Anaconda Prompt Visual Style

Alain Reguera Delgado

March 12, 2010

Abstract

This article describes Anaconda Prompt. Anaconda Prompt is the first screen shown after booting up with the install CD/DVD medium. Anaconda Prompt is based on H. Peter Anvin's syslinux suite of bootloaders, specifically on the `isolinux` bootloader. The `syslinux` suite and its documentation come inside the `syslinux` package, available through `yum` in the `[base]` repository of CentOS Distribution.

Anaconda is the name of the install program used by CentOS. It is python-based with some custom modules written in C. The anaconda installer works on a wide variety of Linux-based computing architectures (ia32, Itanium, Alpha, S/390, PowerPC), and is designed to make it easy to add platforms.

Contents

1 Introduction

Anaconda Prompt Visual Style is organized inside CentOS Artwork Repository.

2 Installation

This section describes the tools you need to have installed in your CentOS workstation in order to interact with your working copy of CentOS Artwork Repository.

2.1 Subversion

Subversion is used to interact with CentOS Artwork Repository.

Subversion is a version control system, which allows you to keep old versions of files and directories (usually source code), keep a log of who, when, and why changes occurred, etc., like CVS, RCS or SCCS.[1]

To install Subversion client tools in your workstation you can use the following command:

    yum install subversion

2.2 Inkscape

Inkscape is used to design and render images inside CentOS Artwork Repository.

Inkscape is a GUI editor for Scalable Vector Graphics (SVG) format drawing files, with capabilities similar to Adobe Illustrator, CorelDraw, Visio, etc. Inkscape features include versatile shapes, bezier paths, freehand drawing, multiline text, text on path, alpha blending, arbitrary affine transforms, gradient and pattern fills, node editing, SVG-to-PNG export, grouping, layers, live clones, and more.

Note that Inkscape is not inside CentOS Distribution, so you need to configure a third party repository like RPMForge or EPEL to install Inkscape. Installation of a third party repositories inside CentOS Distribution is described in the following URL:

    http://wiki.centos.org/AdditionalResources/Repositories

Once you have configured the third party repository you can install Inkscape using the following command:

    yum install inkscape

---

[1]More documentation about Subversion and its tools, including detailed usage explanations of the svn, svnadmin, svnserve and svnlook programs, historical background, philosophical approaches and reasonings, etc., can be found at `http://svnbook.red-bean.com/`.

2.3 ImageMagick

ImageMagick is used by scripts inside CentOS Artwork Repository.

ImageMagick is a free software suite for the creation, modification and display of bitmap images. It can read, convert and write images in a large variety of formats. Images can be cropped, colors can be changed, various effects can be applied, images can be rotated and combined, and text, lines, polygons, ellipses and Bzier curves can be added to images and stretched and rotated.

To install ImageMagick in your workstation you can run the following command:

    yum install ImageMagick

2.4 Netpbm

Netpbm is used by scripts inside CentOS Artwork Repository.

Netpbm is a toolkit for manipulation of graphic images, including conversion of images between a variety of different formats. There are over 300 separate tools in the package including converters for about 100 graphics formats.

To install Netpbm in your workstation you can run the following command:

    yum install netpbm{-progs}

2.5 Syslinux

The package `syslinux` provides the programs `ppmtolss16` and `lss16toppm` which are used to produce Anaconda Prompt images. The `ppmtolss16` Perl program also includes the file format specification.

Syslinux is a suite of bootloaders, currently supporting DOS FAT filesystems, Linux ext2/ext3 filesystems (EXTLINUX), PXE network boots (PXELINUX), or ISO 9660 CD-ROMs (ISOLINUX). It also includes a tool, MEMDISK, which loads legacy operating systems from these media.

To install Syslinux in your workstation you can run the following command:

    yum install syslinux

2.6 GNU Image Manipulation Program

GNU Image Manipulation Program (GIMP) is used to manipulate images inside CentOS Artwork Repository.

