantiation *method* it is then appended with "instance differentiation string" to generate the final instance directory path. This directory is created if it did not exist already, and is then bind mounted on the *<polydir>* to provide an instance of *<polydir>* based on the *<method>* column. The special string `$HOME` is replaced with the user's home directory, and `$USER` with the username. This field cannot be blank. The directory where polyinstantiated instances are to be created, must exist and must have, by default, the mode of `000`. The requirement that the instance parent be of mode `000` can be overridden with the command line option *ignore_instance_parent_mode*

The third field, *method*, is the method used for polyinstantiation. It can take 3 different values; "user" for polyinstantiation based on user name, "level" for polyinstantiation based on process MLS level and user name, and "context" for polyinstantiation based on process security context and user name. Methods "context" and "level" are only available with SELinux. This field cannot be blank.

The fourth field, *list_of_uids*, is a comma separated list of user names for whom the polyinstantiation is not performed. If left blank, polyinstantiation will be performed for all users.

In case of context or level polyinstantiation the SELinux context which is used for polyinstantiation is the context used for executing a new process as obtained by `getexeccon`. This context must be set by the calling application or `pam_selinux.so` module. If this context is not set the polyinstantiation will be based just on user name.

The "instance differentiation string" is `<user name>` for "user" method and `<user name>_<raw directory context>` for "context" and "level" methods. If the whole string is too long the end of it is replaced with md5sum of itself. Also when command line option `gen_hash` is used the whole string is replaced with md5sum of itself.

6.22.3. OPTIONS

<code>debug</code>	A lot of debug information is logged using syslog
<code>unmnt_remnt</code>	For programs such as <code>su</code> and <code>newrole</code> , the login session has already setup a polyinstantiated namespace. For these programs, polyinstantiation is performed based on new user id or security context, however the command first needs to undo the polyinstantiation performed by login. This argument instructs the command to first undo previous polyinstantiation before proceeding with new polyinstantiation based on new id/context
<code>unmnt_only</code>	For trusted programs that want to undo any existing bind mounts and process instance directories on their own, this argument allows them to unmount currently mounted instance directories
<code>require_selinux</code>	If selinux is not enabled, return failure
<code>gen_hash</code>	Instead of using the security context string for the instance name, generate and use its md5 hash.
<code>ignore_config_error</code>	If a line in the configuration file corresponding to a polyinstantiated directory contains format error, skip that line process the next line. Without this option, pam will return an error to the calling program resulting in termination of the session.
<code>ignore_instance_parent_mode</code>	Instance parent directories by default are expected to have the restrictive mode of 000. Using this option, an administrator can choose to ignore the mode of the instance parent. This option should be used with caution as it will reduce security and isolation goals of the polyinstantiation mechanism.
<code>no_unmount_on_close</code>	For certain trusted programs such as <code>newrole</code> , open session is called from a child process while the parent performs close session and pam end functions. For these commands use this option to instruct <code>pam_close_session</code> to not unmount the bind mounted polyinstantiated directory in the parent.

6.22.4. MODULE SERVICES PROVIDED

The `session` service is supported.

6.22.5. RETURN VALUES

PAM_SUCCESS	Namespace setup was successful.
PAM_SERVICE_ERR	Unexpected system error occurred while setting up namespace.
PAM_SESSION_ERR	Unexpected namespace configuration error occurred.

6.22.6. FILES

/etc/security/namespace.conf	Configuration file
------------------------------	--------------------

6.22.7. EXAMPLES

These are some example lines which might be specified in `/etc/security/namespace.conf`.

```
# The following three lines will polyinstantiate /tmp,
# /var/tmp and user's home directories. /tmp and /var/tmp
# will be polyinstantiated based on the security level
# as well as user name, whereas home directory will be
# polyinstantiated based on the full security context and user name.
# Polyinstantiation will not be performed for user root
# and adm for directories /tmp and /var/tmp, whereas home
# directories will be polyinstantiated for all users.
#
# Note that instance directories do not have to reside inside
# the polyinstantiated directory. In the examples below,
# instances of /tmp will be created in /tmp-inst directory,
# where as instances of /var/tmp and users home directories
# will reside within the directories that are being
# polyinstantiated.
#
/tmp /tmp-inst/ level root,adm
/var/tmp /var/tmp/tmp-inst/ level root,adm
$HOME $HOME/$USER.inst/inst- context
```

For the `<service>s` you need polyinstantiation (login for example) put the following line in `/etc/pam.d/<service>` as the last line for session group:

```
session required pam_namespace.so [arguments]
```

This module also depends on `pam_selinux.so` setting the context.

6.22.8. AUTHORS

The namespace setup scheme was designed by Stephen Smalley, Janak Desai and Chad Sellers. The `pam_namespace` PAM module was developed by Janak Desai `<janak@us.ibm.com>`, Chad Sellers `<csellers@tresys.com>` and Steve Grubb `<sgrubb@redhat.com>`.

6.23. pam_nologin - prevent non-root users

from login

```
pam_nologin.so [ file=/path/nologin ] [ successok ]
```

6.23.1. DESCRIPTION

pam_nologin is a PAM module that prevents users from logging into the system when `/etc/nologin` exists. The contents of the `/etc/nologin` file are displayed to the user. The pam_nologin module has no effect on the root user's ability to log in.

6.23.2. OPTIONS

<code>file=/path/nologin</code>	Use this file instead the default <code>/etc/nologin</code> .
<code>successok</code>	Return <code>PAM_SUCCESS</code> if no file exists, the default is <code>PAM_IGNORE</code> .

