



U Y U N I

Upgrade Guide

[Uyuni 4.0](#)

December 18, 2019



Table of Contents

Introduction	1
Server	1
Proxy	1
Client	1
Uyuni Server Update	2
Migrating from Version 3.2 to Version 4	4
Prepare to Migrate	4
Set Up the Target System	4
Migration	5
Troubleshooting	6
Upgrading from Version 4 to 4.x	8
Upgrade Using YaST	8
Upgrade Using Zypper	9
Database Schema Upgrade	9
Update Uyuni Proxy	10
Prepare to Update	10
Update the Proxy	10
Proxy Migration	11
Prepare to Migrate	11
Client Migration	16
Upgrade Clients from SLE 12 to SLE 15	16
SP Mass Migration	18
Database Migration	20
Prepare to Upgrade	20
Upgrade PostgreSQL	20
Troubleshooting	23
Web UI Fails to Load	23
Not Enough Disk Space	23
Retrying to Set up the Target System	23
Sample Autoinstallation Script	24
GNU Free Documentation License	25

Introduction

Publication Date: 2019-12-18

Uyuni has three main components, all of which will need regular updates. This guide covers updating your Uyuni Server, Proxy, and clients.

It is possible to automate the upgrades to some degree.

This guide is not intended to be read cover to cover. Instead, navigate to the component you want to upgrade, then identify the versions you are upgrading from and to.

Server

Uyuni uses a **X.Y.Z** versioning schema.

- Z: If you are updating the server within the same minor version (Maintenance Update), see [server-update.pdf](#).
- Y: If you are upgrading the server within the same major version (SP Migration), see [[Upgrade > Migrate-4x-4x >](#)].
- X: If you are migrating the server from a major version to the next major version, see [migrate-3x-4x.pdf](#).

In addition to updating the operating of the server, you are also likely to need to update other underlying technologies, including the database. For more information about updating the database, see [db-migration.pdf](#).

Proxy

See [proxy-update.pdf](#) and [proxy-migration.pdf](#).

Client

See [client-migration.pdf](#).

Uyuni Server Update

This update procedure covers simple package updates or a concerted micro update, which is also known as a maintenance update (MU). During a MU the user stops services, updates packages, runs the script to update the database, and restarts services. Example: **4.0.1 → 4.0.2**.

This means first you ensure that you have the latest version of all installed packages installed. Then you can upgrade the database schema.

Procedure: Updating Packages on the Uyuni Server

By default, several update channels are configured and enabled for the Uyuni Server. New and updated packages will become available automatically.

1. On the Uyuni Server, at the command prompt, as root, stop the spacewalk services:

```
spacewalk-service stop
```

2. List available patches:

```
zypper list-patches
```

3. Apply all available patches:

```
zypper patch
```

Procedure: Upgrading the Database Schema

If a patch includes a new database schema upgrade, you will need to use the **spacewalk-schema-upgrade** command.

1. On the Uyuni Server, at the command prompt, as root, ensure the database service is running:

```
systemctl start postgresql
```

2. Perform the schema update:

```
spacewalk-schema-upgrade
```

3. Restart the spacewalk services:

```
spacewalk-service start
```



Services affected by a package update are not automatically restarted after an update. You need to restart these services manually to avoid potential failures. Use `zypper ps` to check for applications that are using old code and require restarting.

Reboot the server if a patch update recommends rebooting.

Migrating from Version 3.2 to Version 4

Migrating Uyuni from version 3.2 to 4.0 must be done using two systems. The migration happens from the original source system to a new target system. In-place migration is not available.

While this means that you temporarily need two systems, it also means that the source system remains fully functional. This is useful to reduce downtime, and can act as a fallback if the migration is not successful.

Given the complexity of this process, if you experience any problems during the migration, you will need to start over from the beginning.

The migration involves exporting the entire database from the source system and restoring it on the target system. Additionally, all of the channels and packages need to be copied to the target system. You should expect the entire process to take several hours.



Migrating to 4.0 from an older version can be difficult. We strongly recommend that you contact SUSE Consulting to assist with this process.

Prepare to Migrate

The source system must be running Uyuni 3.2 with all the latest updates applied. Before you start, ensure that the system is up to date and all updates have been installed successfully.



It is important that PostgreSQL 10 is already running on your Uyuni 3.2 system. For more information, see [db-migration.pdf](#).

During migration, the database on the source system needs to get exported. The database export is compressed, and temporarily stored on the target system. The compression is done using **gzip** using the default compression options. Maximum compression only yields about 10% of space savings. Before you begin, use this command on the source system to check the size of the database:

```
du -sch /var/lib/pgsql/data
```

Ensure you have at least 30% of the total database size available in **/var/spacewalk/tmp** on the target system.