To install GIMP in your workstation you can run the following command:

```
yum install gimp
```

2.7 GNU Core Utilities

The GNU core utilities are a set of tools commonly used in shell scripts.

To install the GNU core utilities in your workstation you can run the following command:

```
yum install core-utils
```

2.8 LaTeX

LaTeX is used to create manuals inside CentOS Artwork Repository.

LaTeX is a document preparation system implemented as a macro package for Donald E. Knuth's TeX typesetting program. The LaTeX command typesets a file of text using the TeX program and the LaTeX Macro package for TeX. To be more specific, it processes an input file containing the text of a document with interspersed commands that describe how the text should be formatted.

To install LaTeX in your workstation you can run the following command:

```
yum install tetex-{latex,fonts,doc,xdiv,dvips}
```

3 Configuration

3.1 Firewall

The CentOS Artwork Repository lives on the following URL:

```
https://projects.centos.org/svn/artwork/
```

To reach this location you need to have Internet access and be sure no rule in your firewall is denying this site. Note that the URL uses the SSL protocol (port 443).

3.2 Subversion Behind Squid

Sometimes it is convenient to proxy Subversion client's requests through a proxy-cache server like Squid. In cases like this, the Squid proxy server is in the middle between you and CentOS Artwork Repository. If you want to proxy Subversion client's requests through Squid proxy-cache server, you need to configure your Subversion client and your Squid proxy server to do so.

3.2.1 Subversion Client Configuration

Subversion client needs to be configured to send requests to your Squid proxy-cache server. This configuration takes place in the file:

~/.subversion/servers

3.2.2 Squid Server Configuration

Squid proxy-cache server needs to be configured to accept the extension methods REPORT MERGE MKACTIVITY CHECKOUT MKCOL. This configuration takes place in the file:

/etc/squid/squid.conf

specifically in the configuration text described below:

```
#  TAG: extension_methods
#       Squid only knows about standardized HTTP request methods.
#       You can add up to 20 additional "extension" methods here.
#
#Default:
# none
extension_methods REPORT MERGE MKACTIVITY CHECKOUT MKCOL
```

3.3 Working Copy

A Subversion working copy is an ordinary directory tree on your local system, containing a collection of files (i.e. Translations, Designs, Manuals, and Scripts). You can edit these files however you wish. Your working copy is

your own private work area: Subversion will never incorporate other people's changes, nor make your own changes available to others, until you explicitly tell it to do so. You can even have multiple working copies of the same project.[2]

After you've made some changes to the files in your working copy and verified that they work properly, Subversion provides you with commands to "publish" your changes to the other people working with you on your project (by writing to the repository). If other people publish their own changes, Subversion provides you with commands to merge those changes into your working directory (by reading from the repository).

To download your working copy of CentOS Artwork Repository in the location ∼/Desktop/artwork, run the following command:

```
svn co https://projects.centos.org/svn/artwork ∼/Desktop/
```

The previous command will download lots of files into your workstation. This process may take some time. When finish you are ready to start exploring and improving available works.

3.4   User Identification

At this point you probably have made some changes inside your working copy and wish to publish them. To publish your changes you need to have a registered account with commit privilege in CentOS Artwork Repository.

> **Note:** If you are new in CentOS Artwork Repository it is possible that you can't commit your changes. That is because new registered accounts haven't commit privilege set by default. In order for your registered account to have commit privilege inside CentOS Artwork Repository you need to request it. See section 3.4.2.

---

[2]Even this is basically correct, doing so when using CentOS Artowrk Repository can bring some confusion when executing scripts. Actually, only one absolute path can be defined as absolute path for scripts' execution. You can have as many working copies of CentOS Artwork Repository as you want but scripts will be executed from just one working copy absolute path —the one you defined in the variable CentOS_ARTWORK_WC. For more information about this, see section 3.5.

3.4.1 Account Registration

To register a user account inside CentOS Artwork Repository, you need to go to the following URL:

```
https://projects.centos.org/trac/artwork/
```

3.4.2 Account Privileges

To have commit privileges in CentOS Artwork Repository it is needed that you show your interest first, preferably with something useful like a new or improved design, translation, manual, or script. As convention people working on CentOS Artwork Repository share ideas in the mailing list centos-devel@centos.org. If you are interested in joining us go there and express yourself.