6.23.3. MODULE SERVICES PROVIDED

The `auth` and `acct` services are supported.

6.23.4. RETURN VALUES

<code>PAM_AUTH_ERR</code>	The user is not root and <code>/etc/nologin</code> exists, so the user is not permitted to log in.
<code>PAM_BUF_ERR</code>	Memory buffer error.
<code>PAM_IGNORE</code>	This is the default return value.
<code>PAM_SUCCESS</code>	Success: either the user is root or the <code>/etc/nologin</code> file does not exist.
<code>PAM_USER_UNKNOWN</code>	User not known to the underlying authentication module.

6.23.5. EXAMPLES

The suggested usage for `/etc/pam.d/login` is:

```
auth required pam_nologin.so
```

6.23.6. AUTHOR

pam_nologin was written by Michael K. Johnson <johnsonm@redhat.com>.

6.24. pam_permit - the promiscuous module

```
pam_permit.so
```

6.24.1. DESCRIPTION

`pam_permit` is a PAM module that always permit access. It does nothing else.

In the case of authentication, the user's name will be set to *nobody* if the application didn't set one. Many applications and PAM modules become confused if this name is unknown.

This module is very dangerous. It should be used with extreme caution.

6.24.2. OPTIONS

This module does not recognise any options.

6.24.3. MODULE SERVICES PROVIDED

The services `auth`, `account`, `password` and `session` are supported.

6.24.4. RETURN VALUES

`PAM_SUCCESS` This module always returns this value.
S

6.24.5. EXAMPLES

Add this line to your other login entries to disable account management, but continue to permit users to log in.

```
account    required    pam_permit.so
```

6.24.6. AUTHOR

`pam_permit` was written by Andrew G. Morgan, <morgan@kernel.org>.

6.25. `pam_rhosts` - grant access using `.rhosts` file

```
pam_rhosts.so
```

6.25.1. DESCRIPTION

This module performs the standard network authentication for services, as used by traditional implementations of **rlogin** and **rsh** etc.

The authentication mechanism of this module is based on the contents of two files; `/etc/hosts.equiv` (or `and ~/.rhosts`). Firstly, hosts listed in the former file are treated as equivalent to the localhost. Secondly, entries in the user's own copy of the latter file is used to map "*remote-host remote-user*" pairs to that user's account on the current host. Access is granted to the user if their host is present in `/etc/hosts.equiv` and their remote account is identical to their local one, or if their remote account has an entry in their personal configuration file.

The module authenticates a remote user (internally specified by the item *PAM_RUSER* connecting from the remote host (internally specified by the item **PAM_RHOST**). Accordingly, for applications to be compatible this authentication module they must set these items prior to calling `pam_authenticate()`. The module is not capable of independently probing the network connection for such information.

6.25.2. OPTIONS

<code>debug</code>	Print debug information.
<code>silent</code>	Don't print informative messages.
<code>superuser=account</code>	Handle <i>account</i> as root.

6.25.3. MODULE SERVICES PROVIDED

Only the `auth` service is supported.

6.25.4. RETURN VALUES

<code>PAM_AUTH_ERR</code>	The remote host, remote user name or the local user name couldn't be determined or access was denied by <code>.rhosts</code> file.
<code>PAM_USER_UNKNOWN</code>	User is not known to system.

6.25.5. EXAMPLES

To grant a remote user access by `/etc/hosts.equiv` or `.rhosts` for **rsh** add the following lines to `/etc/pam.d/rsh`:

```
##PAM-1.0
#
auth      required      pam_rhosts.so
auth      required      pam_nologin.so
auth      required      pam_env.so
auth      required      pam_unix.so
```

6.25.6. AUTHOR

`pam_rhosts` was written by Thorsten Kukuk <kukuk@thkukuk.de>

6.26. pam_rootok - gain only root access

`pam_rootok.so [debug]`

6.26.1. DESCRIPTION

`pam_rootok` is a PAM module that authenticates the user if their *UID* is 0. Applications that are created

setuid-root generally retain the *UID* of the user but run with the authority of an enhanced effective-UID. It is the real *UID* that is checked.

6.26.2. OPTIONS

debug	Print debug information.
-------	--------------------------

6.26.3. MODULE SERVICES PROVIDED

Only the `auth` service is supported.

6.26.4. RETURN VALUES

PAM_SUCCESS	The <i>UID</i> is 0.
PAM_AUTH_E RR	The <i>UID</i> is <i>not</i> 0.

6.26.5. EXAMPLES

In the case of the `su(1)` application the historical usage is to permit the superuser to adopt the identity of a lesser user without the use of a password. To obtain this behavior with PAM the following pair of lines are needed for the corresponding entry in the `/etc/pam.d/su` configuration file:

```
# su authentication. Root is granted access by default.
auth    sufficient    pam_rootok.so
auth    required      pam_unix.so
```

6.26.6. AUTHOR

`pam_rootok` was written by Andrew G. Morgan, <morgan@kernel.org>.

6.27. pam_securetty - limit root login to special devices

```
pam_securetty.so [ debug ]
```

6.27.1. DESCRIPTION

`pam_securetty` is a PAM module that allows root logins only if the user is logging in on a "secure" tty, as defined by the listing in `/etc/securetty`. `pam_securetty` also checks to make sure that `/etc/securetty` is a plain file and not world writable.

This module has no effect on non-root users and requires that the application fills in the `PAM_TTY` item correctly.

