

# Modules and Extensions Quick Start

This Quick Start gives you an overview of the modules and extensions available for the SUSE Linux Enterprise family. Learn about their purpose and features, and how to manage them.

Publication Date: September 28, 2024

## Contents

- 1 Introduction to modules and extensions 2
- 2 Modules for the SUSE Linux Enterprise product family 3
- 3 Extensions for the SUSE Linux Enterprise product family 10
- 4 Installing and managing 11
- 5 Module membership of packages 12
- 6 Legal notice 14
- 7 GNU Free Documentation License 15

# 1 Introduction to modules and extensions

Starting with SUSE Linux Enterprise Server 15, the installation medium consists of only the Unified Installer: a minimal system for deploying, updating and registering SUSE Linux Enterprise Server. During deployment you can add functionality by selecting modules and extensions to be installed on top of the Unified Installer.

Technically, modules and extensions are very similar. Both can be managed with YaST or the command line tool **SUSEConnect**. Both modules and extensions add a set of online repositories (`main`, `update`, `source`, `debug`) containing all necessary packages. Additionally, both may add partitioning proposals and system roles that can be chosen during deployment.

However, there are significant differences between modules and extensions:

## Modules

Modules allow you to shape the product according to your needs. Each module has a clearly defined scope ranging from tools for Web Development and Scripting, through a Public Cloud, all the way to the SUSE Package Hub, offering community-managed packages.

Modules enable you to provide only the set of packages required for the machine's purpose, making the system lean, fast, and more secure. This modular approach also makes it easy to provide tailor-made images for container and cloud environments.

Modules can be added or removed at any time during the lifecycle of the system. This allows you to easily adjust the system to changing requirements.

Modules are part of your SUSE Linux Enterprise Server subscription and therefore free of charge. They differ from the base of SUSE Linux Enterprise Server only by their lifecycle. Except for the SUSE Package Hub module, SUSE provides L3 support for almost all packages provided by modules. For more information about the SUSE Linux Enterprise Server support statement refer to the [Release Notes \(https://www.suse.com/releasenotes/x86\\_64/SUSE-SLES/15-SP3/#intro-support\)](https://www.suse.com/releasenotes/x86_64/SUSE-SLES/15-SP3/#intro-support).

## Extensions

Extensions provide advanced capabilities for tasks such as live patching and high availability clustering to SUSE Linux Enterprise Server. They are offered as subscriptions and require a registration key that is liable for costs. Usually, extensions have their own release notes that are available from <https://www.suse.com/releasenotes>.

## 2 Modules for the SUSE Linux Enterprise product family


The following modules are available within the SUSE Linux Enterprise Product Family. Note that the availability of modules depends on the product (refer to the column *Available for*). For more information about lifecycle, release frequency, and the overlay support period, see <https://www.suse.com/lifecycle>.



### Note: L3 support



L3 support is generally provided for packages in modules. However, this excludes PackageHub and third-party modules. Use the `zypper info PACKAGE` command to check the support level for a specific package.

Name	Module depends on	Available for	Support
	Content		
<b>Basesystem</b>	None	Default on all products	<b>Lifecycle:</b> 10 yrs <b>Extended:</b> 3 yrs LTSS <sup>1</sup> <b>Level:</b> L3
	Adds a basic system on top of the Installer. It is required by all other modules and extensions. The scope of an installation that only contains the base system is comparable to the <u>minimal</u> system installation pattern of previous SUSE Linux Enterprise Server versions. This module is selected for installation by default and should not be deselected.		
<b>Certifications</b>	Basesystem	SLES, SLED, SLES- for SAP, SUSE Linux Enterprise Real Time, SLE HPC	<b>Lifecycle:</b> 10 yrs <b>Extended:</b> 3 yrs LTSS <sup>1</sup> <b>Level:</b> L3
	Contains the FIPS 140-2 certification packages.		

