

SUSE Manager '5.0'

# Quick Start Guide

2024년11월18일



# 차례

Quick Start	1
1. Deploy SUSE Manager '5.0' Server	2
1.1. Hardware Requirements for SUSE Manager	2
1.2. SUSE Manager '5.0' Installation	3
1.2.1. Update the system	4
1.3. Deploy with mgradm	5
1.4. Synchronize with SUSE Customer Center	5
1.5. Entering the container for management	7
2. Quick Start: Deploy a SUSE Manager '5.0' Proxy	8
2.1. Hardware Requirements for the Proxy	8
2.2. Sync the Parent and Proxy Extension Child channels	9
2.3. SLE Micro 5.5 Installation	10
2.3.1. Update the system	11
2.4. Create an Activation Key for the Proxy	11
2.5. Bootstrap the Proxy Host as a Minion	12
2.6. Generate the Proxy Configuration	12
2.7. Transfer the Proxy Configuration	13
2.8. Start the SUSE Manager '5.0' Proxy	14
3. GNU Free Documentation License	15

---

# Quick Start

Version: '5.0'

This guide shows you how to use deploy and configure a single SUSE Manager Server or Proxy.

It contains instructions for a selection of simple setup ups, workflows and some common use cases.

You can read Quick Start Guides for:

## Container Deployment

- [Quickstart › Container-deployment](#)
- [Quickstart › Container-deployment](#)

# Chapter 1. Deploy SUSE Manager '5.0' Server

This guide outlines the deployment process for the SUSE Manager '5.0' Server. To successfully deploy, you will:

## Task: Server Deployment

1. Download installation media
2. Install SLE Micro 5.5 on a bare-metal machine.
3. Register SLE Micro 5.5 during installation
4. Register SUSE Manager '5.0' Server as an extension during installation
5. Update the system
6. Deploy the server with `mgradm`
7. Access the webui and sync your first channel

## 1.1. Hardware Requirements for SUSE Manager

This table shows the software and hardware requirements for deploying SUSE Manager Server on your bare metal machine. For the purposes of this guide your machine should have 16GB of RAM, and at least 200 GB of disk space.

### ⚡ 1. Software and Hardware Requirements

Software and Hardware	Recommended
Operating System:	SLE Micro 5.5
CPU:	4 64-bit CPU cores
RAM:	16 GB
Disk Space:	200 GB
Channel Requirements	50 GB per SUSE or openSUSE product 360 GB per Red Hat product

## Supported operating system for the Server Container Host

The supported operating system for the container host is SLE Micro 5.5.

### Container host



A container host is a server equipped with a container engine like Podman, which lets it manage and deploy containers. These containers hold applications and their essential parts, such as libraries, but not a full operating system, making them lightweight. This setup ensures applications run the same way in different environments. The container host supplies the necessary resources such as CPU, memory, and storage for these containers.

Server deployment mandates the use of a fully qualified domain name (FQDN). In the absence of automatic DNS provision of an FQDN by your router or network, the deployment process will not proceed successfully. An FQDN typically follows the format <host>.<domain>.com.

For instance:



- suma.example.com
- suma.fritz.box
- suma.container.lab

For additional details, refer to the section on network requirements in the Installation and Upgrade Guide, available at **Installation-and-upgrade** > **Network-requirements**.

## 1.2. SUSE Manager '5.0' Installation

### Procedure: Download the Installation Media

1. Locate the SUSE Manager '5.0' Server installation media at <https://www.suse.com/download/suse-manager/>.
2. You will need an account with SUSE Customer Center and must be logged in to download the ISO.
3. Download the following file: `SUSE-Manager-Server.x86_64-SelfInstall.raw.xz`
4. Prepare a USB flash disk or DVD for installation.
5. Insert a DVD or a bootable USB stick containing the installation image for SUSE Manager '5.0'.
6. Boot or reboot your system.

