



U Y U N I

# Uyuni '2024.10'

## Installation and Upgrade Guide

October 17 2024



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# Deployment and Upgrade Guide Overview

**Updated:** 2024-10-17

This book provides guidance on deploying and upgrading Uyuni Server and Proxy. It is split into the following sections:

## Requirements

Describes hardware, software, and networking requirements before you begin.

## Deployment

Describes tasks for deploying Uyuni as a container and initial setup.

## Upgrade and Migration

Describes upgrade and migration of Uyuni

## Public Cloud

You can also deploy Uyuni to a public cloud instance.

For more information on using Uyuni on a public cloud, see [Specialized-guides > Public-cloud-guide](#).

# Chapter 1. Requirements

## 1.1. Requirements

The following tables specify the minimum server and proxy requirements.

### 1.1.1. Server Requirements

*Table 1. Server Requirements for x86-64 Architecture*

Software and Hardware	Details	Recommendation
openSUSE Leap 15.5	Clean installation, up-to-date	openSUSE Leap 15.5
CPU	-	Minimum 4 dedicated 64-bit CPU cores (x86-64)
RAM	Test or Base Installation	Minimum 16 GB
	Production Server	Minimum 32 GB
Disk Space	/ (root directory)	Minimum 40 GB
	/var/lib/pgsql	Minimum 50 GB
	/var/spacewalk	Minimum storage required: 100 GB (this will be verified by the implemented check)  * 50 GB for each SUSE product and Package Hub  * 360 GB for each Red Hat product
	/var/cache	Minimum 10 GB. Add 100 MB per SUSE product, 1 GB per Red Hat or other product. Double the space if the server is an ISS Master.
	Swap space	3 GB

### 1.1.2. Proxy Requirements

*Table 2. Proxy Requirements*

Software and Hardware	Details	Recommendation
openSUSE Leap 15.5	Clean installation, up-to-date	openSUSE Leap 15.5

Software and Hardware	Details	Recommendation
CPU		Minimum 2 dedicated 64-bit CPU cores
RAM	Test Server	Minimum 2 GB
	Production Server	Minimum 8 GB
Disk Space	/ (root directory)	Minimum 40 GB
	/srv	Minimum 100 GB
	/var/cache (Squid)	Minimum 100 GB

Uyuni Proxy caches packages in the `/var/cache/` directory. If there is not enough space available in `/var/cache/`, the proxy will remove old, unused packages and replace them with newer packages.

As a result of this behavior:

- The larger `/var/cache/` directory is on the proxy, the less traffic there will be between it and the Uyuni Server.
- By making the `/var/cache/` directory on the proxy the same size as `/var/spacewalk/` on the Uyuni Server, you avoid a large amount of traffic after the first synchronization.
- The `/var/cache/` directory can be small on the Uyuni Server compared to the proxy. For a guide to size estimation, see the [\[server-hardware-requirements\]](#) section.

## 1.2. Network Requirements

This section details the networking and port requirements for Uyuni.

### 1.2.1. Fully Qualified Domain Name (FQDN)

The Uyuni server must resolve its FQDN correctly. If the FQDN cannot be resolved, it can cause serious problems in a number of different components.

For more information about configuring the hostname and DNS, see <https://documentation.suse.com/sles/15-SP4/html/SLES-all/cha-network.html#sec-network-yast-change-host>.

### 1.2.2. Hostname and IP Address

To ensure that the Uyuni domain name can be resolved by its clients, both server and client machines must be connected to a working DNS server. You also need to ensure that reverse lookups are correctly configured.

For more information about setting up a DNS server, see <https://documentation.suse.com/sles/15-SP4/html/SLES-all/cha-dns.html>.

### 1.2.3. Air-gapped Deployment

If you are on an internal network and do not have access to SUSE Customer Center, you can use an **Installation-and-upgrade > Container-deployment**.

In a production environment, the Uyuni Server and clients should always use a firewall. For a comprehensive list of the required ports, see **Installation-and-upgrade > Ports**.

### 1.2.4. Ports

This section contains a comprehensive list of ports that are used for various communications within Uyuni.

You will not need to open all of these ports. Some ports only need to be opened if you are using the service that requires them.

#### 1.2.4.1. External Inbound Server Ports

External inbound ports must be opened to configure a firewall on the Uyuni Server to protect the server from unauthorized access.

Opening these ports allows external network traffic to access the Uyuni Server.

*Table 3. External Port Requirements for Uyuni Server*

Port number	Protocol	Used By	Notes
22			Required for ssh-push and ssh-push-tunnel contact methods.
67	TCP/UDP	DHCP	Required only if clients are requesting IP addresses from the server.
69	TCP/UDP	TFTP	Required if server is used as a PXE server for automated client installation.
80	TCP	HTTP	Required temporarily for some bootstrap repositories and automated installations.
443	TCP	HTTPS	Serves the Web UI, client, and server and proxy ( <code>tftpsync</code> ) requests.
4505	TCP	salt	Required to accept communication requests from clients. The client initiates the connection, and it stays open to receive commands from the Salt master.
4506	TCP	salt	Required to accept communication requests from clients. The client initiates the connection, and it stays open to report results back to the Salt master.

Port number	Protocol	Used By	Notes
25151	TCP	Cobbler	

#### 1.2.4.2. External Outbound Server Ports

External outbound ports must be opened to configure a firewall on the Uyuni Server to restrict what the server can access.

Opening these ports allows network traffic from the Uyuni Server to communicate with external services.

*Table 4. External Port Requirements for Uyuni Server*

Port number	Protocol	Used By	Notes
80	TCP	HTTP	Required for SUSE Customer Center. Port 80 is not used to serve the Web UI.
443	TCP	HTTPS	Required for SUSE Customer Center.
25151	TCP	Cobbler	

#### 1.2.4.3. Internal Server Ports

Internal port are used internally by the Uyuni Server. Internal ports are only accessible from localhost.

In most cases, you will not need to adjust these ports.

*Table 5. Internal Port Requirements for Uyuni Server*

Port number	Notes
2828	Satellite-search API, used by the RHN application in Tomcat and Taskomatic.
2829	Taskomatic API, used by the RHN application in Tomcat.
8005	Tomcat shutdown port.
8009	Tomcat to Apache HTTPD (AJP).
8080	Tomcat to Apache HTTPD (HTTP).
9080	Salt-API, used by the RHN application in Tomcat and Taskomatic.
32000	Port for a TCP connection to the Java Virtual Machine (JVM) that runs Taskomatic and satellite-search.