For canonical usage, should be listed as a *required* authentication method before any *sufficient* authentication methods.

6.27.2. OPTIONS

<code>debug</code>	Print debug information.
--------------------	--------------------------

6.27.3. MODULE SERVICES PROVIDED

Only the `auth` service is supported.

6.27.4. RETURN VALUES

<code>PAM_SUCCESS</code>	The user is allowed to continue authentication. Either the user is not root, or the root user is trying to log in on an acceptable device.
<code>PAM_AUTH_ERR</code>	Authentication is rejected. Either root is attempting to log in via an unacceptable device, or the <code>/etc/securetty</code> file is world writable or not a normal file.
<code>PAM_INCOMPLETE</code>	An application error occurred. <code>pam_securetty</code> was not able to get information it required from the application that called it.
<code>PAM_SERVICE_ERR</code>	An error occurred while the module was determining the user's name or tty, or the module could not open <code>/etc/securetty</code> .
<code>PAM_IGNORE</code>	The module could not find the user name in the <code>/etc/passwd</code> file to verify whether the user had a UID of 0. Therefore, the results of running this module are ignored.

6.27.5. EXAMPLES

```
auth required pam_securetty.so
auth required pam_unix.so
```

6.27.6. AUTHOR

`pam_securetty` was written by Elliot Lee <sopwith@cuc.edu>.

6.28. pam_selinux - set the default security context

```
pam_selinux.so [ close ] [ debug ] [ open ] [ nottys ] [ verbose ] [ select_context ] [ use_current_range ]
```

6.28.1. DESCRIPTION

In a nutshell, `pam_selinux` sets up the default security context for the next `execed` shell.

When an application opens a session using `pam_selinux`, the shell that gets executed will be run in the default security context, or if the user chooses and the pam file allows the selected security context. Also the controlling tty will have its security context modified to match the users.

Adding `pam_selinux` into a pam file could cause other pam modules to change their behavior if the exec another application. The `close` and `open` option help mitigate this problem. `close` option will only cause the close portion of the `pam_selinux` to execute, and `open` will only cause the open portion to run. You can add `pam_selinux` to the config file twice. Add the `pam_selinux close` as the executes the open pass through the modules, `pam_selinux open_session` will happen last. When PAM executes the close pass through the modules `pam_selinux close_session` will happen first.

6.28.2. OPTIONS

<code>close</code>	Only execute the <code>close_session</code> portion of the module.
<code>debug</code>	Turns on debugging via <code>syslog(3)</code> .
<code>open</code>	Only execute the <code>open_session</code> portion of the module.
<code>nottys</code>	Do not try to setup the ttys security context.
<code>verbose</code>	attempt to inform the user when security context is set.
<code>select_context</code>	Attempt to ask the user for a custom security context role. If MLS is on ask also for sensitivity level.
<code>use_current_range</code>	Use the sensitivity range of the process for the user context. This option and the <code>select_context</code> option are mutually exclusive.

6.28.3. MODULE SERVICES PROVIDED

Only the `session` service is supported.

6.28.4. RETURN VALUES

<code>PAM_AUTH_ERR</code>	Unable to get or set a valid context.
<code>PAM_SUCCESS</code>	The security context was set successful.
<code>PAM_USER_UNKNOWN</code>	The user is not known to the system.

6.28.5. EXAMPLES

```
auth    required pam_unix.so
session required pam_permit.so
session optional pam_selinux.so
```

6.28.6. AUTHOR

`pam_selinux` was written by Dan Walsh <dwalsh@redhat.com>.

6.29. `pam_shells` - check for valid login shell

`pam_shells.so`

6.29.1. DESCRIPTION

`pam_shells` is a PAM module that only allows access to the system if the users shell is listed in `/etc/shells`.

It also checks if `/etc/shells` is a plain file and not world writable.

6.29.2. OPTIONS

This module does not recognise any options.

6.29.3. MODULE SERVICES PROVIDED

The services `auth` and `account` are supported.

6.29.4. RETURN VALUES

<code>PAM_AUTH_ERR</code>	Access to the system was denied.
<code>PAM_SUCCESS</code>	The users login shell was listed as valid shell in <code>/etc/shells</code> .
<code>PAM_SERVICE_ERR</code>	The module was not able to get the name of the user.

6.29.5. EXAMPLES

```
auth required pam_shells.so
```

6.29.6. AUTHOR

`pam_shells` was written by Erik Troan <ewt@redhat.com>.

6.30. `pam_succeed_if` - test account characteristics

`pam_succeed_if.so` [*flag...*] [*condition...*]

6.30.1. DESCRIPTION

`pam_succeed_if.so` is designed to succeed or fail authentication based on characteristics of the account

belonging to the user being authenticated. One use is to select whether to load other modules based on this test.

The module should be given one or more conditions as module arguments, and authentication will succeed only if all of the conditions are met.

6.30.2. OPTIONS

The following *flags* are supported:

<code>debug</code>	Turns on debugging messages sent to syslog.
<code>use_uid</code>	Evaluate conditions using the account of the user whose UID the application is running under instead of the user being authenticated.
<code>quiet</code>	Don't log failure or success to the system log.
<code>quiet_fail</code>	Don't log failure to the system log.
<code>quiet_success</code>	Don't log success to the system log.

Conditions are three words: a field, a test, and a value to test for.