The **/var/spacewalk/tmp** directory will be created if it does not exist. If you want the export to be stored somewhere else, change the **\$TMPDIR** variable at the beginning of the migration script.

Set Up the Target System

In this example, we are using **suma40** as the hostname of the target system.

Procedure: Setting Up the Target System

1. On the target system, install Uyuni Server 4.0 on SUSE Linux Enterprise 15 SP1, using the unified installer. For more information about installing Uyuni, see [[Installation > Install-server-unified >](#)].
2. From the command prompt, run the YaST Uyuni setup tool:

```
yast2 susemanager_setup
```

3. On the setup screen, check **Migrate a SUSE Manager compatible server**.
4. In the **Hostname of source SUSE Manager Server** field, enter the source system hostname and domain.
5. Enter the database credentials of the source system.
6. Enter the IP address of the target system, or accept the default value if it is correct. If multiple IP addresses are available, ensure you specify the correct one.
7. Follow the prompts to complete the migration. YaST will terminate after the process is complete.



Be careful when you specify the database credentials. Ensure you use the same database parameters as the source system. Even if you intend to change it later on, the database credentials must match during migration.



During the migration process, the target system will fake its hostname to match the source system. Do not change the hostname during the process. Be careful when you log in to your systems during migration, as they will both show the same hostname.

To speed up the actual migration and thus reducing the server downtime, you can copy the system data in advance. For more information, see [Copy System Data to the Target System](#).

Migration

When your target system is ready, begin the migration with this command:

```
/usr/lib/susemanager/bin/mgr-setup -m
```

This command reads the data that was gathered during the setup procedure, sets up Uyuni on the new target system, and transfers all of the data from the source system.

Several operations need to be performed on the source system using SSH, so you will be prompted once for the root password of the source system. A temporary SSH key named **migration-key** is created and installed on the source system, so you need to give the root password only once. The temporary SSH key will be deleted after the migration is finished.

Depending on the size of the installation, the migration can take several hours. When the migration has finished successfully, a **migration successful**' message is shown, and you are prompted to shut

down the source system.

When you have received the **migration successful`** message, you need to reconfigure the network of the target system to use the same IP address and host name as the original system. You will also need to restart the target system before it can be used.

Troubleshooting

A complete migration can consume a lot of time. This is caused by the amount of data that must be copied. Here are some hints how you can compensate it.

Copy System Data to the Target System

These numbers from a test installation illustrate the approximate time it takes to export and import a small 1.8 GB database:

```
14:53:37 Dumping remote database to /var/spacewalk/tmp/susemanager.dmp.gz on target system.  
Please wait...  
14:58:14 Database successfully dumped. Size is: 506M  
14:58:29 Importing database dump. Please wait...  
15:05:11 Database dump successfully imported.
```

In this example, exporting the database took around five minutes, and importing the export onto the target system took an additional seven minutes. For big installations this can take up to several hours.

You also need to account for the time it takes to copy all the package data to the target system. Depending on your network infrastructure and hardware, this can also take a significant amount of time.

You can copy the data at any time before the migration process. Copying the data before you migrate can significantly reduce the amount of downtime required.

Procedure: Migrating System Data

1. On the target system, at the command prompt, migrate the data:

```
mgr-setup -r
```

While the data migration is in progress, the SUSE Manager services will be shut down. This is to ensure that no data is written to the database during the migration.

Integrate Externally Stored Package Data

Procedure: Migrating Data on an External Storage Device

If you have package data on external storage you do not need to copy this data to the new system. For example, if you have an NFS mount at **/var/spacewalk/packages**.

Follow this procedure after migration is finished, and before you start your target system for the first time.

1. Open the script at `/usr/lib/susemanager/bin/mgr-setup`.
2. Locate the `rsync` command on or around line 442, delete or comment it out, and save the file.
3. Ensure your external storage is mounted on the target system.
4. If `/srv/www/htdocs/pub` exists on your external storage, ensure it is mounted.
5. Start the upgraded target system for the first time, and ensure it can access your external storage device.



All files and directories that have not been copied by the migration tool will need to be manually copied to the new system.

Upgrading from Version 4 to 4.x

You can upgrade Uyuni from version 4 to 4.x (when available) using either the YaST online migration tool or the Zypper command line tool. This procedure is also known as SP migration (service pack migration). This procedure does not replace the server with an updated copy. It is an in-place upgrade. Example: **4.0.x → 4.1.0**.



Upgrades should be run from a text console, rather than a graphical interface like GNOME. If you are logged into a GNOME session running on the machine you are going to migrate, you will need to switch to a text console. This does not apply if you are logged in from a remote machine (unless you are running a VNC session with GNOME).