3.5 Shell Environment

CentOS Artwork Repository uses scripts to automate tasks. When executing scripts we need to provide their path, relative or abolute.

3.5.1 Relative Paths

Using relative paths makes difficult to call functions from different levels inside the directory structure of your working copy of CentOS Artwork Repository.

3.5.2 Absolute Paths

Using absolute paths let us use functions from different levels inside the directory structure of your working copy of CentOS Artwork Repository but creates an incovenient. It forces us to use an unchangable absolute path that people should use to download their working copy of CentOS Artwork Respository in their workstations.

3.5.3 Environment Variable Definition

To avoid forcing a predifined absolute path to store your working copy of CentOS Artwork Repository, we desided to define the following environment variable:

CentOS_ARTWORK_WC: The value of this environment variable contains the absolute path used to store your working copy of CentOS Artwork Repository in your workstation. This way you can download your working copy of CentOS Artwork Repository wherever you want and be sure that scripts inside it execute correctly.

3.5.4 Environment Variable Initialization

As `CentOS_ARTWORK_WC` environment variable defines the absolute path used to execute scripts, it isn't possible to initialize it inside scripts themselves. To initialize the environment variable `CentOS_ARTWORK_WC` we use the personal initialization file ($\sim$/`.bash_profile`), executed for login shells.

For example, if you downloaded your working copy of CentOS Artwork Repository in the absolute path $\sim$/`Desktop/artwork`, then you need to add the following lines to your personal initialization file:

```
CentOS_ARTWORK_WC=~/Desktop/artwork
export CentOS_ARTWORK_WC
```

For changes to take effect you need to logout and do login again.

4 Framework

Anaconda Prompt framework is inside your working copy of CentOS Artwork Repository. Anaconda Prompt framework is organized in the following sections:

4.1 Identity

trunk/Identity/Themes/$THEME/Distro/Anaconda/Prompt/

Here is where graphic designers provide SVG files with Anaconda Prompt designs and render them as PNG images.

4.1.1 Designs

Anaconda Prompt design is stored inside 'svg/' directory. The following files are the one you need to change in order to improve Anaconda Prompt Visual Style. To edit these files you can use a vectorial graphic tool like Inkscape.

syslinux-splash.svg: This design is common to each major release of CentOS Distribution by sharing the same artistic motif. This design is unique to each major relase of CentOS Deistribution by means of CentOS Release Brand.

This design should have the following identity components:

1. The CentOS Release Brand.
2. The CentOS Default Artistic Motif.

Note that all Anaconda Prompt designs are based on the same artistic motif (also known as Theme).[3] If you want to improve an existent artistic motif then share your ideas with its author before commit any change up to CentOS Artwork Repository. Doing so is polite and enforce our community feeling.

Otherwise, if you have designed a new Artistic Motif you become its author and surely people will ask you about it.

4.1.2 Export Id

The export id is used inside design templates to define the area that will be exported as PNG image. As convention, we use the word 'CENTOSARTWORK' as export id. In Inkscape, you can set the export id to a selected object by pressing Ctrl+Shift+O and filling the appropriate fields.

To know what is the area set as export id, in Inkscape you can press Ctrl+F to find it. If it exist, the object holding the string as id is selected. Sometimes, this can be used to verify the design bounderies.

4.1.3 Markers

The markers are used as replacement pattern to help image translation both in design templates and translation files. When we render images, translation files are applied to design templates to get a PNG translated image as result. In order to have the appropriate translation, markers should match both in design templates and translation files.

Markers used in Anaconda Prompt design templates and translation files are described in Table 1.

---

[3]To know more about the artistic motif concept take a look to the document "CentOS Artistic Motif" in trunk/Manuals/Identity/Themes/Motif/Manual.pdf.

Marker	Description
=VERSION=	Major release number of CentOS Distribution.