Available fields are *user*, *uid*, *gid*, *shell*, *home* and *service*:

<code>field < number</code>	Field has a value numerically less than number.
<code>field <= number</code>	Field has a value numerically less than or equal to number.
<code>field eq number</code>	Field has a value numerically less equal to number.
<code>field >= number</code>	Field has a value numerically greater than or equal to number.
<code>field > number</code>	Field has a value numerically greater than number.
<code>field ne number</code>	Field has a value numerically different from number.
<code>field = string</code>	Field exactly matches the given string.
<code>field != string</code>	Field does not match the given string.
<code>field =~ glob</code>	Field matches the given glob.
<code>field !~ glob</code>	Field does not match the given glob.
<code>field in item:item:...</code>	Field is contained in the list of items separated by colons.
<code>field notin item:item:...</code>	Field is not contained in the list of items separated by colons.
<code>user ingroup group</code>	User is in given group.
<code>user notingroup group</code>	User is not in given group.
<code>user innetgr netgroup</code>	(user,host) is in given netgroup.
<code>user notinnetgr group</code>	(user,host) is not in given netgroup.

6.30.3. MODULE SERVICES PROVIDED

All services are supported.

6.30.4. RETURN VALUES

PAM_SUCCESS	The condition was true.
PAM_AUTH_ERR	The condition was false.
PAM_SERVICE_ERR	A service error occurred or the arguments can't be parsed as numbers.

6.30.5. EXAMPLES

To emulate the behaviour of *pam_wheel*, except there is no fallback to group 0:

```
auth required pam_succeed_if.so quiet user ingroup wheel
```

Given that the type matches, only loads the othermodule rule if the UID is over 500. Adjust the number after default to skip several rules.

```
type [default=1 success=ignore] pam_succeed_if.so quiet uid > 500
type required othermodule.so arguments...
```

6.30.6. AUTHOR

Nalin Dahyabhai <nalin@redhat.com>

6.31. pam_tally - login counter (tallying) module

```
pam_tally.so [ file=/path/to/counter ] [ onerr=[fail|succeed] ] [ magic_root ] [
even_deny_root_account ] [ deny=n ] [ lock_time=n ] [ unlock_time=n ] [ per_user ] [ no_lock_time ] [
no_reset ] [ audit ]
```

```
pam_tally [ --file /path/to/counter ] [ --user username ] [ --reset[=n] ] [ --quiet ]
```

6.31.1. DESCRIPTION

This module maintains a count of attempted accesses, can reset count on success, can deny access if too many attempts fail.

pam_tally comes in two parts: *pam_tally.so* and **pam_tally**. The former is the PAM module and the latter, a stand-alone program. **pam_tally** is an (optional) application which can be used to interrogate and manipulate the counter file. It can display users' counts, set individual counts, or clear all counts. Setting artificially high counts may be useful for blocking users without changing their passwords. For example, one might find it useful to clear all counts every midnight from a cron job. The `faillog(8)` command can

be used instead of `pam_tally` to maintain the counter file.

Normally, failed attempts to access *root* will *not* cause the root account to become blocked, to prevent denial-of-service: if your users aren't given shell accounts and root may only login via **su** or at the machine console (not telnet/rsh, etc), this is safe.

6.31.2. OPTIONS

GLOBAL OPTIONS

This can be used for *auth* and *account* services.

<code>onerr=[fail succeed]</code>	If something weird happens (like unable to open the file), return with <code>PAM_SUCESS</code> if <code>onerr=succeed</code> is given, else with the corresponding PAM error code.
<code>file=/path/to/counter</code>	File where to keep counts. Default is <code>/var/log/faillog</code> .
<code>audit</code>	Will display the username typed if the user is not found.

AUTH OPTIONS

Authentication phase first checks if user should be denied access and if not it increments attempted login counter. Then on call to `pam_setcred(3)` it resets the attempts counter.

<code>deny=n</code>	Deny access if tally for this user exceeds <i>n</i> .
<code>lock_time=n</code>	Always deny for <i>n</i> seconds after failed attempt.
<code>unlock_time=n</code>	Allow access after <i>n</i> seconds after failed attempt. If this option is used the user will be locked out for the specified amount of time after he exceeded his maximum allowed attempts. Otherwise the account is locked until the lock is removed by a manual intervention of the system administrator.
<code>magic_root</code>	If the module is invoked by a user with <code>uid=0</code> the counter is not incremented. The sys-admin should use this for user launched services, like su , otherwise this argument should be omitted.

no_lock_time	Do not use the .fail_locktime field in /var/log/faillog for this user.
no_reset	Don't reset count on successful entry, only decrement.
even_deny_root_account	Root account can become unavailable.
even_deny_root_account	Root account can become unavailable.
per_user	If /var/log/faillog contains a non-zero .fail_max/fail_locktime field for this user then use it instead of deny=n/lock_time=n parameter.
no_lock_time	Don't use .fail_locktime field in /var/log/faillog for this user.

ACCOUNT OPTIONS

Account phase resets attempts counter if the user is *not* magic root. This phase can be used optionally for services which don't call pam_setcred(3) correctly or if the reset should be done regardless of the failure of the account phase of other modules.

magic_root	If the module is invoked by a user with uid=0 the counter is not incremented. The sys-admin should use this for user launched services, like su , otherwise this argument should be omitted.
no_reset	Don't reset count on successful entry, only decrement.

6.31.3. MODULE SERVICES PROVIDED

The auth and account services are supported.

6.31.4. RETURN VALUES

PAM_AUTH_ERR	A invalid option was given, the module was not able to retrieve the user name, no valid counter file was found, or too many failed logins.
--------------	--------------------------------------------------------------------------------------------------------------------------------------------

PAM_SUCCESS	Everything was successful.
PAM_USER_UNKNOWN	User not known.