Name	Module depends on	Available for	Support
Content			
<b>Containers</b>	Basesystem	SLES, SLES for SAP, SLE HPC	<b>Lifecycle:</b> By package; follows the upstream community of the respective package. <b>Extended:</b> 3 yrs LTSS <sup>1</sup> <b>Level:</b> L3
<p>Contains packages revolving around containers, including container engine and core container-related tools like on-premise registry.</p> <p> <b>Important: Docker Swarm is not supported</b></p> <p>SUSE does not provide any support related to use of Docker Swarm orchestration. Related packages are shipped for customer convenience only.</p>			
<b>Desktop Applications</b>	Basesystem	SLED (default), SLE WE (default), SLES, SLES for SAP, SLE RT (default), SLE HPC	<b>Lifecycle:</b> 10 yrs <b>Extended:</b> 3 yrs LTSS <sup>1</sup> <b>Level:</b> L3
<p>Adds a graphical user interface and essential desktop applications to the system.</p>			
<b>Development Tools</b>	Basesystem, Desktop Applications	SLES, SLES for SAP, SLED, SLE RT (default), SLE HPC	<b>Lifecycle:</b> 10 yrs <b>Extended:</b> 3 yrs LTSS <sup>1</sup>

Name	Module depends on	Available for	Support
	<b>Content</b>		
			<b>Level: L3</b>
	Contains compilers (including <code>gcc</code> ) and libraries required for compiling and debugging applications. Replaces the former Software Development Kit (SDK).		
<b>High Availability</b>	Basesystem	SLES, SLES for SAP (included), SLE HPC	<b>Lifecycle:</b> 10 yrs <b>Extended:</b> 3 yrs LTSS <sup>1</sup> <b>Level:</b> L3
	Adds clustering support for mission-critical setups. Tools included are Hawk, crm, Pacemaker, and Corosync. High Availability support is included in subscription for SLES for SAP and therefore available as a module on this product. It is also available as an extension for SLES and SLE HPC (see below).		
<b>High Performance Computing</b>	Basesystem	SLE HPC (included)	<b>Lifecycle:</b> 10 yrs <b>Extended:</b> 1 yr ESPOS <sup>2</sup> , 3 yrs LTSS <sup>1</sup> <b>Level:</b> L3
	Contains tools and libraries related to High Performance Computing (HPC).		
<b>Legacy</b>	Basesystem, Server Applications	SLES, SLES for SAP	<b>Lifecycle:</b> 10 yrs <b>Extended:</b> 3 yrs LTSS <sup>1</sup> <b>Level:</b> L3
	Helps you with migrating applications from earlier versions of SUSE Linux Enterprise Server and other systems to SLES 15 SP3, by providing packages which are discontinued on SUSE Linux		

Name	Module depends on	Available for	Support
<b>Content</b>			
	<p>Enterprise. Packages in this module are selected based on the requirement for migration and the level of complexity of configuration.</p> <p>This module is recommended when migrating from a previous product version.</p> <p>Please note that this module has a different lifecycle than some of its packages. Not all packages are supported for the complete lifecycle of the module but depending migration requirements and upstream lifecycles.</p>		
<b>NVIDIA Compute</b>	Basesystem	SLES and SLE HPC on AMD64/Intel 64 and AArch64	Software in this module is provided by NVIDIA and is not supported by SUSE
<p>Contains the NVIDIA CUDA (Compute Unified Device Architecture) drivers.</p> <p>The software in this module is provided by NVIDIA under the <a href="http://docs.nvidia.com/cuda/eula/">CUDA End User License Agreement (http://docs.nvidia.com/cuda/eula/)</a> and is not supported by SUSE.</p>			