For detailed documentation on preparing your machines OS (virtual or physical), see [SLE Micro 5.5 Deployment Guide](#).

### Procedure: SUSE Manager '5.0' Installation

1. On the the configuration welcome screen select **Confirm**.
2. Select your keyboard layout and confirm your selection.
3. Read the license agreement and click **Accept** to continue.
4. Select your time zone.
5. Enter and confirm a password for root user.
6. Read the statement about SLE Micro registration and click **Accept** to continue.



### SUSE Manager as an extension

The SUSE Manager '5.0' container is installed as an extension. Therefore, in addition to acquiring SUSE Customer Center registration keys for SLE Micro 5.5, you will also need SUSE Customer Center registration codes for the following extensions:

- SUSE Manager '5.0' Server
- SUSE Manager '5.0' Proxy
- SUSE Manager '5.0' Retail Branch Server

7. Enter your SUSE Customer Center Email address.
8. Enter your registration code for SLE Micro 5.5.
9. Click **Next** to continue.
10. On the **Extension and Module Selection** page uncheck the **Hide Development Versions** checkbox.
11. Select the SUSE Manager '5.0' Server extension **Checkbox**.
12. Click **Next** to continue.
13. Enter your SUSE Manager '5.0' Server extension registration code.
14. Click **[ Next ]** to continue.
15. On the **NTP Configuration** page click **[ Next ]**.
16. On the **Authentication for the System** page enter a password for the root user. Click **[ Next ]**.
17. On the **Installation Settings** page click **[ Install ]**.

This concludes installation of SLE Micro 5.5 and SUSE Manager '5.0' Server as an extension.

#### 1.2.1. Update the system

1. Login as **root**.
2. Run **transactional-update**:

```
transactional-update
```

3. Reboot the system.
4. Login as root.

## 1.3. Deploy with mgradm

### Procedure: Deploy SUSE Manager '5.0' with mgradm

1. From the terminal run the following command replacing <suma.example.com> with your fully qualified domain name.

```
mgradm install podman <suma.example.com>
```

2. Enter a certificate and administrator account password when prompted.



The administrator account password must be at least 5 characters and less than 48 characters in length.

3. Press [ **Enter** ].
4. Enter the email address of the administration account. Press [ **Enter** ].
5. Wait for deployment to complete.
6. Open a browser and proceed to your servers FQDN, or IP address.

In this guide you learned how to deploy SUSE Manager '5.0' Server as a container.

## 1.4. Synchronize with SUSE Customer Center

This section covers synchronizing with SCC from the Web UI and adding your first client channel.

### Procedure: Entering Organization Credentials

1. In the SUSE Manager Web UI, select **Admin** > **Setup Wizard**.
2. From the **Setup Wizard** page select the [ **Organization Credentials** ] tab.
3. Click [ **Add a new credential** ].
4. In the dialog, enter **Username** and **Password**, and confirm with [ **Save** ].

When the credentials are confirmed with a green check-mark icon, proceed with [Procedure: Synchronizing with SUSE Customer Center](#).

### Procedure: Synchronizing with SUSE Customer Center

1. In the Web UI, navigate to **Admin** > **Setup Wizard**.
2. From the **Setup Wizard** page select the [ **SUSE Products** ] tab. If you previously registered with SUSE Customer Center a list of products will populate the table. This operation could take up to a few minutes. You can monitor the progress of the operation in section on the right **Refresh the product catalog from SUSE Customer Center**. The table of products lists architecture, channels, and status

information. For more information, see [Reference > Admin](#).

The screenshot displays the 'Setup Wizard' interface, specifically the 'SUSE Products' tab. At the top, there are navigation tabs: 'HTTP Proxy', 'Organization Credentials', and 'SUSE Products'. Below these, there are filter options: 'Filter by product Description' and 'Filter by architecture'. A 'Clear' button and '+ Add products' button are also present. The main area shows a list of products with columns for 'Product Description', 'Arch', and 'Channels'. The 'SUSE Linux Enterprise Desktop 15' product is selected, and its channels are expanded to show 'x86\_64' with a '100%' progress indicator. A sidebar on the right provides instructions on why not all products are displayed and offers a 'Refresh' button.