Table 1: Anaconda Prompt translation markers.

4.1.4 Images

Anaconda Prompt final images are stored inside 'img/' directory. Final images are rendered using the render.sh script (see section 4.1.8).

4.1.5 Color Limitations

Anaconda Prompt does have color limitations. Initially, Anaconda Prompt images are rendered without color limitation and later they are indexed to 16 colors and converted to LSS16 format, as described in section 4.1.6.

4.1.6 Color Palettes

turnk/Identity/Themes/$THEME/Palettes/

Here is where graphic designers define specific theme palettes. In Anaconda Prompt particular case they define the `Syslinux.gpl`, `Syslinux.ppm`, and `Syslinux.hex` palettes.

Syslinux.gpl: The `Syslinux.gpl` palette defines the 16 colors used in Anaconda Prompt 16 colors images. The palette `Syslinux.gpl` is created as described below:

1. Render the final design of syslinux-splash.png image.

2. Open the syslinux-splash.png image with GIMP and index it to 16 colors using the indexing feature *Generate optimum palette.*

3. With the syslinux-splash.png image already indexed to 16 colors, create a palette from it using the GIMP *Palettes* (Ctrl+P) and the *Import Palette . . .* feature based on the 16 colors image you already have. The result will be saved in ∼/.gimp-2.2/palettes/ with the name you specified.

Syslinux.ppm: The `Syslinux.ppm` palette is used by render.sh script to index images down to 16 colors automatically. The `Syslinux.ppm` palette
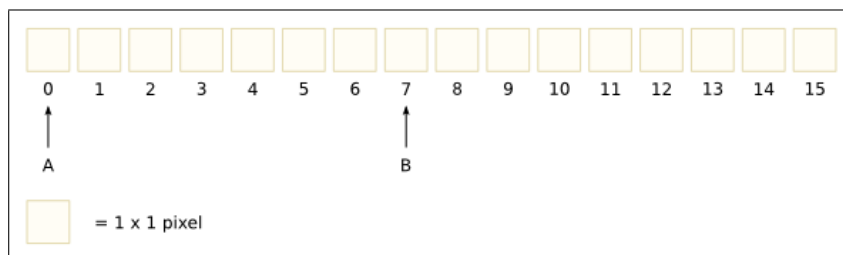
Figure 1: Color position in `Syslinux.ppm` image. Syslinux background color (A) is in the position 0. Syslinux foreground color (B) is in the position 7.

is created using `Syslinux.gpl` palette color information as reference. The palette `Syslinux.ppm` is created as described below:

1. Use GIMP to create a new image with 16 x 1 pixels of dimension.

2. Fill its pixels with the colors specified in the `Syslinux.gpl` palette.

3. Set the appropriate order of colors inside the `Syslinux.ppm` palette. Relevant positions are indices 0 and 7. The index position 0 is the background color, and the index position 7 is the color used for the text printed by `syslinux` itself.

   To grant the highest contrast use the darkest color as background, and the lightest one as foreground. The color position inside `Syslinux.ppm` index is described in `syslinux` documentation and illustrated in Figure 1.

Syslinux.hex: The `Syslinux.hex` palette is used by render.sh to create the LSS16 image format (syslinux-splash.lss). The LSS16 format is the final format used by syslinux. The `Syslinux.hex` palette should have the same color information and order that `Syslinux.ppm` do.

To create `Syslinux.hex` create a new plain text file and put the hexadecimal color information and its index position defined in `Syslinux.ppm` palette in just one line. The format used to create `Syslinux.hex` file is `#rrbbgg=i` .... Where `#rrggbb=i` indicate that the color `#rrggbb` (hex) should be assigned index i (decimal).

Anaconda Prompt images, inside the same artistic motif, have the same visual style and color information. This let us create a common set of `.gpl`, `.ppm`, and `.hex` palettes that can be reused.