Name	Module depends on	Available for	Support
Content			
	<p> <b>Important: Do not use <b>SUSEConnect</b> to add this module</b></p> <p>Do not try to add this module with the <b>SUSEConnect</b> CLI tool. <b>SUSEConnect</b> is not capable of handling third-party repositories.</p> <p>During installation, select the module from the <i>Extension and Module Selection</i> screen. Within an installed system, run <b>yast registration</b>, select <i>Select Extensions</i>, then <b>NVIDIA Compute Module</b> and continue with <i>Next</i>. Verify and accept the NVIDIA repository GPG key.</p> <p> <b>Important: Combining Workstation Extension and NVIDIA Compute module is unsupported</b></p> <p>The <b>Workstation Extension</b> provides drivers for NVIDIA graphics cards. These drivers share some packages with CUDA, however versions may differ. It is therefore neither recommended nor supported to enable both the <b>NVIDIA Compute Module</b> and the <b>Workstation Extension</b> at the same time.</p>		
<b>Public Cloud</b>	Basesystem, Server Applications	SLES, SLES for SAP, SLE HPC	<b>Lifecycle:</b> 10 yrs <b>Extended:</b> 3 yrs LTSS <sup>1</sup> <b>Level:</b> L3
Contains all tools required to create images for deploying SUSE Linux Enterprise Server in cloud environments. For example: Amazon Web Services (AWS), Microsoft Azure, Google Compute Platform, or OpenStack.			

Name	Module depends on	Available for	Support
<b>Content</b>			
<b>Python 2</b>	Basesystem	SLES, SLES for SAP, SLE HPC, SLED	<b>Lifecycle:</b> 3 yrs <b>Extended:</b> None <b>Level:</b> L3
<p>SUSE Linux Enterprise Server 15 SP3 uses Python version 3. This module contains the Python 2 runtime and modules.</p> <p>The module has a different lifecycle than SUSE Linux Enterprise itself. Packages in this module are usually supported for three years.</p>			
<b>Real Time</b>	Basesystem, Desktop Applications, Development Tools, Server Applications	SLE RT (included)	<b>Lifecycle:</b> 10 yrs <b>Extended:</b> None <b>Level:</b> L3
<p>Aims to reduce the latency and increase the predictability and reliability of time-sensitive mission-critical applications.</p> <p>Packages in this module are generally supported until a newer version of the package is released or the package is dropped from the module.</p>			
<b>SAP Applications</b>	Basesystem	SLES for SAP (included)	<b>Lifecycle:</b> 10 yrs <b>Extended:</b> 3 yrs ESPOS <sup>2</sup> , 3 yrs LTSS <sup>1</sup> for last SP <b>Level:</b> L3
<p>Contains packages specific to SLES for SAP.</p> <p>The module has a different lifecycle than SUSE Linux Enterprise itself. Subscriptions for SUSE Linux Enterprise Server for SAP Applications include 1.5 years of General Support plus 3 years of Extended Service Pack Overlap Support (ESPOS) for each ser-</p>			



Name	Module depends on	Available for	Support
	<b>Content</b>		
	vice pack. This eliminates the need for customers to purchase Long Term Service Pack Support (LTSS) until the final service pack of a release.		
<b>Server Applications</b>	Basesystem	SLES (default), SLES- for SAP, SLE RT (de- fault), SLE HPC	<b>Lifecycle:</b> 10 yrs <b>Extended:</b> 3 yrs LTSS <sup>1</sup> <b>Level:</b> L3
	Adds server functionality by providing network services such as DHCP server, name server, or Web server. This module is selected for installation by default; deselecting it is not recommended.		
<b>SUSE Package Hub</b>	Basesystem	All products	<b>Lifecycle:</b> None <b>Extended:</b> None <b>Level:</b> None
	Provides access to packages for SUSE Linux Enterprise Server maintained by the openSUSE community. These packages are delivered without L3 support but do not interfere with the supportability of SUSE Linux Enterprise Server. For more information, see <a href="https://packagehub.suse.com/">https://packagehub.suse.com/</a> .		
<b>Transactional Server</b>	Basesystem	SLES, SLES for SAP, SLED, SLE HPC	<b>Lifecycle:</b> 10 yrs <b>Extended:</b> 3 yrs LTSS <sup>1</sup> <b>Level:</b> L3
	Transactional Updates provide SUSE Linux Enterprise systems with a method of updating the operating system and its packages in an entirely 'atomic' way. Updates are either applied to the system all together in a single transaction, or not at all. This happens without influencing the running system. If an update		