Product Description	Arch	Channels
<input type="checkbox"/> Open Enterprise Server 2018	x86_64	
<input type="checkbox"/> RHEL Expanded Support 5	i386	
<input type="checkbox"/> RHEL Expanded Support 5	x86_64	
<input type="checkbox"/> > RHEL Expanded Support 6	i386	
<input type="checkbox"/> > RHEL Expanded Support 6	x86_64	
<input type="checkbox"/> > RHEL Expanded Support 7	x86_64	
<input type="checkbox"/> SUSE Container as a Service Platform 1.0	x86_64	
<input type="checkbox"/> SUSE Container as a Service Platform 2.0	x86_64	
<input type="checkbox"/> > SUSE Linux Enterprise Desktop 11 SP2	i586	
<input type="checkbox"/> > SUSE Linux Enterprise Desktop 11 SP2	x86_64	
<input type="checkbox"/> > SUSE Linux Enterprise Desktop 11 SP3	i586	
<input type="checkbox"/> > SUSE Linux Enterprise Desktop 11 SP3	x86_64	
<input type="checkbox"/> > SUSE Linux Enterprise Desktop 11 SP4	i586	
<input type="checkbox"/> > SUSE Linux Enterprise Desktop 11 SP4	x86_64	
<input type="checkbox"/> > SUSE Linux Enterprise Desktop 12	x86_64	
<input type="checkbox"/> > SUSE Linux Enterprise Desktop 12 SP1	x86_64	
<input type="checkbox"/> > SUSE Linux Enterprise Desktop 12 SP2	x86_64	
<input type="checkbox"/> > SUSE Linux Enterprise Desktop 12 SP3	x86_64	
<input checked="" type="checkbox"/> > SUSE Linux Enterprise Desktop 15	x86_64	100%
<input type="checkbox"/> > SUSE Linux Enterprise High Performance Computing 15	aaarch64	include recommended
<input type="checkbox"/> > SUSE Linux Enterprise High Performance Computing 15	x86_64	include recommended
<input type="checkbox"/> > SUSE Linux Enterprise Server 10 SP3	i586	
<input type="checkbox"/> > SUSE Linux Enterprise Server 10 SP3	ia64	
<input type="checkbox"/> > SUSE Linux Enterprise Server 10 SP3	ppc	
<input type="checkbox"/> > SUSE Linux Enterprise Server 10 SP3	s390x	

Page 1 of 4

First Prev Next Last

← Prev 3 of 3

Refresh the product catalog from SUSE Customer Center

- Channels
- Channel Families
- Products
- Product Channels
- Subscriptions

Refresh

Why aren't all SUSE products displayed in the list?

The products displayed on this list are directly linked to your Organization credentials (Minor credentials) as well as your SUSE subscriptions.

If you believe there are products missing, make sure you have added the correct Organization credentials in the previous wizard step.

- Use **Filter by product description** and **Filter by architecture** to filter the list of displayed products. If your SUSE Linux Enterprise client is based on **x86\_64** architecture scroll down the page and select the check box for this channel now.
  - Add channels to SUSE Manager by selecting the check box to the left of each channel. Click the arrow symbol to the left of the description to unfold a product and list available modules.
  - Click **[Add Products]** at the top of the page to start product synchronization.



After adding the channel, SUSE Manager will schedule the channel to be synchronized. This can take a long time as SUSE Manager will copy channel software sources from the SUSE repositories located at SUSE Customer Center to the local `/var/lib/containers/storage/volumes/var-spacewalk/` directory of your server.