Port 32768 and higher are used as ephemeral ports. These are most often used to receive TCP connections. When a TCP connection request is received, the sender will choose one of these ephemeral port numbers to match the destination port.

You can use this command to find out which ports are ephemeral ports:

```
cat /proc/sys/net/ipv4/ip_local_port_range
```

#### 1.2.4.4. External Inbound Proxy Ports

External inbound ports must be opened to configure a firewall on the Uyuni Proxy to protect the proxy from unauthorized access.

Opening these ports allows external network traffic to access the Uyuni proxy.

*Table 6. External Port Requirements for Uyuni Proxy*

Port number	Protocol	Used By	Notes
22			Required for ssh-push and ssh-push-tunnel contact methods. Clients connected to the proxy initiate check in on the server and hop through to clients.
67	TCP/UDP	DHCP	Required only if clients are requesting IP addresses from the server.
69	TCP/UDP	TFTP	Required if the server is used as a PXE server for automated client installation.
443	TCP	HTTPS	Web UI, client, and server and proxy ( <code>tftpsync</code> ) requests.
4505	TCP	salt	Required to accept communication requests from clients. The client initiates the connection, and it stays open to receive commands from the Salt master.
4506	TCP	salt	Required to accept communication requests from clients. The client initiates the connection, and it stays open to report results back to the Salt master.

#### 1.2.4.5. External Outbound Proxy Ports

External outbound ports must be opened to configure a firewall on the Uyuni Proxy to restrict what the proxy can access.

Opening these ports allows network traffic from the Uyuni Proxy to communicate with external services.

*Table 7. External Port Requirements for Uyuni Proxy*

Port number	Protocol	Used By	Notes
80			Used to reach the server.

Port number	Protocol	Used By	Notes
443	TCP	HTTPS	Required for SUSE Customer Center.

#### 1.2.4.6. External Client Ports

External client ports must be opened to configure a firewall between the Uyuni Server and its clients.

In most cases, you will not need to adjust these ports.

*Table 8. External Port Requirements for Uyuni Clients*

Port number	Direction	Protocol	Notes
22	Inbound	SSH	Required for ssh-push and ssh-push-tunnel contact methods.
80	Outbound		Used to reach the server or proxy.
9090	Outbound	TCP	Required for Prometheus user interface.
9093	Outbound	TCP	Required for Prometheus alert manager.
9100	Outbound	TCP	Required for Prometheus node exporter.
9117	Outbound	TCP	Required for Prometheus Apache exporter.
9187	Outbound	TCP	Required for Prometheus PostgreSQL.

#### 1.2.4.7. Required URLs

There are some URLs that Uyuni must be able to access to register clients and perform updates. In most cases, allowing access to these URLs is sufficient:

- scc.suse.com
- updates.suse.com

If you are using non-SUSE clients you might also need to allow access to other servers that provide specific packages for those operating systems. For example, if you have Ubuntu clients, you will need to be able to access the Ubuntu server.

For more information about troubleshooting firewall access for non-SUSE clients, see **Administration > Troubleshooting**.

## 1.3. Public Cloud Requirements

This section provides the requirements for installing Uyuni on public cloud infrastructure. We have tested these instructions on Amazon EC2, Google Compute Engine, and Microsoft Azure, but they should work on other providers as well, with some variation.

Before you begin, here are some considerations:

- The Uyuni setup procedure performs a forward-confirmed reverse DNS lookup. This must succeed in order for the setup procedure to complete and for Uyuni to operate as expected. It is important to perform hostname and IP configuration before you set up Uyuni.
- Uyuni Server and Proxy instances need to run in a network configuration that provides you control over DNS entries, but cannot be accessed from the internet at large.
- Within this network configuration DNS resolution must be provided: `hostname -f` must return the fully qualified domain name (FQDN).
- DNS resolution is also important for connecting clients.
- DNS is dependent on the cloud framework you choose. Refer to the cloud provider documentation for detailed instructions.
- We recommend that you locate software repositories, the server database, and the proxy squid cache on an external virtual disk. This prevents data loss if the instance is unexpectedly terminated. This section includes instructions for setting up an external virtual disk.

### 1.3.1. Network Requirements

When you use Uyuni on a public cloud, you must use a restricted network. We recommend using a VPC private subnet with an appropriate firewall setting. Only machines in your specified IP ranges must be able to access the instance.



Running Uyuni on the public cloud means implementing robust security measures. It is essential to limit, filter, monitor, and audit access to the instance. SUSE strongly advises against a globally accessible Uyuni instance that lacks adequate perimeter security.

To access the Uyuni Web UI, allow HTTPS when configuring the network access controls. This allows you to access the Uyuni Web UI.

In EC2 and Azure, create a new security group, and add inbound and outbound rules for HTTPS. In GCE, check the `Allow HTTPS traffic` box under the `Firewall` section.

### 1.3.2. Prepare Storage Volumes

We recommend that the repositories and the database for Uyuni are stored on separate storage devices from the root volume. This will help to avoid data loss and possibly increase performance.

The Uyuni container utilizes default storage locations. These locations should be configured prior to deployment for custom storage. For more information see **Installation-and-upgrade > Container-management**



Do not use logical volume management (LVM) for public cloud installations.

The size of the disk for repositories storage is dependent on the number of distributions and channels you intend to manage with Uyuni. When you attach the virtual disks, they will appear in your instance as Unix device nodes. The names of the device nodes will vary depending on your provider, and the instance type selected.

Ensure the root volume of the Uyuni Server is 100 GB or larger. Add an additional storage disk of 500 GB or more, and choose SSD storage if you can. The cloud images for Uyuni Server use a script to assign this separate volume when your instance is launched.

When you launch your instance, you can log in to the Uyuni Server and use this command to find all available storage devices:

```
hwinfo --disk | grep -E "Device File:"
```

If you are not sure which device to choose, use the `lsblk` command to see the name and size of each device. Choose the name that matches with the size of the virtual disk you are looking for.

You can set up the external disk with the `mgr-storage-server` command. This creates an XFS partition mounted at `/manager_storage` and uses it as the location for the database and repositories:

```
/usr/bin/mgr-storage-server <devicename>
```

# Chapter 2. Deployment and Installation

## 2.1. Server

### 2.1.1. Deploy on openSUSE Leap Micro 5.5

#### 2.1.1.1. Deployment preparations

In this section, you will gain expertise in setting up and deploying a Uyuni Server. The process encompasses the installation of Podman, Uyuni container utilities, deployment, and then initiating interaction with the container through `mgrctl`.



This section assumes you have already configured an openSUSE Leap Micro 5.5 host server, whether it is running on a physical machine or within a virtual environment.

#### 2.1.1.2. Container Host general requirements

For general requirements, see [Installation-and-upgrade > General-requirements](#).

An openSUSE Leap Micro 5.5 server should be installed from installation media. This procedure is described below.

#### 2.1.1.3. Container Host Requirements

For CPU, RAM, and storage requirements, see [Installation-and-upgrade > Hardware-requirements](#).



To guarantee that clients can resolve the FQDN domain name, both the containerized server and the host machines must be linked to a functional DNS server. Additionally, it is essential to ensure correct configuration of reverse lookups.

#### 2.1.1.4. Installing Uyuni tools for use with containers

*Procedure: Installing Uyuni Tools on openSUSE Leap Micro 5.5*

1. On your local host open a terminal window or start up a virtual machine running openSUSE Leap Micro 5.5.
2. Login.
3. Enter the `transactional-update` shell:

```
transactional-update shell
```

4. Add the following repository to your openSUSE Leap Micro 5.5 server:

```
zypper ar
https://download.opensuse.org/repositories/systemsmanagement:/Uyuni:/Stable/images/repo/Uyuni-Server-POOL-x86_64-Media1/
```

5. Refresh the repository list and accept the key:

```
zypper ref
```

6. Install the container tools:

```
zypper in mgradm mgrctl mgradm-bash-completion mgrctl-bash-completion
netavark uyuni-storage-setup-server
```

7. Exit the transactional shell:

```
transactional update # exit
```

8. Reboot the host.

For more information on the Uyuni Container Utilities, see [Uyuni Container Utilities](#).

#### 2.1.1.5. Configure Custom Persistent Storage

This step is optional. However, if custom persistent storage is required for your infrastructure, use the `mgr-storage-server` tool.

- For more information, see `mgr-storage-server --help`. This tool simplifies creating the container storage and database volumes.

Use the command in the following manner:

+

```
mgr-storage-server <storage-disk-device> [<database-disk-device>]
```

For example:

```
mgr-storage-server /dev/nvme1n1 /dev/nvme2n1
```

+



This command will create the persistent storage volumes at `/var/lib/containers/storage/volumes`.

For more information, see [Installation-and-upgrade > Container-management](#).

### 2.1.1.6. Deploying an Uyuni container with Podman

#### 2.1.1.6.1. mgradm overview

Uyuni is deployed as a container using the `mgradm` tool. There are two methods of deploying a Uyuni server as a container. In this section we will focus on basic container deployment.

For information on using a custom configuration file to deploy, see [Installation-and-upgrade > Container-management](#).

For additional information, you can explore further by running `mgradm --help` from the command line.

*Procedure: Deploying an Uyuni container with Podman*

1. From the terminal run the following command as the sudo user or as root.

```
sudo mgradm install podman
```



You must deploy the container as sudo or root. The following error will be displayed at the terminal if you miss this step.

```
INF Setting up uyuni network
9:58AM INF Enabling system service
9:58AM FTL Failed to open /etc/systemd/system/uyuni-
server.service for writing error="open
/etc/systemd/system/uyuni-server.service: permission
denied"
```

2. Wait for deployment to complete.
3. Open a browser and proceed to your servers FQDN.

In this section you learned how to deploy an Uyuni Server container.

#### 2.1.1.6.2. Persistent volumes

Many users will want to specify locations for their persistent volumes.



If you are just testing out Uyuni you do not need to specify these volumes. `mgradm` will setup the correct volumes by default.

Specifying volume locations will generally be used for larger production deployments.

By default podman stores its volumes in `/var/lib/containers/storage/volumes/`.

You can provide custom storage for the volumes by mounting disks on this path or the expected volume path inside it such as: `/var/lib/containers/storage/volumes/var-spacewalk`. This is especially important for the database and package mirrors.

For a list of all persistent volumes in the container, see [\\* Installation-and-upgrade > Container-management](#) [\\* Administration > Troubleshooting](#)

## 2.1.2. Uyuni Server Air-gapped Deployment

### 2.1.2.1. What is air-gapped deployment?

Air-gapped deployment refers to the setup and operation of any networked system that is physically isolated from insecure networks, especially the internet. This type of deployment is commonly used in high-security environments such as military installations, financial systems, critical infrastructure, and anywhere sensitive data is handled and must be protected from external threats.

You can easily deploy container images using Podman, Docker, or Skopeo on a machine with internet access.

Pull the desired image then, save the image as a tar archive. For example:

#### *Listing 1. Podman*

```
podman pull registry.suse.com/suse/manager/5.0/x86_64/server:5.0.0
podman save --output server.tar
registry.suse.com/suse/manager/5.0/x86_64/server:5.0.0
```

#### *Listing 2. Docker*

```
docker pull registry.suse.com/suse/manager/5.0/x86_64/server:5.0.0
docker save --output server.tar
registry.suse.com/suse/manager/5.0/x86_64/server:5.0.0
```

#### *Listing 3. Skopeo*

```
skopeo copy docker://registry.suse.com/suse/manager/5.0/x86_64/server:5.0.0
docker-
archive:server.tar:registry.suse.com/suse/manager/5.0/x86_64/server:5.0.0
```

Transfer the resulting `server-image.tar` to the Server container host and load it using the following command:

***Listing 4. Load the Server Image***

```
podman load -i server.tar
```

## 2.2. Proxy

### 2.2.1. Containerized Uyuni Proxy Setup

Once container host for Uyuni Proxy containers is prepared, setup of containers require few additional steps to finish configuration.

1. Generate Uyuni Proxy configuration archive file
2. Transfer configuration archive to the container host prepared in installation step and extract it
3. Start the proxy services with `mgrpxy`

#### 2.2.1.1. Generate the Proxy Configuration

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



2 GB represents the default proxy squid cache size. This will need to be adjusted for your environment.



For Podman deployment, the container host for the Uyuni Proxy must be registered as a client to the Uyuni Server prior to generating this proxy configuration.

If a proxy FQDN is used to generate a proxy container configuration that is not a registered client (as in the Kubernetes use case), a new system entry will appear in system list. This new entry will be shown under previously entered Proxy FQDN value and will be of `Foreign` system type.

#### 2.2.1.1.1. Generate the Proxy Configuration with Web UI

*Procedure: Generating a Proxy Container Configuration using Web UI*

1. In the Web UI, navigate to **Systems > Proxy Configuration** and fill the required data:
2. In the `Proxy FQDN` field type fully qualified domain name for the proxy.
3. In the `Parent FQDN` field type fully qualified domain name for the Uyuni Server or another Uyuni Proxy.
4. In the `Proxy SSH port` field type SSH port on which SSH service is listening on Uyuni Proxy. Recommended is to keep default 8022.
5. In the `Max Squid cache size [MB]` field type maximal allowed size for Squid cache. Recommended is to use at most 60% of available storage for the containers.



2 GB represents the default proxy squid cache size. This will need to be adjusted for your environment.

- In the SSL certificate selection list choose if new server certificate should be generated for Uyuni Proxy or an existing one should be used. You can consider generated certificates as Uyuni builtin (self signed) certificates.

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

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

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

- Click **[Generate]** to register a new proxy FQDN in the Uyuni Server and generate a configuration archive (`config.tar.gz`) containing details for the container host.
- After a few moments you are presented with file to download. Save this file locally.

#### Container Based Proxy Configuration [?](#)

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

Proxy FQDN *: <input type="text" value="e.g., proxy.domain.com"/> Server FQDN *: <input type="text" value="e.g., server.domain.com"/> <small>FQDN of the server of proxy to connect to.</small> Proxy SSH port: <input type="text" value="8022"/> <small>Port range: 1 - 65535</small> Max Squid cache size (MB) *: <input type="text" value="e.g., 2048"/> Proxy administrator email *: <input type="text" value="admin"/> SSL certificate *: <input checked="" type="radio"/> Create <input type="radio"/> Use existing	<input type="button" value="Browse..."/> <small>No file selected.</small> <input type="button" value="Browse..."/> <small>No file selected.</small> <small>.....</small> <b>SSL Certificate data</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;">Alternate CNAMEs</td> <td style="text-align: right; padding: 5px;"><input type="button" value="+"/></td> </tr> <tr> <td colspan="2" style="height: 100px; vertical-align: top;">           2-letter country code: <input type="text"/>            State: <input type="text"/>            City: <input type="text"/>            Organization: <input type="text"/>            Organization Unit: <input type="text"/>            Email: <input type="text"/> </td> </tr> </table>	Alternate CNAMEs	<input type="button" value="+"/>	2-letter country code: <input type="text"/> State: <input type="text"/> City: <input type="text"/> Organization: <input type="text"/> Organization Unit: <input type="text"/> Email: <input type="text"/>	
Alternate CNAMEs	<input type="button" value="+"/>				
2-letter country code: <input type="text"/> State: <input type="text"/> City: <input type="text"/> Organization: <input type="text"/> Organization Unit: <input type="text"/> Email: <input type="text"/>					
<input type="button" value="Generate"/> <span style="margin-left: 20px;"><input type="button" value="Clear fields"/></span>					

### 2.2.1.1.2. Generate the Proxy Configuration with spacecmd and Self-Signed Certificate

*Procedure: Generating Proxy Configuration with spacecmd and Self-Signed Certificate*

You can generate a Proxy configuration using spacecmd.

1. SSH into your container host.
2. Execute the following command replacing the Server and Proxy FQDN:

```
mgrctl exec -ti 'spacecmd proxy_container_config_generate_cert -- dev-
pxy.example.com dev-srv.example.com 2048 email@example.com -o
/tmp/config.tar.gz'
```

3. Copy the generated configuration from the server container:

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

### 2.2.1.1.3. Generate the Proxy Configuration with spacecmd and Custom Certificate

You can generate a Proxy configuration using spacecmd for a custom certificates rather than the default self-signed certificates.

*Procedure: Generating Proxy Configuration with spacecmd and Custom Certificate*

1. SSH into your Server container host.
2. Execute the following command replacing the Server and Proxy FQDN:

```
for f in ca.crt proxy.crt proxy.key; do
    mgrctl cp $f server:/tmp/$f
done
mgrctl exec -ti 'spacecmd proxy_container_config -- -p 8022
pxy.example.com srv.example.com 2048 email@example.com /tmp/ca.crt
/tmp/proxy.crt /tmp/proxy.key -o /tmp/config.tar.gz'
```

3. Copy the generated configuration from the server container:

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

### 2.2.1.2. Transfer Uyuni Proxy configuration

Both spacecmd command and Web UI ways generate a configuration archive. This archive needs to be made available on container host.

Transfer this generated archive to the container host.

For installation instructions to use the archive to get the proxy containers, see **Installation-and-upgrade > Container-deployment**.

### 2.2.1.3. Start Uyuni Proxy containers

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

*Listing 5. Procedure: Start Uyuni Proxy containers*

```
mgrpxy start uyuni-proxy-pod
```

Check if all containers started up as expected by calling

```
podman ps
```

Five Uyuni Proxy containers should be present:

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

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

### 2.2.2. Deploy a Uyuni '2024.10' Proxy

This guide outlines the deployment process for the Uyuni '2024.10' Proxy. This guide presumes you have already successfully deployed a Uyuni '2024.10' Server. To successfully deploy, you will perform the following actions:

*Checklist: Proxy Deployment*

1. Review hardware requirements.
2. Install openSUSE Leap Micro 5.5 on a bare-metal machine.
3. Bootstrap the Proxy as a Salt minion.
4. Generate a Proxy configuration.
5. Transfer the Proxy configuration from Server to Proxy
6. Use the Proxy configuration to register the Salt minion as a Proxy with Uyuni.

### *Supported operating system for the Proxy Container Host*

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



### Container host

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

#### 2.2.2.1. Hardware Requirements for the Proxy

This table shows the hardware requirements for deploying Uyuni Proxy.

*Table 9. Proxy Hardware Requirements*

Hardware	Details	Recommendation
CPU	x86-64, ARM	Minimum 2 dedicated 64-bit CPU cores
RAM	Minimum	2 GB
	Recommended	8 GB
Disk Space	/ (root directory)	Minimum 40 GB
	/var/lib/containers/storage/volumes	Minimum 100 GB, Storage requirements should be calculated for the number of ISO distribution images, containers, and bootstrap repositories you will use.

#### 2.2.2.2. Container Host General Requirements

For general requirements, see **Installation-and-upgrade > General-requirements**.

An openSUSE Leap Micro 5.5 server should be installed from installation media. This procedure is described below.

#### 2.2.2.3. Container Host Requirements

For CPU, RAM, and storage requirements, see **Installation-and-upgrade > Hardware-requirements**.



To guarantee that clients can resolve the FQDN domain name, both the containerized server and the host machines must be linked to a functional DNS server. Additionally, it is essential to ensure correct configuration of reverse lookups.

#### 2.2.2.4. Installing Uyuni Tools for Use with Containers

*Procedure: Installing Uyuni Tools on openSUSE Leap Micro 5.5*

1. On your local host open a terminal window or start up a virtual machine running openSUSE Leap Micro 5.5.
2. Login.
3. Enter the transactional-update shell:

```
transactional-update shell
```

4. Add the following repository to your openSUSE Leap Micro 5.5 server:

```
zypper ar
https://download.opensuse.org/repositories/systemsmanagement:/Uyuni:/Stable/images/repo/Uyuni-Proxy-POOL-x86_64-Medial/
```

5. Refresh the repository list and accept the key:

```
zypper ref
```

6. Install the container tools:

```
zypper in mgrpxy mgrpxy-bash-completion uyuni-storage-setup-proxy
```



Alternatively you may install mgrpxy-zsh-completion or mgrpxy-fish-completion.

7. Exit the transactional shell:

```
transactional update # exit
```

8. Reboot the host.

For more information on the Uyuni Container Utilities, see [Uyuni Container Utilities](#).

### 2.2.2.5. Configure Custom Persistent Storage

This step is optional. However, if custom persistent storage is required for your infrastructure, use the `mgr-storage-proxy` tool.

- For more information, see `mgr-storage-proxy --help`. This tool simplifies creating the container storage and Squid cache volumes.

Use the command in the following manner:

```
mgr-storage-proxy <storage-disk-device>
```

For example:

```
mgr-storage-proxy /dev/nvme1n1
```

This command will create the persistent storage volumes at `/var/lib/containers/storage/volumes`.



For more information, see

- [Installation-and-upgrade > Container-management](#)
- [Administration > Troubleshooting](#)

### 2.2.2.6. Bootstrap the Proxy Host as a Minion

#### *Task: Bootstrap the Proxy Host*

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

#### *Task: Update the Proxy Host*

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

### 2.2.2.7. Generate the Proxy Configuration

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



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

You will perform the following tasks:

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

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

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

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

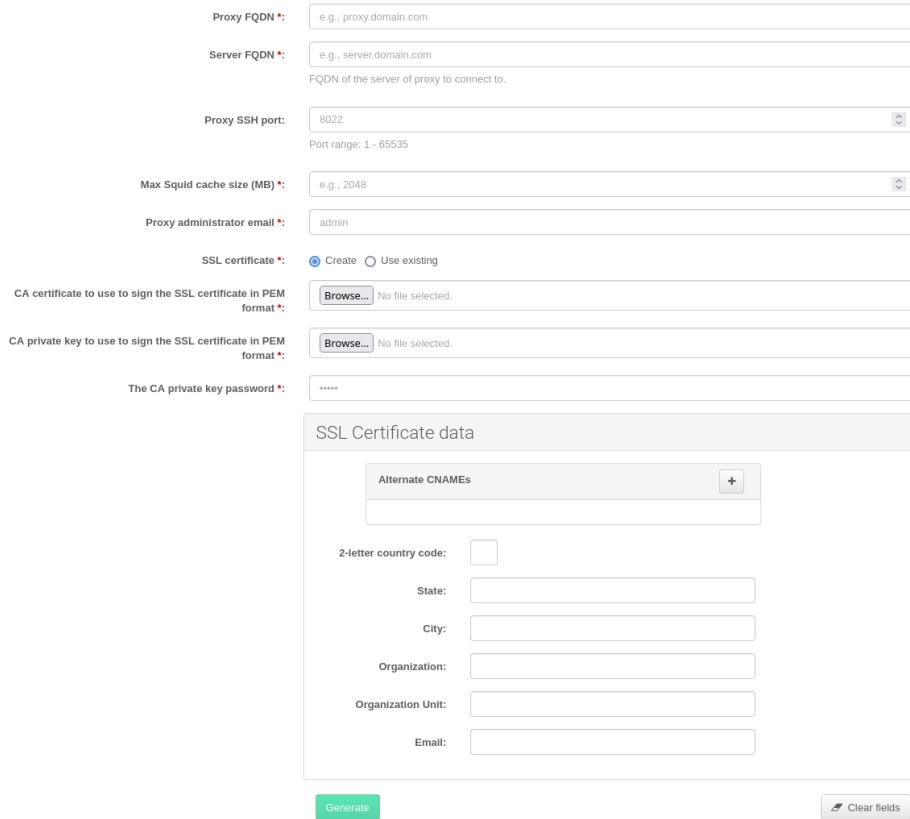
The CA certificates generated on the server are stored in the `/var/lib/containers/storage/volumes/root/ssl-build` directory.

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

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

## Container Based Proxy Configuration [?](#)

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



Proxy FQDN \*:

Server FQDN \*:

FQDN of the server of proxy to connect to.

Proxy SSH port:  Port range: 1 - 65535

Max Squid cache size (MB) \*:

Proxy administrator email \*:

SSL certificate \*:

- Create
- Use existing

CA certificate to use to sign the SSL certificate in PEM format \*:  No file selected.

CA private key to use to sign the SSL certificate in PEM format \*:  No file selected.

The CA private key password \*:

**SSL Certificate data**

Alternate CNAMEs	<input type="button" value="+"/>
2-letter country code:	<input type="text"/>
State:	<input type="text"/>
City:	<input type="text"/>
Organization:	<input type="text"/>
Organization Unit:	<input type="text"/>
Email:	<input type="text"/>

### 2.2.2.8. Transfer the Proxy Configuration

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

*Task: Copy the Proxy configuration*

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

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

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

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

3. Install the Proxy with:

```
mgrpctl install podman config.tar.gz
```

### 2.2.2.9. Start the Uyuni '2024.10' Proxy

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

*Task: Start and Check Proxy Status*

1. Start the Proxy by calling:

```
mgrpxy start
```

2. Check container status by calling:

```
mgrpxy status
```

Five Uyuni Proxy containers should be present:

- proxy-salt-broker
- proxy-htpd
- proxy-tftpd
- proxy-squid
- proxy-ssh

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

#### 2.2.2.9.1. Using a Custom Container Image for a Service

By default, the Uyuni Proxy suite is set to use the same image version and registry path for each of its services. However, it is possible to override the default values for a specific service using the install parameters ending with `-tag` and `-image`.

For example, use it like this:

```
mgrpxy install podman --httpd-tag 0.1.0 --httpd-image
registry.opensuse.org/uyuni/proxy-htpd /path/to/config.tar.gz
```

It adjusts the configuration file for the httpd service, where `registry.opensuse.org/uyuni/proxy-htpd`s is the image to use and `0.1.0` is the version tag, before restarting it.

To reset the values to defaults, run the install command again without those parameters:

```
mgrpxy install podman /path/to/config.tar.gz
```

This command first resets the configuration of all services to the global defaults and then reloads it.

## 2.2.3. Install Containerized Uyuni Proxy on k3s

### 2.2.3.1. Installing k3s

On the container host machine, install k3s (replace <K3S\_HOST\_FQDN> with the FQDN of your k3s host):

```
curl -sfL https://get.k3s.io | INSTALL_K3S_EXEC="--tls-san=<K3S_HOST_FQDN>" sh -
```

### 2.2.3.2. Installing tools

The installation requires the `mgrpxy` and `helm` packages.

The `mgrpxy` package is available in the container utils repository: pick the one matching the distribution in: <https://download.opensuse.org/repositories/systemsmanagement:/Uyuni:/Stable:/ContainerUtils/>.

To install them run:

```
zypper in helm mgrpxy
```

### 2.2.3.3. Deploying the Uyuni proxy helm chart

To configure the storage of the volumes to be used by the Uyuni Proxy pod, define persistent volumes for the following claims. If you do not customize the storage configuration, k3s will automatically create the storage volumes for you.

The persistent volume claims are named:

- `squid-cache-pv-claim`
- `/package-cache-pv-claim`
- `/tftp-boot-pv-claim`

Create the configuration for the Uyuni Proxy as documented in **Installation-and-upgrade > Container-deployment**. Copy the configuration `tar.gz` file and then install:

```
mgrpxy install kubernetes /path/to/config.tar.gz
```

For more information see <https://kubernetes.io/docs/concepts/storage/persistent-volumes/> (kubernetes) or <https://rancher.com/docs/k3s/latest/en/storage/> (k3s) documentation.

# Chapter 3. Upgrade and Migration

## 3.1. Server

### 3.1.1. Migrating the Uyuni Server to a Containerized Environment

To migrate a legacy Uyuni Server (RPM installation) to a container, a new machine is required.



It is not possible to perform an in-place migration.

Self trusted GPG keys are not migrated. GPG keys that are trusted in the RPM database only are not migrated. Thus synchronizing channels with `spacewalk-repo-sync` can fail.



The administrator must migrate these keys manually from the previous Uyuni installation to the container host after the actual server migration.

1. Copy the keys from the previous Uyuni server to the container host of the new server.
2. Later, add each key to the migrated server with the command `mgradm gpg add <PATH_TO_KEY_FILE>`.

The migration procedure currently does not include any hostname renaming functionality. The fully qualified domain name (FQDN) on the new server will remain identical to that on the old server. Therefore, following migration, it will be necessary to manually adjust the DNS records to point to the new server.

#### 3.1.1.1. Initial Preparation on the Legacy Server

*Procedure: Initial preparation on the legacy server*

1. Stop the Uyuni services:

```
spacewalk-service stop
```

2. Stop the PostgreSQL service:

```
systemctl stop postgresql
```

#### 3.1.1.2. Prepare the SSH Connection

*Procedure: Preparing the SSH connection*

1. Ensure that for `root` an SSH key exists on the new '2024.10' server. If a key does not exist, create it with:

```
ssh-keygen -t rsa
```

2. The SSH configuration and agent should be ready on the new server host for a passwordless connection to the legacy server.



To establish a passwordless connection, the migration script relies on an SSH agent running on the new server. If the agent is not active yet, initiate it by running `eval $(ssh-agent)`. Then add the SSH key to the running agent with `ssh-add` followed by the path to the private key. You will be prompted to enter the password for the private key during this process.

3. Copy the public SSH key to the legacy Uyuni Server (`<oldserver.fqdn>`) with `ssh-copy-id`. Replace `<oldserver.fqdn>` with the FQDN of the legacy server:

```
ssh-copy-id <oldserver.fqdn>
```

The SSH key will be copied into the legacy server's [path]`~/.ssh/authorized\_keys` file.  
For more information, see the [literal]`ssh-copy-id` manpage.

4. Establish an SSH connection from the new server to the legacy Uyuni Server to check that no password is needed. Also there must not be any problem with the host fingerprint. In case of trouble, remove old fingerprints from the `~/.ssh/known_hosts` file. Then try again. The fingerprint will be stored in the local `~/.ssh/known_hosts` file.

### 3.1.1.3. Perform the Migration



When planning your migration from a legacy Uyuni to a containerized Uyuni, ensure that your target instance meets or exceeds the specifications of the old setup. This includes, but is not limited to, Memory (RAM), CPU Cores, Storage, and Network Bandwidth.

#### *Procedure: Performing the Migration*

1. This step is optional. If custom persistent storage is required for your infrastructure, use the `mgr-storage-server` tool.
  - For more information, see `mgr-storage-server --help`. This tool simplifies creating the container storage and database volumes.
  - Use the command in the following manner:

```
mgr-storage-server <storage-disk-device> [<database-disk-device>]
```

For example:

```
mgr-storage-server /dev/nvme1n1 /dev/nvme2n1
```



This command will create the persistent storage volumes at `/var/lib/containers/storage/volumes`.

For more information, see [Installation-and-upgrade > Container-management](#).

2. Execute the following command to install a new Uyuni server. Replace `<oldserver.fqdn>` with the FQDN of the legacy server:

```
mgradm migrate podman <oldserver.fqdn>
```

3. Migrate trusted SSL CA certificates.

Trusted SSL CA certificates that were installed as part of an RPM and stored on a legacy Uyuni in the `/usr/share/pki/trust/anchors/` directory will not be migrated. Because SUSE does not install RPM packages in the container, the administrator must migrate these certificate files manually from the legacy installation after migration:



1. Copy the file from the legacy server to the new server. For example, as `/local/ca.file`.
2. Copy the file into the container with:

```
mgradm cp /local/ca.file
server:/etc/pki/trust/anchors/
```



After successfully running the `mgradm migrate` command, the Salt setup on all clients will still point to the old legacy server.

To redirect them to the '2024.10' server, it is required to rename the new server at the infrastructure level (DHCP and DNS) to use the same Fully Qualified Domain Name and IP address as legacy server.

#### 3.1.1.4. Prepare for Kubernetes

Before executing the migration with `mgradm migrate` command, it is essential to predefine **Persistent Volumes**, especially considering that the migration job initiates the container from scratch. For more information, see the installation section for comprehensive guidance on preparing these volumes in [Installation-and-upgrade > Container-management](#).

### 3.1.1.5. Migrating

Execute the following command to install a new Uyuni server, replacing <oldserversource.fqdn> with the appropriate FQDN of the old server:

```
mgradm migrate podman <oldnserver.fqdn>
```

or

```
mgradm migrate kubernetes <oldnserver.fqdn>
```



After successfully running the mgradm migrate command, the Salt setup on all clients will still point to the old server. To redirect them to the new server, it is required to rename the new server at the infrastructure level (DHCP and DNS) to use the same FQDN and IP address as the old server.

## 3.2. Proxy

### 3.2.1. Proxy Migration

In Uyuni '2024.10', the containerized proxy is managed by a set of systemd services.

In Uyuni '2024.10', management of the containerized proxy was re-designed and made simpler with the mgrpxy tool.

This section will help you migrate from the legacy systemd proxy using the new mgrpxy tool.



An in-place migration from previous releases of Uyuni to '2024.10' will remain unsupported due to the HostOS change from openSUSE Leap to openSUSE Leap Micro.

The traditional contact protocol is no longer supported in Uyuni '2024.10' and later. Before migrating from previous Uyuni releases to '2024.10', any existing traditional clients including the traditional proxies must be migrated to Salt.

#### 3.2.1.1. Migrate from Legacy to Containerized Proxy with Systemd

##### 3.2.1.1.1. Generate the Proxy Configuration

*Task: Generate the Proxy Configuration*

1. Log in to the Uyuni Server Web UI.
2. Select **Systems > Proxy Configuration** from the left navigation.
3. Enter your Proxy FQDN. Use the same FQDN as the original proxy host.

4. Enter your Server FQDN.
5. Enter the Proxy port number. *We recommend using the default port of 8022*
6. Certificate and private key are located on the Server container host in `/var/lib/containers/storage/volumes/root/_data/ssl-build/`.
  - RHN-ORG-TRUSTED-SSL-CERT
  - RHN-ORG-PRIVATE-SSL-KEY
7. Copy the certificate and key to your machine with:

```
scp root@uyuni-server-example.com:/root/ssl-build/RHN-ORG-PRIVATE-SSL-KEY .
scp root@uyuni-server-example.com:/root/ssl-build/RHN-ORG-TRUSTED-SSL-CERT .
```

8. Select **[Choose File]** and browse your local machine for the certificate.
9. Select **[Choose File]** and brose your local machine for the private key.
10. Enter the CA password.
11. Click **[Generate]**.

### 3.2.1.1.2. Transfer Proxy Configuration to New Host

*Task: Transfer the Proxy Configuration*

1. From the Server transfer the generated tar.gz file containing the proxy configuration to the new Proxy host:

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

2. Disable the legacy proxy prior to executing the next step:

*Listing 6. Disable the Legacy Proxy*

```
spacewalk-proxy stop
```

3. Deploy the new Proxy with:

```
systemctl start uyuni-proxy-pod
```

4. Enable the new Proxy with:

```
systemctl enable --now uyuni-proxy-pod
```

5. Run `podman ps` to verify all the containers are present and running:

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

### 3.2.1.2. Migrate Uyuni Proxy to Uyuni '2024.10' Containerized Proxy

*Task: Migrate Uyuni Containerized Proxy to Uyuni '2024.10' New Containerized Proxy*

1. Boot your new machine and begin installation of openSUSE Leap Micro 5.5.
2. Complete the installation.
3. Update the system:

```
transactional-update --continue
```

4. Install `mgrpxy` and optionally, `mgrpxy-bash-completion`:

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

5. Reboot.
6. Copy your tar.gz proxy configuration to the host.

### 3.2.1.3. Installing packages using the Web UI

The `mgrpxy` and `mgrpxy-bash-completion` packages can also be installed via the web UI after the minion has been bootstrapped and registered with the Server.

*Task: Installing Packages using the Web UI*

1. After installation, ensure that the SLE Micro 5.5 Parent channel and Proxy child channels are added and synced from the **Admin > Setup Wizard → Products** page.
2. In the Web UI, go to **Systems > Activation Keys** and create an activation key linked to the synced SLE Micro 5.5 channel.
3. Bootstrap your system as a minion using the **Systems > Bootstrapping** page.
4. Once the new machine is onboarded and displayed in the systems list, select the system and navigate to the **System Details > Install Package** page.
5. Install the packages `mgrpxy` and `mgrpxy-bash-completion`.
6. Reboot the system.

### 3.2.1.4. Generate Proxy Config with spacecmd and Self-Signed Certificate

*Task: Generate Proxy Config with spacecmd and Self-Signed Certificate*

You can generate a Proxy configuration using spacecmd.

1. SSH into your container host.
2. Execute the following command replacing the Server and Proxy FQDN:

```
mgrctl exec -ti 'spacecmd proxy_container_config_generate_cert -- dev-pxy.example.com dev-srv.example.com 2048 email@example.com -o /tmp/config.tar.gz'
```

3. Copy the generated config to the Proxy:

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

4. Deploy the Proxy with:

```
mgrpxy install podman config.tar.gz
```

### 3.2.1.5. Generate Proxy Config with spacecmd and Custom Certificate

You can generate a Proxy configuration using spacecmd for a custom certificates rather than the default self signed certificates.



2 GB represents the default proxy squid cache size. This will need to be adjusted for your environment.

*Task: Generate Proxy Config with spacecmd and Custom Certificate*

1. SSH into your Server container host.
2. Execute the following command replacing the Server and Proxy FQDN:

```
for f in ca.crt proxy.crt proxy.key; do
  mgrctl cp $f server:/tmp/$f
done
mgrctl exec -ti 'spacecmd proxy_container_config -- -p 8022
pxy.example.com srv.example.com 2048 email@example.com /tmp/ca.crt
/tmp/proxy.crt /tmp/proxy.key -o /tmp/config.tar.gz'
```

3. Copy the generated config to the Proxy:

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

4. Deploy the Proxy with:

```
mgrpxy install podman config.tar.gz
```

---

## 3.3. Clients

### 3.3.1. Upgrade the Clients

Clients use the versioning system of their underlying operating system. For clients using SUSE operating systems, you can perform upgrades within the Uyuni Web UI.

For more information about upgrading clients, see [Client-configuration > Client-upgrades](#).

# Chapter 4. Basic Server Management

## 4.1. Custom YAML Configuration and Deployment with mgradm

You have the option to create a custom `mgradm.yaml` file, which the `mgradm` tool can utilize during deployment.



- mgradm will prompt for basic variables if they are not provided using command line parameters or the `mgradm.yaml` configuration file.
- For security, **using command line parameters to specify passwords should be avoided**: use a configuration file with proper permissions instead.

*Procedure: Deploying the Uyuni container with Podman using a custom configuration file*

1. Prepare a configuration file named `mgradm.yaml` similar to the following example:

```
# Database password. Randomly generated by default
db:
    password: MySuperSecretDBPass

# Password for the CA certificate
ssl:
    password: MySuperSecretSSLPASSWORD

# Your SUSE Customer Center credentials
scc:
    user: ccUsername
    password: ccPassword

# Organization name
organization: YourOrganization

# Email address sending the notifications
emailFrom: notifications@example.com

# Administrators account details
admin:
    password: MySuperSecretAdminPass
    login: LoginName
    firstName: Admin
    lastName: Admin
    email: email@example.com
```

2. From the terminal, as root, run the following command. Entering your server's FQDN is optional.

```
mgradm -c mgradm.yaml install podman <FQDN>
```

You must deploy the container as sudo or root. The following error will be displayed on the terminal if you miss this step.



```
INF Setting up uyuni network
9:58AM INF Enabling system service
9:58AM FTL Failed to open /etc/systemd/system/uyuni-
server.service for writing error="open
/etc/systemd/system/uyuni-server.service: permission
denied"
```

3. Wait for deployment to complete.
4. Open a browser and proceed to your server's FQDN or IP address.

In this section you learned how to deploy an Uyuni '2024.10' Server container using a custom YAML configuration.

## 4.2. Starting and Stopping Containers

The Uyuni '2024.10' Server container can be restarted, started, and stopped using the following commands:

To restart the Uyuni '2024.10' Server execute the following command:

```
# mgradm restart
5:23PM INF Welcome to mgradm
5:23PM INF Executing command: restart
```

To start the server execute the following command:

```
# mgradm start
5:21PM INF Welcome to mgradm
5:21PM INF Executing command: start
```

To stop the server execute the following command:

```
# mgradm stop
5:21PM INF Welcome to mgradm
5:21PM INF Executing command: stop
```

## 4.3. List of persistent storage volumes

Modifications performed within containers are not retained. Any alterations made outside of persistent volumes will be discarded. Below is a list of persistent volumes for Uyuni '2024.10'.

To customize the default volume locations, ensure you create the necessary volumes before launching the pod for the first time, utilizing the `podman volume create` command.



Ensure that this table aligns precisely with the volumes mapping outlined in both the Helm chart and the systemctl services definitions.

The following volumes are stored under the **Podman** default storage location.

*Table 10. Persistent Volumes: Podman Default Storage*

Volume Name	Volume Directory
<b>Podman Storage</b>	/var/lib/containers/storage/volumes/

*Table 11. Persistent Volumes: root*

Volume Name	Volume Directory
<b>root</b>	/root

*Table 12. Persistent Volumes: var/*

Volume Name	Volume Directory
<b>var-cobbler</b>	/var/lib/cobbler
<b>var-salt</b>	/var/lib/salt
<b>var-pgsql</b>	/var/lib/pgsql
<b>var-cache</b>	/var/cache
<b>var-spacewalk</b>	/var/spacewalk
<b>var-log</b>	/var/log

*Table 13. Persistent Volumes: srv/*

Volume Name	Volume Directory
<b>srv-salt</b>	/srv/salt
<b>srv-www</b>	/srv/www/
<b>srv-tftpboot</b>	/srv/tftpboot
<b>srv-formulametadata</b>	/srv/formula_metadata
<b>srv-pillar</b>	/srv/pillar
<b>srv-susemanager</b>	/srv/susemanager
<b>srv-spacewalk</b>	/srv/spacewalk

*Table 14. Persistent Volumes: etc/*

Volume Name	Volume Directory
<b>etc-apache2</b>	/etc/apache2
<b>etc-rhn</b>	/etc/rhn
<b>etc-systemd-multi</b>	/etc/systemd/system/multi-user.target.wants
<b>etc-systemd-sockets</b>	/etc/systemd/system/sockets.target.wants
<b>etc-salt</b>	/etc/salt
<b>etc-sssd</b>	/etc/sssd
<b>etc-tomcat</b>	/etc/tomcat
<b>etc-cobbler</b>	/etc/cobbler
<b>etc-sysconfig</b>	/etc/sysconfig
<b>etc-tls</b>	/etc/pki/tls
<b>etc-postfix</b>	/etc/postfix
<b>ca-cert</b>	/etc/pki/trust/anchors

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