Upgrade Using YaST

To perform the upgrade with YaST, use the Online Migration tool.

Procedure: Upgrading with YaST

1. From the command prompt, as root, launch the YaST online migration tool:

```
yast2 migration
```

YaST will show the possible migration targets with detailed summaries.

2. Select the appropriate target, and follow the prompts to complete the migration.
3. Reboot the server.
4. Ensure the spacewalk services are running:

```
spacewalk-service start
```

If the process fails, check these issues first:

- If YaST does not have the online migration module available, install the **yast2-migration** package. After installing, restart YaST to ensure the module is available.
- If there are older updates available, YaST will notify you and ask to install them first. You must install all package updates before performing the migration. For more information, see [server-update.pdf](#).

During the upgrade, YaST will install all recommended packages. This can significantly increase the installation size of the system. To only install required packages, open the **/etc/zypp/zypp.conf** configuration file and set these variables:

```
solver.onlyRequires = true  
installRecommends = false
```

This changes the behavior of all future package operations.

Upgrade Using Zypper

To perform the upgrade with Zypper, use the Zypper migration tool.

Procedure: Upgrading with Zypper

1. From the command prompt, as root, launch the Zypper migration tool:

```
zypper migration
```

Zypper will show the possible migration targets with detailed summaries.

2. Select the appropriate target, and follow the prompts to complete the migration.
3. Reboot the server.
4. Ensure the spacewalk services are running:

```
spacewalk-service start
```

If the process fails, check these issues first:

- If Zypper does not have the migration tool available, install the **zypper-migration-plugin** package.
- If there are older updates available, Zypper will notify you and ask to install them first. You must install all updates before performing the upgrade.

Database Schema Upgrade

Most likely, you also must upgrade the database schema. For more information, see [server-update.pdf](#), Procedure "Upgrading the Database Schema".

Update Uyuni Proxy

Uyuni Proxies are managed in the same way as clients. Maintenance updates (MU) can be installed on a Uyuni Proxy in the same way as other clients. MU updates require a restart of the proxy service.

Prepare to Update

Before you perform any proxy update, schedule a maintenance window. The clients registered to Uyuni through the proxy will not be able to connect to Uyuni while the update is in progress. For more information about maintenance windows, see [[Administration > Maintenance-window >](#)].

Update the Proxy

To update a proxy you first stop the proxy service, then update the software and finally restart the proxy service.

Procedure: Updating the Uyuni Proxy

1. On the Uyuni Server where the proxy is registered as a client, stop the proxy service:

```
spacewalk-proxy stop
```

2. Select the packages to be updated on the proxy, and then apply the selection.
3. On the Uyuni Server where the proxy is registered as a client, start the proxy service:

```
spacewalk-proxy start
```

If you need to update many proxies, you can create an action chain of this command sequence. You can use the action chain to perform updates on multiple proxies at the same time.

Proxy Migration

Uyuni Proxy can be upgraded from version 3.2 to 4.0 if it was registered as a traditional client. The upgrade process is automated, but you will need to do some preparation steps before you can upgrade.

You will need to complete the Uyuni Server migration before you start.

The system must be running Uyuni 3.2 with all the latest updates applied. Before you start, ensure that the system is up to date and all updates have been installed successfully.



- This process cannot be used to upgrade a Uyuni Proxy that was registered as a Salt client.

Prepare to Migrate

Before you can update your proxy, you will need an autoinstallation distribution, and an autoinstallation profile. The distribution must be based on SUSE Linux Enterprise 15 SP1, because Uyuni 4 is part of the SUSE Linux Enterprise 15 SP1 product family.

Procedure: Preparing Installation Media

1. On the Uyuni Server, create a local directory for the SLE 15 installation media.
2. Download an ISO image with the installation sources, and mount the ISO image on your server:

```
mkdir /mnt/sle15sp1
mount -o loop DVD1.iso /mnt/sle15sp1
```

Procedure: Creating an Autoinstallation Distribution

1. In the Uyuni Web UI, navigate to **Systems > Autoinstallation > Distributions** and click [**Create Distribution**].
2. In the **Create Autoinstallable Distribution** section, use these parameters:
 - In the **Distribution Label** section, type a unique name for the distribution. Use only letters, numbers, hyphens (-), periods (.), and underscores (_), and ensure the name is longer than four characters.
 - In the **Tree Path** field, type an absolute path to the installation source. In this example, this would be `/mnt/sle15sp1`.
 - In the **Base Channel** field, select `SLE-Product-SUSE-Manager-Proxy-4.0-Pool for x86_64`.
 - In the **Installer Generation** field, select `SUSE Linux Enterprise 15`.
 - In the **Kernel Options** field, type any options to be passed to the kernel when booting for the installation. The `install=` parameter and the `self_update=0 pt.options=self_update` parameter are added by default.