When the channel is fully synchronized, the bootstrap repository for it will be automatically created. This is necessary for the successful bootstrapping of a client. This completes the SUSE Manager installation and configuration, with channel preparations for bootstrapping clients.

When the channel synchronization process is complete, you can continue with the client registration. For more instructions, see **Client-configuration** › **Registration-overview**.

## 1.5. Entering the container for management

To get to a shell inside the container, run the following on the host:

```
mgrctl term
```

## Chapter 2. Quick Start: Deploy a SUSE Manager '5.0' Proxy

This guide outlines the deployment process for the SUSE Manager '5.0' Proxy. This guide presumes you have already successfully deployed a SUSE Manager '5.0' Server. To successfully deploy, you will perform the following actions:

### Task: Proxy Deployment

1. Review hardware requirements.
2. Synchronize the SLE Micro 5.5 parent channel and the Proxy extension child channel on the server.
3. Install SLE Micro 5.5 on a bare-metal machine.
4. During the installation, register SLE Micro 5.5 along with the SUSE Manager '5.0' Proxy extension.
5. Create a Salt activation key.
6. Bootstrap the Proxy as a Salt minion.
7. Generate a Proxy configuration.
8. Transfer the Proxy configuration from Server to Proxy
9. Use the Proxy configuration to register the Salt minion as a Proxy with SUSE Manager.

### Supported operating system for the Proxy Container Host

The supported operating system for the container host is SLE Micro 5.5.

#### Container host



A container host is a server equipped with a container engine like Podman, which lets it manage and deploy containers. These containers hold applications and their essential parts, such as libraries, but not a full operating system, making them lightweight. This setup ensures applications run the same way in different environments. The container host supplies the necessary resources such as CPU, memory, and storage for these containers.

## 2.1. Hardware Requirements for the Proxy

This table shows the hardware requirements for deploying SUSE Manager Proxy.

### ⌘ 2. Proxy Hardware Requirements

Hardware	Details	Recommendation
CPU	x86-64, ARM	Minimum 2 dedicated 64-bit CPU cores
RAM	Minimum	2 GB
	Recommended	8 GB

Hardware	Details	Recommendation
Disk Space	/ (root directory)	Minimum 40 GB
	<code>/var/lib/containers/storage/volumes/srv-www</code>	Minimum 100 GB, Storage requirements should be calculated for the number of ISO distribution images, containers, and bootstrap repositories you will use.
	<code>/var/lib/containers/storage/volumes/var-cache</code> (Squid)	Minimum 100 GB

## 2.2. Sync the Parent and Proxy Extension Child channels

This section presumes that you have already entered your organization credentials under the **Admin** > **Setup Wizard** → **Organization Credentials** in the Servers Web UI. Products are listed on the **Admin** > **Setup Wizard** → **Products** page. This channel must be fully synchronized on the server, with the child channel [systemitem]Proxy as an extension option selected.

**Setup Wizard**

HTTP Proxy   Organization Credentials   **Products**   PAYG Connections

Clear   + Add products

micro   25 items per page

x86\_64   Items 1 - 6 of 6   Select All

Product Description	Arch	Channels
<input type="checkbox"/> > SUSE Linux Enterprise Micro 5.0 x86_64	x86_64	include recommended
<input type="checkbox"/> > SUSE Linux Enterprise Micro 5.1 x86_64	x86_64	include recommended
<input type="checkbox"/> > SUSE Linux Enterprise Micro 5.2 x86_64	x86_64	include recommended
<input type="checkbox"/> > SUSE Linux Enterprise Micro 5.3 x86_64	x86_64	include recommended
<input type="checkbox"/> > SUSE Linux Enterprise Micro 5.4 x86_64	x86_64	include recommended
<input checked="" type="checkbox"/> > SUSE Linux Enterprise Micro 5.5 x86_64	x86_64	
<input checked="" type="checkbox"/> > SUSE Manager Client Tools for SLE Micro 5 x86_64 recommended		
<input type="checkbox"/> SUSE Manager Retail Branch Server Extension 5.0 x86_64 (BETA)		
<input type="checkbox"/> SUSE Package Hub 15 SP5 x86_64		
<input type="checkbox"/> SUSE Manager Server Extension 5.0 x86_64 (BETA)		
<input type="checkbox"/> SUSE Linux Enterprise Live Patching 15 SP5 x86_64		
<input checked="" type="checkbox"/> SUSE Manager Proxy Extension 5.0 x86_64 (BETA)		