6.31.5. EXAMPLES

Add the following line to `/etc/pam.d/login` to lock the account after too many failed logins. The number of allowed fails is specified by `/var/log/faillog` and needs to be set with `pam_tally` or `faillog(8)` before.

auth	required	pam_securetty.so
auth	required	pam_tally.so per_user
auth	required	pam_env.so
auth	required	pam_unix.so
auth	required	pam_nologin.so
account	required	pam_unix.so
password	required	pam_unix.so
session	required	pam_limits.so
session	required	pam_unix.so
session	required	pam_lastlog.so nowtmp
session	optional	pam_mail.so standard

6.31.6. AUTHOR

`pam_tally` was written by Tim Baverstock and Tomas Mraz.

6.32. pam_time - time controlled access

`pam_time.so`

6.32.1. DESCRIPTION

The `pam_time` PAM module does not authenticate the user, but instead it restricts access to a system and or specific applications at various times of the day and on specific days or over various terminal lines. This module can be configured to deny access to (individual) users based on their name, the time of day, the day of week, the service they are applying for and their terminal from which they are making their request.

By default rules for time/port access are taken from config file `/etc/security/time.conf`.

6.32.2. DESCRIPTION

The `pam_time` PAM module does not authenticate the user, but instead it restricts access to a system and or specific applications at various times of the day and on specific days or over various terminal lines. This module can be configured to deny access to (individual) users based on their name, the time of day, the day of week, the service they are applying for and their terminal from which they are making their request.

For this module to function correctly there must be a correctly formatted `/etc/security/time.conf` file present. White spaces are ignored and lines maybe extended with `\` (escaped newlines). Text following a `#` is ignored to the end of the line.

The syntax of the lines is as follows:

```
services;ttys;users;times
```

In words, each rule occupies a line, terminated with a newline or the beginning of a comment; a '#'. It contains four fields separated with semicolons, ';'.

The first field, the *services* field, is a logic list of PAM service names that the rule applies to.

The second field, the *tty* field, is a logic list of terminal names that this rule applies to.

The third field, the *users* field, is a logic list of users or a netgroup of users to whom this rule applies.

For these items the simple wildcard '*' may be used only once. With netgroups no wildcards or logic operators are allowed.

The *times* field is used to indicate the times at which this rule applies. The format here is a logic list of day/time-range entries. The days are specified by a sequence of two character entries, MoTuSa for example is Monday Tuesday and Saturday. Note that repeated days are unset MoMo = no day, and MoWk = all weekdays bar Monday. The two character combinations accepted are Mo Tu We Th Fr Sa Su Wk Wd Al, the last two being week-end days and all 7 days of the week respectively. As a final example, AlFr means all days except Friday.

Each day/time-range can be prefixed with a '!' to indicate "anything but". The time-range part is two 24-hour times HHMM, separated by a hyphen, indicating the start and finish time (if the finish time is smaller than the start time it is deemed to apply on the following day).

For a rule to be active, ALL of service+ttys+users must be satisfied by the applying process.

Note, currently there is no daemon enforcing the end of a session. This needs to be remedied.

Poorly formatted rules are logged as errors using syslog(3).

6.32.3. OPTIONS

This module does not recognise any options.

6.32.4. MODULE SERVICES PROVIDED

Only the `account` service is supported.

6.32.5. RETURN VALUES

PAM_SUCCESS	Access was granted.
PAM_ABORT	Not all relevant data could be gotten.
PAM_BUF_ERR	Memory buffer error.
PAM_PERM_DENIED	Access was not granted.
PAM_USER_UNKNOWN	The user is not known to the system.

6.32.6. FILES

`/etc/security/time.conf` Default configuration file

6.32.7. EXAMPLES

These are some example lines which might be specified in `/etc/security/time.conf`.

All users except for *root* are denied access to console-login at all times:

```
login ; tty* & !ttyp* ; !root ; !A10000-2400
```

Games (configured to use PAM) are only to be accessed out of working hours. This rule does not apply to the user *waster*:

```
games ; * ; !waster ; Wd0000-2400 | Wk1800-0800
```

6.32.8. AUTHOR

`pam_time` was written by Andrew G. Morgan <morgan@kernel.org>.

6.33. pam_umask - set the file mode creation mask

```
pam_umask.so [ debug ] [ silent ] [ usergroups ] [ umask=mask ]
```

6.33.1. DESCRIPTION

`pam_umask` is a PAM module to set the file mode creation mask of the current environment. The `umask` affects the default permissions assigned to newly created files.

The PAM module tries to get the `umask` value from the following places in the following order:

- `umask=` argument
- `umask=` entry of the users GECOS field
- `pri=` entry of the users GECOS field
- `ulimit=` entry of the users GECOS field
- `UMASK=` entry from `/etc/default/login`
- `UMASK` entry from `/etc/login.defs`

6.33.2. OPTIONS

<code>debug</code>	Print debug information.
<code>silent</code>	Don't print informative messages.
<code>usergroups</code>	If the user is not root, and the user ID is equal to the group ID, and the username is the same as primary group name, the umask group bits are set to be the same as owner bits (examples: 022 -> 002, 077 -> 007).
<code>umask=mask</code>	Sets the calling process's file mode creation mask (umask) to mask & 0777. The value is interpreted as Octal.

6.33.3. MODULE SERVICES PROVIDED

Only the `session` service is supported.

