

Performing Major Version Upgrades of SUSE Linux Enterprise

When Standard Boot Options Are Unavailable

SUSE Linux Enterprise 11 and newer

Jiri Srain, Project Manager Engineering (SUSE)

Performing Major Version Upgrades of SUSE Linux Enterprise

When Standard Boot Options Are Unavailable

This guide shows how to perform an upgrade of a SUSE Linux Enterprise system to a new major version in environments which do not allow for standard booting of the installation, neither via the local boot media, nor via PXE boot.

Disclaimer: Documents published as part of the SUSE Best Practices series have been contributed voluntarily by SUSE employees and third parties. They are meant to serve as examples of how particular actions can be performed. They have been compiled with utmost attention to detail. However, this does not guarantee complete accuracy. SUSE cannot verify that actions described in these documents do what is claimed or whether actions described have unintended consequences. SUSE LLC, its affiliates, the authors, and the translators may not be held liable for possible errors or the consequences thereof.

Contents

- 1 Introduction 4
- 2 Terminology 4
- 3 Requirements 5
- 4 Preparing the Installation Repository 5
- 5 Preparing the Installation Kernel and Initrd 6
- 6 Configuring the Boot Loader 7
- 7 Preparing the Installation System for an Upgrade via SMT 10
- 8 Performing the Upgrade 10
- 9 Legal notice 11
- 10 GNU Free Documentation License 12

1 Introduction

To upgrade your SUSE Linux Enterprise system to a newer service pack, there are tools available which allow for an online upgrade of the system. This means that new packages are installed while the system is running. After the installation of the packages, a reboot is necessary.

This process has the advantage that you only need access to the system, be it a local console or an SSH session. You do not need to configure the firmware to boot a different media.

However, upgrading a system to a new *major* version cannot be performed online. To perform an upgrade, you need to boot the system from the installation media (DVD, USB stick), or start it via PXE boot.

In some environments, it is not possible to insert a new media to the server, configure the firmware to boot from a different or even a virtual disk, or prepare the PXE boot environment for starting the upgrade process. This can be the case for example in clouds or in remote server rooms.

This document describes how the existing boot loader can be used in such environments to perform an upgrade from SUSE Linux Enterprise 11 to SUSE Linux Enterprise 12, or from SUSE Linux Enterprise 12 to SUSE Linux Enterprise 15.

While the examples below focus on the AMD64 or Intel 64 system architecture, a similar approach can be applied to other architectures too.

2 Terminology

The *Installation Media* is the media you use to boot the installation. It can be either a physical DVD or USB stick, an ISO image attached to a virtual machine, or the content on such media available via a network share.

For SUSE Linux Enterprise 12 products, the installation medium is the first DVD of the respective product. For SUSE Linux Enterprise 15 products, it is the unified installer DVD.

The *Installation Repository* contains packages for installation and metadata. It is included in the installation media. Online repositories, which are for example mirrored on the Subscription Management Tool (SMT), can serve the same purpose.

The *Installation System* is the environment which contains all tools that are needed to perform the installation (including for example YaST). It is also available from the installation media.

3 Requirements

To perform an upgrade, you need to have prepared the following components:

- The installation repository and installation system
- The installation kernel and `initrd`

The installation repository should be either copied to a local disk, or made available via the network. The installer supports all common transfer protocols, like HTTP(S), FTP, NFS, SMB. For local media, it supports a local disk or a CD/DVD drive. It is recommended to copy the entire content of the installation media, so that the installation system is included. The required disk space is approximately 5 GB for upgrading to SUSE Linux Enterprise 12, and approximately 1 GB for upgrading to SUSE Linux Enterprise 15, on top of the disk space needed for the upgrade itself. The installation kernel and `initrd` must be made available in the boot area of the respective hardware architecture. For example, for legacy booting of AMD64 or Intel 64 systems, this is the `/boot` directory. The required disk space is approximately 100 MB.

4 Preparing the Installation Repository

Preparing the installation repository is an easy task. Extract the content of the installation media to the respective location either on your local system or on a network share. Use the content of DVD1 of any SUSE Linux Enterprise 12 product, or the Installer DVD of the unified SUSE Linux Enterprise 15 installer.

If you intend to put the installation media to a local storage, either use a second disk or a stand-alone partition, which is not mounted by your system by default. The reason behind is that YaST mounts all partitions during the upgrade process. This would result in the partition being mounted twice at the same time.

If you use a network share, make sure that it is accessible from the host you aim to upgrade. You can test this for example via a Web browser.

If you use the installation media, copy its entire content to ensure it includes the installation system.

If you have a local Subscription Management Tool (SMT) or Repository Mirroring Tool (RMT) server available, the repository may already be mirrored on that server. If this is the case, point the installer to the POOL repository of the product you want to upgrade to. Ensure that the installation system is available too.