- In the **Post Kernel Options** section, type any options to be passed to the kernel when booting the installed system for the first time.

3. Click **[Create Autoinstallable Distribution]** to save.

Edit Autoinstallable Distribution

Edit **Variables**

Edit Autoinstallable Distribution

The following details are needed to define an autoinstallable distribution. The tree path field should be a valid path to an installation tree located on this SUSE Manager server.

The Distribution Label field should contain only letters, numbers, hyphens, periods, and underscores. It must also be at least 4 characters long.

The Tree Path, Base Channel, and Installer Generation should always match. This generally means that the versions for each field should be from the same version of SUSE Linux Enterprise.

The Tree Path must be a local disk path on your SUSE Manager server containing the entire autoinstallable tree for a distribution including kernel, initrd, and repo information, but excluding any rpms. This directory should be readable by the apache and tomcat users. If you have media located on the SUSE Manager server at: `/var/distro-trees/sles-11-server/` you would specify that path as your Tree Path value.

Distribution Label* :	proxy4
Tree Path* :	/var/distro-trees/sle15
Base Channel* :	SLE-Product-SUSE-Manager-Proxy-4.0-Pool for x86_64
Installer Generation* :	SUSE Linux Enterprise 15
Kernel Options :	Install=http://g228.suse.de/ks/dist/proxy4 self_update=0 pt.options=+self_update
Post Kernel Options :	
Update Autoinstallable Distribution	

When you have created an autoinstallable distribution, you can edit it by navigating to **Systems > Autoinstallation > Distributions** and selecting the distribution you want to edit.

Autoinstallation profiles contain all the installation and configuration data needed to install a system. They can also contain scripts to be executed after the installation is complete.

Use this example profile as a starting point for your own autoinstallation profile:

Listing 1. Example: Autoinstallation Profile

```
<?xml version="1.0"?>
<!DOCTYPE profile>
<profile xmlns="http://www.suse.com/1.0/yast2ns"
  xmlns:config="http://www.suse.com/1.0/configns">
  <add-on>
    <add_on_products config:type="list">
      <listentry>
        <ask_on_error config:type="boolean">true</ask_on_error>
        <media_url>http://$redhat_management_server/ks/dist/child/sle-product-suse-manager-
proxy-4.0-updates-x86_64/proxy4</media_url>
        <name>sle-product-suse-manager-proxy-4.0-updates-x86_64</name>
        <product>SUSE Manager Proxy 4.0</product>
        <product_dir></product_dir>
      </listentry>
      <listentry>
        <ask_on_error config:type="boolean">true</ask_on_error>
        <media_url>http://$redhat_management_server/ks/dist/child/sle-module-basesystem15-
sp1-pool-x86_64-proxy-4.0/proxy4</media_url>
        <name>sle-module-basesystem15-sp1-pool-x86_64-proxy-4.0</name>
        <product>SUSE Manager Proxy 4.0</product>
        <product_dir></product_dir>
      </listentry>
      <listentry>
```

```

<ask_on_error config:type="boolean">true</ask_on_error>
<media_url>http://$redhat_management_server/ks/dist/child/sle-module-basesystem15-
sp1-updates-x86_64-proxy-4.0/proxy4</media_url>
<name>sle-module-basesystem15-sp1-updates-x86_64-proxy-4.0</name>
<product>SUSE Manager Proxy 4.0</product>
<product_dir></product_dir>
</listentry>
<listentry>
<ask_on_error config:type="boolean">true</ask_on_error>
<media_url>http://$redhat_management_server/ks/dist/child/sle-module-server-
applications15-sp1-pool-x86_64-proxy-4.0/proxy4</media_url>
<name>sle-module-server-applications15-sp1-pool-x86_64-proxy-4.0</name>
<product>SUSE Manager Proxy 4.0</product>
<product_dir></product_dir>
</listentry>
<listentry>
<ask_on_error config:type="boolean">true</ask_on_error>
<media_url>http://$redhat_management_server/ks/dist/child/sle-module-server-
applications15-sp1-updates-x86_64-proxy-4.0/proxy4</media_url>
<name>sle-module-server-applications15-sp1-updates-x86_64-proxy-4.0</name>
<product>SUSE Manager Proxy 4.0</product>
<product_dir></product_dir>
</listentry>
<listentry>
<ask_on_error config:type="boolean">true</ask_on_error>
<media_url>http://$redhat_management_server/ks/dist/child/sle-module-suse-manager-
proxy-4.0-pool-x86_64/proxy4</media_url>
<name>sle-module-suse-manager-proxy-4.0-pool-x86_64</name>
<product>SUSE Manager Proxy 4.0</product>
<product_dir></product_dir>
</listentry>
<listentry>
<ask_on_error config:type="boolean">true</ask_on_error>
<media_url>http://$redhat_management_server/ks/dist/child/sle-module-suse-manager-
proxy-4.0-updates-x86_64/proxy4</media_url>
<name>sle-module-suse-manager-proxy-4.0-updates-x86_64</name>
<product>SUSE Manager Proxy 4.0</product>
<product_dir></product_dir>
</listentry>
</add_on_products>
</add-on>
<general>
$SNIPPET('spacewalk/sles_no_signature_checks')
<mode><confirm config:type="boolean">false</confirm></mode>
</general>
<upgrade>
<only_installed_packages config:type="boolean">false</only_installed_packages>
<stop_on_solver_conflict config:type="boolean">true</stop_on_solver_conflict>
</upgrade>
<backup>
<sysconfig config:type="boolean">true</sysconfig>
<modified config:type="boolean">true</modified>
<remove_old config:type="boolean">false</remove_old>
</backup>
<networking>
<keep_install_network config:type="boolean">true</keep_install_network>
<start_immediately config:type="boolean">true</start_immediately>
</networking>
<software>
<image/>
<install_recommended config:type="boolean">true</install_recommended>
<instsource/>
<patterns config:type="list">
<pattern>suma_proxy</pattern>
</patterns>
<products config:type="list">
<listentry>SUSE-Manager-Proxy</listentry>
</products>