13

Anaconda Prompt image rendering and format conversion is automated using the render.sh script. For example if you want to propagate the current Anaconda Prompt image design to a new CentOS major release, let say CentOS 6, you only need to add the appropriate translation path and use the render.sh script for it. There is no need to create new palettes or memorize long sequences of commands to do rendering and conversions each time a new major relase comes out. Just add the appropriate translations files and run the render.sh script to get what you need.

The predefined set of palettes can be reused as long as Anaconda Prompt image color information remains the same.[4] If you make changes to the graphic design, change colors or something else that affects color information, you need to redefine the common set of palettes in order to comply the new color information.

4.1.7 Models

trunk/Identity/Model/Distro/Anaconda/Prompt/

Here is where graphic designers provide SVG files with firstboot design models and render them. A design model is a representative image used to illustrate key components inside a specific design. Design models are frequently used in documentation.

Anaconda Progress design model is shown in Figure 2.

4.1.8 Rendering

To render images you need to execute the render.sh script. This script does the appropriate calls and applies translations (see section 4.2) to design templates to create translated images. The render.sh script has the following form:

```
./render.sh 'REGEX'
```

The REGEX argument is optional. It is used to reduce the amount of images you want to render. It is a posix-egrep regular expression pattern, applied against the translation path.

---

[4]and it should because the monolithic visual structure the CentOS project is attached to.

Figure 2: Anaconda Prompt design model.

4.1.9 Issues

When creating Anaconda Prompt images some issues were found. They are described below:

Many Different Colors : As more different colors you have on your design, more are the possibilities of increasing the amount of noise in your design after indexing to 16 colors. For example, if you include the actual CentOS symbol in this image, it ocupies 3 colors (for the orange, green, violet) in the indexed image which are completely different and non-reusable in the blue toned background image.

The CentOS Symbol : As previously said, if we include the CentOS default symbol in Anaconda Prompt there is a color degradation and a reduction of available colors to use in the 16 colors indexed image.

Some tests were made with variants of CentOS default symbol, but they all were declined because they bring confusion about which is the CentOS default symbol.

It would be very convenient to CentOS visual identity if the CentOS default symbol could be included, *exactly as it is*, in Anaconda Prompt images.

4.2   Translations

trunk/Translations/Themes/Distro/Anaconda/Prompt/

Here is where translators locale images. Image localization is defined inside `.sed` files, also known as translation files. Translation files can be common or specific. The given organization of translation files defines the translation path.

4.2.1   Common Translations

Common translation files contain common localization or no localization at all for their related images. They are in the root directory of the translation path. Common translation files create common images for all major releases of CentOS Distribution.

4.2.2   Specific Translations

Specific translation files hold specific localization for their related images. Specific translation files are not in the root directory of the translation path. Specific translation files are inside directories which describe the type of translation they are doing.

4.2.3   Translation Path

Translation path is where we organize common and specific translation files. Translation path is also used as reference to build the path of rendered images inside image directory (see section 4.1.4).

When rendering images, if no REGEX argument is provided to render.sh, all translation files in the translation path are read and as consequence one image is rendered for each one of them. The image name is the same name of translation file but with the extension .png.

When rendering images, if you want to render one or more, but not all images, you need to look into the translation path and create a regular expression pattern that match the translation path or paths related to the

image or images you want to render. For example if we have the translation path shown in Figure 3 and we want to render the CentOS 5 Anaconda Prompt only, then we can do:

```
./render.sh '5/syslinux-splash'
```

```
trunk/Translations/Identity/Themes/Distro/Anaconda/Prompt/
|-- 3
|   '-- syslinux-splash.sed
|-- 4
|   '-- syslinux-splash.sed
|-- 5
|   '-- syslinux-splash.sed
'-- 6
    '-- syslinux-splash.sed

4 directories, 4 files
```

Figure 3: Anaconda Prompt translation path.

If we want to render Anaconda Prompt for CentOS 5 and 6 but not for CentOS 4 and 3, then we can do:

```
./render.sh '(5|6)/syslinux-splash'
```

When using REGEX note that pattern is applied to the entire translation path. The regular expression pattern that you use should match it in order to be valid. Otherwise it will fail, and if nothing match the translation path, nothing is rendered. It is not the same to say '5/syslinux-splash' that 'syslinux-splash', the frist expression match but the last one does not.