6.33.4. RETURN VALUES

<code>PAM_SUCCESS</code>	The new umask was set successfull.
<code>PAM_SERVICE_ERR</code>	No username was given.
<code>PAM_USER_UNKNO</code> <code>WN</code>	User not known.

6.33.5. EXAMPLES

Add the following line to `/etc/pam.d/login` to set the user specific umask at login:

```
session optional pam_umask.so umask=0022
```

6.33.6. AUTHOR

`pam_umask` was written by Thorsten Kukuk <kukuk@thkukuk.de>.

6.34. pam_unix - traditional password authentication

```
pam_unix.so [ ... ]
```

6.34.1. DESCRIPTION

This is the standard Unix authentication module. It uses standard calls from the system's libraries to retrieve and set account information as well as authentication. Usually this is obtained from the `/etc/passwd` and the `/etc/shadow` file as well if shadow is enabled.

The account component performs the task of establishing the status of the user's account and password based on the following *shadow* elements: `expire`, `last_change`, `max_change`, `min_change`, `warn_change`.

In the case of the latter, it may offer advice to the user on changing their password or, through the *PAM_AUTHTOKEN_REQD* return, delay giving service to the user until they have established a new password. The entries listed above are documented in the *shadow(5)* manual page. Should the user's record not contain one or more of these entries, the corresponding *shadow* check is not performed.

The authentication component performs the task of checking the users credentials (password). The default action of this module is to not permit the user access to a service if their official password is blank.

A helper binary, *unix_chkpwd(8)*, is provided to check the user's password when it is stored in a read protected database. This binary is very simple and will only check the password of the user invoking it. It is called transparently on behalf of the user by the authenticating component of this module. In this way it is possible for applications like *xlock(1)* to work without being *setuid-root*. The module, by default, will temporarily turn off *SIGCHLD* handling for the duration of execution of the helper binary. This is generally the right thing to do, as many applications are not prepared to handle this signal from a child they didn't know was *fork()*d. The *noreap* module argument can be used to suppress this temporary shielding and may be needed for use with certain applications.

The password component of this module performs the task of updating the user's password.

The session component of this module logs when a user logs in or leave the system.

Remaining arguments, supported by others functions of this module, are silently ignored. Other arguments are logged as errors through *syslog(3)*.

6.34.2. OPTIONS

<code>debug</code>	Turns on debugging via <i>syslog(3)</i> .
<code>audit</code>	A little more extreme than <i>debug</i> .
<code>nullok</code>	The default action of this module is to not permit the user access to a service if their official password is blank. The <i>nullok</i> argument overrides this default.
<code>try_first_pass</code>	Before prompting the user for their password, the module first tries the previous stacked module's password in case that satisfies this module as well.
<code>use_first_pass</code>	The argument <i>use_first_pass</i> forces the module to use a previous stacked modules password and will never prompt the user - if no password is available or the password is not appropriate, the user will be denied access.
<code>nodelay</code>	This argument can be used to discourage the authentication component from requesting a delay should the authentication as a whole fail. The default action is for the module to request a delay-on-failure of the order of two second.
<code>use_authtok</code>	When password changing enforce the module to set the new password to the one provided by a previously stacked password module (this is used in the example of the stacking of the <i>pam_cracklib</i> module documented above).
<code>not_set_pass</code>	This argument is used to inform the module that it is not to pay attention to/make available the old or new passwords from/to other (stacked) password modules.
<code>nis</code>	NIS RPC is used for setting new passwords.

<code>remember=n</code>	The last <i>n</i> passwords for each user are saved in <code>/etc/security/opasswd</code> in order to force password change history and keep the user from alternating between the same password too frequently.
<code>shadow</code>	Try to maintain a shadow based system.
<code>md5</code>	When a user changes their password next, encrypt it with the MD5 algorithm.
<code>bigcrypt</code>	When a user changes their password next, encrypt it with the DEC C2 algorithm.
<code>broken_shadow</code>	Ignore errors reading shadow information for users in the account management module.

Invalid arguments are logged with `syslog(3)`.

6.34.3. MODULE SERVICES PROVIDED

All service are supported.

6.34.4. RETURN VALUES

`PAM_IGNORE` Ignore this module.
`E`

6.34.5. EXAMPLES

An example usage for `/etc/pam.d/login` would be:

```
# Authenticate the user
auth      required    pam_unix.so
# Ensure users account and password are still active
account   required    pam_unix.so
# Change the users password, but at first check the strength
# with pam_cracklib(8)
password  required    pam_cracklib.so retry=3 minlen=6 difok=3
password  required    pam_unix.so use_authtok nullok md5
session   required    pam_unix.so
```

6.34.6. AUTHOR

`pam_unix` was written by various people.

6.35. `pam_userdb` - authenticate against a db database

```
pam_userdb.so db=path/database [ debug ] [ crypt=[crypt|none] ] [ icase ] [ dump ] [
try_first_pass ] [ use_first_pass ] [ unknown_ok ] [ key_only ]
```

6.35.1. DESCRIPTION

The `pam_userdb` module is used to verify a username/password pair against values stored in a Berkeley DB database. The database is indexed by the username, and the data fields corresponding to the username keys are the passwords.