```

```

</software>
<scripts>
  <chroot-scripts config:type="list">
    <script>
      <filename>cleanup.sh</filename>
      <chrooted config:type="boolean">true</chrooted>
      <interpreter>shell</interpreter>
      <source>
        <![CDATA[
#!/bin/sh
  sysconf_addword /etc/sysconfig/apache2 APACHE_MODULES wsgi
  if [ -e /etc/rhn/rhn.conf.rpmsave ]; then
    cp /etc/rhn/rhn.conf.rpmsave /etc/rhn/rhn.conf
  fi
  zypper rr --all
  ]]>
      </source>
    </script>
  </chroot-scripts>
</scripts>
</profile>

```

Migration

Before you begin, check that all the channels referenced in the autoinstallation profile are available and fully synchronized.

Procedure: Migrating

1. On the Uyuni Server Web UI, navigate to **Systems > Autoinstallation > Profiles** and upload your autoinstallation profile.
2. In the **Kernel Options** field, enter **autoupgrade=1 Y2DEBUG=1**
3. OPTIONAL: The debug setting is not required but can help with investigating any future problems.
4. Check the **autoupgrade** option.
5. In the **System List**, select the proxy, navigate to the **Provisioning** tab, and select the autoinstallation profile you uploaded.
6. Click **[Schedule Autoinstallation and Finish]**. The system will download the required files, change the bootloader entries, reboot, and start the upgrade.

Clean Up

When the Uyuni Proxy has finished upgrading process, it will still show the originally assigned channels.



If the server reports that there are updates available for the proxy, do not apply them before completing the clean up.

Procedure: Cleaning Up

1. On the Uyuni Server Web UI, navigate to the **System List**, select the proxy, and navigate to the **Software > Software Channels** subtab.

2. Clear the old channels.
3. In the **Base Channel** field, select **SLE-Product-SUSE-Manager-Proxy-4.0-Pool for x86_64**.
4. In the **Child Channels** field, select all the recommended channels.

 d14.suse.de [?](#)

[Delete System](#) | [Add to SSM](#)

Details Software Configuration Provisioning Groups Audit Events

Patches Packages **Software Channels** SP Migration Software Crashes

When subscribing to a channel that contains a product, the product package will automatically be installed on traditionally registered systems or added to the package states on Salt managed systems. [?](#)

Base Channel

You can change the base software channel your system is subscribed to. The system will be unsubscribed from all software channels, and subscribed to the new base software channel.

include recommended

(none, disable service)

SUSE Channels

SLE-Product-SUSE-Manager-Proxy-4.0-Pool for x86_64 [?](#)

Child Channels

This system is subscribed to the checked channels beneath, if any. Disabled checkboxes indicate channels that can't be manually subscribed or unsubscribed from.