When using REGEX note that you don't need to specify the file extension. They are removed from translation path before applying the REGEX pattern, so they don't count here.

4.3 Manuals

trunk/Manuals/Identity/Themes/Distro/Anaconda/Prompt/

Here is where we prepare the documentation you are reading right now. If you want to help improving Anaconda Prompt Visual Style Manual this is the place you need to go.

4.4 Scripts

4.4.1 Rendering

The rendering process is invoked by the render.sh script. Each section, where rendering is automated, has a render.sh script inside it. You use the section's render.sh script to start a rendering process specific to that section. The work of each section's render.sh script is calling a common pre-rendering script which defines the way rendering is performed.

4.4.2 Pre-rendering

trunk/Scripts/Identity/Themes/Distro/Anaconda/Prompt/

Here is where Anaconda Prompt pre-rendering script is stored. The pre-rendering script is the first script called when the render.sh script is executed by you. In the pre-rendering script you define what translation files apply what design template. You can also configure some post-rendering actions.

4.4.3 Post-rendering

Post-rendering actions are configured in the pre-rendering scripts and defined inside rendering functions to extend their functionality. Post-rendering actions are applied to files, one by one, once they have been rendered. The following are common post-rendering actions you may found:

renderFormats: The renderFormat post-rendering action is common to all image rendering. After rendering the PNG image, the renderFormats post-rendering action is applied to produce images in specific formats (i.e. tif, ppm, pdf, xpm, etc.), using the previous PNG image as base.
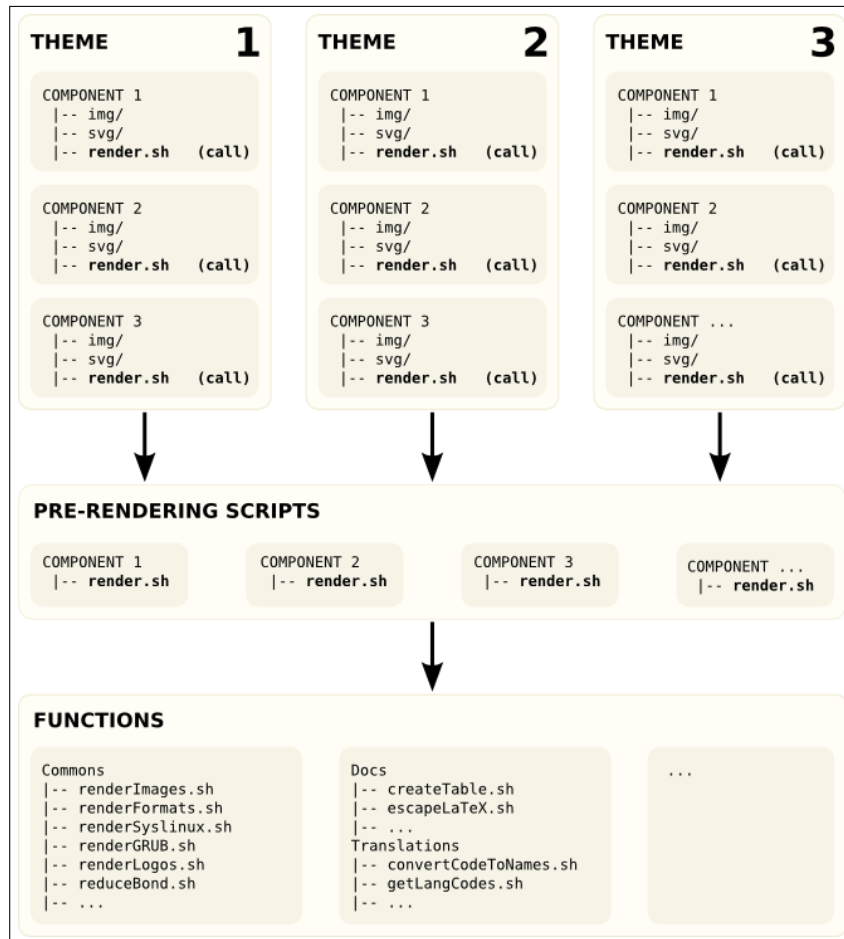
Figure 4: Rendering design model.

