Macrotone Password Control Guide

Macrotone Consulting Ltd.

Geoffrey S. Chapman

Macrotone Password Control Guide:

Geoffrey S. Chapman

Publication date January 2016

Abstract

This manual covers the use of the Macrotone Consulting Joomla Password Control plug-in which allows you to control password changing for your users on your Joomla!™-powered web sites

Table of Contents

List of Figures

Preface

Password Control

Joomla

Extension

Author:	G S Chapman
Date:	6th January 2016
Version:	0.1.6

DOCUMENT HISTORY

Version	Date	Changed By:	Remarks
0.0.4A	13/12/2011	G S Chapman	Consolidation of information and update with details of User Profile Plug-in. First web issue.
0.0.6	03/01/2013	G S Chapman	Convert to DocBook format and update for latest release information.
0.0.8	20/05/2013	G S Chapman	Incorporate all outstanding fixes ready for next major update.
0.0.9	15/06/2013	G S Chapman	Introduce modified logic for handling single date forced change. Also make use off onUserBeforeStore event to stop update of #__users table and adds a few configuration improvements. The documentation logic has also been reworked into a single section for this release.
0.1.0	20/08/2013	G S Chapman	Introduce checks upon the specified passwords in the onUserBeforeStore event trigger. Also introduce the option of a password generator into the User Profile Edit, User Registration and Back End Users Edit Forms. The documentation has also been extended with more details of the User Plugin.
0.1.2	17/08/2014	G S Chapman	Updated to reflect the 0.1.2 release.
0.1.3	14/04/2015	G S Chapman	Updated to reflect the 0.1.3 release.
0.1.4	05/06/2015	G S Chapman	Updated to reflect the 0.1.4 release.
0.1.5	26/11/2015	G S Chapman	Updated to reflect the 0.1.5 release.
0.1.6	06/01/2016	G S Chapman	Updated to reflect the 0.1.6 release. Also includes User plugin release 0.0.5 details

---

PURPOSE OF DOCUMENT

This is the public documentation for the Macrotone Consulting Ltd's Joomla Extension Password Control. It provides detailed some of the technical knowledge of the extension and its capabilities.

Part I. System Documentation

Table of Contents

Chapter 1. Introduction

This Joomla extension is intended to introduce some security into the users' access into Joomla. Currently as released Joomla only has a simple user name and password mechanism but there is no checking of the password itself once it is defined and it could easily be the same as the user name.

Figure 1.1. Password Control icon

This was originally introduced as a system plug-in, with later additions to make it become a more comprehensive product. It was originally written for Joomla version 1.7, although early testing upon Joomla version 1.6 showed that it worked successfully at that time in the development cycle. With the dropping of support for Joomla 1.6, 1.7 and 2.5 it is no longer actively supported on those platforms. Release 0.1.4 and earlier run upon Joomla 2.5 but there is limited support available. The current release version works upon Joomla 3.4.

Important

Note that release 0.1.5 has **not** been tested against Joomla 2.5.

Table 1 - Latest Release Versions

Type	Version	Comments
System plug-in	0.1.6	Current released version.
User Profile plug-in	0.0.5	Current released version.
Component	1.0.0	Not on general released.

Versions are released when they have been through internal testing and no known problems exist.

Version numbering

The component version number was decided to begin at release 1.0.0 and the earlier releases of the plug-ins thus start at version 0.0.1. This does not imply that they are incomplete or 'pre-release'.

For transparency and insight into our release cycle, and for striving to maintain backward compatibility, our Joomla components will be maintained under the following Semantic Versioning guidelines as much as possible.

Releases will be numbered with the following format: <major>.<minor>.<patch>

And constructed with the following guidelines:

- Breaking backward compatibility bumps the major (and resets the minor and patch)

- New additions without breaking backward compatibility bumps the minor (and resets the patch)

- Bug fixes and miscellaneous changes bumps the patch

Testing

All development and testing is carried out on our own Joomla systems. Due to the vast complexity of maintaining multiple versions of Joomla and MySQL it is not possible to guarantee that the releases

will function without problems on every possible combination of options, although great care is taken to document any known problems.

The latest version plugin(s) have been tested against Joomla 3.4.8 which is the latest Joomla version at the time of the latest Password Control Plugin release.

The released version has also been installed and is also in use upon our live web site.

Chapter 2. Installation

Installation uses the standard Joomla install method.

Important

Do NOT uninstall Macrotone Password Control before updating it! Uninstalling will remove all of your configuration information and the user's password history!

Note

The language (translation) files are NOT installed automatically. You can download and install them from our language download page. Do note that you will have to install both the component and the language packages for the component to work.

Macrotone Consulting Ltd only produces the English language files. All other languages are contributed freely by third parties. If you spot an error if the first instance please go to the translation project page to find the contact information of the translator. Abandoned languages will show the maintainer being our staff member "geoffc". In this case we will try to help you but our knowledge of foreign languages is very limited; if you would like to fix the language package you will need to create a Transifex account and to volunteer to take over the translation project for that language.

Download the Latest Version

Once you have downloaded the latest version, you are ready to install the component. The steps outlined below are generic and apply to the installation of most Joomla components.

Step 1 of 3 - Install the Component: Login to your Joomla Administrative centre and in the Extensions menu, click on the Browse button and navigate to the file location where you downloaded the file. Click on the file and then click on the Install/Uninstall button.

Figure 2.1. Initial Installation Screen.
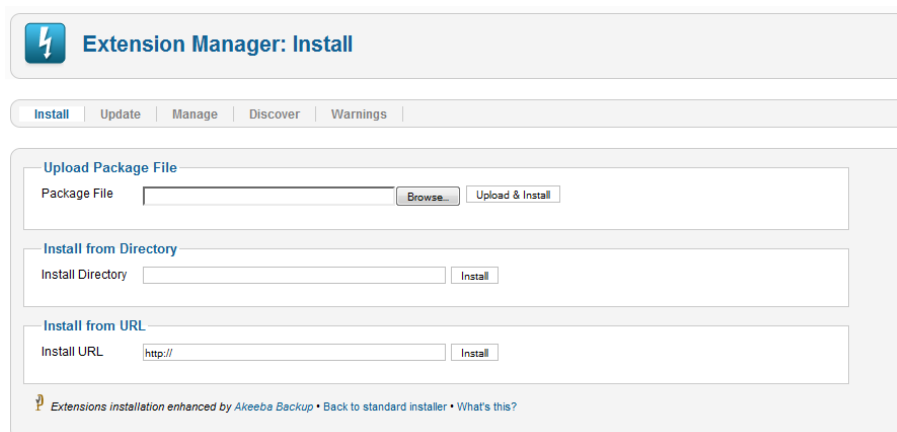
Step 2 of 3 - Once the Plugin is installed, enable the Plug-in in the Extensions menu, click on Plugin Manager and find your newly installed plugin called System - Password Control. A screen similar to the following will be displayed.

Figure 2.2. Plug-in screen
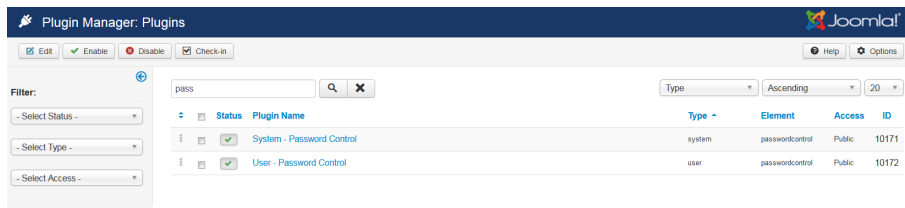
Enable your Password Control Plugin by marking the box on the left hand side opposite the plugin name, and then click the Green Enable button. After you click on it, the plugin should turn into a Green Tickmark.

Step 3 of 3 - Configure The Plugin: Whilst on this same page, click on the link System - Password Control. This will take you to the Plugin settings. In the Plugin Parameters section, enter your desired options. Settings are described in the relevant sections below.

Chapter 3. Password Control Usage

This section describes the various plugin options.

Configuration

The plugin configuration is illustrated below.

Once all parameters have been specified save them to take effect. Remember that the plugin also has to be enabled!

Plugin Configuration

When entering the administrator plugin screen for the Password Control system plugin, the following screen will be displayed. Note that the text displayed will vary between releases.

Figure 3.1. Administrator Plugin Screen
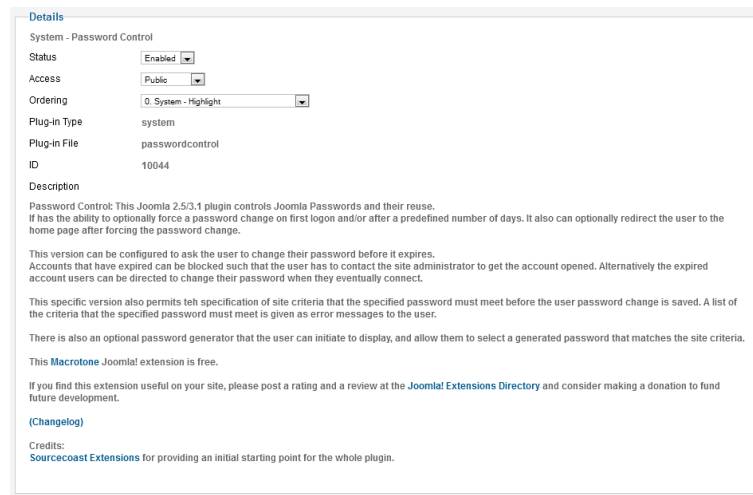
Clicking upon the various links will navigate to the specified screen. For example clicking upon the 'Changelog' will show a popup window with the changes for each release. An example of the changelog display is shown in the figure below:

Figure 3.2. Plugin Changelog
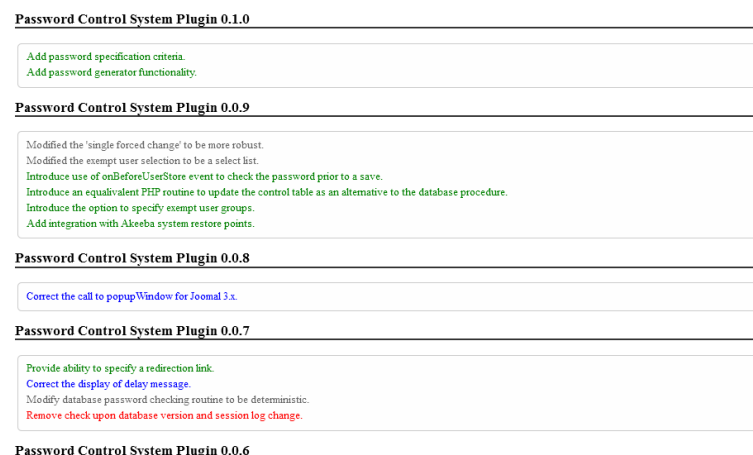
Basic Settings

The following screen shows the configuration parameters part of the plugin screen for the system plugin. It is here that one specifies the details of how often passwords should be changed, how many passwords are we retaining per user for checking etc. Most of the required parameters are self evident and do not require any further explanation here.

Hovering over the parameter label with the mouse will display a tooltip for the particular parameter, with more details if appropriate.

Figure 3.3. Basic Control Settings

The displayed users and user groups illustrated in the above display will be different for each site, as the users and usergroups are dependant upon those configured and registered on the particular site.

The use of the 'Force on First Logon' parameter is useful when a 'weak' password has been supplied by an administrator when setting up an account. It is suggested that if the Password Generator is used that it is probably not necessary to force the user to change their password yet again on first logon.

Note

The 'Unique Change Date' parameter has a specific ability to force all uses (except exempt users) to change their passwords on a specific date. This parameter is specified in the usual way, but when the parameter is handled by the front end in normal operation it will modify the plugin control table for the required users and then 'reset' the plugin parameter back to a null value. This is intentional so that the user is not continually forced to change their password if a date in the past is specified.