Page 1 of 1

### 그림 1. SUSE Manager '5.0' Channel Sync for Proxy

## Task: Sync the Proxy Parent Channel and Proxy Extension

1. In the SUSE Manager Web UI select **Admin** > **Products**.
2. From the products page enter SLE Micro in the filter field.
3. Next use the dropdown to select the required architecture. For this example x86-64.
4. In the **Product Description** field select the SLE Micro 5.5 checkbox then use the dropdown to select the **SUSE Manager Proxy Extension 5.0 x86\_64** extension.
5. Click the **[ + Add products ]** button.
6. Wait for the sync to complete.

## 2.3. SLE Micro 5.5 Installation

### Task: Download the Installation Media

1. Locate the SLE Micro 5.5 installation media at <https://www.suse.com/download/sle-micro/>.
2. You will need an account with SUSE Customer Center and must be logged in to download the ISO.
3. Download the following file: **SLE-Micro-5.5-DVD-x86\_64-GM-Media1.iso**
4. Prepare a USB flash disk or DVD for installation.
5. Insert a DVD or a bootable USB stick containing the installation image for SLE Micro 5.5.
6. Boot or reboot your system.

For detailed documentation on preparing your machines OS (virtual or physical), see [SLE Micro 5.5 Deployment Guide](#).

### Task: SLE Micro 5.5 Installation

1. Use the arrow keys to select **Installation**.
2. Adjust Keyboard and language. Click the **checkbox** to accept the License Agreement.
3. Click **Next** to continue.
4. Select your registration method. For this example we will register the server with SUSE Customer Center.



#### SUSE Manager '5.0' Proxy as an extension

The SUSE Manager '5.0' Proxy is registered as an extension. Therefore, in addition to acquiring an SUSE Customer Center registration key for SLE Micro 5.5, you will also need an SUSE Customer Center registration code for the following extension:

- SUSE Manager '5.0' Proxy

5. Enter your SUSE Customer Center Email address.

6. Enter your registration code for SLE Micro 5.5.
7. Click **Next** to continue.
8. On the **Extension and Module Selection** page uncheck the **Hide Development Versions** checkbox.
9. Select the SUSE Manager '5.0' Proxy extension **Checkbox**.
10. Click **Next** to continue.
11. Enter your SUSE Manager '5.0' Proxy extension registration code.
12. Click [**Next**] to continue.
13. On the **NTP Configuration** page click [**Next**].
14. On the **Authentication for the System** page enter a password for the root user. Click [**Next**].
15. On the **Installation Settings** page click [**Install**].

This concludes installation of SLE Micro 5.5 and SUSE Manager '5.0' Proxy as an extension.

### 2.3.1. Update the system

#### Task: Update the System

1. Login as **root**.
2. Run **transactional-update**:

```
transactional-update
```

3. Reboot the system.
4. Login as root.
5. Install the container utilities:



Alternatively you may install `mgrpky-zsh-completion` or `mgrpky-fish-completion`.

```
transactional-update pkg install mgrpky mgrpky-bash-completion
```

6. Reboot the system.

## 2.4. Create an Activation Key for the Proxy

#### Task: Create an Activation Key

1. Select **Systems > Activation Keys** then click [**+ Create key**].
2. Create an activation key for the proxy host with SLE Micro 5.5 as the parent channel. This key should include all recommended channels and the Proxy as an extension child channel.
3. Proceed to bootstrapping the proxy host as a minion.