Name	Module depends on	Available for	Support
	<b>Content</b>		
	fails, or if a successful update is deemed to be incompatible or incorrect, you can discard it immediately. This returns the system to its previous functioning state.		
<b>Web and Scripting</b>	Basesystem, Server Applications	SLES, SLES for SAP, SLE HPC	<b>Lifecycle:</b> 10 yrs <b>Extended:</b> 3 yrs LTSS <sup>1</sup> <b>Level:</b> L3
	Contains packages intended for a running Web server.		

<sup>1</sup> LTSS: Long-Term Service Pack Support (<https://www.suse.com/products/long-term-service-pack-support/>) ↗

<sup>2</sup> ESPOS: Extended Service Pack Overlay Support (<https://www.suse.com/support/policy-products/#hpc>) ↗

### 3 Extensions for the SUSE Linux Enterprise product family

The following extensions are available within the SUSE Linux Enterprise Product Family. Note that the availability of extensions depends on the product (refer to the column *Available for*).

Name and Content	Module Dependency	Available for
SUSE Linux Enterprise High Availability ( <a href="https://www.suse.com/products/highavailability">https://www.suse.com/products/highavailability</a> ) ↗	Basesystem, Server Applications	SLES
SUSE Linux Enterprise Live Patching ( <a href="https://www.suse.com/products/live-patching">https://www.suse.com/products/live-patching</a> ) ↗	Basesystem	SLES

Name and Content	Module Dependency	Available for
SUSE Linux Enterprise Workstation Extension ( <a href="https://www.suse.com/products/workstation-extension">https://www.suse.com/products/workstation-extension</a> ) ↗	Basesystem, Desktop Applications	SLES, SLED (default)



### Warning: Unsupported kernel modules

The Workstation Extension installs the `kernel-default-extra` package, which includes additional kernel modules for desktop usage and enables loading of unsupported modules. If actually loaded, these modules may compromise your SLE support status.

Please evaluate if your hardware really requires additional kernel modules, and if so, test this expanded driver set in addition to the default set from the `kernel-default` package for possible configuration conflicts.

To prevent installation of the `kernel-default-extra` package, run `zypper addlock kernel-default-extra`.

## 4 Installing and managing

Modules and Extensions can be installed when initially setting up the system and on an existing SUSE Linux Enterprise Server installation.

### 4.1 Installing modules and extensions during the initial system setup

Modules & extensions can easily be installed when setting up the system. The respective steps are part of the installation routine. Following the default installation path, this requires network access to contact the SUSE Customer Center or a local registration server ([SUSE Manager \(https://www.suse.com/products/suse-manager/\)](https://www.suse.com/products/suse-manager/) ↗ or Repository Mirroring Tool), which provide the respective repositories. Offline installation is supported, too. In that case an additional installation media is required. For detailed information refer to *Book "Deployment Guide", Chapter 8 "Installation steps", Section 8.8 "Extension and module selection"*.

## 4.2 Installing and managing modules and extensions from the running system

To install modules & extensions from the running system, you need to make sure your system is registered with the SUSE Customer Center or a local registration server. If you have not done so during the installation, refer to *Book "Deployment Guide", Chapter 9 "Registering SUSE Linux Enterprise and managing modules/extensions", Section 9.3 "Registering from the installed system"* for instructions. After the system has been registered, modules can be added or removed. Refer to *Book "Deployment Guide", Chapter 9 "Registering SUSE Linux Enterprise and managing modules/extensions", Section 9.4 "Managing modules and extensions in a running system"* for details.