Release 0.1.3 adds an additional option to force the user to change their email address upon initial login. Some sites using components such as eshop virtuemart, have a situation where they provide their customers with free logins. They create a number of logins with usernames such as the name of the shop + a client number, a password of 12345 and with a created email address similar to ZK1504-01@ourdomain.com. When the user logs in there is a need to force the customer to change their password, and this option that will force the mandatory email change on first login. We need to force the email change otherwise it is suspected that it will be overlooked. The change is only required for the initial login and a check for the previous email is not necessary. Email validation is performed by Joomla.

It is possible to specify specific users, or even specific groups of users that are exempt from being forced to change their passwords periodically. This might typically be applied for internal support staff for example.

Release 0.1.2 extended this so that the exempted users/groups are also able to reuse their previously specified passwords as well.

Form Field Settings

These settings control the display of the 'other' fields upon the User Profile Edit Form. These include the 'username', 'name' and the email fields. Some sites may desire to hide these fields either to make it 'simpler' for the users' or because they are not used on the site.

It is also possible to add an additional 'informational' field to the form. This might be used to provide some additional instructions to the users, such as the form that a suppled password has to take.

Figure 3.4. Form Field Settings

The specification of the 'informational' field can make it more obvious to the user the format require-ments of the password field. The only other method, which was previously available of providing the user with this sort of information was by changing the tooltip text that is displayed when the mouse hovers over the 'password' field, which it is acknowledged is not always so obvious to most users.

If the option to force a user to change their email address upon initial login is chosen then the email address field will be displayed when the user initially logs in. The option to hide the address is not enforced in this particular situation.

Password Criteria Check Settings

Figure 3.5. Password Criteria Check Settings

There are four separate parts to the Password Criteria. The first is whether a check should be performed to prevent the user's name and site username from being in the specified password.

The second is whether a check should be performed upon the email address being contained within the specified password.

The next part is where the majority of the checks are specified.

The password criteria checks can check for the following:

i. At least one numeric character. i.e. 0 -> 9

ii. At least one lowercase character. i.e. a -> z

iii. At least one uppercase character. i.e. A -> Z

iv. At least one special character. i.e. !, #, @, % etc.

v. The minimum length of the required password. Default 8. The longer the better.

vi. The minimum required entropy of the password. Entropy is defined as a measure of the uncertainty in a random variable and is a common and easy way to estimate the password strength.

The entropy is given by H = L log? N where L is the length of the password and N is the alphabet size, usually measured in bits.

The entropy measures the number of bits it would take to represent every password of length L under an alphabet with N different symbols.

i.e. a password of 7 lower-case characters (such as: example, polmnni, etc.) has an entropy of H = 7 log? 26 ~ 32.9bits.

A password of 10 alpha-numeric characters (such as: P4ssw0Rd97, K5lb42eQa2) has an entropy of H = 10 log? 62 ~ 59.54bits.

Higher entropy means stronger password (in terms of resistance to brute force attacks). Enter 0 to disable this check.

vii.The maximum number of the any specific character within the specified password. Enter 0 to skip this check.

vi-Maximum number of identical consecutive characters in the password. 1 indicates that there should
ii. be no identical consecutive characters. Enter 0 to skip this check.

The fourth and final part is whether a one line message about the determined strength of the supplied password should be displayed. This is also an optional display. There is a range of ten possible values for the determined strength of the supplied password.

Password Generator Settings

Figure 3.6. Password Generator Settings

Most of the parameters are reasonably obvious as can be seen in the figure above.

The administrator can decide whether they wish to have the back end User Edit screen display the 'Password Generator' button.

The controls over the size of the Dialog box popup window are provided for the administrator to specify which will depend upon the length of the information strings included in the dialog box. Note that the display itself will depend upon the site template (front end and back end) CSS settings.

Because the Generator Dialog window is using jQuery there are options to specify the version of jQuery to use and the location from where the files will be downloaded. The default is to make use of the (currently) latest version from a Content Delivery Network (CDN).

Note

The jQuery setting is ignored for Joomla 3.1 sites. The reason is that this version of Joomla comes with Bootstrap and jQuery already present so any specified setting is ignored.

The code also checks whether jQuery has previously been loaded in the template and if it has, will silently ignore any specified value and use the previously loaded version.

The display of the Dialog box is controlled by the 'theme'. Various alternative themes are available and it is only necessary to specify the specific required theme in the parameters. See http://jqueryui.com/themeroller/ for some possible themes that one may choose. The default is the 'start' theme.

Alternative dialog window code

One particularly nasty problem was seen when testing the plugin upon a site template based upon Bootstrap 3 which included a piece of jQuery code known as mmenu used for the display of on and off screen mobile menus. The problem was traced down to a coding conflict between jQuery-ui and mmenu which was difficult to discover due to the lack of any error information and indeed any indication of what the possible cause might be. The symptoms were such that the jQuery-ui dialog window would be shown to the user but that it was impossible for any user selection to occur, or indeed for the user to be able to perform any action except to refresh the page.

The solution was to stop using the jQuery-ui code and instead substitute a different jQuery plugin known as 'jQuery.bootstrap'. This has the effect of resolving the specific conflict, but also creates a slightly different 'look' to the dialog window.

The 'jQuery.bootstrap' code is based upon Bootstrap 3 so worked flawlessly in our tests with a Bootstrap 3 site template. A new parameter has been provided to enable the use of this jQuery plugin instead of the jQuery.ui code.

Testing with Bootstrap 2 based templates such as 'protostar', indicates that the dialog window also works so it is suspected(and subsequently confirmed) that it is the 'mmenu' code that is the contributing party to the problem, not the Bootstrap code.

The admin back end continues to make use of the jQuery.ui interface.

Front end displays

All of the following images may display differently upon the user site depending upon the site template and CSS parameters that are in use. They are shown as a guide as to what you may expect to see.

The normal user profile change screen is shown below without the 'Password Generator' feature enabled. [See later in this document for an example screen with the Generator enabled.] When a user is being forced to change their password the '(optional)' immediately after the two password fields will be changed so that an asterisk '*' is shown indicating that the parameter is mandatory.

Figure 3.7. Profile Change screen

The initial welcome screen is shown when the user is configured to change their password upon the first visit to the site.

Figure 3.8. Default initial welcome message

If the user is changing their password, either voluntarily or as a consequence of the plugin requiring them to do so, and they attempt to specify a previously used password, then the following display is seen.

Figure 3.9. Password already used default message

As specified earlier the displays may be different upon the users site due to template of CSS differences.

Figure 3.10. Password strength information text.

If the strength indicator is selected to be displayed it is shown as in the figure above. There are currently ten different ratings, and are meant only as a guide.

Figure 3.11. Password errors detected messages
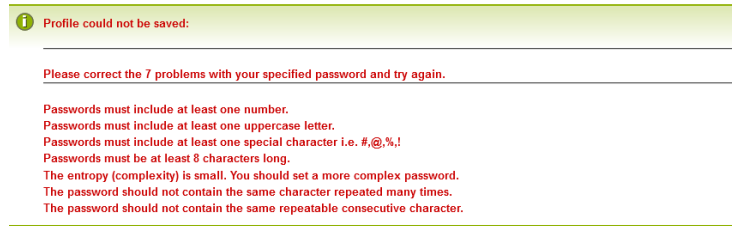
The screen above shows error messages displayed when an invalid password , such as 'aaaaaa' is entered. The information is shown immediately preceding the users profile change screen. The actual messages shown will obviously depend upon the errors detected.

Password Generator Screens

The following displays illustrate the screens shown by the Password generator if configured.

Figure 3.12. Modified User Edit Profile Form.

The screen above shows the modified Front end User Edit Profile Form with the additional 'Generate Password' button that the user may invoke to view an automatically generated password matching the site defined preferences. Not shown are the front end Users Registration Form and the Back end Users Edit form which display with the button similarly.

The screen below shows the same screen with the options of removing the 'username', 'name' and/ or 'email' fields, and also displaying the informational field. The text displayed will be the text as specified in the plugin parameters, and there is no default supplied since it is very dependant upon the individual site specifictions/requirements.

Figure 3.13. Modified User Edit Profile Form (2).
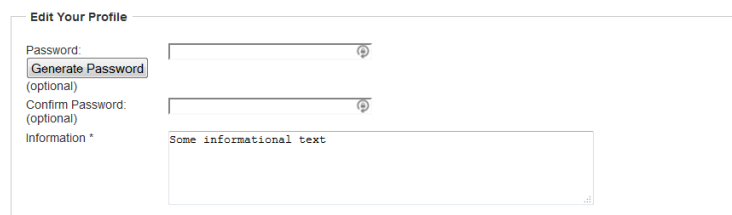
Release 0.1.6 added the password checking to the Pssword Reset for. This is shown in the image below.

Figure 3.14. Modified User Password Reset Form.

The above screen is the second screen displayed when a password rest is requested by the user, the first which is not show is unaltered and allows the user to enter their verification code, before the above screen is displayed.

The dialog popup shown as a result of pressing the 'Generate Password' button is illustrated below. This is using the a JQuery-UI theme. Other themes are available..

Figure 3.15. Popup Dialog Password Generator Window.

The above display shows a sample popup dialog window with sample text and an automatically generated password. The displayed CSS example above is provided by the jQuery 'start' theme. Other themes are available.

For comparison the dialog popup shown when using the 'jQuery.bootstrap' plugin is illustrated below.

Figure 3.16. Alternative Popup Dialog Password Generator Window.

Chapter 4. Password Control System Plug-in

This chapter describes the various releases but also some details of the various features and provides a good background to some of the parameters and their usage.

Release 0.0.1

This release was also known as RC1. As part of the development process Release 0.0.1 has some options to force users to change their password upon their first logon, and also after a specified number of days. Additional options will cause a redirect back to the home page after the password has been changed. At this release the password is not checked, only that the password is changed. The change after a number of days is based on the last_visit_date really only catches users who have not logged on for the specified number of days. In this version only the onAfterRoute event is used.

It was based upon an early plug-in release by Source Coast Systems, significantly enhanced to meet our specific requirements.

Release 0.0.2

This version builds upon the earlier version and introduces two database tables (passwordcontrol and passwordcontrol_meta). The first table is the main table and contains details of when the user last changed their password and the hashed version of the current password. The second table contains details of the plug-in version.

When the user first connects to the system an entry is made in the passwordcontrol table. When the password is changed the table is updated by the onUserAfterSave event. Part of the checks involved includes verifying whether the user has actually changed their password. The new password is hashed using the same salt as the original password and compared. If they are the same then the password-control table is NOT updated, thus the user would be prompted again to change their password.

Two routines onUserBeforeSave and onUserAfterSave have been looked at. Ideally we wanted to use onUserBeforeSave but this did not (at the time) have the passwords in the clear to enable them to be checked. Routine onUserAfterSave had them visible but of course at this stage the details have already been saved in the database (in the #__users table). This means that even if the password is changed to itself we can still force them to change it again.

All newly registered users created after the plug-in is enabled will automatically be subject to the specifications of the parameters as specified. Any pre-existing users will not by default be forced to change their passwords unless the check box is ticked to indicate that they must be subject to the same rules.

It is recognised that there may be some users for whom it is desired that they are not forced to change their passwords. These users are catered for by specifying their user identifiers in the 'exempt users' box. Multiple user identifiers are specified by separating the ids by a space or a comma, which ever is preferred. [Since replaced by a select list.]

There is a specific check for when a user changes their password before they are prompted. In this situation the next change date is adjusted so that it is the specified number of days into the future, assuming of course that the periodic change feature is configured.

Release 0.0.3

This release was the first widely spread release, helped no doubt by the entry in the Joomla Extensions Directory (JED). It addresses a minor issue with the previous release where the edit profile screen

displayed the password as being an optional parameter, when in actual fact the plug-in demands it as a mandatory specification. This is achieved by the use of session variables and an onContentPrepareForm event.