renderSyslinux: The renderSyslinux post-rendering action is specific to Anaconda Prompt rendering. After rendering the PNG image of your design, the renderSyslinux post-rendering action is applied to produce the LSS16 image format, using the previous PNG image as based.

renderGRUB: The renderGRUB post-rendering action is specific to GRUB image rendering. After rendering the PNG image of your design, the renderGRUB post-rendering action is applied to produce the 14 colors xpm.gz file, using the previous PNG image as based.

5 Rebranding

To comply with upstream redistribution policy, the CentOS Project removes all upstream brands and artworks from CentOS Distribution. The CentOS Project has its own brand and its own artwork. The CentOS Brand and CentOS Artwork are what the CentOS Project uses in CentOS Distribution.

The action of removing upstream brands and artworks and add CentOS brands and artworks is what we call rebranding.

CentOS Brands and artworks are organized inside CentOS Artwork Repository. The CentOS Artwork Repository is maintain by CentOS Artwork SIG which is formed by CentOS Community People.

When rebranding use original names as much as possible. Do not rename original file names if you don't need to. To rebrand the orignal file information, update just the file content using the 'cp' command or something similar.

5.1 Images

This section describes relation between SRPM packages and image files you need to modify in order to rebrand firstboot artwork correctly.

5.1.1 redhat-logos

The `redhat-logos` package contains files created by the CentOS Project to replace the Red Hat "Shadow Man" logo and RPM logo. The Red Hat "Shadow Man" logo, RPM, and the RPM logo are trademarks or registered trademarks of Red Hat, Inc.

The following images in `redhat-logos` need to be rebranded respectively:

```
/usr/share/anaconda/pixmaps/
|-- syslinux-splash.png
```

by the files:

```
trunk/Identity/Themes/$THEME/Distro/Anaconda/Prompt/img/$VERSION/
|-- syslinux-splash-16c.png
```

Once you rebrand the image files inside the SRPM package, you need to rebuild it with the new brand information.

5.2 Syslinux

The syslinux information you need to rebrand is not inside CentOS Distribution itself, but in the medium's filesystem you use to install CentOS Distribution (i.e. CD, DVD, etc.).

The following images need to be rebranded respectively:

```
media:/isolinux/
|-- splash.lss
```

by the files:

```
trunk/Identity/Themes/$THEME/Distro/Anaconda/Prompt/img/$VERSION/
|-- syslinux-splash.lss
```

Colors used in syslinux messages are set using color codes around the text you want to remark. Syslinux text's color codes are described in syslinux documentation (see /usr/share/doc/syslinux-x.xx/syslinux.doc).

5.3 Messages Locale

Anaconda Prompt doesn't have messages locale. Image translation is done as explain section 4.1, and section 4.2.

6 GNU Free Documentation License

Version 1.2, November 2002

Copyright (C) 2000,2001,2002 Free Software Foundation, Inc.
59 Temple Place, Suite 330, Boston, MA 02111-1307, USA
Everyone is permitted to copy and distribute verbatim copies of this license
document, but changing it is not allowed.

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.

6.1 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.

6.2   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 6.3.

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

6.3   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.

6.4   Modifications

You may copy and distribute a Modified Version of the Document under the conditions of sections 6.2 and 6.3 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.

6.5   Combining Documents

You may combine the Document with other documents released under this License, under the terms defined in section 6.4 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".

6.6   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.

6.7 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 6.3 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.

6.8 Translation

Translation is considered a kind of modification, so you may distribute translations of the Document under the terms of section 6.4. 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 6.4) to Preserve its Title (section 6.1) will typically require changing the actual title.

6.9   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.

6.10   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/`.

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.

6.11   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.