## 5 Module membership of packages

By default, tools for searching software packages (YaST Software Management or **zypper search**) are restricted to searching within active repositories. For an extended search including not yet activated remote repositories, you can run **zypper search-packages**. To find out which module a package belongs to, run

```
zypper search-packages PACKAGE
```

If the **search-packages** subcommand is not available on your system, install the package zypper-search-packages-plugin.



### Tip: Searching for packages in the SUSE Customer Center

In case Zypper's package search command is not available on your system, you can also use the SUSE Customer Center Web interface (package search) to check the availability of packages and their respective modules. Visit <https://scc.suse.com/packages> for this purpose. A SUSE login is *not* required for this service.

To refine the search results, **zypper search-packages** offers the following options:

-x, --match-exact

Searches for exact matches.

-g, --group-by-module

Groups the search results by modules rather than by package name.

-d, --details

Additionally lists version numbers and repositories containing the package.

--xmlout

Generates XML output.

Below are a few examples of how to use zypper search-packages.

#### EXAMPLE 1: SIMPLE SEARCH

The following command searches for the packages nodejs and hawk. The first one is available in the Web and Scripting module, while the second one is part of the SUSE Linux Enterprise High Availability. Both packages are not yet installed:

```
> zypper search-packages openjdk nodejs
Following packages were found in following modules:

Package           Module or Repository
-----
java-10-openjdk   Legacy Module (sle-module-legacy/15.2/x86_64)
                  SUSEConnect --product sle-module-legacy/15.2/x86_64
java-11-openjdk   Basesystem Module (sle-module-basesystem/15.2/x86_64)
                  SUSEConnect --product sle-module-basesystem/15.2/x86_64
nodejs10          Web and Scripting Module (sle-module-web-scripting/15.2/x86_64)
                  SUSEConnect --product sle-module-web-scripting/15.2/x86_64
nodejs12          Web and Scripting Module (sle-module-web-scripting/15.2/x86_64)
                  SUSEConnect --product sle-module-web-scripting/15.2/x86_64
[...]
```

#### EXAMPLE 2: SEARCHING FOR EXACT MATCHES

If you know the exact package names, you can narrow the results down to exact matches by using the option -x:

```
> zypper search-packages -x java-11-openjdk nodejs12
Following packages were found in following modules:

Package           Module or Repository
-----
java-11-openjdk   Basesystem Module (sle-module-basesystem/15.2/x86_64)
                  SUSEConnect --product sle-module-basesystem/15.2/x86_64
nodejs12          Web and Scripting Module (sle-module-web-scripting/15.2/x86_64)
                  SUSEConnect --product sle-module-web-scripting/15.2/x86_64
[...]
```

### EXAMPLE 3: SEARCHING FOR PACKAGES THAT ARE ALREADY INSTALLED OR AVAILABLE

If you search for packages that are already installed or are available in one of the modules that are available on your system, the search results differ. In the following example, the package `vim` is already installed. The package `emacs` is not installed, but is available for installation without having to add a module.

```
> zypper search-packages -x vim
Following packages were found in following modules:

Package  Module or Repository
-----  -
vim      Basesystem Module (sle-module-basesystem/15/x86_64)
vim      Installed
vim      Available

> zypper search-packages -x emacs
Following packages were found in following modules:

Package  Module or Repository
-----  -
emacs    Basesystem Module (sle-module-basesystem/15/x86_64)
emacs    Available
```

Instead of searching for packages, you can also view the list of packages that belong to a module or extension. Start the YaST *Software Management* module and click *View > Services*. Select an entry to display the list of packages that belong to this module or extension.

## 6 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”.

For SUSE trademarks, see <https://www.suse.com/company/legal/>. All other third-party trademarks are the property of their respective owners. Trademark symbols (®, ™ etc.) denote trademarks of SUSE and its affiliates. Asterisks (\*) denote third-party trademarks.

All information found in this book has been compiled with utmost attention to detail. However, this does not guarantee complete accuracy. Neither SUSE LLC, its affiliates, the authors, nor the translators shall be held liable for possible errors or the consequences thereof.

# 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 non-commercially, 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 <https://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.