The specification of the password chance form is now an optionally specified administrator parameter.

This release also builds upon the earlier releases by making use of the underlying database tables to give two specific abilities:

i. The ability to force password changes for a single specified one off occurrence.

ii. The provision of advance warning to the users enabling them to change their passwords in advance, prior to being forced to change them.

The module uses session variables. One named 'password_force' is used to control the setting of the 'optional' setting in the password change form. The second named 'prompt_check' ensures that a user is not continually prompted to change their password in advance more than once in a particular logon session. Each is located in their own name space 'PasswordControl'.

When a user has signed in to the system the module gets the last password change date from the database. There are then several checks performed.

If the administrator has specified that 'all' users (exempt those that are specifically exempt) should change their password after a specified date (once_date), and that date has now passed, then the user is instructed to change their password and sent to the specified screen (by default com_users&view=profile&layout=edit) to make the change.

If the specified number of days has passed since the last logon and the administrator has requested blocking of accounts, then the account is blocked and the user is instructed to contact the administrator.

If the specified number of days has passed since the last password change and the account is not blocked then the user is requested to change their password and redirected to the specified screen.

The last check is to see how many days are remaining before the password is due to be changed. If it is within the specified limit the user is given the option of changing the password straight away of continuing with their session.

The information requests are provided by Java script.

One minor change in this release is that when a password change is enforced by the specification of the one off change, that all users including existing users will be forced to change their passwords. Formally there was an option that permitted pre-registered users to be left unchanged. This release removes that option.

Release 0.0.4

This was originally intended to be a stabilisation release. The following changes / fixes are included.

Fixes

The following fixes have been applied to this release:

i. Error JParameter not found on some systems. This error is seen only on a few systems and is resolved by adding an addition include file in the main file header.

ii. The release information within the passwordcontrol_meta file was not updated correctly. Update has been modified to update with the correct version.

iii. There is a warning message generated on some sites when the checking for exempt users is performed. An additional check has been placed around the source of the error.

Changes:

i. There are a couple of minor changes to determine whether to load the parameters from the plug-in itself, or from the password control component (not yet released). This check is also used to load the language for the component rather than for the system plug-in.

ii. The manifest file has been amended to add details of update servers to make use of Joomla update notifications.

iii. An additional file to make up of Joomla install, update and uninstall actions has been added to the distribution.

iv. The ability to save multiple passwords for a user has been introduced. This is specified by an additional parameter. The change allows for the additional checks for these passwords. Using a large value will cause some additional time to be used for the checking, which will depend very much on the performance of the host platform for the site. Database procedures are used to give the best possible performance of the checking.

v. It is possible to specify a value of zero for the number of passwords to check. This is provided for those who want to force users to change their passwords but who do not specifically care whether they use different passwords or not.

vi. Additional parameter to specify whether password checks should be performed by the bespoke database functions, or use PHP code. See database notes below.

Database notes.

For performance reasons it was desirable to use a bespoke database function for password checks against previously specified user passwords. In developing this password checking function it was discovered that to perform the checking in the database required the MySQL binlog_format to be set to ROW or MIXED, otherwise the function failed. The setting discovered on the internal databases was set to ROW.

The setting is used by MySQL specifically where replication is being performed between databases. The default setting for all MySQL 6 databases and above is set to MIXED, but I am wary of forcing a change upon all users of the plug-in. For that reason there is PHP checking routine included as part of the plug-in as we l as the database function. Which is used depends upon the setting of the DBCHECK parameter. The default is to use the PHP routine. In tests the database routine is faster for large number of passwords being checked which might be the preference, but because of the logging this is not the default. Both routines generate the same result.

If database replication is not a consideration for a site then for the use of the database routine is recommended.

The storing of multiple passwords for a user is performed by a bespoke MySQL database procedure created when the plug-in is installed. The database procedure for storing passwords in the control table is not impacted by the logging mode.

Being experienced database engineers we tend to use database routines for performance reasons, something that is not very common with other Joomla extension authors, so it is possible that some database problems which may or may not have shown up with other plugins may be seen. These problems usually manifest themselves as errors accessing database procedures or functions. These problems may be caused by underlying problems with the MySQL database system tables, and are sometimes encountered when a MySQL database upgrade has not been completed successfully. Unfortunately this means that when others (i.e. service providers) fail to perform their upgrades we can appear to be at fault. There are several examples of theses types of problems reported on the Forum on the support site system.

Release 0.0.5

This release introduces support for Joomla 3.0 and adds a few minor additions such as a changelog.

Release 0.0.6

This minor release fixes a problem with the reporting of database errors when they are encountered. It also changes the display of the changelog to be within a modal wiindow.

Release 0.0.7

This was a special release for a specific client who required a version of the plugin for Joomla 1.5. This has involved making changes to the code to accommodate the restrictions present in that particular Joomla release.

This release was never publicly release since Joomla 1.5 is no longer a supported product.

This release did however incorporate a few improvements that were developed prior to the Joomla 1.5 conversion, and were thus present in the release.

i. Provide ability to specify a redirection link.

ii. Correct the display of delay message.

iii. Modify database password checking routine to be deterministic.

iv. Remove check upon database version and session log change.

Release 0.0.8

This release resolved a few minor problems incorporates the previously developed changes for release 0.0.7 and adds one further Joomla 3.x fix.

i. Correct the call to popupWindow for Joomal 3.x.

Other additions will be considered depending upon user demand.

Release 0.0.9

This release add a reworked handler for the single 'once only' forced password change. If also introduces the use of the 'before' user store event when checking passwords for reuse thus eliminating the save into the #__users table and well as introducing a few improvements in the configuration and normal running through the use of a PHP routine for updating the database control table for sites where they cannot use the supplied database procedure due to hosting restrictions.

i. Modified the 'single forced change' to be more robust.

ii. Modified the exempt user selection to be a select list.

iii. Introduce use of onUserBeforeStore event to check the password prior to a save.

iv. Introduce an equivalent PHP routine to update the control table as an alternative to the database procedure.

v. Introduce the option to specify exempt user groups.

vi. Add integration with Akeeba system restore points. Requires Akeeba Backup Pro release 3.7.8 or higher.

Release 0.1.0

This major release introduces the long awaited control over the specification of passwords. This is briefly described below.

The following settings are configured to set how strong a password has to be.

i.   One can optionally choose whether the password should to be checked on its strength.

ii. One can set the minimum length of the password (minimum 8 / maximum 16 characters).

iii. One can set the minimum usage of :

   i.   one number;

   ii. one lowercase character;

   iii. one uppercase character;

   iv. one special character.

iv. One can optionally show a message, so the user can see how strong their specified password is.

There are two other checks that may be performed, both of which are individually configured.

i.   Is it acceptable for the password to include the user's name or site username.

ii. Is it acceptable for the password to include the user's email address.

This release also has an optionally configured password generator that is added to the User Edit Profile Form, the User Registration Form and optionally the Administrator's User Edit Form. When configured and invoked by the user a pop up dialog box is presented to the user with a suggested password that meets the site criteria for specifying passwords. The user may use the suggested value or cause an alternative password to be generated. An unlimited number of passwords may be generated for the user to choose one. When chosen the password is inserted into the User Edit Profile Form password fields automatically, so the user does not have to perform any 'cut and paste' actions.

There is one fix in this release which is to correct the usage of the entries in the password control table, when the supplied PHP routine is used. The supplied equivalent Database routine is unaffected by the problem.

Release 0.1.1

This release adds support for the PHPPass encryption mechanism introduced in Joomla 3.2. It also addresses a few small problems found in the earlier 0.1.0 release.

i.   Code Refactorisation.

ii. Eliminate use of deprecated functions.

iii. Update copyright date.

iv. Change to follow change to use PHPass for password encryption in Joomla 2.5.18 and Joomla 3.2.x.

v. Change to allow for revised edit profile screen.

Release 0.1.2

This release implements a few changes to allow for new encryption mechanisms introduced in Joomla 3.3. It also implements a change requested by our users relating to the display of the fields in the User Profile Edit Form.

i.   More Code Refactorisation.

ii. Change to use jQuery 1.11.0.

iii. Change to use jQuery-ui 1.10.4.

iv. Change to allow for new encryption methods Joomla 3.3.

v. Change to allow for Joomla 3 user password reset required flag.

vi. Modify checks for checking password change required.

vii. Introduced ability to hide some of the other user profile fields such as the email, username and name fields Also permit the addition of an informative text area field to display some helpful text to assist the user in entering their password.

vi-
ii. Due to a coding conflict between jQuery-UI dialog windows and mmenu (a jQuery plugin for mobile menus) add ability to use an alternative jQuery bootstrap dialog plugin.

Release 0.1.3

This release adds a new requested feature to force a user to change their email address upon initial log(See above for more specific details). It also address a few changes required by the removal of support for certain features previously used by the plugins.

Note

One other change made in the 0.1.3 release was to address a strange situation where upon one specific site, a user editing their profile and then saving the change redisplayed the 'edit profile form' again and not the expected 'display your profile' page. In the redisplay the layout and the task parameters were not set, which resulted in the 'generate' button not being displayed. We have added a check upon the Joomla version and if it is greater than 3.2 then in this situation the generator button (if configured) will be shown. We have tested this change on other Joomla versions and have not seen any problems so believe that the change is innocuous. One to be aware of.

i. Change copyright year to 2015.

ii. Support for Akeeba Restore Points removed as they are no longer supported by Akeeba.

iii. New option to force the user to change their email address on first login.

iv. Clean up of parameter settings.

Release 0.1.4

This release adds additional exemption options for the forced changing of the email address upon initial login. There has also been a small restructuring of the code.

There is a check to catch an observed situation where one is in the process of editing ones' user profile but the view layout is set to null, rather than 'edit'. This was observed upon a Joomla 3.4 installation.

Release 0.1.5

This release adds a few changes requested in the forum and also corrects a few problems discovered in the earlier release. It also adds a few additional changes reflecting changes in other software used by the plugin.

Permit a minimum length of 6 characters for a password. This is not something that we specifically recommend as short passwords are more easily compromised. It might be acceptable upon an internal site.

A small problem was discovered where if the front end password generator was disabled, then the back end generator would not work. The code has been restructured to prevent this problem.

Another problem identified was that if the password checking was configured such that only numerics were checked, then the password generator would only create passwords with numerics. This was caused as a consequence of using the password checking criteria as a basis for the generator. The code has been restructured and new parameters created for the generator. An additional check has been added so that if the password is being checked for a specific character type then irrespective of the generator setting, this type would be part of the generated password. It does however permit passwords to be created and minimal (or none) password checked performed upon the generated passwords.

A new class has been added to the generator button code to permit a site to use their own CSS styling if they wish. The new class is named 'btn-pwdgen'.

There are some additional code checks to avoid a situation where user upon logging in the first time, and being presented with the password request immediately logs out. Upon relogging in they were not in some circumstances being prompted again to change their password. This change has required a change in the database table to ensure that the change requst is honoured over different sessions.

Note

To ensure backward compatibility this is separate from the 'force password reset' option available in Joomla 3.4, although this may be reviewed in later versions.

A new option has been added to control the loading of jQueryUI in front end. Formally there was an assumption that it was loaded if jQuery was also loaded, which is not true for many modern templates. This is now separately controlled.

The default version of the jQuery UI has been changed to the 1.11.4 release.

If jQuery is selected to be loaded by the plugin then the version default has changed to use the jQuery 1.11.3 release.

Release 0.1.6

This release adds the password checking criteria to the user reset of their password when they have 'forgotten' it. This was previously omitted. The release also updates the copyright year and changes the 'once date' force change parameter to accept a calendar field instead of a text entry.

Release 0.1.7

This release will address any discovered problems with the 0.1.6 release. There are no confirmed enhancement in this release currently.

Other additions will be considered depending upon user demand.