5 Preparing the Installation Kernel and Initrd

To boot the installer, you need to extract the installation kernel and `initrd` from the media and put it to the location where the boot loader can load it from. There are two ways to obtain the installation kernel and `initrd`:

- From the DVD1 of the SUSE Linux Enterprise 12-based product, respective the SUSE Linux Enterprise 15 unified installer
- From packages shipped with a new product for network booting

The examples below require as system architecture AMD64 or Intel 64 with legacy booting, and as product SUSE Linux Enterprise Server. For other products or architectures, the paths or package names may differ.

5.1 Extracting the Installation Kernel from the Media

The examples and explanations in this section require that the installation media is mounted under `/mnt`.

Copy the kernel and `initrd` from the installation media to the same location where your system stores its kernel and `initrd`:

```
# cp /mnt/boot/x86_64/loader/initrd /boot/initrd.install
# cp /mnt/boot/x86_64/loader/linux /boot/linux.install
```

5.2 Extracting the Installation Kernel from a Package

SUSE Linux Enterprise 12 SP4-based products and newer product versions include a package which contains all files needed for setting up a PXE boot server for installation of the respective product. The name of the package looks like the following example: `tftpboot-installation-<product>-<version>-<architecture>.noarch.rpm`. Download the package from the repositories of the product you install to. The package is architecture-independent and does not require any packages from the new product.

```
# rpm -i tftpboot-installation-SLES-12-SP4-x86_64-14.337.5-1.33.noarch.rpm
# cp /srv/tftpboot/SLES-12-SP4-x86_64/boot/x86_64/loader/linux /boot/linux.install
# cp /srv/tftpboot/SLES-12-SP4-x86_64/boot/x86_64/loader/initrd /boot/initrd.install
# rpm -e tftpboot-installation-SLES-12-SP4-x86_64
```

6 Configuring the Boot Loader

To perform the upgrade, you need to configure the boot loader of the old and still running system.

6.1 Configuring GRUB for an Upgrade from SUSE Linux Enterprise 11

The GRUB configuration is stored in `/boot/grub/menu.lst`. Open this file and append a section as shown below. This will start the upgrade:

```
title SUSE Linux Enterprise Server 12 Update
  root (hd0,1)
  kernel /boot/linux.install <options>
  initrd /boot/initrd.install
```

For `<options>`, find below the parameters which need to be included. Make sure that the root value matches the one of your other sections so that it points to the same partition. Optionally, you can configure GRUB to boot a different default section next time. To do so, adjust the number according to your menu, starting from 0:

```
# grubonce 2
Using entry #2: SUSE Linux Enterprise Server 12 Installer
```

6.2 Configuring GRUB2 for an Upgrade from SUSE Linux Enterprise 12

GRUB2 generates the boot menu based from kernels and other operating systems found in the system. However, it still allows you to add a custom section.

First, locate the menu entry for your system in `/boot/grub2/grub.cfg`. It should look like following:

```
menuentry 'SLES 12-SP4' --class sles --class gnu-linux --class gnu --class os
  $menuentry_id_option 'gnulinux-simple-cd77493e-f701-4624-8074-21f0061e0727' {
    load_video
    set gfxpayload=keep
    insmod gzio
    insmod part_msdos
```

```

insmod ext2
set root='hd0,msdos2'
if [ x$feature_platform_search_hint = xy ]; then
    search --no-floppy --fs-uuid --set=root --hint='hd0,msdos2' cd77493e-
f701-4624-8074-21f0061e0727
else
    search --no-floppy --fs-uuid --set=root cd77493e-f701-4624-8074-21f0061e0727
fi
echo 'Loading Linux 4.12.14-94.41-default ...'
linux /boot/vmlinuz-4.12.14-94.41-default root=UUID=cd77493e-
f701-4624-8074-21f0061e0727 resume=/dev/vda1 splash=silent quiet showopts
echo 'Loading initial ramdisk ...'
initrd /boot/initrd-4.12.14-94.41-default
}

```

Next, open the file `/etc/grub.d/40_custom` and create a custom entry in it. It will only differ from the one above in the title, path to kernel, and `initrd` and kernel parameters (see the lines `menuentry`, `linux` and `initrd`):

```

menuentry 'SLES 15 Upgrade' {
    load_video
    set gfxpayload=keep
    insmod gzio
    insmod part_msdos
    insmod ext2
    set root='hd0,msdos2'
    if [ x$feature_platform_search_hint = xy ]; then
        search --no-floppy --fs-uuid --set=root --hint='hd0,msdos2' cd77493e-
f701-4624-8074-21f0061e0727
    else
        search --no-floppy --fs-uuid --set=root cd77493e-f701-4624-8074-21f0061e0727
    fi
    echo 'Loading Linux 4.12.14-94.41-default ...'
    linux /boot/linux.install <options>
    echo 'Loading initial ramdisk ...'
    initrd /boot/initrd.install
}

```

Keep the lines you do not need to change unchanged. They ensure that the boot loader loads the right modules to load your installation kernel.