6.35.2. OPTIONS

<code>crypt=[crypt none]</code>	Indicates whether encrypted or plaintext passwords are stored in the database. If it is <code>crypt</code> , passwords should be stored in the database in <code>crypt(3)</code> form. If <code>none</code> is selected, passwords should be stored in the database as plaintext.
<code>db=/path/database</code>	Use the <code>/path/database</code> database for performing lookup. There is no default; the module will return <code>PAM_IGNORE</code> if no database is provided.
<code>debug</code>	Print debug information.
<code>dump</code>	Dump all the entries in the database to the log. Don't do this by default!
<code>icase</code>	Make the password verification to be case insensitive (ie when working with registration numbers and such). Only works with plaintext password storage.
<code>try_first_pass</code>	Use the authentication token previously obtained by another module that did the conversation with the application. If this token can not be obtained then the module will try to converse. This option can be used for stacking different modules that need to deal with the authentication tokens.
<code>use_first_pass</code>	Use the authentication token previously obtained by another module that did the conversation with the application. If this token can not be obtained then the module will fail. This option can be used for stacking different modules that need to deal with the authentication tokens.
<code>unknown_ok</code>	Do not return error when checking for a user that is not in the database. This can be used to stack more than one <code>pam_userdb</code> module that will check a username/password pair in more than a database.
<code>key_only</code>	The username and password are concatenated together in the database hash as 'username-password' with a random value. if the concatenation of the username and password with a dash in the middle returns any result, the user is valid. this is useful in cases where the username may not be unique but the username and password pair are.

6.35.3. MODULE SERVICES PROVIDED

The services `auth` and `account` are supported.

6.35.4. RETURN VALUES

PAM_AUTH_ERR	Authentication failure.
PAM_AUTHTOK_RECOVERY_ERR	Authentication information cannot be recovered.
PAM_BUF_ERR	Memory buffer error.
PAM_CONV_ERR	Conversation failure.
PAM_SERVICE_ERR	Error in service module.
PAM_SUCCESS	Success.
PAM_USER_UNKNOWN	User not known to the underlying authentication module.

6.35.5. EXAMPLES

```
auth sufficient pam_userdb.so icase db=/etc/dbtest.db
```

6.35.6. AUTHOR

pam_userdb was written by Cristian Gafton <gafton@redhat.com>.

6.36. pam_warn - logs all PAM items

```
pam_warn.so
```

6.36.1. DESCRIPTION

pam_warn is a PAM module that logs the service, terminal, user, remote user and remote host to syslog(3). The items are not probed for, but instead obtained from the standard PAM items. The module always returns *PAM_IGNORE*, indicating that it does not want to affect the authentication process.

6.36.2. OPTIONS

This module does not recognise any options.

6.36.3. MODULE SERVICES PROVIDED

The services `auth`, `account`, `password` and `session` are supported.

6.36.4. RETURN VALUES

PAM_IGNORE This module always returns *PAM_IGNORE*.

6.36.5. EXAMPLES

```
##PAM-1.0
```

```
#
# If we don't have config entries for a service, the
# OTHER entries are used. To be secure, warn and deny
# access to everything.
other auth      required      pam_warn.so
other auth      required      pam_deny.so
other account   required      pam_warn.so
other account   required      pam_deny.so
other password  required      pam_warn.so
other password  required      pam_deny.so
other session   required      pam_warn.so
other session   required      pam_deny.so
```

6.36.6. AUTHOR

pam_warn was written by Andrew G. Morgan <morgan@kernel.org>.

6.37. pam_wheel - only permit root access to members of group wheel

```
pam_wheel.so [ debug ] [ deny ] [ group=name ] [ root_only ] [ trust ] [ use_uid ]
```

6.37.1. DESCRIPTION

The pam_wheel PAM module is used to enforce the so-called *wheel* group. By default it permits root access to the system if the applicant user is a member of the *wheel* group. If no group with this name exist, the module is using the group with the group-ID 0.

6.37.2. OPTIONS

debug	Print debug information.
deny	Reverse the sense of the auth operation: if the user is trying to get UID 0 access and is a member of the wheel group (or the group of the group option), deny access. Conversely, if the user is not in the group, return PAM_IGNORE (unless trust was also specified, in which case we return PAM_SUCCESS).
group= <i>name</i>	Instead of checking the wheel or GID 0 groups, use the <i>name</i> group to perform the authentication.
root_only	The check for wheel membership is done only.
trust	The pam_wheel module will return PAM_SUCCESS instead of PAM_IGNORE if the user is a member of the wheel group (thus with a little play stacking the modules the wheel members may be able to su to root without being prompted for a passwd).
use_uid	The check for wheel membership will be done against the current uid instead of the original one (useful when jumping with su from one account to another for example).

6.37.3. MODULE SERVICES PROVIDED

The *auth* and *account* services are supported.

6.37.4. RETURN VALUES

PAM_AUTH_ERR	Authentication failure.
PAM_BUF_ERR	Memory buffer error.
PAM_IGNORE	The return value should be ignored by PAM dispatch.
PAM_PERM_DENIED	Permission denied.
PAM_SERVICE_ERR	Cannot determine the user name.
PAM_SUCCESS	Success.
PAM_USER_UNKNOWN	User not known.

6.37.5. EXAMPLES

The root account gains access by default (rootok), only wheel members can become root (wheel) but Unix authenticate non-root applicants.

su	auth	sufficient	pam_rootok.so
su	auth	required	pam_wheel.so
su	auth	required	pam_unix.so

6.37.6. AUTHOR

pam_wheel was written by Cristian Gafton <gafton@redhat.com>.

6.38. pam_xauth - forward xauth keys between users

```
pam_xauth.so [ debug ] [ xauthpath=/path/to/xauth ] [ systemuser=UID ] [ targetuser=UID ]
```

6.38.1. DESCRIPTION

The pam_xauth PAM module is designed to forward xauth keys (sometimes referred to as "cookies") between users.