Chapter 5. Password Control User Profile Plug-in

The Password Control User Profile Plug-in is an optional plug-in that requires the Password Control System Plug-in to work. It should work with the system plug-in releases 0.0.3 and above.

Installation is using the same mechanism as described above for the System Plugin, with the obvious difference in Plugin name.

This Password Control User Plug-in provides some additional options for the site administrator.

User Plug-in Parameters

Figure 5.1. User Plugin Parameters
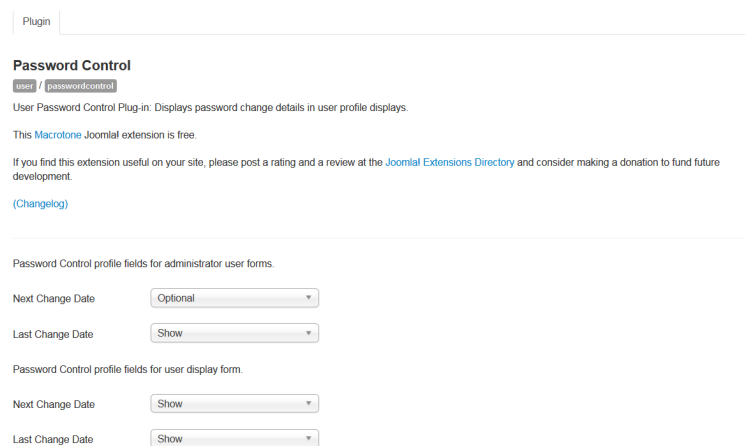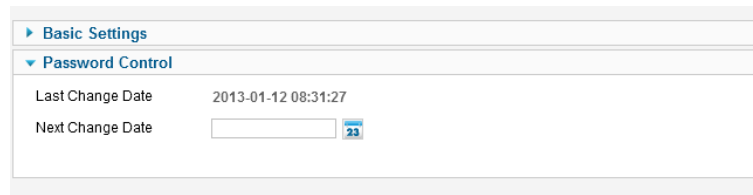
It can be configured to provide the following features:

1. The profile summary presented to the user when then look at their profile can optionally display the details of their last and next scheduled password change. Either, both or none can be configured for display. Note that the user is not presented with the detail, if they choose to edit their profile. It is not desirable that a user could edit their next password change date.

2. The details of the last and next password changes can also be configured for display in the back end user edit as well. The last password change is a display only option, where as the next password change may optionally be edited in the back end by the administrator

3. Setting the next password change date in the back end user edit will update the details for the user, but note that depending upon the configuration of the Password Control system plug-in parameters, this setting may or may not be used. See notes below for more details.

User Plug-in Screens

The figure below shows the additional information presented in the Administrator's User Edit Form.

Figure 5.2. User Plugin Information in Administrator
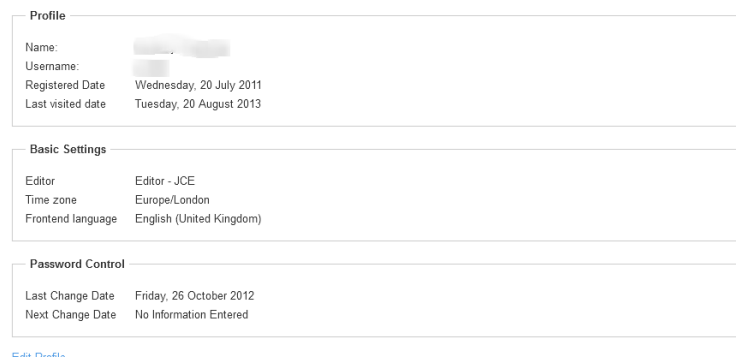
In the Front End User Profile the additional information is as indicated in the figure below.

Figure 5.3. User Information in User Profile

Hints

Note

a. If a new user is created then the (optional or mandatory) setting of the next password change date at the time of user creation will be over ridden by the system plug-in if the system is configured to force the user to change their password on their initial login.

b. The user profile plug-in requires the existence of the password control system plug-in to enable it to access the underlying database user information.

c. The Password Control System Plug-in does not require the Password Control User Profile plug-in to be installed.

Releases

The User Plug-In release details are shown below:

User Plug-in Release 0.0.1

This is the initial release of the plug-in.

User Plug-in Release 0.0.2

This release introduces support for Joomla 3.0.0 and also introduces a changelog.

User Plug-in Release 0.0.3

This minor release corrected the display of the change log so that it displays within a modal window.

User Plug-in Release 0.0.4

This minor release corrected the display of the change log upon Joomla 3.4 and has had a code review.

User Plug-in Release 0.0.5

This minor release adds the display of the internal 'force' flag in the administrators user display. It also updates the copyright date.

Chapter 6. Logic Flows

This section describes the logic flows for the plugin events.

Event onContentPrepareForm

1. Check if this is a form, if not return

2. Check if this is the com_users, profile edit form. If not return.

3. Check whether administration back end or debugging and if so return.

4. If guest user return

5. Get session variable 'password_force'

6. If variable enabled set form field variables for passwords to mandatory.

7. Else set field variables to optional.

8. If the options to modify the displayed form fields such as username, name and email are requested, change settings for these fields in the form.

9. If the variable to force an email change is set then empty out any existing email field values and ensure that the email field is displayed.

10. If the optional informative field is requested create the form field and add it to the form.

11. If the password generator is enabled then modify the edit profile form so that it contains an additional button which when clicked will cause the popup dialog window to appear.

Event onAfterRoute

1. Check whether within the administration back end or debugging and if so return

2. If guest user return

3. Get plug-in parameters

4. Determine whether the user is specified in the user exemption list, or is a member of any specified exemption groups.

5. Check whether we have this particular users change details. If not we need to add them to our database table. The settings used will depend on the specified parameters.

   i. If the user is exempt just add them to the table with the change date as null.

   ii. If we are forcing first time password changes set the last password change to the register date.

   iii. If we have a one off change date and it is greater than the current date, set the next change date to that date.

   iv. If we are **only** forcing changes every so many days set the next change date based upon the current date.

   v. Otherwise the change date is left null.

If the user is exempt, either by virtue of being specified in the user exemption list or because they are members of an exemption group we do not need to go any further and can return.

If the user exists in our table we now check whether a single one off password change has been requested by the system administrator. Depending upon the actual date specified in the plugin parameter 'once_date' the parameter will be handled as follows:

i. If no single change date is specified return to calling point.

ii. If once_date is more than the 'change days' setting in the future, the routine just returns until such time as the change date comes into range, at which time it is processed.

iii. If the once_date is in the past, the next password_change will be forced whenever the user next logs in or if already logged in when they navigate to a new page.

iv. If once_date is between the current date and 'change days' in the future, if sets the change date to that specified.

In cases iii and iv above after changing the last_password_change and next_password_change in the #__passwordcontrol table, the code then will reset the plugin parameter back to null.

6. If we are not forcing a password change return.

7. If we are forcing the initial password change and our last visit date is null the user has never visited before.

   a. If the user is saving their profile we just update our last visit time and update the next password change time to now.

   b. If the user is editing their profile ensure the next change date is set to current date. Set the session variable to make the password change mandatory.

   c. If the option to force an email address change is set then set the session variable to be picked up by the form setup.

   d. Otherwise redirect to the edit profile form.

8. The user has logged in before

9. Check if a password change is required

10. If last change date is null set it to the account registration date.

11. If we have a one off change date greater than the current date set the next change date to the one off date.

12. If the next change date is not set update it to the current date.

13. If we are performing regular password changes

   a. If the user is saving their profile do nothing.

   b. If they have saved their profile and we have requested redirection, redirect the user.

   c. If they are editing their profile

      i. If next change is null return

      ii. If the last change is greater than the next change date update the next change date.

      iii. If the next change date is in the future return

iv. Otherwise redirect the user if requested.

At this point we are changing the passwords periodically and the next change date should never be null. However on a fresh installation of the plug-in the pre-existing users will have a null value for the next change date. It would also be NULL if the system administration had tried setting initial password change before setting periodic password changes because then users would have already been created on the system.

14. If the next change date is set to null return

15. Check if we have the situation where the user has optionally changed their password early without us prompting. What we do here is just update the next change time as appropriate.

16. Determine if the current date is lower than the next change date.

a. If the next_change date is not within our specified time to give an early change prompt return.

b. In it is then prompt the user to change their password.

1. If they accept direct them to the change screen

2. Otherwise set the session variable so they are not prompted again this session.

17. If the user has exceeded our criteria and is to be blocked, block the user in the database and inform them to contact the site administrator. There is a specific check to ensure that the user is not an administrator co that they are not blocked. In addition there is a check to ensure that if the change date is the registration date they are not blocked either. This allows for the situation where the user was previously blocked and the registration date was set to the last change date and it would obviously be a lot older than our change criteria. Clear the user's session and then redirect them to the front page.

18. From here on we now know we have to change the password

a. If the user is saving their profile do nothing but we will update the last visit date to current.

b. If they have saved their profile and we have requested redirection, redirect the user.

c. If they are editing their profile
   i. If next change is null return
   ii. If the last change is greater than the next change date update the next change date in the database.
   iii. Otherwise ensure password specification is mandatory and redirect the user to change their password.

Event onUserAfterSave

Executes after the user (or administrator) has saved their data. We need to check whether the password was changed and if so update the passwordcontrol table.

Note

Releases prior to 0.0.9 only made use of the 'OnAfterUserSave' event so that '#__password-control' table is only updated if the passwords do not match, however by making use of this 'after' event changes to the '#__users' table may/will have already been make even if the password specified has been used previously. This does not impact the display of the password reuse checks and message displays since the user is forced back to the 'edit screen to re-supply their password.

Release 0.0.9 introduces the use of the 'before' event trigger to prevent the saving of the user supplied information to the '#__users' if a previously used password is supplied.

1. If this is a real user id and we have a result.

2. Check if we have previously loaded the parameters we require into the session. If not load the few parameters we require.

3. Check if we are interested in checking previous passwords. If not go to step 9 below.

4. Check if the exempt users can reuse their passwords. If they can step 9 below.

5. Check if a password change has occurred. If a password change has not occurred just return

6. Check whether the new password is the same as any of the previously saved passwords either by calling the database routine or by calling the equivalent PHP routine.

7. If we have already used the password before (for that user) and this is an administrator then raise an exception. Update the session variable and return

8. If we have not used the new password before then go to step 9.

9. Update the control table.

10. Update session variable so that password specification is now optional.

11. Update session variable so that email changing is not forced.

12. Return.

Event onUserBeforeStore

Executes before the user (or administrator) has saved their data. This checks the specified user's password to ensure it meets the site specified criteria.

Note

The password reuse check in this event trigger is essentially the save as the former logic contained in the onUserAfterStore event with the exception that the control table is not updated, which remains in the onUserAfterStore event.

1. If this action is taking place in the back end (administration) of the site return.

2. If the password is not being changed return.

3. Load the exemption parameters and check if the user is exempt. If so return.

4. Load the other plugin parameters. If we have previously loaded the multiple password parameters we require into the session, load them from there, if not load the few parameters we require.

5. Check if we are configured to test the password strength. If so, carry out the following checks if configured.

   1. Ensure password does not contain a space character.

   2. Check if the password it must contain at least one numeric character.

   3. Check if the password must contain an upper case character.

   4. Check if the password must contain at least one lowercase character.

   5. Check if the password must contain at lest one special character.

   6. Check we meet or exceed the minimum password length.

7. Check the entropy of the password.

8. Check the quantity of characters in the password.

9. Check the password for identical consecutive characters.

6. Check if a we are testing for the user's name and username in the password.

7. Check if a we are testing for the user's email address in the password.

8. Check whether the new password is the same as any of the previously saved passwords either by calling the database routine or by calling the equivalent PHP routine.

9. Prepare the optional password strength text if configured.

10. If we have detected and errors in our earlier checks prepare the error message and raise an exception.

11. Return.

Password check logic

The following logic is used by both the database function and the equivalent PHP code.

1. If we are not interested in checking the passwords then return.

2. Select an old password from the control table.

3. Extract the salt from the old password.

4. Use the salt to encrypt the new password (provided in the clear).

5. Compare the newly encrypted password with our loaded value.

6. If the two match return to the calling routine with a TRUE value.

7. If we have any more stored passwords to check go to step 2

8. With no more passwords to check return to the caller with a FALSE value.

Password Generator logic

The following logic is used by the password generator and is Java code executed upon the client machine.

The User profile edit screen is populated with an additional button that can be 'clicked' upon to cause the display of a popup Dialog box.

1. When clicked the popup dialog window is shown with a suggested password that matches the site criteria for passwords.

2. The user has a number of options that they can take at this point.

    1. The user may choose to exit the window either by clicking the 'Cancel' button, or by clicking upon the 'X' in the top right hand site of the window.

    2. The user may decide that they do not like the suggested password and they may click upon the 'Regenerate' button which will then cause an alternative password to be created. The user may continue selecting the 'Regenerate button for as long or for as many times as they wish to obtain a password with which they are content.

3. The user may decide that they like the suggested password and may click upon the 'Use' button at which point the dialog window is closed and the selected password value is passed back to the User edit screen.

3. If the user selected an automatically generated password the chosen password value is inserted into the appropriate password fields within the user edit profile form.

4. The password generator performs no other function within the plugin.

Session variables

The passwordcontrol system uses a number of session variables to control its operation. This does effectively save constant reference to the plugin parameters and is done mainly to simplify the handling of sessions over the various methods.

Variable	Remarks
password_force	Used to indicate that a forced password change is requested.
email_force	Used to indicate that a forced email address change is requested upon initial login.
password_forced_change	Indicates a forced password change is required.
password_invalid	An invalid password has been provided. A change is still required. Usually this is if the user has cancelled out of the password change or a password that has been used before has been repeatedly tried.
paramset	Used as an indicator for the OnUserAfterSave event.
periodicity	Used to store the frequency (in days) required for password changes.
npassword	Used to hold the number of possible unique passwords for a user.
dbchecks	Used to indicate that database checks for the password are preferred.
db_version_stat	Used to determine whether the database has binary logging enabled.
prompt_check	Used to determine whether a prompted password change is required.

Notes:

a. When an administrator is performing a password change for a user, they do not use the onAfterRoute functionality (there is an early check and return if an administrator) however they do make use of the onUserAfterSave routine. The check for a password being previously used is therefore in force and the administrator will be presented with a message stating that the account user already has the password in their 'history' if the specified password has been previously used. This is not an error but expected functionality.

b. If an administrator changes a password for a user, then the user will be prompted to change their password on their next connection.

Chapter 7. Common Questions

Additional Comments

There is a Frequently Asked Questions section on the website that attempts to answer most of the commonly asked questions. However there are a few questions that it is worth mentioning in this document since they are of general interest.

The password entry form displays options I do not want users to change.

This is possible since this is a Joomla configuration option. In the User profile the settings are in two categories: Profile, which includes username and password, and Basic Settings, which include editor, time zone, front end language.

In the back end if you navigate to User Manager -> Options, under Component (Users Configuration) you will see two options 'Front End User Parameters' and 'Front End User Language'.

Set 'Front End User Parameters to "Hide" and that will hide the 'Basic Settings' in the Users profile.

i.   Front-end Language
ii. User Editor
iii. Time Zone

In the User Profile Edit form the 'default' Joomla Password tip says 'Specify 4 characters'.

This is a consequence of the COM_USERS_DESIRED_PASSWORD language string being specified in the Joomla release as: 'Enter your desired password - Enter a minimum of four characters'. This can be changed by a site language override where it can be specified to be what ever the site desires. Typically the text required would reflect the settings determined for the site.

As an example one of our sites used the following text:

```
Enter your desired password – Minimum length 10 characters and
 must
        include one Upper case letter, one lower case letter, one
numeric character and
        one special character (i.e. !, #, @, %).
```

Language overrides can be performed in the Joomla administrator. First open the language override menu in Joomla admin. The menu is located under Extensions > Language Manager, under the tab Overrides. This presents a simple interface where one can filter, choose a language file for the admin or front-end, and a table list of any current overrides that are present upon the site. If there is more than one language installed then it is possible, depending upon the language which we are working upon, to select it from the drop down.

Release 0.1.2 has introduced the ability to provide an additional informational field in the front end User Edit Profile Form to also display some text to assist the user in choosing a suitable password, which is very useful especially if the password generator is not used.

How do language overrides work

When first used Joomla will create an 'overrides' folder under the language folder upon the site. It then creates a file named zz-ZZ.override.ini within that folder, where zz-ZZ is the language criteria. i.e en-GB for an English translation. By using this mechanism when a component or Joomla is updated the contents of this file will remain unchanged.

Overriding the default language strings

Most of the time you will want to overwrite the default language strings. The quickest way is to click on the button New, which brings you to a screen where you enter your desired string to override and the desired value. A language string consists from two parts, a constant and a value. If we know the names and values we can insert them into the field on the left side of the screen.

Note

This is an additional task for the site administrator to perform. It was decided to not to automate this change of language text, due to the work required in having to update it every time the plugin parameters are changed. This may be implemented in a later release.

Chapter 8. Password Control Component

Release 1.0.0

This is a future release to augment the plug-in as part of a Joomla component.

The plug-in(s) will be separate entities capable of existing in their own right or as part of the component. If the plug-in is a stand alone it will use the specified plug-in parameter settings. If the component is installed then the component parameters are used in the plug-in. There is check within the plug-in (Release 0.0.4 and above) to determine whether the component is installed and if it is, to use the component parameters. This makes sense since if the plug-in is installed via the component there would be no plug-in parameters per sec, since the component install does not need them. This also means that when the component is installed it takes over control of parameter settings completely.

When the component is installed the plug-in is also be installed. If it already exists it would be over written. Likewise when the component is uninstalled the plug-in is also uninstalled. In the situation where the site installed the component and then decides they only want the plug-in, the plug-in would need to be installed again after the component is uninstalled.

On the component install the latest version of the plug-in compatible with the component is installed. Any prior setting for a stand alone version of the plug-in are lost and would need to be set in the component. The underlying tables and their data would however remain.

Chapter 9. Future considerations

Possible expansion options

The details below are possible options that may be added to the product as time, circumstances and demand dictate.

1. The possibility for a user to delete their own account.

2. The use of mail-only for the renewal of passwords (as mails are unique anyway)

3. Set min. number of days, after which accounts get disabled if no login to site. Partially implemented in system plug-in version 0.0.4.

4. Password ageing (expiration). Partially addressed in version 0.0.4 of the system plug-in, this should be revisited to see if there if it can be improved upon.

Authentication Policies

One major part of the Password Control Component is the implementation of site authentication policies. An authentication policy should consist of a number of items:

1. A proper password ageing policies should be in place to naturally take care of old or unused accounts. The idea behind password ageing is that after a certain amount of time, a password expires. A password is less prone to compromise if it is changed frequently. Likewise, if an account is compromised, its usefulness will be limited to the amount of time left before the expiry timer concludes. Ageing account passwords can reduce exposure if brute-force, social engineering, or sniffing attempts are successful.

2. The password strength is extremely important. It is imperative that the systems requiring users to change their passwords also enforce some level of strictness with regards to what passwords are accepted. An unguessable password makes brute-force attacks 'the premiere method by which accounts are compromised' mostly futile. An exhaustive brute-force attack will eventually discover all passwords, given enough time, but the idea is to use a password of sufficient length, so that it cannot be guessed in a reasonable amount of attempts. The successful guessing attempts normally find extremely trivial passwords, such as ones that are the same as the user name.

3. Account ageing, that is the disabling of unused accounts, is another factor. Unused accounts are probably the second most commonly compromised. If you do not have a password ageing policy, at least be certain to disable old or unused accounts.

4. There are different ways to implement password ageing. The ageing of a password should naturally disable unused accounts. Since a user must login to be given notice that their password has expired, and if they fail to do so within a certain amount of time, the account itself can be disabled. Some of these things can be achieved with products such as Windows Active Directory and various Unix-based LDAP servers support the setting of password policies such as LDAP. It is however extremely unlikely that the majority of Joomla systems available upon the web make use of these types of systems. For that reason it is important that there is some form of control within Joomla itself. [Joomla authentication plug-ins can be used to make the necessary connections to the third party products such as LDAP if the need exists.]

5. The Password Control Component is intended to implement some form of authentication policies. This would enable a site to have different policies for different groups of users

Password Guidelines

Despite the name, there is no need for passwords to be actual words; indeed passwords which are not actual words are harder to guess (a desirable property), but are generally harder for users to remember (an undesirable property). A strong password is a password that meets the following guidelines:

1. Be eight or more characters long. For obvious reasons, longer length passwords are preferable.

2. Contain both uppercase and lowercase letters.

3. Contain numbers.

4. Contain symbols, such as +-*@#%=?!_;.

5. Not resemble any of previously entered passwords.

6. Not be the user's name, a friend's or a family member's name, or the login value.

7. Not be a dictionary word or common name.

Password guessing

Studies of production computer systems have for decades consistently shown that about 40% of all user-chosen passwords are readily guessed automatically, and still more with some individual research regarding a particular user. Password strength is the likelihood that a password cannot be guessed or discovered by an unauthorised person or computer. Passwords easily guessed are termed weak or vulnerable; passwords very difficult or impossible to guess are considered strong.

Part II. Appendices

Table of Contents

Appendix A. GNU General Public License version 3

Version 3, 29 June 2007

Copyright (C) 2007 Free Software Foundation, Inc. http://fsf.org/

Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

Preamble

The GNU General Public License is a free, copyleft license for software and other kinds of works.

The licenses for most software and other practical works are designed to take away your freedom to share and change the works. By contrast, the GNU General Public License is intended to guarantee your freedom to share and change all versions of a program - to make sure it remains free software for all its users. We, the Free Software Foundation, use the GNU General Public License for most of our software; it applies also to any other work released this way by its authors. You can apply it to your programs, too.

When we speak of free software, we are referring to freedom, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for them if you wish), that you receive source code or can get it if you want it, that you can change the software or use pieces of it in new free programs, and that you know you can do these things.

To protect your rights, we need to prevent others from denying you these rights or asking you to surrender the rights. Therefore, you have certain responsibilities if you distribute copies of the software, or if you modify it: responsibilities to respect the freedom of others.

For example, if you distribute copies of such a program, whether gratis or for a fee, you must pass on to the recipients the same freedoms that you received. You must make sure that they, too, receive or can get the source code. And you must show them these terms so they know their rights.

Developers that use the GNU GPL protect your rights with two steps: (1) assert copyright on the software, and (2) offer you this License giving you legal permission to copy, distribute and/or modify it.

For the developers' and authors' protection, the GPL clearly explains that there is no warranty for this free software. For both users' and authors' sake, the GPL requires that modified versions be marked as changed, so that their problems will not be attributed erroneously to authors of previous versions.

Some devices are designed to deny users access to install or run modified versions of the software inside them, although the manufacturer can do so. This is fundamentally incompatible with the aim of protecting users' freedom to change the software. The systematic pattern of such abuse occurs in the area of products for individuals to use, which is precisely where it is most unacceptable. Therefore, we have designed this version of the GPL to prohibit the practice for those products. If such problems arise substantially in other domains, we stand ready to extend this provision to those domains in future versions of the GPL, as needed to protect the freedom of users.

Finally, every program is threatened constantly by software patents. States should not allow patents to restrict development and use of software on general-purpose computers, but in those that do, we wish to avoid the special danger that patents applied to a free program could make it effectively proprietary. To prevent this, the GPL assures that patents cannot be used to render the program non-free.

The precise terms and conditions for copying, distribution and modification follow.

TERMS AND CONDITIONS

0. Definitions.

"This License" refers to version 3 of the GNU General Public License.

"Copyright"; also means copyright-like laws that apply to other kinds of works, such as semiconductor masks.

"The Program"; refers to any copyrightable work licensed under this License. Each licensee is addressed as "you". "Licensees" and "recipients" may be individuals or organizations.

To "modify" a work means to copy from or adapt all or part of the work in a fashion requiring copyright permission, other than the making of an exact copy. The resulting work is called a "modified version" of the earlier work or a work "based on" the earlier work.

A "covered work" means either the unmodified Program or a work based on the Program.

To "propagate" a work means to do anything with it that, without permission, would make you directly or secondarily liable for infringement under applicable copyright law, except executing it on a computer or modifying a private copy. Propagation includes copying, distribution (with or without modification), making available to the public, and in some countries other activities as well.

To "convey" a work means any kind of propagation that enables other parties to make or receive copies. Mere interaction with a user through a computer network, with no transfer of a copy, is not conveying.

An interactive user interface displays "Appropriate Legal Notices" to the extent that it includes a convenient and prominently visible feature that (1) displays an appropriate copyright notice, and (2) tells the user that there is no warranty for the work (except to the extent that warranties are provided), that licensees may convey the work under this License, and how to view a copy of this License. If the interface presents a list of user commands or options, such as a menu, a prominent item in the list meets this criterion.

1. Source Code.

The "source code" for a work means the preferred form of the work for making modifications to it. "Object code" means any non-source form of a work.

A "Standard Interface" means an interface that either is an official standard defined by a recognized standards body, or, in the case of interfaces specified for a particular programming language, one that is widely used among developers working in that language.

The "System Libraries" of an executable work include anything, other than the work as a whole, that (a) is included in the normal form of packaging a Major Component, but which is not part of that Major Component, and (b) serves only to enable use of the work with that Major Component, or to implement a Standard Interface for which an implementation is available to the public in source code form. A "Major Component", in this context, means a major essential component (kernel, window system, and so on) of the specific operating system (if any) on which the executable work runs, or a compiler used to produce the work, or an object code interpreter used to run it.

The "Corresponding Source" for a work in object code form means all the source code needed to generate, install, and (for an executable work) run the object code and to modify the work, including scripts to control those activities. However, it does not include the work's System Libraries, or general-purpose tools or generally available free programs which are used unmodified in performing those activities but which are not part of the work. For example, Corresponding Source includes interface definition files associated with source files for the work, and the source code for shared libraries and dynamically linked subprograms that the work is specifically designed to require, such as by intimate data communication or control flow between those subprograms and other parts of the work.

The Corresponding Source need not include anything that users can regenerate automatically from other parts of the Corresponding Source.

The Corresponding Source for a work in source code form is that same work.

2. Basic Permissions.

All rights granted under this License are granted for the term of copyright on the Program, and are irrevocable provided the stated conditions are met. This License explicitly affirms your unlimited permission to run the unmodified Program. The output from running a covered work is covered by this License only if the output, given its content, constitutes a covered work. This License acknowledges your rights of fair use or other equivalent, as provided by copyright law.

You may make, run and propagate covered works that you do not convey, without conditions so long as your license otherwise remains in force. You may convey covered works to others for the sole purpose of having them make modifications exclusively for you, or provide you with facilities for running those works, provided that you comply with the terms of this License in conveying all material for which you do not control copyright. Those thus making or running the covered works for you must do so exclusively on your behalf, under your direction and control, on terms that prohibit them from making any copies of your copyrighted material outside their relationship with you.

Conveying under any other circumstances is permitted solely under the conditions stated below. Sublicensing is not allowed; section 10 makes it unnecessary.

3. Protecting Users' Legal Rights From Anti-Circumvention Law.

No covered work shall be deemed part of an effective technological measure under any applicable law fulfilling obligations under article 11 of the WIPO copyright treaty adopted on 20 December 1996, or similar laws prohibiting or restricting circumvention of such measures.

When you convey a covered work, you waive any legal power to forbid circumvention of technological measures to the extent such circumvention is effected by exercising rights under this License with respect to the covered work, and you disclaim any intention to limit operation or modification of the work as a means of enforcing, against the work's users, your or third parties' legal rights to forbid circumvention of technological measures.

4. Conveying Verbatim Copies.

You may convey verbatim copies of the Program's source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice; keep intact all notices stating that this License and any non-permissive terms added in accord with section 7 apply to the code; keep intact all notices of the absence of any warranty; and give all recipients a copy of this License along with the Program.

You may charge any price or no price for each copy that you convey, and you may offer support or warranty protection for a fee.

5. Conveying Modified Source Versions.

You may convey a work based on the Program, or the modifications to produce it from the Program, in the form of source code under the terms of section 4, provided that you also meet all of these conditions:

a. The work must carry prominent notices stating that you modified it, and giving a relevant date.

b. The work must carry prominent notices stating that it is released under this License and any conditions added under section 7. This requirement modifies the requirement in section 4 to "keep intact all notices".

c. You must license the entire work, as a whole, under this License to anyone who comes into possession of a copy. This License will therefore apply, along with any applicable section 7 additional terms, to the whole of the work, and all its parts, regardless of how they are packaged. This License gives no permission to license the work in any other way, but it does not invalidate such permission if you have separately received it.

d. If the work has interactive user interfaces, each must display Appropriate Legal Notices; however, if the Program has interactive interfaces that do not display Appropriate Legal Notices, your work need not make them do so.

A compilation of a covered work with other separate and independent works, which are not by their nature extensions of the covered work, and which are not combined with it such as to form a larger program, in or on a volume of a storage or distribution medium, is called an "aggregate" if the compilation and its resulting copyright are not used to limit the access or legal rights of the compilation's users beyond what the individual works permit. Inclusion of a covered work in an aggregate does not cause this License to apply to the other parts of the aggregate.

6. Conveying Non-Source Forms.

You may convey a covered work in object code form under the terms of sections 4 and 5, provided that you also convey the machine-readable Corresponding Source under the terms of this License, in one of these ways:

a. Convey the object code in, or embodied in, a physical product (including a physical distribution medium), accompanied by the Corresponding Source fixed on a durable physical medium customarily used for software interchange.

b. Convey the object code in, or embodied in, a physical product (including a physical distribution medium), accompanied by a written offer, valid for at least three years and valid for as long as you offer spare parts or customer support for that product model, to give anyone who possesses the object code either (1) a copy of the Corresponding Source for all the software in the product that is covered by this License, on a durable physical medium customarily used for software interchange, for a price no more than your reasonable cost of physically performing this conveying of source, or (2) access to copy the Corresponding Source from a network server at no charge.

c. Convey individual copies of the object code with a copy of the written offer to provide the Corresponding Source. This alternative is allowed only occasionally and noncommercially, and only if you received the object code with such an offer, in accord with subsection 6b.

d. Convey the object code by offering access from a designated place (gratis or for a charge), and offer equivalent access to the Corresponding Source in the same way through the same place at no further charge. You need not require recipients to copy the Corresponding Source along with the object code. If the place to copy the object code is a network server, the Corresponding Source may be on a different server (operated by you or a third party) that supports equivalent copying facilities, provided you maintain clear directions next to the object code saying where to find the Corresponding Source. Regardless of what server hosts the Corresponding Source, you remain obligated to ensure that it is available for as long as needed to satisfy these requirements.

e. Convey the object code using peer-to-peer transmission, provided you inform other peers where the object code and Corresponding Source of the work are being offered to the general public at no charge under subsection 6d.

A separable portion of the object code, whose source code is excluded from the Corresponding Source as a System Library, need not be included in conveying the object code work.

A "User Product" is either (1) a "consumer product", which means any tangible personal property which is normally used for personal, family, or household purposes, or (2) anything designed or sold for incorporation into a dwelling. In determining whether a product is a consumer product, doubtful cases shall be resolved in favor of coverage. For a particular product received by a particular user, "normally used" refers to a typical or common use of that class of product, regardless of the status of the particular user or of the way in which the particular user actually uses, or expects or is expected to use, the product. A product is a consumer product regardless of whether the product has substantial commercial, industrial or non-consumer uses, unless such uses represent the only significant mode of use of the product.

"Installation Information" for a User Product means any methods, procedures, authorization keys, or other information required to install and execute modified versions of a covered work in that User Product from a modified version of its Corresponding Source. The information must suffice to ensure that the continued functioning of the modified object code is in no case prevented or interfered with solely because modification has been made.

If you convey an object code work under this section in, or with, or specifically for use in, a User Product, and the conveying occurs as part of a transaction in which the right of possession and use of the User Product is transferred to the recipient in perpetuity or for a fixed term (regardless of how the transaction is characterized), the Corresponding Source conveyed under this section must be accompanied by the Installation Information. But this requirement does not apply if neither you nor any third party retains the ability to install modified object code on the User Product (for example, the work has been installed in ROM).

The requirement to provide Installation Information does not include a requirement to continue to provide support service, warranty, or updates for a work that has been modified or installed by the recipient, or for the User Product in which it has been modified or installed. Access to a network may be denied when the modification itself materially and adversely affects the operation of the network or violates the rules and protocols for communication across the network.

Corresponding Source conveyed, and Installation Information provided, in accord with this section must be in a format that is publicly documented (and with an implementation available to the public in source code form), and must require no special password or key for unpacking, reading or copying.

7. Additional Terms.

"Additional permissions" are terms that supplement the terms of this License by making exceptions from one or more of its conditions. Additional permissions that are applicable to the entire Program shall be treated as though they were included in this License, to the extent that they are valid under applicable law. If additional permissions apply only to part of the Program, that part may be used separately under those permissions, but the entire Program remains governed by this License without regard to the additional permissions.

When you convey a copy of a covered work, you may at your option remove any additional permissions from that copy, or from any part of it. (Additional permissions may be written to require their own removal in certain cases when you modify the work.) You may place additional permissions on material, added by you to a covered work, for which you have or can give appropriate copyright permission.

Notwithstanding any other provision of this License, for material you add to a covered work, you may (if authorized by the copyright holders of that material) supplement the terms of this License with terms:

a. Disclaiming warranty or limiting liability differently from the terms of sections 15 and 16 of this License; or

b. Requiring preservation of specified reasonable legal notices or author attributions in that material or in the Appropriate Legal Notices displayed by works containing it; or

    c. Prohibiting misrepresentation of the origin of that material, or requiring that modified versions of such material be marked in reasonable ways as different from the original version; or

    d. Limiting the use for publicity purposes of names of licensors or authors of the material; or

    e. Declining to grant rights under trademark law for use of some trade names, trademarks, or service marks; or

    f. Requiring indemnification of licensors and authors of that material by anyone who conveys the material (or modified versions of it) with contractual assumptions of liability to the recipient, for any liability that these contractual assumptions directly impose on those licensors and authors.

All other non-permissive additional terms are considered "further restrictions" within the meaning of section 10. If the Program as you received it, or any part of it, contains a notice stating that it is governed by this License along with a term that is a further restriction, you may remove that term. If a license document contains a further restriction but permits relicensing or conveying under this License, you may add to a covered work material governed by the terms of that license document, provided that the further restriction does not survive such relicensing or conveying.

If you add terms to a covered work in accord with this section, you must place, in the relevant source files, a statement of the additional terms that apply to those files, or a notice indicating where to find the applicable terms.

Additional terms, permissive or non-permissive, may be stated in the form of a separately written license, or stated as exceptions; the above requirements apply either way.

8. Termination.

You may not propagate or modify a covered work except as expressly provided under this License. Any attempt otherwise to propagate or modify it is void, and will automatically terminate your rights under this License (including any patent licenses granted under the third paragraph of section 11).

However, if you cease all violation of this License, then your license from a particular copyright holder is reinstated (a) provisionally, unless and until the copyright holder explicitly and finally terminates your license, and (b) permanently, if the copyright holder fails to notify you of the violation by some reasonable means prior to 60 days after the cessation.

Moreover, your license from a particular copyright holder is reinstated permanently if the copyright holder notifies you of the violation by some reasonable means, this is the first time you have received notice of violation of this License (for any work) from that copyright holder, and you cure the violation prior to 30 days after your receipt of the notice.

Termination of your rights under this section does not terminate the licenses of parties who have received copies or rights from you under this License. If your rights have been terminated and not permanently reinstated, you do not qualify to receive new licenses for the same material under section 10.

9. Acceptance Not Required for Having Copies.

You are not required to accept this License in order to receive or run a copy of the Program. Ancillary propagation of a covered work occurring solely as a consequence of using peer-to-peer transmission to receive a copy likewise does not require acceptance. However, nothing other than this License grants you permission to propagate or modify any covered work. These actions infringe copyright if you do not accept this License. Therefore, by modifying or propagating a covered work, you indicate your acceptance of this License to do so.

10. Automatic Licensing of Downstream Recipients.

Each time you convey a covered work, the recipient automatically receives a license from the original licensors, to run, modify and propagate that work, subject to this License. You are not responsible for enforcing compliance by third parties with this License.

An "entity transaction" is a transaction transferring control of an organization, or substantially all assets of one, or subdividing an organization, or merging organizations. If propagation of a covered work results from an entity transaction, each party to that transaction who receives a copy of the work also receives whatever licenses to the work the party's predecessor in interest had or could give under the previous paragraph, plus a right to possession of the Corresponding Source of the work from the predecessor in interest, if the predecessor has it or can get it with reasonable efforts.

You may not impose any further restrictions on the exercise of the rights granted or affirmed under this License. For example, you may not impose a license fee, royalty, or other charge for exercise of rights granted under this License, and you may not initiate litigation (including a cross-claim or counterclaim in a lawsuit) alleging that any patent claim is infringed by making, using, selling, offering for sale, or importing the Program or any portion of it.

11. Patents.

A "contributor" is a copyright holder who authorizes use under this License of the Program or a work on which the Program is based. The work thus licensed is called the contributor's "contributor version".

A contributor's "essential patent claims" are all patent claims owned or controlled by the contributor, whether already acquired or hereafter acquired, that would be infringed by some manner, permitted by this License, of making, using, or selling its contributor version, but do not include claims that would be infringed only as a consequence of further modification of the contributor version. For purposes of this definition, "control" includes the right to grant patent sublicenses in a manner consistent with the requirements of this License.

Each contributor grants you a non-exclusive, worldwide, royalty-free patent license under the contributor's essential patent claims, to make, use, sell, offer for sale, import and otherwise run, modify and propagate the contents of its contributor version.

In the following three paragraphs, a "patent license" is any express agreement or commitment, however denominated, not to enforce a patent (such as an express permission to practice a patent or covenant not to sue for patent infringement). To "grant" such a patent license to a party means to make such an agreement or commitment not to enforce a patent against the party.

If you convey a covered work, knowingly relying on a patent license, and the Corresponding Source of the work is not available for anyone to copy, free of charge and under the terms of this License, through a publicly available network server or other readily accessible means, then you must either (1) cause the Corresponding Source to be so available, or (2) arrange to deprive yourself of the benefit of the patent license for this particular work, or (3) arrange, in a manner consistent with the requirements of this License, to extend the patent license to downstream recipients. "Knowingly relying" means you have actual knowledge that, but for the patent license, your conveying the covered work in a country, or your recipient's use of the covered work in a country, would infringe one or more identifiable patents in that country that you have reason to believe are valid.

If, pursuant to or in connection with a single transaction or arrangement, you convey, or propagate by procuring conveyance of, a covered work, and grant a patent license to some of the parties receiving the covered work authorizing them to use, propagate, modify or convey a specific copy of the covered work, then the patent license you grant is automatically extended to all recipients of the covered work and works based on it.

A patent license is "discriminatory" if it does not include within the scope of its coverage, prohibits the exercise of, or is conditioned on the non-exercise of one or more of the rights that are specifically granted under this License. You may not convey a covered work if you are a party to an arrangement with a third party that is in the business of distributing software, under which you make payment to the third party based on the extent of your activity of conveying the work, and under which the third party grants, to any of the parties who would receive the covered work from you, a discriminatory patent license (a) in connection with copies of the covered work conveyed by you (or copies made from those copies), or (b) primarily for and in connection with specific products or compilations that contain the covered work, unless you entered into that arrangement, or that patent license was granted, prior to 28 March 2007.

Nothing in this License shall be construed as excluding or limiting any implied license or other defenses to infringement that may otherwise be available to you under applicable patent law.

12. No Surrender of Others' Freedom.

If conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License. If you cannot convey a covered work so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not convey it at all. For example, if you agree to terms that obligate you to collect a royalty for further conveying from those to whom you convey the Program, the only way you could satisfy both those terms and this License would be to refrain entirely from conveying the Program.

13. Use with the GNU Affero General Public License.

Notwithstanding any other provision of this License, you have permission to link or combine any covered work with a work licensed under version 3 of the GNU Affero General Public License into a single combined work, and to convey the resulting work. The terms of this License will continue to apply to the part which is the covered work, but the special requirements of the GNU Affero General Public License, section 13, concerning interaction through a network will apply to the combination as such.

14. Revised Versions of this License.

The Free Software Foundation may publish revised and/or new versions of the GNU General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns.

Each version is given a distinguishing version number. If the Program specifies that a certain numbered version of the GNU General Public License "or any later version" applies to it, you have the option of following the terms and conditions either of that numbered version or of any later version published by the Free Software Foundation. If the Program does not specify a version number of the GNU General Public License, you may choose any version ever published by the Free Software Foundation.

If the Program specifies that a proxy can decide which future versions of the GNU General Public License can be used, that proxy's public statement of acceptance of a version permanently authorizes you to choose that version for the Program.

Later license versions may give you additional or different permissions. However, no additional obligations are imposed on any author or copyright holder as a result of your choosing to follow a later version.

15. Disclaimer of Warranty.

THERE IS NO WARRANTY FOR THE PROGRAM, TO THE EXTENT PERMITTED BY APPLI-
CABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLD-
ERS AND/OR OTHER PARTIES PROVIDE THE PROGRAM "AS IS" WITHOUT WARRANTY
OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO,
THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR
PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE PRO-
GRAM IS WITH YOU. SHOULD THE PROGRAM PROVE DEFECTIVE, YOU ASSUME THE
COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.

16. Limitation of Liability.

IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING
WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MODIFIES AND/OR CON-
VEYS THE PROGRAM AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES,
INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES
ARISING OUT OF THE USE OR INABILITY TO USE THE PROGRAM (INCLUDING BUT NOT
LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUS-
TAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE PROGRAM TO OPERATE
WITH ANY OTHER PROGRAMS), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN
ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

17. Interpretation of Sections 15 and 16.

If the disclaimer of warranty and limitation of liability provided above cannot be given local legal
effect according to their terms, reviewing courts shall apply local law that most closely approximates
an absolute waiver of all civil liability in connection with the Program, unless a warranty or assumption
of liability accompanies a copy of the Program in return for a fee.

END OF TERMS AND CONDITIONS

How to Apply These Terms to Your New Programs

If you develop a new program, and you want it to be of the greatest possible use to the public, the
best way to achieve this is to make it free software which everyone can redistribute and change under
these terms.

To do so, attach the following notices to the program. It is safest to attach them to the start of each
source file to most effectively state the exclusion of warranty; and each file should have at least the
"copyright" line and a pointer to where the full notice is found.

```
one line to give the program's name and a brief idea of what it
 does.
Copyright (C) year name of author

This program is free software: you can redistribute it and/or
 modify
it under the terms of the GNU General Public License as published
 by
the Free Software Foundation, either version 3 of the License, or
(at your option) any later version.
```

```
This program is distributed in the hope that it will be useful,
but WITHOUT ANY WARRANTY; without even the implied warranty of
MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.  See the
GNU General Public License for more details.

You should have received a copy of the GNU General Public License
along with this program.  If not, see
      http://www.gnu.org/licenses/ [http://www.gnu.org/licenses/].
```

Also add information on how to contact you by electronic and paper mail.

If the program does terminal interaction, make it output a short notice like this when it starts in an interactive mode:

```
program Copyright (C) year name of author
This program comes with ABSOLUTELY NO WARRANTY; for details type
 'show w'.
This is free software, and you are welcome to redistribute it
under certain conditions; type 'show c' for details.
```

The hypothetical commands 'show w' and 'show c' should show the appropriate parts of the General Public License. Of course, your program's commands might be different; for a GUI interface, you would use an "about box".

You should also get your employer (if you work as a programmer) or school, if any, to sign a "copyright disclaimer" for the program, if necessary. For more information on this, and how to apply and follow the GNU GPL, see http://www.gnu.org/licenses/ [http://www.gnu.org/licenses/].

The GNU General Public License does not permit incorporating your program into proprietary programs. If your program is a subroutine library, you may consider it more useful to permit linking proprietary applications with the library. If this is what you want to do, use the GNU Lesser General Public License instead of this License. But first, please read http://www.gnu.org/philosophy/why-not-lgpl.html [http://www.gnu.org/philosophy/why-not-lgpl.html].

Appendix B. GNU Free Documentation License

Copyright (C) 2000, 2001, 2002 Free Software Foundation, Inc. 51 Franklin St , Fifth Floor, Boston, MA 02110-1301 USA . Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

0. PREAMBLE

The purpose of this License is to make a manual, textbook, or other functional and useful document "free" in the sense of freedom: to assure everyone the effective freedom to copy and redistribute it, with or without modifying it, either commercially or noncommercially. Secondarily, this License preserves for the author and publisher a way to get credit for their work, while not being considered responsible for modifications made by others.

This License is a kind of "copyleft", which means that derivative works of the document must themselves be free in the same sense. It complements the GNU General Public License, which is a copyleft license designed for free software.

We have designed this License in order to use it for manuals for free software, because free software needs free documentation: a free program should come with manuals providing the same freedoms that the software does. But this License is not limited to software manuals; it can be used for any textual work, regardless of subject matter or whether it is published as a printed book. We recommend this License principally for works whose purpose is instruction or reference.

1. APPLICABILITY AND DEFINITIONS

This License applies to any manual or other work, in any medium, that contains a notice placed by the copyright holder saying it can be distributed under the terms of this License. Such a notice grants a world-wide, royalty-free license, unlimited in duration, to use that work under the conditions stated herein. The "Document", below, refers to any such manual or work. Any member of the public is a licensee, and is addressed as "you". You accept the license if you copy, modify or distribute the work in a way requiring permission under copyright law.

A "Modified Version" of the Document means any work containing the Document or a portion of it, either copied verbatim, or with modifications and/or translated into another language.

A "Secondary Section" is a named appendix or a front-matter section of the Document that deals exclusively with the relationship of the publishers or authors of the Document to the Document's overall subject (or to related matters) and contains nothing that could fall directly within that overall subject. (Thus, if the Document is in part a textbook of mathematics, a Secondary Section may not explain any mathematics.) The relationship could be a matter of historical connection with the subject or with related matters, or of legal, commercial, philosophical, ethical or political position regarding them.

The "Invariant Sections" are certain Secondary Sections whose titles are designated, as being those of Invariant Sections, in the notice that says that the Document is released under this License. If a section does not fit the above definition of Secondary then it is not allowed to be designated as Invariant. The Document may contain zero Invariant Sections. If the Document does not identify any Invariant Sections then there are none.

The "Cover Texts" are certain short passages of text that are listed, as Front-Cover Texts or Back-Cover Texts, in the notice that says that the Document is released under this License. A Front-Cover Text may be at most 5 words, and a Back-Cover Text may be at most 25 words.

A "Transparent" copy of the Document means a machine-readable copy, represented in a format whose specification is available to the general public, that is suitable for revising the document straightforwardly with generic text editors or (for images composed of pixels) generic paint programs or (for drawings) some widely available drawing editor, and that is suitable for input to text formatters or for automatic translation to a variety of formats suitable for input to text formatters. A copy made in an otherwise Transparent file format whose markup, or absence of markup, has been arranged to thwart or discourage subsequent modification by readers is not Transparent. An image format is not Transparent if used for any substantial amount of text. A copy that is not "Transparent" is called "Opaque".

Examples of suitable formats for Transparent copies include plain ASCII without markup, Texinfo input format, LaTeX input format, SGML or XML using a publicly available DTD, and standard-conforming simple HTML, PostScript or PDF designed for human modification. Examples of transparent image formats include PNG, XCF and JPG. Opaque formats include proprietary formats that can be read and edited only by proprietary word processors, SGML or XML for which the DTD and/or processing tools are not generally available, and the machine-generated HTML, PostScript or PDF produced by some word processors for output purposes only.

The "Title Page" means, for a printed book, the title page itself, plus such following pages as are needed to hold, legibly, the material this License requires to appear in the title page. For works in formats which do not have any title page as such, "Title Page" means the text near the most prominent appearance of the work's title, preceding the beginning of the body of the text.

A section "Entitled XYZ" means a named subunit of the Document whose title either is precisely XYZ or contains XYZ in parentheses following text that translates XYZ in another language. (Here XYZ stands for a specific section name mentioned below, such as "Acknowledgements", "Dedications", "Endorsements", or "History".) To "Preserve the Title" of such a section when you modify the Document means that it remains a section "Entitled XYZ" according to this definition.

The Document may include Warranty Disclaimers next to the notice which states that this License applies to the Document. These Warranty Disclaimers are considered to be included by reference in this License, but only as regards disclaiming warranties: any other implication that these Warranty Disclaimers may have is void and has no effect on the meaning of this License.

2. VERBATIM COPYING

You may copy and distribute the Document in any medium, either commercially or noncommercially, provided that this License, the copyright notices, and the license notice saying this License applies to the Document are reproduced in all copies, and that you add no other conditions whatsoever to those of this License. You may not use technical measures to obstruct or control the reading or further copying of the copies you make or distribute. However, you may accept compensation in exchange for copies. If you distribute a large enough number of copies you must also follow the conditions in section 3.

You may also lend copies, under the same conditions stated above, and you may publicly display copies.

3. COPYING IN QUANTITY

If you publish printed copies (or copies in media that commonly have printed covers) of the Document, numbering more than 100, and the Document's license notice requires Cover Texts, you must enclose the copies in covers that carry, clearly and legibly, all these Cover Texts: Front-Cover Texts on the front cover, and Back-Cover Texts on the back cover. Both covers must also clearly and legibly identify you as the publisher of these copies. The front cover must present the full title with all words of the title equally prominent and visible. You may add other material on the covers in addition. Copying with changes limited to the covers, as long as they preserve the title of the Document and satisfy these conditions, can be treated as verbatim copying in other respects.

If the required texts for either cover are too voluminous to fit legibly, you should put the first ones listed (as many as fit reasonably) on the actual cover, and continue the rest onto adjacent pages.

If you publish or distribute Opaque copies of the Document numbering more than 100, you must either include a machine-readable Transparent copy along with each Opaque copy, or state in or with each Opaque copy a computer-network location from which the general network-using public has access to download using public-standard network protocols a complete Transparent copy of the Document, free of added material. If you use the latter option, you must take reasonably prudent steps, when you begin distribution of Opaque copies in quantity, to ensure that this Transparent copy will remain thus accessible at the stated location until at least one year after the last time you distribute an Opaque copy (directly or through your agents or retailers) of that edition to the public.

It is requested, but not required, that you contact the authors of the Document well before redistributing any large number of copies, to give them a chance to provide you with an updated version of the Document.

4. MODIFICATIONS

You may copy and distribute a Modified Version of the Document under the conditions of sections 2 and 3 above, provided that you release the Modified Version under precisely this License, with the Modified Version filling the role of the Document, thus licensing distribution and modification of the Modified Version to whoever possesses a copy of it. In addition, you must do these things in the Modified Version:

A. Use in the Title Page (and on the covers, if any) a title distinct from that of the Document, and from those of previous versions (which should, if there were any, be listed in the History section of the Document). You may use the same title as a previous version if the original publisher of that version gives permission.

B. List on the Title Page, as authors, one or more persons or entities responsible for authorship of the modifications in the Modified Version, together with at least five of the principal authors of the Document (all of its principal authors, if it has fewer than five), unless they release you from this requirement.

C. State on the Title page the name of the publisher of the Modified Version, as the publisher.

D. Preserve all the copyright notices of the Document.

E. Add an appropriate copyright notice for your modifications adjacent to the other copyright notices.

F. Include, immediately after the copyright notices, a license notice giving the public permission to use the Modified Version under the terms of this License, in the form shown in the Addendum below.

G. Preserve in that license notice the full lists of Invariant Sections and required Cover Texts given in the Document's license notice.

H. Include an unaltered copy of this License.

I. Preserve the section Entitled "History", Preserve its Title, and add to it an item stating at least the title, year, new authors, and publisher of the Modified Version as given on the Title Page. If there is no section Entitled "History" in the Document, create one stating the title, year, authors, and publisher of the Document as given on its Title Page, then add an item describing the Modified Version as stated in the previous sentence.

J. Preserve the network location, if any, given in the Document for public access to a Transparent copy of the Document, and likewise the network locations given in the Document for previous versions it was based on. These may be placed in the "History" section. You may omit a network location for a work that was published at least four years before the Document itself, or if the original publisher of the version it refers to gives permission.

K. For any section Entitled "Acknowledgements" or "Dedications", Preserve the Title of the section, and preserve in the section all the substance and tone of each of the contributor acknowledgements and/or dedications given therein.

L. Preserve all the Invariant Sections of the Document, unaltered in their text and in their titles. Section numbers or the equivalent are not considered part of the section titles.

M. Delete any section Entitled "Endorsements". Such a section may not be included in the Modified Version.

N. Do not retitle any existing section to be Entitled "Endorsements" or to conflict in title with any Invariant Section.

O. Preserve any Warranty Disclaimers.

If the Modified Version includes new front-matter sections or appendices that qualify as Secondary Sections and contain no material copied from the Document, you may at your option designate some or all of these sections as invariant. To do this, add their titles to the list of Invariant Sections in the Modified Version's license notice. These titles must be distinct from any other section titles.

You may add a section Entitled "Endorsements", provided it contains nothing but endorsements of your Modified Version by various parties--for example, statements of peer review or that the text has been approved by an organization as the authoritative definition of a standard.

You may add a passage of up to five words as a Front-Cover Text, and a passage of up to 25 words as a Back-Cover Text, to the end of the list of Cover Texts in the Modified Version. Only one passage of Front-Cover Text and one of Back-Cover Text may be added by (or through arrangements made by) any one entity. If the Document already includes a cover text for the same cover, previously added by you or by arrangement made by the same entity you are acting on behalf of, you may not add another; but you may replace the old one, on explicit permission from the previous publisher that added the old one.

The author(s) and publisher(s) of the Document do not by this License give permission to use their names for publicity for or to assert or imply endorsement of any Modified Version.

5. COMBINING DOCUMENTS

You may combine the Document with other documents released under this License, under the terms defined in section 4 above for modified versions, provided that you include in the combination all of the Invariant Sections of all of the original documents, unmodified, and list them all as Invariant Sections of your combined work in its license notice, and that you preserve all their Warranty Disclaimers.

The combined work need only contain one copy of this License, and multiple identical Invariant Sections may be replaced with a single copy. If there are multiple Invariant Sections with the same name but different contents, make the title of each such section unique by adding at the end of it, in parentheses, the name of the original author or publisher of that section if known, or else a unique number. Make the same adjustment to the section titles in the list of Invariant Sections in the license notice of the combined work.

In the combination, you must combine any sections Entitled "History" in the various original documents, forming one section Entitled "History"; likewise combine any sections Entitled "Acknowledgements", and any sections Entitled "Dedications". You must delete all sections Entitled "Endorsements".

6. COLLECTIONS OF DOCUMENTS

You may make a collection consisting of the Document and other documents released under this License, and replace the individual copies of this License in the various documents with a single copy that is included in the collection, provided that you follow the rules of this License for verbatim copying of each of the documents in all other respects.

You may extract a single document from such a collection, and distribute it individually under this License, provided you insert a copy of this License into the extracted document, and follow this License in all other respects regarding verbatim copying of that document.

7. AGGREGATION WITH INDEPENDENT WORKS

A compilation of the Document or its derivatives with other separate and independent documents or works, in or on a volume of a storage or distribution medium, is called an "aggregate" if the copyright resulting from the compilation is not used to limit the legal rights of the compilation's users beyond what the individual works permit. When the Document is included in an aggregate, this License does not apply to the other works in the aggregate which are not themselves derivative works of the Document.

If the Cover Text requirement of section 3 is applicable to these copies of the Document, then if the Document is less than one half of the entire aggregate, the Document's Cover Texts may be placed on covers that bracket the Document within the aggregate, or the electronic equivalent of covers if the Document is in electronic form. Otherwise they must appear on printed covers that bracket the whole aggregate.

8. TRANSLATION

Translation is considered a kind of modification, so you may distribute translations of the Document under the terms of section 4. Replacing Invariant Sections with translations requires special permission from their copyright holders, but you may include translations of some or all Invariant Sections in addition to the original versions of these Invariant Sections. You may include a translation of this License, and all the license notices in the Document, and any Warranty Disclaimers, provided that you also include the original English version of this License and the original versions of those notices and disclaimers. In case of a disagreement between the translation and the original version of this License or a notice or disclaimer, the original version will prevail.

If a section in the Document is Entitled "Acknowledgements", "Dedications", or "History", the requirement (section 4) to Preserve its Title (section 1) will typically require changing the actual title.

9. TERMINATION

You may not copy, modify, sublicense, or distribute the Document except as expressly provided for under this License. Any other attempt to copy, modify, sublicense or distribute the Document is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.

10. FUTURE REVISIONS OF THIS LICENSE

The Free Software Foundation may publish new, revised versions of the GNU Free Documentation License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns. See http://www.gnu.org/copyleft/ [http://www.gnu.org/copyleft/] .

Each version of the License is given a distinguishing version number. If the Document specifies that a particular numbered version of this License "or any later version" applies to it, you have the option of following the terms and conditions either of that specified version or of any later version that has been published (not as a draft) by the Free Software Foundation. If the Document does not specify a version number of this License, you may choose any version ever published (not as a draft) by the Free Software Foundation.

ADDENDUM: How to use this License for your documents

To use this License in a document you have written, include a copy of the License in the document and put the following copyright and license notices just after the title page:

> Copyright (C) YEAR YOUR NAME.
>
> Permission is granted to copy, distribute and/or modify this document under the terms of the GNU Free Documentation License, Version 1.2 or any later version published by the Free Software Foundation; with no Invariant Sections, no Front-Cover Texts, and no Back-Cover Texts. A copy of the license is included in the section entitled "GNU Free Documentation License".

If you have Invariant Sections, Front-Cover Texts and Back-Cover Texts, replace the "with...Texts." line with this:

> with the Invariant Sections being LIST THEIR TITLES, with the Front-Cover Texts being LIST, and with the Back-Cover Texts being LIST.

If you have Invariant Sections without Cover Texts, or some other combination of the three, merge those two alternatives to suit the situation.

If your document contains nontrivial examples of program code, we recommend releasing these examples in parallel under your choice of free software license, such as the GNU General Public License, to permit their use in free software.