For `<options>`, find the parameters which need to be included below.

After the menu entry is created, re-create the GRUB menu and, optionally, set the default boot option for the next reboot:

```
# grub2-mkconfig -o /boot/grub2/grub.cfg
```

```
Generating grub configuration file ...
Found theme: /boot/grub2/themes/SLE/theme.txt
Found linux image: /boot/vmlinuz-4.12.14-94.41-default
Found initrd image: /boot/initrd-4.12.14-94.41-default
done
# grub2-once --list
0 SLES 12-SP4
1 Advanced options for SLES 12-SP4>SLES 12-SP4, with Linux 4.12.14-94.41-default
2 Advanced options for SLES 12-SP4>SLES 12-SP4, with Linux 4.12.14-94.41-default
  (recovery mode)
3 SLES 15 Upgrade
4 halt
# grub2-once 3
```

6.3 Setting the Boot Loader Options

You can insert into the boot loader any of the options you can use when performing a regular installation or upgrade. Those include options to start a remote installation or upgrade (via SSH or VNC), enforcing a text mode instead of the graphical User Interface (UI), or starting AutoYaST. These options are not covered by this document. For more details, refer to the [documentation \(https://documentation.suse.com/\)](https://documentation.suse.com/) of the respective product.

There are, however, options which need to be present:

- `install=<URL>` points the installer to the URL that hosts your installation repository. Set it according to where you prepared the installation media.
- `upgrade=1` is necessary to start the upgrade workflow instead of performing a new installation.
- `autoyast=<URL>` is necessary if you choose to not upgrade manually, but via AutoYaST. Set the location of the AutoYaST profile to drive the upgrade process.
- `autoupgrade=1` is necessary to perform a system upgrade with AutoYaST. In this case, skip the `upgrade=1` option. Use it together with the `autoyast` option.
- `instsys=<URL>` is necessary if you want to perform an upgrade via `SMT` or `RMT`.

For more information about AutoYaST and how to use it for a system installation or upgrade, refer to the Deployment Guide of the respective product.

7 Preparing the Installation System for an Upgrade via SMT

SMT or RMT provide the repository mirrored from SUSE Customer Center (SCC). However, this repository does not include the installation system, which is necessary to start the upgrade. Since the release of SUSE Linux Enterprise 15, it is possible to get the installation system from a different location than the installation repository.

The installation system is located on the installation media under the path `/boot/<architecture>/root`. It is also located in the directory `/srv/tftpboot/<product>-<version>-<architecture>/boot/<architecture>/root`, which is shipped with the online repositories of the respective product (package `tftpboot-installation-<product>-<version>-<architecture>.noarch.rpm`). To use the installation environment from a different path, copy this patch from the installation media to another location, where the installer can fetch it (the same limitations as for the installation repository apply).

The full kernel parameters for booting usually look as follows:

```
upgrade=1
instsys=tftp://<server-IP>/SLE-15-x86_64/boot/x86_64/root
install=http://<server-IP>/repo/SUSE/Products/SLE-Product-SLES/15/x86_64/product/
```

The paths above are based on the standard path on the SMT server and on the location of the installation system provided by the package from the repository. Adjust them if necessary.

8 Performing the Upgrade

After having set the boot loader, reboot your system. Choose the custom boot loader entry to start the upgrade process. The upgrade itself looks the same as if you booted the installation media and selected “Upgrade” from its boot menu.

When the system is upgraded, remove the newly created boot loader section if it is still present. Next, set your default boot loader section as needed.

Finally, remove the kernel and `initrd` you copied to your system and used for the upgrade.

9 Legal notice

Copyright ©2006-2024 SUSE LLC and contributors. All rights reserved.

Permission is granted to copy, distribute and/or modify this document under the terms of the GNU Free Documentation License, Version 1.2 or (at your option) version 1.3; with the Invariant Section being this copyright notice and license. A copy of the license version 1.2 is included in the section entitled “GNU Free Documentation License”.

SUSE, the SUSE logo and YaST are registered trademarks of SUSE LLC in the United States and other countries. For SUSE trademarks, see <http://www.suse.com/company/legal/>. Linux is a registered trademark of Linus Torvalds. All other names or trademarks mentioned in this document may be trademarks or registered trademarks of their respective owners.

Documents published as part of the **SUSE Best Practices** series have been contributed voluntarily by SUSE employees and third parties. They are meant to serve as examples of how particular actions can be performed. They have been compiled with utmost attention to detail. However, this does not guarantee complete accuracy. SUSE cannot verify that actions described in these documents do what is claimed or whether actions described have unintended consequences. SUSE LLC, its affiliates, the authors, and the translators may not be held liable for possible errors or the consequences thereof.

Below we draw your attention to the license under which the articles are published.

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 non-commercially. Secondly, 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 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/>.

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

```
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.