Without pam_xauth, when xauth is enabled and a user uses the su(1) command to assume another user's privileges, that user is no longer able to access the original user's X display because the new user does not have the key needed to access the display. pam_xauth solves the problem by forwarding the key from the user running su (the source user) to the user whose identity the source user is assuming (the target user) when the session is created, and destroying the key when the session is torn down.

This means, for example, that when you run su(1) from an xterm session, you will be able to run X pro-

grams without explicitly dealing with the `xauth(1)` `xauth` command or `~/.Xauthority` files.

`pam_xauth` will only forward keys if `xauth` can list a key connected to the `$DISPLAY` environment variable.

Primitive access control is provided by `~/.xauth/export` in the invoking user's home directory and `~/.xauth/import` in the target user's home directory.

If a user has a `~/.xauth/import` file, the user will only receive cookies from users listed in the file. If there is no `~/.xauth/import` file, the user will accept cookies from any other user.

If a user has a `.xauth/export` file, the user will only forward cookies to users listed in the file. If there is no `~/.xauth/export` file, and the invoking user is not *root*, the user will forward cookies to any other user. If there is no `~/.xauth/export` file, and the invoking user is *root*, the user will *not* forward cookies to other users.

Both the import and export files support wildcards (such as `*`). Both the import and export files can be empty, signifying that no users are allowed.

6.38.2. OPTIONS

<code>debug</code>	Print debug information.
<code>xauthpath=/path/to/xauth</code>	Specify the path the <code>xauth</code> program (it is expected in <code>/usr/X11R6/bin/xauth</code> , <code>/usr/bin/xauth</code> , or <code>/usr/bin/X11/xauth</code> by default).
<code>systemuser=UID</code>	Specify the highest UID which will be assumed to belong to a "system" user. <code>pam_xauth</code> will refuse to forward credentials to users with UID less than or equal to this number, except for <i>root</i> and the "targetuser", if specified.
<code>targetuser=UID</code>	Specify a single target UID which is exempt from the <code>systemuser</code> check.

6.38.3. MODULE SERVICES PROVIDED

Only the *session* service is supported.

6.38.4. RETURN VALUES

<code>PAM_BUF_ERR</code>	Memory buffer error.
<code>PAM_PERM_DENIED</code>	Permission denied by import/export file.
<code>PAM_SESSION_ERR</code>	Cannot determine user name, UID or access users home directory.
<code>PAM_SUCCESS</code>	Success.
<code>PAM_USER_UNKNOWN</code>	User not known.

6.38.5. EXAMPLES

Add the following line to `/etc/pam.d/su` to forward xauth keys between users when calling `su`:

```
session optional pam_xauth.so
```

6.38.6. AUTHOR

`pam_xauth` was written by Nalin Dahyabhai <nalin@redhat.com>, based on original version by Michael K. Johnson <johnsonm@redhat.com>.

Chapter 7. See also

- The Linux-PAM Application Writers' Guide.
- The Linux-PAM Module Writers' Guide.
- The V. Samar and R. Schemers (SunSoft), ``UNIFIED LOGIN WITH PLUGGABLE AUTHENTICATION MODULES'', Open Software Foundation Request For Comments 86.0, October 1995.

Chapter 8. Author/acknowledgments

This document was written by Andrew G. Morgan (morgan@kernel.org) with many contributions from Chris Adams, Peter Allgeyer, Tim Baverstock, Tim Berger, Craig S. Bell, Derrick J. Brashear, Ben Buxton, Seth Chaiklin, Oliver Crow, Chris Dent, Marc Ewing, Cristian Gafton, Emmanuel Galanos, Brad M. Garcia, Eric Hester, Michel D'Hooge, Roger Hu, Eric Jacksch, Michael K. Johnson, David Kinchlea, Olaf Kirch, Marcin Korzonek, Thorsten Kukuk, Stephen Langasek, Nicolai Langfeldt, Elliot Lee, Luke Kenneth Casson Leighton, Al Longyear, Ingo Luetkebohle, Marek Michalkiewicz, Robert Milkowski, Aleph One, Martin Pool, Sean Reifschneider, Jan Rekorajski, Erik Troan, Theodore Ts'o, Jeff Uphoff, Myles Uyema, Savochkin Andrey Vladimirovich, Ronald Wahl, David Wood, John Wilmes, Joseph S. D. Yao and Alex O. Yuriev.

Thanks are also due to Sun Microsystems, especially to Vipin Samar and Charlie Lai for their advice. At an early stage in the development of *Linux-PAM*, Sun graciously made the documentation for their implementation of PAM available. This act greatly accelerated the development of *Linux-PAM*.

Chapter 9. Copyright information for this document

Copyright (c) 2006 Thorsten Kukuk <kukuk@thkukuk.de>
Copyright (c) 1996-2002 Andrew G. Morgan <morgan@kernel.org>

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

1. Redistributions of source code must retain the above copyright notice, and the entire permission notice in its entirety, including the disclaimer of warranties.
2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
3. The name of the author may not be used to endorse or promote products derived from this software without specific prior written permission.

Alternatively, this product may be distributed under the terms of the GNU General Public License (GPL), in which case the provisions of the GNU GPL are required instead of the above restrictions. (This clause is necessary due to a potential bad interaction between the GNU GPL and the restrictions contained in a BSD-style copyright.)

THIS SOFTWARE IS PROVIDED ``AS IS'' AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE AUTHOR BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH