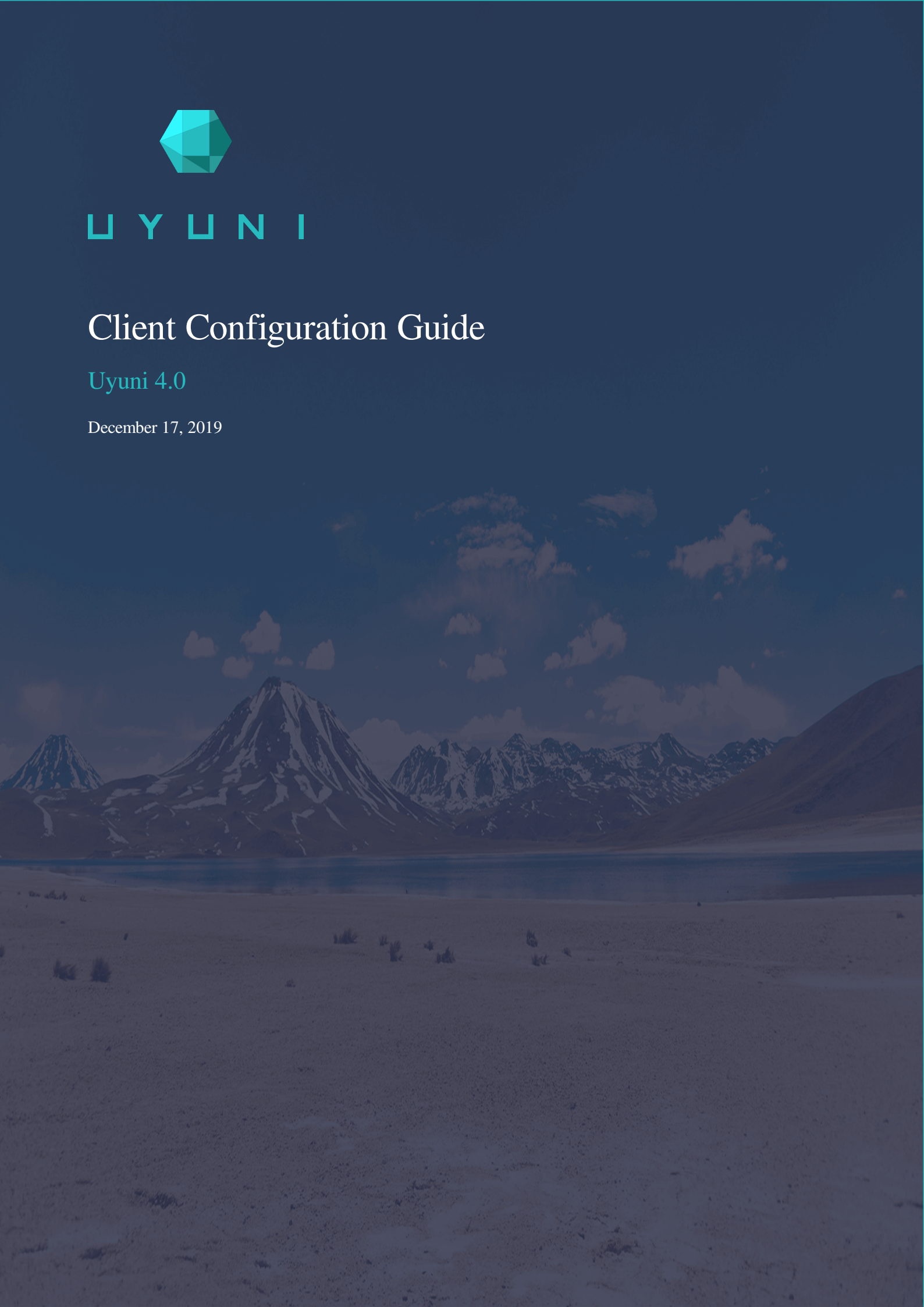

# Client Configuration Guide

## Uyuni 4.0

December 17, 2019

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# Introduction

**Publication Date:** 2019-12-17

Registering clients is the first step after installing Uyuni, and most of the time you spend with Uyuni will be spent on maintaining those clients.

Uyuni is compatible with a range of client technologies: you can install traditional or Salt clients, running SUSE Linux Enterprise or another Linux operating system, with a range of hardware options.

For a complete list of supported clients and features, see [ **Client-configuration** › **Supported-features** › ].

This guide discusses how to register and configure different clients, both manually and automatically.

## Supported Clients and Features

Uyuni is compatible with a range of client technologies. You can install traditional or Salt clients, running SUSE Linux Enterprise or another Linux operating system, with a range of hardware options.

This section contains summary of supported client systems. For a detailed list of features available on each client, see the following pages.

### Supported Client Systems

Supported operating systems for traditional and Salt clients are listed in this table.

The icons in this table indicate:

- ✔ clients running this operating system are supported by SUSE
- ✖ clients running this operating system are not supported by SUSE
- ? clients are under consideration, and may or may not be supported at a later date.

Client operating system versions and SP levels must be under general support (normal or LTSS) to be supported with Uyuni. For details on supported product versions, see https://www.suse.com/lifecycle.

*Table 1. Supported Client Systems*

| Operating System | Architecture | Traditional Clients | Salt Clients |
|---|---|---|---|
| SUSE Linux Enterprise 15 | x86_64, POWER, IBM Z, ARM | ✔ | ✔ |
| SUSE Linux Enterprise 12 | x86_64, POWER, IBM Z, ARM | ✔ | ✔ |

| Operating System | Architecture | Traditional Clients | Salt Clients |
|---|---|---|---|
| SUSE Linux Enterprise 11 | x86, x86_64, Itanium, IBM POWER, IBM Z | ✔ | ✔ |
| SUSE Linux Enterprise Server for SAP | x86_64, POWER | ✔ | ✔ |
| openSUSE Leap 15.1 | x86_64 | ✖ | ✔ |
| SUSE Linux Enterprise Server-ES 7 | x86_64 | ✔ | ✔ |
| SUSE Linux Enterprise Server-ES 6 | x86, x86_64 | ✔ | ✔ |
| Red Hat Enterprise Linux 7 | x86_64 | ✔ | ✔ |
| Red Hat Enterprise Linux 6 | x86, x86_64 | ✔ | ✔ |
| CentOS 7 | x86_64 | ?/✔ (with ES) | ? / ✔ (with ES) |
| CentOS 6 | x86, x86_64 | ?/✔ (with ES) | ? / ✔ (with ES) |
| Ubuntu 18.04 | x86_64 | ✖ | ✔ |
| Ubuntu 16.04 | x86_64 | ✖ | ✔ |

## Supported SUSE and openSUSE Client Features

This table lists the availability of various features on SUSE and openSUSE clients. This table covers all variants of the SUSE Linux Enterprise operating system, including SLES, SLED, SUSE Linux Enterprise Server for SAP, and SUSE Linux Enterprise Server for HPC.

The icons in this table indicate:

- ✔ the feature is available on both traditional and Salt clients
- ✖ the feature is not available
- ? the feature is under consideration, and may or may not be made available at a later date
- `Traditional` the feature is supported only on traditional clients
- `Salt` the feature is supported only on Salt clients.

*Table 2. Supported Features on SUSE and openSUSE Operating Systems*

| Feature | SUSE Linux Enterprise 11 | SUSE Linux Enterprise 12 | SUSE Linux Enterprise 15 | openSUSE 15.1 |
|---|---|---|---|---|
| Client | ✔ | ✔ | ✔ | ✔ |
| Operating system packages | ✔ | ✔ | ✔ | ✔ |

| Feature | SUSE Linux Enterprise 11 | SUSE Linux Enterprise 12 | SUSE Linux Enterprise 15 | openSUSE 15.1 |
|---|---|---|---|---|
| Registration | ✔ | ✔ | ✔ | Salt |
| Install packages | ✔ | ✔ | ✔ | Salt |
| Apply patches | ✔ | ✔ | ✔ | Salt |
| Remote commands | ✔ | ✔ | ✔ | Salt |
| System package states | Salt | Salt | Salt | Salt |
| System custom states | Salt | Salt | Salt | Salt |
| Group custom states | Salt | Salt | Salt | Salt |
| Organization custom states | Salt | Salt | Salt | Salt |
| System set manager (SSM) | ✔ | ✔ | ✔ | Salt |
| Service pack migration | ✔ | ✔ | ✔ | Salt |
| Basic Virtual Guest Management ✱ | Traditional | ✔ | ✔ | `Salt |
| Advanced Virtual Guest Management ✱ | ✘ | Salt | Salt | Salt |
| Virtual Guest Installation (AutoYaST), as Host OS | Traditional | Traditional | Traditional | ✘ |
| Virtual Guest Installation (image template), as Host OS | ✘ | Salt | Salt | Salt |
| Virtual Guest Management | ✘ | Salt | Salt | Salt |
| System deployment (PXE/AutoYaST) | ✔ | ✔ | ✔ | ✔ |
| System redeployment (AutoYaST) | Traditional | ✔ | ✔ | Salt |

| Feature | SUSE Linux Enterprise 11 | SUSE Linux Enterprise 12 | SUSE Linux Enterprise 15 | openSUSE 15.1 |
|---|---|---|---|---|
| Contact methods | `Traditional`: OSAD, RHNSD, SSH-push. `Salt`: ZeroMQ, Salt-SSH | `Traditional`: OSAD, RHNSD, SSH-push. `Salt`: ZeroMQ, Salt-SSH | `Traditional`: OSAD, RHNSD, SSH-push. `Salt`: ZeroMQ, Salt-SSH | `Salt`: ZeroMQ, Salt-SSH |
| Works with Uyuni Proxy | ✔ | ✔ | ✔ | `Salt` |
| Action chains | ✔ | ✔ | ✔ | `Salt` |
| Software crash reporting | ✘ | ✘ | ✘ | ✘ |
| Staging (pre-download of packages) | ✔ | ✔ | ✔ | `Salt` |
| Duplicate package reporting | ✔ | ✔ | ✔ | `Salt` |
| CVE auditing | ✔ | ✔ | ✔ | `Salt` |
| SCAP auditing | ✔ | ✔ | ✔ | `Salt` |
| Package verification | `Traditional` | `Traditional` | `Traditional` | ✘ |
| Package locking | `Traditional` | `Traditional` | `Traditional` | ✘ |
| System locking | `Traditional` | `Traditional` | `Traditional` | ✘ |
| System snapshot | `Traditional` | `Traditional` | `Traditional` | ✘ |
| Configuration file management | ✔ | ✔ | ✔ | `Salt` |
| Package profiles | `Traditional`. `Salt`: Profiles supported, Sync not supported | `Traditional`. `Salt`: Profiles supported, Sync not supported | `Traditional`. `Salt`: Profiles supported, Sync not supported | `Salt`: Profiles supported, Sync not supported |
| Power management | ✔ | ✔ | ✔ | ✔ |
| Monitoring | ? | `Salt` | `Salt` | `Salt` |
| Docker buildhost | ✘ | `Salt` | `Salt` | ? |
| Build Docker image with OS | ✘ | `Salt` | `Salt` | `Salt` |
| Kiwi buildhost | ✘ | `Salt` | ? | ? |

| Feature | SUSE Linux Enterprise 11 | SUSE Linux Enterprise 12 | SUSE Linux Enterprise 15 | openSUSE 15.1 |
|---|---|---|---|---|
| Build Kiwi image with OS | ✗ | Salt | ? | ✗ |

✱ Virtual Guest Management:

In this table, virtual guest management is split into basic and advanced.

Basic virtual guest management includes listing VMs, slow refresh, VM lifecycle actions (start, stop, resume, pause), and modifying VM vCPU and Memory.

Advanced virtual guest management includes fast refresh, VM lifecycle actions (delete, reset, power off), modifying VM disk, network, graphical display, and graphical display configuration.

## Supported SUSE Linux Enterprise Server with Expanded Support Features

This table lists the availability of various features on SUSE Linux Enterprise Server with Expanded Support clients.

The icons in this table indicate:

- ✔ the feature is available on both traditional and Salt clients
- ✗ the feature is not available
- ? the feature is under consideration, and may or may not be made available at a later date
- `Traditional` the feature is supported only on traditional clients
- `Salt` the feature is supported only on Salt clients.

*Table 3. Supported Features on SUSE Linux Enterprise Server with Expanded Support Operating Systems*

| Feature | SLES ES 6 | SLES ES 7 |
|---|---|---|
| Client | ✔ | ✔ |
| Operating system packages | ✔ | ✔ |
| Registration | ✔ | ✔ |
| Install packages | ✔ | ✔ |
| Apply patches | ✔ | ✔ |
| Remote commands | ✔ | ✔ |
| System package states | Salt | Salt |
| System custom states | Salt | Salt |
| Group custom states | Salt | Salt |

| Feature | SLES ES 6 | SLES ES 7 |
|---|---|---|
| Organization custom states | Salt | Salt |
| System set manager (SSM) | Salt | Salt |
| Service pack migration | ✗ | ✗ |
| Basic Virtual Guest Management ✱ | Traditional | ✓ |
| Advanced Virtual Guest Management ✱ | ✗ | Salt |
| Virtual Guest Installation (Kickstart), as Host OS | Traditional | Traditional |
| Virtual Guest Installation (image template), as Host OS | Traditional | ✓ |
| System deployment (PXE/Kickstart) | ✓ | ✓ |
| System redeployment (Kickstart) | Traditional | ✓ |
| Contact methods | Traditional: OSAD, RHNSD, SSH-push.<br>Salt: ZeroMQ, Salt-SSH | Traditional: OSAD, RHNSD, SSH-push.<br>Salt: ZeroMQ, Salt-SSH |
| Works with Uyuni Proxy | ✓ | ✓ |
| Action chains | ✓ | ✓ |
| Software crash reporting | ✗ | Traditional |
| Staging (pre-download of packages) | ✓ | ✓ |
| Duplicate package reporting | ✓ | ✓ |
| CVE auditing | ✓ | ✓ |
| SCAP auditing | ✓ | ✓ |
| Package verification | Traditional | Traditional |
| Package locking | Traditional | Traditional |
| System locking | Traditional | Traditional |
| System snapshot | Traditional | Traditional |
| Configuration file management | ✓ | ✓ |
| Snapshots and profiles | Traditional.<br>Salt: Profiles supported, Sync not supported | Traditional.<br>Salt: Profiles supported, Sync not supported |
| Power management | ✓ | ✓ |

| Feature | SLES ES 6 | SLES ES 7 |
|---|---|---|
| Monitoring | `Salt` | `Salt` |
| Docker buildhost | ✗ | ✗ |
| Build Docker image with OS | ? | ? |
| Kiwi buildhost | ✗ | ✗ |
| Build Kiwi image with OS | ✗ | ✗ |

✱ Virtual Guest Management:

In this table, virtual guest management is split into basic and advanced.

Basic virtual guest management includes listing VMs, slow refresh, VM lifecycle actions (start, stop, resume, pause), and modifying VM vCPU and Memory.

Advanced virtual guest management includes fast refresh, VM lifecycle actions (delete, reset, power off), modifying VM disk, network, graphical display, and graphical display configuration.

## Supported Red Hat Enterprise Linux Features

This table lists the availability of various features on native Red Hat Enterprise Linux clients (without Expanded Support).

The icons in this table indicate:

- ✔ the feature is available on both traditional and Salt clients
- ✗ the feature is not available
- ? the feature is under consideration, and may or may not be made available at a later date
- `Traditional` the feature is supported only on traditional clients
- `Salt` the feature is supported only on Salt clients.

*Table 4. Supported Features on Red Hat Enterprise Linux Operating Systems*

| Feature | RHEL 6 | RHEL 7 |
|---|---|---|
| Client | ✔ | ✔ |
| Operating system packages | ✗ | ✗ |
| Registration | ✔ | ✔ |
| Install packages | ✔ | ✔ |
| Apply patches | ✔ | ✔ |
| Remote commands | ✔ | ✔ |
| System package states | `Salt` | `Salt` |

| Feature | RHEL 6 | RHEL 7 |
|---|---|---|
| System custom states | Salt | Salt |
| Group custom states | Salt | Salt |
| Organization custom states | Salt | Salt |
| System set manager (SSM) | Salt | Salt |
| Service pack migration | ✗ | ✗ |
| Basic Virtual Guest Management ✱ | Traditional | ✓ |
| Advanced Virtual Guest Management ✱ | ✗ | Salt |
| Virtual Guest Installation (Kickstart), as Host OS | Traditional | Traditional |
| Virtual Guest Installation (image template), as Host OS | Traditional | ✓ |
| System deployment (PXE/Kickstart) | ✓ | ✓ |
| System redeployment (Kickstart) | Traditional | ✓ |
| Contact methods | Traditional: OSAD, RHNSD, SSH-push.<br>Salt: ZeroMQ, Salt-SSH | Traditional: OSAD, RHNSD, SSH-push.<br>Salt: ZeroMQ, Salt-SSH |
| Works with Uyuni Proxy | ✓ | ✓ |
| Action chains | ✓ | ✓ |
| Software crash reporting | ✗ | Traditional |
| Staging (pre-download of packages) | ✓ | ✓ |
| Duplicate package reporting | ✓ | ✓ |
| CVE auditing | ✓ | ✓ |
| SCAP auditing | ✓ | ✓ |
| Package verification | Traditional | Traditional |
| Package locking | Traditional | Traditional |
| System locking | Traditional | Traditional |
| System snapshot | Traditional | Traditional |
| Configuration file management | ✓ | ✓ |

| Feature | RHEL 6 | RHEL 7 |
|---|---|---|
| Snapshots and profiles | `Traditional`.<br>`Salt`: Profiles supported, Sync not supported | `Traditional`.<br>`Salt`: Profiles supported, Sync not supported |
| Power management | ✔ | ✔ |
| Monitoring | `Salt` | `Salt` |
| Docker buildhost | ✖ | ✖ |
| Build Docker image with OS | ? | ? |
| Kiwi buildhost | ✖ | ✖ |
| Build Kiwi image with OS | ✖ | ✖ |

✱ Virtual Guest Management:

In this table, virtual guest management is split into basic and advanced.

Basic virtual guest management includes listing VMs, slow refresh, VM lifecycle actions (start, stop, resume, pause), and modifying VM vCPU and Memory.

Advanced virtual guest management includes fast refresh, VM lifecycle actions (delete, reset, power off), modifying VM disk, network, graphical display, and graphical display configuration.

## Supported CentOS Features

This table lists the availability of various features on CentOS clients.

CentOS is not currently an officially supported client operating system. It may or may not be supported in a future version of Uyuni. However, CentOS with an Expanded Support subscription is supported.

The icons in this table indicate:

- ✔ the feature is available on both traditional and Salt clients
- ✖ the feature is not available
- ? the feature is under consideration, and may or may not be made available at a later date
- `Traditional` the feature is supported only on traditional clients
- `Salt` the feature is supported only on Salt clients.

*Table 5. Supported Features on CentOS Operating Systems*

| Feature | CentOS 6 | CentOS 7 |
|---|---|---|
| Client | ? (plain CentOS) / ✓ (with Expanded Support) | ? (plain CentOS) / ✓ (with Expanded Support) |
| Operating system packages | ✗ (plain CentOS) / ✓ (with Expanded Support) | ✗ (plain CentOS)/✓ (with Expanded Support) |
| Registration | ✓ | ✓ |
| Install packages | ✓ | ✓ |
| Apply patches | ✓ (third-party service required for errata) | ✓ (third-party service required for errata) |
| Remote commands | ✓ | ✓ |
| System package states | Salt | Salt |
| System custom states | Salt | Salt |
| Group custom states | Salt | Salt |
| Organization custom states | Salt | Salt |
| System set manager (SSM) | ✓ | ✓ |
| Service pack migration | ✗ | ✗ |
| Basic Virtual Guest Management ✱ | Traditional | ✓ |
| Advanced Virtual Guest Management ✱ | ✗ | Salt |
| Virtual Guest Installation (Kickstart), as Host OS | Traditional | Traditional |
| Virtual Guest Installation (image template), as Host OS | Traditional | ✓ |
| System deployment (PXE/Kickstart) | ✓ | ✓ |
| System redeployment (Kickstart) | Traditional | ✓ |
| Contact methods | Traditional: OSAD, RHNSD, SSH-push.<br>Salt: ZeroMQ, Salt-SSH | Traditional: OSAD, RHNSD, SSH-push.<br>Salt: ZeroMQ, Salt-SSH |
| Works with Uyuni Proxy | ✓ | ✓ |
| Action chains | ✓ | ✓ |
| Software crash reporting | ✗ | Traditional |
| Staging (pre-download of packages) | ✓ | ✓ |
| Duplicate package reporting | ✓ | ✓ |

| Feature | CentOS 6 | CentOS 7 |
|---|---|---|
| CVE auditing | ✔ | ✔ |
| SCAP auditing | ✔ | ✔ |
| Package verification | `Traditional` | `Traditional` |
| Package locking | `Traditional` | `Traditional` |
| System locking | `Traditional` | `Traditional` |
| System snapshot | `Traditional` | `Traditional` |
| Configuration file management | ✔ | ✔ |
| Snapshots and profiles | `Traditional`.<br>`Salt`: Profiles supported, Sync not supported | `Traditional`.<br>`Salt`: Profiles supported, Sync not supported |
| Power management | ✔ | ✔ |
| Monitoring | `Salt` | `Salt` |
| Docker buildhost | ✘ | ✘ |
| Build Docker image with OS | ✘ | ✘ |
| Kiwi buildhost | ✘ | ✘ |
| Build Kiwi image with OS | ✘ | ✘ |

✱ Virtual Guest Management:

In this table, virtual guest management is split into basic and advanced.

Basic virtual guest management includes listing VMs, slow refresh, VM lifecycle actions (start, stop, resume, pause), and modifying VM vCPU and Memory.

Advanced virtual guest management includes fast refresh, VM lifecycle actions (delete, reset, power off), modifying VM disk, network, graphical display, and graphical display configuration.

## Supported Ubuntu Features

This table lists the availability of various features on Ubuntu clients.

{debian} is not an officially supported operating system in this version of SUSE Manager.

The icons in this table indicate:

- ✔ the feature is available on both traditional and Salt clients
- ✘ the feature is not available

- ? the feature is under consideration, and may or may not be made available at a later date
- `Traditional` the feature is supported only on traditional clients
- `Salt` the feature is supported only on Salt clients.

*Table 6. Supported Features on Ubuntu Operating Systems*

| Feature | Ubuntu 16.04 | Ubuntu 18.04 |
|---|---|---|
| Client | ✔ | ✔ |
| Operating system packages | ✖ | ✖ |
| Registration | `Salt` | `Salt` |
| Install packages | `Salt` | `Salt` |
| Apply patches | ? | ? |
| Remote commands | `Salt` | `Salt` |
| System package states | `Salt` | `Salt` |
| System custom states | `Salt` | `Salt` |
| Group custom states | `Salt` | `Salt` |
| Organization custom states | `Salt` | `Salt` |
| System set manager (SSM) | `Salt` | `Salt` |
| Service pack migration | N/A | N/A |
| Basic Virtual Guest Management ✱ | `Salt` | `Salt` |
| Advanced Virtual Guest Management ✱ | `Salt` | `Salt` |
| Virtual Guest Installation (Kickstart), as Host OS | ✖ | ✖ |
| Virtual Guest Installation (image template), as Host OS | `Salt` | `Salt` |
| System deployment (PXE/Kickstart) | ✖ | ✖ |
| System redeployment (Kickstart) | ✖ | ✖ |
| Contact methods | `Salt`: ZeroMQ, Salt-SSH | `Salt`: ZeroMQ, Salt-SSH |
| Works with Uyuni Proxy | `Salt` | `Salt` |
| Action chains | `Salt` | `Salt` |
| Software crash reporting | ✖ | ✖ |
| Staging (pre-download of packages) | ? | ? |

| Feature | Ubuntu 16.04 | Ubuntu 18.04 |
|---|---|---|
| Duplicate package reporting | Salt | Salt |
| CVE auditing | ? | ? |
| SCAP auditing | ? | ? |
| Package verification | ✗ | ✗ |
| Package locking | ✗ | ✗ |
| System locking | ✗ | ✗ |
| System snapshot | ✗ | ✗ |
| Configuration file management | Salt | Salt |
| Package profiles | Salt: Profiles supported, Sync not supported | Salt: Profiles supported, Sync not supported |
| Power management | ✓ | ✓ |
| Monitoring | ✗ | Salt |
| Docker buildhost | ? | ? |
| Build Docker image with OS | Salt | Salt |
| Kiwi buildhost | ✗ | ✗ |
| Build Kiwi image with OS | ✗ | ✗ |

✱ Virtual Guest Management:

In this table, virtual guest management is split into basic and advanced.

Basic virtual guest management includes listing VMs, slow refresh, VM lifecycle actions (start, stop, resume, pause), and modifying VM vCPU and Memory.

Advanced virtual guest management includes fast refresh, VM lifecycle actions (delete, reset, power off), modifying VM disk, network, graphical display, and graphical display configuration.

## Supported {debian} Features

This table lists the availability of various features on {debian} clients.

The icons in this table indicate:

- ✓ the feature is available on both traditional and Salt clients
- ✗ the feature is not available
- ? the feature is under consideration, and may or may not be made available at a later date
- Traditional the feature is supported only on traditional clients

- `Salt` the feature is supported only on Salt clients.

*Table 7. Supported Features on {debian} Operating Systems*

| Feature | {debian} 9 | {debian} 10 |
|---|---|---|
| Client | ✔ | ✔ |
| Operating system packages | ✖ | ✖ |
| Registration | `Salt` | `Salt` |
| Install packages | `Salt` | `Salt` |
| Apply patches | ? | ? |
| Remote commands | `Salt` | `Salt` |
| System package states | `Salt` | `Salt` |
| System custom states | `Salt` | `Salt` |
| Group custom states | `Salt` | `Salt` |
| Organization custom states | `Salt` | `Salt` |
| System set manager (SSM) | `Salt` | `Salt` |
| Service pack migration | N/A | N/A |
| Basic Virtual Guest Management ✱ | `Salt` | `Salt` |
| Advanced Virtual Guest Management ✱ | `Salt` | `Salt` |
| Virtual Guest Installation (Kickstart), as Host OS | ✖ | ✖ |
| Virtual Guest Installation (image template), as Host OS | `Salt` | `Salt` |
| System deployment (PXE/Kickstart) | ✖ | ✖ |
| System redeployment (Kickstart) | ✖ | ✖ |
| Contact methods | `Salt`: ZeroMQ, Salt-SSH | `Salt`: ZeroMQ, Salt-SSH |
| Works with Uyuni Proxy | `Salt` | `Salt` |
| Action chains | `Salt` | `Salt` |
| Software crash reporting | ✖ | ✖ |
| Staging (pre-download of packages) | ? | ? |
| Duplicate package reporting | `Salt` | `Salt` |
| CVE auditing | ? | ? |

| Feature | {debian} 9 | {debian} 10 |
|---|---|---|
| SCAP auditing | ? | ? |
| Package verification | ✗ | ✗ |
| Package locking | ✗ | ✗ |
| System locking | ✗ | ✗ |
| System snapshot | ✗ | ✗ |
| Configuration file management | Salt | Salt |
| Package profiles | Salt: Profiles supported, Sync not supported | Salt: Profiles supported, Sync not supported |
| Power management | ✓ | ✓ |
| Monitoring | Salt | Salt |
| Docker buildhost | ? | ? |
| Build Docker image with OS | Salt | Salt |
| Kiwi buildhost | ✗ | ✗ |
| Build Kiwi image with OS | ✗ | ✗ |

✱ Virtual Guest Management:

In this table, virtual guest management is split into basic and advanced.

Basic virtual guest management includes listing VMs, slow refresh, VM lifecycle actions (start, stop, resume, pause), and modifying VM vCPU and Memory.

Advanced virtual guest management includes fast refresh, VM lifecycle actions (delete, reset, power off), modifying VM disk, network, graphical display, and graphical display configuration.

# Client Registration Overview

There are two ways to register clients to your Uyuni Server. Both methods are described in this section:

- For Salt clients, the simplest method is to register your clients using the Uyuni Web UI. For more information, see **[ Client-configuration › Registration-webui › ]**.
- If you need to have more control over the process, want to register many clients, or are registering traditional clients, we recommend creating a bootstrap script. For more information, see **[ Client-configuration › Registration-bootstrap › ]**.

You must create an activation key first, to use one of these methods. For more information, see **[ Client-configuration › Clients-and-activation-keys › ]**.

## Registering Clients with the Web UI

Registering clients with the Uyuni Web UI works for Salt clients only.

*Procedure: Registering clients in the Web UI*

1. In the Uyuni Web UI, navigate to **Systems › Bootstrapping**.
2. In the `Host` field, type the fully qualified domain name (FQDN) of the client to be bootstrapped.
3. In the `SSH Port` field, type the SSH port number to use to connect and bootstrap the client. By default, the SSH port is `22`.
4. In the `User` field, type the username to log in to the client. By default, the username is `root`.
5. In the `Password` field, type password to log in to the client.
6. In the `Activation Key` field, select the activation key that is associated with the software channel you want to use to bootstrap the client. For more information, see **[ Client-configuration › Clients-and-activation-keys › ]**.
7. OPTIONAL: In the `Proxy` field, select the proxy to register the client to.
8. By default, the `Disable SSH Strict Key Host Checking` checkbox is selected. This allows the bootstrap process to automatically accept SSH host keys without requiring you to manually authenticate.
9. OPTIONAL: Check the `Manage System Completely via SSH` checkbox. If you check this option, the client will be configured to use SSH for its connection to the Server, and no other connection method will be configured.
10. Click **`[Bootstrap]`** to begin registration. When the bootstrap process has completed, your client will be listed at **Systems › System List**.

When new packages or updates are installed on the client using Uyuni, any end user license agreements (EULAs) are automatically accepted. To review a package EULA, open the package detail page in the Web UI.

# Registering Clients with a Bootstrap Script

Registering clients with a bootstrap script gives you good control over parameters, and can help if you have to register a large number of clients at once. This method works for both Salt and traditional clients.

To register clients using a bootstrap script, we recommend you create a template bootstrap script to begin, which can then be copied and modified. The bootstrap script you create is executed on the client when it is registered, and ensures all the necessary packages are deployed to the client. There are some parameters contained in the bootstrap script which ensure the client system can be assigned to its base channel, including activation keys, and GPG keys.

It is important that you check the repository information carefully, to ensure it matches the base channel repository. If the repository information does not match exactly, the bootstrap script will not be able to download the correct packages.

If you are bootstrapping Salt clients using the Web UI, you will need to ensure that the client system has Python installed before you begin. For Salt clients running SUSE Linux Enterprise Server 12 or older, you will also require the `python-xml` package.

*GPG Keys and Uyuni Client Tools*

The GPG key used by Uyuni Client Tools is not trusted by default. When you create your bootstrap script, add a path to the file containing the public key fingerprint with the `ORG_GPG_KEY` parameter.

*openSUSE Leap 15 and SLES 15 and Python 3*

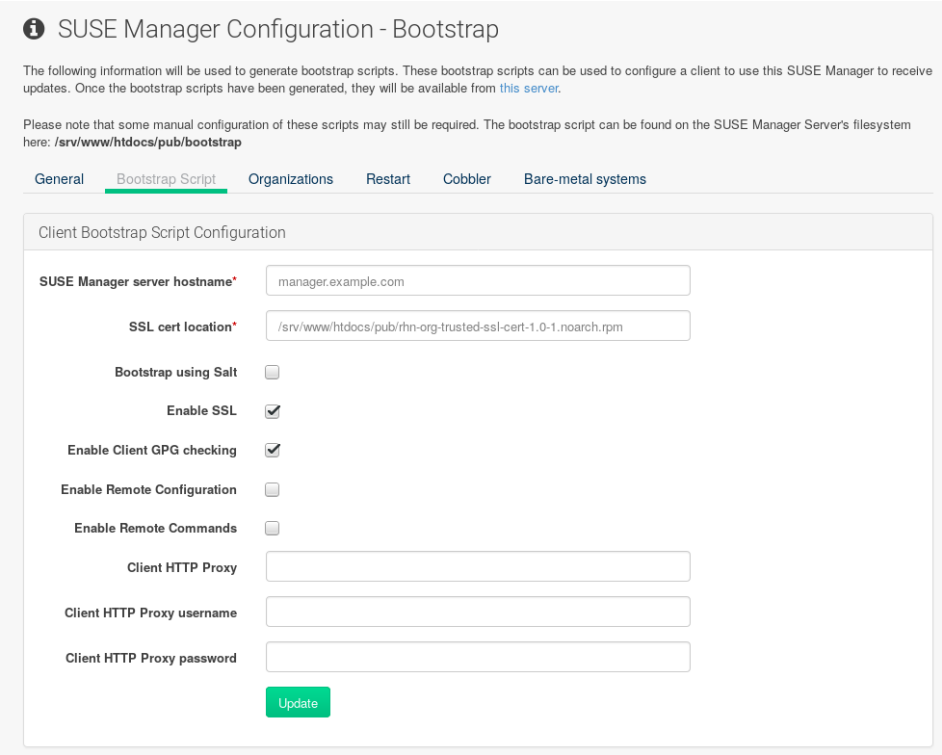
openSUSE Leap 15 and SLE 15 use Python 3 by default. Bootstrap scripts based on Python 2 must be re-created for openSUSE Leap 15 and SLE 15 systems. Attempting to register openSUSE Leap 15 or SLE 15 systems using Python 2 bootstrap scripts will fail.

## Create a Bootstrap Script

This procedure describes how to generate a bootstrap script.

*Procedure: Creating a Bootstrap Script*

1. In the Uyuni Web UI, navigate to **Admin › Manager Configuration › Bootstrap Script**.
2. In the `SUSE Manager Configuration - Bootstrap` dialog, uncheck the `Bootstrap using Salt` checkbox if you are installing a traditional client. For Salt clients, leave it checked. Use default settings and click the **`[Update]`** button.




*Using SSL*

Unchecking **Enable SSL** in the Web UI or setting `USING_SSL=0` in the bootstrap script is not recommended. If you disable SSL nevertheless you will need to manage custom CA certificates to be able to run the registration process successfully.

3. A template bootstrap script is generated and stored on the server's file system in the `/srv/www/htdocs/pub/bootstrap` directory.

```
cd /srv/www/htdocs/pub/bootstrap
```

The bootstrap script is also available at your server over HTTPS; replace `example.com` with the host name of your server:

```
https://example.com/pub/bootstrap/bootstrap.sh
```

## Edit a Bootstrap Script

You can copy and modify the template bootstrap script you created to customize it.

A minimal requirement when modifying a bootstrap script for use with Uyuni is the inclusion of an activation key.

Most packages are signed with GPG, so you will also need to have trusted GPG keys on your system to

install them.

In this procedure, you will need to know the exact name of your activation keys. Navigate to **Home › Overview** and click on `Manage Activation keys`. All keys created for channels are listed on this page. You must enter the full name of the key you wish to use in the bootstrap script exactly as presented in the key field. For more information about activation keys, see **[ Client-configuration › Clients-and-activation-keys › ]**.

*Procedure: Modifying a Bootstrap Script*

1. Login as root from the command line on your Uyuni server.
2. Navigate to the bootstrap directory with:

```
cd /srv/www/htdocs/pub/bootstrap/
```

3. Create and rename two copies of the template bootstrap script for use with each of your clients.

```
cp bootstrap.sh bootstrap-sles11.sh
cp bootstrap.sh bootstrap-sles12.sh
```

4. Open `bootstrap-sles12.sh` for modification. Scroll down and modify both lines marked in green. You must comment out `exit 1` with a hash mark (`#`) to activate the script and then enter the name of the key for this script in the `ACTIVATION_KEYS=` field as follows:

```
echo "Enable this script: comment (with #'s) this block (or, at least just"
echo "the exit below)"
echo
#exit 1

# can be edited, but probably correct (unless created during initial install):
# NOTE: ACTIVATION_KEYS *must* be used to bootstrap a client machine.
ACTIVATION_KEYS=1-sles12
ORG_GPG_KEY=
```

5. When you have finished, save the file, and repeat this procedure for the second bootstrap script.

## Connect Clients

When you have finished creating your script, you can use it to register clients.

*Procedure: Running the Bootstrap Script*

1. On the Uyuni Server, log in as root at the command prompt, and navigate to this directory:

```
cd /srv/www/htdocs/pub/bootstrap/
```

2. Run this command to execute the bootstrap script on the client; replace `example.com` with the host name of your server:

```
cat MODIFIED-SCRIPT.SH | ssh root@example.com /bin/bash
```

The script will execute and proceed to download the required dependencies located in the repositories directory you created earlier.

3. When the script has finished running, you can check that your client is registered correctly by opening the Uyuni Web UI and navigating to **Systems › Overview** to ensure the new client is listed.

When new packages or updates are installed on the client using Uyuni, any end user license agreements (EULAs) are automatically accepted. To review a package EULA, open the package detail page in the Web UI.

## Package Locks

Package locks can only be used on traditional clients that use the Zypper package manager. The feature is not currently supported on Red Hat Enterprise Linux or Salt clients.

Package locks are used to prevent unauthorized installation or upgrades to software packages on traditional clients. When a package has been locked, it will show a padlock icon, indicating that it can not be installed. Any attempt to install a locked package will be reported as an error in the event log.

Locked packages can not be installed, upgraded, or removed, either through the Uyuni Web UI, or directly on the client machine using a package manager. Locked packages will also indirectly lock any dependent packages.

*Procedure: Using Package Locks*

1. On the client machine, install the `zypp-plugin-spacewalk` package as `root`:

```
zypper in zypp-plugin-spacewalk
```

2. Navigate to the **Software › Packages › Lock** tab on the managed system to see a list of all available packages.
3. Select the packages to lock, and click **`[Request Lock]`**. You can also choose to enter a date and time for the lock to activate. Leave the date and time blank if you want the lock to activate as soon as possible. Note that the lock might not activate immediately.
4. To remove a package lock, select the packages to unlock and click **`[Request Unlock]`**. Leave the date and time blank if you want the lock to deactivate as soon as possible. Note that the lock might not deactivate immediately.

# Activation Keys

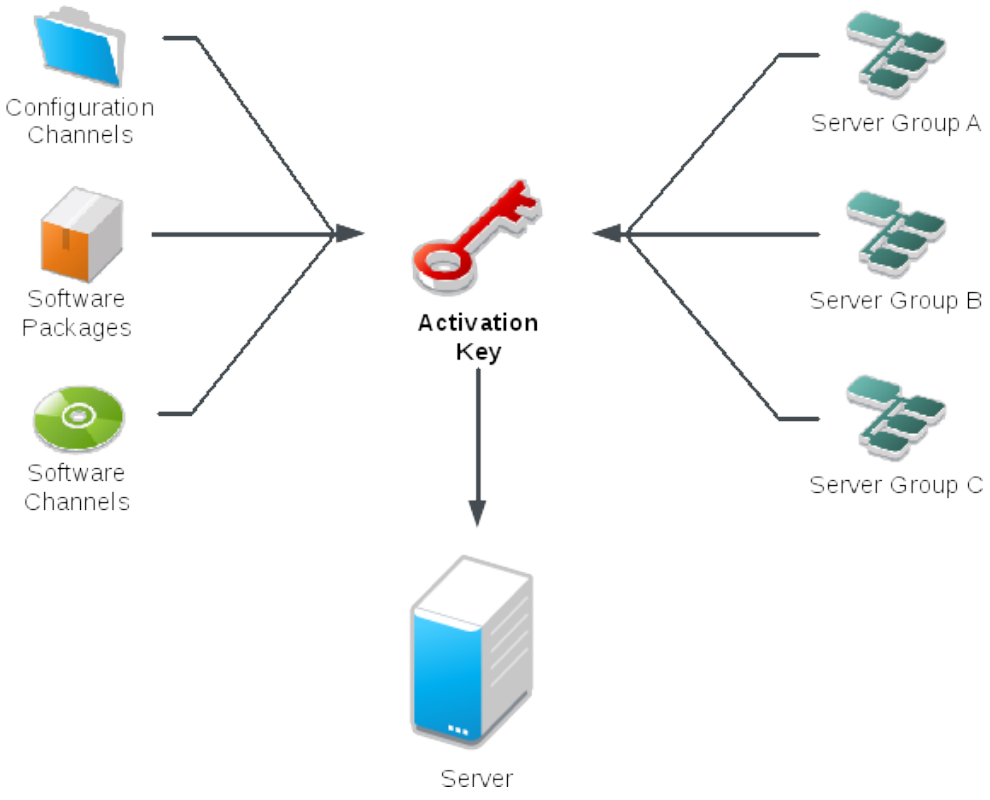
Activation keys are used with traditional and Salt clients to ensure that your clients have the correct

software entitlements, are connecting to the appropriate channels, and are subscribed to the relevant groups. Each activation key is bound to an organization, which you can set when you create the key.

In Uyuni, an activation key is a group of configuration settings with a label. You can apply all configuration settings associated with an activation key by adding its label as a parameter to a bootstrap script. We recommend you use an activation key label in combination with a bootstrap script. When the bootstrap script is executed all configuration settings associated with the label are applied to the system the script is run on.

An activation key can specify:

- Channel Assignment
- System Types (Traditionally called Add-on Entitlements)
- Contact Method
- Configuration Files
- Packages to be Installed
- System Group Assignment




*Procedure: Creating an Activation Key*

1. In the Uyuni Web UI, as an administrator, navigate to **Systems › Activation Keys**.
2. Click the **`[Create Key]`** button.
3. On the `Activation Key Details` page, in the `Description` field, enter a name for the activation key.

4. In the Key field, enter the distribution and service pack associated with the key. For example, SLES12-SP4 for SUSE Linux Enterprise Server 12 SP4.

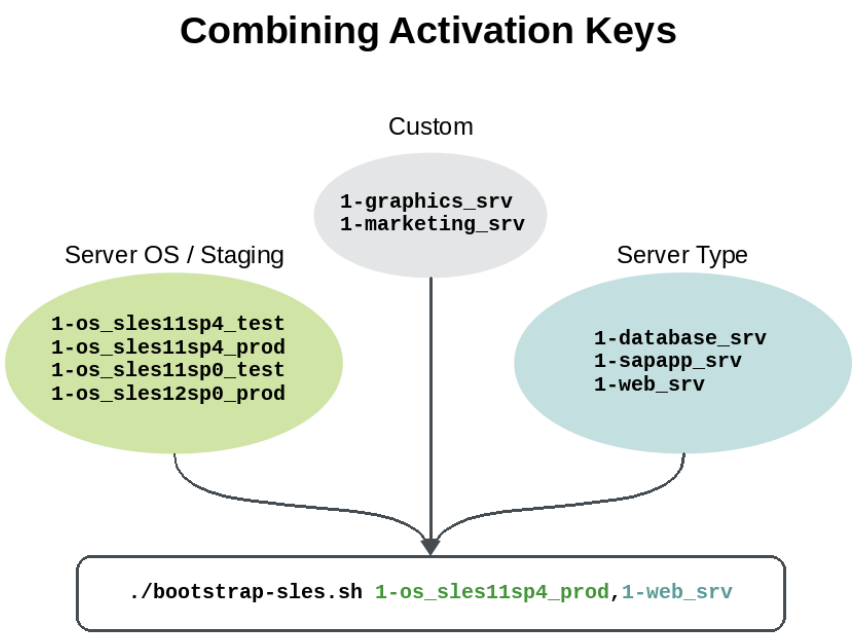
Do not use commas in the Key field for any SUSE products. However, you **must** use commas for Red Hat Products. For more information, see **[ Reference › Systems › ]**.

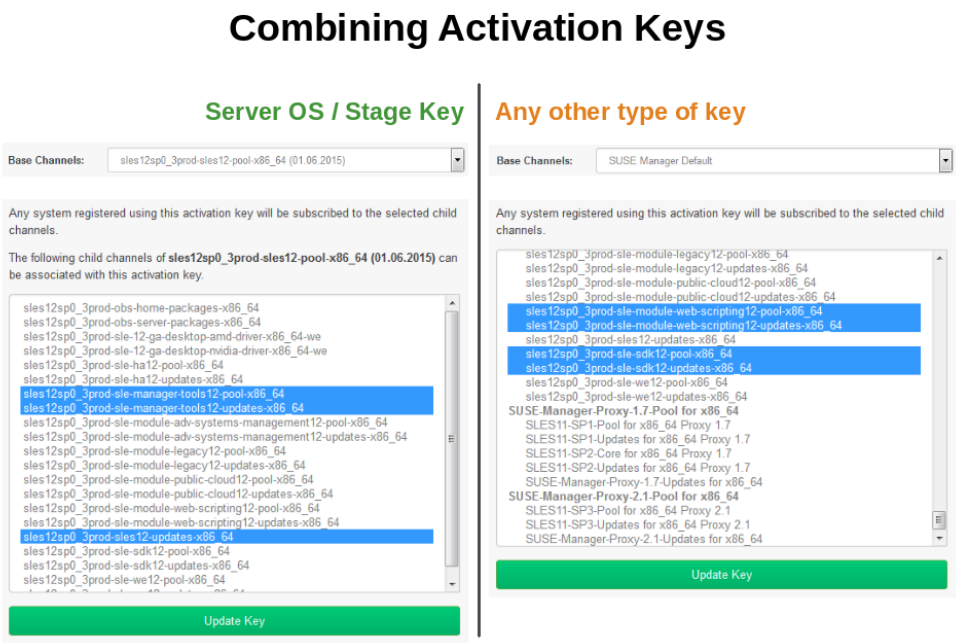
5. In the Base Channels drop-down box, select the appropriate base software channel, and allow the relevant child channels to populate. For more information, see reference:admin/setup-wizard.pdf and **[ Administration › Custom-channels › ]**.
6. Select the child channels you need (for example, the mandatory SUSE Manager tools and updates channels).
7. We recommend you leave the Contact Method set to Default.
8. We recommend you leave the Universal Default setting unchecked.
9. Click **[Create Activation Key]** to create the activation key.
10. Check the Configuration File Deployment check box to enable configuration management for this key, and click **[Update Activation Key]** to save this change.

The Configuration File Deployment check box does not appear until after you have created the activation key. Ensure you go back and check the box if you need to enable configuration management.

## Combining Activation Keys

You can combine activation keys when executing the bootstrap script on your clients. Combining keys allows for more control on what is installed on your systems and reduces duplication of keys for large or complex environments.




## Activation Key Best Practices

*Default Parent Channel*

Avoid using the `SUSE Manager Default` parent channel. This setting forces Uyuni to choose a parent channel that best corresponds to the installed operating system, which can sometimes lead to unexpected behavior. Instead, we recommend you create activation keys specific to each distribution and architecture.

*Bootstrapping with Activation Keys*

If you are using bootstrap scripts, consider creating an activation key for each script. This will help you align channel assignments, package installation, system group memberships, and configuration channel assignments. You will also need less manual interaction with your system after registration.

### *Bandwidth Requirements*

Using activation keys might result in automatic downloading of software at registration time, which might not be desirable in environments where bandwidth is constrained.

These options create bandwidth usage:

- Assigning a SUSE Product Pool channel will result in the automatic installation of the corresponding product descriptor package.
- Any package in the `Packages` section will be installed.
- Any Salt state from the `Configuration` section might trigger downloads depending on its contents.

### *Key Label Naming*

If you do not enter a human-readable name for your activation keys, the system will automatically generate a number string, which can make it difficult to manage your keys.

Consider a naming scheme for your activation keys to help you keep track of them. Creating names which are associated with your organization's infrastructure will make it easier for you when performing more complex operations.

When creating key labels, consider these tips:

- OS naming (mandatory): Keys should always refer to the OS they provide settings for
- Architecture naming (recommended): Unless your company is running on one architecture only, for example x86_64, then providing labels with an architecture type is a good idea.
- Server type naming: What is, or what will this server be used for?
- Location naming: Where is the server located? Room, building, or department?
- Date naming: Maintenance windows, quarter, etc.
- Custom naming: What naming scheme suits your organizations needs?

Example activation key label names:

```
sles12-sp2-web_server-room_129-x86_64
```

```
sles12-sp2-test_packages-blg_502-room_21-ppc64le
```

Do not use commas in the `Key` field for any SUSE products. However, you **must** use commas for Red Hat Products. For more information, see **[ Reference › Systems › ]**.

*Included Channels*

When creating activation keys you also need to keep in mind which software channels will be associated with it.

Keys should have a specific base channel assigned to them, for example: `SLES12-SP2-Pool-x86_64`. If this is not the case, Uyuni cannot use specific stages. Using the default base channel is not recommended and may cause problems.

- Channels to be included:
  - suse-manager-tools
- Typical packages to be included:
  - mgr-osad (pushing tasks)
    - Installs `python-jabberpy` and `pyxml` as dependencies
  - `mgr-cfg-actions` (Remote Command, Configuration Management)
    - Installs `mgr-cfg` and `mgr-cfg-client` as dependencies

The `suse-manager-tools` channel is mandatory.

Typical packages to be included:

- osad (pushing tasks): Installs `python-jabberpy` and `pyxml` as dependencies
- `rhncfg-actions` (Remote Command, Configuration Managment): Installs `rhncfg` and `rhncfg-client` as dependencies

# Registering Clients on a Proxy

Proxy servers can act as a broker and package cache for both tradional and Salt clients. Registering clients on a Uyuni Proxy is very similar to registering them directly on Uyuni, with a few key differences.

This section contains information on registering Salt clients on a proxy using the Web UI, or with a bootstrap script.

Within the Web UI, proxy pages will show information about both Salt and traditional clients.

You can see a list of clients that are connected to a proxy by clicking on the name of the proxy in **Main Navigation › Systems › Systems › Proxy**, selecting the `Details` tab, and then selecting the `Proxy` tab.

A list of chained proxies for a Salt client can be seen by clicking on the name of the client in **Main Navigation › Systems › All**, selecting the `Details` tab, and then selecting the `Connection` tab.

If you decide to move any of your clients between proxies or the server you will need to repeat the registration process from the beginning.

## Registering with the Web UI to a Proxy

Registering Salt clients to a Uyuni Proxy using the Web UI is similar to registering clients directly with the Uyuni Server.

*Procedure: Registering Clients to a Proxy in the Web UI*

1. In the Uyuni Web UI, navigate to **Systems › Bootstrapping**.
2. In the `Host` field, type the fully-qualified domain name (FQDN) of the client to be bootstrapped.
3. In the `SSH Port` field, type the SSH port number that will be used to connect and bootstrap the client. By default, the SSH port is `22`.
4. In the `User` field, type the username to log in to the client. By default, the username is `root`.
5. In the `Password` field, type password to log in to the client.
6. In the `Activation Key` field, select the activation key that is associated with the software channel you want to use to bootstrap the client.
7. In the `Proxy` field, select the proxy server you want to register to.
8. By default, the `Disable SSH Strict Key Host Checking` checkbox is selected. This allows the bootstrap process to automatically accept SSH host keys without requiring you to manually authenticate.
9. OPTIONAL: Check the `Manage System Completely via SSH` checkbox. If you check this option, the client will be configured to use SSH for its connection to the server, and no other connection method will be configured.
10. Click **`[Bootstrap]`** to begin registration. When the bootstrap process has completed, your client will be listed at **Systems › System List**.

Instead of the Web UI, you can use the command line to register a Salt client to a proxy. This procedure requires that you have installed the Salt package on the Salt client before registration, and have activated the `Advanced` systems module.

*Procedure: Registering Clients to a Proxy Using the Command Line*

1. Choose a clients configuration file located at:

   ```
   /etc/salt/minion
   ```

   or:

   ```
   /etc/salt/minion.d/NAME.conf
   ```

2. Add the proxy FQDN as the master to the client configuration file (sometimes also called minion file):

   ```
   master: proxy123.example.com
   ```

   Save and restart the `salt-minion` service:

   ```
   systemctl restart salt-minion
   ```

3. On the Server, accept the new client key with; replace `<client>` with the name of your client:

   ```
   salt-key -a '<client>'
   ```

   The client connects to the proxy exclusively for Salt operations and normal HTTP package downloads.

## Registering with Bootstrap on a Proxy

Registering clients (either traditional or Salt) via SUSE Manager Proxy with a script is done almost the same way as registering clients directly with the Uyuni server. The difference is that you create the bootstrap script on the SUSE Manager Proxy with a command-line tool. The bootstrap script then deploys all necessary information to the clients. The bootstrap script requires some parameters (such as activation keys or GPG keys) that depend on your specific setup.

*Procedure: Registering clients to a proxy with a bootstrap script*

1. Create a client activation key on the Uyuni server using the Web UI. See **[ Client-configuration › Clients-and-activation-keys › ]**.

2. On the proxy, execute the `mgr-bootstrap` command line tool as root. If needed, use the additional

command line switches to tune your bootstrap script. To install a traditional client instead of a Salt client, ensure you use the `--traditional` switch.

To view available options type `mgr-bootstrap --help` from the command line:

```
# mgr-bootstrap --activation-keys=key-string
```

3. Optional: edit the resulting bootstrap script.
4. Execute the bootstrap script on the clients.

# Automate Client Installation

AutoYaST and Kickstart configuration files allow you to automate client system installations. This is useful if you need to install a large number of clients.

For SUSE Linux Enterprise clients, use AutoYaST. When you have created an AutoYaST file, you can upload and manage it using the Uyuni Web UI.

For Red Hat Enterprise Linux clients, use Kickstart. Kickstart files are created, modified, and managed within the Uyuni Web UI.

We recommend that you use PXE boot for installing clients. PXE booting requires a DHCP server that points to your Uyuni Server. The Uyuni Server then acts as a TFTP server.

The TFTP environment is generated with Cobbler. Cobbler can also generate a bootable ISO image. The ISO image can be used to install machines when PXE boot is not an option; for more information, see [ **Client-configuration › Cobbler ›** ].

## Preparation

A configured distribution and an autoinstallation profile is required.

*Procedure: Preparing a Distribution*

1. Provide the files required to start an installation. Unpack an installation medium such as a DVD image on your Server. It contains the Linux kernel, an initrd, and other files required to boot the OS in installation mode.
2. In the Uyuni Web UI, navigate to **System › Autoinstallation › Distributions**.
3. In the `Autoinstallable Distributions` dialog, click `Create Distribution`:
    - In the `Distribution Label` field, enter a name to identify your autoinstallable distribution.
    - In the `Tree Path` field, enter the path to an installation tree located on your Uyuni Server.
    - Select the matching `Base Channel` mirrored on the Uyuni Server. This base channel must represent the distribution you want to install. It can be the `Vendor`, `Custom`, or `Cloned Channels`.
    - The `Installer Generation` should also match.
    - Optionally, you can specify kernel options which should be added when booting this distribution. Note that there are multiple places where you can provide kernel options. Only add options here that are generic for the distribution.
4. Click **`[Create Autoinstallable Distribution]`**.

For more information, see [ **Reference › Systems ›** ].

*Procedure: Preparing a Profile*

1. In the Uyuni Web UI, navigate to **System › Autoinstallation › Profiles**.
2. In the `Autoinstallation Profiles` dialog, add the profile for your autoinstallation. It can be an `AutoYaST` or `Kickstart` profile.
3. There are two ways to create profiles:
    - Create a `Kickstart` profile using a wizard
    - Upload an externally created profile (`Kickstart` or `AutoYaST`)

For more information about the `Kickstart` wizard, see **[ Reference › Systems › ]**.

## Upload a Profile

Profiles require a label, and an `Autoinstallation Tree` (distribution).

Upload the `Kickstart` or `AutoyaST` profile. You can write your own kickstart or AutoYaST profile directly in the Web UI, or create the profile and upload it from your local filesystem.

AutoYaST is able to dump a profile from an existing installation. This can be used as template, but will need to be edited to make it usable by Uyuni:

- Change the `add-on` section and add Uyuni URLs. These URLs must have a special format:

```
http://$redhat_management_server/ks/dist/child/<channel-label>/<distribution-label>
```

- Replace `<channel-label>` and `<distribution-label>` with the correct labels. You can also use a variable for `distribution-label`. Ensure that the distribution label corresponds to the autoinstallable distribution you selected. You can only configure child channels in this file. The channels must be children of the base channel you selected in the distribution you use for this profile.

You do not need to specify a base channel. The base channel is defined in the distribution.

- Register the system after it is installed. For this step we provide script snippets that can be used.

  For Salt managed clients, use the `spacewalk/minion_script` snippet:

```
<scripts>
  <init-scripts config:type="list">
    $SNIPPET('spacewalk/minion_script')
  </init-scripts>
</scripts>
```

  For traditional clients, use the `spacewalk/sles_register_script` snippet:

```
<scripts>
  <init-scripts config:type="list">
    $SNIPPET('spacewalk/sles_register_script')
  </init-scripts>
</scripts>
```

For registering Salt clients, you must accept the Salt key on the Uyuni Server before you attempt autoinstallation.

For more information about autoinstallation profiles, see **[ Reference › Systems › ]**.

## Variables and snippets

Profiles are not finalized until they are requested by a client. This allows you to use variables in profiles. You can define profile variables in the Web UI by navigating to **Profiles › Variables**.

Some common variables are:

**redhat_management_server**

The server Red Hat clients register to (automatically set).

**org**

The organization ID where this profile is created (automatically set).

**registration_key**

The key used in the registration snippets. By specifying this variable, you can set the activation key to be used to register the system.

**dont_register**

If specified, the registration will be skipped.

**allow_config_actions**

If set to 1, it will allow traditional configuration management (traditional only).

**allow_remote_commands**

If set to 1, it will allow traditional remote command execution (traditional only).

**dont_disable_automatic_onlineupdate**

If set, the automatic online update will stay enabled (SUSE OSes only).

**dont_disable_local_repos**

If set, local repositories will stay active (not recommended).

Navigate to **Systems › Autoinstallation › Autoinstallation Snippets** to see which snippets are available. For more information, see **[ Reference › Systems › ]**.

# Autoinstallation with AutoYaST

When **[ Client-configuration › Client-automating-preparation › ]** is successfully finished you can begin with the actual installation.

To start an autoinstallation the system must already be known to Uyuni. You can use bare metal provisioning to bring systems into Uyuni. For more information, see **[ Reference › Admin › ]**.

On the command line, you can use the API calls `system.createSystemRecord` or `system.createSystemProfile` to bring systems into Uyuni. For example (replace `<hw_addr>` with a hardware address such as `00:25:22:71:e7:c6` and `<name>` with the name of your system):

```
spacecmd api -- --args '["systemname", {"hwAddress": "<hw_addr>", "hostname":"<name>"}]'
system.createSystemProfile
```

*Procedure: Autoinstalling with AutoYaST*

1. In Uyuni Web UI, navigate to **Systems** › **Overview**, and select the system for the automated installation.
2. On the systems details page, navigate to the **Provisioning** › **Autoinstallation** › **Schedule** tab, and select the AutoYaST profile you want to use to (re-)install the system.

## Advanced PXE Installation Configuration

If the client needs to be installed for the first time, you can use the `Create PXE installation configuration` option. This option creates a PXE boot configuration. When you power on the client system, it boots from the network and the correct profile is selected for installation.

If the system is already managed, click **`[Schedule Autoinstallation and Finish]`** to start the installation.

For more information about AutoYaST, see https://doc.opensuse.org/projects/autoyast/.

# Kickstart

When you install a Red Hat Enterprise Linux client, there are a number of questions you need to answer. To automate installation, you can create a Kickstart file with all the answers to those questions, so that no user intervention is required.

Kickstart files can be kept on a server and read by individual clients during installation. The same Kickstart file is used to install multiple clients.

Kickstart can be used to schedule a registered system to be installed with a new operating system and package profile, or you can use it to install a new system that was not previously registered, or does not yet have an operating system installed.

For more information about Kickstart, see the Red Hat documentation.

## Before you Begin

Some preparation is required for your infrastructure to handle Kickstart installations. Before you create a Kickstart profile, consider:

- A DHCP server is not required for kickstarting, but it can make things easier. If you are using static IP addresses, select static IP while developing your Kickstart profile.
- An FTP server can be used instead of hosting the Kickstart distribution tree using HTTP.
- If you are performing a bare metal Kickstart installation, use these settings:
  - Configure DHCP to assign the required networking parameters and the bootloader program location.
  - In the bootloader configuration file, specify the kernel and appropriate kernel options to be used.

## Build a Bootable ISO

You will need to create a bootable ISO image to be used by the target system for installation. When the system is rebooted or switched on, it boots from the image, loads the Kickstart configuration from your Uyuni, and installs Red Hat Enterprise Linux according to the Kickstart profile.

*Building a Bootable ISO*

1. Copy the contents of `/isolinux` from the first CD-ROM of the target distribution.
2. Edit the `isolinux.cfg` file to default to 'ks'. Change the 'ks' section to read:

   ```
   label ks
   kernel vmlinuz
     append text ks=`url`initrd=initrd.img lang= devfs=nomount \
       ramdisk_size=16438`ksdevice`
   ```

   IP address-based Kickstart URLs will look like this:

   ```
   http://`my.manager.server`/kickstart/ks/mode/ip_range
   ```

   The Kickstart distribution defined via the IP range should match the distribution from which you are building, or errors will occur.

3. OPTIONAL: If you want to use the `ksdevice`, it looks like:

   ```
   ksdevice=eth0
   ```

   It is possible to change the distribution for a Kickstart profile within a family, such as Red Hat Enterprise Linux AS 4 to Red Hat Enterprise Linux ES 4, by specifying the new distribution label. Note that you cannot move between versions (4 to 5) or between updates (U1 to U2).

4. Customize `isolinux.cfg` further as required. For example, you can add multiple options, different boot messages, or shorter timeout periods.
5. Create the ISO with this command:

```
mkisofs -o file.iso -b isolinux.bin -c boot.cat -no-emul-boot \
  -boot-load-size 4 -boot-info-table -R -J -v -T isolinux/
```

   Note that `isolinux/` is the relative path to the directory containing the modified isolinux files copied from the distribution CD, while `file.iso` is the output ISO file, which is placed into the current directory.

6. Burn the ISO to CD-ROM and insert the disk.
7. Boot the system and type `ks` at the prompt (if you left the label for the Kickstart boot as 'ks').
8. Press `Enter` to start Kickstart.

### Integrating with PXE

Instead of using a bootable ISO image, you can use a PXE image instead. This is less error-prone, allows Kickstart installation from bare metal, and integrates with existing PXE/DHCP environments.

To use this method, make sure your systems have network interface cards (NICs) that support PXE. You will need to install and configure a PXE server, ensure DHCP is running, and place the installation repository on an HTTP server that is reachable by the Uyuni Server.

Upload the Kickstart profile to the Uyuni Server using the Uyuni Web UI.

When the AutoYaST profile has been created, use the URL from the **Autoinstallation Overview** page as the image location.

For more information about PXE boot, see https://documentation.suse.com/sles/15-SP1/html/SLES-all/cha-deployment-prep-pxe.html.

For more information about autoinstallation profiles, see **[ Reference › Systems › ]**.

## Cobbler

Cobbler is an installation server that allows you to perform unattended system installations. Cobbler is installed on the Uyuni Server.

SUSE only supports Cobbler functions that are available in the Uyuni Web UI, or through the Uyuni API. Only supported features are documented here.

If you intend to use your installation with SUSE Manager for Retail formulas, do not follow this guide to configure Cobbler on the branch server. In SUSE Manager for Retail installations, the TFTPD formula manages these settings. For more information about the TFTPD formula, see **[ Salt › Formula-tftpd › ]**.

This section explains the Cobbler features most commonly used with Uyuni:

- The `cobbler sync` command is triggered from Uyuni Server and generate the TFTP boot environment
- Installation environment analysis using the `cobbler check` command
- Virtual machine guest installation automation with the `koan` client-side tool
- Building installation ISOs with PXE-like menus using the `cobbler buildiso` command (for Uyuni systems with x86_64 architecture)

For more information about Cobbler, see https://cobbler.readthedocs.io.

## Cobbler Requirements

To use Cobbler for system installation with PXE, you will require a TFTP server. Uyuni installs a TFTP server by default. To PXE boot systems, you will require a DHCP server, or have access to a network DHCP server.

Cobbler uses host names as a unique key for each system. If you are using the `pxe-default-image` to onboard bare metal systems, make sure every system has a unique host name. Non-unique host names will cause all systems with the same host name to have the configuration files overwritten when a provisioning profile is assigned.

## Configure Cobbler

Cobbler configuration is primarily managed using the `/etc/cobbler/settings` file. Cobbler will run with the default settings unchanged. All configurable settings are explained in detail in the `/etc/cobbler/settings` file.

The PXE boot process uses DHCP to find the TFTP boot server. The Uyuni Server can act as such a TFTP boot server and Cobbler can generate the content for it. You must have administrative access to the network's DHCP server. Edit the DHCP configuration file so that it points to the Uyuni Server as the TFTP boot server:

*Procedure: Example for Configuring the ISC DHCP Server*

1. On the DHCP server, as root, open the `/etc/dhcpd.conf` file.
2. Append a new class with options for performing PXE boot installation. For example:

```
allow booting;
allow bootp;
class "PXE"
{match if substring(option vendor-class-identifier, 0, 9) = "PXEClient";
next-server 192.168.2.1;
filename "pxelinux.0";}
```

This example:

- Enables the `bootp` protocol for network booting.
- Creates a class called `PXE`.
- Identifies systems as `PXEClient` if they are configured with PXE as the first boot priority.
- Directs PXEClients to the Cobbler server at `192.168.2.1`.
- Retrieves the `pxelinux.0`bootloader file.

3. Save the file.

*Procedure: Configuring PXE Boot in KVM*

While it is possible to use KVM with PXE booting, it can be unreliable. We do not recommend you use this on production systems.

1. Use the `virsh` command to produce a dump of the current network XML description:

```
virsh net-dumpxml --inactive network > network.xml
```

2. Open the XML dump file at `network.xml` and add a `bootp` parameter within the `<dhcp>` element:

```
<bootp file='/pxelinux.0' server='192.168.100.153'/>
```

3. Use the `virsh` command to install the updated description:

```
virsh net-define network.xml
```

Alternatively, you can use the `net-edit` subcommand, which will also perform some error checking.

*Listing 1. Example: Minimal Network XML Description for KVM*

```
<network>
  <name>default</name>
  <uuid>1da84185-31b5-4c8b-9ee2-a7f5ba39a7ee</uuid>
  <forward mode='nat'>
    <nat>
      <port start='1024' end='65535'/>
    </nat>
  </forward>
  <bridge name='virbr0' stp='on' delay='0'/>
  <mac address='52:54:00:29:59:18'/>
  <domain name='default'/>
  <ip address='192.168.100.1' netmask='255.255.255.0'>
    <dhcp>
      <range start='192.168.100.128' end='192.168.100.254'/>
      <bootp file='/pxelinux.0' server='192.168.100.153'/>
    </dhcp>
  </ip>
</network>
```

## TFTP

Uyuni uses the `tftp` daemon. The `tftp` daemon is the recommended method for PXE services, and is installed by default. The default configuration works in most cases. However, if you need to change the configuration, use the YaST Services Manager.

The TFTP service must be running so it can serve the `pxelinux.0` boot image. Start YaST and use **System › Services Manager** to configure the `tftp` daemon.

You can also synchronize Cobbler-generated TFTP contents to a Uyuni Proxy. For synchronization, HTTPS port 443 must be open.

*Procedure: Installing TFTP*

1. On the Uyuni Server, as root, install the `susemanager-tftpsync` package:

```
zypper install susemanager-tftpsync
```

2. On the Uyuni Proxy, as root user, install the `susemanager-tftpsync-recv` package:

```
zypper install susemanager-tftpsync-recv
```

*Procedure: Configuring TFTP on a Proxy*

1. On the Uyuni Proxy, as root, run the `configure-tftpsync.sh` script.
2. The script will interactively ask you for details on the host names and IP addresses of the Uyuni Server and Proxy, as well for the location of the `tftpboot` directory on the Proxy.

For more information, use the `configure-tftpsync.sh --help` command.

*Procedure: Configuring TFTP on a Server*

1. On the Uyuni Server, as root, run the `configure-tftpsync.sh` script.

```
configure-tftpsync.sh proxy1.example.com proxy2.example.com
```

2. Run the `cobbler sync` command to push the files to the proxy. This will fail if you have not configured the proxies correctly.
3. If you want to change the list of proxies later on, you can use the `configure-tftpsync.sh` script to edit them.

If you reinstall an already configured proxy and want to push all the files again, you must remove the cache file at `/var/lib/cobbler/pxe_cache.json` before you call `cobbler sync`.

### Background Information about the Synchronization Process

A `cobbler sync` is a rebuild of every file Cobbler touched. On Uyuni, `cobbler sync` does the following actions:

1. Run pre-sync triggers. This can be any number of shell scripts.
2. Delete all files and directories that are not allowed in `/srv/www/cobbler/`.
3. Create all needed directories.
4. Delete all elements inside the directories.
5. Create the TFTPD directory.
6. Write the DHCP files if management is enabled (unsupported). For more information, see Configure Cobbler.
7. Do the same with DNS (unsupported).
8. Clean up the cache.
9. Run `rsync` if rsync management is enabled.
10. Run post-sync triggers. This can be any number of shell scripts (unsupported).

Uyuni also adds or removes, or edits systems that are in Cobbler. Those actions trigger a so-called lite sync process. This sync only touches files and directories that are related to the change which triggered it.

## Synchronize and Start the Cobbler Service

When tftpsync is configured, the Uyuni Server must be able to access the Uyuni Proxy systems directly.

Do not start or stop the `cobblerd` service independent of the Uyuni service. Doing so can cause errors. Always use `/usr/sbin/spacewalk-service` to start or stop Uyuni.

Check that all the prerequisites the Cobbler service requires, are configured according to your requirements. You can do this by running the `cobbler check` command.

When you had to change the configuration, restart the Uyuni service:

```
/usr/sbin/spacewalk-service restart
```

## Autoinstallation Templates

AutoYaST or Kickstart profiles are used to automate SUSE Linux Enterprise or Red Hat Enterprise Linux client installations. Templates are used to describe how to create autoinstallation profiles. You can create autoinstallation variables within the Uyuni Web UI. This allows you to create and manage large numbers of profiles and systems, without having to manually create profiles for each.

Cobbler uses a template engine called Cheetah that provides support for templates, variables, and snippets.

For more information on creating profiles, see **[ Reference › Systems › ]**.

### Kickstart Template Syntax

Kickstart templates can have static values for certain common items such as PXE image file names, subnet addresses, and common paths such as `/etc/sysconfig/network-scripts/`. However, templates differ from standard Kickstart files in their use of variables.

For example, a standard Kickstart file might have a networking section like this:

```
network --device=eth0 --bootproto=static --ip=192.168.100.24 \
  --netmask=255.255.255.0 --gateway=192.168.100.1 --nameserver=192.168.100.2
```

In a Kickstart template file, the networking section would look like this instead:

```
network --device=$net_dev --bootproto=static --ip=$ip_addr \
  --netmask=255.255.255.0 --gateway=$my_gateway --nameserver=$my_nameserver
```

These variables are substituted with the values set in your Kickstart profile variables or in your system detail variables. If the same variable is defined in both the profile and the system detail, then the system detail variable takes precedence.

Kickstart templates use syntax rules that rely on punctuation symbols. To avoid clashes, they need to be properly treated.

If the template contains shell script variables like `$(example)`, the content needs to be escaped with a backslash: `\$(example)`. If the variable is defined in the template, the templating engine will evaluate it correctly. If there is no such variable, the content will be left unchanged. Escaping the *$* symbol will prevent the templating engine from evaluating the symbol as an internal variable.

Long scripts or strings can be escaped by wrapping them with the `\#raw` and `\#end raw` directives. For example:

```
#raw
#!/bin/bash
for i in {0..2}; do
 echo "$i - Hello World!"
done
#end raw
```

Any line with a # symbol followed by a whitespace is treated as a comment and is therefore not evaluated. For example:

```
#start some section (this is a comment)
echo "Hello, world"
#end some section (this is a comment)
```

### Kickstart Snippets

Kickstart snippets are sections of Kickstart code that can be called by a `$SNIPPET()` function. The snippet is parsed by Cobbler and substituted with the contents of the snippet.

This example sets up a snippet for a common hard drive partition configuration:

```
clearpart --all
part /boot --fstype ext3 --size=150 --asprimary
part / --fstype ext3 --size=40000 --asprimary
part swap --recommended

part pv.00 --size=1 --grow

volgroup vg00 pv.00
logvol /var --name=var vgname=vg00 --fstype ext3 --size=5000
```

Save this snippet of the configuration to a file in `/var/lib/cobbler/snippets/`, where Cobbler can access it.

Use the snippet by calling the `$SNIPPET()` function in your Kickstart templates. For example:

```
$SNIPPET('my_partition')
```

Cobbler will parse the function with the snippet of code contained in the `my_partition` file.

## Build ISOs with Cobbler

Cobbler can create ISO boot images that contain a set of distributions, kernels, and a menu, that work similar to a PXE installation.

Building ISOs with Cobbler is not supported on IBM Z.

The Cobbler `buildiso` command takes parameters to define the name and output location of the boot ISO. For example:

```
cobbler buildiso --iso=/path/to/boot.iso
```

The boot ISO includes all profiles and systems by default. You can limit which profiles and systems are used, with the `--profiles` and `--systems` options. For example:

```
cobbler buildiso --systems="system1,system2,system3" \
  --profiles="profile1,profile2,profile3"
```

If you cannot write an ISO image to a public `tmp` directory, check your systemd settings in `/usr/lib/systemd/system/cobblerd.service`.

## Bare Metal Provisioning

Systems that have not yet been provisioned are called bare metal systems. You can provision bare metal systems using Cobbler. Once a bare metal system has been provisioned in this way, it will appear in the `Systems` list, where you can perform regular provisioning with autoinstallation, for a completely unattended installation.

To successfully provision a bare metal system, you will require a fully patched Uyuni server.

The system to be provisioned must have x86_64 architecture, with at least 2 GB RAM, and be capable of PXE booting.

The server uses TFTP to provision the bare metal client, so the appropriate port and networks must be configured correctly in order for provisioning to be successful. In particular, ensure that you have a DHCP server, and have set the `next-server` parameter to the Uyuni server IP address or hostname.

### Enable Bare Metal Systems Management

Bare metal systems management can be enabled or disabled in the Uyuni Web UI by navigating to **Admin › SUSE Manager Configuration › Bare-metal systems**.

New systems are added to the organization of the administrator who enabled the bare metal systems management feature. To change the organization, log in as an Administrator of the required organization, and re-enable the feature.

When the feature has been enabled, any bare metal system connected to the server network will be automatically added to the organization when it is powered on. The process can take a few minutes, and the system will automatically shut down when it is complete. The system will now be visible in the **Systems › System list**. Click on the name of the system to see basic information. For more details, go to the `Properties`, `Notes`, and `Hardware` tabs. You can migrate bare metal systems to other organizations if required, using the `Migrate` tab.

### Provision Bare Metal Systems

Provisioning bare metal systems is similar to provisioning other systems, and can be done using the `Provisioning` tab. However, you will not be able to schedule provisioning, it will happen automatically as soon as the system is configured and powered on.

System Set Manager can be used with bare metal systems. However, not all SSM features are available, because bare metal systems do not have an operating system installed. This also applies to mixed sets that contain bare metal systems. All features will be re-enabled if the bare metal systems are removed from the set.

# Other Clients

It is possible to register clients using operating systems from Red Hat, CentOS, or Ubuntu.

This section contains information specific to clients running operating systems other than those provided by SUSE.

## Registering SUSE Linux Enterprise Server with Expanded Support Clients

This section contains information about registering traditional and Salt clients running SUSE Linux Enterprise Server with Expanded Support (Expanded Support) operating systems.

Expanded Support clients are based on Red Hat Enterprise Linux or CentOS.

They are sometimes also called SLESES, RES or Red Hat Expanded Support.

You are responsible for arranging access to Red Hat or CentOS base media repositories and installation media.

SUSE does not provide support for Expanded Support systems on Uyuni.

### Server Requirements

Before you begin, check that your Uyuni Server meets the requirements at **[ Installation › Hardware-requirements › ]**.

Taskomatic uses one CPU core, and requires at least 3072 MB of RAM. To ensure that taskomatic has access to enough memory, open the `/etc/rhn/rhn.conf` configuration file, and add this line:

```
taskomatic.java.maxmemory=3072
```

Restart Taskomatic:

```
systemctl restart taskomatic
```

### Add Client Tools

For Expanded Support clients, some required packages are contained on the Red Hat Enterprise Linux or CentOS installation media. You must have these packages installed before you can register a Expanded Support client.

The Expanded Support product is provided by SUSE Customer Center. This also includes the client tools package.

Before you register Expanded Support clients to your Uyuni Server, check that you have the corresponding Expanded Support product enabled, and the required channels are fully synchronized.

You need to select two different sets of channels, one for Expanded Support and the other for the Client Tools.

You will need an activation key associated with the correct Expanded Support channels. For more information about activation keys, see **[ Client-configuration › Clients-and-activation-keys › ]**.

*Procedure: Adding Client Tools Channels*

1. On the Uyuni Server, add the appropriate Expanded Support channels:
    - For Expanded Support 6:

      From the Web UI, add `RHEL6 Base x86_64` and `SUSE Linux Enterprise Client Tools RES6 x86_64`.

      From the command prompt, add `rhel-x86_64-server-6` and `res6-suse-manager-tools-x86_64`.

    - For Expanded Support 7:

      From the Web UI, add `RHEL7 Base x86_64` and `SUSE Linux Enterprise Client Tools RES7 x86_64`.

      From the command prompt, add `rhel-x86_64-server-7` and `res7-suse-manager-tools-x86_64`.

2. Synchronize the Uyuni Server with the SUSE Customer Center. You can do this using the Web UI, or by running `mgr-sync` at the command prompt.
3. Add the new channel to your activation key.

There are two ways to check if a channel has finished synchronizing:

- In the Uyuni Web UI, navigate to **Admin › Setup Wizard** and select the `SUSE Products` tab.

  This dialog displays a completion bar for each product when they are being synchronized.

- Check the synchronization log file at the command prompt with `tail -f /var/log/rhn/reposync/channel-label.log` file.

  Each child channel will generate its own log during the synchronization progress. You will need to check all the base and child channel log files to be sure that the synchronization is complete.

The Expanded Support channels can be very large. The initial channel synchronization can sometimes take up to 24 hours.

When the initial synchronization is complete, we recommended you clone the channel before you work with it. This gives you a backup of the original synchronization data.

### Add Base Media

The base Expanded Support channel does not contain any packages, because SUSE does not provide Red Hat Enterprise Linux or CentOS base media. You will need to obtain base media from Red Hat or CentOS, which you can add as a child channel to the Expanded Support parent channel.

You can use Uyuni custom channels to set up the Red Hat Enterprise Linux or CentOS media. All packages on the base media are mirrored into a child channel.

*Procedure: Creating a Red Hat Enterprise Linux or CentOS Custom Channel*

1. In the Uyuni Web UI, navigate to **Software › Manage › Channels**.
2. Click **[Create Channel]** and set these parameters:
    - In the `Channel Name` field, type a name for your channel, specifying the OS name and architecture.
    - In the `Channel Label` field, type a label for your channel, specifying the OS name and architecture.
    - In the `Parent Channel` field, select the corresponding Red Hat Enterprise Linux or CentOS distribution channel for your architecture. The parent channel will not contain any packages.
    - In the `Architecture` field, select the appropriate architecture.
    - In the `Repository Checksum Type` field, select `sha1`.
    - In the `Channel Summary` field, type a summary for your channel, specifying the OS name and architecture.
    - In the `Organization Sharing` field, select `Public`.
3. Click **[Create Channel]**.
4. Add the new channel to your activation key.

When you have created the custom child channel, you can add the base media image to the channel.

*Procedure: Adding Base Media to Custom Channels*

1. On the Uyuni Server command prompt, as root, copy the base media image to the `/tmp` directory.
2. Create a directory to contain the media content. Replace `<os_name>` with either `rhel` or `centos`:

```
mkdir -p /srv/www/htdocs/pub/<os_name>
```

3. Mount the image:

```
mount -o loop /tmp/<iso_filename> /srv/www/htdocs/pub/<os_name>
```

4. Synchronize the packages

   For Red Hat Enterprise Linux or CentOS 7:

```
spacewalk-repo-sync -c channel_name -u https://127.0.0.1/pub/<os_name>/
Repo URL: https://127.0.0.1/pub/rhel/
Packages in repo:              [...]
Packages already synced:       [...]
Packages to sync:              [...]
[...]
```

   For Red Hat Enterprise Linux or CentOS 6:

```
spacewalk-repo-sync -c channel_name -u https://127.0.0.1/pub/<os_name>/Server/
```

### Troubleshooting Synchronization

Sometimes, the `spacewalk-repo-sync` command will stop running during a synchronization, and give this error:

```
[Errno 256] No more mirrors to try.
```

If this occurs, run `spacewalk-repo-sync` in debugging mode to determine the error.

Start debugging mode:

```
export URLGRABBER_DEBUG=DEBUG
```

Check the output:

```
/usr/bin/spacewalk-repo-sync --channel <channel-label> --type yum
```

Disable debug mode:

```
unset URLGRABBER_DEBUG
```

## Register Expanded Support Clients

You Expanded Support clients are now ready to be registered.

For more information on registering your clients, see **[ Client-configuration › Registration-overview › ]**.

# Registering Red Hat Enterprise Linux Clients

This section contains information about registering traditional and Salt clients running Red Hat Enterprise Linux operating systems.

Red Hat Enterprise Linux clients are based on Red Hat and are unrelated to SUSE Linux Enterprise Server with Expanded Support, RES, Red Hat, or SUSE Linux Enterprise Server. You are responsible for arranging access to Red Hat base media repositories and RHEL installation media, as well as connecting Uyuni Server to the Red Hat content delivery network. You must obtain support from Red Hat for all your RHEL systems. If you do not do this, you might be violating your terms with Red Hat.

## Server Requirements

Before you begin, check that your Uyuni Server meets the requirements at **[ Installation › Hardware-requirements › ]**.

Taskomatic uses one CPU core, and requires at least 3072 MB of RAM. To ensure that taskomatic has access to enough memory, open the `/etc/rhn/rhn.conf` configuration file, and add this line:

```
taskomatic.java.maxmemory=3072
```

Restart Taskomatic:

```
systemctl restart taskomatic
```

## Import Entitlements and CA Certificate

Red Hat clients require a Red Hat certificate authority (CA) and entitlement certificate and entitlement key.

Entitlement certificates are embedded with expiration dates, which match the length of the support subscription. To avoid disruption, you will need to repeat this process at the end of every support subscription period.

Red Hat supply a subscription manager tool to manage subscription assignments. It runs locally to track installed products and subscriptions. Clients must be registered with the subscription manager to obtain certificates.

Red Hat clients use a URL to replicate repositories. The URL will change depending on where the Red Hat client is registered.

Red Hat clients can be registered in three different ways:

- Red Hat content delivery network (CDN) at redhat.com
- Red Hat Satellite Server
- Red Hat update infrastructure (RHUI) in the cloud

This guide covers clients registered to Red Hat CDN. You must have at least one system registered to the CDN, with an authorized subscription for repository content.

Entitlement certificates for RHUI (cloud-based systems) only allow you to download content, not repository data. Satellite certificates for client systems require a Satellite server and subscription. Clients using Satellite certificates are not supported with Uyuni Server.

Entitlement certificates are embedded with expiration dates, which match the length of the support subscription. To avoid disruption, you will need to repeat this process at the end of every support subscription period.

Red Hat supplies the subscription-manager tool to manage subscription assignments. It runs locally on the client system to track installed products and subscriptions. Register to redhat.com with subscription-manager, then follow this procedure to obtain certificates.

*Procedure: Registering Clients to Subscription Manager*

1. On the client system, at the command prompt, register with the subscription manager tool:

```
subscription-manager register
```

   Enter your Red Hat Portal username and password when prompted.

2. Copy your entitlement certificate and key from the client system, to a location that the Uyuni Server can access:

```
cp /etc/pki/entitlement/ /<example>/entitlement/
```

Your entitlement certificate and key will both have a file extension of `.pem`. The key will also have `key` in the filename.

3. Copy the Red Hat CA Certificate file from the client system, to the same web location as the entitlement certificate and key:

```
cp /etc/rhsm/ca/redhat-uep.pem /example/entitlement
```

To manage repositories on your Red Hat client, you need to import the CA and entitlement certificates to the Uyuni Server. This requires three entries: one each for the entitlement certificate, the entitlement key, and the Red Hat certificate.

*Procedure: Importing Certificates to the Server*

1. On the Uyuni Server Web UI, navigate to **Systems › Autoinstallation › GPG and SSL Keys**.
2. Click **[Create Stored Key/Cert]** and set these parameters for the entitlement certificate:
    - In the `Description` field, type `Entitlement-Cert-date`.
    - In the `Type` field, select `SSL`.
    - In the `Select file to upload` field, browse to the location where you saved the entitlement certificate, and select the `.pem` certificate file.
3. Click **[Create Key]**.
4. Click **[Create Stored Key/Cert]** and set these parameters for the entitlement key:
    - In the `Description` field, type `Entitlement-key-date`.
    - In the `Type` field, select `SSL`.
    - In the `Select file to upload` field, browse to the location where you saved the entitlement key, and select the `.pem` key file.
5. Click **[Create Key]**.
6. Click **[Create Stored Key/Cert]** and set these parameters for the Red Hat certificate:
    - In the `Description` field, type `redhat-uep`.
    - In the `Type` field, select `SSL`.
    - In the `Select file to upload` field, browse to the location where you saved the Red Hat certificate, and select the certificate file.
7. Click **[Create Key]**.

## Repository Management

You can use the subscription manager tool to get the URLs of the repositories you want to mirror:

```
subscription-manager repos
```

You can use these repository URLs to create custom repositories. This allows you to mirror only the content you need to manage your clients.

You can only create custom versions of Red Hat repositories if you have the correct entitlements in your Red Hat Portal.

*Procedure: Creating Custom Repositories*

1. On the Uyuni Server Web UI, navigate to **Software › Manage › Repositories**.
2. Click **[Create Repository]** and set these parameters for the entitlement certificate:
    - In the `Repository Label` field, type `rhel-7-server-rpms`.
    - In the `Repository URL` field, type the URL of the repository to mirror. For example, `https://cdn.redhat.com/content/dist/rhel/server/7/7Server/x86_64/os/`.
    - In the `Has Signed Metadata?` field, uncheck all Red Hat Enterprise Repositories.
    - In the `SSL CA Certificate` field, select `redhat-uep`.
    - In the `SSL Client Certificate` field, select `Entitlement-Cert-date`.
    - In the `SSL Client Key` field, select `Entitlement-Key-date`.
    - Leave all other fields as the default values.
3. Click **[Create Repository]**.
4. Repeat for every repository you want to define.

When you have created the custom repositories, you can create corresponding custom channels.

*Procedure: Creating Custom Channels*

1. On the Uyuni Server Web UI, navigate to **Software › Manage › Channels**.
2. Click **[Create Channel]** and set these parameters for the entitlement certificate. Ensure you use the correct RHEL version:
    - In the `Channel Name` field, type `RHEL 7 x86_64`.
    - In the `Channel Label` field, type `rhel7-x86_64-server`.
    - In the `Parent Channel` field, select `None`.
    - In the `Architecture` field, select `x86_64`.
    - In the `Repository Checksum Type` field, select `sha1`.
    - In the `Channel Summary` field, type `RHEL 7 x86_64`.
    - In the `Organization Sharing` field, select `Public`.
3. Click **[Create Channel]**.
4. Navigate to the `Repositories` tab, check the appropriate repository, and click **[Update repositories]**.
5. OPTIONAL: Navigate to the `Sync` tab to set a recurring schedule for synchronization of this repository.

6. Click **[Sync Now]** to begin synchronization immediately.

Red Hat Enterprise Linux channels can be very large. Synchronization can sometimes take several hours.

When you have created the custom channels and synchronized them with the repositories, you can create child channels.

*Procedure: Creating Child Channels*

1. On the Uyuni Server Web UI, navigate to **Software › Manage › Channels**.
2. Click **[Create Channel]** and set these parameters for the entitlement certificate. Ensure you use the correct RHEL version:
    - In the `Channel Name` field, type `RHEL 7 x86_64`.
    - In the `Channel Label` field, type `rhel7-x86_64-extras`.
    - In the `Parent Channel` field, select `rhel7-x86_64-server`.
    - In the `Architecture` field, select `x86_64`.
    - In the `Repository Checksum Type` field, select `sha1`.
    - In the `Channel Summary` field, type `RHEL 7 x86_64 Extras`.
    - In the `Organization Sharing` field, select `Public`.
3. Click **[Create Channel]**.
4. Navigate to the `Repositories` tab, check the appropriate repository, and click **[Update repositories]**.
5. OPTIONAL: Navigate to the `Sync` tab to set a recurring schedule for synchronization of this repository.
6. Click **[Sync Now]** to begin synchronization immediately.

Red Hat Enterprise Linux channels can be very large. Synchronization can sometimes take several hours.

## Add Client Tools

When you have set up all the custom channels, you can add the client tools.

For this section, you will require an activation key. For more information about activation keys, see [ **Client-configuration › Clients-and-activation-keys ›** ].

*Procedure: Adding Client Tools Channels*

1. On the Uyuni Server Web UI, navigate to **Software › Manage › Repositories**.
2. Click **[Create Repository]** and set these parameters for the entitlement certificate:

- In the `Repository Label` field, type `centos7-uyuni-client`.
- In the `Repository URL` field, type the URL of the repository to mirror. For example, `https://download.opensuse.org/repositories/systemsmanagement:/Uyuni:/Stable:/CentOS7-Uyuni-Client-Tools/CentOS_7/`.
- In the `Has Signed Metadata?` field, uncheck all Red Hat Enterprise Repositories.
- Leave all other fields as the default values.

3. Click **`[Create Repository]`**.
4. Navigate to **Software › Manage › Channels**.
5. Click **`[Create Channel]`** and set these parameters. Ensure you use the correct RHEL version:
   - In the `Channel Name` field, type `Uyuni Client Tools for CentOS 7 (x86_64)`.
   - In the `Channel Label` field, type `centos7-uyuni-client-x86_64`.
   - In the `Parent Channel` field, select `rhel7-x86_64-server`.
   - In the `Architecture` field, select `x86_64`.
   - In the `Repository Checksum Type` field, select `sha1`.
   - In the `Channel Summary` field, type `Uyuni Client Tools for CentOS 7 (x86_64)`.
   - In the `Organization Sharing` field, select `Public`.
6. Click **`[Create Channel]`**.
7. Navigate to the `Repositories` tab, check the `centos7-uyuni-client` repository, and click **`[Update repositories]`**.
8. OPTIONAL: Navigate to the `Sync` tab to set a recurring schedule for synchronization of this repository.
9. Click **`[Sync Now]`** to begin synchronization immediately.
10. Add the new channel to your activation key.

You can choose to disable the Red Hat Enterprise Linux subscription-manager yum plugins.

The yum plugins are disabled with a configuration Salt state.

This procedure is optional.

*Procedure: Creating a Salt State to Deploy Configuration Files*

1. On the Uyuni Server Web UI, navigate to **Configuration › Channels**.
2. Click **`[Create State Channel]`**
   - In the `Name` field, type `subscription-manager: disable yum plugins`.
   - In the `Label` field, type `subscription-manager-disable-yum-plugins`.

- In the `Description` field, type `subscription-manager: disable yum plugins`.
- In the `SLS Contents` field, leave it empty.

3. Click **`[Create Config Channel]`**
4. Click **`[Create Configuration File]`**
   - In the `Filename/Path` field type `/etc/yum/pluginconf.d/subscription-manager.conf`.
   - In the `File Contents` field type:

```
[main]
enabled=0
```

1. Click **`[Create Configuration File]`**
2. Take note of the value of the field `Salt Filesystem Path`.
3. Click on the name of the Configuration Channel.
4. Click on `View/Edit 'init.sls' File`
   - In the `File Contents` field, type:

```
configure_subscription-manager-disable-yum-plugins:
  cmd.run:
    - name: subscription-manager config --rhsm.auto_enable_yum_plugins=0
    - watch:
      - file: /etc/yum/pluginconf.d/subscription-manager.conf
  file.managed:
    - name: /etc/yum/pluginconf.d/subscription-manager.conf
    - source: salt:///etc/yum/pluginconf.d/subscription-manager.conf
```

1. Click **`[Update Configuration File]`**

*Procedure: Creating a System Group for Red Hat Enterprise Linux Clients*

1. On the Uyuni Server Web UI, navigate to **Systems › System Groups**.
2. Click **`[Create Group]`**.
   - In the `Name` field, type `rhel-systems`.
   - In the `Description` field, type `All RHEL systems`.
3. Click **`[Create Group]`**.
4. Click `States` tab.
5. Click `Configuration Channels` tab.
6. Type `subscription-manager: disable yum plugins` at the search box.
7. Click **`[Search]`** and the state will appear.

8. Click the checkbox for the state at the `Assign` column.
9. Click **`[Save changes]`**.
10. Click **`[Confirm]`**.

If you already have RHEL systems added to Uyuni, assign them to the new system group, and then apply the highstate.

*Procedure: Adding the System Group to Activation Keys*

You need to modify the activation keys you used for RHEL systems to include the system group created above.

1. On the Uyuni Server Web UI, navigate to **Systems › Activation Keys**.
2. For each the Activation Keys you used for RHEL systems, click on it and:
3. Navigate to the `Groups` tab, and the `Join` subtab.
4. Check `Select rhel-systems`.
5. Click **`[Join Selected Groups]`**.

## Trust GPG Keys on Clients

By default, Red Hat Enterprise Linux does not trust the GPG key for Uyuni CentOS client tools.

The clients can be successfully bootstrapped without the GPG key being trusted. However, they will not be able to install new client tool packages or update them. If this occurs, add GPG key to the `ORG_GPG_KEY=` parameter in all Red Hat Enterprise Linux bootstrap scripts.

On Uyuni, use:

```
uyuni-gpg-pubkey-0d20833e.key
```

You will find all keys available on the server in `/srv/www/htdocs/pub/`.

You do not need to delete any previously stored keys.

If you are boostrapping clients from the Uyuni Web UI, you will need to use a salt state to trust the key. Create the salt state and assign it to the organization. You can then use an activation key and configuration channels to deploy the key to the clients.

## Register Clients

To register your Red Hat clients, you will need a bootstrap repository. Create the bootstrap repository at the command prompt, with this command:

```
mgr-create-bootstrap-repo --with-custom-channels
```

For more information on registering your clients, see **[ Client-configuration › Registration-overview › ]**.

# Registering CentOS Clients

This section contains information about registering traditional and Salt clients running CentOS operating systems.

CentOS clients are based on CentOS and are unrelated to SUSE Linux Enterprise Server with Expanded Support, RES, Red Hat, or Expanded Support. You are responsible for arranging access to CentOS base media repositories and CentOS installation media, as well as connecting Uyuni Server to the CentOS content delivery network.

## Server Requirements

Before you begin, check that your Uyuni Server meets the requirements at **[ Installation › Hardware-requirements › ]**.

Taskomatic uses one CPU core, and requires at least 3072 MB of RAM. To ensure that taskomatic has access to enough memory, open the `/etc/rhn/rhn.conf` configuration file, and add this line:

```
taskomatic.java.maxmemory=3072
```

Restart Taskomatic:

```
systemctl restart taskomatic
```

## Channel and Repository Management

The `spacewalk-utils` package contains a number of command line tools required for client administration, including the `spacewalk-common-channels` tool.

*Procedure: Adding Channels and Repositories*

1. At the command prompt on the Uyuni Server, as root, install the `spacewalk-utils` package:

```
zypper in spacewalk-utils
```

1. Add the CentOS base, updates, and client channels, specifying the CentOS version and architecture:

```
spacewalk-common-channels -a x86_64 centos7 \
centos7-uyuni-client centos7-uyuni-client
```

The client tools channel provided by `spacewalk-common-channels` is sourced from Uyuni and not from SUSE.

*Procedure: Synchronizing CentOS repositories*

1. In the Uyuni Web UI, navigate to **Software › Manage**, and check every CentOS channel.
2. In the `Repositories` tab, navigate to the `Sync` subtab, and click **`[Sync Now]`**. You can also create a regular synchronization schedule on this page.

## Create an Activation Key

You will need to create an activation key that is associated with your CentOS channels.

For more information on activation keys, see **[ Client-configuration › Clients-and-activation-keys › ]**.

## Trust GPG Keys on Clients

By default, CentOS does not trust the GPG key for Uyuni CentOS client tools.

The clients can be successfully bootstrapped without the GPG key being trusted.

However, they will not be able to install new client tool packages or update them.

To fix this, add this key to the `ORG_GPG_KEY=` parameter in all CentOS bootstrap scripts:

```
uyuni-gpg-pubkey-0d20833e.key
```

```
You do not need to delete any previously stored keys.
```

If you are boostrapping clients from the Uyuni Web UI, you will need to use a salt state to trust the key. Create the salt state and assign it to the organization. You can then use an activation key and configuration channels to deploy the key to the clients.

## Register Clients

CentOS clients are registered in the same way as all other clients. For more information, see **[ Client-configuration › Registration-overview › ]**.

# Registering Ubuntu Clients

This section contains information about registering Salt clients running Ubuntu operating systems.

SUSE Manager supports Ubuntu 16.04 LTS and 18.04 LTS Clients using Salt. Traditional clients are not supported.

Canonical does not endorse or support SUSE Manager.

Bootstrapping is supported for starting Ubuntu clients and performing initial state runs such as setting repositories and performing profile updates. However, the root user on Ubuntu is disabled by default, so to use bootstrapping, you will require an existing user with `sudo` privileges for Python.

## Prepare to Register

Some preparation is required before you can register Ubuntu clients to the Uyuni Server.

*Procedure: Adding the Ubuntu Channels*

1. At the command prompt on the Uyuni Server, as root, install the `spacewalk-utils` package:

```
zypper in spacewalk-utils
```

2. Add the Ubuntu channels. Adjust the version of the channel names to match your Ubuntu version:

```
spacewalk-common-channels ubuntu-1804-pool-amd64-uyuni \
ubuntu-1804-amd64-main-uyuni \
ubuntu-1804-amd64-main-update-uyuni \
ubuntu-1804-amd64-main-security-uyuni \
ubuntu-1804-amd64-universe-uyuni \
ubuntu-1804-amd64-uyuni-client
```

3. Synchronize the new custom channels.

You need all the new channels fully synchronized, including Universe (Universe contains important dependencies for Salt), before bootstrapping any Ubuntu client.

Ubuntu channels can be very large. Synchronization can sometimes take several hours.

There are two ways to check if a channel has finished synchronizing:

- In the Uyuni Web UI, navigate to **Admin › Setup Wizard** and select the `SUSE Products` tab.

  This dialog displays a completion bar for each product when they are being synchronized.

- Check the synchronization log file at the command prompt with `tail -f /var/log/rhn/reposync/channel-label.log`.

  Each child channel will generate its own log during the synchronization progress. You will need to check all the base and child channel log files to be sure that the synchronization is complete.

## Trust GPG Keys on Clients

By default, Ubuntu does not trust the GPG key for Uyuni Ubuntu client tools.

The clients can be successfully bootstrapped without the GPG key being trusted.

However, they will not be able to install new client tool packages or update them.

To fix this, add this key to the `ORG_GPG_KEY=` parameter in all Ubuntu bootstrap scripts:

```
uyuni-gpg-pubkey-0d20833e.key
```

You do not need to delete any previously stored keys.

If you are boostrapping clients from the Uyuni Web UI, you will need to use a salt state to trust the key. Create the salt state and assign it to the organization. You can then use an activation key and configuration channels to deploy the key to the clients.

## Root Access

The root user on Ubuntu is disabled by default. You can enable it by editing the `sudoers` file.

*Procedure: Granting Root User Access*

1. On the client, edit the `sudoers` file:

   ```
   sudo visudo
   ```

   Grant `sudo` access to the user by adding this line to the `sudoers` file. Replace `<user>` with the name of the user that will be used to bootstrap the client in the Web UI:

   ```
   <user>  ALL=NOPASSWD: /usr/bin/python, /usr/bin/python2, /usr/bin/python3
   ```

## Register Clients

1. To register your Ubuntu clients, you will need a bootstrap repository. Create the bootstrap repository at the command prompt, with this command:

```
mgr-create-bootstrap-repo --with-custom-channels
```

For more information on registering your clients, see **[ Client-configuration › Registration-overview › ]**.

# Virtualization

You can use Uyuni to manage virtualized clients in addition to regular traditional or Salt clients. In this type of installation, a virtual host is installed on the Uyuni Server to manage any number of virtual guests. If you choose to, you can install several virtual hosts to manage groups of guests.

The range of capabilities that virtualized clients have depends on the third-party virtualization provider you choose.

Xen and KVM hosts and guests can be managed directly in Uyuni. This enables you to autoinstall hosts and guests using AutoYaST or Kickstart, and manage guests in the Web UI.

For VMWare, including VMWare vSphere, Uyuni requires you to set up a virtual host manager (VHM) to control the VMs. This gives you control over the hosts and guests, but in a more limited way than available with Xen and KVM.

Other third-party virtualization providers are not directly supported by Uyuni. However, if your provider allows you to export a JSON configuration file for the VM, you can upload that configuration file to Uyuni and manage it with a VHM.

## Virtualization with Xen and KVM

Xen and KVM virtualized clients can be managed directly in Uyuni.

To begin, you will need to set up a virtual host on your Uyuni Server. You can then set up autoinstallation using AutoYaST or Kickstart for future virtual hosts, and for virtual guests.

This section also includes information about administering your virtual guests after they have been installed.

### Host Setup

The way that you set up Xen or KVM on a VM host depends on what operating system you want to use on its associated guests.

For SUSE operating systems, see the SLES Virtualization Guide available from https://documentation.suse.com/sles/15-SP1/html/SLES-all/book-virt.html.

For Red Hat Enterprise Linux operating systems, refer to the Red Hat documentation for your version.

Uyuni uses `libvirt` to install and manage guests. You must have the `libvirtd` package installed on your host. In most cases, the default settings are usually sufficient, and you should not need to adjust them. However, if you want to access the VNC console on your guests as a non-root user, you will need to perform some configuration changes. For more information about how to set this up, consult the relevant documentation for your operating system.

You will require a bootstrap script on the Uyuni Server. Your bootstrap script must include the activation

key for your host. We also recommend that you include your GPG key for additional security. For more on creating a bootstrap script, see **[ Client-configuration › Registration-bootstrap › ]**.

When your bootstrap script is ready, execute it on the host to register it with the Uyuni Server. For more on client registration, see **[ Client-configuration › Registration-overview › ]**.

For Salt clients, you will need to enable the `Virtualization Host` entitlement. This allows you to see VM changes instantly. To do this, in the Uyuni Web UI, navigate to the `System Details` page for the host, and click on the `Properties` tab. In the `Add-On System Types` section, check `Virtualization Host`, and click **`[Update Properties]`** to save the changes. You will need to schedule a hardware refresh to activate the change. Navigate to **System Details › Hardware**, and click **`[Schedule Hardware Refresh]`**.

By default, VM hosts use the `rhnsd` service to check for scheduled actions every four hours, in order to load balance in environments where there are a lot of clients. This can create delays of up to four hours before an action is carried out. When you are managing VM guests, this long delay is not always ideal, especially for actions like rebooting a guest. To address this, you can disable the `rhnsd` service, and enable the `osad` service. The `osad` service receives commands using a jabber protocol, and will execute commands instantly.

To disable the `rhnsd` service, and enable the `osad` daemon, run these commands as the root user:

```
service rhnsd stop
service rhnsd disable
```

```
service osad enable
service osad start
```

## Autoinstallation

You can use AutoYaST or Kickstart to automatically install and register Xen and KVM guests.

You will require an activation key for the VM host you want to register the guests to, and for each guest. Your activation key must have the `provisioning` and `Virtualization Platform` entitlements. Your activation key must also have access to the `mgr-virtualization-host` and `mgr-osad` packages. For more on creating activation keys, see **[ Client-configuration › Clients-and-activation-keys › ]**.

If you want to automatically register the guests with Uyuni after installation, you will need to create a bootstrap script. For more on creating a bootstrap script, see **[ Client-configuration › Registration-bootstrap › ]**.

Autoinstallation of VM guests works only if they are configured as Traditional clients. Salt clients can be created using a template disk image, but not by using AutoYaST or Kickstart.

### Create an Autoinstallable Distribution

You will need to create an autoinstallable distribution on the VM host to be able to autoinstall clients from Uyuni. The distribution can be made available from a mounted local or remote directory, or on a loop-mounted ISO image.

The configuration of the autoinstallable distribution will differ depending on whether you are using a SLES or Red Hat Enterprise Linux operating system on your guests. The packages for a Red Hat Enterprise Linux installation are fetched from the associated base channel. Packages for installing SUSE systems are fetched from the autoinstallable distribution. Therefore, for SLES systems, the autoinstallable distribution must be a complete installation source.

*Table 8. Paths for autoinstallable distributions*

| Operating System Type | Kernel Location | initrd Location |
|---|---|---|
| Red Hat Enterprise Linux | `images/pxeboot/vmlinuz` | `images/pxeboot/initrd.img` |
| SLES | `boot/<arch>/loader/initrd` | `boot/<arch>/loader/linux` |

In all cases, ensure that the base channel matches the autoinstallable distribution.

Before you begin, ensure you have a installation media available to your VM Host. It can be on a network resource, a local directory, or an loop-mounted ISO image. Additionally, ensure that all files and directories are world-readable.

*Procedure: Creating an Autoinstallable 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 the `Base Channel` field, select the channel that matches the installation source. This channel is used as the package source for non-SUSE installations.
    - In the `Installer Generation` field, select the operating system version that matches the installation source.
    - 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.

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.

### Create and Upload an Autoinstallation Profile

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.

Kickstart profiles can be created using the Uyuni Web UI, by navigating to **Systems › Autoinstallation › Profiles**, clicking **[Create New Kickstart File]**, and following the prompts. You can also create AutoYaST or Kickstart autoinstallation profiles by hand.

An example AutoYaST profile that includes a script for registering the client with Uyuni is available in **[ Client-configuration › Autoyast-example › ]**. If you are using AutoYaST to install SLES, you will also need to include this snippet:

```
<products config:type="list">
  <listentry>SLES</listentry>
</products>
```

- For more on AutoYaST, see **[ Client-configuration › Client-automating-installation › ]**.
- For more on Kickstart, see **[ Client-configuration › Kickstart › ]**, or refer to the Red Hat documentation for your installation.

*Procedure: Uploading an Autoinstallation Profile*

1. In the Uyuni Web UI, navigate to **Systems › Autoinstallation › Profiles** and click **[Upload Kickstart/AutoYaST File]**.
2. In the `Create Autoinstallation Profile` section, use these parameters:
    - In the `Label` field, type a unique name for the profile. Use only letters, numbers, hyphens (`-`), periods (`.`), and underscores (`_`), and ensure the name is longer than six characters.
    - In the `Autoinstall Tree` field, select the autoinstallable distribution you created earlier.
    - In the `Virtualization Type` field, select the relevant Guest type (for example, `KVM Virtualized Guest`. Do not choose `Xen Virtualized Host` here.
    - OPTIONAL: If you want to manually create your autoinstallation profile, you can type it directly into the `File Contents` field. If you have a file already created, leave the `File Contents` field blank.
    - In the `File to Upload` field, click **[Choose File]**, and use the system dialog to select the file to upload. If the file is successfully uploaded, the filename will be shown in the `File to Upload` field.
    - The contents of the uploaded file will be shown in the `File Contents` field. If you need to

make edits, you can do so directly.

3. Click **[Create]** to save your changes and store the profile.

When you have created an autoinstallation profile, you can edit it by navigating to **Systems** › **Autoinstallation** › **Profiles** and selecting the profile you want to edit. Make the desired changes and save your settings by clicking **[Create]**.

If you change the `Virtualization Type` of an existing Kickstart profile, it might also modify the bootloader and partition options, potentially overwriting any custom settings. Carefully review the `Partitioning` tab to verify these settings before making changes.

### Automatically Register Guests

When you install VM guests automatically, they are not registered to Uyuni. If you want your guests to be automatically registered as soon as they are installed, you can add a section to the autoinstallation profile that invokes a bootstrap script, and registers the guests.

This section gives instructions for adding a bootstrap script to an existing AutoYaST profile.

For more on creating a bootstrap script, see **[ Client-configuration › Registration-bootstrap › ]**. For instructions on how to do this for {kickstart], refer to the Red Hat documentation for your installation.

*Procedure: Adding a Bootstrap Script to an AutoYaST Profile*

1. Ensure your bootstrap script contains the activation key for the VM guests you want to register with it, and that is located on the host at `/srv/www/htdocs/pub/bootstrap_vm_guests.sh`.
2. In the Uyuni Web UI, navigate to **Systems** › **Autoinstallation** › **Profiles**, and select the AutoYaST profile to associate this script with.
3. In the `File Contents` field, add this snippet at the end of the file, immediately before the closing `</profile>` tag. Ensure you replace the example IP address in the snippet with the correct IP address for your Uyuni Server:

```
<scripts>
  <init-scripts config:type="list">
    <script>
      <interpreter>shell </interpreter>
      <location>
        http://`192.168.1.1`/pub/bootstrap/bootstrap_vm_guests.sh
      </location>
    </script>
  </init-scripts>
</scripts>
```

4. Click **Update** to save your changes.

If your AutoYaST profile already contains a `<scripts>` section, do not add a second one. Place the bootstrap snippet inside the existing `<scripts>` section.

### Autoinstall VM Guests

Once you have everything set up, you can start to autoinstall your VM guests.

Each VM host can only install one guest at a time. If you are scheduling more than one autoinstallation, make sure you time them so that the next installation does not begin before the previous one has completed. If a guest installation starts while another one is still running, the running installation will be canceled.

1. In the Uyuni Web UI, navigate to **Systems › Overview**, and select the VM host you want to install guests on.
2. Navigate to the `Virtualization` tab, and the `Provisioning` subtab.
3. Select the autoinstallation profile you want to use, and specify a unique name for the guest.
4. Choose a proxy if applicable and enter a schedule.
5. To change the guest's hardware profile and configuration options, click **`[Advanced Options]`**.
6. Click **`[Schedule Autoinstallation and Finish]`** to complete.

## Manage VM Guests

You can use the Uyuni Web UI to manage your VM Guests, including actions like shutting downa nd restarting, and adjusting CPU and memory allocations.

To do this, you will need your Xen or KVM VM host registered to the Uyuni Server, and have the `libvirtd` service running on the host. You will also need the `mgr-cfg-actions` package installed on your Uyuni Server.

In the Uyuni Web UI, navigate to **Systems › System List**, and click on the VM host for the guests you want to manage. Navigate to the `Virtualization` tab to see all guests registered to this host, and access the management functions.

For more information on managing VM guests using the Web UI, see **[ Reference › Systems › ]**.

# Virtualization with VMWare

You can use VMWare vSphere virtual machines, including ESXi and vCenter, with Uyuni by setting up a virtual host manager (VHM).

To begin, you will need to set up a VHM on your Uyuni Server, and inventory the available VM hosts. Taskomatic can then begin data collection using the VMs API.

## VHM Setup

The Virtual Host Manager (VHM) runs on the Uyuni Server.

To run a VHM, your Uyuni Server will need to have port 443 open, in order to access the VMWare API.

VMWare hosts use access roles and permissions to control access to hosts and guests. Ensure that any VMWare objects or resources that you want to be inventoried by the VHM have at least `read-only` permissions. If you want to exclude any objects or resources, mark them with `no-access`.

When you are adding new hosts to Uyuni, you will need to consider if the roles and permissions that have been assigned to users and objects need to be inventoried by Uyuni.

For more on users, roles, and permissions, see the VMWare vSphere documentation: https://docs.vmware.com/en/VMware-vSphere/index.html

*Procedure: Creating a VMWare VHM*

1. In the Uyuni Web UI, navigate to **Systems › Virtual Host Managers**.
2. Click **`[Create]`** and select `VMWare-based`.
3. In the `Add a VMWare-based Virtual Host Manager` section, use these parameters:
    - In the `Label` field, type a custom name for your VHM.
    - In the `Hostname` field, type the fully-qualified domain name (FQDN) or host IP address.
    - In the `Port` field, type the ESXi API port to use (for example, `443`).
    - In the `Username` field, type the username associated with the VM host.
    - In the `Password` field, type the password associated with the VM host user.
4. Click **`[Create]`** to save your changes and create the VHM.
5. On the `Virtual Host Managers` page select the new VHM.
6. On the `Properties` page, click **`[Refresh Data]`** to inventory the new VHM.

To see which objects and resources have been inventoried, navigate to **Systems › System List › Virtual Systems**.

Connecting to the ESXi server from a browser using HTTPS can sometimes log an `invalid certificate` error. If this occurs, refreshing the data from the virtual hosts server will fail. To correct the problem, extract the certificate from the ESXi server, and copy it to `/etc/pki/trust/anchors`. Re-trust the certificate by running the `update-ca-certificates` command on the command line, and restart the spacewalk services.

After your VHM has been created and configured, Taskomatic will run data collection automatically. If you want to manually perform data collection, navigate to **Systems › Virtual Host Managers**, select the

appropriate VHM, and click **[Refresh Data]**.

Uyuni ships with a tool called `virtual-host-gatherer` that can connect to VHMs using their API, and request information about virtual hosts. `virtual-host-gatherer` maintains the concept of optional modules, where each module enables a specific VHM. This tool is automatically invoked nightly by Taskomatic. Log files for the `virtual-host-gatherer` tool are located at `/var/log/rhn/gather.log`.

## Virtualization with Other Third Party Providers

If you want to use a third-party virtualization provider other than Xen, KVM, or VMware, you can import a JSON configuration file to Uyuni.

Similarly, if you have a VMWare installation that does not provide direct access to the API, a file-based VHM will provide you with some basic management features.

This option is for importing files that have been created with the `virtual-host-gatherer` tool. It is not designed for manually created files.

*Procedure: Exporting and Importing a JSON File*

1. Export the JSON configuration file by running `virtual-host-gatherer` on the VM network.
2. Save the produced file to a location accessible by your Uyuni Server.
3. In the Uyuni Web UI, navigate to **Systems › Virtual Host Managers**.
4. Click **[Create]** and select `File-based`.
5. In the `Add a file-based Virtual Host Manager` section, use these parameters:
    - In the `Label` field, type a custom name for your VHM.
    - In the `Url` field, type the path to your exported JSON configuration file.
6. Click **[Create]** to save your changes and create the VHM.
7. On the `Virtual Host Managers` page, select the new VHM.
8. On the `Properties` page, click **[Refresh Data]** to inventory the new VHM.

*Listing 2. Example: Exported JSON configuration file:*

```
{
    "examplevhost": {
        "10.11.12.13": {
            "cpuArch": "x86_64",
            "cpuDescription": "AMD Opteron(tm) Processor 4386",
            "cpuMhz": 3092.212727,
            "cpuVendor": "amd",
            "hostIdentifier": "'vim.HostSystem:host-182'",
            "name": "11.11.12.13",
            "os": "VMware ESXi",
            "osVersion": "5.5.0",
            "ramMb": 65512,
            "totalCpuCores": 16,
            "totalCpuSockets": 2,
            "totalCpuThreads": 16,
            "type": "vmware",
            "vms": {
                "vCenter": "564d6d90-459c-2256-8f39-3cb2bd24b7b0"
            }
        },
        "10.11.12.14": {
            "cpuArch": "x86_64",
            "cpuDescription": "AMD Opteron(tm) Processor 4386",
            "cpuMhz": 3092.212639,
            "cpuVendor": "amd",
            "hostIdentifier": "'vim.HostSystem:host-183'",
            "name": "10.11.12.14",
            "os": "VMware ESXi",
            "osVersion": "5.5.0",
            "ramMb": 65512,
            "totalCpuCores": 16,
            "totalCpuSockets": 2,
            "totalCpuThreads": 16,
            "type": "vmware",
            "vms": {
                "49737e0a-c9e6-4ceb-aef8-6a9452f67cb5": "4230c60f-3f98-2a65-f7c3-
600b26b79c22",
                "5a2e4e63-a957-426b-bfa8-4169302e4fdb": "42307b15-1618-0595-01f2-
427ffcddd88e",
                "NSX-gateway": "4230d43e-aafe-38ba-5a9e-3cb67c03a16a",
                "NSX-l3gateway": "4230b00f-0b21-0e9d-dfde-6c7b06909d5f",
                "NSX-service": "4230e924-b714-198b-348b-25de01482fd9"
            }
        }
    }
}
```

For more information, see the man page on your Uyuni server for `virtual-host-gatherer`:

```
man virtual-host-gatherer
```

The `README` file of that package provides background information about the `type` of a hypervisor, etc.:

```
/usr/share/doc/packages/virtual-host-gatherer/README.md
```

The man page and the `README` file also contain example configuration files.

# Virtual Host Managers

Virtual Host Managers (VHMs) are used to gather information from a range of client types.

VHMs can be used to collect private or public cloud instances and organize them into virtualization groups. With your virtualized clients organized this way, Taskomatic collects data on the clients for display in the Uyuni{ Web UI. VHMs also allow you to use subscription matching on your virtualized clients.

You can create a VHM on your Uyuni Server, and use it to inventory available public cloud instances. You can also use a VHM to manage clusters created with Kubernetes and SUSE CaaS Platform.

For more information on using a VHM with Microsoft Azure, see **[ Client-configuration › Vhm-azure › ]**. For more information on using a VHM with Amazon Web Services, see **[ Client-configuration › Vhm-aws › ]**. For more information on using a VHM with Google Compute Engine, see **[ Client-configuration › Vhm-gce › ]**. For more information on using a VHM with Kubernetes, see **[ Client-configuration › Vhm-kubernetes › ]**.

## SUSE Support and VM Zones

Public cloud providers use regions to define the physical geographic location of the datacenter providing virtual machines. For example, `US-East`, or `Asia`.

Regions are then further divided into zones. For example, the `US-East` region might contain zones called `us-east-2a` and `us-east-2b`, among others.

SUSE uses the zone of a virtual machine to determine the appropriate subscription to provide. If all of your VMs are provided by the same zone, you are within the terms and conditions of the `1-2 Virtual Machines` subscription.

If your VMs are provided by different zones, even if they are within the same region, you might not meet the conditions of the `1-2 Virtual Machines` subscription. In this case, check your subscription carefully.

For more information, see https://www.suse.com/products/terms_and_conditions.pdf or contact SUSE.

## VHM and Azure

You can use a Uyuni VHM to gather instances from Microsoft Azure.

The VHM allows Uyuni to obtain and report information about your virtual machines. For more information on VHMs, see **[ Client-configuration › Vhm › ]**.

### Create an Azure VHM

The Virtual Host Manager (VHM) runs on the Uyuni Server.

Ensure you have installed the `virtual-host-gatherer-libcloud` package on the Uyuni Server.

*Procedure: Creating an Azure VHM*

1. In the Uyuni Web UI, navigate to **Systems › Virtual Host Managers**.
2. Click **[Create]** and select `Azure` from the drop-down menu.
3. In the `Add an Azure Virtual Host Manager` section, use these parameters:
    - In the `Label` field, type a custom name for your VHM.
    - In the `Subscription ID` field, type the subscription ID provided by Azure.
    - In the `Application ID` field, type the application ID provided by Azure.
    - In the `Tenant ID` field, type the tenant ID provided by Azure.
    - In the `Secret Key` field, type the secret key associated with the Azure instance.
    - In the `Zone` field, type the zone your VM is located in. This is required for subscription matching to work.
4. Click **[Create]** to save your changes and create the VHM.
5. On the `Virtual Host Managers` page, select the new VHM.
6. On the `Properties` page, click **[Refresh Data]** to inventory the new VHM.

To see which objects and resources have been inventoried, navigate to **Systems › System List › Virtual Systems**.

## Assigning Permissions

The VHM you create needs to have the correct permissions assigned, in order for it to access the Azure VM.

Log in to your Azure account as the subscription administrator, and ensure that the Azure user account and application are in the correct groups. The group that the application is in determines the role it has, and therefore the permissions.

If the permissions are not set correctly, you might receive an error like this when you run `virtual-host-gatherer`:

```
General error: [AuthorizationFailed] The client 'client_name' with object id 'object_ID' does
not have authorization to perform action 'Microsoft.Compute/virtualMachines/read' over scope
'/subscriptions/not-very-secret-subscription-id' or the scope is invalid. If access was
recently granted, please refresh your credentials.
```

To determine the correct credentials, run this command at the prompt on the Uyuni Server:

```
virtual-host-gatherer -i input_azure.json -o out_azure.json -vvv
```

The `input_azure.json` file should contain this information:

```
[
    {
        "id": "azure_vhm",
        "module": "Azure",
        "subscription_id": "subscription-id",
        "application_id": "application-id",
        "tenant_id": "tenant-id",
        "secret_key": "secret-key",
        "zone": "zone"
    }
]
```

### Azure UUID

Instances running on the Azure public cloud will report this UUID to the Uyuni Server:

```
13f56399-bd52-4150-9748-7190aae1ff21
```

## VHM and Amazon Web Services

You can use a Uyuni VHM to gather instances from Amazon Web Services (AWS).

The VHM allows Uyuni to obtain and report information about your clusters. For more information on VHMs, see **[ Client-configuration › Vhm › ]**.

### Create an Amazon EC2 VHM

The Virtual Host Manager (VHM) runs on the Uyuni Server.

Ensure you have installed the `virtual-host-gatherer-libcloud` package on the Uyuni Server.

*Procedure: Creating an Amazon EC2 VHM*

1. In the Uyuni Web UI, navigate to **Systems › Virtual Host Managers**.
2. Click **`[Create]`** and select `Amazon EC2` from the drop-down menu.
3. In the `Add an Amazon EC2 Virtual Host Manager` section, use these parameters:
    - In the `Label` field, type a custom name for your VHM.
    - In the `Access Key ID` field, type the access key ID provided by Amazon.
    - In the `Secret Access Key` field, type the secret access key associated with the Amazon instance.
    - In the `Region` field, type the region to use.
    - In the `Zone` field, type the zone your VM is located in. This is required for subscription matching to work.

4. Click **[Create]** to save your changes and create the VHM.
5. On the Virtual Host Managers page, select the new VHM.
6. On the Properties page, click **[Refresh Data]** to inventory the new VHM.

To see which objects and resources have been inventoried, navigate to **Systems › System List › Virtual Systems**.

Instances running on the Amazon public cloud will report this UUID to Uyuni Server:

```
i-1234567890abcdef0
```

## VHM and Google Compute Engine

You can use a Uyuni VHM to gather instances from Google Compute Engine (GCE).

The VHM allows Uyuni to obtain and report information about your virtual machines. For more information on VHMs, see **[ Client-configuration › Vhm › ]**.

### Create a GCE VHM

The Virtual Host Manager (VHM) runs on the Uyuni Server.

To run a VHM, your Uyuni Server will need to have port 443 open, in order to access the clients.

Ensure you have installed the virtual-host-gatherer-libcloud package on the Uyuni Server.

Before you begin, log in to the GCE panel, and download a certificate file. Store this file locally on your Uyuni Server, and take note of the path.

*Procedure: Creating a GCE VHM*

1. In the Uyuni Web UI, navigate to **Systems › Virtual Host Managers**.
2. Click **[Create]** and select Google Compute Engine from the drop-down menu.
3. In the Add a Google Conpute Engine Virtual Host Manager section, use these parameters:
    - In the Label field, type a custom name for your VHM.
    - In the Service Account Email field, type the email address associated with your Google account.
    - In the Cert Path field, type the path to the certificate downloaded from the GCE panel.
    - In the Project ID field, type the project ID used by the GCE instance.
    - In the Zone field, type the zone your VM is located in. This is required for subscription matching to work.

4. Click **[Create]** to save your changes and create the VHM.
5. On the `Virtual Host Managers` page, select the new VHM.
6. On the `Properties` page, click **[Refresh Data]** to inventory the new VHM.

To see which objects and resources have been inventoried, navigate to **Systems › System List › Virtual Systems**.

## Assigning Permissions

The VHM you create needs to have the correct permissions assigned, in order for it to access the GCE VM.

Log in to your Google Cloud Platform account as an administrator, and use the Cloud Identity and Access Management (IAM) tool to ensure that the service account has the appropriate roles. You will also need to ensure that the VM has been assigned the `VM`` role.

If the permissions are not set correctly, you might receive an error like this when you run `virtual-host-gatherer`:

```
ERROR: {'domain': 'global', 'reason': 'forbidden', 'message': "Required 'compute.zones.list'
permission for 'projects/project-id'"}
ERROR: Could not connect to the Google Compute Engine Public Cloud using specified
credentials.
```

To determine the correct credentials, run this command at the prompt on the Uyuni Server:

```
virtual-host-gatherer -i input_google.json -o out_google.json -vvv
```

The `input_google.json` file should contain this information:

```
[
    {
        "id": "google_vhm",
        "module": "GoogleCE",
        "service_account_email": "mail@example.com",
        "cert_path": "secret-key",
        "project_id": "project-id",
        "zone": "zone"
    }
]
```

## GCE UUID

Instances running on the Google public cloud will report this UUID to Uyuni Server:

```
152986662232938449
```

# VHM and Kubernetes

You can use a Uyuni VHM to manage Kubernetes clusters.

The VHM allows Uyuni to obtain and report information about your clusters. For more information on VHMs, see **[ Client-configuration › Vhm › ]**.

To use Uyuni with Kubernetes, you will need to have your Uyuni Server configured for container management, with all required channels present, and a registered container build host available.

You will also require:

- At least one Kubernetes or SUSE CaaS Platform cluster available on your network.
- The `virtual-host-gatherer-Kubernetes` package installed on the Uyuni Server.
- Kubernetes version 1.5.0 or higher, or SUSE CaaS Platform.
- Docker version 1.12 or higher on the container build host.

## Create a Kubernetes VHM

Kubernetes clusters are registered with Uyuni as a VHM.

You will need a `kubeconfig` file to register and authorize your Kubernetes cluster. You can get a `kubeconfig` file using the Kubernetes command line tool `kubectl`. If you are using SUSE CaaS Platform, you can download the file from the Velum interface.

*Procedure: Creating a Kubernetes VHM*

1. In the Uyuni Web UI, navigate to **Systems › Virtual Host Managers**.
2. Click **`[Create]`** and select `Kubernetes Cluster`.
3. In the `Add a Kubernetes Virtual Host Manager` section, use these parameters:
    - In the `Label` field, type a custom name for your VHM.
    - Select the `kubeconfig` file that contains the required data for the Kubernetes cluster.
4. In the `context` field, select the appropriate context for the cluister. This is specified in the `kubeconfig` file.
5. Click **`[Create]`**.

*Procedure: Viewing the Nodes in a Cluster*

1. In the Uyuni Web UI, navigate to **Systems › Virtual Host Managers**.
2. Select the Kubernetes cluster.
3. Refresh the node data by clicking **`[Schedule refresh data]`**.

The node data can take a few moments to update. You might need to refresh your browser window to see

the updated information.

Any connection or authentication problems are logged to `gatherer.log`.

Node data is not refreshed during registration. You will need to manually refresh the data to see it.

## Retrieve Image Runtime Data

You can view runtime data about Kubernetes images in the Uyuni Web UI, by navigating to **Images › Image List**.

The image list table contains three columns:

- `Revision`:

  A sequence number that increments on every rebuild for images built by Uyuni, or on every import for externally built images.

- `Runtime`:

  Overall status of the running instances for each image in registered clusters.

- `Instances`:

  Number of instances running this image across all the clusters registered in Uyuni. You can see a breakdown of numbers by clicking the pop-up icon next to the number.

The `Runtime` column displays one of these status messages:

- `All instances are consistent with SUSE Manager`:

  All the running instances are running the same build of the image as tracked by Uyuni.

- `Outdated instances found`:

  Some of the instances are running an older build of the image. You might need to redeploy the image.

- `No information`:

  The checksum of the instance image does not match the image data contained in Uyuni. You might need to redeploy the image.

*Procedure: Building an Image*

1. In the Uyuni Web UI, navigate to **Images › Stores**.

2. Click **[Create]** to create an image store.
3. Navigate to **Images › Profiles**.
4. Click **[Create]** to create an image profile. You will need to use a dockerfile that is suitable to deploy to Kubernetes.
5. Navigate to **Images › Build** to build an image with the new profile.
6. Deploy the image into one of the registered Kubernetes clusters. You can do this with the `kubectl` tool.

The updated data should now be available in the image list at **Images › Image List**.

*Procedure: Importing a Previously Deployed Image*

1. In the Uyuni Web UI, navigate to **Images › Image Stores**.
2. Add the registry that owns the image you want to import, if it is not already there.
3. Navigate to **Images › Image List** and click **[Import]**.
4. Complete the fields, select the image store you created, and click **[Import]**.

The imported image should now be available in the image list at **Images › Image List**.

*Procedure: Rebuilding a Previously Deployed Image*

1. In the Uyuni Web UI, navigate to **Images › Image List**, locate the row that contains the image you want to rebuild, and click **[Details]**.
2. Navigate to the `Build Status` section, and click **[Rebuild]**. The rebuild can take some time to complete.

When the rebuild has successfully completed, the runtime status of the image is updated in the image list at **Images › Image List**. This shows that the instances are running a previous build of the image.

You can only rebuild images if they were originally built with Uyuni. You cannot rebuild imported images.

*Procedure: Retrieving Additional Runtime Data*

1. In the Uyuni Web UI, navigate to **Images › Image List**, locate the row that contains the running instance, and click **[Details]**.
2. Navigate to the `Overview` tab. In the `Image Info` section, there is data in the `Runtime` and `Instances` fields.
3. Navigate to the `Runtime` tab. This section contains a information about the Kubernetes pods running this image in all the registered clusters. The information in this section includes:
    - Pod name.
    - Namespace which the pod resides in.
    - The runtime status of the container in the specific pod.

## Permissions and Certificates

You can only use `kubeconfig` files with Uyuni if they contain all embedded certificate data.

The API calls from Uyuni are:

- `GET /api/v1/pods`
- `GET /api/v1/nodes`

The minimum recommended permissions for Uyuni are:

- A ClusterRole to list all the nodes:

```
resources: ["nodes"]
verbs: ["list"]
```

- A ClusterRole to list pods in all namespaces (role binding must not restrict the namespace):

```
resources: ["pods"]
verbs: ["list"]
```

If `/pods` returns a 403 reponse, the entire cluster will be ignored by Uyuni.

For more information on working with RBAC Authorization, see https://kubernetes.io/docs/admin/authorization/rbac/.

# Software Channels

Channels are a method of grouping software packages. In Uyuni, channels are divided into base channels and child channels. Organizing channels in this way ensures that only compatible packages are installed on each system.

A base channel consists of packages built for a specific operating system type, version, and architecture. For example, all of the packages in SUSE Linux Enterprise Server 12 for the `x86_64` architecture make up a base channel. The list of packages in SUSE Linux Enterprise Server 12 for the `s390x` architecture make up a different base channel. A system must be subscribed to only one base channel, which is assigned automatically during registration based on the SUSE Linux Enterprise release and system architecture. For paid channels provided by a vendor, you must have an associated subscription.

A child channel is associated with a specific base channel and provides only packages that are compatible with that base channel. A system can be subscribed to multiple child channels of its base channel. When a system has been assigned to a base channel, it is only possible for that system to install the related child channels. For example, if a system has been assigned to the SUSE Linux Enterprise Server 12 `x86_64` base channel, they will only be able to install or update packages compatible with SUSE Linux Enterprise Server 12 `x86_64`.

In the Uyuni Web UI you can browse your available channels by navigating to **Software › Channel List › All**. You can modify or create new channels by navigating to **Software › Manage › Channels**.

## Custom Channels

If you require packages that are not provided by the standard Uyuni base channels, you can create custom channels. Uyuni Administrators and Channel Administrators have channel management authority, which gives them the ability to create and manage their own custom channels.

For more on creating custom channels, see **[ Administration › Custom-channels › ]**.

# Creating the Uyuni Tools Repository

A tools repository contains packages for installing Salt on clients, as well as the required packages for registering traditional clients during bootstrapping. You can create a tools repository on the Uyuni Server.

When you have created the tools repository, the packages in the repository will be installed during client registration.

## Preparing to Create a Tools Repository

Before you create the tools repository, ensure client is fully synchronized with your vendor channel.

There are two ways to check if a channel has finished synchronizing:

- In the UyuniWeb UI, navigate to **Admin › Setup Wizard** and select the **SUSE Products** tab. This dialog displays a completion bar for each product when they are being synchronized.
- You can also check the synchronization log file at the command prompt. Use the `cat` or `tail -f` command to view the `/var/log/rhn/reposync/channel-label.log` file. If you use this method, remember that base channels can contain multiple child channels. Each of the child channels will generate its own log during the synchronization progress. You will need to check all the base and child channel log files to be sure that the synchronization is complete.

## Generate a Tools Repository

*Procedure: Generating the Tools Repository for SUSE Linux Enterprise*

1. At the command prompt on the Uyuni Server, as root, list the available bootstrap repositories:

```
mgr-create-bootstrap-repo -l
```

2. Create the bootstrap repository, using the appropriate repository name as the product label:

```
mgr-create-bootstrap-repo -c SLE-version-x86_64
```

The client tools repository is located in `/srv/www/htdocs/pub/repositories/`.

*Procedure: Specify a Bootstrap Repository*

If you have mirrored more than one SUSE Linux Enterprise 15 Product (for example, SLES and SLES for SAP), you can specify the one you are actually interested in.

1. Check what bootstrap repositories you have available:

```
mgr-create-bootstrap-repo -c SLE-15-x86_64 --with-custom-channel
Multiple options for parent channel found. Please use option
--with-parent-channel <label> and choose one of:
- sle-product-sles15-pool-x86_64
- sle-product-sles_sap15-pool-x86_64
- sle-product-sled15-pool-x86_64
```

2. Specify the appropriate repository:

```
mgr-create-bootstrap-repo -c SLE-15-x86_64 --with-parent-channel sle-product-sled15-
pool-x86_64
```

# Contact Methods

There are a number of ways that the Uyuni Server can communicate with clients. Which one you use depends on your network architecture.

The Uyuni daemon (`rhnsd`) runs on traditional client systems and periodically connects with Uyuni to check for new updates and notifications. It does not apply to Salt clients.

Push via SSH and Push via Salt SSH are used in environments where clients cannot reach the Uyuni Server directly. In this environment, clients are located in a firewall-protected zone called a DMZ. No system within the DMZ is authorized to open a connection to the internal network, including the Uyuni Server.

OSAD is an alternative contact method between Uyuni and its clients. OSAD allows registered client systems to execute scheduled actions immediately.

## SUSE Manager Daemon (rhnsd)

The Uyuni daemon (`rhnsd`) runs on traditional client systems and periodically connects with Uyuni to check for new updates and notifications. It does not apply to Salt clients.

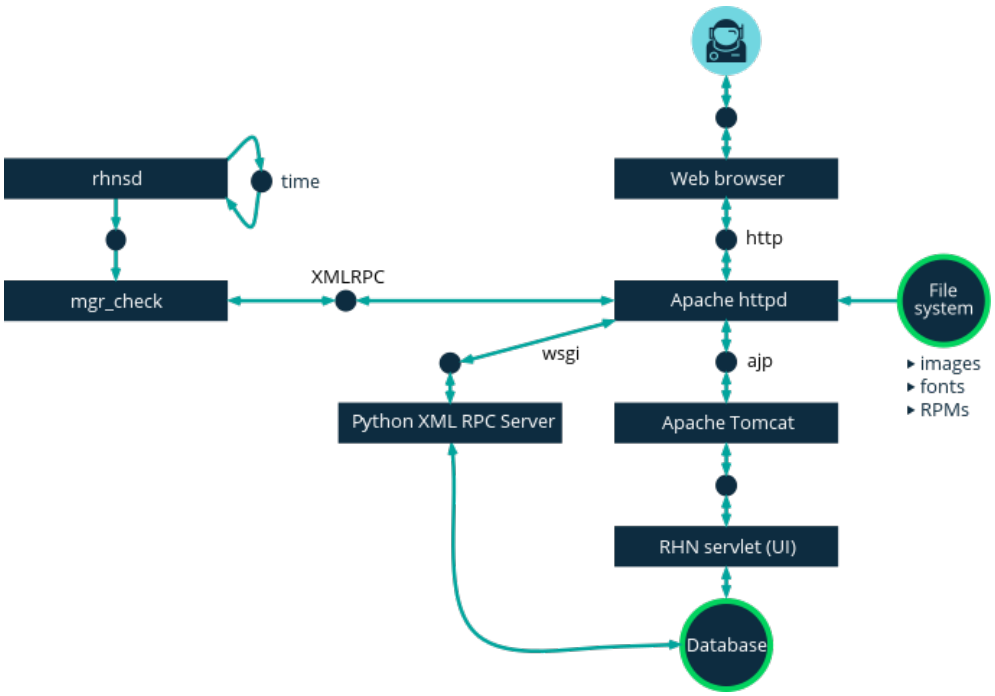
It is only used on SUSE Linux Enterprise 11 and Red Hat Enterprise Linux Server 6, as these systems do not use systemd. On later operating systems, a systemd timer (`rhnsd.timer`) is used and controlled by `rhnsd.service`.

Start the daemon with `/etc/init.d/rhnsd`.

By default, it will check every four hours for new actions. This means it can take some time for clients to execute scheduled actions.

To check for updates, `rhnsd` runs the external `mgr_check` program located in `/usr/sbin/`. This is a small application that establishes the network connection to Uyuni. The SUSE Manager daemon does not listen on any network ports or talk to the network directly. All network activity is performed by the `mgr_check` utility.

This figure provides an overview of the default `rhnsd` process path. All items left of the `Python XMLRPC server` block represent processes running on a Uyuni client.




## Configure rhnsd

The `rhnsd` initialization script has a configuration file on the client system at `/etc/sysconfig/rhn/rhnsd`.

An important parameter for the daemon is its check-in frequency. The default interval time is four hours (240 minutes). The minimum allowed time interval is one hour (60 minutes). If you set the interval below one hour, it will change back to the default of 4 hours (240 minutes).

If you modify the `rhnsd` configuration file, execute this command as root to restart the daemon and pick up your changes:

```
/etc/init.d/rhnsd restart
```

To see the status of `rhnsd`, use this command as root:

```
/etc/init.d/rhnsd status
```

On SUSE Linux Enterprise 12 and later, the default time interval is set in `/etc/systemd/system/timers.target.wants/rhnsd.timer`, in this section:

```
[Timer]
OnCalendar=00/4:00
RandomizedDelaySec=30min
```

You can create an overriding drop-in file for `rhnsd.timer` using `systemctl`:

```
systemctl edit rhnsd.timer
```

For example, if you want configure a two hour time interval:

```
[Timer]
OnCalendar=00/2:00
```

The file will be saved as `/etc/systemd/system/rhnsd.timer.d/override.conf`.

For more information about system timers, see the `systemd.timer` and `systemctl` manpages.

## Push via SSH

Push via SSH is used in environments where traditional clients cannot reach the Uyuni Server directly. In this environment, clients are located in a firewall-protected zone called a DMZ. No system within the DMZ is authorized to open a connection to the internal network, including the Uyuni Server.

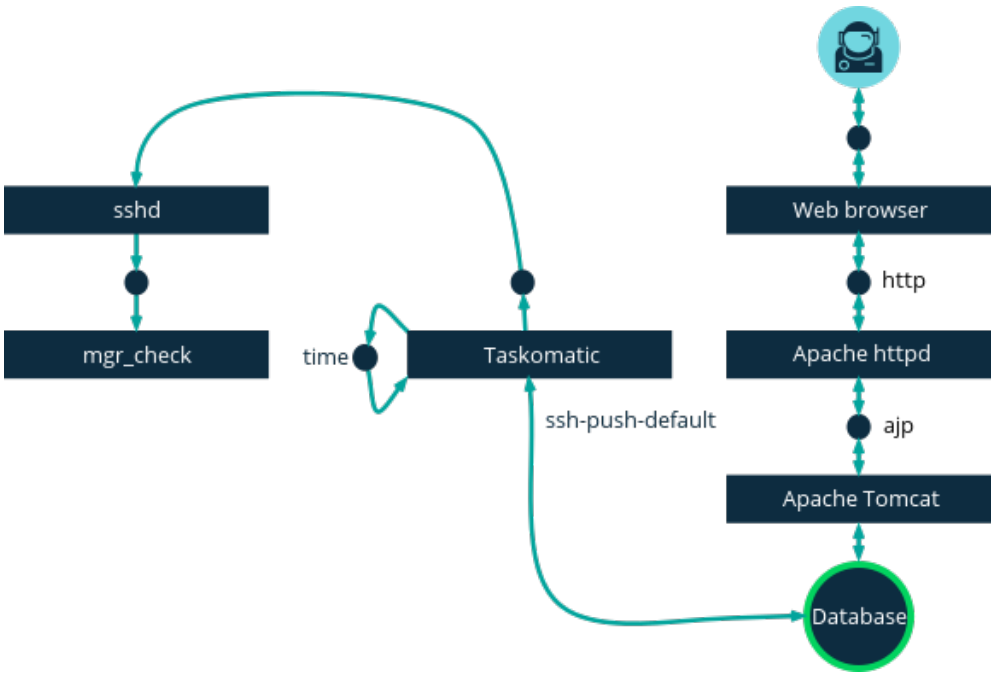
The Push via SSH method creates an encrypted tunnel from the Uyuni Server on the internal network to the clients located on the DMZ. After all actions and events are executed, the tunnel is closed.

The server uses SSH to contact the clients at regular intervals, checking in and performing scheduled actions and events.

This contact method works for traditional clients only. For Salt clients, use Push via Salt SSH.

Re-installing systems using the provisioning model is not currently supported on clients managed with push via SSH.

This image demonstrates the push via SSH process path. All items left of the `Taskomatic` block represent processes running on a Uyuni client.




For tunneling connections via SSH, two available port numbers are required, one for tunneling HTTP and the second for tunneling via HTTPS (HTTP is only necessary during the registration process). The port numbers used by default are `1232` and `1233`. To overwrite these, you can add two custom port numbers greater than 1024 to `/etc/rhn/rhn.conf`:

```
ssh_push_port_http = high_port_1
ssh_push_port_https = high_port_2
```

If you would like your clients to be contacted using their hostnames instead of an IP address, set this option:

```
ssh_push_use_hostname = true
```

It is also possible to adjust the number of threads to use for opening client connections in parallel. By default two parallel threads are used. Set `taskomatic.ssh_push_workers` in `/etc/rhn/rhn.conf`:

```
taskomatic.ssh_push_workers = number
```

For security reasons, you might want to use sudo with SSH, to access the system as an unprivileged user instead of as root.

*Procedure: Configuring Unprivileged SSH Access*

1. Ensure you have the latest `spacewalk-taskomatic` and `spacewalk-certs-tools` packages installed on the Uyuni Server.
2. On each client system, create an appropriate unprivileged user.

3. On each client system, open the `/etc/sudoers` file and comment out these lines:

```
#Defaults targetpw   # ask for the password of the target user i.e. root
#ALL    ALL=(ALL) ALL   # WARNING! Only use this together with 'Defaults targetpw'!
```

4. On each client system, in the `User privilege specification` section, add these lines:

```
<user> ALL=(ALL) NOPASSWD:/usr/sbin/mgr_check
<user> ALL=(ALL) NOPASSWD:/home/<user>/enable.sh
<user> ALL=(ALL) NOPASSWD:/home/<user>/bootstrap.sh
```

5. On each client system, in the `/home/user/.bashrc` file, add these lines:

```
PATH=$PATH:/usr/sbin
export PATH
```

6. On the Uyuni Server, in the `/etc/rhn/rhn.conf` configuration file, add or amend this line to include the unprivileged username:

```
ssh_push_sudo_user = <user>
```

Because clients are in the DMZ and cannot reach the server, you need to use the `mgr-ssh-push-init` tool to register them with the Uyuni Server.

To use the tool, you will need the client hostname or IP address, and the path to a valid bootstrap script on the Uyuni Server. For more information about bootstrapping, see **[ Client-configuration › Registration-bootstrap › ]**.

The bootstrap script will need to have an activation key associated with it that is configured for Push via SSH. For more information on activation keys, see **[ Client-configuration › Clients-and-activation-keys › ]**.

Before you begin, you need to ensure that you have specified which ports to use for SSH tunneling. If you have registered clients before changing the port numbers, they will need to be registered again.

Clients that are managed with Push via SSH cannot reach the server directly. When you use the `mgr-ssh-push-init` tool, the `rhnsd` daemon is disabled.

*Procedure: Registering Clients with Push via SSH*

1. At the command prompt on the Uyuni Server, as root, execute this command:

```
# mgr-ssh-push-init --client <client> --register \
/srv/www/htdocs/pub/bootstrap/bootstrap_script --tunnel
```

OPTIONAL: You can remove the `--tunnel` option, if you do not want to use tunneling.

2. Verify that the SSH connection is active:

```
# ssh -i /root/.ssh/id_susemanager -R <high_port>:<susemanager>:443 \
<client> zypper ref
```

*Example: API Access to Push via SSH*

You can use the API to manage which contact method to use. This example Python code sets the contact method to `ssh-push`.

Valid values are:

- `default` (pull)
- `ssh-push`
- `ssh-push-tunnel`

```
client = xmlrpclib.Server(SUMA_HOST + "/rpc/api", verbose=0)
key = client.auth.login(SUMA_LOGIN, SUMA_PASSWORD)
client.system.setDetails(key, 1000012345, {'contact_method' : 'ssh-push'})
```

If you have a client that has already been registered, and you want to migrate it to use Push via SSH, some extra steps are required. You can use the `mgr-ssh-push-init` tool to set up your client.

*Procedure: Migrating Registered Systems to Push via SSH*

1. At the command prompt on the Uyuni Server, as root, set up the client:

```
# mgr-ssh-push-init --client <client> \
/srv/www/htdocs/pub/bootstrap/bootstrap_script --tunnel
```

2. Using the Uyuni Web UI, change the client's contact method to `ssh-push` or `ssh-push-tunnel`.
3. OPTIONAL: If you need to edit an existing activation key, you can do so with this command:

```
client.activationkey.setDetails(key, '1-mykey', {'contact_method' : 'ssh-push'})
```

You can also use Push via SSH for clients that connect using a Uyuni Proxy. Ensure your proxy is updated before you begin.

*Procedure: Registering Clients with Push via SSH to a Proxy*

1. At the command prompt on the Uyuni Proxy, as root, set up the client:

```
# mgr-ssh-push-init --client <client> \
/srv/www/htdocs/pub/bootstrap/bootstrap_script --tunnel
```

2. At the command prompt on the Uyuni Server, copy the SSH key to the proxy:

```
mgr-ssh-push-init --client <proxy>
```

## Push via Salt SSH

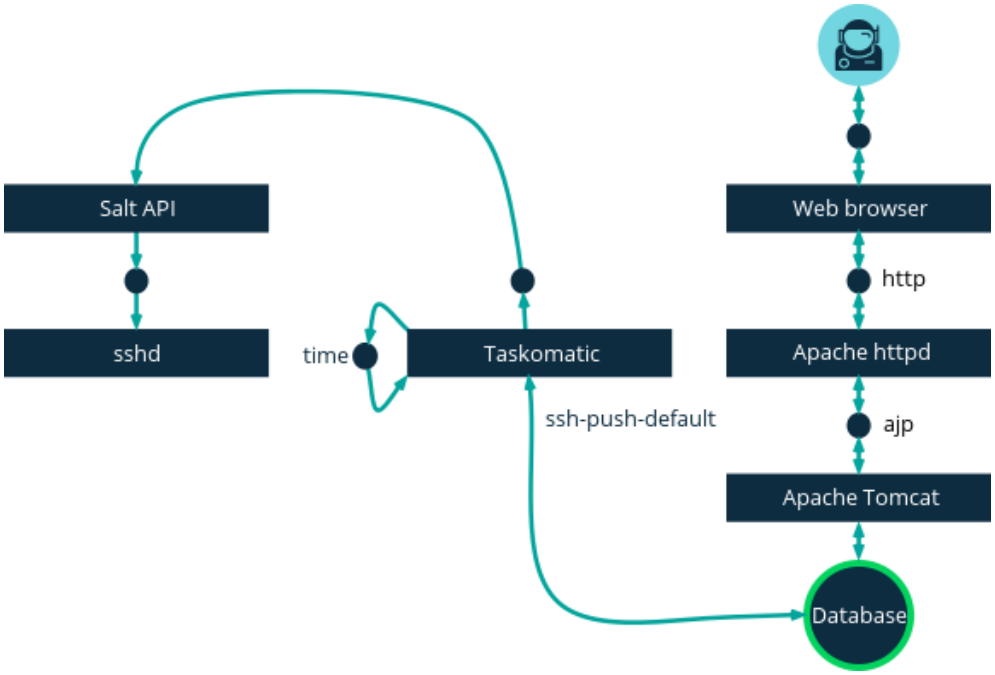
Push via Salt SSH is used in environments where Salt clients cannot reach the Uyuni Server directly. In this environment, clients are located in a firewall-protected zone called a DMZ. No system within the DMZ is authorized to open a connection to the internal network, including the Uyuni Server.

The Push via Salt SSH method creates an encrypted tunnel from the Uyuni Server on the internal network to the clients located on the DMZ. After all actions and events are executed, the tunnel is closed.

The server uses the `salt-ssh` tool to contact the clients at regular intervals, checking in and performing scheduled actions and events. For more information about Salt SSH, see **[ Salt › Salt-ssh › ]**.

This contact method works for Salt clients only. For traditional clients, use Push via SSH.

This image demonstrates the Push via Salt SSH process path. All items left of the `Taskomatic` block represent processes running on a Uyuni client.




To use Push via Salt SSH, you must have the SSH daemon running on the client, and reachable by the `salt-api` daemon running on the Uyuni Server. Additionally, Python must be available on the remote system, and be a version supported by Salt.

Red Hat Enterprise Linux 5, CentOS 5, and earlier are not supported, as they use unsupported versions of Python.

*Procedure: Registering Clients with Push via Salt SSH*

1. In the Uyuni Web UI, navigate to **Systems › Bootstrapping** and complete the appropriate fields.
2. Select an activation key with the Push via SSH contact method configured. For more information about activation keys, see **[ Client-configuration › Clients-and-activation-keys › ]**.
3. Check the `Manage system completely via SSH` checkbox.
4. Click **`[Bootstrap]`** to begin registration.
5. Confirm that the system has been registered correctly by navigating to **Systems › Overview**.

When you are configuring Push via Salt SSH, you can modify parameters that are used when a system is registered, including the host, activation key, and password. The password is used only for bootstrapping, it is not saved anywhere. All future SSH sessions are authorized via a key/certificate pair. These parameters are configured in **Systems › Bootstrapping**.

You can also configure persistent parameters that are are used system-wide, including the sudo user. For more information on configuring the sudo user, see the Push via SSH section in this chapter.

The Push via Salt SSH feature uses taskomatic to execute scheduled actions using `salt-ssh`. The taskomatic job periodically checks for scheduled actions and executes them. Unlike Push via SSH on traditional clients, the Push via Salt SSH feature executes a complete `salt-ssh` call based on the scheduled action.

There are some features that are not yet supported on Push via Salt SSH. These features will not work on Salt SSH clients:

- OpenSCAP auditing
- Beacons, resulting in:
    - Installing a package on a system using `zypper` will not invoke the package refresh.
    - Virtual Host functions (for example, a host to guests) will not work if the virtual host system is Salt SSH-based.

For more information about Salt SSH, see https://docs.saltstack.com/en/latest/topics/ssh/.

## OSAD

OSAD is an alternative contact method between Uyuni and its clients. By default, Uyuni uses `rhnsd`, which contacts the server every four hours to execute scheduled actions. OSAD allows registered client systems to execute scheduled actions immediately.

Use OSAD in addition to `rhnsd`. If you disable `rhnsd` your client will be shown as not checking in after 24 hours.

OSAD has several distinct components:

- The `osa-dispatcher` service runs on the server, and uses database checks to determine if clients need to be pinged, or if actions need to be executed.
- The `osad` service runs on the client. It responds to pings from `osa-dispatcher` and runs `mgr_check` to execute actions when directed to do so.
- The `jabberd` service is a daemon that uses the `XMPP` protocol for communication between the client and the server. The `jabberd` service also handles authentication.
- The `mgr_check` tool runs on the client to execute actions. It is triggered by communication from the `osa-dispatcher` service.

The `osa-dispatcher` periodically runs a query to check when clients last showed network activity. If it finds a client that has not shown activity recently, it will use `jabberd` to ping all `osad` instances running on all clients registered with your Uyuni server. The `osad` instances respond to the ping using `jabberd`, which is running in the background on the server. When the `osa-dispatcher` receives the response, it marks the client as online. If the `osa-dispatcher` fails to receive a response within a certain period of time, it marks the client as offline.

When you schedule actions on an OSAD-enabled system, the task will be carried out immediately. The `osa-dispatcher` periodically checks clients for actions that need to be executed. If an outstanding action is found, it uses `jabberd` to execute `mgr_check` on the client, which will then execute the action.

OSAD clients use the fully qualified domain name (FQDN) of the server to communicate with the `osa-dispatcher` service.

SSL is required for `osad` communication. If SSL certificates are not available, the daemon on your client systems will fail to connect. Make sure your firewall rules are set to allow the required ports. For more information, see [tab.install.ports.server].

*Procedure: Enabling OSAD*

1. At the command prompt on the Uyuni Server, as root, start the `osa-dispatcher` service:

```
systemctl start osa-dispatcher
```

2. On each client, install the `mgr-osad` package from the `Tools` child channel. The `mgr-osad` package should be installed on clients only. If you install the `mgr-osad` package on your Uyuni Server, it will conflict with the `osa-dispatcher` package.
3. On each client, as root, start the `osad` service:

```
systemctl start osad
```

Because `osad` and `osa-dispatcher` are run as services, you can use standard commands to manage them, including `stop`, `restart`, and `status`.

Each OSAD component is configured using local configuration files. We recommend you keep the default configuration parameters for all OSAD components.

| Component | Location | Path to Configuration File |
|---|---|---|
| `osa-dispatcher` | Server | `/etc/rhn/rhn.conf` Section: `OSA configuration` |
| `osad` | Client | `/etc/sysconfig/rhn/osad.conf` |
| `osad` log file | Client | `/var/log/osad` |
| `jabberd` log file | Both | `/var/log/messages` |

*Troubleshooting OSAD*

If your OSAD clients cannot connect to the server, or if the `jabberd` service takes a lot of time responding to port 5552, it could be because you have exceeded the open file count.

Every client needs one always-open TCP connection to the server, which consumes a single file handler. If the number of file handlers currently open exceeds the maximum number of files that `jabberd` is allowed to use, `jabberd` will queue the requests, and refuse connections.

To resolve this issue, you can increase the file limits for `jabberd` by editing the `/etc/security/limits.conf` configuration file and adding these lines:

```
jabbersoftnofile5100
jabberhardnofile6000
```

Calculate the limits required for your environment by adding 100 to the number of clients for the soft limit, and 1000 to the current number of clients for the hard limit.

In the example above, we have assumed 500 current clients, so the soft limit is 5100, and the hard limit is 6000.

You will also need to update the `max_fds` parameter in the `/etc/jabberd/c2s.xml` file with your chosen hard limit:

```
<max_fds>6000</max_fds>
```

# Using the System Set Manager

System Set Manager (SSM) is used to administrate groups of systems, rather than performing actions on one system at a time. It works for both Salt and traditional clients.

For a complete list of the tasks that you can perform with the SSM, see **[ Reference › Systems › ]**.

## Setting up System Set Manager

You need to select which systems or system group you want to work with before you can use SSM to perform operations.

You can access SSM in three different ways:

- Navigate to **Systems › System List**, select systems you want to work with, and navigate to **Systems › System Set Manager**.
- Navigate to **Systems › System Groups**, and click **`[Use in SSM]`** for the system group you want to work with.
- Navigate to **Systems › System Groups**, select the group you want to work with, and click **`[Work with Group]`**.

## Using System Set Manager

The details you see in SSM might differ slightly from the details available in other parts of the Uyuni Web UI. If you are looking at the details of a single system in the Web UI, then you will only be able to see the latest available versions of package updates. When you look at package updates in SSM, all available versions will be shown. This is intended to make it easier for system administrators to manage package versions, and choose to upgrade to packages that might not be the latest version.

# Troubleshooting Clients

## Bare Metal Systems

If a bare metal system on the network is not automatically added to the `Systems` list, check these things first:

- You must have the `pxe-default-image` package installed.
- File paths and parameters must be configured correctly. Check that the `vmlinuz0` and `initrd0.img` files, which are provided by `pxe-default-image`, are in the locations specified in the `rhn.conf` configuration file.
- Ensure the networking equipment connecting the bare metal system to the Uyuni server is working correctly, and that you can reach the Uyuni server IP address from the server.
- The bare metal system to be provisioned must have PXE booting enabled in the boot sequence, and must not be attempting to boot an operating system.
- The DHCP server must be responding to DHCP requests during boot. Check the PXE boot messages to ensure that:
  - the DHCP server is assigning the expected IP address
  - the DHCP server is assigning the the Uyuni server IP address as `next-server` for booting.
- Ensure Cobbler is running, and that the Discovery feature is enabled.

If you see a blue Cobbler menu shortly after booting, discovery has started. If it does not complete successfully, temporarily disable automatic shutdown in order to help diagnose the problem. To disable automatic shutdown:

1. Select `pxe-default-profile` in the Cobbler menu with the arrow keys, and press the Tab key before the timer expires.
2. Add the kernel boot parameter `spacewalk-finally=running` using the integrated editor, and press Enter to continue booting.
3. Enter a shell with the username `root` and password `linux` to continue debugging.

*Duplicate profiles*

Due to a technical limitation, it is not possible to reliably distinguish a new bare metal system from a system that has previously been discovered. Therefore, we recommended that you do not power on bare metal systems multiple times, as this will result in duplicate profiles.

## Cloned Salt Clients

If you have used your hypervisor clone utility, and attempted to register the cloned Salt client, you might get this error:

```
We're sorry, but the system could not be found.
```

This is caused by the new, cloned, system having the same machine ID as an existing, registered, system. You can adjust this manually to correct the error and register the cloned system successfully.

For more information and instructions, see **[ Administration › Tshoot-registerclones › ]**.

## Mounting /tmp with noexec

Salt runs remote commands from `/tmp` on the client's filesystem. Therefore you must not mount `/tmp` with the `noexec` option.

## SSL errors

On SLES 11 systems, clients can sometimes have SSL errors which make some operations unusable, including package management and bootstrapping. In this case, you will see an error like this:

```
Repository 'SLES11-SP4-SUSE-Manager-Tools x86_64' is invalid.
[|] Valid metadata not found at specified URL(s)
Please check if the URIs defined for this repository are pointing to a valid repository.
Skipping repository 'SLES11-SP4-SUSE-Manager-Tools x86_64' because of the above error.
Download (curl) error for 'www.example.com':
Error code: Unrecognized error
Error message: error:1409442E:SSL routines:SSL3_READ_BYTES:tlsv1 alert protocol version
```

This occurs because Apache requires TLS v1.2, but older versions of SLES do not support this version of the TLS protocol. To fix this error, you need to force Apache to accept a greater range of protocol versions. Open the `/etc/apache2/ssl-global.conf` configuration file, locate the `SSLProtocol` line, and update it to read:

```
SSLProtocol all -SSLv2 -SSLv3
```

This will need to be done manually on the server, and with a Salt state on the Proxy. Restart the `apache` service on each system after making the changes.

# AutoYast Example File

## Minimalist AutoYaST Profile for Automated Installations and Useful Enhancements

The AutoYaST profile in this section installs a SUSE Linux Enterprise Server system with all default installation options including a default network configuration using DHCP. After the installation is finished, a bootstrap script located on the Uyuni server is executed in order to register the freshly installed system with Uyuni. You need to adjust the IP address of the Uyuni server, the name of the bootstrap script, and the root password according to your environment:

```
<user>
 ...
 <username>root</username>
 <user_password>`linux`</user_password>
</user>

<location>http://`192.168.1.1`/pub/bootstrap/`my_bootstrap.sh`</location>
```

The complete AutoYaST file:

```
<?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>
  <mode>
   <confirm config:type="boolean">false</confirm>
  </mode>
 </general>
 <networking>
  <keep_install_network config:type="boolean">true</keep_install_network>
 </networking>
 <software>
  <install_recommended config:type="boolean">true</install_recommended>
   <patterns config:type="list">
    <pattern>base</pattern>
   </patterns>
 </software>
 <users config:type="list">
  <user>
   <encrypted config:type="boolean">false</encrypted>
   <fullname>root</fullname>
   <gid>0</gid>
   <home>/root</home>
   <password_settings>
    <expire></expire>
    <flag></flag>
    <inact></inact>
    <max></max>
    <min></min>
    <warn></warn>
   </password_settings>
   <shell>/bin/bash</shell>
   <uid>0</uid>
   <username>root</username>
   <user_password>linux</user_password>
  </user>
 </users>
 <scripts>
  <init-scripts config:type="list">
   <script>
    <interpreter>shell</interpreter>
    <location>http://192.168.1.1/pub/bootstrap/my_bootstrap.sh</location>
   </script>
  </init-scripts>
 </scripts>
</profile>
```

Use this enhancement fragment to add child channels:

```
<add-on>
 <add_on_products config:type="list">
  <listentry>
   <ask_on_error config:type="boolean">true</ask_on_error>
   <media_url>http://$c_server/ks/dist/child/`channel-label`/`distribution-label`</media_url>
   <name>$c_name</name>
   <product>$c_product</product>
   <product_dir>/</product_dir>
  </listentry>
  <listentry>
  <!-- SLES SUSE Manager tools Pool -->
    <media_url>http://$c_server/ks/dist/child/`channel-label`/`sle-manager-
tools`/`distribution-label`</media_url>
    ...
  </listentry>
  ...
 </add_on_products>
</add-on>
```

Replace `channel-label` and `distribution-label` with the correct labels (such as `sles12-sp4-updates-x86_64` and `sles12-sp4-x86_64`). Ensure that the distribution label corresponds to the Autoinstallable Distribution. Set the variables (such as `$c_server`) according to your environment. For more information about variables, see **[ Reference › Systems › ]**.

Here is a literal example for `sles12-sp4-x86_64`:

```
<add-on>
  <add_on_products config:type="list">
    <listentry>
      <!-- SLES12 Updates -->
      <media_url>http://192.168.150.10/ks/dist/child/dev-sles12-sp4-updates-x86_64/dev-
sles12sp4</media_url>
      <product>SLES 12 Updates</product>
      <product_dir>/</product_dir>
      <name>SLES12 Updates</name>
    </listentry>
    <listentry>
      <!-- SLES12 SUSE Manager Tools Pool -->
      <media_url>http://192.168.150.10/ks/dist/child/dev-sle-manager-tools12-pool-x86_64-
sp4/dev-sles12sp4</media_url>
      <product>SLES 12 Pool SUSE Manager Tools</product>
      <product_dir>/</product_dir>
      <name>SLES12 Pool SUSE Manager Tools</name>
    </listentry>
    <listentry>
      <!-- SLES12  SUSE Manager Tools Updates -->
      <media_url>http://192.168.150.10/ks/dist/child/dev-sle-manager-tools12-updates-x86_64-
sp4/dev-sles12sp4</media_url>
      <product>SLES 12 Updates SUSE Manager Tools</product>
      <product_dir>/</product_dir>
      <name>SLES12 Updates SUSE Manager Tools</name>
    </listentry>
  </add_on_products>
</add-on>
```

*Add the Updates Channel*

It is required that you add the updates tools channel to the `<add-on>` AutoYaST snippet section. This ensures your systems are provided with an up-to-date version of the `libzypp` package. If you do not include the updates tools channel, you will encounter `400` errors. In this example, the (DISTRIBUTION_NAME) is replaced with the name of the autoinstallation distribution from **Systems › Autoinstallation › Distributions**.

```
<listentry>
  <ask_on_error config:type="boolean">true</ask_on_error>
   <media_url>http://$redhat_management_server/ks/dist/child/sles12-
sp2-updates-x86_64/(DISTRIBUTION_NAME)</media_url>
  <name>sles12 sp2 updates</name>
  <product>SLES12</product>
  <product_dir>/</product_dir>
</listentry>
```

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