SLE-Product-SUSE-Manager-Proxy-4.0-Pool for x86_64 [?](#)

SLE-Module-Basesystem15-SP1-Pool for x86_64 Proxy 4.0 [?](#)
recommended [?](#)

SLE-Module-Basesystem15-SP1-Updates for x86_64 Proxy 4.0 [?](#)
recommended [?](#)

SLE-Module-Server-Applications15-SP1-Pool for x86_64 Proxy 4.0 [?](#)
[?](#) recommended [?](#)

SLE-Module-Server-Applications15-SP1-Updates for x86_64 Proxy 4.0 [?](#)
[?](#) recommended [?](#)

SLE-Module-SUSE-Manager-Proxy-4.0-Pool for x86_64 [?](#)
recommended [?](#)

SLE-Module-SUSE-Manager-Proxy-4.0-Updates for x86_64 [?](#)
recommended [?](#)

SLE-Product-SUSE-Manager-Proxy-4.0-Updates for x86_64 [?](#)
mandatory [?](#)

Important: All the 'mandatory' channels should be subscribed to have a consistent set of channels.

Client Migration

Upgrading traditional clients from SLE 12 with the latest Service Pack to SLE 15 is automated, but you will need to do some preparation steps before you can upgrade.

Upgrading traditional clients from earlier SLE 15 Service Packs to later SLE 15 Service Packs is fully automated.

For supported SUSE Linux Enterprise 15 upgrade paths, see <https://documentation.suse.com/sles/15-SP1/html/SLES-all/cha-upgrade-paths.html>



- This process cannot be used to upgrade Salt clients.

Upgrade Clients from SLE 12 to SLE 15

Your clients must have the latest available SLE 12 Service Pack, with all the latest updates applied. Before you start, ensure that the system is up to date and all updates have been installed successfully.

The upgrade is controlled by YaST and AutoYaST, it does not use Zypper.

Prepare to Migrate

Before you can migrate your client from SLE 12 to SLE 15, you need to make these preparations:

1. Prepare installation media
2. Create an auto-installation distribution
3. Create an activation key
4. Upload an AutoYaST profile

Procedure: Preparing Installation Media

1. On the Uyuni Server, create a local directory for the SLE 15 installation media.
2. Download an ISO image with the installation sources, and mount the ISO image on your server:

```
mkdir /mnt/sle15
mount -o loop DVD1.iso /mnt/sle15
```

Procedure: Creating an Autoinstallation Distribution

1. In the Uyuni Web UI, navigate to **Systems > Autoinstallation > Distributions** and click [**Create Distribution**].
2. In the **Create Autoinstallable Distribution** section, use these parameters:
 - In the **Distribution Label** section, type a unique name for the distribution. Use only letters, numbers, hyphens (-), periods (.), and underscores (_), and ensure the name is longer

than four characters.

- In the **Tree Path** field, type an absolute path to the installation source. For example, `/mnt/sle15`.
- In the **Base Channel** field, select **SLE-Product-SLES15-Pool for x86_64**.
- In the **Installer Generation** field, select **SUSE Linux Enterprise 15**.
- In the **Kernel Options** field, type any options to be passed to the kernel when booting for the installation. The `install=` parameter and the `self_update=0` `pt.options=self_update` parameter are added by default.
- In the **Post Kernel Options** section, type any options to be passed to the kernel when booting the installed system for the first time.

3. Click [**Create Autoinstallable Distribution**] to save.

Procedure: Creating an Activation Key

In order to switch from the old SLE 12 SP4 base channel to the new SLE 15 channel, you need an activation key.

1. In the Uyuni Server Web UI, navigate to **Systems > Activation Keys** and click **Create Key**.
2. Enter a description for your key.
3. Enter a key or leave it blank to generate an automatic key.
4. OPTIONAL: If you want to limit the usage, enter your value in the **Usage** text field.
5. Select the **SLE-Product-SLES15-Pool for x86_64** base channel.
6. OPTIONAL: Select any **Add-On System Types**. For more information, see <https://documentation.suse.com/sles/15-SP1/html/SLES-all/art-modules.html>.
7. Click [**Create Activation Key**].
8. Click the **Child Channels** tab and select the required channels.
9. Click [**Update Key**].

Procedure: Uploading an AutoYaST Profile

Create an AutoYaST profile. For more information about AutoYaST, see [**Client-configuration > Client-automating-installation >**].

1. In the Uyuni Server Web UI, navigate to **Systems > Autoinstallation** and click **Upload Kickstart/Autoyast File**.
2. Paste the XML content in the text area or select the file to upload and click [**Create**].
3. Navigate to the **Details** tab.
4. In the **Kernel Options** field, select `autoupgrade=1` and click [**Update**].
5. Navigate to the **Variable** tab.

-
6. In the **registration_key=** field, enter the activation key, and click [**Update Variables**].

Migration

Before you begin the migration, make sure that the migration target channels are completely mirrored. For the upgrade to SUSE Linux Enterprise 15, at least the **SLE-Product-SLES15-Pool** base channel with the **SLE-Manager-Tools15-Pool** child channel for your architecture is required. The matching update channels such as **SLE-Manager-Tools15-Updates** and **SLE-Product-SLES15-Updates** are recommended.

You can monitor the mirroring progress in **/var/log/rhn/reposync/sles15-pool-x86_64.log**.

Procedure: Migrating

1. In the Uyuni Server Web UI, navigate to **Systems** and select the client to be upgraded.
2. Navigate to **System Details** > **Provisioning** > **Autoinstallation** > **Schedule**, and select the AutoYaST profile you uploaded.
3. Click [**Schedule Autoinstallation and Finish**].

Next time the client synchronizes with the Uyuni Server, it will receive a re-installation job. The re-installation job fetches the new kernel and initrd packages. It will also write a new **/boot/grub/menu.lst**, containing pointers to the new kernel and initrd packages.

When the client next boots, it will use grub to boot the new kernel with its initrd. PXE booting is not used during this process.

Approximately three minutes after the job was fetched, the client will go down for reboot.

SP Mass Migration

If you want to migrate a large number of clients to the next SP version, you can use Uyuni API calls.

Procedure: SP Mass Migration

1. You need to know to which migration target you want to migrate. List available migration targets:

```
spacecmd api -- system.listMigrationTargets -A 1000010001
```

Create a list of system IDs you want to migrate.

2. For each system ID, call **listMigrationTarget** and check that it is an available target.
 - If the system ID is an available target, call **system.scheduleSPMigration**.
 - If it is not an available target, skip the system.

Adapt this template for your environment:

```
target = '....'
basechannel = 'channel-label'
system_ids = [1, 2, 3]

session = auth.login(user, pass)
for system in system_ids
    if system.listMigrationTargets(session, system).ident == target
        system.scheduleSPMigration(session, system, target, basechannel, [], False, <now>)
    else
        print "Cannot migrate to requested target -- skipping system"
    endif
endfor
```

Database Migration

This section covers upgrading the PostgreSQL database from version 9 to version 10. If you are already using PostgreSQL 10, you do not need to perform this migration.

If you want to upgrade to the latest Uyuni version, you must be using PostgreSQL version 10. If you are using an older version, such as version 9.6, you must migrate PostgreSQL to version 10 before you begin the Uyuni migration.



If you run PostgreSQL 9.4 on Uyuni 3.2, see the product documentation at <https://documentation.suse.com/external-tree/en-us/suma/3.2/susemanager-best-practices/html/book.suma.best.practices/bp.sp.migration.html#sp.migration.postgresql>. You cannot migrate directly from PostgreSQL 9.4 to version 10.

Prepare to Upgrade

Before you begin the upgrade, prepare your existing Uyuni Server and create a database backup.

PostgreSQL stores data at `/var/lib/pgsql/data/`.

Procedure: Preparing to Upgrade

1. Check the active PostgreSQL version:

```
psql --version
```

If you are using PostgreSQL 9.6, you can upgrade to PostgreSQL 10.

If you are already using PostgreSQL 10, you do not need to perform this migration.

2. Check the active smdba version:

```
rpm -q smdba
```

PostgreSQL 10 requires `smbda` version 1.6.2 or later.

3. Perform a database backup. For more information on backing up, see [**Administration > Backup-restore >**].

Upgrade PostgreSQL



Always create a database backup before performing a migration. For more information about a database backup, see [db-migration.pdf](#).

PostgreSQL upgrades can be performed in two ways: a regular upgrade, or a fast upgrade:

A regular upgrade will create a complete copy of the database, so you will need double the existing database size of space available. Regular upgrades can take a considerable amount of time, depending on the size of the database and the speed of the storage system.

A fast upgrade only takes a few minutes, and uses almost no additional disk space. However, if a fast upgrade fails, you must restore the database from the backup. A fast upgrade reduces the risk of running out of disk space. A regular upgrade will copy the database files instead of creating hard links between the files.

PostgreSQL stores data at `/var/lib/pgsql/data/`.

Procedure: Performing a Regular Upgrade

1. Perform a database backup. For more information on backing up, see [**Administration > Backup-restore >**].
2. Start the upgrade:

```
/usr/lib/susemanager/bin/pg-migrate-96-to-10.sh
```

3. When the upgrade has successfully completed, you can safely delete the old database directory and reclaim lost disk space. The old directory is renamed to `/var/lib/pgsql/data-pg96`.

The `pg-migrate-96-to-10.sh` script performs these operations:

- Stop spacewalk services
- Shut down the running database
- Check if PostgreSQL 10 is installed and install it if necessary
- Switch from PostgreSQL 9.6 to PostgreSQL 10 as the new default
- Initiate the database migration
- Create a PostgreSQL configuration file tuned for use by Uyuni
- Start the database and spacewalk services



If the upgrade fails, the migration script will attempt to restore the database to its original state.

Procedure: Performing a Fast PostgreSQL Upgrade

1. Perform a database backup. Without a verified database backup, you must not initiate a fast upgrade. For more information on backing up, see [**Administration > Backup-restore >**].
2. Start the upgrade:

```
/usr/lib/susemanager/bin/pg-migrate-96-to-10.sh fast
```

- When the upgrade has successfully completed, you can safely delete the old database directory and reclaim lost disk space. The old directory is renamed to **/var/lib/pgsql/data-pg96**.

Troubleshooting

This section contains some common problems you might encounter with Uyuni upgrades, and solutions to resolving them.

Web UI Fails to Load

Sometimes, the Web UI will not load after migration. This is usually caused by browser caching, if the new system has the same hostname and IP address as the old system. This duplication can confuse some browsers.

This issue is resolved by clearing the cache and reloading the page. In most browsers, you can do this quickly by pressing *Ctrl+F5*.

Not Enough Disk Space

Check the available disk space before you begin migration. We recommend locating `/var/spacewalk` and `/var/lib/pgsql` on separate XFS file systems.

When you are setting up a separate file system, edit `/etc/fstab` and remove the `/var/lib/pgsql` subvolume. Reboot the server to pick up the changes.

Retrying to Set up the Target System

If you need to retry setting up the target system, follow these steps:

1. Delete `/root/.MANAGER_SETUP_COMPLETE`.
2. Stop PostgreSQL and remove `/var/lib/pgsql/data`.
3. Set the target system hostname to match the source system hostname.
4. Check the `/etc/hosts` file, and correct it if necessary.
5. Check `/etc/setup_env.sh` on the target system, and ensure the database name is set:

```
MANAGER_DB_NAME='susemanager'
```

6. Reboot the target system.
7. Run `mgr-setup` again.

Sample Autoinstallation Script

This section contains an example autoinstallation script. Use this script as the basis for an upgrade from SLE 12 SP4 to SLE 15.

Listing 2. Example: Autoinstallation Script

```
<?xml version="1.0"?>
<!DOCTYPE profile>
<profile xmlns="http://www.suse.com/1.0/yast2ns"
          xmlns:config="http://www.suse.com/1.0/configns">
    <general>
        $SNIPPET('spacewalk/sles_no_signature_checks')
        <mode>
            <confirm config:type="boolean">false</confirm>
        </mode>
    </general>
    <add-on>
        <add_on_products config:type="list">
            <listentry>
                <ask_on_error config:type="boolean">true</ask_on_error>
                <media_url>http://$redhat_management_server/ks/dist/child/sle15-updates-
x86_64/autumn2018</media_url>
                <name>SLE15 Updates</name>
                <product>SLE15</product>
                <product_dir></product_dir>
            </listentry>
            <listentry>
                <ask_on_error config:type="boolean">true</ask_on_error>
                <media_url>http://$redhat_management_server/ks/dist/child/sle-manager-tools15-pool-
x86_64/summer2017</media_url>
                <name>SLE15 Manager Tools Pool</name>
                <product>SLE15</product>
                <product_dir></product_dir>
            </listentry>
            <listentry>
                <ask_on_error config:type="boolean">true</ask_on_error>
                <media_url>http://$redhat_management_server/ks/dist/child/sle-manager-tools15-
updates-x86_64/autumn2018</media_url>
                <name>SLE15 Manager Tools Updates</name>
                <product>SLE15</product>
                <product_dir></product_dir>
            </listentry>
        </add_on_products>
    </add-on>
    <upgrade>
        <only_installed_packages config:type="boolean">false</only_installed_packages>
        <stop_on_solver_conflict config:type="boolean">true</stop_on_solver_conflict>
    </upgrade>
    <backup>
        <sysconfig config:type="boolean">true</sysconfig>
        <modified config:type="boolean">true</modified>
        <remove_old config:type="boolean">false</remove_old>
    </backup>
    <networking>
        <keep_install_network config:type="boolean">true</keep_install_network>
        <start_immediately config:type="boolean">true</start_immediately>
    </networking>
    <scripts>
        <init-scripts config:type="list">
            $SNIPPET('spacewalk/sles_register_script')
        </init-scripts>
    </scripts>
    </profile>
```

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. Secondarily, this License preserves for the author and publisher a way to get credit for their work, while not being considered responsible for modifications made by others.

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

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

1. APPLICABILITY AND DEFINITIONS

This License applies to any manual or other work, in any medium, that contains a notice placed by the copyright holder saying it can be distributed under the terms of this License. Such a notice grants a worldwide, 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{ldquo}GNU
Free Documentation License{rdquo}.

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.