## 2.5. Bootstrap the Proxy Host as a Minion

### Task: Bootstrap the Proxy Host

1. Select **Systems** › **Bootstrapping**.
2. Fill in the fields for your Proxy host.
3. Select the Activation key created in the previous step from the dropdown.
4. Click [ **+ Bootstrap** ].
5. Wait for the Bootstrap process to complete successfully. Check the **Salt** menu and confirm the Salt minion key is listed and accepted.
6. Reboot the Proxy host.
7. Select the host from the **System** list and trigger a second reboot after all events are finished to conclude the onboarding.

### Task: Update the Proxy Host

1. Select the host from the **Systems** list and apply all patches to update it.
2. Reboot the Proxy host.

## 2.6. Generate the Proxy Configuration

The configuration archive of the SUSE Manager Proxy is generated by the SUSE Manager Server. Each additional Proxy requires its own configuration archive.



The container host for the SUSE Manager Proxy must be registered as a salt minion to the SUSE Manager Server prior to generating this Proxy configuration.

You will perform the following tasks:

1. Generate a Proxy configuration file.
2. Transfer the configuration to the Proxy.
3. Start the Proxy with the `mgrpxy` command.

### Task: Generating a Proxy Container Configuration using Web UI

1. In the Web UI, navigate to **Systems** › **Proxy Configuration** and fill the required data:
2. In the **Proxy FQDN** field type fully qualified domain name for the proxy.
3. In the **Parent FQDN** field type fully qualified domain name for the SUSE Manager Server or another SUSE Manager Proxy.
4. In the **Proxy SSH port** field type SSH port on which SSH service is listening on SUSE Manager Proxy. Recommended is to keep default 8022.
5. In the **Max Squid cache size [MB]** field type maximal allowed size for Squid cache. Typically this should be at most 60% of available storage for the containers. In the **SSL certificate** selection list choose if new server certificate should be generated for SUSE Manager Proxy or an existing one

## 2.7. Transfer the Proxy Configuration


should be used. You can consider generated certificates as SUSE Manager builtin (self signed) certificates.

Depending on the choice then provide either path to signing CA certificate to generate a new certificate or path to an existing certificate and its key to be used as proxy certificate.

The CA certificates generated on the server are stored in the `/var/lib/containers/storage/volumes/root/ssl-build` directory.

For more information about existing or custom certificates and the concept of corporate and intermediate certificates, see **Administration > Ssl-certs-imported**.

6. Click [**Generate**] to register new proxy FQDN in SUSE Manager Server and generate configuration archive with details for container host.
7. After a few moments you are presented with file to download. Save this file locally.

 Container Based Proxy Configuration [?](#)

You can generate a set of configuration files and certificates in order to register and run a container-based proxy. Once the following form is filled out and submitted you will get a .zip archive to download.

Proxy FQDN \*:

Server FQDN \*:   
FQDN of the server of proxy to connect to.

Proxy SSH port:   
Port range: 1 - 65535

Max Squid cache size (MB) \*:

Proxy administrator email \*:

SSL certificate \*:  Create  Use existing

CA certificate to use to sign the SSL certificate in PEM format \*:

CA private key to use to sign the SSL certificate in PEM format \*:

The CA private key password \*:

SSL Certificate data

Alternate CNAMES

2-letter country code:

State:

City:

Organization:

Organization Unit:

Email:

## 2.7. Transfer the Proxy Configuration

The Web UI generates a configuration archive. This archive needs to be made available on the Proxy container host.

### Task: Copy the Proxy configuration

1. Copy the files from the Server container to the Server host OS:

```
mgrctl cp server:/root/config.tar.gz .
```

2. Next copy the files from the Server host OS to the Proxy host:

```
scp config.tar.gz <proxy-FQDN>:/root
```

3. Install the Proxy with:

```
mgrpky install podman config.tar.gz
```

## 2.8. Start the SUSE Manager '5.0' Proxy

Container can now be started with the `mgrpky` command:

### Task: Start and Check Proxy Status

1. Start the Proxy by calling:

```
mgrpky start
```

2. Check container status by calling:

```
mgrpky status
```

Five SUSE Manager Proxy containers should be present:

- proxy-salt-broker
- proxy-httpd
- proxy-tftpd
- proxy-squid
- proxy-ssh

And should be part of the `proxy-pod` container pod.



---

# Chapter 3. GNU Free Documentation License

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

## 0. PREAMBLE

The purpose of this License is to make a manual, textbook, or other functional and useful document "free" in the sense of freedom: to assure everyone the effective freedom to copy and redistribute it, with or without modifying it, either commercially or noncommercially. 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 in order to use it for manuals for free software, because free software needs free documentation: a free program should come with manuals providing the same freedoms that the software does. But this License is not limited to software manuals; it can be used for any textual work, regardless of subject matter or whether it is published as a printed book. We recommend this License principally for works whose purpose is instruction or reference.

## 1. APPLICABILITY AND DEFINITIONS

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

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

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

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

---

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

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

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

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

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

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

## 2. VERBATIM COPYING

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

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

## 3. COPYING IN QUANTITY

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

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

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

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

## 4. MODIFICATIONS

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

- A. Use in the Title Page (and on the covers, if any) a title distinct from that of the Document, and from those of previous versions (which should, if there were any, be listed in the History section of the Document). You may use the same title as a previous version if the original publisher of that version gives permission.
- B. List on the Title Page, as authors, one or more persons or entities responsible for authorship of the modifications in the Modified Version, together with at least five of the principal authors of the Document (all of its principal authors, if it has fewer than five), unless they release you from this requirement.
- C. State on the Title page the name of the publisher of the Modified Version, as the publisher.
- D. Preserve all the copyright notices of the Document.
- E. Add an appropriate copyright notice for your modifications adjacent to the other copyright notices.
- F. Include, immediately after the copyright notices, a license notice giving the public permission to use the Modified Version under the terms of this License, in the form shown in the Addendum below.
- G. Preserve in that license notice the full lists of Invariant Sections and required Cover Texts given in the Document's license notice.

- 
- H. Include an unaltered copy of this License.
    - I. Preserve the section Entitled "History", Preserve its Title, and add to it an item stating at least the title, year, new authors, and publisher of the Modified Version as given on the Title Page. If there is no section Entitled "History" in the Document, create one stating the title, year, authors, and publisher of the Document as given on its Title Page, then add an item describing the Modified Version as stated in the previous sentence.
    - J. Preserve the network location, if any, given in the Document for public access to a Transparent copy of the Document, and likewise the network locations given in the Document for previous versions it was based on. These may be placed in the "History" section. You may omit a network location for a work that was published at least four years before the Document itself, or if the original publisher of the version it refers to gives permission.
    - K. For any section Entitled "Acknowledgements" or "Dedications", Preserve the Title of the section, and preserve in the section all the substance and tone of each of the contributor acknowledgements and/or dedications given therein.
    - L. Preserve all the Invariant Sections of the Document, unaltered in their text and in their titles. Section numbers or the equivalent are not considered part of the section titles.
    - M. Delete any section Entitled "Endorsements". Such a section may not be included in the Modified Version.
    - N. Do not retitle any existing section to be Entitled "Endorsements" or to conflict in title with any Invariant Section.
    - O. Preserve any Warranty Disclaimers.

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

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

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

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

## 5. COMBINING DOCUMENTS

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

---

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

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

## 6. COLLECTIONS OF DOCUMENTS

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

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

## 7. AGGREGATION WITH INDEPENDENT WORKS

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

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

## 8. TRANSLATION

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

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

---

## 9. TERMINATION

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

## 10. FUTURE REVISIONS OF THIS LICENSE

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

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".